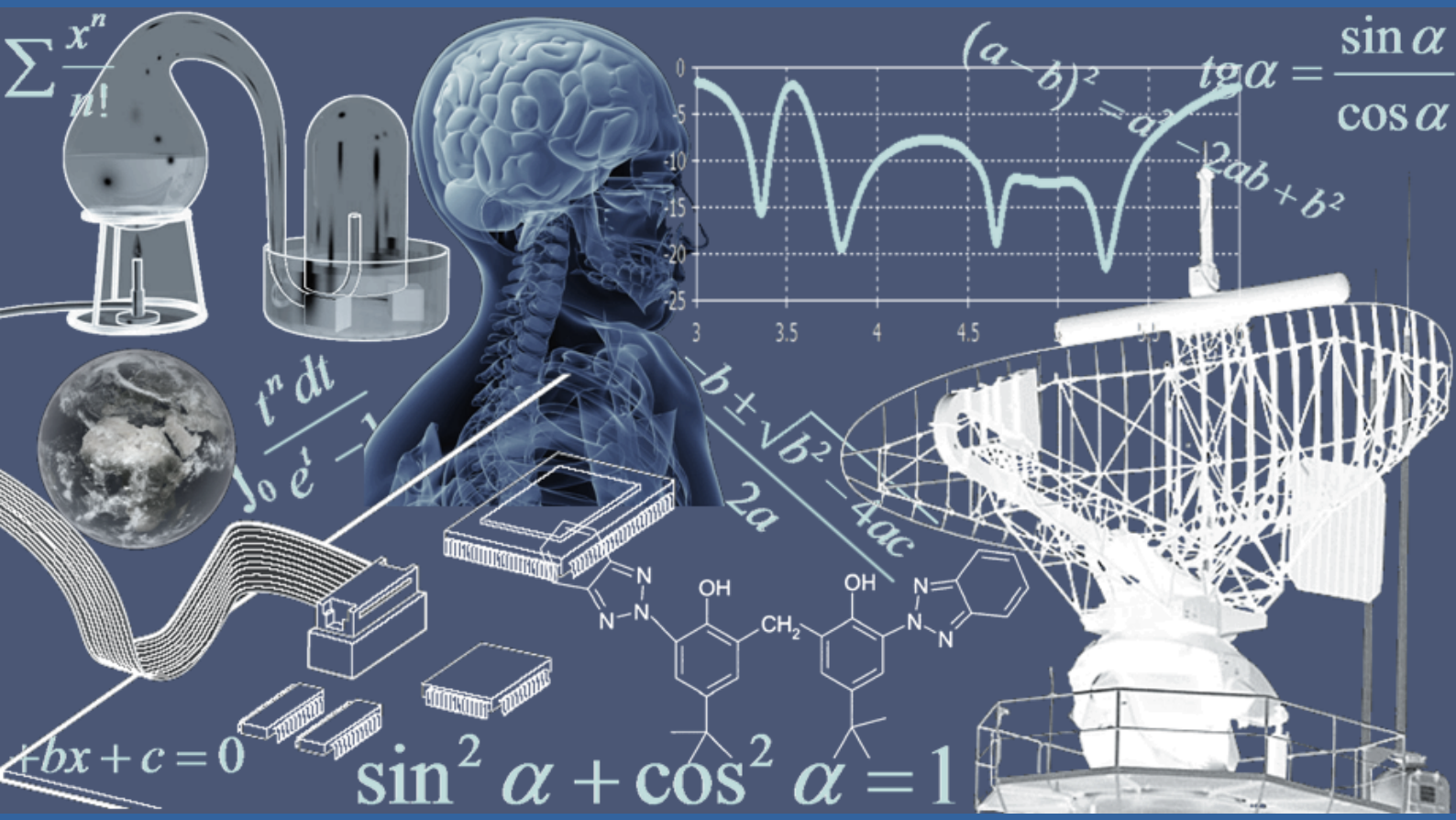
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Implications on Linking Overseas Trainings with Strategic Needs of the 21st Century: A Case Observation of Foreign Students in South Korea

Adilu Mussa Salim[1] and SooBong Uh[2]

[1]Ph.D. Candidate, Korea University of Technology and Education, Republic of Korea

[2]Professor, Korea University of Technology and Education, Republic of Korea

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ABSTRACT: This study attempts to explore the aspect of International Human Resource Development with reference to foreign students currently enrolled in Universities in South Korea in terms of the role human resource development helps the country of origin of the international students and how international students can link the International Human Resource Development goals to their home country's strategic needs. The study, studied the responses of 46 international students randomly selected from 76 responses among the 83 returned survey questionnaires. The surveys contained information about the foreign scholars' attitudes, perceptions and motivations with respect to the training received or receiving in foreign countries and the connection to the strategic goals from their home country. The results of the study offer meaningful assistance to the suggested assumptions showing that attitudes, perceptions and motivations have significant influence not only in the choices individuals made with regard to studying in a foreign country but also in the accuracy of familiarity and understanding of the strategic needs of the country of origin. Greater part of the participants has seen their training as important to their countries to facilitate economic development. The findings may have remarkable contribution to HRD professionals, funding agencies and training facilitators.

KEYWORDS: Attitudes, International Students, Perception, South Korea, IHRD, Effectiveness.

1 BACKGROUND

There is no doughty that, in order to compete successfully in the current global professional arena more nations and organizations are focusing on the role of human resources as a critical part of their core competence and vital source of competitive advantage. The focus has become not only for competence but also for creating capacity to adapt effectively to newly multicultural settings of business, for creating strategies to more effective globalization and for rethinking of the traditional ways of developing human resources.

Influential and growing, the discipline or field of human resource development has come to be defined as the framework useful in helping human labour develop knowledge, abilities, and personal and organisational skills. Due to the continued regard of human resource as the most useful resource in an organisation, the human resource development framework has come to be seen as a significant source of sustainable competitive advantage in an organisation or nation. The continued development in internationalization and globalization has made it important for nations and organisations to operate effectively in order to be competitive, sustainable, and to keep up in terms of development. The emergence of the global economies has led to reduced differentiation between nations and organisations especially in the world of business as they have both been forced to work together in order to mediate the differences brought into the international arena. International Human Resource Development, which henceforth will be referred to as IHRD, has emerged as what mediate the labour needs in the international arena through ensuring that employees are sufficiently trained and developed to meet the global needs (Stahl and Björkman, eds, 2006). This research explores the aspect of IHRD with reference to foreign students in South Korea in terms of the role human resource development helps the country of origin of international students.

Corresponding Author: Adilu Mussa Salim

1.1 GLOBAL PERSPECTIVE OF HUMAN INVESTMENT IN THE 21ST CENTURY

With the rise in globalisation and internationalisation, nations and organisations have been forced to seek competencies to ensure that they improve their international competitiveness and enhance ties between nations. According to Sirageldin (2003), human development as a concept is multidimensional and complex, and this is partly as a result of complexity of human nature, the nature of human interactions as social groups or individuals, and the way people perceive their role in the ecosystem or treat their environment. In terms of human resource development, since human resources are not used in a void, their development is aimed at ensuring that they are best suited to exploit the existing environment. In the 21st century, human capital formation, scientific development, globalization processes and culture have become more internationalized, hence this has expanded the scope of human development to an international one. The cumulative process of globalization which started with interaction and communication among civilization has gained unstoppable momentum that cannot be stopped. Among nations around the world, this has led to increased interdependence, spread of information, emergence of regulatory institutions, and diffusion of finance capital.

Human resource development involves the identification of both the skills needed in the market and the training needs of the people being trained. In the world today where strategic management has become a competitive advantage, the development of human resources needs to be proactive and not reactive. This means anticipating the future needs and making sure that the human labour is developed to meet such needs. In order to successfully train international human resources, there is a need to recognise the differences between international and domestic human resource management. According to (Dowling, Festing and Engle, 2006), these differences are due to employing different national categories of employees and the complexities associated with operating in different countries. This can be attributed to more human resource activities, more involvement in the personal lives of the employees, the need for broader perspectives, broader external influences, increases in the risks the employee is exposed to, and the need to deal with the consequences of locals mixing with expatriates and foreign expatriates.

1.2 IMPACT OF OVERSEAS TRAINEES IN ECONOMY

Globalisation and internationalisation of learning institutions in the world today has led to the advancement of the education industry as countries seek to follow the international standards and trends. As countries seek to become hosts to international students, competition from other countries has forced the level of education offered to rise significantly. This is in addition to ensuring that the levels of training of the human resources are at an international level, hence improving production and competitiveness. Through training overseas, knowledge and skills are shared and transferred faster and more effectively, hence fuelling development at significant speed. This is in addition to the fact that training overseas acts as international relations between the host country and country of origin. Students that gain employment in foreign countries not only contribute to the country's economy but can even decide to invest in their home countries or help their kinsmen, hence a source of foreign exchange earner for the country (Stahl and Björkman, eds, 2006).

Since nations are currently operating in the international economies and markets, ensuring that their manpower meets the competitive skills and training of their international compatriots makes them competitive in the industry. Globalisation has ended the need or organisations and nations to be inward looking; hence looking for approaches to compete effectively with others has taken precedence over others. All nations envision a situation where they can have optimum labour at all times, and the rest exported to earn revenue in the international markets. This competition for effective labour, of the training institutions, and of nations and organisations has led to effective global training of human resources (Dowling, Festing and Engle, 2006).

1.3 GENERATING PEOPLE ADVANTAGE IN SOUTH KOREA

Apart from moderately growing number of international students in the country, there are still few international or foreign learning institutions in the country. With the university sector in the country being regarded as relatively incapable of competing in the international arena, according to OECD (2012), the recognition of introducing foreign learning institution in the country was identified during the research. The reason behind this was that if the educational sector in South Korea needs to compete effectively internationally, it should be effectively exposed to the variables and competition in the international arena. The logic behind this is that the nation should not use a tunnel vision with regard to education and labour needs (OECD, 2012; Varma and Budhwar, 2013).

The most serious problem facing South Korea in terms of education and human resources is the high levels of brain drain without an equal or higher compensation with foreign students. Since international learning has been identified as being influenced by the standards of learning, it has been deduced that a significant number of South Koreans that seek out international learning and training are influenced by the reality or perception of their institutions and countries of destination as more equipped that South Korea or learning institutions in the country to meet their educational and skills needs (OECD, 2012; Organisation for Economic Co-operation and Development, 2011).

2 MATERIAL AND METHODS

2.1 THE FRAMEWORK

The study involved the use of both the primary and secondary sources of data. The secondary data was used to establish the theoretical framework for the study, establish the background of human resource development and IHRD, and understand the labour and human workforce needs and their impacts on the economy. Attaining secondary data involved the use of both library books and references together with internet resources. Although a significant amount of information was found on human resource management and development, just a few sources were found about the subject in the international arena. In order to ensure the reliability and validity of the secondary information obtained, only scholarly articles, journals and books were consulted. Purposive sampling was used in the case of IHRD where the information sources with the pertinent information were sought. Due to the need for understanding the dynamics of human resource in the global scope, a random sampling was conducted on the significantly large amount of sources found on the topic (Hathaway, 1995).

Information from the secondary sources was compared for consistency, differences, and gaps. The results of the findings regarding the significance of human resource development in the international labour industry formed the basis under which the case observation of South Korea was examined. For primary research, on the other hand, involved the use of questionnaire survey. 100 questionnaires were sent to 10 tertiary learning institutions that were purposely sampled for the reason that they had international students. 10 questionnaires were sent to each institution through 10 foreign students with the request that the questionnaires be filled and returned to the researcher by email. Only 83 questionnaires were returned after three weeks, and after a further analysis of the questionnaires, it was found out that 7 were not completely filled, hence were eliminated from the population. Of the remaining 76 questionnaires, a sample of 46 questionnaires was randomly selected. The randomness made it possible to generalize the study to represent great part of foreign students studying in South Korea (Hathaway, 1995).

2.2 GUIDING ASSUMPTIONS

I. It was assumed that just like in the national or local human resource management and development, human resources in the global arena are just as important, and a significant source of competitive advantages for organisations and organisations. This helped in the review of the background and in the introduction of the issue of human resource development in the international arena.
II. Effectiveness depends on or can be predicted on the student's attitudes, perception and belief of overseas training programs together with the understanding and familiarity of his/her home country's strategic needs.
III. The accuracy of familiarity and understanding of the strategic needs of a country depends on the attitude and perceptions.
IV. Respondents were truthful in their responses

2.3 THE POPULATION REACTION

As with majority of studies, according to the secondary data, the respondents were wary of the intentions of the study and the possible consequences were they to be involved in the study. According to the reports from 8 different tertiary learning institutions sampled, it was necessary to address the fears of the potential respondents before they agreed on becoming part of the sample. Guarantees of anonymity and description of the researcher's status, background and competency was introduced and persuaded them to be part of the respondents. The logic behind giving enough information to them was to ensure that the answers were valid and reliable (Hathaway, 1995).

2.4 MORAL CONSIDERATIONS

I. The validity and reliability of the study was observed till the presentation of the factual and actual data collected.
II. Consent was sought before the beginning of the study
III. The identity of the respondents was kept anonymous
IV. The researcher intends to allow access to the results of the study to the general public so that international students can benefit.

2.5 INDIVIDUAL PERFORMANCE IMPROVEMENT

As a researcher, the main focus of during the collection and analysis of data was acquiring an insightful knowledge about the topic, while at the same time observing the intellectual, moral and ethical requirements and obligations of the study. Through observing objectivity, researcher's bias was avoided. The questionnaire was prepared in such a way that same question was asked differently, and the respondent was given independence in making choices. Validity and reliability were the foundations behind which all decisions about the research were based (Hathaway, 1995).

3 RESULTS AND DISCUSSION

3.1 THE SIGNIFICANCE OF STRATEGIC HRD

Strategic human resource development was identified as one of the most significant influences behind the need for people to acquire knowledge, skills and attitudes in other countries. It was identified through the survey that majority of the foreign students in South Korea thought that training and development was essential in ensuring that economic development in their countries of origin was facilitated. Only three respondents in the sample of 46 did not consider this training as essential for economic development, and this was because of the fact that their need to be trained in a foreign country was based on the need to access more employment opportunities. This shows that the majority of responses supported the need to have trained and developed manpower to cater for future manpower needs. Hence satisfy their home country's strategic needs.

The question about whether the decision to earn education in foreign countries was supported by the familiarity and understanding of the country's of origin strategic needs for the skills gained received a positive feedback by the majority of the respondents. This means that an overwhelming majority of the respondents argued that their need for going to foreign countries to earn skills and education was based on the recognition of the problems, situations, and future projections of the situations in their countries. This shows an inclination for not only seeking to ensure that the current problems are resolve but also dealing with future manpower problems in their countries of origin.

3.2 THE PREDICTORS DISTURBING LINKING OF THE TRAINING AND THE NEEDS

I. Attitudes: the reasons behind why the international students seek to study abroad are different and are influenced by a number of factors most of which are not academic in nature. These include the concern about the feelings about other people on the issue, the need to portray a certain image to others, and the desire to follow the current trends. This makes it impossible to identify the skills that would be most suited for such individuals because of the fact that gaining specific skills is not the key motivation for becoming international students.

II. Perceptions about the impact of foreign training on an individual: the issue of unemployment and competitiveness in the employment sector have become common knowledge among many circles. This is in addition to the continued recognition of the problems in the societies in which people live. This has led to people striving to gain competitive advantages academically. With the changes in the world today, existing trends are continually being replaced by newer ones. This has led to keeping training and labour needs out of synchronisation, hence making training lag the needs in the industry.

3.3 TRAINING NEEDS IN THE PERCEPTION OF TRAINEES

The research sought to understand the attitudes, perceptions, and motivations of foreign scholars in seeking for education in foreign countries. Majority of the respondents saw their training and development as important to their countries to facilitate economic development. Although some thought of the opportunity to travel abroad as an opportunity

to satisfy their curiosity, the level to which the respondents agreed to this assertion varied. The content of the training was also another variable surveyed, and majority believed that they were more fulfilled when they were confident of the content of the training. The need for studying abroad was made more appealing because of the challenge involved in understanding the problems in their individual countries, hence the need to seek further and specialized training, and the value the foreign training would add on their certificates.

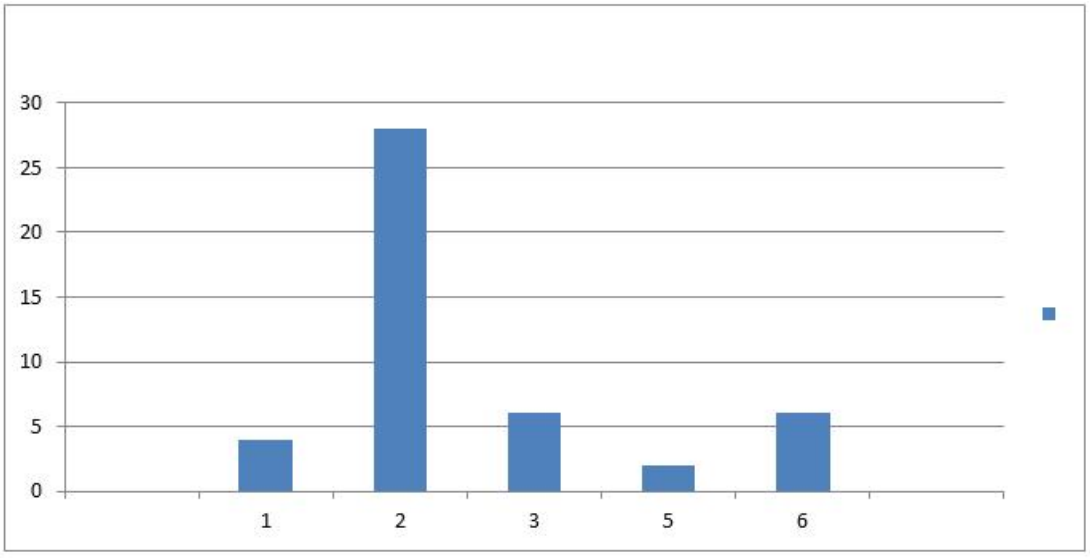
3.4 DESCRIPTIVE STATISTICS

Attitudes, perceptions, and motivations were identified as having significant influence in the choices people made with regard to studying abroad. While majority of the respondents argued in support for self betterment and improvement and development of their countries of origin as the main influence behind their studying abroad, others argued that the reasons for seeking skills and knowledge abroad was based on personal reasons. Despite this, however, majority of them indicated that their countries of origin should take precedence over their individual goals in terms of the choices made when seeking training abroad. This can be seen in the frequency table results table 1. The table indicates that the majority of the respondents (60%) said the reason for studying abroad is for facilitating the economic development in their country of origin.

Table 1: Distribution of respondents with regard to the reason for studying abroad being facilitation of economic development in their countries

Variable options (coded)	Frequency	Percent	Valid Percent	Cumulative Percent
1	4	8.7	8.7	8.7
2	28	60.9	60.9	69.6
3	6	13.0	13.0	82.6
5	2	4.3	4.3	87.0
6	6	13.0	13.0	100.0
Total	46	100.0	100.0	

A column chart showing the frequency of the results can be shown below. Both the table and the chart show that the need to facilitate economic development, represented by number 2, was recognised by the majority of the respondents as the main reason for international human resource training and development. Reduction of a country's reliance on other countries, represented by number 5 with 4.3%, had the least responses. This can be said to be the case because the respondents recognised the fact that the international community is based on interdependence among the interacting countries.



In terms of the relationship between human resource development and strategic needs, majority of the respondents agreed with the fact that training is intertwined with strategic management. This was in addition to recognising the need for training and development as a way to become more proficient workers. Although these respondents were studying in a foreign country, majority of them admitted that their desires for training and development are in line with the development agendas of the countries of their origin. This can be seen in the 6 pie charts of appendix 1 where the respondents were asked whether they agreed or disagreed with the reasoning that human resource training and development is important. An overwhelming majority agreed, and are represented by the portions of the pie charts with the green colour or key 2

Pie chart1 in appendix 1 represents the results of the respondents on the importance of training and development on efficiency and proficiency of individuals, and the quotient of those agreeing with the importance of training and development on efficiency and proficiency of individuals is the larger if the two. Pie chart2 indicates the relationship between the desire for international human resource training and development and development agendas for the country of origin, and according to the chart, many respondents argued that a positive relationship exist between the two. In the pie chart3 shows the responses concerning whether the role of training in terms of creating, gaining, and sharing of skills and knowledge is influenced by human capital investments, the majority of the respondents agreed with the statement. Although a few respondents, 4, did not answer the question, more than three-quarters of the respondents agreed that human capital investment affects the role of training. This pie chart4 shows the relationships between the competition for labor on the global scope, and the impact this has on the capacity strategies and priorities of the national workforce. Majority of the respondents indicated that globalization and increased competition for workforce has led to increased concern about national workforce. This means that nations have recognized the competition for competent workers, hence have sought for domestic workers to be adequately trained to meet the international standards.

In the Piechart5, we can see the responses on whether countries should share knowledge and skills and help one another in the identification of the HR needs in order to mutually benefit, and for international welfare. The majority of the respondents agreed to this, and this can be attributed to the recognition of the high degree of interdependence in the world today. Pie chart 6, represents the responses on what international students should prioritize: their countries of origin or themselves. Almost two-thirds of the respondents argued that the needs of the countries should take precedence over the needs of the individuals. Results of further analysis are included as appendix2.

Table 2: Summary statistics on the respondents' rating on Attitudes, perceptions and Motivation

Statement linking to Attitudes, Perceptions and Motivation	Category of responses	Freq.	Mean	Med.	Mode	Std. dev.
Training and Development are extremely important for my country to:	(a) Create more Jobs	4(8.7)	1.93	2	2	.250
	(b) Facilitate economic development	28(60.9)				
	(c) Build career path for me within my country	6(13)				
	(d) Set an example for other countries to follow	2(4.3)				
	(e) Reduce reliance on	6(13)				
	(f) All of the above	0				
	(g) Other	0				
I think it is important to have the opportunity to satisfy my own curiosity when attending training course abroad.	Strongly disagree	1(2.2)	3.533	4.00	4.00	1.09959
	Disagree	11(23.9)				
	No opinion	3(6.5)				
	Agree	23(50)				
	Strongly agree	7(15.2)				
I feel most fulfilled when I feel confident about the content in the training am attending	Strongly disagree	1(2.2)	3.83	4.00	4	.877
	Disagree	3(6.5)				
	No opinion	7(15.2)				
	Agree	27(58.7)				
	Strongly agree	8(17.4)				
The reason that I am serious to expand my knowledge/skills particularly through a program outside my country is:	(a)Because it's interesting to learn more about the nature of this world	1(2.2)	2.311	2.000	2.00	.51444
	(b) Because it's a challenge to really understand how to contribute in resolving my country's problems	29(63.0)				
	(c)Because a good grade in a foreign training program will look positive on my record	15(32.6)				
	(d)Because I want others to see that I am really intelligent	0(0)				
The option above is better because:	(a) Others might think badly of me if I didn't.	0(0)	2.46	2.00	2	.808
	(b) A solid understanding of my country's problems is important to my academic growth as well	34(73.9)				
	(c) I would feel proud of myself	3(6.5)				
	(d) I just feel like it's a good way to improve my understanding	9(19.6)				
	(e) It creates goodwill	0(0)				

The table 2 shows that respondents rated their idea with respect to perceptions, attitudes and motivation as generally can shown by the frequency percent in brackets given in the table. For example on the reason that training and development are extremely important for their country is mainly shown by respondents to facilitate economic development, with frequency of 28 (60.9%), this shows that the majority of the respondents perceive this way. The mean of 1.93, median of 2 and mode of 2 further support their predictability, and the small standard deviation of 0.250 implies that respondents had similar ratings of themselves with regards to their view on the importance training and development for their countries.

On whether their thinking is to have the opportunity to satisfy their own interests when attending training course abroad, the frequency of 23(50%) indicates that majority of them agree as opposed to 11(23.9%) who disagree. The standard deviation of 1.09959 which is relatively smaller implies that respondents were consistent with their responses regarding their interest in attending course abroad. However, the measures of central tendency where the mean is 3.533, median is 4 and mode is 4 are in agreement with the fact that they are in consistent with their interest in attending course abroad.

On the issue of feeling fulfilled on the content of the training program, 27(58.7%) agree that they are satisfied with the content and that they are self-assured with mean of 3.83, median 4 and mode of 4. The standard deviation of 0.877 indicates that most respondents had relatively similar feeling. Regarding the reason on their urgency to expand their skills through a program abroad, majority 29(63.0%), sensed that is because it's a challenge to really understand how to contribute in resolving their country's problems. The measures of central tendency are in agreement with this fact, where the mean was 2.311, median 2 and mode 2 Respondents results showed a standard deviation of 0.51444, which is small and implying that most respondents had similar reasoning on the variable. Agreeing to the results on the option that , their reason to seek expanding their skills abroad is because it's a challenge to really understand how to contribute in resolving their country's problems, majority 34 (73.9%) of the respondents added that the solid understanding of their country's problems is important to their academic growth as well. The mean of 2.46, median 2 and mode of 2 further indicate this predictability while the very small standard deviation of 0.808 indicates that the respondents had similar views on this variable.

Table 3: Summary statistics on the respondents' score on variables related to HRD, Familiarity & Strategic needs

Statement linking to HRD, Familiarity & Strategic needs	Category of responses	Freq.	Mean	Med.	Mode	Std. dev.
Training & development plans help maintaining job skills so that an individual can be proficient in his/her work	Disagree	3(6.5%)	1.93	2.00	2	.250
	Agree	43(93.5%)				
My training & development desires are associated to the current development agendas of my country	Disagree	5(10.9%)	1.89	2.00	2	.318
	Agree	40(87.0%)				
The current Human Capital Investment influences the role of training from, skills and knowledge gaining to creating and sharing knowledge.	Disagree	3(6.5%)	1.93	2.00	2	.258
	Agree	40(87.0%)				
As competition for talents is increasingly global, national workforce-capacity strategies and priorities become apparent	Disagree	2(4.3%)	1.95	2.00	2	.211
	Agree	42(91.3%)				
Countries should Share Knowledge and skills and help each other to identify demand and supply side of skills for mutual benefits and international welfare	Disagree	2(4.3%)	1.96	2.00	2	.208
	Agree	43(93.5%)				
Perceived needs by countries should be more influential factors encourage individuals to opt for further training and development than perceived needs by themselves	Disagree	14(30.4%)	1.7	2.00	2	.465
	Agree	32(69.6%)				

Table 3 above shows that respondents rated their level of understanding with respect to the extent with which the linking of human resource development, their familiarity with it, and the connection to the strategic needs from their home countries.

For example on whether their training & development desires are associated to the current development agendas of their country, majority 40(87.0%) have shown agreement as against the minority 5(10.9%) who disagreed. This is further supported by the mean of 1.89, median of 2 and mode of 2 with the small standard deviation of 0.318 which implies that respondents had similar ratings of themselves with regards to the variable

On whether training & development plans help maintaining job skills so that an individual can be proficient in his/her work, 43(93.5%) decided to agree with the statement and only regularly publish while only 3(6.5%) disagreed. The mean of 1.93 median of 2.00 and mode of 2 additionally supports this to this agreement. Regarding whether the current Human Capital Investment influences the role of training from, skills and knowledge gaining to creating and sharing knowledge the majority of respondents 40(87.0%) confessed as opposed by only 3(6.5%). The measures of central tendency are in arrangement with the situation, displaying the mean of 1.93, median of 2.00 and mode of 2.The consistency in opinion is shown by the relative smaller standard deviation of 0.258.The regularity on the statement that competition for talents is increasingly global, and that national workforce-capacity strategies and priorities become apparent, the respondents have shown 42(91.3%)of agreement and only 2(4.3%) disagreement. 43(93.5%) also agreed that countries should share knowledge

and skills and help each other to identify demand and supply side of skills for mutual benefits and international welfare. Only 2(4.3%) disagreed on this statement. Finally, respondents shown agreement on the statement that, perceived needs by countries should be more influential factors encourage individuals to opt for further training and development than perceived needs by the students themselves. 32(69.6%) of the respondents agreed as against 14(30.4%) who disagreed.

4 CONCLUSION

4.1 THE DEMAND FOR HUMAN POWER

Quality of programmes of education was identified as one of the most significant predictor of the host countries that students choose their origin countries for. According to Organisation for Economic Co-operation and Development (2011), international students are increasingly selecting study destination based of the level and quality of education offered. With the continued invention and innovation, potential students have access to large amounts of information regarding learning institutions, both local and international, that offer education to international students. In the past, the level of brain drain in South Korea has outweighed its position as a host. According to Guruz (2011), South Korea is placed in the same range as China, Greece, Morocco, Hong Kong, Malaysia, Turkey, Indonesia, Japan, Mexico, and India as some of the major countries of origin of international students. With the high level of brain drain, and the increased changes in demographics in the country, it is projected that the number of people of university age in the country will reduce by a third by 2030. This presents a serious need for South Korea to either turn the tide of brain drain or increase the popularity and choice of South Korea as the host destination for international students (OECD, 2012). This is because of the need for the country to ensure that the labour needs in the country are catered for both in the present and future.

Although South Korea is among the top countries of origin, its quotient as a host to international students is below the 8.7% average instituted by the OECD. In 2009, the number of international students in tertiary education in the country was just 1.6%. This was in relation to the 5% number of foreign students that originated from the country in the year. About 7% of this quotient was made up of South Korean tertiary students, hence indicating the significance of the brain drain in the country. In the world today where the labour industry has become international, being identified as a potential source of international students makes South Korea vulnerable to exploitation by other nations. Competition for local labour on an international scale, as is the case with any issue of demand and supply, will give the employees more bargaining power, hence affects the labour market dynamics in the country. With labour being a significantly influential factor of production in the country, there is a need to ensure that strategic management of labour is managed in the country in order to ensure that the country continues competing healthily in the international markets (OECD, 2012; Organisation for Economic Co-operation and Development, 2011).

4.2 POTENTIAL IMPLICATIONS AND SIGNIFICANCE (IN KOREA)

As identified by Organisation for Economic Co-operation and Development (2011), the quality of education programmes offered in a country or institution is one of the most significant factors that determine the choices of the students. This is especially the case with the increased number of entries of new institutions in the market. Considering the low level of foreign students in the country, a strategic planning involving the utilisation of foreign students for the betterment of South Korea would first involve attraction of such students into the country's learning institutions (Organisation for Economic Co-operation and Development, 2011).

Since the quality of programs offered has been identified as one of the attractions in the international education, the strive by the nation to match or supersede the global standards in terms of the quality of learning programs would not only attract the foreign students but also improve the levels of learning in the country. Since the integration of cultures and populations in the global markets and economies has led to more interactions among culturally differentiated persons, the improvement of standards of learning would improve education in the country holistically. This is especially because of the fact that the local students would have access to the high quality of education offered internationally. This would increase enrolment in learning institutions as the high level of learning programs become more identifiable (Organisation for Economic Co-operation and Development, 2011).

The improvement of education programs in the country might be the eventual answer to the problem of brain drain and the increased popularity of the country as the 'country of origin' of international students. This is because of the fact that with the identification of South Korea and the learning institutions in the country as capable of meeting the needs of the students, these students' motivation to seek education elsewhere will be reduced. This will lead to the development, retaining, and maintaining of a qualified workforce that is ready to meet the needs of the country.

Having foreign educational institutions in the country that are proficient in manpower development will ensure that the goodwill of the country in terms of educational standards rises. This will attract more international students into the country as they seek to make use of the emerging educational proficiencies and capacities. These international organisations will make sure that the education in South Korea is comparable to that in other international countries they operate, hence mapping the country internationally in terms of education standards. Such institutions will also ensure that the need for South Koreans to seek education elsewhere is reduced. As foreign students and institutions continually enter the South Korean market, the level of financial returns to the South Korean government from taxes, fees, and other expenses will increase.

Most students, especially through that are not from the affluent families, work at one time or another when they are in colleges. This is also the case with international students; hence the increase in international students in South Korea will lead to an increase in untapped workforce. Through innovative incentives such as apprenticeship and internship, the government can make working in South Korea seem and become interesting and attractive to the international students as well as the locals. As a result, this can lead to a growing labour supply of qualified human labour, and can also cause retention of the foreign students in the country, hence reversing the brain drain the country is currently experiencing. Well developed and placed employees are equitable to increased production, hence development. This will not only improve the economy of the country but also improve the competitiveness and positioning of the country internationally.

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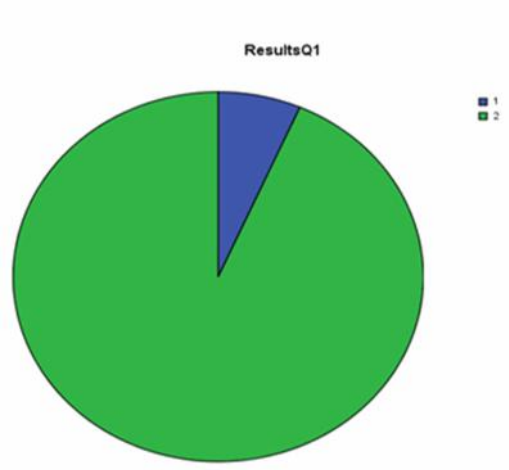
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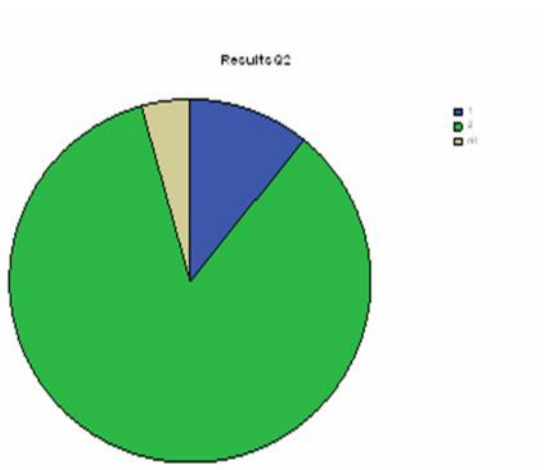
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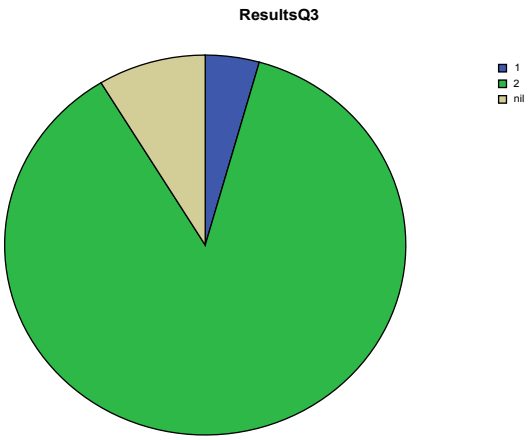
APPENDIX 1

Pie chart 1

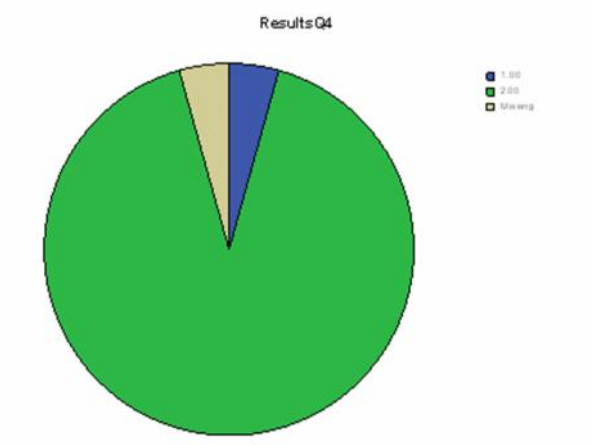


Pie chart 2

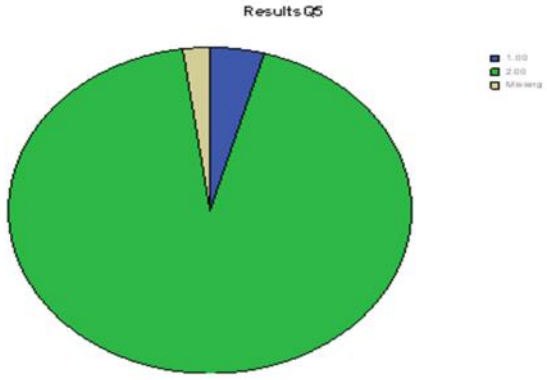




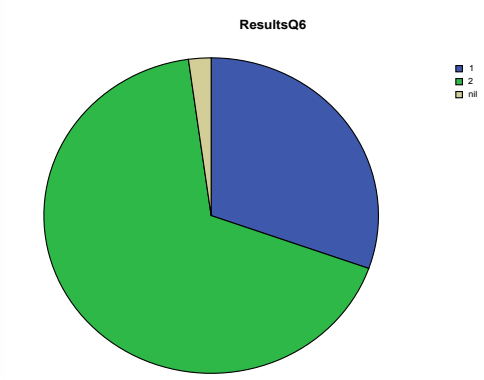
Pie chart 3



Pie chart 4



Pie chart 5



Pie chart 6

APPENDIX2:

Attitudes, Perceptions and Motivation Statistics

		ResultsQI	ResultsQII	ResultsQIII	ResultsQIV	ResultsQV
N	Valid	46	45	46	45	46
	Missing	0	1	0	1	0
Mean		2.70	3.5333	3.83	2.3111	2.46
Std. Error of Mean		.222	.16392	.129	.07669	.119
Median		2.00	4.0000	4.00	2.0000	2.00
Mode		2	4.00	4	2.00	2
Std. Deviation		1.504	1.09959	.877	.51444	.808
Variance		2.261	1.209	.769	.265	.654
Skewness		1.450	-.572	-1.092	.310	1.334
Std. Error of Skewness		.350	.354	.350	.354	.350
Range		5	4.00	4	2.00	2
Minimum		1	1.00	1	1.00	2
Maximum		6	5.00	5	3.00	4
Sum		124	159.00	176	104.00	113
Percentiles	25	2.00	2.0000	3.75	2.0000	2.00
	50	2.00	4.0000	4.00	2.0000	2.00
	75	3.00	4.0000	4.00	3.0000	3.00

Human Resource Development, Familiarity, and Strategic Needs Statistics

		Results-Q1	Results-Q2	Results-Q3	Results-Q4	Results-Q5	Results-Q6
N	Valid	46	45	43	44	45	46
	Missing	0	1	3	2	1	0
Mean		1.93	1.89	1.93	1.95	1.96	1.70
Std. Error of Mean		.037	.047	.039	.032	.031	.069
Median		2.00	2.00	2.00	2.00	2.00	2.00
Mode		2	2	2	2	2	2
Std. Deviation		.250	.318	.258	.211	.208	.465
Variance		.062	.101	.066	.044	.043	.216
Skewness		-3.642	-2.561	-3.501	-4.520	-4.575	-.879
Std. Error of Skewness		.350	.354	.361	.357	.354	.350
Range		1	1	1	1	1	1
Minimum		1	1	1	1	1	1
Maximum		2	2	2	2	2	2
Sum		89	85	83	86	88	78
Percentiles	25	2.00	2.00	2.00	2.00	2.00	1.00
	50	2.00	2.00	2.00	2.00	2.00	2.00
	75	2.00	2.00	2.00	2.00	2.00	2.00

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Dynamics of a Cannon Barrel-Recoil Mechanism with Nonlinear Air-Springs

Galal A. Hassaan

Department of Mechanical Design & Production,
Faculty of Engineering, Cairo University,
Giza, Egypt

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ABSTRACT: The objective of this paper is to investigate the dynamics of the barrel assembly-recoil mechanism of military cannons when using air springs and a constant damping coefficient hydraulic damper in their recoil mechanisms. The elastic characteristics of the air spring is nonlinear and the recoil mechanism orientation introduces extra nonlinearity to the dynamic model of the system. An extremely nonlinear model of the barrel assembly is derived and solved using Runge-Kutta 4 method to provide the dynamic response of the barrel assembly upon firing. The simulation results using the data of a Howitzer M114 cannon are presented for recoil mechanism orientation ≤ 50 degrees. The performance of the recoil mechanism is evaluated through the minimum and maximum displacements of the barrel assembly and the settling time of its response upon firing. The effect of the number of air springs on the performance of recoil mechanism is investigated. The analysis shows that it is possible with air springs to obtain barrel assembly response similar to that of a critically damped second-order system. It is possible with proper selection of the recoil assembly parameters to decrease the maximum barrel displacement to 54 mm and the settling time to less than 2 seconds.

KEYWORDS: Cannon recoil mechanism, Barrel assembly dynamics, Air springs, Nonlinear dynamic model, Barrel response upon firing, Recoil mechanism performance.

1 INTRODUCTION

Researchers pay deep attention to the analysis and design of artillery recoil mechanisms. Hogg (2000) described about 300 artillery pieces from 1900 to 2000 with full dimensions, mass, ammunitions and range details, country of origin and muzzle velocity [1]. Ahmadian, Appleton and Norris (2002) used a MR damper to control the recoil dynamics. The suggested technique for using MR dampers for free out of battery. They used a recoil demonstrator including a 0.5 caliber gun and a MR damper [2]. Slizys (2005) studied the dynamic characteristics of the plane motion of the recoil of the automatic rifle AK-4. He formulated the mathematical models of the recoil plane motion and obtained its dynamic characteristics [3]. Choi, Hoo and Wereley (2005) examined the use of a double adjustable MR damper to produce high damping force over a high speed piston range. They proposed an on-off control algorithm to improve the shock mitigation of the passive MR gun recoil system [4]. Bao-lin (2006) studied the use of a gun recoil MR damper for a gun test application. He constructed a one-dimensional parallel-plate laminar flow model for the damper based on Herchel-Bulkley shear model and obtained the damping characteristic curves for the damper and evaluated its performance [5]. Lin et.al. (2009) derived a mathematical model for the recoil force during firing. They claimed that their results provide a clear understanding for designing the recoil mechanism and improve its performance [6]. Xue-zheng, Jiong and Hong-sheng (2010) designed a large-stroke MR impact damper which can work effectively at the large velocities occurring in artillery recoil. They showed that the MR damper is able to effectively control the recoil dynamics in terms of recoil force and stroke [7]. Gimm, Cha and Cho (2012) investigated experimentally the behavior of shock vibration for a medium caliber gun barrel. They applied the numerical modal analysis, signal processing and shock response analysis techniques in their analysis [8]. Ting, Lu and Rui (2013) designed a deflection system for the breech block and anti-recoil mechanism. They realized the technical indicators detection under the recoil process using advanced hydraulic control technology [9].

Air springs find great attention from a lot of researchers because of its simple design and control. Presthus (2002) developed a mathematical model for air springs. He determined five of the model parameters using thermodynamics and

Corresponding Author: Galal A. Hassaan

fluid dynamic constitutions. He presented the air spring stiffness as function of the vibration frequency [10]. Wei-min, Can-hui, Ya-ling and Yan-sha (2004) studied the deformation and static characteristics of an air spring used in automotive suspension. They compared the characteristic obtained by finite elements to that obtained experimentally [11]. Deo and Sah (2006) proposed a design for a pneumatic automotive suspension system. They showed that the air spring stiffness is function of pressure, volume and temperature [12]. Silva and Costa (2008) developed empirical models relating force acting on the air spring to its deflection and internal pressure for 4 different springs [13]. Koizumi et. al. (2009) proposed an air suspension system coupled with a rotary damper to attain low dynamic stiffness and high damping coefficient. They attained an extremely low dynamic stiffness at a specific frequency [14]. Zhang and Yang (2010) established a nonlinear model for a pneumatic vibration isolator considering the volumetric compressibility of air. They showed that the system has a strong nonlinear characteristics [15]. Todkar and Joshi (2011) discussed the effect of the variation of mass ratio, air damping ratio and air spring stiffness on the motion transmissibility at the resonant frequency of the main system. They designed a control system to vary the air pressure in the damper of the absorber system [16]. Robinson (2012) investigated the use of a pneumatic suspension system containing an air spring, air flow valve and an accumulator where the air spring and accumulator provide the spring characteristics and the valve provides the damping characteristics [17]. Chen et. al. (2013) formulated a nonlinear model of a multi-axle semi-trailer with longitudinal-connected air suspension based on fluid mechanics and thermodynamics. They showed that the influence of air line diameter on load-sharing is more significant than that of he connector [18]. Razdan, Bhave and Awasare (2014) used an active pneumatic suspension with control strategy based on mass flow control for a commercially manufactured small car. They concluded that the active suspension using velocity feedback as the control strategy has better performance at resonance [19].

2 ANALYSIS

The dynamic system of any cannon-recoil mechanism dynamic system is considered as a mass-damper-spring system. Fig.1 shows a typical Howitzer M114 155 mm cannon model [20].



Fig.1 The Howitzer M114 155 mm cannon [20].

The equivalent dynamic model is shown in Fig.2 for the barrel assembly and the recoil mechanism.

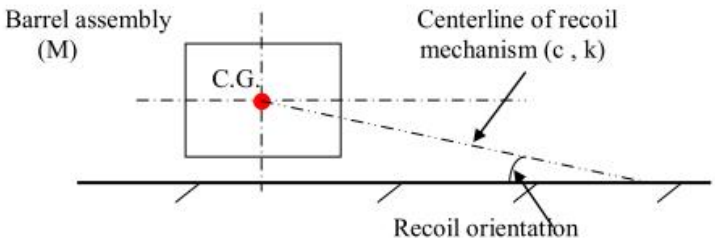


Fig.2 Cannon equivalent dynamic system.

The barrel assembly has a center of mass, G that is translates horizontally by a dynamic motion x. The recoil elements are joined to the barrel assembly and the main cannon chassis secured to the ground and has an original orientation θ_o with the ground. As the gun fires, the barrel assembly moves in the opposite direction of the projectile horizontal motion component with initial velocity depending on the projectile momentum and barrel assembly mass.

The recoil mechanism takes this barrel assembly momentum and tries to return the barrel assembly to the original position before firing to start a new firing cycle. The motion of the equivalent dynamic system upon firing is illustrated in Fig.3.

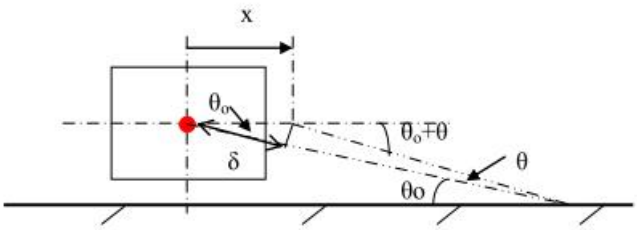


Fig.3 Dynamic system motion.

The dynamic system has the motions and orientation:

x: dynamic motion of the barrel-assembly center of mass (horizontal).
δ: dynamic deflection of the recoil elements.
θ: dynamic orientation of the recoil elements.
$\theta_o+\theta$: new orientation of the recoil mechanism centerline.

The recoil elements dynamic deflection δ is related to the barrel assembly motion x through the geometrical relation (see Fig.3):

$$\delta = x\cos\theta_o \quad (1)$$

The orientation change θ is related to the motion x through (see Fig.3):

$$\theta = \sin^{-1}\{x\sin\theta_o / (L_o - x)\} \quad (2)$$

where L_o = initial length of the buffer elements (dampers & springs).

The dynamics of the barrel assembly-recoil mechanism depend on its differential equation. The differential equation depends on the characteristic nature of the buffer elements and its orientation angle. Fig.4 shows the free body diagram of the barrel assembly.

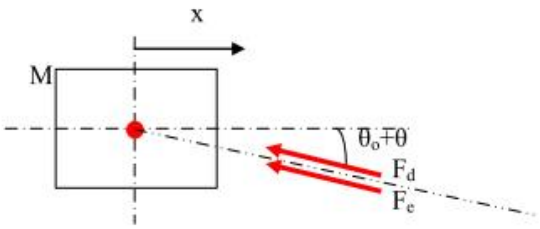


Fig.4 Free body diagram of the barrel assembly.

Using the free body diagram of Fig.4 and the second-law of motion, the differential equation of the barrel assembly of dynamic motion x is:

$$Mx'' = -F_d\cos(\theta_o+\theta) - F_e\cos(\theta_o+\theta) \quad (3)$$

Where: M = barrel assembly mass in kg,
$x'' = d_2x/dt^2$ = barrel assembly acceleration (m/s^2)
F_d = damping force of the hydraulic damper (N).
F_e = elastic force of the recoil mechanism spring.

The damping force F_d of the hydraulic damper used in the present study depends on the damper velocity (dδ/dt). The damping characteristics of a hydraulic damper is usually nonlinear and depends on the direction of motion of the damper piston. Since this study focuses on the effect of using air springs on the dynamics of the cannon-recoil mechanism, the damping coefficient of the recoil mechanism hydraulic damper is assumed constant at an average value in the forward or reverse strokes. Using the data of Polach and Halzman [21], the average damping coefficient of the hydraulic damper is:

And

$$\left.\begin{array}{ll} C_{av1} = 6239 \text{ Ns/m} & \text{(positive velocity)} \\ C_{av2} = 1405 \text{ Ns/m} & \text{(negative velocity)} \end{array}\right\} \quad (4)$$

The elastic characteristics of the air springs suggested for this engineering application depend on the air pressure inside the spring and the spring deflection. A typical air spring characteristics are shown in Fig.5 for spring displacement up to 100 mm and air pressure in the range 1.2 to 3.5 bar [13].

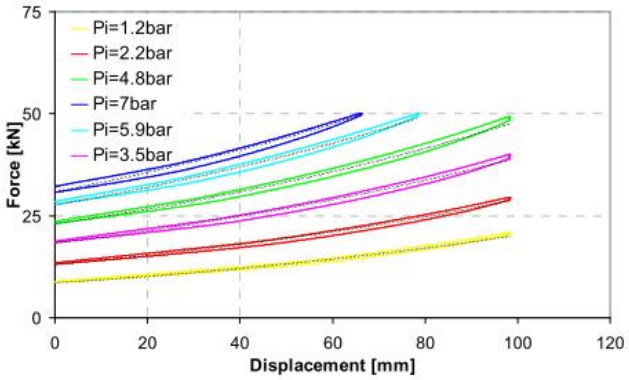


Fig.5 Air spring characteristics [13].

For the computer-aided analysis of the cannon barrel-recoil dynamics, the following mathematical models are fitted by the author to the data in Fig.5. The models are second-order polynomials with parameters depending on spring air pressure . The model takes the form:

$$F_e = a_1 \delta^2 + a_2 \delta + a_3 \quad (5)$$

The parameters and correlation coefficient of the model in Eq.4 are given in Table 1 as obtained by MATLAB using its command "*polyfit*" [22].

Table 1: Air spring parameters

Parameter	1.2 bar air pressure	4.8 bar air pressure	7 bar air pressure
a_1	0.0000670163	0.0012237762	0.001904761905
a_2	0.0525291370	0.1367132860	0.144047619050
a_3	8.9825174825	23.42657342657	32.24999999
Correlation coefficient	0.9989	0.9980	0.9966

Now, the damping force acting on the barrel assembly is:

$$F_d = C_{av}\, \delta' \quad (6)$$

Combining Eqs.1 and 6 gives:

$$F_d = C_{av}\, (\cos\theta_o)\, x' \quad (7)$$

The elastic force now as function of the dynamic motion x is:

$$F_e = a_1(\cos\theta_o)^2 x^2 + a_2 \cos\theta_o x + a_3 \quad (8)$$

Combining the Eqs. 3 through 8 gives the differential equation of the barrel-recoil system as:

$$Mx'' + F_d \cos(\theta_o+\theta) + F_e \cos(\theta_o+\theta) = 0 \quad (9)$$

3 BARREL RECOIL DYNAMICS

The dynamics of the barrel-recoil mechanism of the cannon are defined by solving Eq.9 which is extremely nonlinear. The procedure is as follows:

- Transfer the second-order homogeneous equation of Eq.9 to two first-order homogeneous equations.
- The mathematical tool for this is using state variables approach to build a new state model for the system.
- Use any numerical technique to solve the state model and get the dynamic system response for a specific initial conditions.
- MATLAB can be used to apply Runge-Kutta 4 technique to solve the state model using its command "*ode45*" [23].
- The dynamics can be evaluated for different recoil mechanism orientation θ_o since it has a great effect on the dynamic system characteristics.

The state model of the barrel assembly-recoil mechanism is derived by defining the state variables x_1 and x_2 as:

$$\left.\begin{aligned} x_1 &= x \\ x_2 &= dx/dt = x_1' \end{aligned}\right\} \quad (10)$$

Using all the above derived equations, the state model of the dynamic system is:

$$\left.\begin{aligned} x_1' &= x_2 \\ x_2' &= -(F_d/M)\cos(\theta_o+\theta) - (F_e/M)\cos(\theta_o+\theta) \end{aligned}\right\} \quad (11)$$

And

Where:

$$F_d = C_{av}\cos\theta_o\, x_2$$
$$F_e = a_1(\cos\theta_o)^2 x_1^2 + a_2\cos\theta_o\, x_1 + a_3$$
$$\theta = \sin^{-1}\{x_1\sin\theta_o / (L_o - x_1)\}$$

4 ANALYSIS RESULTS

A MATLAB code is written to apply the analysis and procedures suggested in this work to assign the dynamics of the cannon barrel assembly-recoil system upon firing. The other parameters of the dynamic system are:

- Barrel assembly mass, M: 5600 kg
- Projectile mass: 6.86 kg
- Muzzle velocity upon firing: 564 m/s
- Initial recoil elements length, L_o: 3.5 m.
- Initial horizontal velocity of the barrel assembly upon firing: 0.7 m/s based on momentum conservation of the barrel – projectile rigid bodies.

The results considering the recoil mechanism initial orientation and the spring internal pressure are as follows:

4.1 BAR SPRING AIR PRESSURE

- For zero and 10 degrees recoil mechanism orientation, Figs.6 and 7.

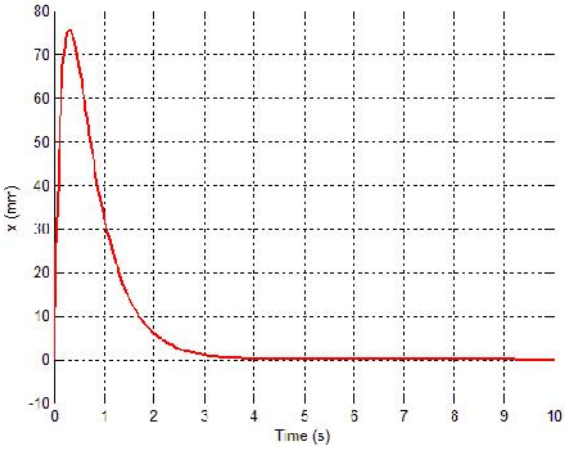


Fig.6 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 0$

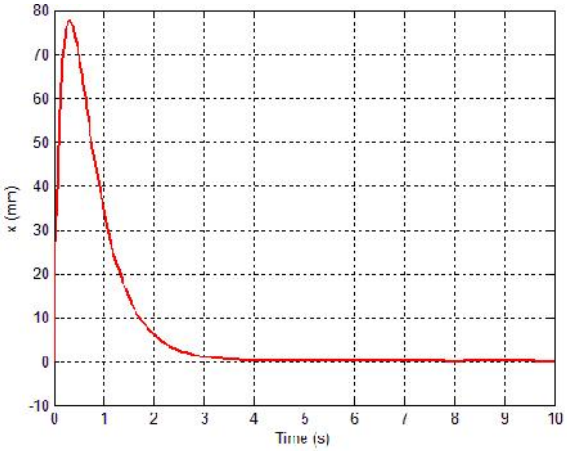


Fig.7 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 10^o$.

- For 20 and 30 degrees recoil mechanism orientation: Figs.8 and 9.

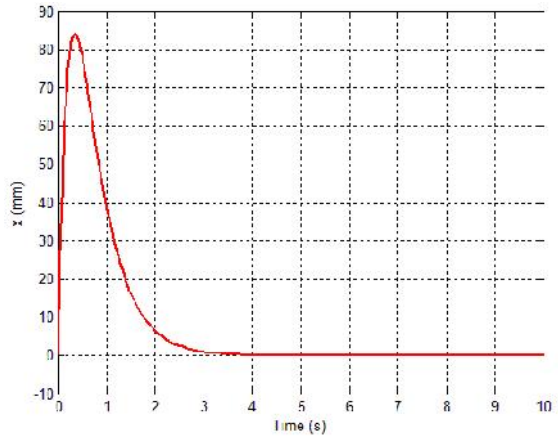


Fig.8 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 20^o$.

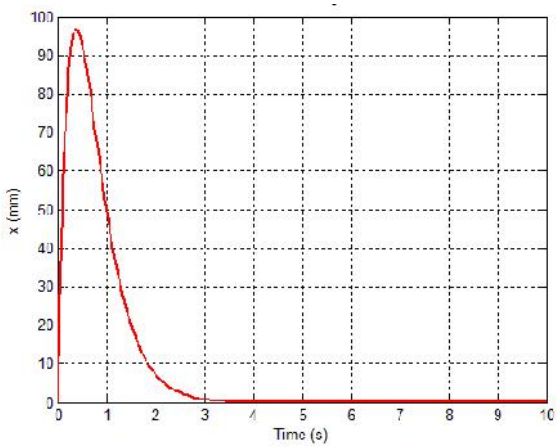


Fig.9 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 30^o$.

- For 40 and 50 degrees recoil mechanism orientation: Figs.10 and 11.

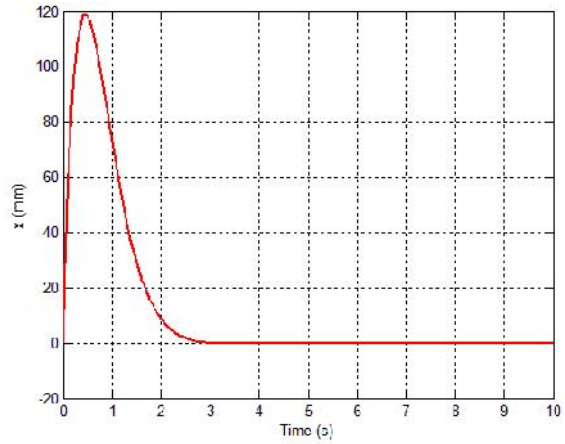


Fig.10 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 40^o$.

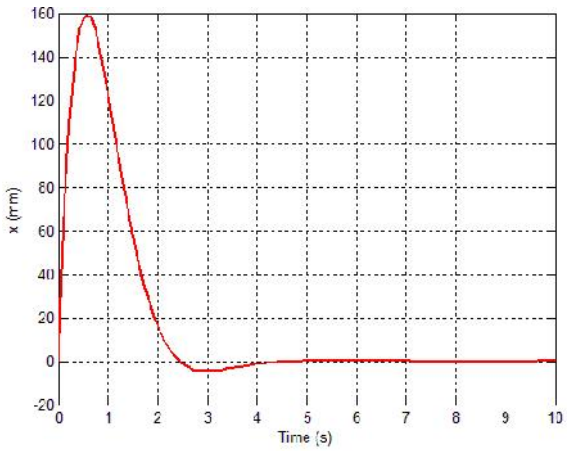


Fig.11 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 50^o$.

4.2 BAR SPRING AIR PRESSURE

- For zero and 10 degrees recoil mechanism orientation , Figs.12 and 13.

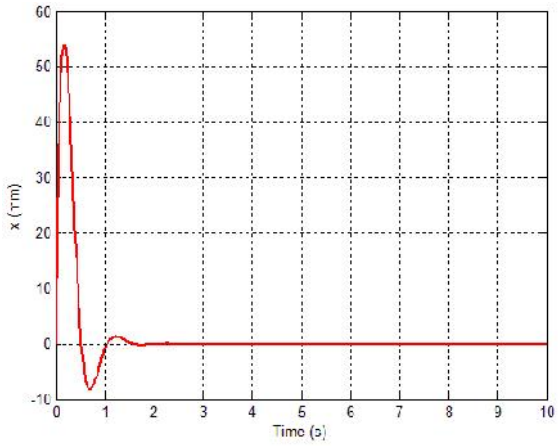


Fig.12 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 0^o$.

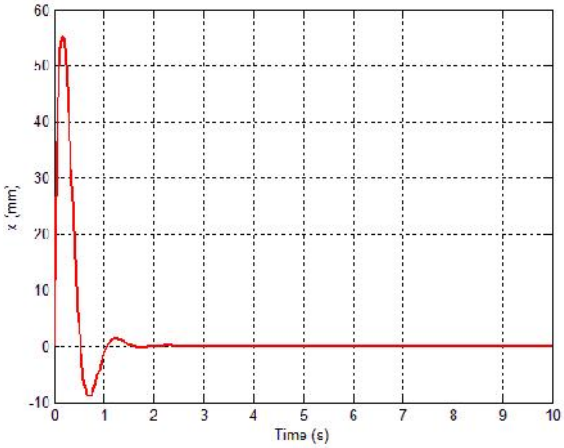


Fig.13 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 10^o$.

- For 20 and 30 degrees recoil mechanism orientation: Figs.14 and 15.

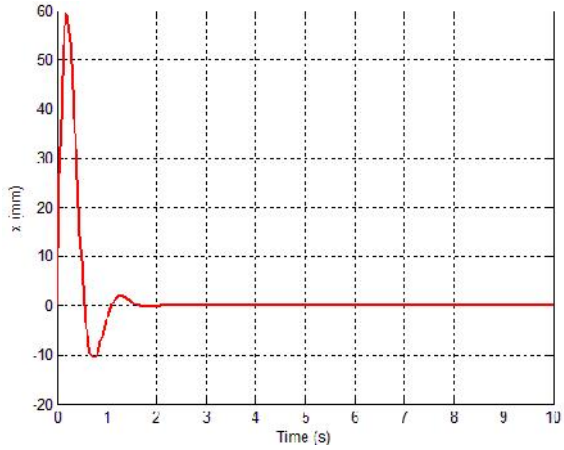


Fig.14 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 20^o$.

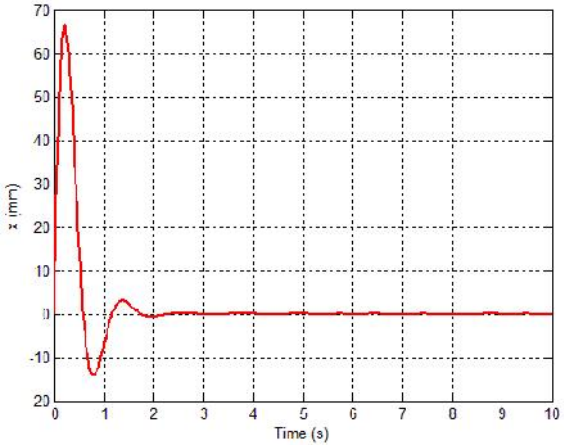


Fig.15 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 30^o$.

- For 40 and 50 degrees recoil mechanism orientation: Figs.16 and 17.

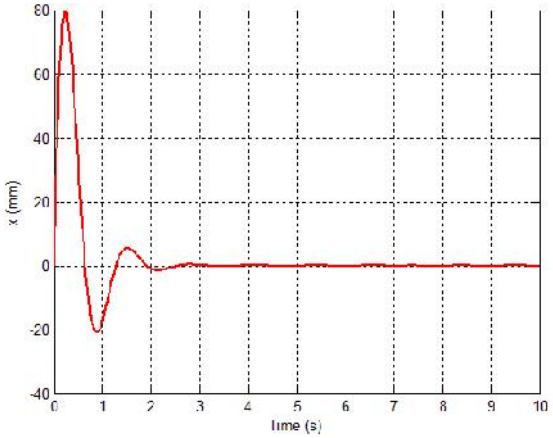


Fig.16 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 40^o$.

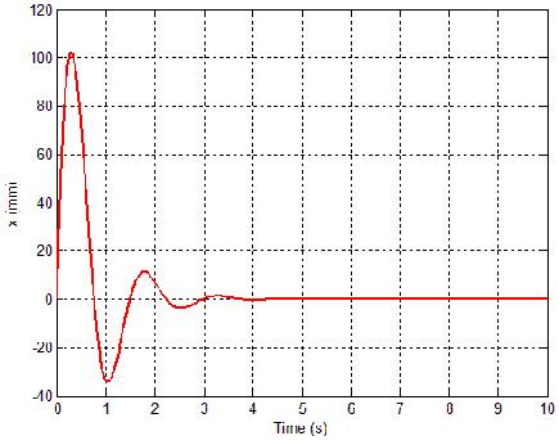


Fig.17 Dynamic response of the barrel assembly upon firing with $\vartheta_o = 50^o$.

5 CHARACTERISTICS OF THE BARREL ASSEMBLY DYNAMIC MOTION

- For an 1.2 bar internal air spring pressure, the dynamic system behaves as a critically damped second-order one except at 50 degrees recoil mechanism orientation.
- For a 4.8 bar internal air spring pressure, the dynamic system behaves as an underdamped second-order one for all the recoil mechanism orientations.
- Upon firing, the dynamic motion of the barrel increases to a maximum value at the end of the return stroke of the barrel. This maximum value, x_{max} increases nonlinearly as the recoil elements orientation increases for the two air pressure levels of the air spring as shown in Fig.18.
- Because the dynamic response is of an oscillating nature, it has a minimum value x_{min} which is the maximum displacement in the forward direction after firing.
- x_{min} is function of the recoil elements orientation and the air spring initial pressure as shown in Fig.19.

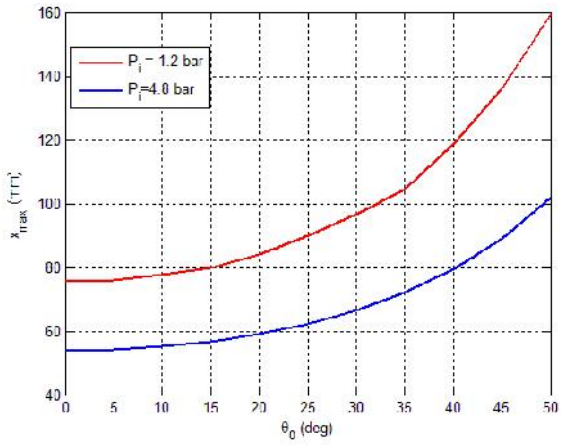


Fig.18. Maximum barrel assembly displacement.

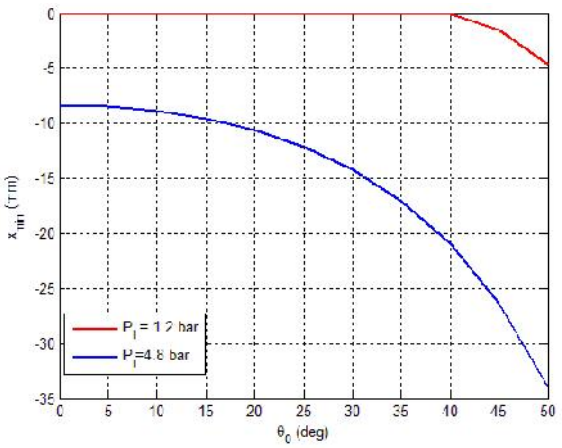


Fig.19 Minimum barrel assembly displacement.

- The minimum displacement of the barrel assembly remains at the zero level for recoil mechanism orientation < 40 degrees, then starts to decrease (increase in the negative direction) for the 1.2 bar internal air pressure of the air spring.
- For 4.8 bar air pressure, the minimum displacement x_{min} decreases as the orientation increases.
- The settling time of the barrel assembly remains constant at 4 seconds for 1.2 bar pressure and orientation ≤ 30 degrees (Fig.20). Then decreases to a minimum value at 40 degrees orientation, after which it increases to reach 4.5 degrees at 50 degrees orientation.

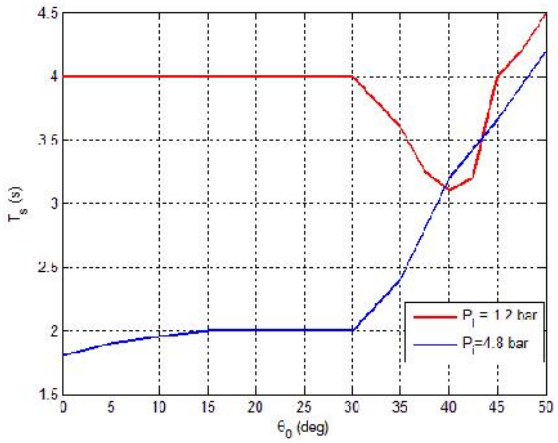


Fig.20 Settling time of the barrel assembly.

- At 4.8 bar air pressure, the settling time increases from 1.8 to 2 seconds gradually during 15 degree orientation, then remains fixed at 2 seconds for another 15 degrees orientation. Then increases in an increasing rate to reach 4.2 seconds at 50 degrees orientation.

6 EFFECT OF THE NUMBER OF AIR SPRINGS ON THE BARREL-RECOIL DYNAMICS

- The number of air springs encountered in the recoil mechanism affects the whole dynamics of the system.
- The are springs are connected to the barrel assembly in parallel.
- The effect of using 1, 2, 3 and 4 air springs for 1.2 bar air spring initial pressure and 30 degrees barrel assembly orientation is illustrated in Figs.21through 24 .

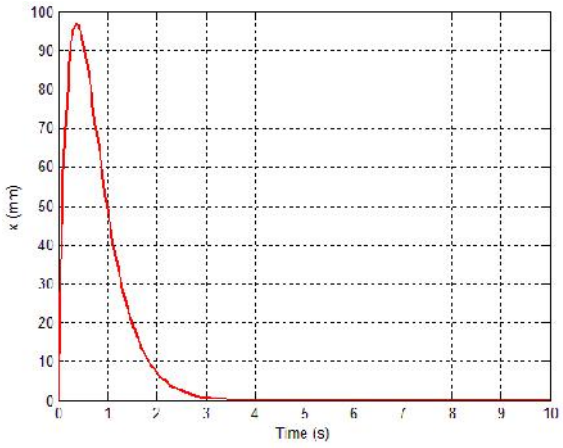


Fig.21 Barrel assembly dynamics with 1 air springs

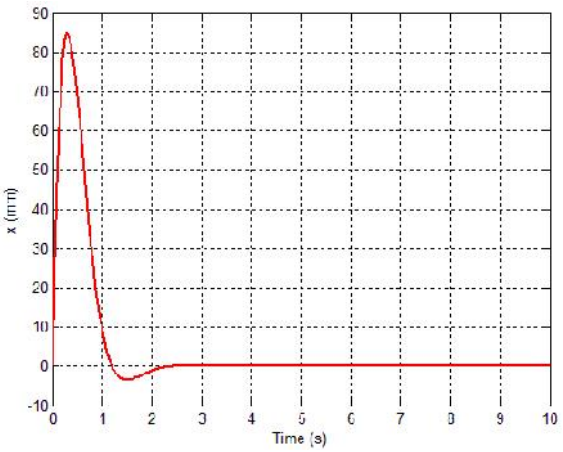


Fig.22 Barrel assembly dynamics with 2 air springs

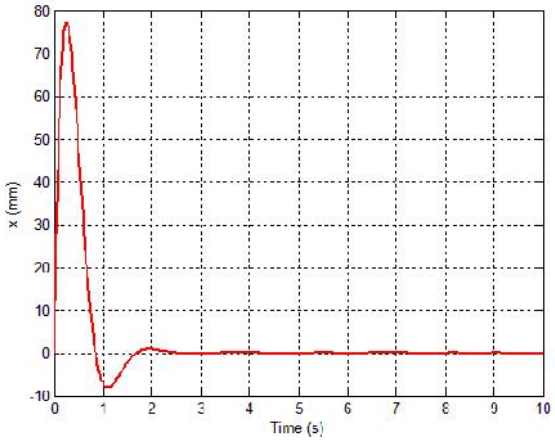


Fig.23 Barrel assembly dynamics with 3 air springs.

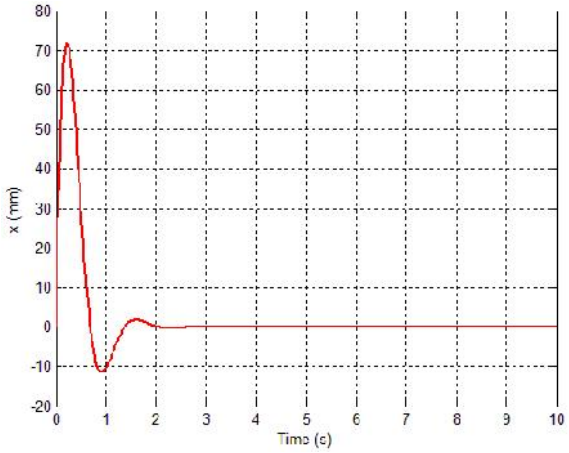


Fig.24 Barrel assembly dynamics with 4 air springs.

- The effect of the number of air springs on the parameters of the recoil mechanism performance is illustrated in Table 2.

Table 2 Effect of the number of air springs on the recoil mechanism performance.

Number of springs	x_{max} (mm)	x_{min} (mm)	T_s (s)
1	96.65	0	4
2	84.83	-3.46	2.5
3	77.23	-8.12	2.5
4	71.89	-11.44	2.1

7 CONCLUSIONS

- The characteristics of air springs depend on its displacement and internal pressure.
- Second order polynomial models are fitted to define the characteristics of the air spring used in this study.
- It was possible to obtain a barrel assembly-recoil mechanism characteristics similar to that of a critically damped second-order dynamic system at 1.2 bar spring initial pressure and recoil mechanism orientation ≤ 40 degrees.
- Increasing the recoil mechanism orientation increased the maximum barrel displacement upon firing and decreased the minimum displacement.
- The maximum barrel displacement increased nonlinearly with recoil mechanism orientation increase.
- The 1.2 bar spring initial pressure was optimum since it provided barrel assembly time response upon firing without any undershoot for recoil mechanism orientation ≤ 40 degrees.
- The settling time of the barrel assembly with 1.2 spring pressure was expected to be between 3.1 and 4.5 seconds for all the recoil orientation range.
- Increasing the spring initial pressure reduced the maximum barrel displacement, increased the minimum barrel displacement (undershoot) and decreased the settling time of the barrel assembly to as low as 1.8 seconds at zero orientation.
- The settling time remained constant at the level of 4 seconds for 1.2 bar spring pressure and recoil orientation ≤ 30 degrees.
- Increasing the number of air springs at 1.2 bar spring pressure and 30 degrees recoil orientation decreased the barrel maximum displacement and barrel settling time, while the minimum barrel displacement has increased (undershoot).

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BIOGRAPHY



Galal Ali Hassaan:

An emeritus professor in the Department of Mechanical Design and Production, Faculty of Engineering, Cairo University, EGYPT. He got his Ph.D. from Bradford University, UK in 1979. He published 10's of research papers in various International Journals. He is the author of books on Experimental Systems Control and History of Mechanical Engineering. His current research is in Mechanical Vibrations, Automatic Control, Mechanism Synthesis and History of Mechanical Engineering.

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Political and Economic History of Personal Law in Pakistan

Asad ur rehman[1], Shamas ul deen[2], and Sadaf farooq[2]

[1]UNDP Research Fellow,
Pakistan Institute of Development Economics, Development studies department,
Quied-e-azam university campus, Islamabad, Pakistan

[2]Research Associate,
Management Sciences Department, Comsats University,
Virtual Campus secretariat Islamabad, Pakistan

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ABSTRACT: The colonial rule of west left ineffaceable imprints over the discourse of Law and on its practice in India. The Public and private sphere of life dealt by two different laws; secular and religious respectively. The economic needs of Raj in India were forced British to collaborate with local notables, women of India and then subsequently of Pakistan denied any opportunity or freedom promised by colonial government. Those coded personal laws to this day in Pakistan is one of the reason hurting the effort of Pakistani women in getting her rightful place in society.

KEYWORDS: Political and Economic History, Personal Law, Pakistan.

1 INTRODUCTION

Miss Nazia Jamal Lecturer in Agriculture Extension department of University of Agriculture Faisalabad was died on the eve of 10th February this year. She received serious burnt injuries because of mysterious fire broke out a couple of days earlier while working in her Kitchen[2]. According to a Facebook page created in her name by her students, fire was not accidental[3]. The father of the deceased alleged that her husband, an employ of a Punjab Bank, murder her daughter out of anger. The reason was her disapproval of permitting her husband (Salman Shahid) for second marriage. Police reluctantly registered a first investigation report (FIR) on the intervention of Regional Police officer, pressurized by the Academic staff association (ASA) of Agriculture university. Unfortunately, the young lecturer was bearing child of six month at the eve of her alleged murder. There is not went a single day in Pakistan when women are not being raped, murdered or beaten by their men-folks. The violence is not limited only to poor, uneducated and uninformed women but neither Gazala[4] nor Nargis[5] are protected from this injustice. The causal determinants of Violence against Women are various and wide-ranging. The patriarchal norms and structures, the treatment of women as other sex, increasing extremism in society, crisis of identity, mismatched marriages, poverty and unequal gender relations neglected by colonial institutional framework reinforced by post-colonial state[6]. The feminist and Women rights activist deal all these reasons comprehensively. Therefore, the focus of this study is the analysis of historical, Political and Economic forces shaping the condition of subjugation of women in Pakistan.

The law as commonly known is an insurance against violence and safeguard against injustice. However, the reality and evidence on offer is different, law did not provide the required safety to the marginalized and underprivileged in Pakistan. There are numerous non-profit organizations working for women rights, the country elected twice a female prime minister and female foreign minister and national assembly speaker once, won an Oscar award for documentary on women issue and provide defiant resistance symbols for women rights; *Malala Yousaf Zai* and *Mukthaan Mae*[7]. It has passed loads of Parliamentary bills to end anti-women discriminations and repealed anti-women laws[8]. The university campuses are teeming with girl students competing with male students at universities and market places in urban centres. As, perceived and documented, education and financial independence has failed in providing the promised empowerment in Pakistan (Miss

Corresponding Author: Shamas ul deen

Nazia Jamal is one such example). The inequality and injustice is neither allowed by the constitution of Pakistan nor Islam the state religion of Islam. However, it prevailed and most alarmingly on rise in Pakistan[8].

The reason of failure , as I argued earlier, are diverse and over lapping but largely stemming from the pre-independence , colonialism experienced by Sub-continent. The policies of colonists, the separation of Public and Private life, the hypocritical-liberal institutions laid over the extractive economic institutions, the marriage of secular common and religious personal law, unstable post-colonial regimes and reinforced conservative hierarchies etc. Such policies laid the foundation for reinforced identities created over the bodies of Women under the shadow of political Islam. The debate over human rights in Pakistan has been facing historical ebb so, as the women rights. The prevention of Anti-women Practices (criminal act) 2011 had become law in 2012. Will it guarantee the bar the injustice treated with women? Some will say, at least it is a welcome step and must be appreciated. However, I would ask, why the true soul of Islamic teachings as Sister of Islam contend, is yet to be realized? The blacks in United States still face the discrimination although equal in the eyes of law. Muslim Indians lives under a secular state yet considered second-rate citizens. The menial castes in Punjab (Pakistan) on paper enjoyed equal rights but treated still as menial on ground. Therefore, in my opinion problem firstly lied in the incapacity of Pakistani state (which is a post-colonial state) in creating an effective institutional mechanism for the implementation of legislated laws. Secondly, the socialization process of post-independent Pakistan was inherently conservative and hypocritical impelled by colonial subjugation and ill-planned and executed partition of the sub-continent[10]. The Pakistan movement as the state ideologues supposedly calls it, inherited disorganized, weak and quasi-liberal state from British. The state institutions formed around subjugation and economic exploitation of the lower classes and ethnicities remained. However, politically very important and potentially revolutionary (As some fundamentalist say) constitutional alteration was made; the diadem of Sovereignty Switched from king to God[11]. The people of Pakistan again denied the virtue of controlling their own lives. The interpretation of God's Law usually performed by the Apostles (prophets), however, Muhammad (PBUH) was the last prophet, so this great responsibility was left on the shoulders of Maulana Maudoodi, which he performed meticulously in the Punjab disturbances of 1953[12]. The universal human right perspective since its day first was absent from the priorities of Pakistani ruling elite. Unfortunately, the women rights can only be secured within the larger framework of human rights. Thirdly, the political parties were less developed and mostly comprise of Bengalis and Urdu-speaking emigrants, while civil and military bureaucracy was overwhelmingly Punjabi[13]. The over-developed state structures and under-developed political institutions because of historical absence of industrial middle class opened the space for reinforced conservative social hierarchy, through the adaptation of British common and Muslim personal law, respectively in public and private spheres of the individual[14.15]. Lastly, the cultural, national and identity struggle between the colonists and indigenous was fought around Sexuality of women[16]. The colonist policy of divide and rule has found an ally in religion and women were the victims of new legal jurisprudence; an amalgam of secular and religious laws. This legacy is continued until this day in Pakistan.

This paper will be separated into five different but connected parts. First Part will deal with the philosophy of law, contesting schools in law, overlapping connection between ideology and law and different legal systems working in the world. Second part will shed light on the politics of rights and evolution of the institution of law in colonial times linking it with the modern discourse of women rights in two distinct schools of thoughts; Universal Human Rights paradigm and Muslim *Shari'ah* framework. Third part will deal with the post-independence struggle for women rights. Fourth Part will focus on the current debates of women rights especially in Pakistan and at large in Muslim world and their purposed roads to freedom. Final part will conclude the argument that violence against women, the discrimination they faced and with unfairness, they are treated can only be ceased through modernization of the economy, raising education, increasing living standards and secularization of the state and law, entailed in a universal human rights perspective.

"In its majestic equality the law forbids the poor and rich alike to sleep under the bridges, beg in the streets and steal loaves of bread". Anatole France, 1894, Red Lilly, The more laws, the less justice. Marcus Tullius Cicero

2 PHILOSOPHY OF LAW

Law is usually defined as, the system of rules and guidelines, enforced by institutions to govern the behaviour individuals and to maintain justice in society. However, this definition is just explaining the utility of law and to an extent the need of law. What is law *per se?* A mind-twisting question dealt by legal theorists, historians and solicitors differently, throughout the whole history. While the other more normative question echoed throughout history, *what it ought to be?* These ontological (analytical) and Normative (epistemological) questions made it difficult for different philosophers and theorists to agree on a single definition of law. The positivists doubt the authenticity of any law resulting from morality[17]. While the Naturalist believed the efficacy of law only when it is accorded the Natural law of universe[18]. Kelsen tried to develop a "Pure" theory of law, aside from moralities and ideologies[19]. The objectivity of law according to Kelsen lied in the interpretation of the primary or basic norm[20]. The actions or social conditions cause a disequilibrium or injustice, which can be redeemed by the

existing law . If any previous law is not helpful than the Sovereign power (Parliament in most cases) after long deliberations can enact a new law. The deliberations made by the parliamentarians, in Kelsen views on reflect over the "is" questions an objective situation faced by them. The law enacted by any such deliberation have to presuppose a basic norm, either the Natural law of God, or the abstract idea of justice or humanity or the precedent of any such law found in past. The basic norm is according to the premises of Kelsen himself offered, is about positive-order of power. The hierarchy of the legal order have to respect the historical first norm (Constitution in modern state) either settled by revolution custom, popular referendum or any historical incidence. The jurist cannot challenge the basic norm[21]. In the case of Pakistan, constitutionally the parliament is sovereign however, the basic norm is not any universal human right but some blurred Islamic injunctions. The sovereignty of the parliament organized and elected on the liberal principles of rationality and universalism denied execution by the un-elected bodies like *Shari 'at Court* and Islamic Ideological Coucil[22]. The legal perspective taken up by Islamic Feminist organizations is of religio-positivism[23]. The struggle for equal woman rights by these organizations confined itself within the framework of Islam ignoring the social, Economic and political forces behind the gendered interpretations of Islam[24]. How the power structure influences the legal institutions and how the ideologies convolute law is yet less rigorously researched area in contemporary Muslim world. The reason are numerous and varied.

2.1 IDEOLOGY AND LAW

The ideology is set of ideas conscious or unconscious perceptions, choices, desires and actions, whereas law is the set of rules enforced by state to control the conflicting desires. Conflicting desires and wants logically, in the opinion of radicals and critical legal theorists, arose from conflict within the society, the conflict between class, race, ethnicity or sex[26].In his famous critique on Law, Althusser explained a direct link between the ideology and law[27]. The pure theory of law considered the basic norm as the sublime source for normativity and objectivity of law. However, in critical theorists argued that the beacon of "rule of law" has been erected on false assumptions of justice. Althusser reasoned that it is typical of some grand propositions to be always untrue, suggest propositions, which are. One of such statement is "All is equal before law". It is theoretically a sound statement to have equal worth before law. However, the rich because of the law of private property can afford better lawyers and this puts equality before law in question[28].

Secondly, the ideological state apparatus governing through the institutions of family, media, religion and particularly education subjectivize the individual; shape its desires ultimately a surrounded subject, created by the structures of state[29]. Who controls these apparatus; find itself in a position to manipulate the subjectivity of its citizen. The post-structuralism's critique of knowledge production in modern society also pinpoints the hegemony over the production of knowledge controlled by those who own the physical means of production[30].

Thirdly, how law is associated with ideology is a question demands further elaboration and separate investigation. The neo-liberal economic ideology purposes three fundamental reforms in the structure of economy, privatization, liberalization and deregulation. This extreme conservative liberal ideology preaching abandoned role for government, forced the developing countries through the International financial institutions (IFI's) to change laws and welcome foreign direct investment, open up markets and reduce government spending[31]. These laws were drafted by considering individuals as completely rational (rationality in itself is a questionable category) and markets equally efficient everywhere just like United States. The principal of equality tied with market efficiency produced the greatest rate of economic inequality all over the world. Marx put avowedly and with immaculate clarity, that ideology is the ideas of ruling class. In Pakistan the ideology of the nation is being stated as Islam, so an explicit link between state apparatus, ideology and law is predictable.

2.2 PUBLIC AND PRIVATE LAW

Rise of law is indelibly correlated with the rise of civilization. Increasing complexity of human intercourse both at home and with other nations necessitate its vigilance. The simultaneous rise of Egyptian and Sumerian civilization developed first time codified civil laws[32]. The city-states of Greece introduce the inclusive political institutions without the codification of any norms or procedures into law. During the Pax Romanic during the reign of Justinian the Roman law, which was procedural earlier was codified. The participatory political institutions of Greek nation-states and roman civil law after the renaissance constituted the modern institution of democracy and procedural law.

Since ancient times the distinction between public and personal, law is apparent. The family relations and compensation for private harms were governed and regulated by the states, regimes, communities or fiefdoms. Modern civil or common law also bifurcated into this public and private realm. Table 1[33] will provide a summary for this distinction.

Table 1.

	Private Law	Public law
Govern	*Private interactions*	*Relationship between state and individual*
Examples	Tort law, Contract law, Family law, Labour law	Constitutional law, administrative law, International law, trust law

Out of the all these law the focus of this study is the family law. The issues of marriage, divorce, Alimony, child custody, inheritance and succession came under the jurisdiction of family laws. Pakistan as the Article 1 and Article 2 of the constitution declare is an Islamic state concomitantly, Muslim Personal law governs the domestic sphere and interaction. Part IX of the Constitution is titled Islamic Provisions and provides for the eventual Islamization of all current laws, reiterating that no laws offensive to the commands of Islam are to be legislated[34].

Similar to the debates world over women rights in Pakistan also gyrate around two universal frameworks; Human Rights perspective and shari'a. The information, debate and struggle for equal human rights for women is limited to only professional, educated and urbanized middle and upper class activists. The social presence of religion is very high and overlaps with the cultural norms and practices. The fundamentalist insurgency and state-led Islamization of every political and social discourse left a little room for any other rational or secular discourse. Nevertheless, to solve the mystery of present the key is past. In next part, I would try to re-construct the political, social and intellectual history of Muslim past since the decline of Mughal Kingdom in 18th century.

3 THE WEIGHT OF HISTORY

The decisive battle for the throne of India was fought between the two sons of Shah Jehan at the plane of *Samugarh* close to Agra. The younger son, then known in history as Aurangzeb Alamgir, won the battle, *Dara Shakoh* was sentenced to death and the fate of India sealed. In retrospect, the win of staunch, conservative and ideologically hard- core religious *Aurangzeb* was a complete opposite of handsome, intellectual fecund and liberal *Dara Shakoh* (In the creed of Akbar). That was the beginning of end, the start of downfall, an end of one of the most prosperous, peaceful and enlightened rule India ever received. The material forces of history, piled up in Indian society, recognized the necessity of a comprehensive social, political and economic framework, which by accepting the cultural, religious and ethnic plurality of India provide an inclusive state apparatus. Unfortunately, the intellectual armoury of India at such a critical juncture of history went into the hands Alamgir[35]. The religiosity of the man widen the gulf between different ethnicities, and the compilation of *Fataw e Alamgiry* into Islamic law closed the path of *Ijma (*Consensus)*and Qiyas* (Reasoning by Analogy)once and for all in Muslim jurisprudence in India[36].

Muslim rulers in India usually used Islam to solve the problem of legitimiacy.[37] the coffers of Mughal Empire were in a state of decline when Alamgir got his hands on throne. Contrary to the practise of previous rulers, Alamgir has left with no easy money to construct monuments of his historic victory or fallen love[38]. His hard-core religious beliefs were rooted in his life as well as in the socio-political necessity of his reign. The "lucrative collaboration" of state and ulemas has started from there on. To halt the political decline of Mughal empire Alamgir used Islam in varied ways, imposed *Jaziya* on non-Muslims, Hindu temple razed to grounds, music was banned even in *the Khanqahs* of *Sufis,* and banning the Shia celebrations of death of Imam Hussein[38]. The loosing grip of central authority, brewing conflicts in North-Western India, revolt of Sikh-Hindu revivalists created a general environment of insecurity particularly for Muslims, surrounded by a huge majority of Infidels[40].

This new socio-political reality of 18th century has given birth to a religious scholar and jurist in the line of *Sheikh Sirhindi*; Shah Wali Ullah. Badly influenced by the insecurity of his times, he took the course of Sirhindi, although with a new vigour in the interpretation of Sharia. He was overwhelmingly influenced by the teachings of Abdul Wahab of Arabia[41]. This specific interpretation of Islam imbued in Arabian culture alienates the true soul of Indian Muslims from a rich cultural legacy of a thousand years[42]. In my opinion, it was one of the greatest intellectual miscarriage of Muslim scholarship in India, because it were the teachings of *Shah Wali Ullah* overtly used *by Syed Ahmad* in jihad against the Sikhs in first quarter of 19th century and implicitly used by founders of Deoband seminary in third quarter and *Maluna Maududi* in the 20th century. Arguably, I would stress that a symbiotic relationship between clergy and state was the outcome of specific social, political and economic era. However, the codification of the knowledge produced within the timeframe of sheer chaos and Muslim insecurity explicitly determine the future course of Muslim politics in India under colonists. The class, Gender and ethnicity

was denied any place in the creation of new Muslim identity and the losers were the poor, women and marginalized ethnicities of Muslims in India respectively.

3.1 LAW IN BRITISH INDIA

At the onset of East India Company's rise to power in India, it was divided and separated into different religions, castes, communities, regions and cultures. Every community has practised different customs, rules and norms unaltered since centuries. The idea of universal law with central enforcing authority, independent judiciary and elected executives was entirely absent. A closed society regulated by religious and cultural mores lacked an autonomous concept and abstract theory of law[43]. Another problem was laid in the execution of authority, a despot sitting on a throne ruled through the traditional institution varied region-to-region and community to community. The traditional rules governing marriage, transaction, succession, ownership and treatment of misdemeanour were diverse and in contradiction to each other[44].

The problem for British was to create an efficient economic base governed by a universal common law (like in Britain of 19th century). The Lockian adaptation of Natural law into common law, which was absent in pre-colonial India required a central authority to impose a universal code of law. As the control of India transferred form the East Indian Company to the throne of England, as series of enactment passed i.e. Code of Civil Procedure 1859, Penal Code 1861 and Code of Criminal Procedure 1861. The demarcation between preservance of authority and political contingency realized through the bi-furcation of law into separate domains namely, public and private.

3.2 PERSONAL AND PUBLIC LAW IN INDIA; HOW IT STARTED?

"In order to prevent another 'mutiny', Queen Victoria proclaimed: The crown was to 'abstain from all interference With the religious belief". Bilimore,2002

The 1857 war of independence put an end to the rule of East India and company, and India become a crown colony. The British were very upset because the uprising shook their perceived stronghold over sub-continent. The legal framework enacted after the uprising in Public sphere enacted a universal civil code, while in order to defy any further resistance, taking inspiration from threatened religious beliefs, Private domain of individual life discerned from the public by the enactment of religious laws[45]. The colonial state achieved multifarious objective through the demarcation of public and private domain;

1) The creation of Central authority governing an extractive Economic system under the umbrella of English Law, was Legislated by English Privy Council, Judged by English Judges.
2) This new statues law, opposite to the traditional and customary laws directed by religious and cultural mores, putatively construct a legal edifice, which treated justice as norm per se.
3) The loyalty of the elites of all religious communities was managed by accepting their right to use religious laws to regulate their personal and family life.
4) The seed of religious and sectarian discord and political intolerance had also sown among the ethnicities and nationalities living side by side in relative harmony since ancient times.

The colonialism as the most liberal thinkers of 19th century considered and rendered as the "Civilizing Project" of the natives, turned out as a new beginning of unprecedented agony and oppression for all marginalized communities, groups, sects, classes and sexes in India. The political contingency of colonial state by codifying religious laws reinforced the patriarchal (traditional/customary) structures and made the bodies of women a location to decide the fight between the colonist and nationalist[46]. The laws passed after the "Entering of India" under the holy shadow of English crown evidently stifle the life and opportunities offered by new system.

Table 2.

Hindu Personal Law	•	**Sutte Regulation, XXVII of 1829.**
	•	**Caste Disabilities Removal Act 1865**
	•	**Hindu Widows Remarriage Act 1856**
	•	**The Hindu Gainful Employment Act 1930**
Muslim Personal Law	•	Muslim Personal Law (Shari at) Application Act 1937
	•	Shari at Act 1937
	•	Dissolution of Muslim Marriages Act 1939
Parsi Personal Law	•	Parsi Marriages & Divorce Act 1936
Christian Personal Law	•	Native Converts Marriage Dissolution Act 1866
	•	Indian Divorce Act 1869
	•	Indian Christian Marriage Act 1872

Source; -Billimore, 2002.

This binary of contradictory rules and regulations created the ambivalent and torn identity for the native, Materialist, progressive and liberal externally while spiritual, saviour of culture and guardian of tradition privately, A half-breed, a mimicry, a white man's burden. Religion in all anti-colonial struggles has remained an ally of the almost all native movements; it entered into politics and even then led to the partition of India on religious lines. This communalist politics also reflected in the codification of personal law as described earlier. The clear division of inner and outer domain of personal and public life gave way to the rise of incoherent, opposite and conflicting values, rules and institutions.

It seems pliable to provide evidence for explaining the outcomes of dichotomous legal procedures face by the nation state of Pakistan, a case study of two laws, one each from public and private domain, can do the business.

- Land Alienation Act 1900, Punjab.
- Sharia Act 1937.

The land alienation act passed in 1900 was in essence a decree of colonial state to hold the transfer of land into the hands of Hindu creditors (Baniya) from Muslim rural land owning gentry. The land colonization of barren lands of Punjab were used by British for dual purpose, 1) Earning Revenue 2) Consolidating political power. The newly colonized land then distributed into three distinct categories among the "Agricultural castes". To put it short, the big land-lords who were Muslims in majority, started to lose their lands to Hindu *Mohajins.* This obviously challenged the conservative hierarchy put in place by the British because the Hindus were settled in urban centres and if this process left unchecked it could have, changes the whole future Economic, political and social evolution of the Punjabi society[47]. This process most importantly could create a commercial market of land and eventually lead to parcellation of land into smaller units, which ultimately broke the stronghold of rural conservative gentry over the politics of the province.

Despite this entire progressive outcome, in line with the Civilizing Project of colonialism British by virtue of power they held, made the transfer of land a non-agriculturist caste illegal. The categories of Agricultural and non-Agricultural were also not in lined with the idea of justice common law celebrates. The enactment of this law deepen the ethnic, religious and class divide and block the required opening up of the society[48]. It could be rendered as a classical example of law codifying the ideology of the ruling class.

The enactment of the Islamic principles into statues of law in 1937 heralded a long waited victory of Educated Muslim elite for more than quarter of a century. The religious principles deduced from the collection of *fatwas* arranged in the reign of Alamgir. The enactment of this law again reduced the lip service of colonial mission to mirth. The old patriarchal structures, norms and regulations were left untouched. Arguably, it could be concluded that enactment of this law was a gift to the educated Muslim elite, flag bearer of the Muslim nationalism in India. However, the ultimate victim was Muslim woman and the politics of Right in post-partition Pakistan. Again, the political contingency caused the sectarian rift (Shia jurisprudence neglected completely), and forgoes the diverse customary practices prevalent within and among communities. Notably, there is a common thread in the enactment of both laws, the fear of rebellion, which in my opinion rendered the post-colonial state in efficient and incapable of enforcing a universal set of rules as well as its implementation[49].

4 MUSLIM NATION AND MUSLIM LAW A POSTCOLONIAL UNION

The colonial politics for independence or sovereignty can be characterised broadly into two meta-categories, Nationalist and Religious. Both of these liberation narratives have shown a serious lack of concern for the provision of concrete, comprehensive and democratic framework for diverse social and culture groups. The personal law re-invented by British in India was a queer mix of local and Western traditional moralism, hardly reflecting the coordinates of the lived culture[50]. Although the personal law governs a limited realm of private community conduct, it nevertheless has implications on the thinking of issues pertaining to citizenship, rights and obligations even at state level[51].

The duty of state (nation state) primarily is to provide conditions for human flourishing to all without any racial, ethnic or gender discrimnination[52]. These conditions only can achieved in a plural society like India and Pakistan through deliberations, democratic dialogue in a universal Human Rights framework, backed by a transformative and constructive politics, which must not marginalized or privatized the question of *human good* to an orthodox and unchanging concept of fixed moralities.

Pre-conditions for such a transformative politics is a well-functioning, representative and effective state, which by avoiding injustice and violence can guarantee a peaceful mechanism for the grievances of its citizen. In the case of Pakistan, the post-colonial state at large lacking all these necessary characteristics problematizes the question of equal women rights. The legacy of colonial rules, institutions, politics, economic structures and legal discourses prevents any new and progressive re-construction of society.

The urgent birth of Pakistan was eclipsed by the tragedy of blood-sewn migration, which eventually reinforced the religious identity of the polity. Even the first (very famous too) address of the founder of Nation (Muhammad Ali Jinnah) fell on deaf ears in which he categorically aspired about a secular state[53]. Within a period of one year after his death, a definite step was taken towards a theocratic state by legislating Objective Resolution as the permeable for constitution for newly independent state[54]. The socialization process of colonial era was inherently conservative and impelled by hypocrisy[55], which inadvertently cleared the way for a parochial social and political culture. Moreover, the introduction of quasi-liberal institutions during colonial rule, which provide legitimacy for economic exploitation seriously deformed the self-governing capacity of the native ruling classes, succeeded the colonial masters. In the case of Pakistan, the bureaucracy lacked professional work force, universal voting franchise was absent and political institutions were biased in favour of landed aristocracy[55]. The organic evolution of liberal, democratic and representative political institutions correlated with the rise of Boursiosie, While in Pakistan inherited at the eve of independence only 34 factories. The result can only be the three fold conjugal union of Clergy and Landed-aristocracy with over developed state structures reinforcing a conservative worldview as a state ideology[56].

The active or passive role of religion in the affairs of state according to empirical findings of Kuru (2007) is explained by the presence or absence of Ancien Regime. He analysed three countries France, United States and Turkey to prove his point. However, the case of Pakistan is almost different from France and Turkey (These countries never colonized) but close to United States (colonized by British). The glaring difference of attitudes towards religion in state policy can explained by the nature of the colonization, Settler in case of United States and Exploitive in Case of Indo-Pak. This ubiquitous difference of socialization process and the edifice of legal framework erected during the colonial rule emphatically affected the post-independence policies of State towards religion.

The *objective resolution* was an implicit expression of the insecurity felt by political elite of Pakistan, completely alienated from ground realities and poor masses. The Economic structures left unchanged, land reforms overlooked and done only half-heartedly, constitution making delayed and fair elections avoided until 1970. The procedural law or law *per se*, govern the economic and social precincts of a society reckoned as just. Therefore, the unchanged exploitive economic structure backed by conservative social hierarchy also required an unchanged law, colonial law enacted with the full vigour. The journey towards real independence of the people of Pakistan halted at the beginning. The consequence of such path stagnancy for women and minorities in Pakistan specifically turned out very ugly. The Muslim Family law considered by zealots as holy depress any further debate over the authenticity of the principles guarding the normativity of these laws. Unfortunately, yet there are no visible signs of any rapprochement can be seen in the policy circles of Islamic Republic of Pakistan.

5 STATE AND WOMEN RIGHTS, A PROBLEMATICAL RELATIONSHIP

Pakistan has travelled a long journey encompassing almost six and half decades, since its hasty birth in 1947. Yet the dream or more correctly if called the bargain chip used by its founders[58], of creating an Islamic welfare state is not achieved. The marginalized, down trodden, ostracized, out casted are still finding themselves in their old position, with a slight change

in the colour and religion of their masters along with a little alteration in the form of oppression. A state, which has failed miserably to even provide the necessities to its large population, to expect from it equal rights for its citizen, is a childish wish. The lack of vision, rulers of Pakistan possessed and absence of any serious institutional and legal alternative forced them to work with the old system. The system- building process at a critical juncture of history significantly affect the outcomes even for centuries[58]. The process of system- building is usually but significantly shaped by the ideology of the dominant group[59]. The dominant groups who to certain extent had a say at state level or have some street strength, chiefly were either conservative or religious. Due to an array of reasons the ruling clique to provide legitimacy to their rule imposed "Islamic identity"[60]. The critical moment was lost, which perpetuate the agony for women of Pakistan because the gendered structures got another life.

The adoption of objective resolution as a principle document, a meta-narrative, a guiding code had reduced the discourse of women rights, at state level to Islamic legal injunctions formulated during the periods of Alamgir, reinforced by Shah Wali Ullah and creed, codified and improvised by British into *Muslim Family act 1937*. Although some attempts were made by Ayub regime in, redefining the Family laws in 1961 but implementation faced serious snags[61]. One of the reasons of this bad implementation was the untouched, reinforced and reified social structures of Patriarchy, which the post-colonial state was neither has the capacity not will to challenge.

Patriarchy, a social structure can live along with all formation of production (Primitive, Feudalist and Capitalist). The relationship between patriarchy and ideology is very complex. However, the ideology of the state accompanied by the state capacity of implementation can effectively dismantle the social structures[62]. Linked with transformation of economy, increasing mobility of women, their financial and economic independence of women, increased literacy through education created an A priori about women rights in Europe. In the meantime, the beginning of capitalist relation of production was closely associated in Europe with the rise of Liberal Middle class demanding a secular state and secular law. In nutshell, it can be concluded that, awareness about rights in historical experience of "West" is linked with transformation of economy and class structure of a nation-state. The historical experience of post-colonial states is completely different, the shock therapy, indigenous cultures received by colonists has produced a divergent set of ideologies. Secondly, introduction of western cultural and political institutions in twisted form, under the influence of western hegemony (both cultural and Economic), over deeply rooted structures of inequality exacerbated the condition of women. The becoming of woman's body as the battle place between the "west and East" is one of the evil gift of colonization, which certainly affect the legislation of private domain.

Other than politically driven, half-hearted effort of Zia regime, the public laws were never tempered with religious injunctions. The public and private separation of legal discourse needs "decontextualization" both from the western notions of "Rule of Law" and "equal justice and from the religious framework for women liberation. As, the post-colonial theory aids in understanding the situation of women in Pakistan, the *binaries* of religious and liberal/secular must be looked through the lens of "hybridity". The de-contextualization is required for developing a discourse over women rights, because both the binaries of "Secular" and "Religious" are value-loaded and ideologically driven. However, to develop such a discourse, rooted in local cultural reality along with a universal sense of equal human rights, secular state is indispensable. A third space is only viable in the presence of a secular state, which can appreciate the pluralism and encourage the dialogue. Therefore, a struggle for equal women rights can only be located in equal human rights under the banner of a secular state.

5. CONCLUSION:-

This paper while taking its lead from the political and Economic history of sub-continent . It delved into the debate of theory of law and tried to develop the connections ideology and Law holds. The ideology is configured by power of the dominant group. A thorough analysis of Mughal history and then colonial rule leave long lasting effects over the process of state formation , institutional building and codification of law, simply system building. The pervasive intrusion made by religion in the formation of ideology and construction of identity in Indo-Pak debilitated the condition of women in this part of the world. The organic weakness of post-colonial state, hybrid identities, failure of the modernization of economy and conservative socialization in connivance with the ideological (religious) codification of law in post-independence Pakistan stifled the opportunities for women of Pakistan. The need of the hour is to give space to more plural discourses of women rights, which in my opinion is only possible in the presence of secular state.

NOTES

1. *Translation of an Urdu couplet;*
2. *http://www.nation.com.pk/pakistan-news-newspaper-daily-english-online/national/21-Feb-2013/asa-demands-probe-into-lecturer-s-death.*
3. *https://www.facebook.com/UAFInformaton*
4. *A pushto singer killed by her Husband for not leaving the showbiz indudtry.*
5. *Famous stage dancer, her head clean-shaved by her lover.*
6. *Carey, 2002*
7. *A rape case victim of Southern Punjab , now running an NGO for women rights.*
8. *A suvey by Aurat foundation provide evidence of the rise of Violence against wome.*
9. *Menial castes mostly are people not allotted land in Punjab.*
10. *Cary, 2002.*
11. *Objective resolution was passed in 1949 and then made the part of constitution during the dictatorship of Zai.*
12. *Punjan disturbance commission report, 1953.*
13. *Alvi,1972.*
14. *Alvi,1972*
15. *Ali, 1985*
16. *Pederson, 1991.*
17. *Benthem, A utilitarian philopsehr and theorist of 19th century.*
18. *Rousseau, a French radical writer of 18th century.*
19. *Kelson, 1934*
20. *Kelson, 1934*
21. *The basic principal interpreted by Religious jurist against land reforms is a right to property ownership, which is indispensable and unchallengeable.*
22. *Islamic ideological council can disregard any law it adjudged against the Islamic law.*
23. *The single pragmatic, shallow interpretation and understanding of religion and law.*
24. *Sister of Islam, a Malaysia based feminist group raising voice for the feminist interpretation of Islamic jurisprudence.*
25. *W.H. auden collected works*
26. *26. critical legal theorist Stanford*
27. *27.Althusser ideological state structures.*
28. *28.lacunar discourse, Althusser, princton.edu http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Ideology.html*
29. *29. althuser ideological state apparatus.*
30. *Peet, 2003*
31. *Rodrik,2005*
32. *. Théodoridés. "law". Encyclopedia of the Archaeology of Ancient Egypt.*
    ** VerSteeg, Law in ancient Egypt*
33. *33, "Private Law vs Public Law". Diffen contributors. Diffen LLC, 2013. Web. Sat Jun 01 2013*
    http://www.diffen.com/difference/Private_Law_vs_Public_Law
34. *http://www.law.emory.edu/ifl/index2.html*
35. *Carey,2002, critical juncture is a moment when new institutions can be replaced by new and more democratic, representative ones.*
36. *Mumtaz and Shaheed,1987.*
37. *Bari,2007*
38. *Alamgir in his youth when he was the "Hakim" of Deccan fell for a courtesan in the Haram of his one of fraternal Uncle. Her early death left the prince heart-broken and seriously influenced his intellectual and ideological growth.*
39. *karen amrstrong quoted by Bari.2008*
40. *Bari,2008.*
41. *Bari, 2008*
42. *Ayasha jalal.*
43. *Bilimoria, 2003*
44. *Bilimoria, 2003*
45. *Shiek,2012*
46. *Naryan, 2003*
47. *Ali,1985*
48 *Ali,1985*
49 *Carey,2002*
50 *billimore, 2003*
51 *billimore.2003*
52 *perry, quoted by bilimore,2003*
53 *Jinnah address. Pakistan has travelled a long journey encompassing almost six and half decades, since its hasty birth in 1947. Yet the dream or more correctly if called the bargain chip used by its founders[58], of creating an Islamic welfare state is not achieved. The marginalized, down trodden, ostracized, out casted are still finding themselves in their old position, with a slight change in the colour*

and religion of their masters along with a little alteration in the form of oppression. A state, which has failed miserably to even provide the necessities to its large population, to expect from it equal rights for its citizen, is a childish wish. The demand for equal women rights can only be justified or become valid after accepting women as human beings, complete conscious living beings. Regrettably, it was never remained a serious concern for those at the helm of power.

54 *Objective resolutions adopted in 1949.*

55 *Carey,2002*

56 *Alvi,1972*

57 *Ali,2008*

58 *Acemoglu and Robinson,2012*

59 *tiger and levy quoted by fareeda shaheed and khawar mumtaz 1987.*

60. *Religious organizations and feudal lords mostly enjoyed the mass following. Educational missionary organizations too, attract some following in urban centres of Lahore. On the other hand, bureaucracy (both) was to large extent liberal and progressive but was not connected to the people at large. The weak political parties, revoked religious identity, need of breaking from colonized path and provide rationale to the idea of Pakistan, they all agreed to use religion for casting a new Pakistani identity.*

61. *Fareeda and Mumtaz.1987*

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Human Computer Interaction (HCI) in Ubiquitous Computing

Rab Nawaz Bashir, Salman Qadri, Rana Muhammad Saleem, Muhammad Naeem, and Yasir Ghafoor

Department of Computer Science & IT,
Islamia University,
Bahawalpur, Punjab, Pakistan

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ABSTRACT: Ubiquitous Computing is new computer paradigm with seamless integration of hundreds and thousands of self-communicating small scale computers and intelligent devices into the user environment and daily life activities. Ubiquitous computing has high prospects for human life along with certain challenges across computer science, system design, system engineering, system modeling and in Human Computer Interactions (HCI) design. In case of Human Computer Interactions (HCI) there are certain requirements and challenges for ubiquitous computing like minimum user attention in order to enable them to focus on tasks rather than technology. Traditional Human computer Interaction models in the form command line, menu driven or Graphical User Interface (GUI) are inadequate and insufficient to meet the unique requirements of the ubiquitous computing environment. The spirit of Ubiquitous Computing requires specialized natural, implicit and embedded interaction paradigm in order to support the unique requirements of interaction patterns in ubiquitous computing. In order to promote implicit Human Computer Interactions (iHCI) the context aware system, natural multimodal interfaces are the prerequisite. With the help of context aware and multimodal natural interfaces user would have the opportunity to pay less time to interact with technology that is the agenda of the implicit Human Computer Interactions (iHCI) and ultimately achieve the objective of Ubiquitous computing of minimum user involvement into technology and to enable them to focus on their tasks.

KEYWORDS: Ubiquitous Computing, Human Computer Interactions (HCI), explicit Human Computer Interactions (eHCI), implicit Human Computer Interactions (iHCI), Context aware Systems, Natural interfaces, Multimodal interfaces.

1 BACKGROUND

Technology had changed our lives to a large extent and still has the potential to change it in a new and dramatic way. Due proliferation of technology into our lives to a large extent we spent our lives in a different way as compared to our fore fathers. Technology has embedded into our daily life activities from working to recreational activities. We are now busy in interactions with different types of gadgets, devices and appliances. In fact it intruded into our life in such a way that it is very difficult to distinguish it apart from our environment.

Ubiquitous Computing is a new and exciting paradigm characterized by hundreds and thousands of self-communicating smart devices, taking active role in every realm of daily activities of human life, in every location and context. The essence of this vision of Ubiquitous computing was first described by Mark Weiser in 1991 in his seminal paper as; *"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life, until they are indistinguishable from it"* [1].

The above statement of the Mark Weiser is actually a motivation to think about computers beyond the desktop model. Ubiquitous computing has many dimensions for understandings and implementations. It also refers to calm technologies. Calm technologies would recede into background of our daily life activities. This paradigm suggest that computing resources would present in such a manner that user would not aware of their presence. Another aspect of calm computing is that these embedded devices provide services with little interactions with users so that user do not distract from their task in a technology overwhelming environment [2].

Corresponding Author: Rab Nawaz Bashir

Mark Weiser put the idea of invisible computing and predicted that in very near future we observe the shift in computer systems. His vision the tremendous change in the computing environment and said that in very near future we observe the phenomenon of “many computer to one user” from “one man to one computer”. He believes that desktop computers would be replaced by hundreds of scattered computers in our environments. These scattered computers in our environments would be enabled to sense our environment and communicate with each other to provide different services to human in a variety of way. The idea of Ubiquitous computing is invisible computers everywhere, embedded into the environment, with dozens of hundreds of computer available to each person, each one operating without much human intervention [3].

Weiser vision is more than the infrastructure; it poses certain new dimension of interaction with the system. The ubiquitous computing goes beyond the integration of hardware and technology into the physical user space. Its main theme is the way we interact with the computational resources. Ubiquitous computing is much more than mere embedded technology into our daily lives, it is about changing our perception about their presence into the physical world. The agenda of Ubiquitous computing interaction demands different themes of interactions as continuous interaction and implicit human computer interactions. There were a lot of efforts along these lines but still a huge prospect to work on these lines is still available [4].

The terms calm computing, invisible computing, embedded interactions and disappearing computers does not imply the size of the computers or seamless integration of the hardware into the user environment. Therese terms tend to describe the aspect of interaction with the computers. They reflect the need to understand the difference between the traditional user computer interaction relationships to the user computer relation in augmented environment, and how the user perceives the computers. In order to make the computer invisible to the user, it means interaction of the user with the computers is in a seamless way integrated into the user’s tasks. Focus of the user is on the task rather than explicit interaction with the system in contrast to traditional user computer interaction relationship where focus is on computer rather than the task [5].

Ubiquitous computing is also considered as post desktop model of interactions in which information processing and smart capabilities would integrate into every realm of life. The core of the vision of the Weiser was that smart phones and appliances would also communicate with each other to provide services in a seamless way through coordination with each other and provide different services to user in a synergetic way through enhanced user experience. Weiser believes that computing resources would present into daily life artifacts rather than a separate computing entity. According to Weiser if this integration and coordination is done on reasonable basis it would be very difficult to distinguish computer as a separate entity for user activities [6].

2 MATERIAL AND METHOD

Ubiquitous applications interfaces should be adaptable to their environment and behave according to the situation. They should adapt according to context and do not require explicit interaction from the user. The main objective of the Ubiquitous computing is to allow user to focus on their tasks rather than on technology. In last few years we observe many applications that gather user context through sensors in order to do right things at right time. Most profound among these applications are CyberGuide, UbiCicero and GoogleAdSense [7].

2.1 HUMAN COMPUTER INTERACTIONS (HCI) REQUIREMENTS FOR UBIQUITOUS COMPUTING

HCI should not only consider ease of use but also focus on assisting user tasks, proving access to information in best way and concentrate on more powerful form of interactions. After considering its perspective HCI has taken new dimension especially in Ubiquitous computing. All the fantasy and novelty of ubiquitous systems based on the novel way of user interaction with the systems. Some core characteristics of Human Computer Interaction (HCI) in Ubiquitous system are given below [4], [8];

- HCI in ubiquitous system would be hidden and implicit rather than traditional explicit interactions of user with the system.
- Ubiquitous system environment should allow the user to focus on the tasks rather than on the technology.
- HCI in ubiquitous computing involves adaptive to situation and support for multimodal of interaction with the user. This requires some sort of intelligence work integrated with interaction paradigm.
- Human interaction pattern in Ubiquitous environment would multimodal of interaction support.
- With advance in technology the interaction in ubiquitous computing tends to be supported with natural interactions like interaction of human to human.

2.2 HUMAN COMPUTER INTERACTION FRAMEWORK FOR UBIQUITOUS COMPUTING

All these requirements of HCI in ubiquitous computing require an enhanced model of interaction with clear defined goals [9]. The agenda of ubiquitous computing require implicit Human Computer Interactions (iHCI) with the help of context aware interactions and natural, intelligent multimodal interfaces. Traditional interactions theme can also be utilized when they can prove to be useful in ubiquitous computing environment.

2.3 IMPLICIT HUMAN COMPUTER INTERACTIONS

The ubiquitous computing had the agenda of implicit Human Computer Interactions (iHCI) with minimum distraction of user from their core activities. The main goal is to focus on the user task rather than user focus on technology. Weiser vision of calm, disappearing computers is manifold and multidimensional. Important context of calm and disappearing computers is their working without much interaction with the user [10]. The system should support the user tasks without much intervention and with minimal distraction of user from their core activities. The system tends to disappear and become calm because human interactions with this system tend to implicit rather than explicit. Due to effective use of implicit mode of interaction the calm or disappearing computers would be reality in very near future. The basic purpose of calm and disappearing computer is that system should proactive rather than user involve in explicit interaction with the system. Clam computing removes user from the system and hope that system work proactive rather than reactive to the user.

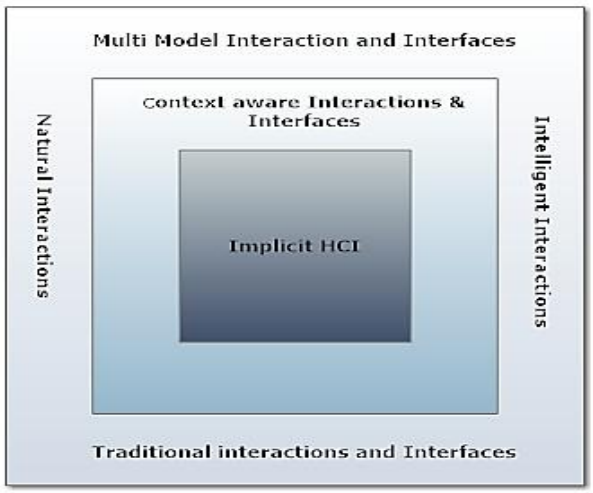


Fig. 1. Human Computer Interaction in Ubiquitous Computing

2.4 CONTEXT AWARE INTERACTIONS

Ubiquitous application has to be context ware system. Previous research on the issue of HCI in Ubiquitous computing has posed the agenda of context ware applications in order to be proactive. The context would play an integral part in ubiquitous application that help to achieve the implicit interaction but there are still unresolved issues relating to representation of context, acquisition of context and its distribution.

Context aware systems are system that are aware of their situation and adopt accordingly. Context aware systems are aware of their environment, situation or context so that system can adapt to the situation and provide services according to the changed situation or context. According to Dey, “a system is said to be context aware if it exploit relevant context to provide services”. Dey and Abowd define context as information that used to characterize the situation of an entity that is relevant to the interaction between the user and application [4].

Context information’s depends upon the type of services and application like location, temperature, light etc. For example many smart phones turned automatically to silent mode for some location without explicit interaction with the user. Context information can be very helpful in proactively of the interactions but it may cause problem if desired level of accuracy not achieved. In order to be successful in ubiquitous environment interactions, different context information and accuracy of this context information is very crucial. Context of use and adaption of application and user interfaces according to the context of use help to create applications that are easy to use especially in ubiquitous computing environment. For

application in ubiquitous computing we have to consider context of use not only in design process but also for different usage scenarios of application and its services in order to adapt according to the situation and environment [10].

For traditional application HCI we design around single context of use and user. Most of our efforts in design spent around the single anticipated use context. For application in ubiquitous computing environment that have to change and provide services according to the situation and environment the traditional approach of HCI may fail. If we attempt to support multiple contexts with single design it also turn to complex one as the number of context and users may increase to a large extent. In order to provide support for a range of context support of Context aware system is necessary for HCI in ubiquitous applications [11].

Context aware system has strong relationship with ubiquitous computing and can play important role in realization of Mark Weiser vision about Ubiquitous computing. When computer would be part of everyday life it would be necessary that such system are easy to use and do not overwhelm the user with explicitly interaction with the system. User environment saturated with thousands of computers may distract user from their tasks and involve user in explicit interaction with the system rather than allow them to focus on their tasks and activities. This is against the vision and spirit of the Ubiquitous computing or clam computing.

For the realization of Ubiquitous computing context aware systems are very important for optimal use and performance of different system in ubiquitous computing environment. Computers with different shapes and sized had already integrated into our life and activities. Different home usage devices and appliances had acquired the smart capabilities due to installations of microprocessors and memories capabilities. These smart integrated devices also have the capabilities for interconnections with available network high capacity bandwidth. What remain is to judge the user situations and environment and provide services according to the environment. In order to provide services by adapting to the user environment it is necessary for the system to have the capabilities of context aware system. Context aware system enables to sense the environment and help the ubiquitous system to adopt and provide services according to changing situation [10].

2.5 INTELLIGENT, NATURAL AND MULTIMODAL INTERFACES

Intelligent user interfaces aim to enhance the efficiency, naturalness, and effectiveness of HCI by using artificial intelligence techniques. If we look into history, user note taking capabilities evaluation starts with typewriter. From type writer it shifted to keyboard and from key board to touch and voice input capabilities suggest that interactions pattern in modern days shifting towards natural paradigm. Intelligent user interfaces enhance user experience by content support for input and output of data and navigational support for navigation between applications. One type of such support is that highlight important information and reduces the user effort to find desired information. Intelligent interfaces can also adapt to provide access to most relevant functionality and information [12].

Single independent channel of interaction is called modality. This is the channel through which information transferred between system and user. A system that is based on single channel is called uni-model whereas system with multiple channels is called multi-model. The most common system based on different modalities is visual, audio and sensors based. With the help of context aware system different input and output modalities can be included in order to increase user experience according to specific context. With help of context user interface can be tailored to specific context and adapt behavior according to context, situation or user requirement. But it is not as simple as it seems to be. User has to learn how to use the system and how to cope with change behavior with change of context. When the user interfaces are adaptive and change their behavior dynamically it becomes very difficult for the user to learn and adjust with the system. It is necessary that user also aware of cause of change of interface. Otherwise user feels very difficult in remember of navigations and interaction with a dynamic changing context of the system. User interface adaptation to context should be designed in careful way so that user can understand it easily. Good design should focus in stability and help the user in memorizing and causes of adaptation of user interface with each change of context. A carful design should avoid user from complexity [13].



Fig. 2. Canasta Key board [14]

Due to multiple focus of HCI research there is also trend in multimodality interfaces from traditional interfaces. Along with shift from traditional to multimodality there is also trend of intelligent, context aware, adaptive interface with implicit human computer interactions rather than explicit interaction pattern through command line and GUI interfaces. Multimodal interaction should be focus of HCI in future. Multimodal interfaces offer additional models like dialogue, gesture and context of use. Challenge is to identify what task fit to what modality. Human to human communication is an ideal standard for future multimodal interactions in Ubiquitous computing [5].

The ubiquitous applications would be different from the desktop model of computing therefore it is known as off the desktop or post desktop interaction paradigm. The interaction pattern in this paradigm would be quite different from desktop computing environment and should be in natural style. It would much like the way human interact with their physical environment. Human exploit speech, gesture and pen based interactions to communicate with the physical artifacts and human being. These natural actions of the human would be source of implicit or explicit interaction with the system. This theme poses an agenda of implicit interaction from the user environment, from user activities and even from user expression. Ideally it should be like man to man communication. Though a lot of research along the lines of pen and gesture input introduced but the inherent error rate still very high and need to be lowered in future. These natural interfaces would be easy to use and have the capability to learn from their environment. They also have the ability to support user task rather than distracting the user from their task to focus on technological issues [15], [16].

3 RESULTS

In order to determine the role of contextual information in implicit Human Computer Interactions (HCI) we design experiment for three activities listed below.

- A user determines his/her locations.
- Find a restaurant in nearby.
- Send an E-mail

We conduct experiment with two different types of handheld devices. One of the devices provides static user interface named device 'A' and second provide context aware adaptable interface named device 'B'. For context aware adaptation we used android context Aviate screen [17]. We repeat the same experiment with both types of devices.

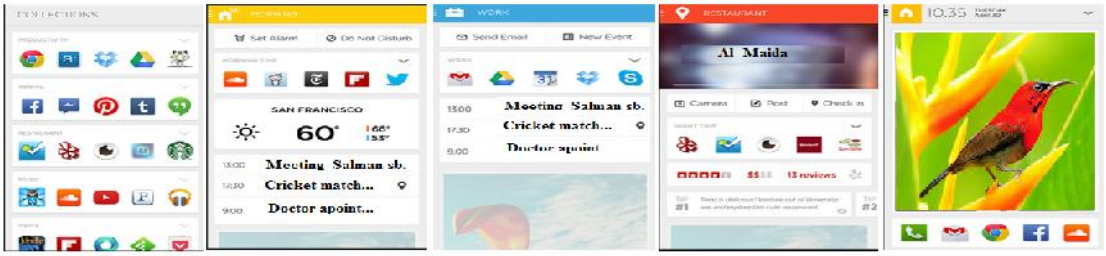


Fig. 3. Device a contextual based interface adaptation capabilities

Experiment was repeated with ten people with each user operates from three different locations. From each location each user repeats the same experiment at least three times with one device. User session recorded for time, accuracy and efficiency to complete each task. About sixteen volunteers are selected randomly who have experience in operating of two

different set of mobile. Each participant was allocated phone sets in a random way at different time. Initially ten minutes are used for the explanation of the task required from the user and then each user time recorded for completion of overall task, the number of moves user made to complete task. A log file is used to record time and number of moves (menu, icons clicks) for each interaction to complete the activities of our experiment. We want to evaluate the interaction usability of different interactions style with these two types of devices. We also want to know how the intelligent, context aware, multimodal and natural interface promote implicit HCI that is the core of our recommended framework. In first experiment prototype we want to test the usability of different interaction style with implementation of context aware User interfaces and using natural multimodal interaction style.

Time and number of moves are the dependent variables for each interaction. Based on the time of activities completion and number of moves we can compare total and average completion time of the activities. Data collected from these experiments would be used to test the fallowing hypothesis.

Hypothesis 1: Context aware interaction improves usability.

Hypothesis 2: Context aware interactions is enabling technology for implicit Human Computer Interactions (iHCI)

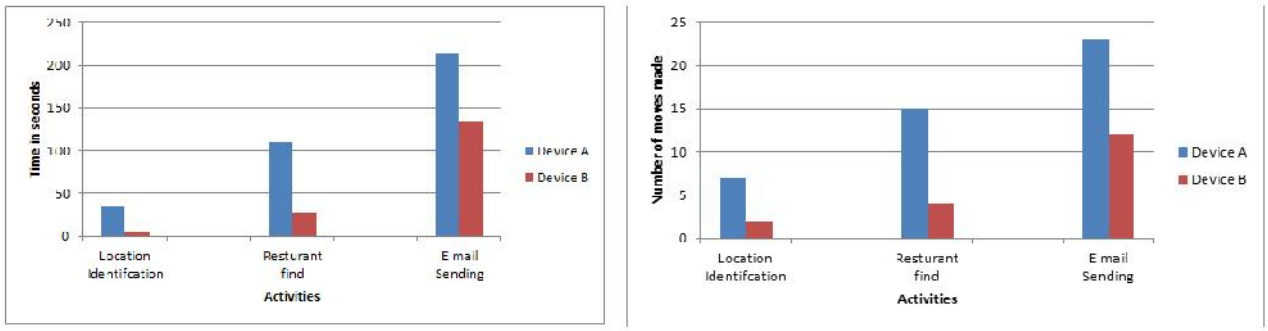


Fig. 4. Time taken and No of moves a user made with device 'A' and Device 'B'

4 DISCUSSIONS

Now we like to discuss some finding from the prototype experiment. We proved our first hypothesis that context aware user interfaces increase usability. From the above results we can infer that context aware interaction improves usability and efficiency, reduce number of moves in term of number of menus, buttons accessed for task completion and net result is that context aware interaction provide basis of implicit Human Computer Interactions (iHCI). These results suggest for accepting our first hypothesis that context aware information improve usability.

Designing such system there should be balance between complexity, usability and proactively or implicit interactions. Contextual information should be accurate enough to take actions otherwise it may lead to strange behavior of application with different context leads to lose of trust of user. Multimodal interactions, natural interactions and intelligent user interface help to adapt to context in an accurate way. We already mention that Implicit Human Computer Interactions (iHCI) is the basic requirement for interaction pattern in Ubiquitous computing and contextual information is useful for developing Implicit Human Computer Interactions (iHCI). This suggests for accepting our second hypothesis that "Context aware interactions are enabling technology for implicit Human Computer Interactions (iHCI)".

5 CONCLUSIONS

Ubiquitous computing has certain requirements and challenges in context of Human Computer Interactions (HCI). The spirit of Ubiquitous computing demands that there should be implicit Human Computer Interactions (HCI) in order to allow user to focus on their task with minimum distractions. Implicit Human Computer Interactions (iHCI) can be successfully achieved through use of contextual information based interactions. Context based interactions improves usability to improve Implicit Human Computer Interactions (iHCI). In this study we identify four themes of interactions named context based interactions, intelligent, natural and multimodal interactions suggested as a framework of Human Computer Interactions (HCI) that contribute towards development of implicit Human Computer Interactions (iHCI) in ubiquitous computing environment.

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Testing Automation in Agile Software Development

Rana Muhammad Saleem, Salman Qadri, Imran ul Hassan, Rab Nawaz Bashir, and Yasir Ghafoor

Department of Computer science & IT,
Islamia University Bahawalpur,
Bawalpur, Punjab, Pakistan

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ABSTRACT: In recent years agile development methods has gain very much popularity due to associated advantages with the agile practices like faster developments, stakeholder involvement, short iterations and quality oriented development. Agile development methods strongly focus on close customer collaboration, short iterations and quick deliveries. Literature review and industry practices reveals agile methodologies have paid little emphasize on software testing. Though agile doctrine present agenda of continuous testing, but it is usually limited to current iteration. Agile practices include very little testing practices at the release of artifacts, which are considered essential for a quality software product. Most of the existing agile methods have employed unit testing which is limited to the current iteration. Agile method seldom agile development methods can be more beneficial if they include a formal framework for testing. The focus of this study is one the development of agile based testing framework to be integrated with existing agile methods and practices, to take full gain and potential of agile methodologies. The proposed agile based frame work will be based on the automation of testing, building and managing of effective testing teams, and a real continuous testing environment.

KEYWORDS: Agile Testing, Test Automation, Continuous testing, Acceptance testing, Productivity

1 BACKGROUND

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test [1]. Agile has its roots in iterative developments during which customer is involved at very early stage by delivering the software system very early to the clients and users. Agile methods are characterized in terms of emphasize collaborative, integrated teams, frequent deliveries and ability to meet business changing needs.

The one of the most desirable attribute of agile process is the capability to adjust with the changing needs the project, organization and even change in development environment. Agile development believes on very early deployment of the software product to the customer, customer can have a view and have a fair chance to review errors, suggest improvement and changes as he deem fit. In this way, agile methodologies involve the user in development process very early by providing feedback to the team very early [2].

The manifesto for agile software development has changed the way companies plan, develop, test and release software. Throwing away years of accumulated orthodoxy, agile development methods have now become the new and accepted way to develop software. Agile development gives preference to the left side over the right side elements. It values the items on the left more [3].

Most of agile development methods endorse collaboration, teamwork, communication with stakes holder, iterative nature of development and process adaptability through the entire development life cycle. Agile methods focus on small iterations with minimum planning. Small iterations help to get rid of long term planning. These iterations completed in short time span though also known as “Time box”, typically span over from one to four weeks [4].

Corresponding Author: Rab Nawaz Bashir

2 MATERIAL AND METHOD

Over the last few years with the increase in use of Agile practices in software development industry, there is also increase in concern of how we should go about testing in agile based projects. There are different strategies propose with time to time. Keeping in view of all these strategies, we would like to propose agenda of test automation with agile practices. Let we understand the basic philosophical groundwork of agile testing.

Let us start by setting the philosophical groundwork:

- In agile development frameworks, you would like to test as quickly as possible, because in most of the cases the impact of the defect bounces back exponentially over time. In fact, all agile frameworks prefer to "test-first" approach.
- Agile frameworks believes on the philosophy of frequent testing in order to increase chance to find defects. However, it may increase the cost but this investment in testing would return in the form of improved quality of the system.
- Agile practices believe on the notion of "enough testing, means to do testing that justify the situation. Critical natured system, like to deploy at nuclear reactor and in aviation, require more testing as compared to other discipline.
- The last is the idea of "pair testing" as pair programming is an excellent idea. Pair testing has lot of advantages as compared to individual's efforts.

The one difference between the agile and traditional development methodologies is short loop or iterations to incorporate the user feedback at regular interval in the overall system development process. Automation of testing process helps to shorten this loop. Automation help to save cost and test smallest piece of code of the system and things can do quickly and reputedly. It help to test the same code gain and again and test the code for each update and help to shot the feedback process shorter and shorter as shown in the automated test life cycle in the picture. Reduce feedback is consistent with the agile philosophy of short iteration. Automated testing also offers other advantages in the form of repeatability, consistency and better coverage by driven data [5].

In order to reduce risk we proposed testing with test automation also included in short time-boxed efforts called iterations. The proposed optimal approach of small testing groups working with denote goal. The proposed approach try to complete the testing life cycle in quick time but also ensure that quality testing would be in practice. It will be produce effective results in effective time. Testing intends to make the product available to deploy a new functionality at the termination phase of iteration.

2.1 AUTOMATED TESTING

Automation testing requires less human intervention as compared to manual testing and incurs less cost and time. Agile software testing is more effective when it exploits the potential advantages of automated testing. Automation testing is helpful to save time and for effective testing it is very difficult to optimize all testing, and it is necessary to determine that what technique works in what condition. It is good to employ automated testing at agile whenever possible. Tests that require large data as input and have to perform frequently as regression testing are strong candidates for automation. Test automation is best suitable for scenarios, which are repeatable in nature. Followings are the potential advantages of automated tests:

- Automation testing is best suitable for repeatable testing
- Several automated tests can run simultaneously on different machines and saves time by running sequentially
- Reduce testing cost and saves time

2.2 DECIDE AUTOMATE TESTING OR MANUAL TESTING

There are two possibilities for management about testing, manual and automated. Each one of these two has their own associated benefits and pitfalls. Deciding to which streams the project wants to fallow depends upon the nature of project, management intentions and available resources. Manual testing require extensive knowledge of the domain and expertise in testing process while automated testing suited to long codes, where test cases have repeatable behavior. In order to save time and money most of the organizations rely on automated testing but still there are scenarios, which require manual testing approach.

Automated testing is the testing process without intervention of the human being. Automate testing is suitable for scenarios which are not crucial for the success of the project. It performs well when there is repeatable code to test. It can save time and cost of the by running sequentially on multiple machines.

However, there are some disadvantages of automated testing approach. It takes time in initial configuration. Cost of the automated testing is high when there is short term testing after frequent intervals. Expert suggest that automate testing does not believe to be work for all scenarios, it perform well in already well-defined scenarios. The major drawback of the automate testing is that it tool also has limitation for testing in some scenarios like those that visual references cannot be automated.

Manual testing on the other hand is also available to support where human interventions are available. Test engineers perform manual testing, at their own. This approach require comprehensive domain knowledge and testing abilities in term of innovative, speculative, creative, open minded, innovative and skillful. It is suitable to cases when a test case have not to run in a repeatable fashion. New kind of bug exploration is possible. However, keep in mind it is more time consuming and costly [6].

The project manager can decide the type of approach he wants to fallow on the project. It should keep in mind that previous study reveals that only 10 to twenty percent of bugs can found by automatic testing while they may extends to 80% with the manual testing approach. It reveals that human contribution is very important in the bug exploration process. Following is the criteria of automated testing [7].

- Tests are repetitive in nature.
- It is best suited to frequently changing scenarios to catch regression in a timely manner.
- Test that evaluating high-risk condition.
- Tests are difficult and costly to perform manually.
- Test where same action required for multiple data values.
- The test is base line in nature to test with different configurations.
- Automating the repetitive and boring tests provide the opportunity to involve in more interesting test scenarios.



Figure 1: Automated test in iteration

2.3 METHODOLOGY FOR AUTOMATING TESTING

Test automation methodology is given in fallowing lines.

A. SET UP YOUR APPLICATION FOR AUTOMATED TESTING.

Automation tools require well-defined properties and controls in order to identify and locate them. For example if the label of button change from the OK to submit the test script have to inform about this change otherwise it will fail. In any such change, developer should inform the tester so that necessary changes can make to the script of testing. Ideally, there should be unique names for controls so that automation tools perform well.

B. CHARACTERIZE A STANDARD DISPLAY RESOLUTION

In some cases when no unique names for control the tools have to rely on the coordinate in order to locate location. Any change in display setting would change the script execution. It recommended, uses a standard display setting, and if automated testing has to perform in different display setting use different script or subroutine for different setting.

C. PREPARE AUTOMATION TEAM

First, identify the skills and potentials of you team in order to exploit them for best. Definitely some will be best at writing test cases and some at writing test scripts. Tester with Programming background proved to best on writing and running scripts.

D. DEFINE PROCESS

Define and standardize the all process activities help to achieve tasks at time and better for the team members in understanding and cooperation on activities.

E. GENERATE AUTONOMOUS PLAN

It is always advantageous to define your plan in term of your goals. For example, goals can define as:

- Improve test coverage.
- Ensure consistency.
- Improve reliability.
- Speed up testing to speed up release.

F. DEFINE MEASUREMENTS OF SUCCESS.

Define the parameters of effective testing. Define how you can tell that testing is efficient. Some of the potential measures of successful automations are:

- It takes less time.
- More features tested in equivalent time.
- There is reduction in cost of testing due to automation.

G. DEVELOP TEST CASES.

Creating test cases and writing script take time. Avoid automation of those tests that have to perform few times. Only automate those tests that are clear in terms of their goals, pre-requisite in addition, expected outcomes. Ensure that tests have specific purpose and you can verify results.

2.4 IMPLEMENTATION OF AGILE AUTOMATION TESTING

There can be certain problems in term of implementation of automated testing. Writing and management of lot of scripts is a major issue. Test automation requires lot of planning but on the other hand agile frameworks works on loses design and involve a little planning. Actually, there is a little scope of planning in the agile based development and testing. This may lead to some problems, as automation is a complicated task and require extensive planning. One recommended solution is that team should plan for automation when development team is designing the system. [7]

First, it is necessary to create an automation testing standard document. Describe how to organize test cases and scripts after they recorded and define structures of the scripts. It is necessary to adopt standardize naming conventions for scripts before recording them. Also, note all the automated tests and their purpose in a separate document. Apply appropriate comments to explain the logic of tests. Try to create and maintain reusable and maintainable automated tests. Prepare small scripts instead of large one. Small scripts are easy to understand, maintain and for reuse in other scripts. Long scripts increase the complexity of the system.

2.5 WHY AUTOMATED TESTING IN AGILE

Automated testing is best for repeating scenarios but cost can be very high when scripts have to be written again and again and configuration have to be change repeatedly.

- We cannot automate visual references.
- Automation tools also have some limitations.
- Selection of automated testing tool is a difficult task.
- In case of short term, testing cost of automation is also high.

However, automated testing only is not sufficient for complete insurance of quality but certain advantages associated with the automated testing can be streamlines with the basic philosophies and objectives of agile development methodologies [8].

3 RESULTS

A few organizations selected, which have applied the agile testing frameworks, and some radical and substantial results found. I have applied raw data from a real project in order to conclude findings and results. Results offer new evidences that agile testing practices work and dramatically improve quality and productivity. We describe organization success using agile testing keeping in view efficiency in test design, efficiency in activity execution and productivity in defect management using purposed framework for agile based testing.



Figure 1 : Tester time without test automation

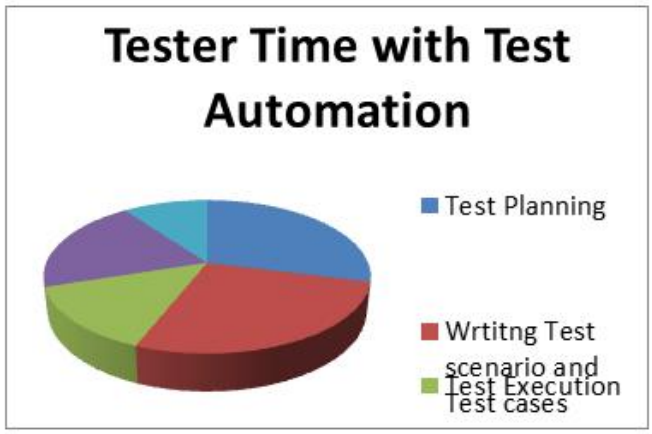


Figure 2 : Tester time with test automation

These two statistics compare scenario of tester time with test automation and without test automation. Figures clearly reveal that with test automation project can avoid substantial cost and time. Tester saved time can used in training other team members and in collaboration and communication tasks. During this time tester can involve in other quality assurance activities.

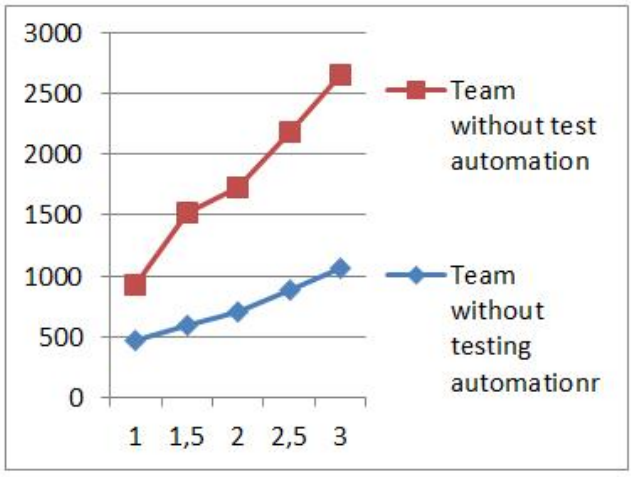


Figure 3 : No of Tasks Completed

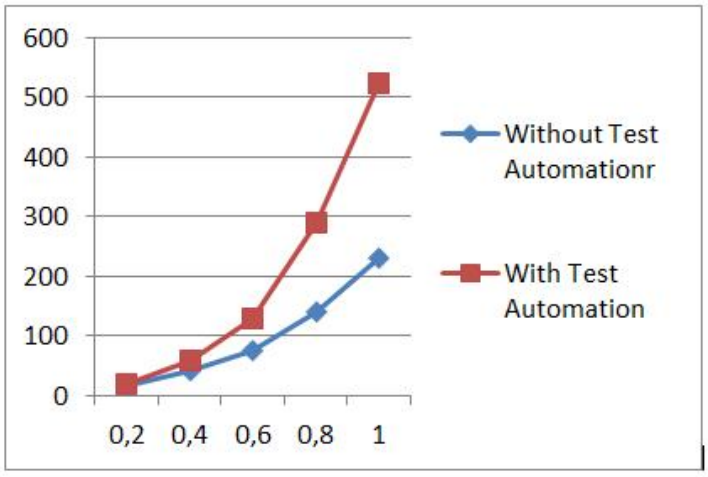


Figure 4: No of Iterations Completed Over Week

Above figure reveals that with test automation team can complete more number of task as compared to team without support of test automation. In the figure, we can see observe an analysis of no of iteration over the time. With test

automation team remains above the schedule, while team without test automation team usually falls below the schedule. In the above analysis of data, we can clearly infer that team can handle more defects with support of test automation.

4 DISCUSSION

Purposed frame testing framework evaluation present substantial results. It can be very advantageous when integrated with existing agile frameworks. Let conclude results.

It save time of developer, tester and other team members that allows team member to focus on other quality assurance activities in the project. During this extra time developer can write more code and tester can involve in training other team members in writing unit test cases. Tester can also devote more time to the customer in understanding, writing and execution of acceptance tests.

Defects managed efficiently with the use of test automation. From the previous analysis, it can be observed that team empowered to handle and tackle substantial number of test cases with support of purposed framework.

When team members handle increase amount of defects and complete more number of tasks team will in position to deliver the iteration on time. There will no chance to lag behind the schedule, which results in goodwill of the team and organization as well.

It is also observed that average longevity of defects in the iteration reduced to substantial amount. Regression testing is good but with framework, it will be under control. Test documentation management help to keep record of similar faults and reuse in future for same type of defects.

5 CONCLUSIONS

It strongly recommends that testing automation should integrate with existing agile framework. It can have synergic impact over the working of agile development framework. Though it may incur initial cost but return on investment are huge. Biggest return is in term of quality, which is source of customer satisfaction, goodwill, growth and survival of organization. Test automation in agile development improves team productivity and performance and also ensures that quality of the final deliverables is up to the mark and on deliveries are on time.

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Issues of Implementation of CMMI in Pakistan Software Industry

Imran ul Hassan, Salman Qadri, Rab Nawaz Bashir, Rana Muhammad Saleem, and Muhammad Naeem

Department of Computer Science & IT,
Islamia University Bahawalpur,
Bawalpur, Punjab, Pakistan

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ABSTRACT: Pakistan Software industry despite having potential failed to progress well in order to capture fair amount of international market share. Due to poor quality practices and lack of standardized practices Pakistan software industry ranked as tier-3 among the taxonomy of software exporting nations. Software Process Improvements (SPI) practices can play their part to overcome problem of Pakistan software industry but we also suffer in implementation of these standard practices. The core aim of this study is to identify the main barriers of Software Process Improvement (SPI) best practices in term of CMMI model in Pakistan. Pakistan based software development organizations suffer with implementation of Software process Areas due to many factor.

Keywords: Capability Maturity Model Integration (CMMI), Software Process Improvement (SPI), Project Planning (PP), Supplier Agreement Management (SAM), Process and Product Quality Assurance (PPQA), Requirements Management (REQM), Project Measurement and Analysis (PMA), Configuration Management (CM)

1. BACKGROUND

Software industry of country can play a significant role in a country national income and considered as enabler technology for the developing country to play their part in globalization and improve their economic gesture for well-being of their people. India is one of the prime examples who took the opportunity and is considered as “mini superpower (software). Pakistan software industry is considered sharing many factors of Indian Software Industry but it is rated as tier-3 in taxonomy of software export nations. Pakistan Software industry blessed with an excellent infrastructure, skills and talented labour force along with government protection deserved to be at least tier-2 industry like China and Russia if not tier-1 like India [1].

Pakistan Information technology despite having lot of potential of growth and success in international market failed to get expected status of at least tier-2 among the taxonomy of software exporting nations. Pakistan software industry failed attains desired level of status in the international market place. Among many other reasons one is that industry have paid little attention to quality assurance and improvements activities especially in process areas. Many issues, problems and barriers block the way of organization to the efforts of process improvements and implementation of any standards like CMMI model for this purpose. But due to many reasons, Pakistan software industry failed to progress and achieve the expected portion of international market place. Out of many factors of poor performance, before we start the subject of quality practices issues and quality enforcement standard implementations we would like to have an overview of Pakistan Information Technology industry [2].

Pakistan Information technology industry is one of the fast growing among the international IT market place with about 2.8 billion US dollar market share. Due to its potential, it is the focus of many offshore and outsources firms. Due to great concerns of Government, availability of skilled staff, better infrastructure and competent rates of connectivity make it attractive for Information Technology (IT) vendors an ideal marketplace for investment. It is one of luckiest industry where Government paid heavy attention towards development of infrastructure and capacity building. Government also declared it a tax free industry till 2016 [1]. Pakistan IT industry faces uneven pattern of growth. Though software houses exist since

1970s but Government was not much interested before last decay of twentieth century. During last decade of twentieth century, many concrete steps were taken to promote software developments in order to meet local needs and to earn foreign revenue. Government of Pakistan also took initiative during this period for supporting by providing infrastructure and policy for the industry.

Let have an overview of salient features of Pakistan IT market place. Pakistan Government has taken serious steps and involve in development of many policies and strategies for the betterment of IT industry in Pakistan result into following characteristics of Pakistan software industry [1].

- Pakistan It market place share 2.8 billion US dollar of international IT market place.
- There are about 110,000 IT professionals available to industries that are fluent in English speaking capabilities.
- Out of these available skilled IT professionals 24,000 are also engaged in export, play important role in national income of Pakistan.
- There are seven hundred IT companies operating in Pakistan. Out of these two are listed on Karachi Stock Exchange (KSE), One on Dubai International Financial Exchange (DIFX) and two on National Association of Securities Dealers Automated Quotations (NASDAQ).
- About seven multinational companies have set up their development offices in Pakistan.
- Out of these companies eleven are ISO 9001 certified, twenty three CMMI and eleven ISO 27001 certified.
- Development of IT parks in all the major cities of the country.
- A strong telecommunication infrastructure presents to support development in Information Technology.

100% profit belongs to software companies in Pakistan with exemption of all kind of Taxes.

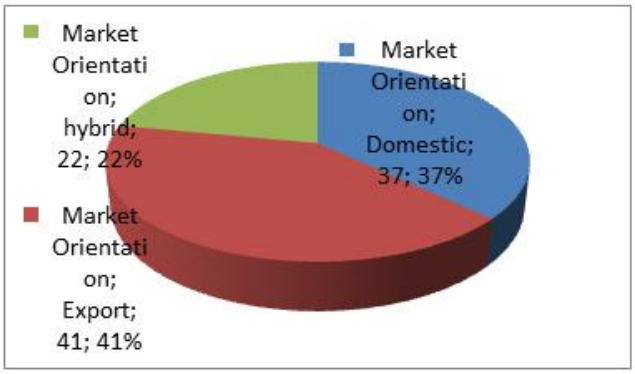


Fig. 1. Market orientation of Pakistan software industry [1]

In short Pakistan is an ideal place for software and Information Technology developments in term of available infrastructure, capacity and Government privileges and protection of industry.

1.1 INTERNATIONAL TREND

We would like to show the trend of adaptation of CMMI in global IT market place with same statistics. More than two thousand organizations evaluated since 1987 to 2005 for CMMI. In the first we show the nature of organization adopting the CMMI and their percentage out of total organization implementing CMMI.

Table 1. Distribution of CMMI certified organization with respect to their types [3]

Sr	Type of organization	Percentage
1	Commercial/ In house	70.5
2	Defense department/Federal contractors	24.9
3	Military/Federal	4.6

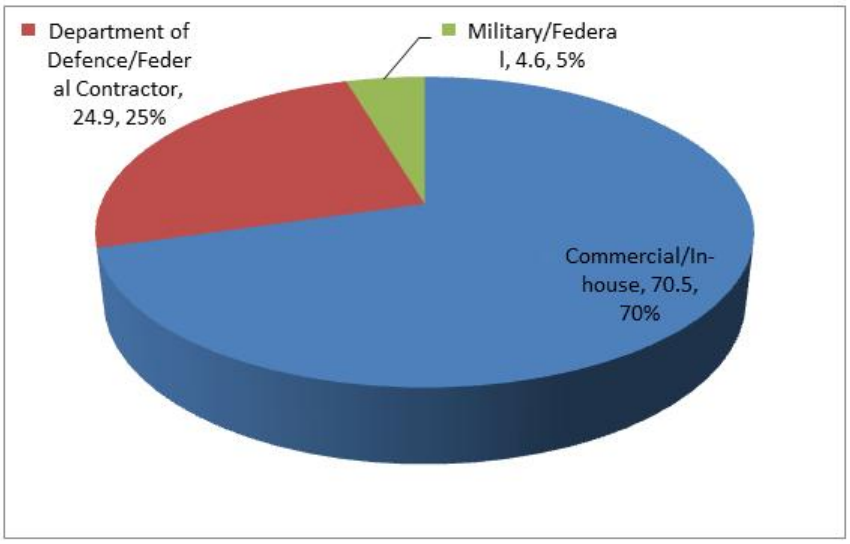


Fig. 2. Distribution of CMMI certified organization in world [3]

Table 2. Distribution with respect to size of organization for CMMI certifies organization worldwide [3]

Sr	Size of organization	Percentage
1	1-100 Employee	48%
2	101-200 Employee	23.5%
3	201-2000 and more	28.5%

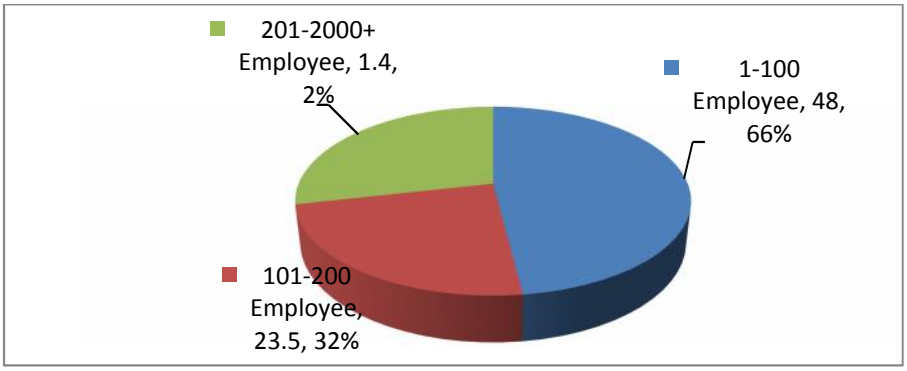


Fig. 3. Distribution of CMMI certified organization with respect to size [3]

What these analyses suggest? It is clear from the analysis that most of the CMMI certified organizations are medium to small. And from the next analysis it would be clear that most of the organizations are at Level 3 and level 2.

Table 3. Distribution with respect to level of CMMI [3]

Sr	Type of organization	Percentage
1	Optimizing Level 5	6.8%
2	Managed Level 4	7.3%
3	Defined Level 3	23.4%
4	Repeatable Level 2	43.4%
5	Initial Level 1	19.3%

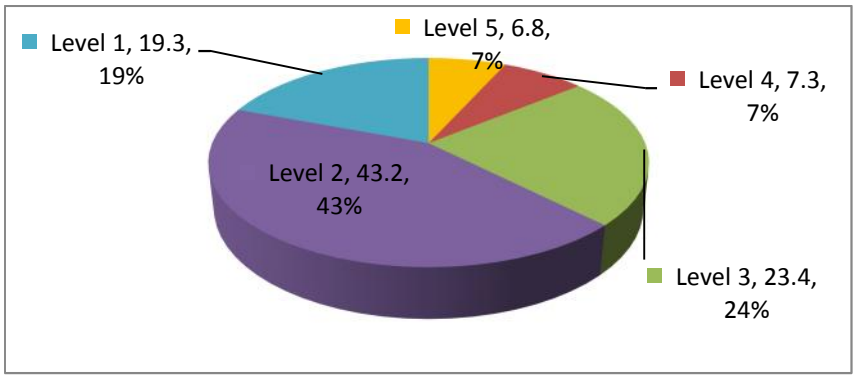


Fig. 4. Distribution with respect to CMMI level [3]

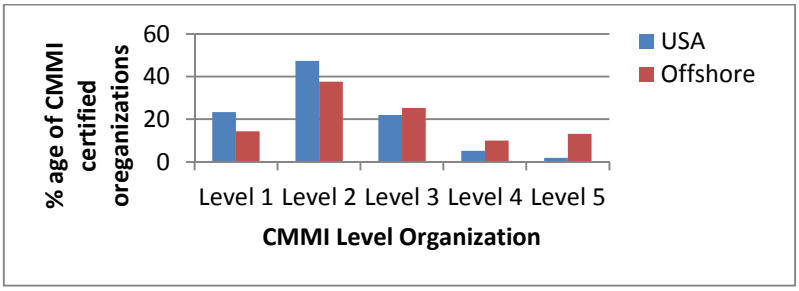


Fig. 5. Comparison of USA and offshore CMMI certified organization since 1998 [3]

Table 4. Countries from where data taken [3]

Argentina	Venezuela	Republic of Korea	Singapore
Australia	Finland	Malaysia	South Africa
Austria	France	Mexico	Spain
Barbados	Germany	Netherlands	Sweden
Belgium	Greece	New Zealand	Switzerland
Brazil	Hong Kong	Pakistan	Taiwan
Canada	Hungary	Philippines	Thailand
Chile	India	Poland	Turkey
China	Ireland	Portugal	United Kingdom
Colombia	Israel	Puerto Rico	United States
Denmark	Italy	Russia	Uruguay
Egypt	Japan	Saudi Arabia	Vietnam

Thanks to NetSol, due to which Pakistan name is also in the list. There is still increasing trends of adaptation to the CMMI worldwide. What all this data and analysis depict. There is change in IT vendors and clients from the last two decades. From the last few decades concern of quality products and services increased to significant amount. Organizations around the globe want to be more efficient and productive in term of their product quality.

Table 5. Concentration of high level organization in different countries [3]

Sr.	Country	Level 4 Organization	Level 5 Organization
1	USA	39	19
2	India	28	46
3	Australia	2	0
4	Ireland	1	0
5	Israel	1	0
6	Singapore	1	0
7	Russia	0	1
8	China	0	2
9	Canada	0	1

From the above table, it is clear that most of the high maturity organizations are concentrated in America and India.

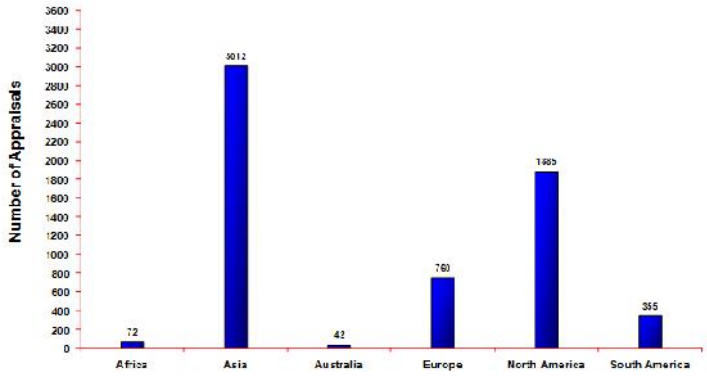


Fig. 6. Number of appraisals [4]

This might be the reason India is the leading country of software development and IT related services. It is very necessary to promote implementation of CMMI in Pakistan industry in order to compete and get their share in global market place.

1.2 CAPABILITY MATURITY MODEL INTEGRATION (CMMI) STATUS IN PAKISTAN

Pakistan software industry was in right direction in the last decade and many organizations were moving towards acquisition of CMMI certification by year 2002 but due to some unavoidable circumstances Pakistan software industry suffered. The most noticeable among these are the economic recession in international market place, security conditions in Pakistan and most importantly the war against terrorism in the regions hit most of the Pakistan industries including the IT industry in 2003-2004. Due to this changing scenarios most of the organizations changed their policies and strategies in different aspects including their determination to be CMMI certified.

But at the same time NetSol break the shackles for Pakistan with introduction of CMMI practices in their organizations in 2002 and become the pioneer among the Pakistan organization for CMMI certification. During this stage NetSol was assessed as at Level 2 due to CMM based appraisal for internal process improvements [5].

Pakistan software industry faces many problems regarding implementation of CMMI in Pakistan. In order to promote Pakistan software industry and improve its product and standards PSEB play significant role in different time of history. In 2004, PSEB launched the first phase of plan to implement CMMI in Pakistan software industry with at least level 3. In this phase five Software development organizations were selected that are [2];

- NetSol Technologies (Pvt.) Ltd.
- Xavor Pakistan (Pvt.) Ltd.
- Systems (Pvt.) Ltd.
- KalSoft (Pvt.) Ltd.
- Digital Processing Systems

PSEB selected the following companies for training and consultancy in implementation of CMMI practices in above selected organization [2];

- Moody's International/Quality Assurance Institute, Middle East, Africa
- Pakistan NetSol Consulting Services (Pvt.) Ltd.

Keeping in view of importance of quality and its role in success of organization many IT organization in Pakistan also strive to implement quality enhancement practices and policies. With this motive in mind many companies are moving towards different quality implementations standards including CMMI with the support of PSEB and other policy making organization like PASHA etc. Let we have status of CMMI implementation in Pakistan.

CMMI LEVEL 1 & LEVEL 2

Initially all the organizations are at level 1 by default. About sixteen companies in Pakistan planning to achieve level 2. These sixteen companies are registered with PSEB. These organizations also successfully cleared class C appraisal but not class A appraisal to be qualified at level 2 of CMMI model. In Pakistan there are about seven hundred software development companies and only 25 striving for CMMI implantation in their organization. Since 2007 out of these twenty five companies in Pakistan only 2 are successful in reaching at level 5, two at level 3 and 2 at level 2. [6]

Masinfosoft Pvt. (Ltd.) ended their efforts even without class C appraisal for CMMI Level 2 Organization

CMMI LEVEL 3

According to PSEB and published result of SEI-CMU two organizations in Pakistan achieved level 3[6].

CMMI LEVEL 4

There is no organization in Pakistan at CMMI-Level 4.

CMMI LEVEL 5

According to PSEB and published result of SEI-CMU only two organizations in Pakistan named as "NetSol Technologies Pvt (Ltd) and NCR Pakistan Pvt (Ltd.) achieved level 5.

2 MATERIAL AND METHOD

Despite the tremendous start and blooming growth in last decade there are some bottlenecks that hinder the Pakistan software industry to be a source of large income from international market like our neighbor India. Pakistan Industry fails to develop vision, commitment and infrastructure for being a global resource. Where we go wrong and what are the circumstances that lead to change in our direction. Identification of these barriers is the main objective of this study.

Pakistan software industry has fallen into a ghost cycle of quality and resources. Pakistan slowly and steadily losing their international market shares due to quality issues of products and services from industry. Most of these bad quality issues are due to bad practices in industry [1]. Due to lose of market share organizations failed to generate revenue and income. With the reduced income organization resources also tend to decline result in less efforts for improvements in quality and practices across the industry.

2.1 DATA COLLECTION METHOD

We want to use following methods of data collection

- Literature review
- Survey
- Interview
- Case study

Extensive background on literature review is covered in previous chapter that help use to identify the major areas of problem and categorize them as shown in list;

- Organizational
- Project related
- Personal

2.2 ANALYSIS METHOD

As we divide the organization into four groups for data collection and findings to have a mix of all. This mix is based on;

- Organization those are extremely successful in implementation of CMMI in Pakistan like NetSol Pvt. Ltd.
- Organization that are level 3
- Organization that are at level 2
- Organization that take initiative but abandoned
- Organization that do not take initiative or at level 1

For our discussion we categorize these organizations into following categories:-

Table 6. Category design for organization with CMMI level in Pakistan

Category	Characteristics
A	Organization that are successful in implementation of CMMI level 2 and above like CMMI-5 and CMMI-3
B	Organization that are striving for level 2 and completed appraisal C and B
C	Organization at level 1 and do not striving for CMMI implementation

As from analysis out of the seven hundred registered organizations only twenty two opt for CMMI and out of these twenty two organizations sixteen are at level two. This reveals those major problems are at level 2 for Pakistan industry. Out of twenty two process areas of CMMI model we would like to focus only on seven process areas of CMMI level 2 [7]. These are;

- Project Planning (PP)
- Supplier Agreement Management (SAM)
- Process and Product Quality Assurance (PPQA)
- Requirements Management (REQM)
- Project Measurement and Analysis (PMA)
- Configuration Management (CM)
- Project Monitoring & Control (PMC)

We want to determine to what extent the practices of seven process areas of level 2 are practiced in organization. We rate the implementation of process areas as listed below to determine how strongly organizations in Pakistan implementing these practices of process area improvements in Pakistan or to assess the capability level of process in Pakistan industry organization.

Table 7. Process area implementation rate design [7]

Ranking	% age practices implemented of process area
Fully Implemented	100%
Mostly implemented	81-99%
Largely implemented	50-70%
Partially implemented	21-49%
Not implemented	0-20%

We also rate the organization according to the presence of above mentioned seven process areas and performance in term of their parentage of presence of these practices in any organization

These are many recognized challenges across the world while implementation of Software Process Improvements especially. But in context of Pakistan where industry struggle at CMMI level 2 we selected only twenty challenging factors or barriers that are more crucial in context of Pakistan industry. With the identification of these factors and their impacts we would be in better position to identify the practices that best suits to Pakistan industry for process improvements [8].

Through literature review we were able to extract out twenty factors that are crucial for the successful implementation of above mentioned seven process areas as we set target area of our research [9]. These twenty successful factors that are crucial for seven process areas identified above in Pakistan industry context are:

- Organizational culture
- Organization's goals
- Lack of infrastructure
- Lack of motivation
- People related factors
- Technical staffing issues
- Lack of knowledge & skills
- Lack of new tools & technology
- Lack of trainings
- Reluctant to investment
- Inadequate budgets & schedules
- Lack of management support
- Lack of commitments
- Documentation issues
- Improper data management
- Lack of stakeholder involvement
- Improper communication
- Lack of internal audits & reviews

In additional we also want to collect data about organization as size, status, profile, market access, practices, politics and culture of the organization. We also want to get some information about respondents in term of their education, skills, experience, job level and affiliation with the organization.

3 RESULTS AND DISCUSSIONS

We want to discuss our findings both in term of process areas and challenges. We start our findings with the process areas.

3.1 PROCESS AREA WISE RESULTS AND DISCUSSIONS

PROJECT PLANNING (PP)

a. Survey result reveals that 100% of category A organization implement fully implementation of Project Planning (PP) process area of CMMI level
b. There is a mix trend of implementation of practices of PP process area and 50% of these organizations implementing with most of full and largely implementation.

There are many reasons behind this performance of the Pakistan based organization some of these are listed below;

a. No proper planning for issues with conflicts
b. No planning for early identification of problems and threats
c. No document management
d. Lack of stakeholder involvement in planning
e. Organization not involved in making agreements

SUPPLIER AGREEMENT MANAGEMENT (SAM)

a. For category A all the companies with level 5 and 3 show 100% full implementation of best practices of SAM process area while level 2 are also performing these practices at satisfied level.

b. For category B results are not satisfactory with only 9% full implementation.

The main reasons of poor performance for this process area are;

a. No agreements settlements with supplier
b. No standard method for supplier selection
c. Supplier not involved in management and technical practices

PROCESS AND PRODUCT QUALITY ASSURANCE (PPQA)

a. In case of category A there is 95% of implantation of best practices of PPQA process area.
b. In case of category B implantation rate change from organization to organization. 14% organization show full implementation, 50% largely, 29% partially and 7% with no implementation of best practices of this process area.

The main reasons behind this poor performance in this process area are;

a. There is not define method for product and services quality assurance
b. There is no method for evaluation of product and services quality assurance
c. Stakeholders are communicated about discrepancies
d. Stakeholder are not involved and results are seldom communicated

REQUIREMENTS MANAGEMENT (RM)

a. In case of category A all organization of CMMI level 5 and 3 show full implementation with 100% practices of RM process area. Both CMMI level 2 organization also full implemented practices of RM but with implementation rate of 92%. Whatever the case this category of organization still rated as excellent in term of implementation of practices of RM process area of CMMI level 2.
b. In case of category B implementation rate varies from organization to organization with 7% of fully implementation and 21% non-implementation. For this process area we can rate category B as average.

When we analyze our finding from different sources we came to know the different reasons of poor performance of requirement management performance as listed below;

a. Organization usually not recognize important of requirement management
b. Failed to maintain a consistent record of requirement management and requirement change history
c. Do not assess the validity of requirements and requirement management
d. Analyze requirements only in term of schedule and cost.

PROJECT MEASUREMENT AND ANALYSIS (PMA)

a. In category 1, it can be rated as excellent in term of implementation rate of best practices of PMA
b. In category 2 it is 0% fully implemented, 41%largely implemented, 43% partially implemented and 17% not implanted

Most of organization of all categories in Pakistan struggle to get higher rating of project measurement and analysis (PMA) process area due to following reasons;

a. Objectives are nor cleared and refined
b. No process of feedback
c. Occasional objective review
d. No training and guidelines

CONFIGURATION MANAGEMENT (CM)

a. In case of category A level 5 rate as excellent with 1005 full implementation of practices of CM process area. But organization with level 3 rated as good and level 2 as average against the implementation of practices of CM process area.
b. In case of category 2 result reveals average implementation of CM practices with 14% fully implementation, 36% largely implementation, 29 % partial and 21% non-implementation of practices of CM process area of CMMI level 2.

Out of many reasons following are considered important for poor performance in context of configuration management process area;

a. Configuration Management not properly defined and managed
b. Not updated properly and on continuous basis
c. Lake of methods of backup and access
d. Change is not properly analyzed
e. Lack of standards practices of CM

PROJECT MONITORING CONTROL (PMC)

a. Category A organization rated as excellent for implementation of practices of Project Monitoring and Control (PMC) process area. Survey reveals 100% full implementation of practices of PMC process area in category A organization.
b. For category B they vary from poor to average and not satisfactory at all. For category B there is 0% full implementation, 57% largely implementation and 43% of partially implementation of practices of PMC process area.
c. In case of category C the practices implementation rate is from 0% for full implementation.

There may be many reasons but some important are;

a. Organization do not fallow plan for work
b. Never measure actual cost and schedule against the planed
c. In case of change there are no review for proper analysis and documentation

3.2 FACTOR WISE ANALYSIS

ORGANIZATIONAL CULTURE

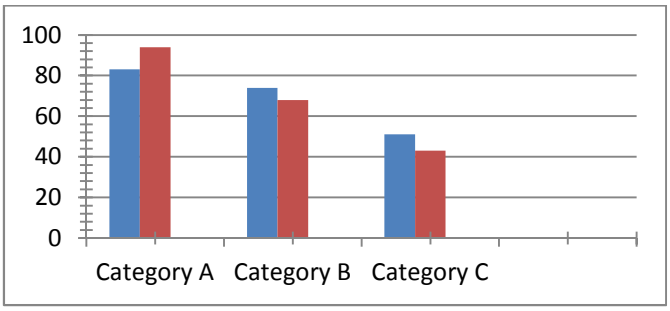


Fig. 7. Organization culture practices response and implementation rate

From analysis we conclude that culture of organization with category A is supportive while organizations in categories B and C failed to establish culture that is supportive for the implementation of best practices of certain process areas. We got 83% response rate that culture of the industry organization is not supportive for CMMI from category A, 74% from category B and 51% from category C. After close observation we came to know that implementation rate in these organization are 94, 59 and 41% respectively.

ORGANIZATION'S GOALS

Organization in category A are more goal oriented as compared to organization in category B. 93% of category A organization believes that goals are crucial while 61% of category B and 43% of category C. Through case studies we determine the implementation rate for practices to overcome this problem in Pakistan industry are 93% for category A, 58% for category B and 39 5 for category C. Both these statistics are shown in simulation.

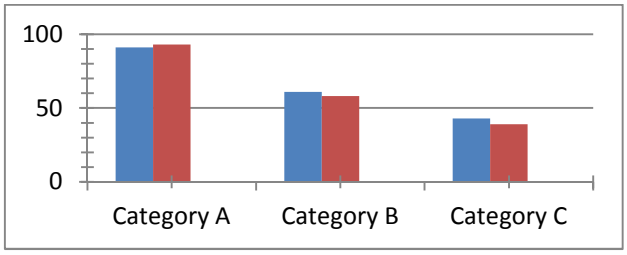


Fig. 8. Goal setting practices response and implementation rate

LACK OF INFRASTRUCTURE

All the organization from all categories agrees that infrastructure is very necessary for implementation of best practices of SPI in Pakistan industry.

Without proper infrastructure it would be difficult for the organization to take initiative for SPI practices implementation. Category 'A' organization response rate in favor of this factor are 89%, category B 71% and category c with 75%. Implementation rate of best practices to overcome this factors are 95% in category A, 71% category b and 41% category C as shown in next figure

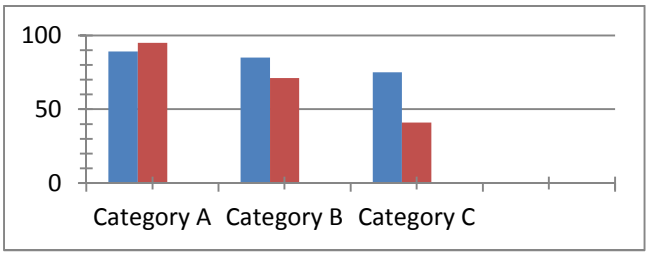


Fig. 9. Lack of infrastructure practices response and implementation rate

LACK OF MOTIVATION

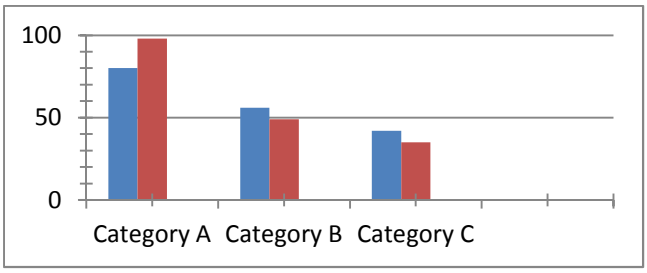


Fig. 10. Lack of motivation practices response and implementation rate

Management and employee motivation factor is very important in successful implementation of process improvements practices. 80% of responses of employee of organization from category A are in favor of motivation factor while only 56% from category B and 42% from category C believes that motivation is a crucial factor for implementation of best practices. While implementation rate for this factors are 98%, 71% and 41% in category A, B and c respectively.

PEOPLE FACTOR

Employee motivation, empowerment, responsibility delegation, and encouragement are the factors that play important role in inclination of organization for SPI best practices implementation. 87% responses from category A , 65% from category B and 58% from category C consider these factors are important for process improvements in Pakistan industry. While implementation rate of best practices for improvement in people factor are 96%, 42% and 31% for category A, B and c respectively.

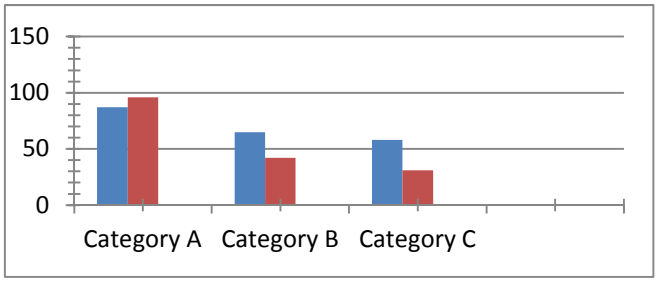


Fig. 11. Lack of people factor practices response and implementation rate

TECHNICAL STAFFING ISSUES

Staffing issues relate to organization approach of hiring people for SPI implementation. organization from category A is about 93% for need and hiring of specialized task for SPI improvements and only 33% from organization of category B and C.

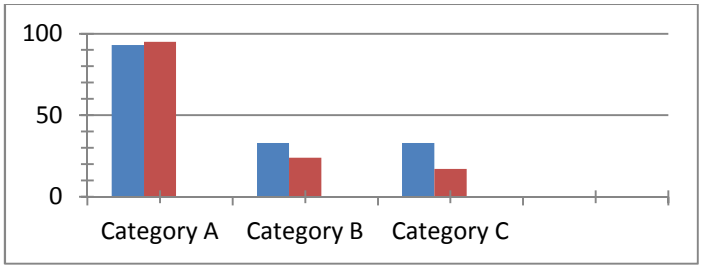


Fig. 12. Practices response and implementation rate regarding people factor

While implementation rate of best practices for to improve the technical and staffing issue are 96%, 24% and 17% for category A, B and C respectively.

LACK OF KNOWLEDGE & SKILLS

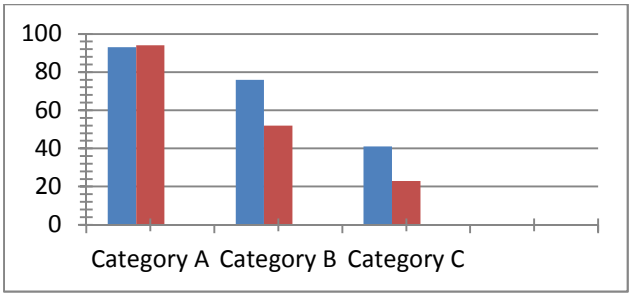


Fig. 13. practices response and implementation rate about knowledge and skills

Knowledge, skill and expertise and experience of employee also contribute positively towards the implementation practices if improvements. From category A we got 933% responses in favor of the factors while 76% from category B and 41% from category C organizations. While implementation rate of best practices for to improve the knowledge and skills are 94%, 52% and 23% for category A, B and C respectively.

LACK OF NEW TOOLS & TECHNOLOGY

Inclination of staff for adaptation to new tools and techniques is also considered important for adaptation of practices of SPI. employee of organization from category A are more motivated and ready for adaptation to new technologies, tools as compared to employee of organization of category B and category C. After detailed analysis we determine that 91% from category A, 65% from category b and 54% from category C are in favor of new tools and technologies for SPI practices. While implementation rate of best practices for to improve the tools, technology and techniques are 94%, 41% and 23% for category A,B and c respectively.

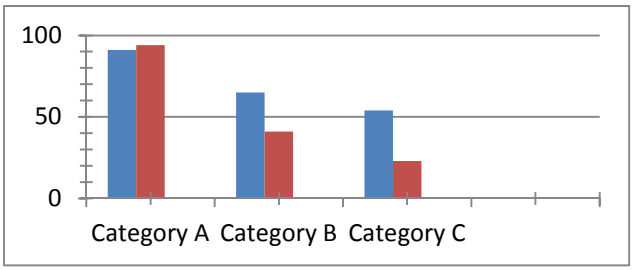


Fig. 14. practices response and implementation rate about new tools and technology

LACK OF TRAININGS

Trainings are very essentials for capacity building and to be ready for new trends and improvements patterns. Without training it would be difficult for the organization to withstand with emerging needs of the clients.. It is found that organization who are successful in reaching to higher levels of CMMI are frequently involve their employee in different types of trainings as compared to organization of category B and C. Category A positive response rate are 92%, category B with 71% and category C with 45%. While implementation rate of best practices for training the people are 93%, 55% and 19% for category A, B and C respectively.

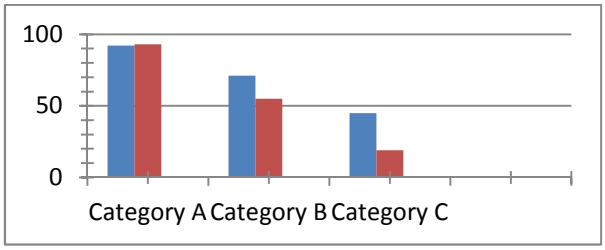


Fig. 15. practices response and implementation rate about lack of training

RELUCTANT TO INVESTMENT

Organizations are reluctant to invest and afraid of high conversion cost for improvements in process. Though these practices help the organization to cut cost in long run but most of the organization focus is on short term objectives especially in Pakistan. From our study we revels that there are 88% positive response from category A, 65% from category B and 44% from category C to invest for SPI practices. While implementation rate of category A are 92%, category B are 43% and category C are 29%.

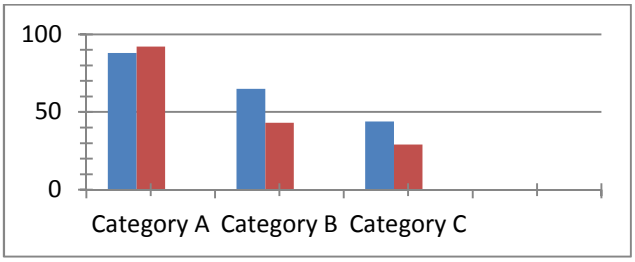


Fig. 16. practices response and implementation rate about investment

INADEQUATE BUDGETS & SCHEDULES

From different source we reveal that organization always want to cut costs across the projects in order to maximize the profit. Profit margin can be improved through SPI but most of the organization focus on short term goals rather than think big and in long run. Inadequate budget and schedule over project can affect quality practice implementation. Our data reveals that category A organization response rate are 89% towards importance of his issue while category B and C are 76

and 65% respectively. The implementation of best practices to overcome this barrier is 92% in category A, 45% in category b and 32% in category C organizations of Pakistan.

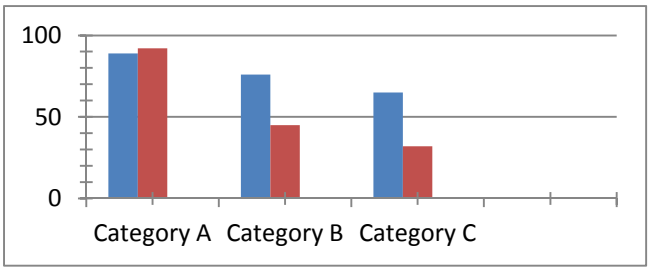


Fig. 17. practices response and implementation rate about budget and schedules

LACK OF MANAGEMENT SUPPORT

Management usually focuses on short goals and wants to improve their reports, competencies and financial savings. Most of the today managers think narrowly towards project rather than organization. Management are also not ready to delegate powers, responsibilities and to their employee. 87% responses from category A , 61% from category B and 43% from category C consider these factors are important for process improvements in Pakistan industry. While implementation rate of best practices for improvement in enhancements of management support are are 91%, 41% and 16% for category A, B and C respectively.

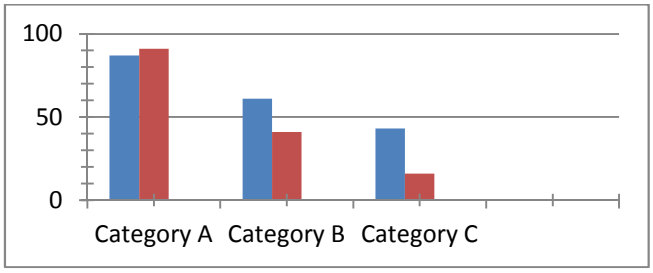


Fig. 18. practices response and implementation rate about management support

LACK OF COMMITMENTS

All the organization including top management and workforce in the industry not committed to organization, project and quality improvements practices. Our data reveals that category A organization response rate are 87% towards importance of his issue while category B and C are 67% and 41% respectively. The implementation of best practices to overcome this barrier is 91% in category A, 55% in category b and 27% in category C organizations of Pakistan.

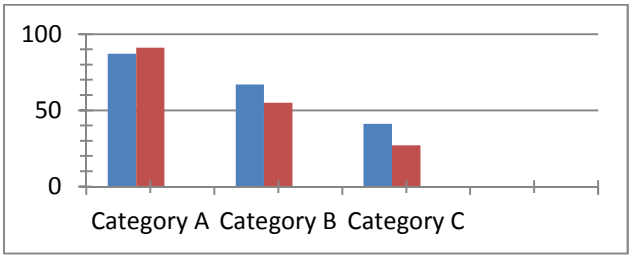


Fig. 19. practices response and implementation rate about commitment

DOCUMENTATION ISSUES

Documents are crucial for the organization operation and survival but in Pakistan most of agreement and deals are taken verbally. Data collected through different resources show that 93% responses from category A, 67% from category B and 33% from category C consider document management is important for process improvements in Pakistan industry. While implementation rate of best practices for improvement in document management are 94%, 35% and 14% for category A, B and C respectively.

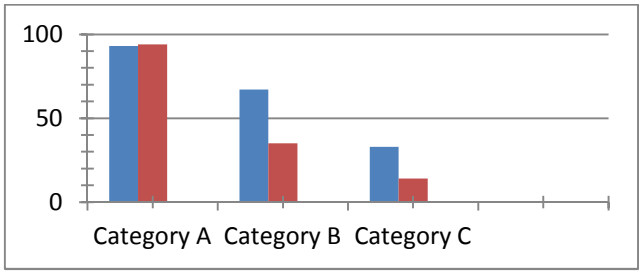


Fig. 20. practices response and implementation rate about document management

IMPROPER DATA MANAGEMENT

Data is important source of decision making that is the core of management. But in Pakistan most of the organization suffers with adequate data management practices. From survey and other resource we came to know that category A organization response rate are 91% towards importance of his issue while category B and C are 76 and 35% respectively. The implementation of best practices to overcome this barrier is 94% in category A, 47% in category b and 18% in category organizations of Pakistan.

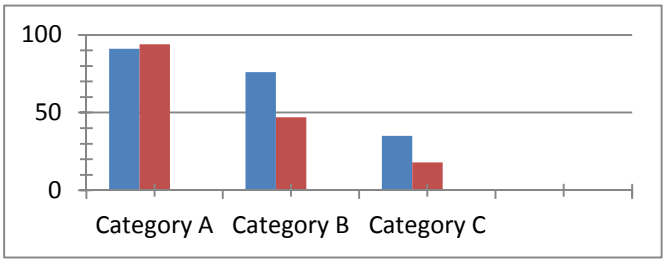


Fig. 21. practices response and implementation rate about data management

LACK OF STAKEHOLDER INVOLVEMENT

It is necessary that stakeholders are identified and involved in the project as early as possible from the initial stage of project to improve the credibility of the work and project. But in Pakistan software industry we lack this trend. From our study we found 86% responses from category A, 69 % from category B and 43% from category C consider these factors are important for process improvements in Pakistan industry. While implementation rate of best practices for improvement in stakeholder involvement are 91%, 51% and 23% for category A, B and C respectively.

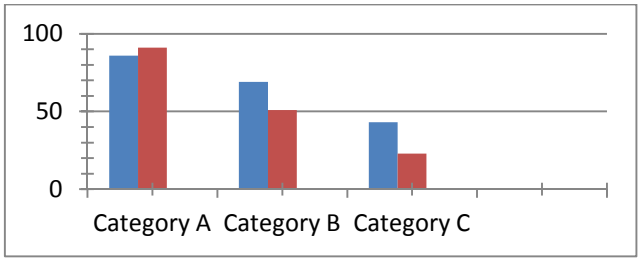


Fig. 22. practices response and implementation rate

IMPROPER COMMUNICATION

Our data reveals that category A organization response rate are 94% towards importance of his issue while category B and C are 65 and 34% respectively. The implementation of best practices to overcome this barrier is 94% in category A, 56% in category b and 17% in category C organizations of Pakistan.

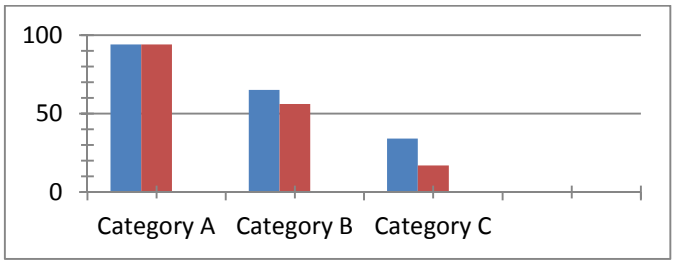


Fig. 23. practices response and implementation rate about data management

LACK OF INTERNAL AUDITS & REVIEWS

In Pakistan most of the organization believes that audit is not vital but they face problem in term of lack of resources, weak control and loss of revenue. From our analysis and research we found that 87% responses from category A, 67% from category B and 32% from category C consider these factors are important for process improvements in Pakistan industry. While implementation rate of best practices for improvement in internal audits reviews are 92%, 39% and 11% for category A, B and C respectively.

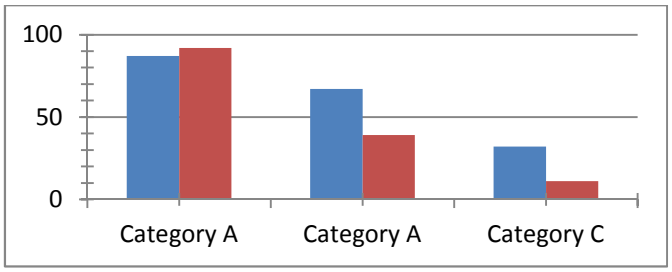


Fig. 24. Response and implementation rate of audit and review

4 RECOMMENDATIONS

We suggest a very simple framework that can be used by any organization to take initiative for the implementation of any SPI model like CMMI in Pakistan. It based on five core areas to address as access, analyze, set objectives, streamline with business objectives and evaluate as shown in the figure.

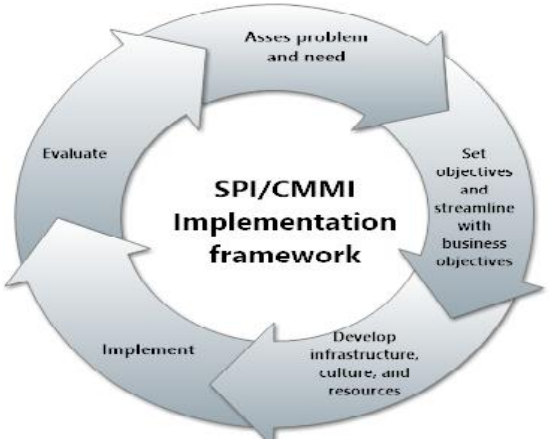


Fig. 25. Response and implementation rate of audit and review

Let describe each one of the following;

- Before going to any SPI effort or CMMI implantation it is necessary to assess the problem, need for improvements and potential problems. Carefully analyze the situation in term of problems and solutions, possibilities, cost, resource allocation, infrastructure, culture and people.
- Set realistic goals and objectives of improvements. These goals and objectives must be streamlined with the business objectives in for attracting market, going for more market share, competitive advantage and quality enhancement.
- Build infrastructure, culture and resources for SPI or CMMI implementation. There is immense need to create awareness of importance of quality and role of software process improvements for quality. This awareness of importance of quality practices and SPI should focus at all levels and in all departments of organization. Awareness program should start with high level management and span to the all levels in organizations. Another important consideration is the arrangement of resources for SPI like process engineers, assessors and consultants. This capacity and resource building is only possible if organization is committed to introduce the culture of learning and training of its employee. But such trainings are difficult to find and may prove to be very costly if available outside the Pakistan.
- Evaluate the outcomes against the set objectives of improvements. This Evolution should be in term of cause and effect of each process area.

5 CONCLUSION

Pakistan software industry fails to compete in international market place for export. The main reason for poor quality in software industry of Pakistan is related with process area deficiencies. A few organizations take initiative in international standards implementation. Many factors identified that block the way of organization for any standard implementation in Pakistan industry. Out of fifteen hundred organizations in industry only twenty two take initiative for CMMI. It is only 0.15% of total organizations in industry who inclined towards adaptation of CMMI model. Out of these twenty two organizations that opt for CMMI implementation only two achieve status of level 5, three status of level 3 and two status of level 2. Let we consider them successful in term of implementation of CMMI practices and requirements. Than out of seven hundred organizations only five are successful in implementation of CMMI this is about 0.01% of CMMI success rate in Pakistan industry and success rate is only 0.28% for organization who opt for CMMI implementation.

Out of the twenty two about sixteen organizations are striving for Level-2 achievements. It indicates that most of organization have problem with process areas. It is also identified the reasons of the problem for improvements in these seven specific process areas where Pakistan industry suffer. We also suggest a framework for going to CMMI model that best suits with the requirements of Pakistan industry for going with CMMI implementation.

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Geographically Distributed Software Quality Assurance Team Management

Muhammad Naeem, Salman Qadri, Rana Muhammad Saleem, Rab Nawaz Bashir, and Yasir Ghafoor

Department of Computer Science & IT,
Islamia University Bahawalpur,
Bawalpur, Punjab, Pakistan

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ABSTRACT: Globalization has embraced the world business, even the software development industry also affected. In order to exploit the universe talent there is major trend of offshore development, testing and for other quality assurance activities. Organization in order to save costs, and use specialized expertise has focus on distributed software development and quality assurance practices. Along with certain advantages there may be certain loopholes and problems, if the distributed process and teams are not managed in a proper ways. The focus of the study is to provide a framework for understanding and supporting the management of geographical distributed quality assurance teams. The proposed framework stresses the need of effective team organization, configuration management, collaboration, coordination and communication across team members. The study also evaluates the performances of team geographical distributed teams while applying these parameters.

KEYWORDS: Quality Assurance, Geographically Distributed software Quality Assurance (GDQA), Configuration Management, Coordination, Collaboration, Communication.

1 BACKGROUND

Globalization has effects on all aspects of life, from how a person spent a day to complex business activities. Due to far reaching technologies, most of the entities and functions of life has changed to take advantage of the shift and add value to their business. Technology and Globalization also has impact on business. Now the small business has the capability to reach in far areas of the world. Software development industry also witnessed dramatic and revolutionary shift in ways it do business, perform process, and manage people. New technology equipped the modern business to reach in far-flung areas to access the resources, skills and competencies, which considered essential for the business [1].

In recent years software vendors have emphasize on cutting the cost of software development while there is also increase in concern of quality of software products both from customer and organization perspectives. Keeping in view of globalization and availability of modern technologies a modern software development paradigm is offshore and distributed development, which also tends to promote geographical distributed software quality assurance [2]. This can be evident from many cases of off shoring and outsourcing of software development and quality assurance activities to low-cost countries like India, China, Russia etc. This distributed and offshore development paradigm shift the development and testing from co-located teams to geographical distributed teams, which impose certain challenges and new agenda of research for effective management of such team [3].

Geographical distributed quality assurance (GDQA) can save money, help to market early and provide skills that are not available locally. There is need of flexibility in the process of development and quality management to support and working of such teams. It is customary to develop new process and tools for the support of such teams and even a new model of working due to unique challenges induced by demands of flexibility and speed in new paradigm [4].

In order to lower the costs of development a new paradigm of software development is development and testing in distributed and offshore fashion. The basic theme of offshore and distributed development and testing based on the

Corresponding Author: Rab Nawaz Bashir

utilization of viable talent at lower prices from different parts of the world. It also tends to exploit geographical distributed talent in an efficient and productive manner at lower costs. This distributive approach to quality management made the software quality assurance to a more complex level. Handling of such a large geographically distributed team for tracking and managing quality for variety of diverse projects not proven to an easy task [5].

Geographically Distributed Development is common approach within the software development organization nowadays. Despite tremendous concern in quality of software product budget still fall short for the required efforts. In order to attract best talent and save cost organization shifting towards globally distributed team of software development. In order to manage quality assurance team there required greater agility in quality management. Due to shortfall of budget for quality, efforts and staff required for quality management. One solution for organization is accelerating quality management practices by leveraging quality practices [6].

1.1 CHALLENGES WHILE MANAGING DISTRIBUTED TEAMS

There is a transition from in-house to distributed development result in save cost and high skill and talent availability. A lot of expertise and commitment required in managing distributed team otherwise it might not work well for the organization results in failure of projects due to loss of time and quality of finished products [4] . There are certain challenges while managing distributed team, some listed below;

- Sometimes distributed team members not treated as true as true member of team or treated differently.
- Usually there is insufficient communication between the distributed members. Team management should think beyond medium and tools. There should be adequate process in place for effective interaction, collaboration and communication for team members [7].
- Distributed team members lack required skills to operate in distributed environment [3].
- Distributed team members falls below the required motivation result in effect on quality of work and product and high turnover. Its responsibility of management to train the team members in required skills as well as skills required to operate in distributed fashion [8].

In a traditional environment most of their efforts of team not aligned with the requirements. Due to poor communication and collaboration, many unattended changes to the product took place due to testing process. Role of quality persons limited to testing department only. Real value of quality management team usually ignored [5].The net result is that integrity and quality of the product is at risk. In order to reduce risk in distributed quality management its necessary that all the quality team members and others teams are in close collaboration and in synchronization with each other. Every team member should have a common focus and stay in touch with requirement changes. Both development and quality team members should act according to changed requirement [9].

2 MATERIAL AND METHOD

Managing distributed team is complex phenomenon and lot of ingredients included in the framework. Understanding the fundamental of software quality practice in distributed environment is very important before their implementation. In order to limit the scope of our work we focus on organization of the team, Configuration management, coordination, collaboration and communication of geographical distributed team members.

2.1 TEAM ORGANIZATION

Distributed quality management team also offers many advantages beyond attracting skills and cost saving. It allows simultaneous parallel activity execution result in more time to market. Each team members allocated fixed portion of code for evaluation, allowing the quality assurance activity in parallel. With the help of independent task intercommunication overhead can reduced, allows each member to act autonomously and progress without substantial hinders. Effective use of distributed team can provide lot of advantages for the organization in term of [10] [11];

- Overlap activities provide opportunities for continuous 24-hour working.
- Reduce time to market
- Better use of skills of team members
- Add global prospective
- Improved software quality through multiple skills integration into effort
- Low operating overhead

There is also some problem with distributed team if not properly organized. If distributed teams not properly managed, whole project suffers. For geographical distributed team members minimum interdependence required in order to avoid risks involved in communication and collaboration. Situation becomes more complex with existence of team in different time zone result in minimum overlap of working hour. This may introduce potential problem in team interaction and communication [4].

One solution to this problem is shift work. All the locations involved to work for 24 hours around the clock. Luckily, software artifacts are capable to transfer across the location exploiting modern communication capabilities. Continuous working in shift may reduce the problem arises due to existence of team in different time zones. However, it also requires some adjustment as [4]:

- Divide the software project artifacts in semi-independent activities.
- Assign it to distributed team members who can work on it independently.
- Explore possibility of simultaneously start of as many activities as possible.
- Minimize independence between activities.
- Establish transparent communication between tem members.

Aim of distributed team is to promote concurrency by assigning task of system evaluation to separate tem members. Each member proceeds autonomously on his or her allotted work. In a traditional environment, system work decomposed into sub systems and assigned it to team.

Each sub system assigned to specific group for evolution, which also divide it into number of modules for testing and quality assurance activities. This type of decomposition performed for collocated team. There are different requirement for geographical distributed teams. In case of distributed team the team require interface at the sub system level where evaluation and quality assurance of a single sub system carried out by individual team members. There is also need for close interaction and collaboration if the distributed team member has to work on shared tasks. Virtual teams' scenario is presented in figure to depict the two members working from different sites existing in different time zone. Team members are cooperating for quality management tasks over the sub system. One member is developer and other is testing the system. Each member has the chance to review each other work shown in the form of dotted lines. Documents should flow among team members [12].

All the team members can share test cases and test data to increase collaboration with each other. Every tester write his own test cases and test data and after comprehensive review share it with other team members for collaboration and review in order to find more defects and quality activities .It allows concurrent execution of quality assurance activities by decomposing tasks into fine-grained tasks of short duration. This is actually introducing concurrent cooperative quality assurance practices at the individual task level.

2.2 CONFIGURATION MANAGEMENT

With the emergence of geographical development and quality assurance activities it becomes very necessary that all the team members have support of configuration management tailored to adjust their needs and requirements. Theses distributed team members have to support the distributed team members that promote synchronization and centrally controlled [13]. We recommend fallowing CM architecture for distributed team.

- Version control: All the documents, files versions and variants should available to all the concerned team members in such a way that it promotes retrieval, access and comparison in an easy way.
- Build management: All the generated files should be kept updated and can be maintained from where ever required.
- Release management: All deliverables should incorporate into product release and integrated.
- Change management: All the changes can be tracked and managed from wherever required.
- Reporting status: All the members can track the information relating the change.

Document or knowledge management related to creation, capture, about project activities, tasks, goals, problems, solutions, methods, process and solutions. Without face to face interaction knowledge creation is difficult. Without knowledge available it becomes difficult for the team to collaborate and establish knowledge about domain. In a distributed environment where a shared knowledge is very necessary but creation of this knowledge is even more difficult in this environment. Due to changing role, changing relations and properties of electronic communication development of documentation and knowledge is very difficult in distributed environment [14].

Document management in distributed environment is necessary as it is very difficult to access the person for relevant knowledge seeking. Without adequate document and knowledge management team member involve in enhanced communication and collaboration efforts results in waste of resources and time of team members. Increased level of communication has its own pitfalls when knowledge gained through these efforts. There should system for document management for test scenarios, test scripts, test execution and test results. Test management tool is necessary with support of accessibility from multiple locations.

These categories can be refined to serve the team. The structure and size of documentation depends upon many factors like project size, team structure, physical location of team members etc. Centralized repository manages documents in such accessible to all team members [15]. There also proper access mechanism to avoid inconsistencies to concurrent change in documents. One write read many strategies would helpful. At one time only one edit should allow. Ensure each member have access to latest version.

2.3 COORDINATION, COLLABORATION AND COMMUNICATION

Geographically distributed teams should overcome the barriers to communication in term of distance time and culture. If it is feasible, conduct meeting to provide face-to-face interaction with team members. If team members are in different time zones use appropriate schedule that all team members can participate in meetings and interaction with each other.

Team members from different cultures also feed difficulty communicating with each other. Different words and conventions have different meaning in different countries and cultures. It requires appropriate understanding of cultural context and without understanding of cultural context there are chances to make errors and a lot of risk [16].

In order to overcome these problems you have to invest more in communication as compared to traditional environment. Context of communication for distributed dispersed team is different and complex and require continuous interaction among team members. Management has to provide all the opportunities and resources to provide infrastructure for better interaction and communication among team members. Among many choice management has to invest in telecommunication strategies as teleconferencing, videoconferencing, web-based conferencing, and online chat software.

The basic objective of our framework is increase the coordination among team members. Multimodal communication technology helps to increase coordination and collaboration among team members. Use of multimodal communication technology facilitates the collaboration and coordination among team members. Distributed team members should also bound with each other just like co located team members. Try to establish strong bound among tea members and it is the responsibility of management to involve all the team members in close communication with each other. It can prove costly but it cannot avoid.

In order to cope with problems and challenges in distributed environment communication is very vital but it is also not simple in distributed environment. Without appropriate infrastructure it is not possible. With absence of informal and face to face interactions team members may suffer with problem of lack of trust, creativity, decision quality and other management issues.

Without support of appropriate communication distributed team members may not get appropriate insight of project goals and objectives and even may lead to penalization of the project progress. Management here should not think in term of "penny wise and pound foolish" strategy as it could result in huge return on investment. Once the working relationship improves, cost automatically tends to decline. Interaction, collaboration and communication among distributed team members are very vital for the success of the project as compared to traditional in-site developments and quality management practices [1].

Synchronize the tasks of all team members to review what they did yesterday and what they do today preferably at the beginning of each morning. Make sure everyone believe that everyone working [17]. Team lead should encourage the team members to provide feedback and help others. This type of meeting helps to synchronize work and to realize that they are involved and part of an integrated work.

It also helps the team lead and manager to realize that each team members is performing, challenges and problem of individual team members. These meetings should be short and focused. Long meetings may bore where members pay little attention to others. Personal meeting with team members help to know about your team members and motivation of team members. If possible, plan a visit to meet individual team members as frequently as possible. Devise a plan to mix team members by arranging cross-site visit or at least a common tour to some recreational resort [18]. This help the team members to get know each other personally and share work dynamically. They have the opportunity to share challenges, experiences about day-to-day operations.

Standardize the communication and manage from single location. Keep fallowing points in your mind regarding managing site of distributed team:

- Single sited platform should be accessible to all team members from all sites. Access time and accessibility response should not frustrate tem members.
- All the team members can work under the same methodology and can customize according to individual needs if there is some need of individual team members.
- All the team members in a position to seek help from any team members. This help to seek guidelines from other team members and incorporate direct feedback mechanism among team members.

Make sure no team member feels disconnected from actions. Sometime some member has may have close interaction due to different reasons as due to geographical location, because of more interaction with team leads [19]. Whatever the reason, member should not think that he is isolated from the action. Number of actions can help to avoid such problems:

- Make sure all team members have direct access to individual team members and other team members like developers.
- Arrange video meeting with team members that neither are nor frequently related.
- Try to involve them in process improvements, challenges handling.

Distributed quality assurance team members face with the problem of collaboration among team members, management and stakes holders. Collaboration among co located team is difficult task and in distributed environment due to its inherent complexity it becomes very difficult for the team members to collaborate to presence of different type of diversity. There are fallowing reason of lack of collaboration and coordination in spatial dispersed team [20].

- Spatial dispersion of team members is the main source of lack of coordination and collaboration.
- Temporal dispersion or different time zone added another layer of complexity for the promotion of coordination and collaboration among distributed.
- National diversity relates to different norms, communication routines, and different interpersonal skills also contribute towards the lack of coordination and collaboration.
- Due to problematic task coupling and inter-functional conflicts in distributed environment also source of lack of collaboration and coordination.
- Lack of face to face interactions and dependency on electronic communication is also major reason of lack of coordination in distributed environment.

Due to spatial, temporal and cultural difference it is very difficult for the management to establish collaboration among team members in distributed environment. Due to time zone differences for the spatial dispersed team it become very difficult for the management to establish collaboration but it is more important in distributed environment to build trust and share work. There are many source of lack of collaboration among team members like cultural differences; language barriers and lack of face to face interaction reduce the chances of collaboration work among team members [4].

In order to establish collaboration among team members it is essential that there is some mechanism of knowledge share among team distributed team members. Our proposed framework also includes the document management for use team members promote knowledge sharing. Due to document management team members develop collaboration among themselves for task, help and role clarification.

3 RESULTS

Many organizations rely on distributed quality assurance practices. Most prominent among them are IBM, Xerox. In order to evaluate the performance of the teams, data collection methodology should consistent, standardized and systematic across all distributed teams and team members. As team members are not physically at the same place attention should paid to performance measure.

We want to apply observation and questionnaire for data collection across the distributed team members. Data collection methods should remain consistent for all the team members. Next important question is what should measure and how to support the evaluation. Literature review suggests that communication, information exchange and collaborative behavior are important aspects of team performance. These dimensions are more important in distributed environment due to lack of face-to-face communication. Understanding of individual role is also important. Standardized observation applied in order o get uniform feedback and responses from team members.

We try our best to apply uniform data collection methods. We try not to induce any bias in data collection. We receive 264 out of 500 responses from team members with 52 % response rate. Out of 264 we only use 245 responses due to corrupted or lack of appropriate response. Next we move towards interpretation of data. Microsoft excel and statistical used for this purpose.

Hypothesis 1: Proposed framework improves distributed team productivity.

Hypothesis 2: Proposed framework improves team efficiency.

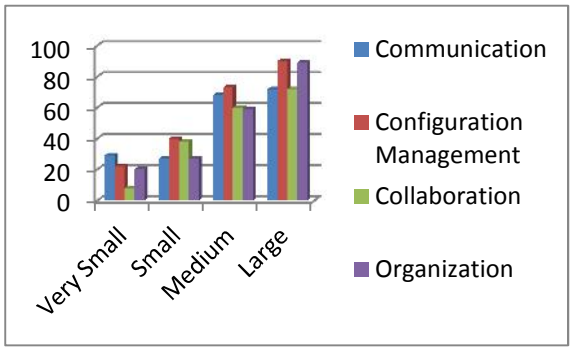


Figure 1 : Percentage productivity improvements in different sized projects

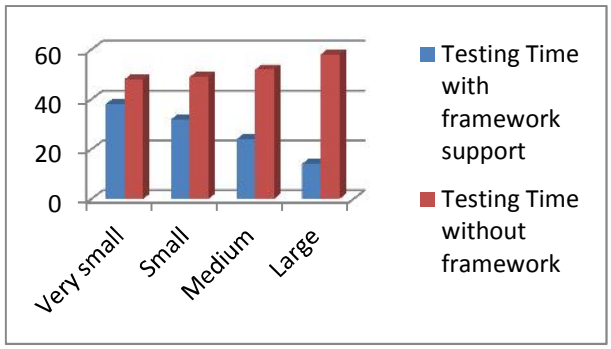


Figure 2: Time saved of team members

We can easily infer that with application of proposed framework in different sized projects testing efforts tends to reduce due to support of other quality assurance practices and effective management of team. Due to increase collaboration, communication and document management teams manage their work effectively. Due to support of other quality assurance practices team have to spent little time in managing the testing process. We can infer that team required less time to communicate, feedback and collaboration with each other when supported with proposed framework as compared to team without support of framework.

Hypothesis 3: Proposed frameworks improve quality of the product.

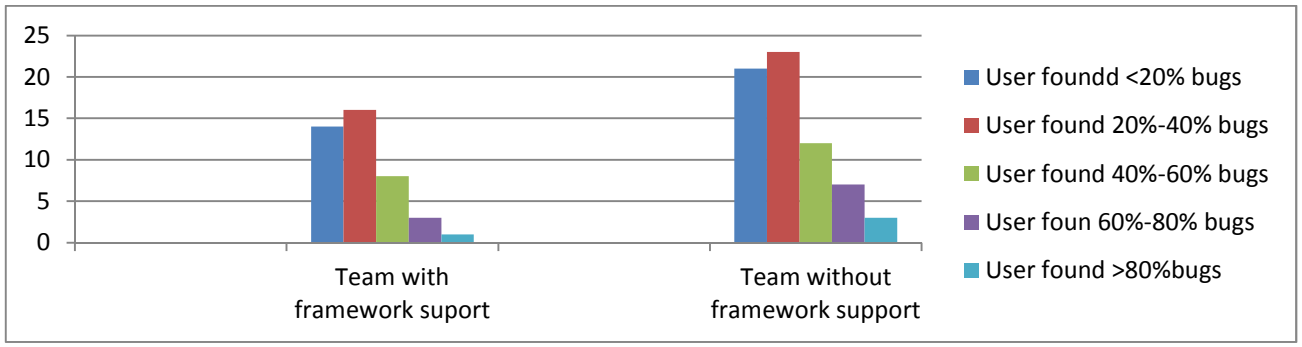


Figure 3: Defect management efficiency

4 DISCUSSION

Through this study, we get greater appreciation of quality assurance activities employed by distributed quality management team managed by proposed framework. We are able to collect certain evidences of successful activities of distributed team, which leads to improved quality management practices. We also able to quantify certain activities and practices in order to objectively assess the virtue of the proposed framework.

Proposed framework revolves around the notions of effective team organization, configuration management, coordination, collaboration and communication of team members. Proposed frame work for effective management of distributed quality assurance team management try to overcome different problems present in traditional distributed

environment. Proposed framework concentrate on some important aspects like communication, collaboration, coordination etc. with fallowing benefits.

- User has more perceived value of the final deliverables when quality assurance team managed with support of proposed framework. There is no alternative for customer satisfaction. With implementation of proposed framework quality of the products improve.
- Document management reduces time in communication, feedback and over collaborative tasks.
- Proposed framework reduces testing efforts of individual team members due to effective communication, feedback and collaboration over tasks.
- With the increase in project size, proposed framework has more subtle effects.
- Proposed framework improves team productivity, efficiency and helps the management to utilize resources in an appropriate way.

5 CONCLUSION

Geographically distributed teams prove to be cost effective and beneficial in many respects like cut of cost and attracting universal talent. In fact management of geographical distributed teams is not as straight forward and simple. Quality assurance is very critical and management of quality assurance teams that is geographically distributed is even more hazardous. With the proper use of configuration management of the product and knowledge management the team member can collaborate, communicate and coordinate in an effective way. This result is that positive impact on performance of such teams. Without coordination, collaboration and effective communication the productivity and performance of such team suffer and the decision to go for globalization may bounce back.

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Inventaire de la flore ligneuse sur la côte occidentale du lac Kivu : cas de la région de Katana, RD Congo

[Inventory of woody flora on the west coast of Lake Kivu: case of Katana region, DR Congo]

Paulin Polepole Ngabo[1], Jean jacques Bagalwa Mashimango[3], Jean Pierre Baluku Bajope[3], Danny Bugoma Mushayuma[1], Gentil Rwamagira Ngabo[2], and Pierre Batumike Cishibanji[3]

[1]Département de l'Environnement, Centre de Recherche en Sciences Naturelles (CRSN) / Lwiro, RD Congo

[2]Université du Cinquantenaire (UNIC) Lwiro, RD Congo

[3]Département de Biologie, Centre de Recherche en Sciences Naturelles (CRSN) / Lwiro, RD Congo

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ABSTRACT: A survey on the inventory of woody flora on the west coast of Lake Kivu has been done precisely in Katana region. Transect and quadrat methods have been used in the sites and many species inventoried of the vegetation have been recognized relics as: *Brideliia bridelifolia , Vernonia amygdalina,Ficus lutea, Albizia grandibracteata, Tabernaemontana jonhstoni, Urera sp, Markhamia lutea, Erythrina abyssinica ,Ficus vallis-choudae, Maessa lanceolata* showing that there was primary forest in the region but was destroyed by anthropogenic activities.

KEYWORDS: Inventory, woody flora, west coast, Lake Kivu, katana, region, DR Congo.

RESUME: Une étude d'inventaire sur la flore ligneuse de la côte occidentale du lac Kivu a été effectuée plus précisément dans la région de katana .Les méthodes de transect et de quadrat ont été utilisées dans les sites et plusieurs espèces inventoriées de la végétation ont été reconnues reliques comme :*Bridelia bridelifolia, Vernonia amygdalina, Bridelia micranta, Ficus exasperata, Ficus thonningii,Ficus lutea, Albizia grandibracteata, Tabernaemontana jonhstoni,Urera sp, Markhamia lutea, Erythrina abyssinica, Ficus vallis choudae, Maessa lanceolata,* témoignant qu'il existerait la foret primaire dans la région mais détruite par les activités anthropogéniques.

MOTS-CLEFS: Inventaire, flore ligneuse, côte occidentale, lac Kivu, région, katana, RD Congo.

1 INTRODUCTION

La flore de la République Démocratique du Congo continue à être exploitée abusivement malgré les efforts consentis depuis l'époque coloniale. Avec la pression humaine sur les ressources naturelles forestières, quelques espèces ligneuses ont déjà disparu et les espèces qui existent encore subissent une menace de disparition [1]. Les habitats de la cote occidentale du lac Kivu dépendant presque entièrement des terres pour subvenir à leurs besoins. Les produits alimentaires, les matériaux de constructions, le bois de chauffage et la pharmacopée traditionnelle font parti de cet éventail des ressources naturelles prioritaires à la survie des populations. L'explosion démographique caractérisant actuellement la cote occidentale du lac Kivu entraine une augmentation de l'exploitation agricole par la coupe des espèces de la flore ligneuse, ce qui résulte à un

Corresponding Author: Pierre Batumike Cishibanji

appauvrissement et une dégradation des sols. Par ailleurs, la gestion inappropriée des terres contribue à cet appauvrissement du sol et de sa végétation. La sur utilisation des ressources en bois répondant à plus de 90 % des besoins énergétiques de la population est un autre facteur d'une grande importance dans la dégradation et la disparition de la flore ligneuse dans la cote occidentale du lac Kivu. A ces pratiques destructives viennent s'ajouter les feux de brousse d'origine anthropique, des techniques agricoles, des mauvaises pratiques de récolte des racines des plantes médicales, etc. Mais, le grand déséquilibre écologique n'est pas seulement de nature socio-économique mais également environnemental. Les espèces de la flore ligneuse abritent des nombreux points chauds de biodiversité et jouent un rôle prépondérant dans la fixation du co_2 que nous émettons massivement et qui perturbe dangereusement notre climat : 40 % du Carbonne terrestre est stocké dans la végétation et les sols de forêt [2].La disparition de la flore ligneuse dans cette région de la cote occidentale du Lac Kivu contribuerait à la dégradation de sa biodiversité, participerait à la modification de la pluviométrie et occasionnerait les changements climatiques. Les végétations ligneuses peuvent bien nous montrer ces dégradations. Depuis longtemps l'homme a développé des mécanismes d'exploitation des ressources naturelles pour subvenir à ses besoins, il a modifié de façon spectaculaire tout ce dont son pouvoir et ses capacités lui ont assuré une effective accessibilité ; ainsi, avec la pression dans l'exploitation des espèces ligneuses, les recules des forets se manifestent chaque année et sont estimés à 16.700 ha/an en RDC selon la référence [3]. Une évaluation de la dégradation de sol à l'échelle mondiale a été réalisée au début des années 1990 et a montré une dégradation prononcée dans les terres arides, [4] ; toutes ces transformations ont des effets négatifs sur la flore ligneuse présente l'avantage d'être mieux adaptée aux conditions éco climatiques [5]. Les études sur les inventaires de la flore ligneuse n'ont jamais été réalisées dans cette partie région. C'est ainsi que nous voulons combler cette lacune en évaluant la situation floristique ligneuse dans cette partie occidentale du lac Kivu en République Démocratique du Congo.

2 MILIEU D'ETUDE

La région de katana se situe sur la rive occidentale du lac Kivu entre 2°et 2°30'de latitude sud et28°30'et 29°de latitude Est. Elle est inclue dans le Territoire de Kabare, province du Sud Kivu en République Démocratique du Congo et se situe à 40km au Nord de la ville de Bukavu. Le relief de la cote occidentale du lac Kivu est en général caractérisé par l'alternance des collines, de larges dépressions fermées ou des vallées qui empêchent l'écoulement de l'eau et qui facilitent la rétention ainsi que l'accumulation de l'humidité excédante des nombreux marais où prédominent une végétation de *Cyperus latifolius*. Cette région fait partie de hautes terres de l'Est de la RD Congo, son relief est dans son ensemble marqué par des mouvements tectoniques qui ont affecté l'Afrique Orientale. Le relief côtier se présente avec une cote très découpée et caractérisée par d'étroites baies, des presqu'iles comme Kadjucu et Bugarura/Cifinjo de Kabamba au bord du lac Kivu. Le climat de notre région d'étude est fortement marqué par l'altitude, l'approximité du lac, les températures y sont fraiches partout. La moyenne annuelle varie entre 18° et 20° avec une faible amplitude thermique d'1°C. Cette région bénéficie d'énormes quantités d'eau de pluie et comprend deux saisons à savoir :la saison de pluie qui est très longue allant de septembre à mai avec des pluies suffisantes toute l'année d' une moyenne supérieure à 1500mm et la saison sèche qui est très courte se situant entre les mois de juin et aout[6].

3 METHODOLOGIE

3.1 LES TRANSECTS ET QUADRATS

Pour inventorier les espèces végétales ligneuses, des transects et quadrats ont été tracés. L'aire minimale d'échantillonnage était de 500m x 20m et 50m x 50m respectivement pour les transects et pour les quadrats.

3.2 COLLECTE ET TRAITEMENT DES DONNÉES

Les échantillons des plantes ont été récoltés et leur identification validée au laboratoire de Botanique du Centre de Recherche en Sciences Naturelles de Lwiro où les exemplaires sont gardés. Les échantillons des plantes ligneuses récoltés moyennant des sécateurs étaient transportés dans des presses pour en assurer une bonne conservation afin de passer à leur identification au laboratoire. Toutes les espèces nommées ont été répertoriées et identifiées. Les noms scientifiques ont été également vérifiés à l'aide des clés d'identification de Troupin [7], [8], [9] ; d'autres végétales étaient directement identifiées sur terrain. Lors des traitements des données au Département d'Environnement, la fréquence par espèce identifiée a eu lieu et cela par transect et par quadrat selon la formule :

$$\textbf{Fréquence (en \%)} = \frac{\textbf{Nombre d'individus par espèce}}{\textbf{Nombre total d'individus du site}} \textbf{X100}$$

Concernant les noms vernaculaires, certains taxons présentaient des difficultés pour leurs identifications ; c'est ainsi que pendant les terrains, nous faisions recours aux paysans.

3.3 CHOIX DES SITES

Des sorties de terrain ont été organisées dans différents sites choisis au hasard dans région d'étude, et ainsi quatre sites ont été retenus :

- mukumba-kampiri, site situé entre les coordonnées ci-après : Alt :1742m, S :02°11'26,6'', E :028°49'59,9'' pour Mukumba et Alt :1668m, S :02°11'11,6'', E :028°11'11,6''pour Kampiri.
- Ciguku-Runigi-kahenu, milieux situés entre les coordonnées suivantes : Ciguku : Alt :1582m, S :02°12'04,3'', E :028°52'00,2'', Runigi : Alt :1742m, S :02°12' 13,1'', E :028°52'33,1'' et kahenu : Alt :1498m, S :02°12'07,7'', E :028°05'46,3''
- Cihembye-Busengura, endroits situés entre les coordonnées suivantes: Cihembye : Alt :1477m, S :02°12'27,0'', E :028°50'38,4'' et Busengura ; Alt :1513m, S :02°12'51,4'', E :028°51'15,8''

- Nkene-Mugeri ,milieux situés entre les coordonnées ci-après : Nkene : Alt :1470m,S :02°13'01,6'', E :028°51'47,0'' et Mugeri : Alt :1450m, S :02°02'17'', E :028°51'00,3''. Il est à signaler que ces coordonnées géographiques ont été prélevées moyennant l'appareil GPS.

4 RESULTATS

25 espèces de plantes ligneuses reliques ont été inventoriées dans les transects choisis dans la région de katana .Ces espèces ont été inventoriées et identifiées, elles sont consignées dans le tableau1.

Tableau1 : Liste des espèces de la flore ligneuse relique inventoriée dans la région de Katana, Province du Sud Kivu en République Démocratique du Congo

N°	Nom scientifique	Nom vernaculaire	Transect Mukumba/ Kampiri	Transect Ciguku/ Runigi/ Kahenu	Transect Chihembye/ Busengura	Transect Nkene/ Mugeri
1	*Urera sp*	Kumbukumbu	+	+	+	+
2	*Harungana madagascariensis*	Kadwamuko	+	+	-	+
3	*Chinchonia sisrubra*	Kakina	+	-	-	+
4	*Tabernaemontana johnstoni*	Muberebere	+	-	-	+
5	*Albizia gummifera*	Ikungushebeyi	+	-	-	+
6	*Bridelia bridelifolia*	Mujimbu	+	+	+	+
7	*Musanga leoerrerae*	Musanga	+	+	+	+
8	*Toddalia asiatica*	X	+	+	-	-
9	*Rhus vulgaris*	X	+	+	-	+
10	*Ficus sp*	Muhumba	-	-	-	+
11	*Bridelia micrantha*	Mugenge	+	+	-	+
12	*Erythrina abyssinica*	Cigohwa	-	-	+	-
13	*Ficus exasperate*	Mutudu	-	+	+	+
14	*Ficus vallis-shoudae*	Mulehe	-	-	-	+
15	*Maesa lanceolata*	Mparhi	-	-	+	+
16	*Adansonia digitata*	Baoba	-	-	-	+
17	*Polyscias fulva*	Ntongi	-	-	-	+
18	*Macaranga spinosa*	Katengetenge	-	-	-	+
19	*Tabernaemontana sp*	Muberebere	-	-	-	+
20	*Securinega virosa*	Kashugishugi	-	+	-	+
21	*Podocarpus usambariensis*	Podo	-	-	-	+
22	*Maytenus arguta*	X	+	+	-	+
23	*Trema orientalis*	X	-	-	-	+
24	*Albizia grandibracteata*	Mushebeyi	-	+	+	+
25	*Ficus esculenta*	Lukenga	-	-	-	+
Total d'espèces/transect			11	11	7	23

Légende

***+** : présence de l'espèce dans le transect*

***-** : absence de l'espèce dans le transect*

***X :** nom vernaculaire inconnu*

Il ressort de ce tableau que 25 espèces de plantes ligneuses reliques ont été inventoriées dans quatre trasects tracés dans la région de Katana. Signalons que le transect Nkene-Mugeri regorge le nombre élevé d'espèces ligneuses reliques soit 23 suivi des transects Mukumba-Kampiri et Ciguku-Runigi- Kahenu ayant chacun 11 espèces de la flore ligneuse relique alors que le transect Chihembye-Busengura n'en contient que 7.

FREQUENCE DES ESPECES DE LA FLORE LIGNEUSE INVENTORIEES DANS LES QUADRATS

Les résultats des espèces floristiques ligneuses inventoriées dans le site Mukumba-Kampiri sont consignés dans la figure1

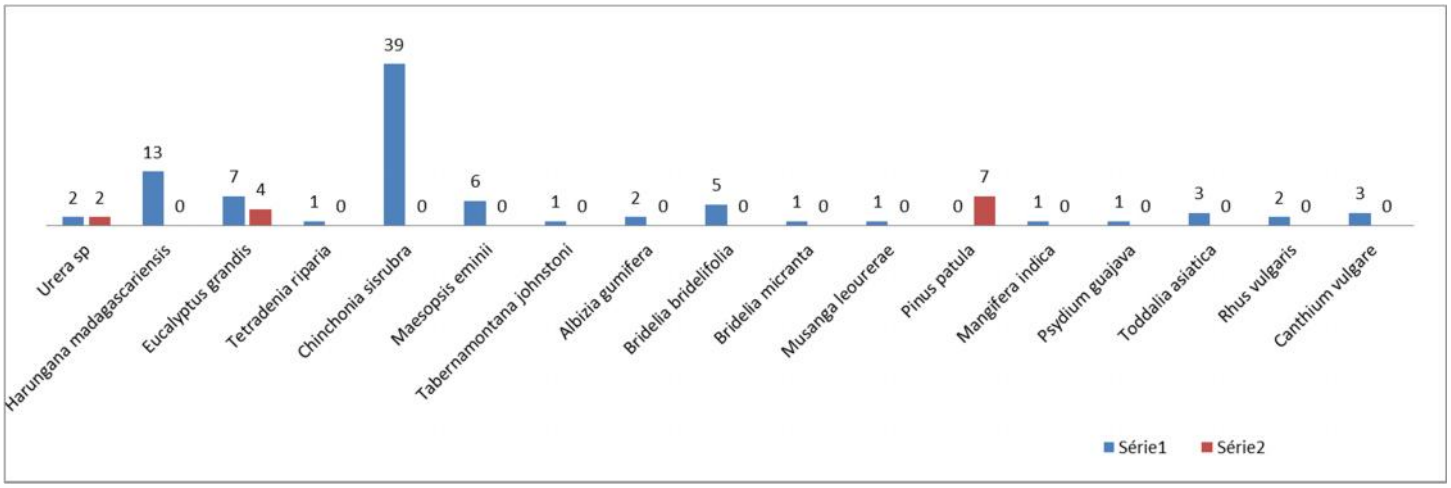


Figure 1 : fréquence de la flore ligneuse de Mukumba-Kampiri.

Légende : Serie1 : quadrat Mukumba, Série 2 : quadrat Kampiri

Il ressort de cette figure que dans le quadrat du site Mukumba, l'espèce *Chinchonia sisrubra* présente une fréquence plus élevée avec 44,31 % suivi de *Harungana madagascariensis* avec 14,77 % de fréquence tandis que le quadrat du site Kampiri est pauvre en biodiversité floristique ligneuse. Trois espèces y ont été inventoriées et identifiées ; il s'agit *de Pinus patula* avec 7 individus représentant 53,84 % de fréquence, suivis *de Eucalyptus grandis* avec 4 individus représentant 30,76 % de fréquence et de *Urera sp* avec 2individus représentant 15,38 %. Dans ce site, seule l'espèce Urera sp y reste indicatrice d'une forêt primaire qui y existerait et de ce fait, le changement climatique pourra s'accélérer suite aux activités anthropogéniques intenses et incontrôlées faisant pression sur notre environnement. Dans ces deux quadrats, nous observons la présence de quelques espèces exotiques qui ont servi au reboisement de cette colline. Ces espèces sont : *Eucalyptus grandis*, Pinus *patula* et *Maesopsis eminii*.

La figure ci-dessous présente la fréquence des espèces de la flore ligneuse dans le site Ciguku-Runigi- Kahenu :

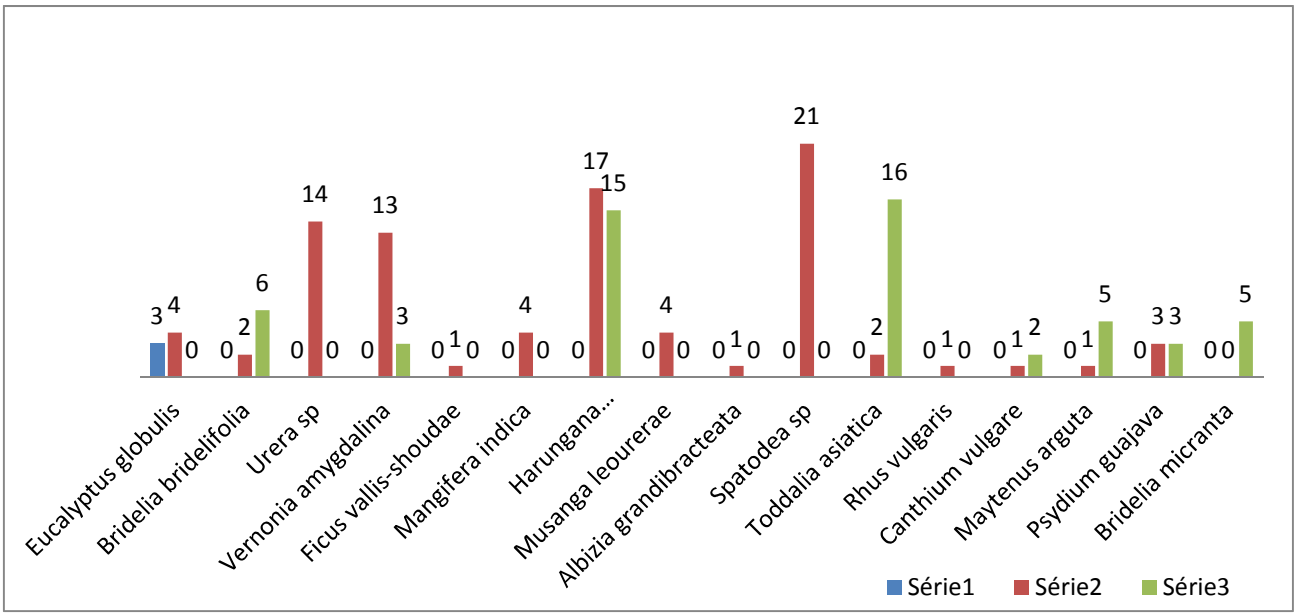


Figure 2 : flore ligneuse de Ciguku-Runigi et Kahenu

***Légende** : Serie1 : quadrat site Ciguku, Serie2 : quadrat site Runigi, Serie3: quadrat site Kahenu.*

De cette figure, il ressort que le quadrat Ciguku n'a qu'une espèce exotique, l'*Eucalyptus sp.* Ce site est nu et ne contient que des herbes qui ne poussent presque pas car ce site est menacé par l'érosion suivi d'une agriculture intense sur des pentes raides. Mais quant au quadrat Runigi ,15 espèces ont été recensées et l'espèce *Spatoddea campanulata* a un pourcentage élevé. Dans le quandrat Kahenu, 8 espèces ont été recensées.

Les résultats des espèces ligneuses identifiées dans le site Chihembye – Mugeri sont consignés dans la figure 3 ci – dessous.

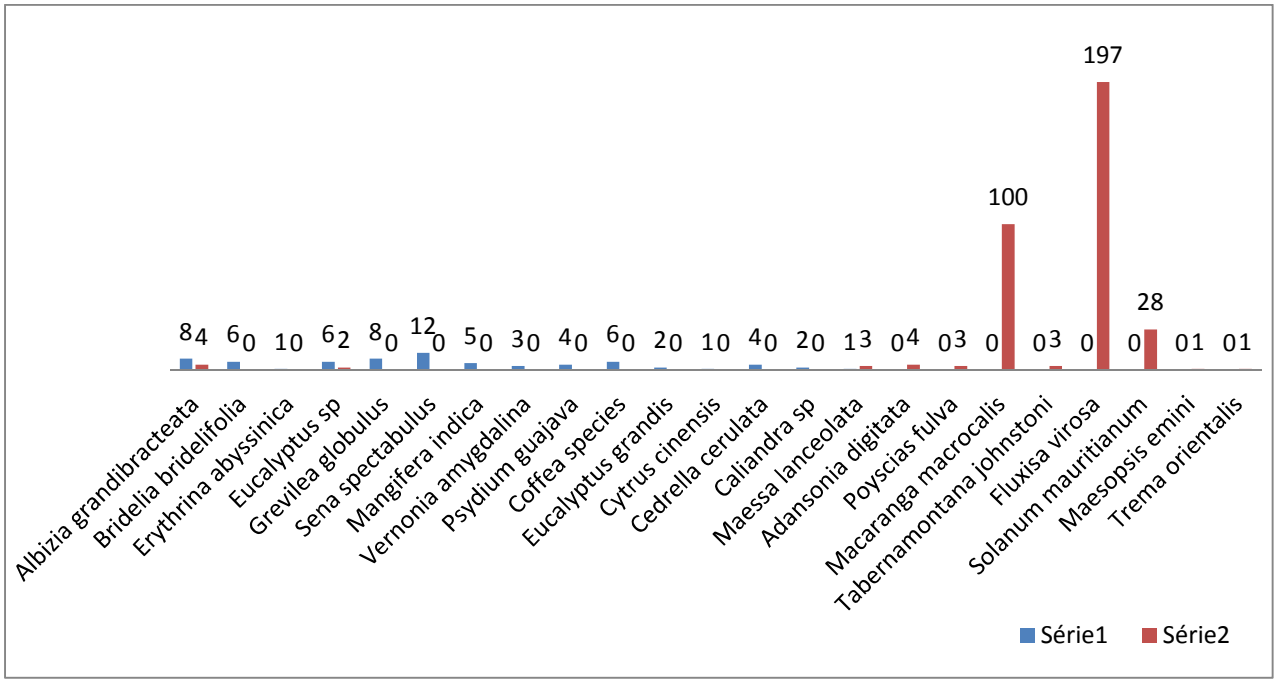


Figure 3 : fréquence de la flore ligneuse de Chihembye-Mugeri.

Légende : Série 1 : quadrat Chihembye, Série 2 : quadrat Mugeri

Le quadrat Chihembye est plus riche en espèces par rapport au quadrat Mugeri. Mais en ce qui concerne l'abondance en spécimens, c'est le quadrat Mugeri qui en contient plus.

5 DISCUSSIONS

Nous référant à nos résultats de la figure 1, dans le quadrat Kampiri, à cause de la forte pression humaine l'ONG GTZ avait initié un projet de reboisement avec l'espèce *Pinus patula* depuis les années 1992 mais ces arbres ont été détruits et il n'y reste que quatre individus de cette espèce qui ont échappé à la pression humaine. Certaines espèces d'insectes commencent à apparaitre et s'attaquent aux plantes ligneuses de la région, ces espèces se trouvent dans l'ordre des coléoptères qui attaquent les plantes ligneuses reliques comme *Urera sp* et *Musanga leo-errerae* du site Mukumba-Kampiri. La prolifération de certaines espèces ravageuses des plantes a été signalée ailleurs et a été attribuée au changement climatique [10].

Partant des résultats des quadrats du site Chihembye-Mugeri de la figure 3, Certaines espèces sont caractéristiques de ce site, il s'agit de *Tabernaemontana johnstoni*, *Polyscias fulva*. Ces deux espèces de plantes n'ont pas été inventoriées dans d'autres sites de la région. Elles ont été signalées par nos prédécesseurs. *Tabernaemontana johnstoni* est fortement convoité par la population car elle sert comme médicament contre la diarrhée et comme aphrodisiaque chez les tradipraticiens [11]. Dans l'ancien Congo la sève de *Tabernaemontana johnstoni* était employée pour le traitement de la syphilis et ses feuilles pour la gomme et les maladies dentaires [12].

6 CONCLUSION ET RECOMMANDATIONS

Le reboisement et la protection des espèces de la flore ligneuse jouent des fonctions écologiques dans la région de Katana, ces stratégies devraient être appliquées car elles lutteraient contre les perturbations climatiques et réduiraient l' effet de serre par l'absorption des rayonnements solaires qui provoqueraient des élévations comme le CO_2, N_2O et CH_4. Dans la région de Katana, les activités anthropogéniques constituent les causes majeures de disparition de la flore ligneuse alors que la perturbation de l'un des éléments de l'écosystème entraine le changement des autres. Les espèces de la flore ligneuse relique inventoriées dans les sites témoignent que la région de Katana contenait en quelque sorte des lambeaux d'une foret primaire mais qui ont subi des pressions humaines. Pour faire face à cette situation, que la population exploite d'autres ressources en énergie en dehors du bois comme source d'énergie, qu'elle procède à reboiser dans les champs avec des espèces ligneuses et exotiques. Cette étude qui ne s'est limitée qu'à certains sites, devra se poursuivre dans d'autres milieux de la région en vue d'aboutir à un inventaire complet de sa flore ligneuse.

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Management of respiratory distress in pregnancy: A case report

Abdellah Babahabib[1], Youssef Benabdejlil[1], Moulay El Mehdi ElHassani[1], Massine ElHammoumi[2], Hicham Bakkali[3], Jaouad Kouach[1], Driss Moussaoui[1], El Hassan Kabiri[2], and Mohammed Dehayni[1]

[1]Department of Gynecology- Military Training Hospital Med V, Rabat, Morocco

[2]Department of Thoracic surgery- Military Training Hospital Med V, Rabat, Morocco

[3]Department of Anesthesiology and Critical Care, Military Training Hospital Med V, Rabat, Morocco

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ABSTRACT: Maternal benefits of fetal extraction have been clearly demonstrated in the case of hemodynamic failure. However, in case of respiratory failure very little data are available. The aim of our study is to discuss the management of patients with respiratory distress during pregnancy secondary to a pleuropulmonary disease.

KEYWORDS: Respiratory distress, dyspnoea, pregnancy.

1 INTRODUCTION

We report the case of a patient of 24 years carrying a destroyed left lung, admitted at 35 weeks of gestation to the obstetrical emergencies for acute dyspnoea with severe preterm labor. Pleural drainage was performed with a marked improvement and natural delivery accepted. The patient was delivered by C- section under spinal anesthesia for cervical stagnation at 5 cm.

2 OBSERVATION

Mrs. YM, 24 year-old primi gravida woman, with no history of lung disease, presented in her fifth month of pregnancy a cough associated to a dyspnoea. Physical examination showed a left pleural effusion syndrom. A chest-X-Rays with abdominal protection revealed a left lung destroyed. A pleural puncture revealed purulent fluid, Rivalta positive, 52400 leukocytes/mm3 (95% neutrophils and 5% lymphocytes), 150 red blood cells/mm3, 80 mesothelial cells / mm3 without mycelian filaments. Direct examination and culture were negative. Pleural biopsy showed no specific inflammatory alterations of the parietal pleural membrane. The patient was admitted to the obstetrical emergencies for dyspnea stage III of NYHA with severe preterm labor at 35 weeks of gestation. The overall examination revealed a conscious patient, heart rate at 100 beats / minute, breath rate at 30 cycles / min, 110/60 mm Hg blood pressure and 90% SaO^2 under 5l / min of O_2. The chest auscultation showed a left pleural effusion. The obstetric examination revealed a fundal height at 30 cm, fetal mouvements were well perceived. The patient contracted at 4 times/ 10 min. There was no bleeding in the speculum examination. In the vaginal touch, the cervix totally effaced, dilated to 2 cm with cephalic presentation. Ultrasound showed a cephalic presentation, the estimation of fetal weight was 2300 g, an anterior placenta, the quantity of amniotic fluid was normal and the femoral inferior ossification point was less than 4 mm. Chest-X-rays radiography with abdominal protection noted a white hemithorax with mediastinal shift (Figure1). Biologic data were normal. C- reactive protein was at 35 mg/l. After a discussion between obstetricians, thoracic surgeons, anesthetist, and pediatricians, the decision was to make in a first time a pleural drainage and accept the natural delivery. The left pleural drainage had brought 1500 ml of a haematic liquid with a clear clinical improvement on the respiratory level without radiological cleaning. Bacterial analysis of the pleural liquid were negative. Therefore, natural delivery was accepted. Considering the favorable score of bishop, the patient was activated

by syntocinon® with a strict monitoring of maternal status, uterine contractions and fetal heart. The patient presented a cervical stagnation at 5cm over 2hours and C section was indicated. It was carried out under spinal anesthesia, allowing the extraction of a newborn baby boy Apgar 10/10 at, weighing 2350g. Examination of the newborn was unremarkable. He was transferred to the neonatal unit because of prematurity After delivery, the physical examination of the mother showed a marked improvement in respiratory status , SaO^2 92 % on room air. She was transferred in the third day after her delivry to the service of thoracic surgery for surgical exploration of the pleural effusion. Three months later the patient was operated through thoracotomy and a mediastinal mature teratoma was diagnosed and totally removed. Post operative course was uneventful.

3 DISCUSSION

Acute respiratory distress during pregnancy represent 2-10 % of the causes of maternal mortality, with fetal morbidity and mortality especially preterm birth [1]. During pregnancy there are physiological cardiovascular and respiratory modifications which explain that cardivascular or respiratory diseases can be affect seriously [2]. There are two causes of respiratory distress in pregnancy. The first one include obstetrical causes and represented by pre-eclampsia , eclampsia, amniotic fluid embolism , acute pulmonary oedema secondary to tocolytic treatment, acute liver steatosis in pregnancy and respiratory distress related to the pregnant state [3]. Fetal extraction is beneficial for the mother in these situations.

The second category includes non- obstetric causes represented by pneumonia or acute severe asthma..etc. In these situations, the child extraction is really controversial.

Fetal extraction increase functional residual capacity and improved thoracic compliance and gas exchanges. Assumptions for fetal extraction are represented by an increase in functional residual capacity and improved thoracic compliance and gas exchange. However, elements that are in disfavor of extraction are: prematurity, the risks increased by C-section, blood loss and the "physiological" stress of C-section [4-5].

Our patient had a left lung destroyed. Our attitude was to accept natural delivery and improve lung function. Indeed, a significant improvement was observed after delivery.



Figure 1: Chest-X-Rays with abdominal protection showing a left lung destroyed at 35 weeks of gestation.

4 CONCLUSION

The management of respiratory distress in pregnancy is primarily a multidisciplinary approach requiring the establishment of a delivery strategy. The fetal extraction will be decided case by case depending on the maternal condition, but especially of the term and fetal vitality.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest related to this article.

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Angioléiomyome vaginal : A propos d'un cas

[Vaginal Angioleiomyoma: A case report]

Moulay El Mehdi ElHassani[1], Youssef Benabdejlil[1], Abdellah Babahabib[1], Adil Boudhas[2], Mohamed Boukhachba[2], Mohammed Oukabli[2], Jaouad Kouach[1], Driss Moussaoui[1], and Mohammed Dehayni[1]

[1]Service de Gynécologie-Obstétrique, Hôpital Militaire d'Instruction Mohamed V- Rabat, Maroc

[2]Service d'Anatomie-Pathologie, Hôpital Militaire d'Instruction Mohamed V- Rabat, Maroc

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ABSTRACT: Vaginal Angioleiomyoma is a rare entity. We report a case of vaginal Angioleiomyoma with literature review. Our case was about a 48 years old woman who consulted for a nodule in the posterior wall of the vagina. The surgery allowed removal of a tissue-like structure of 2 cm. The final histologic diagnosis was a vaginal Angioleiomyoma.

KEYWORDS: Angioleiomyoma, Vagina, Pelvic MRI, case report.

RESUME: L'Angioléiomyome vaginal est une entité rare. Nous rapportons un cas d'angioléiomyome au niveau de la paroi postérieur du vagin avec revue de la littérature. Il s'agissait d'une patiente âgée de 48 ans admise pour nodule au niveau de la paroi postérieur du vagin évoluant depuis un an. L'intervention chirurgicale a permis l'exérèse d'une structure d'allure tissulaire de 2 cm. Le diagnostic histologique final était un angioléiomyome vaginal.

MOTS-CLEFS: Léiomyome, Vagin, Échographie, IRM pelvienne, cas clinique.

1 INTRODUCTION

L'angioléiomyome vaginal est une entité rare. Il se présente le plus souvent sous forme d'un nodule et pose le problème de différenciation entre les formes bénignes et malignes [1]. Nous rapportons le cas d'une patiente avec un angioléiomyome vaginal. A travers cette observation, les auteurs discutent les différents aspects diagnostiques et thérapeutiques de cette pathologie rare.

2 OBSERVATION

Il s'agissait d'une patiente âgée de 48 ans, troisième geste, troisième pare, sans antécédents pathologiques particuliers, aux cycles réguliers, utilisant une contraception naturelle par méthode d'Ogino-Knaus, qui consultait dans notre formation pour un nodule vaginal de découverte fortuite lors de toilettes intimes, évoluant depuis un an, sans autres signes associés. L'examen du vagin au spéculum retrouvait un nodule au niveau de la paroi postérieur du vagin, bien limité, indolore, mobile par rapport au plan profond non ulcérée et sans signes inflammatoires en regard. Il n'y avait pas d'adénopathies inguinales. Le reste de l'examen gynécologique était sans particularités. Une IRM pelvienne réalisée avait révélé la présence d'une formation kystique en isosignal T1 et T2 de siège sous muqueux au niveau de la paroi postérieur du vagin mesurant 16 mm de grand axe (Figure 1). Cette lésion refoulait la muqueuse vaginale en avant qui était intacte ainsi que la cloison recto-vaginale en arrière sans l'envahir. La muqueuse rectale était d'aspect IRM normale. L'utérus était de taille et de morphologie

normale et il n'y avait pas d'adénopathies iliaques associées. L'intervention chirurgicale avait permis l'exérèse d'une structure d'allure tissulaire nacrée de 2 cm (Figure 2 a,b). L'examen histologique avait montré une prolifération nodulaire, limitée en périphérie par une capsule fibreuse fine. Ces cellules tumorales étaient fusiformes pourvues de noyaux allongés à bords arrondies sans atypies cytonucléaires et délimitaient des fentes de taille variable. Le stroma était fibreux montrant des remaniements myxoïdes sans nécrose tumorale (Figure 3 a,b). A l'examen immunohistochimique, les cellules tumorales exprimaient de manière diffuse et intense l'anticorps CD34 (Figure 4). Les suites post opératoires de la patiente étaient simples. Après six mois, l'examen clinique n'avait pas objectivé de récidive.

3 DISCUSSION

Les tumeurs du muscle lisse sont rarement localisées au niveau du vagin, elles sont beaucoup plus fréquentes au niveau de l'utérus. Les tumeurs du muscle lisse de l'utérus ont leurs propres critères de malignité qui ne s'appliquent pas à celles du muscle lisse du vagin. Les tumeurs du muscle lisse ont été classées initialement sur la base de leur emplacement superficiel ou profond. Les lésions génitales ont été placées dans la catégorie du muscle lisse superficiel qui inclut le léiomyome cutané et l'angioléiomyome. Cependant, les tumeurs du muscle lisse du vagin diffèrent cliniquement et histologiquement de ceux du muscle lisse cutané et ne doivent pas avoir la même classification [2]. Trois catégories de tumeurs du muscle lisse sont actuellement reconnues, chacune avec ses propres critères de malignité, superficielle (inclus le mamelon), génitale (vulve, vagin, scrotum) et profonde (utérus).

Les tumeurs du muscle lisse du vagin peuvent être rencontrées à différents âges, mais plus ordinairement à la quatrième et la cinquième décade de vie [1,2]. Elles se présentent typiquement comme une masse sous-cutanée. Ces masses ont des tailles variables, mais quand elles sont bénignes elles sont circonscrites et leur taille est comprise entre 30 et 50mm, en revanche, quand elles sont malignes, elles ont tendance à être infiltrantes et de plus grande taille, supérieure à 50 mm [1,2]. L'IRM reste le meilleur outil radiologique pour analyser et caractériser les lésions vulvo-vaginales [3]. Une constatation caractéristique de signal faible imitant l'intensité du muscle lisse dans les images pondérées en T2 est la clé du diagnostic. Le signal est iso intense en T1 et peut être rehaussé par l'injection de gadolinium [4]. Les tumeurs du muscle lisse du vagin présentent trois principaux modèles histologiques, en fuseau, épithelioide et myxohyalin. Ces modèles peuvent être mélangés ou purs. Le fuseau est comparable à celui des léiomyomes du corps utérin, se composant de cellules en forme de fuseau avec des quantités modérées de cytoplasme éosinophile, avec des noyaux allongés ou ovoïdes et des extrémités arrondies ou émoussées formant des fascicules entrelacés [5]. Dans le modèle myxohyalin, qui est commun dans les tumeurs du muscle lisse de la région vulvo-vaginale, les cellules du fuseau néo-plastique sont séparées par du matériel myxohyalin avec occlusion des petits fascicules donnant un aspect en dentelle ou plexiforme. Dans le modèle épithelioide, une combinaison de cellules épithelioides et en fuseaux est souvent rencontrée, avec les anciennes cellules qui sont arrondies avec des quantités modérées de cytoplasme éosinophile ou clair [5]. En raison de la relative rareté des tumeurs du muscle lisse du vagin et des séries de cas avec suivi à long terme, il existe des difficultés à prédire avec fiabilité le risque de récidive et de différencier entre tumeurs malignes et bénignes.

Des auteurs ont proposé des critères pour distinguer entre léiomyome et léiomyosarcome vaginal [6]. Les tumeurs qui présentent trois ou toutes les caractéristiques suivantes doivent être considérées comme sarcome :

- > 5cm dans sa plus grande dimension ;
- marges infiltrantes [7] ;
- > 5 mitoses par dix champs au fort grossissement ;
- atypie cytologique modérée à sévère.

Une tumeur qui n'a qu'une seule de ces caractéristiques doit être diagnostiquée comme léiomyome, et celle qui présente deux de ces caractéristiques doit être considérée comme léiomyome atypique bénin [1]. La présence de nécrose coagulatrice au sein de la tumeur est une caractéristique, qui doit soulever la possibilité de sarcome si elle est combinée avec l'une des caractéristiques citées ci-dessus [8]. Le sarcome doit être excisé avec des marges qui passent en zone saine ; le léiomyome et le léiomyome atypique doivent bénéficier d'un traitement conservateur avec surveillance prudente et à long terme.

4 CONCLUSION

L'angioléiomyome vaginal est une entité rare. Il se présente typiquement comme un nodule sous muqueux d'allure bénigne. L'IRM est le meilleur outil radiologique pour caractériser la tumeur et étudier ses rapports. L'histologie donne le diagnostic et permet d'éliminer un léiomyosarcome. L'angioléiomyome et le léiomyome atypique doivent bénéficier d'un traitement conservateur avec surveillance prudente et à long terme vu le risque de récidive.

DÉCLARATION D'INTÉRÊTS

Les auteurs déclarent ne pas avoir de conflits d'intérêts en relation avec cet article.

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ANNEXES

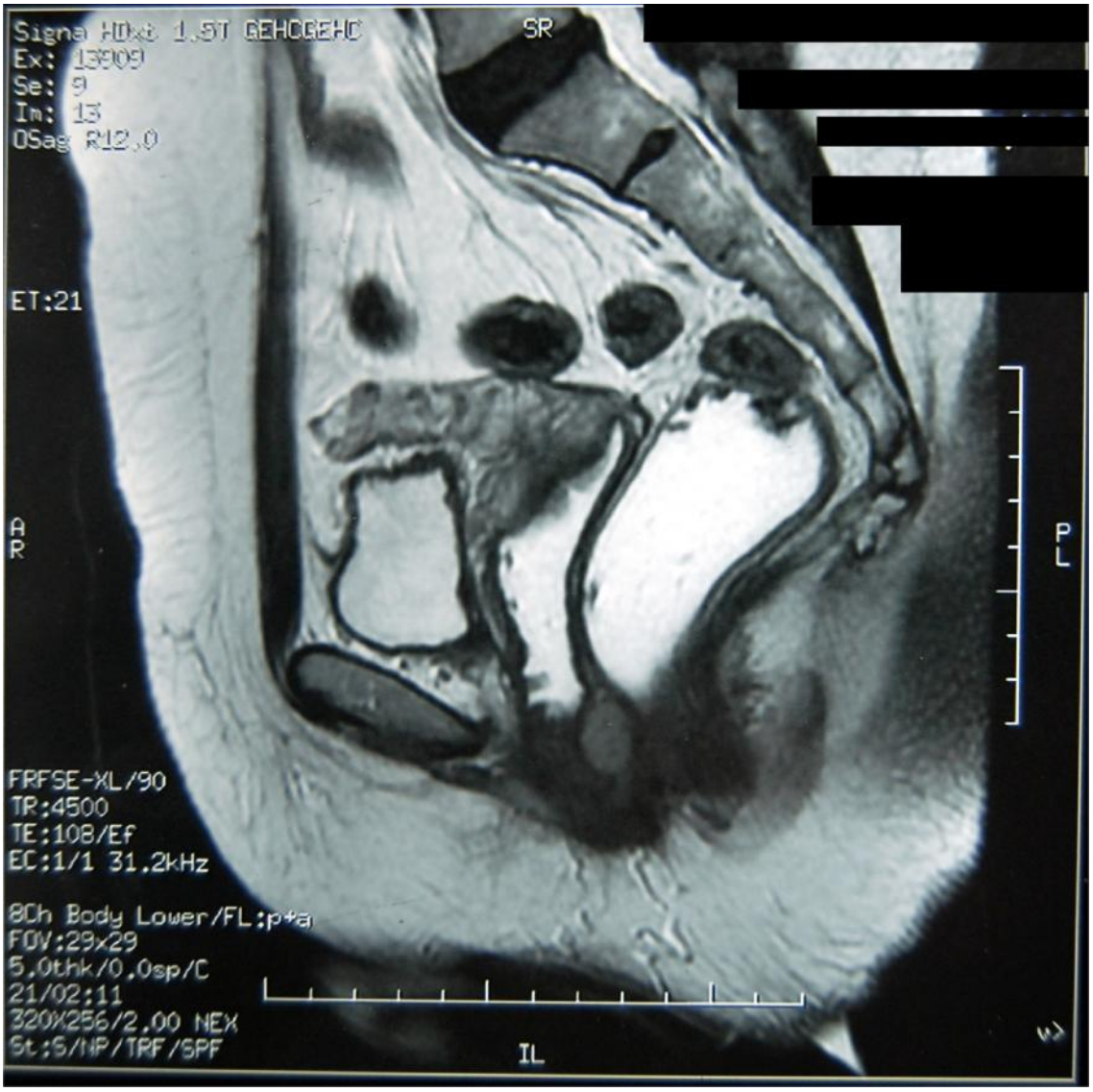


Figure 1: Coupe sagittale du pelvis montrant la présence d'une formation kystique en isosignal T1 et T2 de siège sous muqueux au niveau de la paroi postérieur du vagin mesurant 16 mm de grand axe.



Figure 2a



Figure 2b

Figure 2 a,b : Vue macroscopique de l'Angioléiomyome excisé.

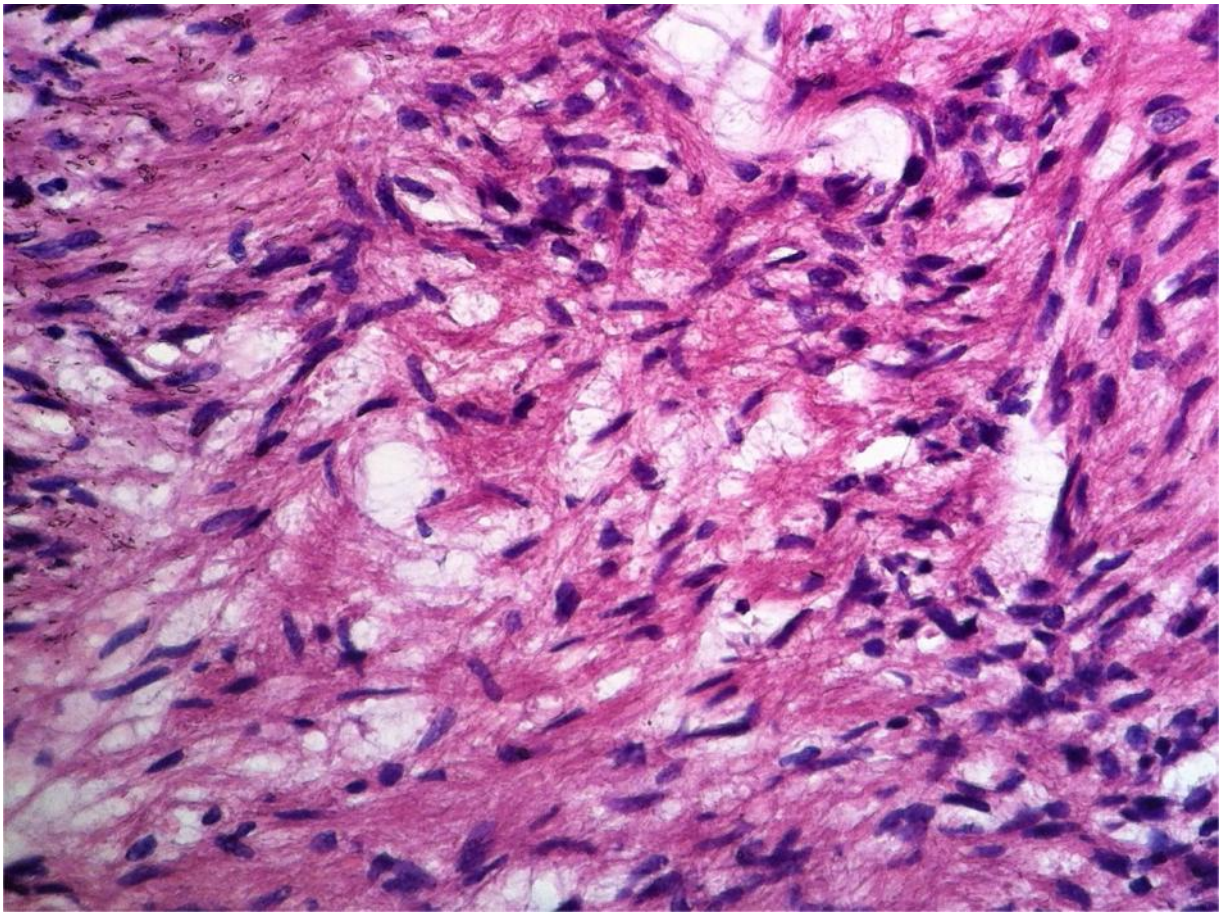


Figure 3a: Hematoxyline Eosine, GX20

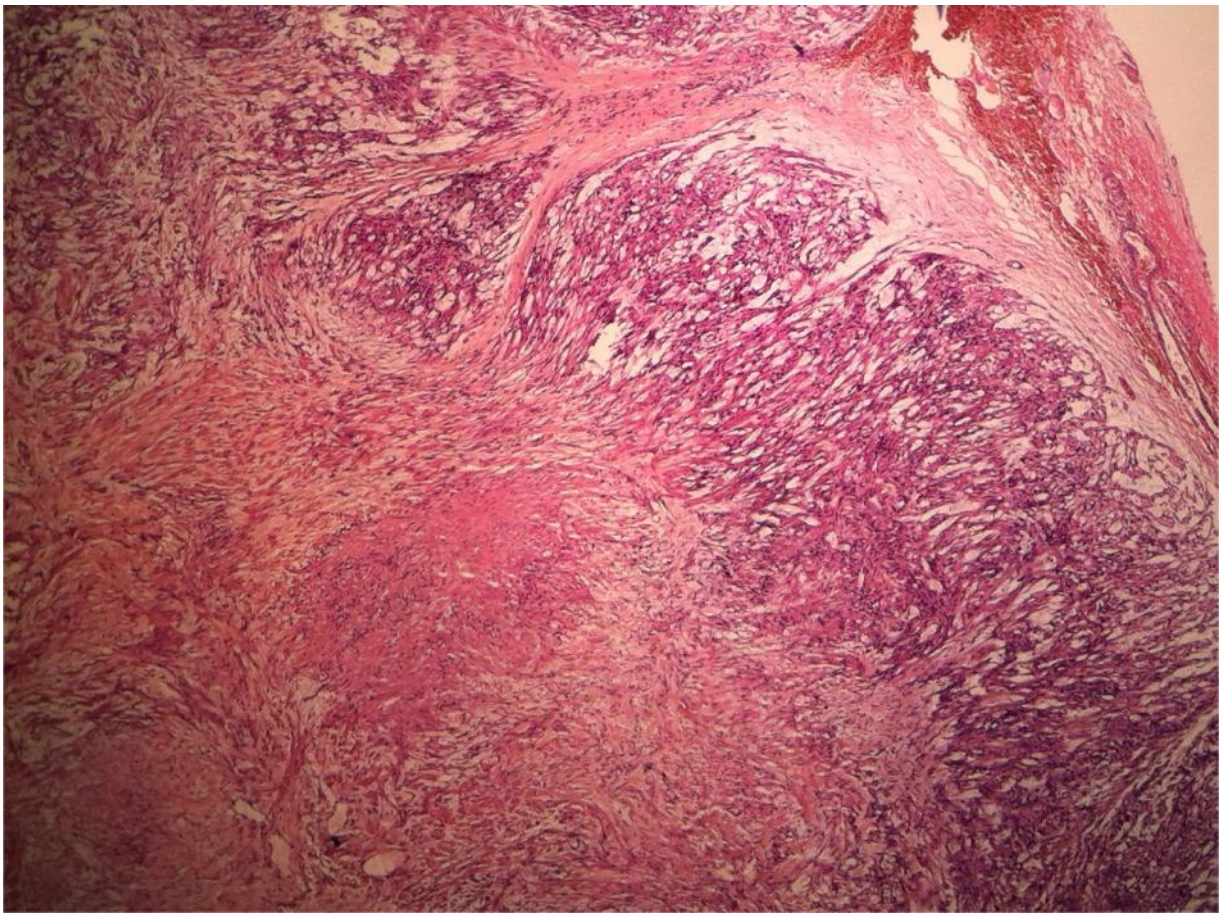


Figure 3b: Hematoxyline Eosine GX4

Figure 3 a,b: Prolifération nodulaire de cellules fusiformes pourvues de noyaux allongés à bords arrondies sans atypies cytonucléaires.

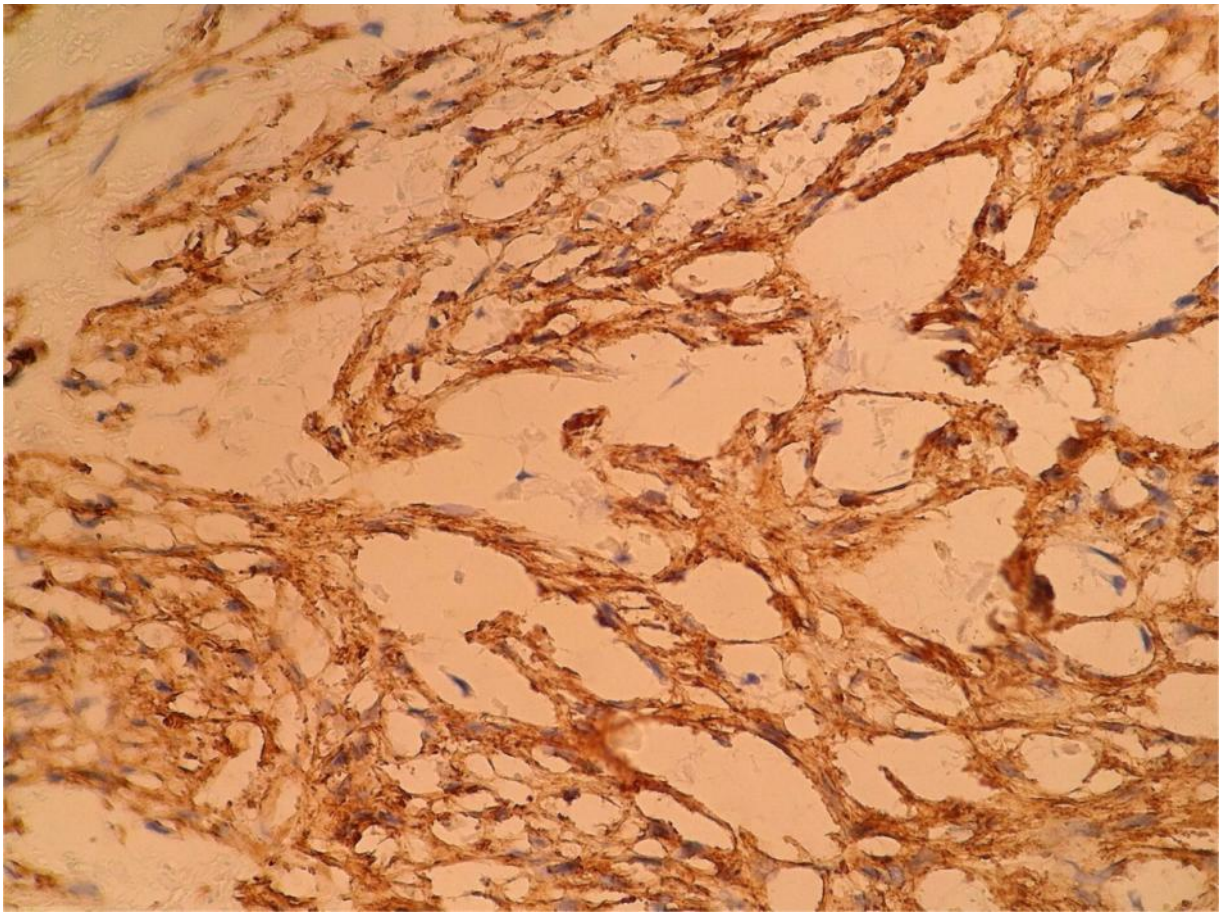


Figure 4: Immunohistochimie: Marquage intense et diffus de l'anticorps CD34.

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SOCIO-ECONOMIC FACTORS AFFECTING THE MATERNAL HEALTH IN RURAL AREAS OF DISTRICT LAYYAH, PAKISTAN

Ahmad Ali, Ghulam Abbas, Mudassir Mubeen Khan, and Tehmina Niaz

Department of Sociology B.Z.U Bahadur sub Campus Layyah, Pakistan

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ABSTRACT: The present quantitative study was conducted to explore the socio-economic factors affecting on the maternal health in the rural areas of District Layyah. The universe of the present study consisted of the all the fertile women those were able to reproduce. 150 women were selected from the rural areas of the research areas through systematic random sampling. Description of the data and analysis was done through SPSS. It was concluded that the early marriages, low level of education and income, unavailability of the maternal homes and general hospitals, far away of the hospitals, and the absence of doctors and gynecologists in the rural areas and the traditional methods of delivery cases are the major causes of the low level of maternal health in the rural areas of the study area. It was recommended that to improve the maternal health education and income level should be raised and awareness should be given in the study areas.

KEYWORDS: Maternal Health, Culture and Maternal Health, Education and Maternal Health.

1 INTRODUCTION

According to World Health Organization that Maternal health refers to the health of women during pregnancy, childbirth and the postnatal period. The progress and development of any country depends upon the complete health status of the mother and the child. Maternal health care is a concept that encompasses family planning, preconception, prenatal, and postnatal care. Goals of preconception care can include providing education, health promotion, screening and interventions for women of reproductive age to reduce risk factors that might affect future pregnancies. Prenatal care is the comprehensive care that women receive and provide for themselves throughout their pregnancy. Women who begin prenatal care early in their pregnancies have better birth outcomes than women who receive little or no care during their pregnancies. Postnatal care issues include recovery from childbirth, concerns about newborn care, nutrition, breastfeeding, and family planning. Most women do not have access to the health care and sexual health education services that they need. In many developing countries, complications of pregnancy and childbirth are the leading causes of death among women of reproductive age. More than one woman dies every minute from such causes; 585,000 women died every year (WHO, 2010). While motherhood is often a positive and fulfilling experience, for too many women it is associated with suffering, ill-health and even death. The main purpose of maternal health care is early identification and management of women at risk of complex pregnancy (van den Heuvel *et al*, 1999). However, according to research survey in developing countries, it is estimated that over 500,000 women die each year from complications arising from pregnancy and childbirths (Addai, 2000). The access to health facility or maternity home can play a vital role to improve the quality of maternal health and it become cause to reduce maternity mortality rate. The usefulness of a maternal health care system also depends on how women at risk are prepared to comply with compulsory health care. It is argued that the use of maternal health services is a function of demographic, cultural, and socio-economic factors, such as age of women, birth order, size of household, education, ethnicity, place of residence, religious background, marital status, employment, income level and accessibility (Obermeyer, 1991; Elo, 1992)It is estimated that 385,000 women died every year during pregnancy, delivery and the postnatal period suggests insufficient overall progress toward reproductive health, including maternal health (WHO, 2010, Bryce et al., 2008,)According to the World Fertility Survey that Many countries comparisons using large data sets, such as Demographic and Health Surveys, have shown that education in general and female education in particular exercise a very strong influence

Corresponding Author: Ghulam Abbas

in reducing child morbidity and mortality (Boerma et al. 1990; Bicego and Boerma 1993; Caldwell and Caldwell 1990;One the objective of United Nations Millennium Development Goal (DMG) was to reduce MMR by an average of 5-4 percent every year from 1990 to 2015. Sub-Saharan African countries are not controlling the maternal death currently estimate is that sub-Saharan countries cannot achieving their goals of maternal death control. In the 14 countries of the world with highest MMR, 13 are from sub-Saharan countries their MMR is more than 1000 per100, 000 live births (WHO 2007)

1.1 CONDITION IN PAKISTAN

National programmes for maternal and newborn care need to be integrated as maternal and child health in Pakistan still present an apologetic state. In terms of infant mortality, Pakistan ranks 183rd out of 220 countries around the globe. Health experts believe that investment in maternal and child health as a central focus in public health policy is critical. In Pakistan, the maternal mortality ratio ranges from 350-400 per hundred thousand births while infant mortality rate is 77 per thousand live births and under-five mortality rate is 94 deaths per 1,000 live births. Statistics reveal that one in 11 children born in Pakistan die before his fifth birthday. Over half of deaths under five occur during the neonatal period (under 1 month) while 26% occur during the post neonatal period. Infant and child mortality has hardly changed in over a decade and newborn deaths account for large percentage of the under-five mortality in the country.

1.2 SIGNIFICANCE OF THE STUDY

Sociology deals with the every aspect of the society. Health is the major aspect of the society. Healthy and the energetic society mainly depend upon the healthy mothers. Poor health is the sign of poor and week nation. Maternal mortality is increasing day to day. Although there are the several reasons of the poor maternal health, so the researcher was very interested in the misery and the poor health of the mothers, although, the world is making progress in the field of medicine and surgery, but the condition of the maternal health is not satisfactory.

1.3 OBJECTIVES OF THE STUDY

- Explore the educational factors affecting on the maternal health
- Explore the Cultural factors effecting on the maternal health
- To see the relationship of poverty with maternal health

2 RESEARCH METHODOLOGY

The population of the present research was all of the married and fertile women in the rural areas of Layyah, sample of 150 respondents selected though convenient sampling, Convenient sampling was used because more data available with the help of which researcher reach the target population directly and so researcher decided to go door to door, interview schedule was used as a tool for data collection. The tool consisted of structured and structured questions. For the statistical analysis the process of coding was made. The mathematical numbers to show different variables coded different responses. After the processing of coding the data was entered and analyzed with the help of Statistical Project for Social Science (SPSS). For the description of the basis characteristics of the sample simple percentage were calculated. The purpose is to simplify Quantitative characteristics in to numeric from the percentage was calculated by using the following formula, P=F/N 100, F=Frequency, N=Total number of frequencies

3 RESULTS AND DISCUSSIONS

Table 1. Distribution of the respondents regarding their age

categories	Frequency	Percent
18-25	20	13.3
26-30	43	28.7
31-45	59	39.3
More than 45	28	18.7
Total	150	100.0

This table shows that 13.3% respondents were 18-25 years old at the time of the research, 28.7% respondents were old 26-30 years, 39.3% respondents were 31-45 years old and 18.7% respondents were more than 45 years old at the time of the study. The researcher explored that majority of the women were 31-45 years old at the time of the research. Second majority 28.7% women were 26-30 years old. The researcher got the information from the fertile women as well as from the old ladies of the house.

Table 2. Percentage and distribution of the respondents regarding Age at the time of marriage

Categories	Frequency	Percent
15-19	86	57.3
20-23	57	38.0
24-28	7	4.7
Total	150	100.0

This table depicts that 57.3% respondents were married at the age of 15-19 years, 38% respondents were married at the time of 20-23 years old and 4.7% respondents were married at the time age of 24-28 years old. The researcher explored that majority of the respondents were married in very young age 15-19 years, because the research area lies in the rural areas of the District Layyah, where there was the trend to marry in early age. The second majority 38% women were married at the age of 20-23 years old. Very few amounts were married at the age of 24-28 years. The researcher explored that the early marriage cause the maternal health problems in the rural areas of the research area.

Table 3. Percentage and distribution of the respondents regarding to respondent's self education

categories	Frequency	Percent
Illiterate	80	53.3
Primary	18	12.0
Middle	3	2.0
High	21	14.0
Inter	8	5.3
Graduation	4	2.7
Post Graduation	16	10.7
Total	150	100.0

This table shows that 53.3% respondents were illiterate, 12.0% respondents were primary passed, 2.0% respondents were middle, 14% respondents were matriculate, 5.3% respondents had got intermediate education, 2.7% respondents were graduate, 10.7% respondents were post graduate. The researcher explored the very different responses to their education. Majority of the women were illiterate because most of them were poor and there was no trend to educate the girls and women. Some of them were literate to some extent and had got some education. Very few were graduates and post graduate. The researcher explored that illiteracy in the research area was the main factor about the awareness about the maternal health in the research area.

Table 4. Percentage and distribution of the respondents regarding to Respondent's occupation

categories	Frequency	Percent
House Wife	124	82.7
Govt. Job	24	16.0
Private Job	2	1.3
Total	150	100.0

This table shows that those 82.7% respondents were house wives, 16% respondents were employed as government job, 1.3% respondents working in the private sectors. The researcher found that the majority of the women were house wives. As the research was conducted in the rural areas, therefore most of them were illiterate and working in the house. They were also performing other duties in the fields. Some of them were employed as government jobs at the government's

departments, schools and other government departments. Some of them were working in the private sectors. Most of them were working in other homes as house mad on monthly basis.

Table 5. Percentage and distribution of the respondents regarding to respondent's family structure

Categories	Frequency	Percent
Nuclear	44	29.3
Joint	106	70.7
Total	150	100.0

This table shows that the 29.3% respondents had nuclear family structure and on the other hand 70.7% respondents belonged to joint family structure. The researcher explored that majority of the women had the joint family structure, that is the mainstream culture of the rural areas of the Pakistan

Table 6. Percentage and distribution of the respondents regarding to respondent's total family monthly income

categories	Frequency	Percent
less than 4000	54	36.0
4100-9000	36	24.0
more than 9000	60	40.0
Total	150	100.0

This table shows that 36% respondents had their total family monthly income less than 4000 rupees, 24% respondents had their total family monthly income 4100-9000 rupees and 40% respondents family monthly income were more than 9000 rupees. The researcher explored that majority of the respondents family was earning more than 9000 rupees, those were the respondents who had the joint family structure that was the reason the had more than 9000 rupees as their family monthly income. The second majority 36% was earning less than 4000 rupees total family monthly income. These were belonged to the nuclear family structure. The researcher found that majority of the population of the research area was very poor that was the reason they could not afford the expenses of the delivery in the hospitals and were relied on the conservative and traditional method of maternal problems.

Table 7. Percentage and distribution of the respondents regarding to respondent's number of living children

Categories	Frequency	Percent
2-3	60	40.0
4-5	42	28.0
6-7	34	22.7
8-9	8	5.3
More Than 9	6	4.0
Total	150	100.0

This table shows that 40% respondents had 2-3 children, 28% respondents had 4-5 children, 22.7% respondents had 6-7 children, 5.3% respondents had 8-9 children and 4% respondents had more than 9 children. The researcher explored that the majority of the women had 2-3 children. These were the women whose marriage duration was about 5-8 years. 28% women had 4-5. In these women some were fertile and some had passed their fertility period. The researcher also explored some women who had dozen of the children. Here becomes the true statement that, "the poor get the children".

Table 8. Percentage and distribution of the respondents regarding to respondent's number of died children

categories	Frequency	Percent
1	32	21.3
2	23	15.3
4	11	7.3
more than 4	84	56.0
Total	150	100.0

This table shows that 21.3% respondents said that their 1 child had been died, 15.3% respondents said that 2 children have been died, 7.3% respondents said that their 4 children had been died and 56% respondents said that their more than 4 children had been died in the infant age. This shows the worst picture of the study area. This was happened due to the lack of maternal facilities and unawareness about the child health and other lack of maternity facilities in the research areas.

Table 9. Percentage and distribution of the respondents regarding to is there any maternity hospital in your area

Categories	Frequency	Percent
Yes	54	36.0
No	96	64.0
Total	150	100.0

This table shows that 36% respondents said that there were present maternal or any other hospital in their area and 64% respondents said that were no maternal or any other hospital in their area. The researcher explored that the majority of areas had no any maternal and general hospital in the research area.

Percentage and distribution of the respondents regarding to how far maternity home is from your area

Categories	Frequency	Percent
Less Than I K.M	24	16.0
1-2 K.M	26	17.3
3-4 K.M	74	49.3
More Than 4 K.M	26	17.3
Total	150	100.0

This table shows how far the maternal home or hospital is from your area? 16% respondents said that the maternity home and hospital was less than 1 kilo meter, 17% respondents said 1-2 K.M, 49.3% respondents said 3-4 K.M, and 17.3% respondents said that the maternity hospital or general hospital was far more than 4 K.M. the researcher conduct her study in the rural area, where there were Basic Health Units and Rural Health Centers. These units and centers were not equipped with the facilities. There were no gynecologist doctors, and the delivery process has no specific time, it may become a barrier in the level of participation in community development? Happen in any time, therefore, they were relied on the 'Dies.' In the private hospitals which were only present in the District Layyah, were also not equipped with the latest facilities and were unaffordable to the lay man.

Table 10. Percentage and distribution of the respondents regarding Visit of any maternity home during pregnancy

Categories	Frequency	Percent
Often	25	16.7
Seldom	71	47.3
Never	54	36.0
Total	150	100.0

This table shows the responses of the women to visit the maternity homes during the pregnancy period. 16.7% respondents said that they often visited the maternity home in the pregnancy period, 47.3 respondents said that they had

seldom visit during the pregnancy and 36% respondents said that they had never visit any maternity home during the pregnancy. The researcher explored that the majority of the women had visited to the maternal homes seldom in the case of any complexity in the pregnancy period. The second majority 36% said that they have never visit any maternal hospital during the pregnancy. From this fact we can imagine the misery condition of the maternal health of the women in the research area.

Table 11. Percentage and distribution of the respondents regarding Balance diet necessary for pregnant women

Categories	Frequency	Percent
To Some Extent	49	32.7
To Great Extent	44	29.3
Not At All	57	38.0
Total	150	100.0

This table shows that 32.7% respondents said that they took the balance diet necessary for pregnant women to some extent, 29.3% respondents said to great extent and 38% respondents said that they did not take balance diet during the pregnancy period. The researcher found that the majority of the women had not taken the balance diet in their pregnancy period. The researcher also found the fact that the women of the rural areas were taking diet in the form of butter, milk and carbohydrates, which is not the balance diet. They were not taking regular exercise, using no dry and wet fruits that are the necessary for the pregnant women.

Table 12. Percentage and distribution of the respondents regarding Help during the delivery case

Categories	Frequency	Percent
Doctor (Gynecologist)	15	10.0
Nurse	9	6.0
Dai	126	84.0
Total	150	100.0

This table shows the responses of the respondents, who helps you during the delivery case? The table reveals that 1o% respondents said that gynecologist doctor helped us during the delivery cases. 6% respondents said that nurse helped us in the delivery process and 84% respondents said that 'Dai' helped us during the delivery process. The researcher explored that most of the women were on relying on the indigenous way of delivery. Dai had been helping to assist the delivery. Cases only some of them were relied on the gynecologists and nurses. From these women, some were the first time pregnant, who had the fear about the pregnancy that was the reason they had to seek the help of the gynecologists and nurses.

Table 13. Percentage and distribution of the respondents regarding satisfaction with the facilities providing them during the delivery process

Categories	Frequency	Percent
To Great Extent	39	26.0
To some Extent	63	42.0
Not At All	48	32.0
Total	150	100.0

This table shows that 26% respondents were satisfied with the facilities providing them at the time of the delivery, 42% respondents were satisfied to some extent and 32% respondents were not satisfied with the facilities providing them at time of delivery. The researcher found that majority of the women was not satisfied with the facilities providing them at the time of delivery.

Hypothesis testing; There is an association between Age at the time of marriage and Respondent's number of died children

Age at the time of marriage	Respondent's number of died children				Total
	1	2	4	More than 4	
15-19	22	6	4	54	86
20-23	10	16	7	24	57
24-28	1			6	7
Total	33	22	11	84	150

Chi squire value = 9.593, degree of freedom = 6, Level of significance = .003

This table shows that there is a relationship between the age at the time of marriage and number of died children. The result shows that these two statements are associated at the significant level of 5 percent.

4 SUMMARY

The progress and development of any country depends upon the complete health status of the mother and the child. The term maternal health encompasses all aspects of physical, mental and social wellbeing of women related to pregnancy, hence includes health status during pregnancy, delivery, post partum period and health consequences related to pregnancy. Poor maternal health affects the health of the mother in the short term (during pregnancy, delivery and the post partum period) and in the long term (reproductive morbidity associated with pregnancy and delivery), health of the newborn, the infant and the young child. All the developing countries including Pakistan are making utmost effort to decline the mortality rate among the mothers and children right from the pre-natal stage to toddler stage. The main factors responsible for the increased death rate among the women are the high level of still-birth and physically or mentally handicapped births of the children, lack of health facilities, lacking in utilizing of these facilities, financial incapacities to afford health facilities, repeated pregnancies, and the poor level of nutrition and polluted environment. At the same time, the traditions of our country have hinder our people to be benefited from the modern health care system because in rural areas still the people don't want to use the facilities available at hospital or medical centers. Due to these reasons, the maternal-child health is severely affected and the result is in the form of many diseases and disabilities. Health is the main institution of the society. Sociologists have long been interested in this major aspect of the society, because, each and every activity is related with the status of the health. Bad maternal health is not only cause; it is the consequences of other abnormalities. The objectives of the study were to explore social, economic, demographic factors that were the major cause of the poor maternal health in the rural areas of the research area. The universe of the present study were the all the females who were in the age of fertility in the rural areas of district Layyah. The sample of 150 respondents was collected from the different union councils of research area. Three union councils were selected through random sampling. The results showed that the early marriage, low level of education and occupation and income, multiple births, far away of the maternal and general hospitals from the rural areas, unavailability of the specialist doctors, unawareness about the maternal complications and the traditional delivery process were the major cause of the poor maternal health in the research area.

5 SUGGESTIONS

The researcher reached the following suggestions, which can helpful to improve the maternal health in the research area.

1. To improve the maternal health, early marriage should be stopped.
2. To improve the health of the child and mother, education should be given.
3. For the achievement of the better health status of the child and mothers, income level should be increased the native poor through helping the poor from the income generating activities and welfare departments.
4. Cultural is a main hurdle in the maternity and delivery cases. Therefore, awareness should be given to improve the maternal health.
5. Multiple births should be decreased through family planning and other contraceptive methods.
6. Availability of the maternal homes and facilities can improve the health of the child and mother.
7. People should be turned from the traditional delivery process to the modern delivery process.

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Empirical Tests of Capital Asset Pricing Model and its Testability for Validity Verses Invalidity

Anthony K. Muthama, Macharia George Munene, and Ondabu Ibrahim Tirimba

Department of Finance, Accounting and Economics,
Jomo Kenyatta University of Agriculture and Technology,
PHD Finance Candidate, Nairobi, Kenya

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ABSTRACT: This paper reviews an advanced literature on capital asset pricing model. It starts by a brief introduction in welcoming scholars into the model background and its relevant assumptions and implications. It then explains the model in its real form, both the conceptual and the analytical part of it. The CAPM and the Index Model is then clearly looked at and explained in the dimensions of the Index Model and Realized Returns and also the Index Model and the Expected Return-Beta Relationship. The researchers penultimately look at a number of empirical tests for CAPM to explain the validity of the model. Some of the Empirical tests looked at by this paper are the tests by Lintner, which is reproduced in Douglas (1968), Fama and MacBeth (1973), tests by Black, Jensen and Scholes (1972), tests by Stambaugh (1982), tests by Gibbons (1982), Miller and Scholes (1972) tests and the Roll (1977) Critique. The paper finds that, there is strong empirical evidence invalidating the CAPM and on the other hand it is clear that the empirical findings themselves are not sufficient to discard the CAPM. The paper found out further that CAPM cannot be used for estimating the cost of capital, to evaluate the performance of fund managers or as an aid in event-study analysis. For practical purposes, Merton's (1973) intertemporal CAPM or some form of the APT would have to be resorted to for the purpose of explaining expected stock returns.

KEYWORDS: Mean Return, testable, beta, CAPM, Expected stock returns.

1 INTRODUCTION

The CAPM is based on Markowitz's (1959) mean variance analysis. Markowitz demonstrated that rational investors would hold assets, which offer the highest possible return for a given level of risk, or conversely assets with the minimum level of risk for a specific level of return. Sharpe (1964) and Lintner (1965) build on Markowitz's work after making a number of assumptions. They developed an equilibrium model of exchange showing the return of each asset as a function of the return on the market portfolio. This model known as the Capital Asset Pricing Model has since been the focuses of a number of empirical tests, majority of them deny the validity of the model. This paper discusses some of the empirical tests of the CAPM.

1.1 THE CAPM AND ITS ASSUMPTIONS

Sharpe (1964) and Lintner (1965) assumed that there are no transaction costs and no income taxes. Further, they assumed that assets are infinitely divisible and there are no restrictions to short selling and that investors can lend and borrow unlimited amounts at the risk free rate of interest. More importantly they assumed the homogeneity of expectations and that individuals hold mean variance efficient portfolios. Another implicit assumption of the CAPM is that all assets including human capital are marketable. Moreover the CAPM is essentially a single period model.

It is clear that these assumptions do not hold in the real world and thus, not surprisingly, the model's validity has been suspect from the outset. Closer examination of the assumptions underlying the CAPM shows that they are not as stringent as they first appear to be. Exactly the same results would obtain if short sales were disallowed. Since in equilibrium no investor sells any security short, prohibiting short selling will not change the equilibrium. More formally the derivative of the

Langrangian with respect to each security will have a Kuhn-Tucker multiplier added to it, but since each security is contained in the market portfolio, the value of the multiplier will be zero and hence the solution will remain unaffected.

Further, Fama (1970) and Elton and Gruber (1975) give a set of conditions under which the multi-period problem reduces to a single period CAPM, where all individuals maximise a single period utility function. The conditions are that firstly consumers act as if the one-period returns are not state dependent, i.e. the distribution of one-period returns on all the assets are known at the beginning of the period. Secondly, the consumption opportunities are not state dependent and lastly consumers' tastes are independent of future events. Fama further shows that given these conditions the derived one period utility is equivalent to a multi-period utility function given non-satiation and risk aversion. However, it is argued by many that the above conditions are rather restrictive.

Merton (1973) has shown that a necessary and sufficient condition for individuals to behave as if they were single-period maximisers and for the equilibrium return relationship of CAPM to hold is that the investment opportunity set is constant. Furthermore, the main results of the model hold if income tax and capital gains taxes are of equal sizes. If the assumption of riskless lending or borrowing is violated, then Black (1972) has shown that we still obtain a linear relationship between an asset's returns and its risk as measured by the covariance of the assets returns with the market. This model as distinct from the standard CAPM is known as the zero-beta CAPM.

Thus, even though the assumptions underlying the Capital Asset Pricing Model are demanding and have been the basis for much of the criticism against the model, nevertheless these assumptions are not altogether inflexible. More importantly, the final test of the model is not how reasonable the assumptions underlying it seem to be, but rather how well the model conforms to reality. Indeed, many proponents of the CAPM argue that due to technological advances, capital markets operate as if these assumptions are satisfied.

Sharpe and Lintner, thus making a number of assumptions, extended Markowitz's mean variance framework to develop a relationship for expected returns, which more precisely is:

$$E[R_i] = R_f + \beta_{im}(E[R_m] - R_f)$$

$$\beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]}$$

Where R_i = return on asset i; R_m = return on market portfolio; R_f = return on the riskless asset.

Thus the return on an asset depends linearly on beta, β_{im} which is a measure of the covariance of the asset's return with that of the market. Intuitively, in rational and competitive market, investors diversify all systematic risk away and thus price assets according to their systematic or non-diversifiable risk. Thus the model invalidates the traditional role of standard deviation as a measure of risk. This is a natural result of the rational expectations hypothesis (applied to asset markets) because if, on the contrary, investors also took into account diversifiable risks, then over time competition will force them out of the market. If, on the contrary, the CAPM does not hold, then the rationality of the asset's markets will have to be reconsidered.

Black (1972) has derived a more general version of the CAPM, which holds in the absence of a riskless asset. For this *zero beta CAPM*, we have:

$$E[R_i] = E[R_{om}] + \beta_{im}(E[R_m] - E[R_{om}])$$

$$\beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]}$$

where R_{om} = return on the zero beta portfolio, i.e. the portfolio (lying on the portfolio frontier) which has a zero correlation with the market portfolio.

1.2 Framework For Testing The Validity Of CAPM

The standard CAPM can also be written in terms of excess returns

$$E[Z_i] = \beta_{im}E[Z_m]$$

$$\beta_{im} = \frac{Cov[R_i, R_m]}{Var[R_m]}$$

where: $Z_i = R_i - R_f$

$Z_m = R_m - R_f$

Empirical tests of the standard CAPM have focused on three testable implications, namely the intercept is zero, beta completely captures the cross sectional expected returns and that the market excess return is positive.

The intercept is zero

The excess return market model is:

$$Z_t = \alpha + \beta Z_{mt} + \varepsilon_t$$

$$E[\varepsilon_t] = 0, \qquad E[\varepsilon_t \varepsilon_t'] = \Sigma$$

$$E[Z_{mt}] = \mu_m, \quad E[(Z_{mt} - \mu_m)^2] = \sigma_m^2$$

$$Cov[Z_{mt}, \varepsilon_t] = 0$$

where Z_t = (Nx1) vector of excess returns for N assets

β = (Nx1) vector of betas

Z_{mt} = time period t market portfolio of excess return

α = (Nx1) vector of intercepts

ε_t = (Nx1) vector of disturbances

The implication of the standard CAPM is that the vector of intercepts is zero. If this is true then the market portfolio will be the 'tangency' portfolio. Assuming that the returns are IID and are normally distributed, the maximum likelihood estimation technique can be used to estimate the parameters α and β. The probability density function (pdf) of excess returns conditional on the market excess return is given by

$$f(Z_t \mid Z_{mt}) = (2\pi)^{-N/2} |\Sigma|^{-1/2} \times \exp[-(1/2)(Z_t - \alpha - \beta Z_{mt})' \Sigma^{-1} (Z_t - \alpha - \beta Z_{mt})]$$

and given that the returns are IID the joint pdf is

$$f(Z_1,\ldots,Z_T \mid Z_{m1},\ldots,Z_{mT}) = \prod f(Z_t \mid Z_{mt})$$

Thus the log-likelihood function is

$$\Lambda(\alpha, \beta, \Sigma) = -(NT/2)\log(2\pi) - (T/2)\log|\Sigma| - (1/2)\textstyle\sum_t (Z_t - \alpha - \beta Z_{mt})' \Sigma^{-1} (Z_t - \alpha - \beta Z_{mt})$$

The first order conditions are:

$$\partial\Lambda/\partial\alpha = \Sigma^{-1}[\textstyle\sum_t (Z_t - \alpha - \beta Z_{mt})] = 0$$

$$\partial\Lambda/\partial\beta = \Sigma^{-1}[\textstyle\sum_t (Z_t - \alpha - \beta Z_{mt}) Z_{mt}] = 0$$

$$\partial\Lambda/\partial\Sigma = -(T/2)\Sigma^{-1} + (1/2)\Sigma^{-1}[\textstyle\sum_t (Z_t - \alpha - \beta Z_{mt})(Z_t - \alpha - \beta Z_{mt})']\Sigma^{-1} = 0$$

Solving the above First Order Conditions we get estimates for α, β and Σ, and it should be noted that these estimates are the same as the ones obtained using Ordinary Least Squares. However, compared to the OLS they have better large sample properties.

The Wald test can then be used to check whether the intercept is zero. The Wald test statistic is given by:

$$W = \Lambda\,[Var(\Lambda)]^{-1}\Lambda$$

which has a chi-square distribution with N degrees of freedom

1.3 VARIABLES OTHER THAN THE MARKET FACTOR AFFECTING STOCK RETURNS

According to the CAPM, only market risk is priced, i.e. only beta affects returns and all other variables are irrelevant. However, there have been a number of empirical studies, which find that non-market factors have a significant effect on average returns. Basu (1983) provides evidence that shares with high earnings yield (low price to earnings ratio) experience on average higher subsequent returns than shares with low earnings yield. Banz (1981) was the first to provide evidence of the 'size effect'; i.e. low market capitalisation firms have higher average returns compared to larger firms.

Merton (1973) has constructed a generalised intertemporal capital asset pricing model in which factors other than market uncertainty are priced. He models individuals as solving lifetime consumption decisions in a multi-period setting. After making a number of assumptions, Merton show that the returns on assets depend not only on the covariance of the asset with the market but also on its covariance with changes in the investment opportunity set. Hence, changes in interest rates, future income and relative prices will all influence returns. Intuitively, individuals will form portfolios to hedge themselves away from these risks. These actions of investor's will affect returns. According to this 'multi-beta CAPM', the return on securities will be affected by a number of indices apart from the market factor. Hence excess returns will be of the following form

$$E[R_i] - R_f = \beta_{im}(E[R_m] - R_f) + \beta_{i/1}(E[R_{/1}] - R_f) + \beta_{i/2}(E[R_{/2}] - R_f) + \ldots$$

This can also be interpreted as another form of the Arbitrage Pricing Theory (APT).

Elton and Gruber (1993 find that a five – factor APT model better explains expected returns compared to the classic CAPM model in the Japanese market. They find that in Japan, smaller stocks are associated with smaller betas and thus according to the CAPM they should give smaller mean returns. Yet, smaller stocks have higher expected returns than their larger counterparts. They also find that a multi-factor model is more useful in constructing hedge portfolios for futures and option trading.

Fama and French (1992) in an influential paper entitled, "The cross-section of expected stock returns", show that two easily measured variables, size and book-to-market equity combine to capture the cross-sectional variation in average stock returns associated with market beta, size, leverage, book-to-market, and earnings-to-price ratios. Fama and French using data for non-financial firms conduct its asset-pricing tests using the Fama and MacBeth regressional approach. Their results from applying the FM regressions show that market beta clearly does not explain the average stock returns. The average slope from the regression of returns on beta alone is 0.15 per cent per month and it is only 0.46 standard errors from zero.

Furthermore, Fama and French point out that variable such as size, earning yield, leverage, and book-to-market are all scaled versions of a firm's stock price and thus some of them are redundant to explain returns. They show that of these variables only size and book-to-market equity explain cross-sectional average returns. Moreover, they find that when allowing for variations in beta that are unrelated to size, the relationship between beta and average return is flat. Hence, they naturally argue that the CAPM is dead.

1.4 CAPM IMPLICATIONS

One of the most important *implications* of the CAPM is that all investors will choose to hold a portfolio of risky assets in proportions that duplicate representation of the assets in the market portfolio (*M*), which includes all traded assets. For simplicity, we generally refer to all risky assets as stocks.

Not only the market portfolio be on the efficient frontier but it also will be the tangency portfolio to the optimal capital allocation line (CAL) derived by each and every investor. As a result, the capital market line (CML), the line from the risk-free rate through the market portfolio, *M*, is also the best attainable capital allocation line. All investors hold *M* as their optimal risky portfolio, differing only in the amount invested in it versus in the risk free asset.

The risk premium on the market portfolio will be proportional to its risk (standard deviation) and the degree of risk aversion of the typical investor. Note that because *M* is the optimal portfolio, which is efficiently diversified across all stocks, standard deviation (σ^2_M) is the systematic risk of this universe.

$$E(r_M) - r_f = \bar{A}\sigma^2_M$$

The risk premium on individual assets will be proportional to the risk premium on the market portfolio, *M*, and the *beta coefficient* of the security relative to the market portfolio. Beta measures the extent to which returns on stock and the market move together.

$$\beta = \frac{Cov(r_i, r_M)}{\sigma^2_M}$$

2 THE CAPM MODEL

2.1 CONCEPTUAL MODEL

The CAPM is given as follows:

$R_i = R_F + [E(R_M - R_F)]ß$

Where R_i is required return of security i

R_F is the risk free rate of return

$E(R_M)$ is the expected market rate of return

ß is Beta.

Note $ß_i = \frac{Cov_{(im)}}{\delta^2_m}$

Where $Cov_{(im)}$ is the covariance between asset i and the market return; and δ^2_m is the variance of the market return.

If we graph $ß_i$ and $E(R_i)$ then we can observe the following relationship

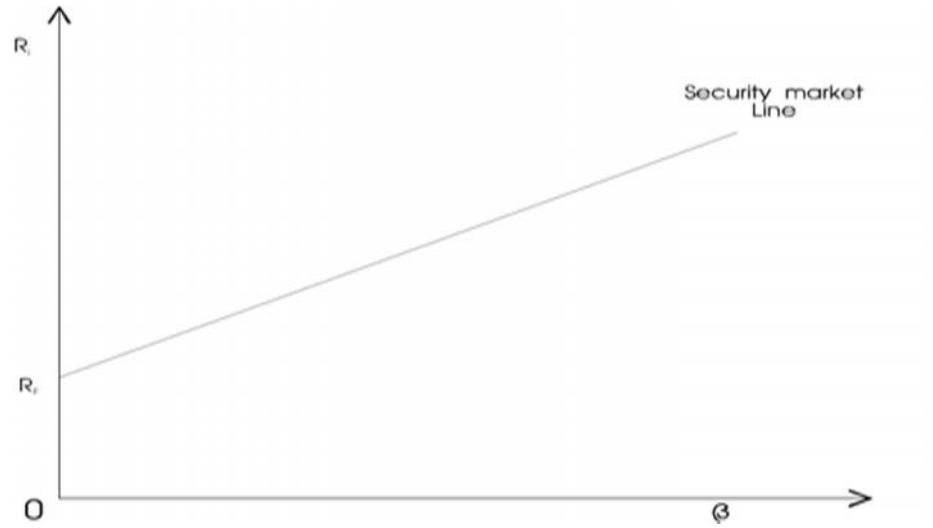


Figure 1

All correctly priced assets will lie on the security market line. Any security off this line will either be overpriced or underpriced.

The security market line therefore shows the pricing of all assets if the market is at equilibrium. It is a measure of the required rate of return if the investor were to undertake a certain amount of risk.

2.1 ANALYTICAL MODEL

2.1.1 THE RISK PREMIUM OF THE MARKET PORTFOLIO

The equilibrium risk premium on the market portfolio will be proportional to the average degree of risk aversion of the investor population and the risk of the market portfolio. Recall that each individual investor chooses a proportion *y*, allocated to the optimal portfolio *M*, such that:

$$y = \frac{E(r_M) - r_f}{A\sigma_M^2}$$

In the simplified CAPM economy, risk-free investments involve borrowing and lending among investors. Any borrowing position must be *offset* by the lending position of the creditor. This means that net borrowing and lending across all investors

must be zero, and in consequence, substituting the representative investor's risk aversion $\bar{A}$, for *A*, the average position in the risky portfolio is 100%, or $\bar{y}$ = 1. Setting *y* = 1 in Equation (2.1) and rearranging, we find that the risk premium on the market portfolio is related to its variance by the average degree of risk aversion:

$$E(r_M) - r_f = \bar{A}\sigma_M^2$$

In equilibrium, of course, the risk premium on the market portfolio must be just high enough to induce investors to hold the average supply of stocks. If the risk premium is too high compared to the average degree of risk aversion, there will be excess demand for securities, and prices will rise; if it is too low, investors will not hold enough stocks to absorb the supply, and the prices will fall. The *equilibrium* risk premium of the market portfolio is therefore proportional to both the risk of the market, as measured by the variance of its returns, *and* to the degree of risk aversion of the average investor, *A*, in the above equation.

2.1.2 EXPECTED RETURNS ON INDIVIDUAL SECURITIES

All investors use the same input list, that is, the same estimates of expected returns, variances, and covariances. These covariances can be arranged in a covariance *matrix*, so that the entry in the fifth row and third column for example, would be the covariance between the rates of return on the fifth and third securities. Each diagonal entry of the matrix is the covariance of one security's return with itself, which is simply the variance of that security.

To calculate the variance of the market portfolio we use the *bordered* covariance matrix with the market portfolio weights,. Recall that we calculate the variance of the portfolio by summing over all the elements of the covariance matrix, first multiplying each element by the portfolio weights from the row and the column. The contribution of one stock to portfolio variance therefore can be expressed as the sum of all the covariance terms in the column corresponding to the stock, where each covariance is first multiplied by both the stock's weight from its row and the weight from its column. For example, the covariance of GE stock to the variance of the market portfolio is:

$$w_{GE}[w_1 Cov(r_1, r_{GE}) + w_2 Cov(r_2, r_{GE}) + \ldots + w_{GE} Cov(r_{GE}, r_{GE}) + \ldots + w_n Cov(r_n, r_{GE})]$$

The *best* measure of the stock's contribution to the risk of the market portfolio is its covariance with that portfolio. Thus, the GE's stock contribution to the market portfolio's variance is:

$$GE\,contribution = w_{GE} Cov(r_{GE}, r_M)$$

To demonstrate this more rigorously, note that the rate of return on the market portfolio may be written as:

$$r_M = \sum_{k=1}^{n} w_k r_k ,$$

Therefore, the covariance of the return on GE with the market portfolio is:

$$Cov(r_{GE}, r_M) = Cov(r_{GE,} \sum_{k=1}^{n} w_k r_k) = \sum_{k=1}^{n} w_k Cov(r_{GE}, r_k)$$

Notice that the last term in Equation (2.4) is precisely the same as the term in brackets in Equation (2.3). Therefore, Equation (2.3), which is the contribution of GE to the variance of the market portfolio, may be simplified to: $w_{GE} Cov(r_{GE}, r_M)$. We also observed that the contribution of our holding of GE to the risk premium of the market portfolio is $w_{GE}[E(r_{GE}) - r_f]$. Therefore, reward-to-risk ratio for investment in GE can be expressed as:

$$\frac{GE's\ contribution\ to\ Risk\ Premium}{GE's\ contribution\ to\ Variance} = \frac{E(r_{GE}) - r_f}{Cov(r_{GE}, \mathrm{r_M})}$$

Having measured the contribution of GE stock to market portfolio variance, we may determine the appropriate risk premium for GE. We note first that the market portfolio is the tangency (efficient mean-variance) portfolio. The reward-to-risk ratio for investment in the market portfolio is:

$$\frac{Market\ risk\ \ premium}{Market\ variance} = \frac{E(r_M) - r_f}{\sigma_M^2}$$

The ratio in Equation (2.5) is often called the market price of risk, because it quantifies the extra return that investors demand to bear portfolio risk. The ratio of risk premium to variance tells us how much *extra* return must be earned per unit of portfolio risk. (Notice that for components of the efficient portfolio, such as shares of GE, we measure risk as the contribution to portfolio variance (which depends on its *covariance* with the market). In contrast, for the efficient portfolio itself, its variance is the appropriate measure of risk).

Now, consider an average investor who is currently invested 100% in the market portfolio and suppose she were to increase her position in the market portfolio by a *tiny* fraction, δ, financed by borrowing at the risk-free rate of return. The portfolio rate of return will be $r_M + \delta(r_M - r_f)$. Taking expectations and comparing with the original expected return, $E(r_M)$, the incremental rate of return will be:

$$\Delta E(r) = \delta[E(r_M) - r_f]$$

To measure the impact of the portfolio shift on risk, we compute the new value of the portfolio variance. The new portfolio has a weight of (1 +δ) in the market and (-δ) in the free-risk asset. The portfolio variance will increase by:

$$\Delta\sigma^2 = (1+\delta)^2\sigma_M^2 = \sigma_M^2 + (2\delta + \delta^2)\sigma_M^2$$

However, if δ is very small, then δ^2 will be negligible compared to 2δ, so we may ignore the term. Therefore, the portfolio variance has increased by $2\delta\sigma_M^2$. Summarizing these results, the trade-off between the incremental risk premium and incremental risk, referred to as the marginal price of risk, and is given by the ratio:

$$\frac{\Delta E(r)}{\Delta\sigma^2} = \frac{E(r_M) - r_f}{2\sigma_M^2},$$

and equals one-half the market price of risk (see Equation 2.5 of reward-to-risk ratio). Now suppose that, instead, investors were to invest the increment δ in GE stock. The increase in mean excess return is:

$$\Delta E(r) = \delta[E(r_{GE}) - r_f]$$

This portfolio has a weight of 1.0 in the market, δ in GE and (-δ) in the risk-free asset. The *increase* in variance includes the variance of the incremental position in GE plus twice its covariance with the market:

$$\Delta\sigma^2 = \delta^2\sigma_{GE}^2 + 2\delta Cov(r_{GE}, r_M).$$

Dropping the negligible term involving δ^2, the marginal price of risk of GE is:

$$\frac{\Delta E(r)}{\Delta\sigma^2} = \frac{E(r_{GE}) - r_f}{2Cov(r_{GE}, r_M)}$$

A basic principle of equilibrium is that all investments should offer the same reward-to-risk ratio. (If the ratio were better for one investment than another, investors would rearrange their portfolio, tilting toward the alternative with better trade-off and shying away from the other. Such activity would impart pressure on security prices until the ratios were equalized.) Therefore, we may conclude that, in equilibrium, the marginal price of risk of GE stock must equal that of the market portfolio:

To determine the fair risk premium of GE stock, we rearrange the above equation slightly to obtain:

$$E(r_{GE}) - r_f = \frac{Cov(r_{GE}, r_M)}{\sigma_M^2}[E(r_M) - r_f]$$

The ratio $\mathrm{Cov}(\mathrm{r_{GE}}, \mathrm{r_M}) / \sigma_{\mathrm{M}}^2$ on the right-hand side of Equation (2.8a) measures the *contribution* of GE stock to the variance of the market portfolio as a fraction of the total variance of the market portfolio. The ratio is called beta and is denoted by *β*. Using this measure, we can restate the previous equation as

$$E(r_{GE}) = r_f + \beta_{GE}[E(r_M) - r_f]$$

This expected return-beta relationship is the most familiar expression of the CAPM to practitioners. We will have a lot more to say about the expected return-beta relationship shortly.

Does the fact that few real-life investors actually hold the market portfolio imply that the CAPM is of no practical importance? Not necessarily. Recall that reasonably well-diversified portfolios shed firm-specific risk, and are left with mostly systematic or market risk. Even if one doesn't hold the precise market portfolio, a well-diversified portfolio will be so highly correlated with the market that a stock's beta relative to the market will still be a useful risk measure.

Several CAPM authors have shown that modified versions of the CAPM will hold true even if we consider differences among individuals leading them to hold different portfolios. For example, Brennan (1973) examined the impact of differences in investors' personal tax rates on market equilibrium, and Mayers (1972) looked at the impact of non-traded assets such as human capital (earning power). Both found that although the market portfolio is no longer each investor's optimal risky portfolio, the expected return-beta relationship should still hold in a somewhat modified form.

If the expected return-beta relationship holds for any individual asset, it must hold for any combination of assets.

$$E(r_P) = r_f + \beta_P[E(r_M) - r_f],$$

Where $E(r_P) = \sum_{\mathrm{k}} \mathrm{w_k E(r_k)}$ is the expected return on the portfolio, and $\beta_{\mathrm{P}} = \sum_{\mathrm{k}} \mathrm{w_k} \beta_{\mathrm{k}}$ is the portfolio beta. Incidentally, this result has to be true for the market portfolio itself:

$$E(r_M) = r_f + \beta_M[E(r_M) - r_f]$$

If the market beta is 1, and the market is a portfolio of all assets in the economy, the weighted-average beta of all assets must be 1. Hence, betas greater that 1 are considered *aggressive* in that investment in high-beta stocks entails above-average sensitivity to market swings. Betas below 1 can be described as *defensive*. (A word of caution: we are all accustomed to hearing that well-managed firms will provide high rates of return. We agree with this if one measures the *firm*'s return on investments in plant and equipment. The CAPM, however, predicts returns on investments in the *securities* of the firm.)

2.1.3 THE CAPM AND THE INDEX MODEL

The CAPM is an elegant model. The question is whether it has real-world value – whether its implications are borne out by experience. For starters, one central prediction of CAPM is that the market portfolio is a mean-variance efficient portfolio. Consider that CAPM treats all traded risky assets. To test the efficiency of the CAPM market portfolio, we would need to construct a value-weighted portfolio of a huge size and test its efficiency. So far, this task has not been feasible. An even more difficult problem, however, is that the CAPM implies relationships among *expected* returns, whereas all we can observe are *actual* or realized holding-period returns, and these need not equal prior expectations. Even supposing we could construct a portfolio to represent the CAPM market portfolio satisfactorily, how would we test its mean-variance efficiency? We would have to show that the reward-to-volatility ratio of the market portfolio is higher than that of any other portfolio. However, this ratio is set in terms of expectations, and we have no way to observe these expectations directly.

2.1.3.1 THE INDEX MODEL AND REALIZED RETURNS

We have said that the CAPM is a statement about *ex-ante* or expected returns, whereas in practice all anyone can observe directly are *ex-post* or realized returns. To make the leap from expected to realized returns, we can employ the index model, which we will use in excess return form as

$$R_i = \alpha_i + \beta_i R_M + e_i$$

Let us now see how the standard regression analysis framework for statistically decomposition of the actual stock returns meshes with the CAPM.

We start by deriving the covariance between the returns on stock *i* and the market index. By definition, the firm-specific or non-systematic component is independent of the market-wide or systematic component, that is, Cov(R_M, e_i) = 0. From this relationship it follows that the covariance of the excess rate of return on security *i* with that of the market index is:

$$\begin{aligned} Cov(R_i, R_M) &= Cov(\beta_i R_M + e_i, R_M) = \\ &= \beta_i Cov(R_M, R_M) + Cov(e_i, R_M) \\ &= \beta_i \sigma_M^2 \end{aligned}$$

Note that we drop α_i from the covariance term because α_i is a constant and thus has zero variance with all variables. Because $Cov(R_i, R_M) = \beta_i \sigma_M^2$, the sensitivity coefficient, β_i, in Equation (2.10), which is the slope of the regression line representing the index model, equals:

$$\beta_i = \frac{Cov(R_i, R_M)}{\sigma_M^2}$$

The index model beta coefficient turns out to be the same beta as that of the CAPM expected return-beta relationship, except that we replace the (theoretical) market portfolio of the CAPM with the well-specified and observable market index.

2.1.3.2 THE INDEX MODEL AND THE EXPECTED RETURN-BETA RELATIONSHIP

Recall that, according to CAPM, the excess rate of return is, for any security *i* and the (theoretical) market portfolio:

$$E(r_i) - r_f = \beta_i [E(r_M - r_f)] \qquad \text{where: } \beta_i = Cov(R_i, R_M)/\sigma_M^2.$$

This is a statement about the mean, or expected excess returns of assets relative to the mean excess return of the (theoretical) market portfolio. If the index *M* in Equation (2.10) represents the *true* market portfolio, we can take the expectations of each side of the equation to show that the index model specification is:

$$E(r_i) - r_f = \alpha_i + \beta_i [E(r_M - r_f)]$$

A comparison of the index model relationship to the CAPM expected return-beta relationship (see above) shows that the CAPM predicts that α_i should be zero for all assets. The *alpha* of a stock is its expected return in excess of (or below) the fair expected return as predicted by the CAPM. If the stock is fairly priced, its alpha must be *zero*.

We emphasise again that this is a statement about expected returns on a security. After the fact, of course, some securities will do better or worse than expected and will have higher or lower than predicted by the CAPM; that is, they will exhibit positive or negative alphas over a sample period. But this superior or inferior performance could not have been forecast in advance. Therefore, if we estimate the index model for several firms, using Equation (2.10) as a regression equation, we should find that the ex-post or realised alphas (the regression intercepts) for the firms in our sample center around zero. If the initial expectation for alpha were zero, as many firms would be expected to have a positive as a negative alpha for some sample period.

The CAPM states that the expected value of alpha is zero for all securities, whereas the index model representation of the CAPM holds that the realized value of alpha should average out to zero for a sample of historical observed returns. Just as important, the sample alphas should be unpredictable, that is, independent from one sample period to the next.

Indirect evidence on the efficiency of the market portfolio can be found in a study by Malkiel (1995), who estimates alpha values for a large sample of equity mutual funds. Their results show that the distribution of alphas is roughly bell shaped, with a mean that is slightly negative. On average, it does not appear that mutual funds outperform the market index (S&P 500) on a risk-adjusted basis.

There is yet another applicable variation on the intuition of the index model, the market model. Formally, the market model states that the return "*surprise*" of any security is proportional to the return "*surprise*" of the market, plus a firm-specific surprise:

$$r_i - E(r_i) = \beta_i [r_M - E(r_M)] + e_i$$

This equation divides returns into firm-specific and systematic components somewhat differently from the index model. If the CAPM is valid, however, you can confirm that, substituting for $E(r_i)$ from the CAPM equation, the market model equation becomes identical to the index model. For this reason the terms "index model" and "market model" are used interchangeably.

3 EMPIRICAL TESTS OF THE CAPM

Let us consider for a moment what testability means. A model consists of (i) a set of assumptions, (ii) logical/mathematical development of the model through manipulation of those assumptions, and (iii) a set of predictions. Assuming the logical/mathematical manipulations are free of errors, we can test a model in two ways, normative, and positive. Normative tests examine the assumptions of the model, while positive tests examine the predictions.

The CAPM implications are embedded in two predictions: 1) the market portfolio is efficient, and 2) the security market line (the expected return-beta relationship) accurately describes the risk-return trade-off, that is, alpha values are zero. The central problem in testing these predictions is that the hypothesized market portfolio is unobservable. The “market” portfolio includes *all r*isky assets that can be held by investors. This is far more extensive than an equity index. It would include bonds, real estates, foreign assets, privately held businesses and human capital. These assets are often traded thinly or (for example, in case of human capital) not traded at all. It is difficult to test the efficiency of an observable portfolio, let alone an unobservable one. These problems alone make adequate testing of the model infeasible. Moreover, even small departures from efficiency in the market portfolio can lead to large departures from the expected return-beta relationship of the SML, which would negate the practical usefulness of the model.

Most of the early tests of the CAPM employed the methodology of first estimating betas using time series regression and then running a cross sectional regression using the estimated betas as explanatory variables to test the hypothesis implied by the CAPM.

3.1 TESTS BY LINTNER

Using this approach one of the first tests of the CAPM was conducted by Lintner, which is reproduced in Douglas (1968). Using data from 1954-1963, Lintner ran the following regression: $R_t = \alpha + bR_{mt} + e_t$

where R_t = (Nx1) vector of asset returns

R_{mt} = return on the market portfolio

b = (Nx1) vector of estimated betas

Lintner then ran the following second pass regression:

$R = a_1 + a_2 b + a_3 S_e^2 + \eta$

where S_e^2 = (NxN) matrix of residual variance (i.e. the variance of e in the first pass regression).

The testable implications of the CAPM are that $\alpha_1 = R_f$; $\alpha_2 = (E[R_m] - R_f)$ and $\alpha_3 = 0$.

However, Lintner found that the actual values did not confirm with the theoretical values. α_1 was found to be much larger than R_f or even R_{om}, α_2 was found to be statistically significant but had a lower value than expected and α_3 was found to be statistically significant as well. Thus Lintner’s results seem to be in contradiction to the Capital Asset Pricing Model.

3.2 TESTS BY FAMA AND MACBETH (1973)

Fama and MacBeth (1973) performed one classic test of the CAPM. They combined the time series and cross-sectional steps to investigate whether the risk premium of the factors in the second pass regression were non-zero. Forming 20 portfolios of securities, they estimated betas from a time-series regression similar to Lintner’s methodology. However, they then performed a cross-sectional regression for each month over the period 1935-1968. Their second pass regression was of the following form: $R_t = \gamma_{0t} + \gamma_{1t}\beta - \gamma_{2t}\beta^2 + \gamma_{3t}S_e + \eta_t$

If the standard CAPM was true then we should have the following:

$E[\gamma_{0t}] = R_f$

$E[\gamma_{1t}] > 0$ as the market risk premium should be positive

$E[\gamma_{2t}] = 0$ as the securities market line (SML) should be linear, i.e. the relationship between return and the relevant risk should be linear.

$E[\gamma_{3t}] = 0$ as the residual risk should not affect asset returns.

All of the above should be true if the standard CAPM is to hold.

Fama and MacBeth (1973) found that γ_3 was statistically insignificant and its value remains very small over several subperiods. Thus, in contrast to Lintner, they find that residual risk has no effect on security returns. Miller and Scholes (1972) showed that residual risk would act as a proxy for risk if beta had a large sampling error. This fact might reconcile Lintner's and Fama and MacBeth's results, as the latter's estimate for beta had much less sampling error due to their use of asset portfolios. Fama and MacBeth further found that γ_2 is not statistically different from zero. Moreover, they found that the estimated mean of γ_1 is positive as predicted by the model. They also find that γ_0 is statistically different from zero. However, their intercept is much greater than the risk free rate and thus this would indicate that the standard CAPM might not hold.

3.3 TESTS BY BLACK, JENSEN AND SCHOLES (1972)

Black, Jensen and Scholes (1972) performed another classic test of the Capital Asset Pricing Model employing time-series regression. They ran the following familiar time series regression:

$$Z_t = \alpha + \beta Z_{mt} + \varepsilon_t$$

As observed before, the intercept should be zero according to the CAPM. Black *et al.* used the return on portfolios of assets rather than individual securities. Time series regression using returns on individual assets may give biased estimates, as it is likely that the covariance between residuals may not equal zero. This is not generally true with portfolios as they utilise more data. The results from the BJS time series regressions show that the intercept term is different from zero and in fact is time varying. They find that when $\beta<1$ the intercept is positive and that it is negative when $\beta>1$. Thus, the findings of Black *et al.* violate the CAPM.

3.4 TESTS BY STAMBAUGH (1982)

Stambaugh (1982) employs a slightly different methodology. From the market model we have

$$R_t = \alpha + \beta(R_{mt}) + e_t$$

If the CAPM was true then the intercept in the above equation should be constrained and should in fact be:

$$\alpha = \kappa(1 - \beta)$$

where $\kappa = R_f$ (under the Sharpe-Lintner CAPM) or $\kappa = R_{om}$ (under the Black's version of CAPM)

Stambaugh (1982) then estimates the market model and using the Lagrange multiplier test finds evidence in support of Black's version of CAPM but finds no support for the standard CAPM.

3.5 TESTS BY GIBBONS (1982)

Gibbons (1982) uses a similar method as the one used by Stambaugh (1982) but instead of the LM test uses a likelihood ratio test. He uses the fact that if the CAPM is true then the constrained market model should have the same explanatory power as the unconstrained model, but if the CAPM is invalid then the unconstrained model should have significantly more explanatory power than the constrained model. Using this test, Gibbons rejects both the standard and the zero beta CAPM.

3.6 MILLER AND SCHOLES (1972)

Miller and Scholes (1972) in their paper "Rates of return in relation to risk" discuss the statistical problems inherent in all the empirical studies of the CAPM. They point out that the CAPM in time series form is:

$$R_t = R_{ft} + \beta\,(R_{mt} - R_{ft}) \text{ or } R_t = (1 - \beta)R_{ft} + \beta R_{mt}$$

and thus if the riskless rate is non-stochastic then the CAPM can easily be tested by finding whether the intercept is significantly different from $(1 - \beta)R_{ft}$. However, if R_{ft} varies with time and moreover is correlated with R_{mt}, then we inevitably encounter the problem of omitted variable bias and thus the estimated betas will be biased.

Miller and Scholes (1972) then using historical data find that R_{ft} and R_{mt} are negatively correlated. Intuitively, a rise in the interest rates is conducive to stock market declines. They then prove that if R_{ft} and R_{mt} are negatively correlated then this will lead to an upward bias in the intercept and further the slope will be biased downwards. This is in fact what many empirical studies find and thus the fact that many studies reject the CAPM does not imply that it does not hold.

Another factor that may bias the intercept upward and the slope downwards is the presence of heteroskedasticity. However, Miller and Scholes find no evidence of heteroskedasticity.

Miller and Scholes then go on to show the biases that one may encounter in the two stage regressions used by Lintner and Douglas and by Fama and MacBeth (1973). The problem in this methodology is that estimated betas instead of the true betas are used in the second pass regressions and thus any error in the first stage is carried to the second stage. Miller and Scholes show that this 'errors-in-variables problem' will bias the intercept upward and the slope downwards.

Another possible problem in many tests of the CAPM arises due to it being a single-period model. Most tests of the CAPM use time series regression, which is only appropriate, if the risk premium and betas are stationary, which is unlikely to be true.

3.7 ROLL (1977) CRITIQUE

In his influential paper "A critique of asset pricing theory's tests", Roll (1977) shows that there has been no single unambiguous test of the CAPM. He points out that tests performed by using any portfolio other than the true market portfolio are not tests of the CAPM but are tests of whether the proxy portfolio is efficient or not. Intuitively, the true market portfolio includes all the risky assets including human capital while the proxy just contains a subset of all assets.

If we choose a portfolio, say *m* from the sample efficient frontier as a proxy for the market, then from efficient set mathematics we know that the mean return on any asset or portfolio *j*, will be a weighted average of the return on *m* and the return on the portfolio which has a zero correlation with *m*,

i.e. $R_j \equiv (1 - \beta_j)R_{om} + \beta_j R_m)$ where $\beta_j = \underline{\text{Cov}(R_j, R_m)}$

More generally, if *A* and *B* are any two sample efficient portfolios, then the mean return on asset *j* is given by:

$$R_j \equiv (1 - \beta_j)R_A + \beta_j R_B \; \forall j$$

Conversely, if R is the mean vector of returns and β is the (Nx1) vector of slope coefficients obtained by regressing asset returns on the returns of some portfolio *m*, then we have

$$R = R_{om}\iota + (R_m - R_{om})\beta \qquad \text{where } \iota = \text{vector of ones}$$

The above relationship will hold if R_m is ex-post efficient. Thus if *m* is not efficient then mean returns will not be linearly related to betas. Using this result from efficient set mathematics, Roll asserted that the only testable implication of the CAPM is that the market portfolio is mean-variance efficient. All other implications of the model, including the linearity of expected returns and beta follow from the efficiency of the market portfolio and thus are not independently testable.

Furthermore, for a given sample of mean returns, there always exist an infinite number of ex-post mean-variance portfolios. For these portfolios there will be an exact linear relationship between sample returns and sample betas. This linearity will hold whether or not the true market portfolio is efficient. Thus, the two-parameter asset pricing theory is not testable unless all assets are included in the sample.

3.8 CONCLUSIVE EMPIRICAL REVIEWS AND RESULTS

Fama and MacBeth (1973) in their paper incorrectly state that there are three testable implications, namely that the relationship between expected returns and beta is linear; that beta is a complete measure of risk; and that given risk averseness, higher return should be associated with higher risk, i.e. $E[R_m] - E[R_{om}] > 0$.

Roll points out that if *m* is efficient then all the above implications are not independently testable and further asserts that the last inequality follows from the mathematical implication of the assumption about *m* rather than risk averseness per se.

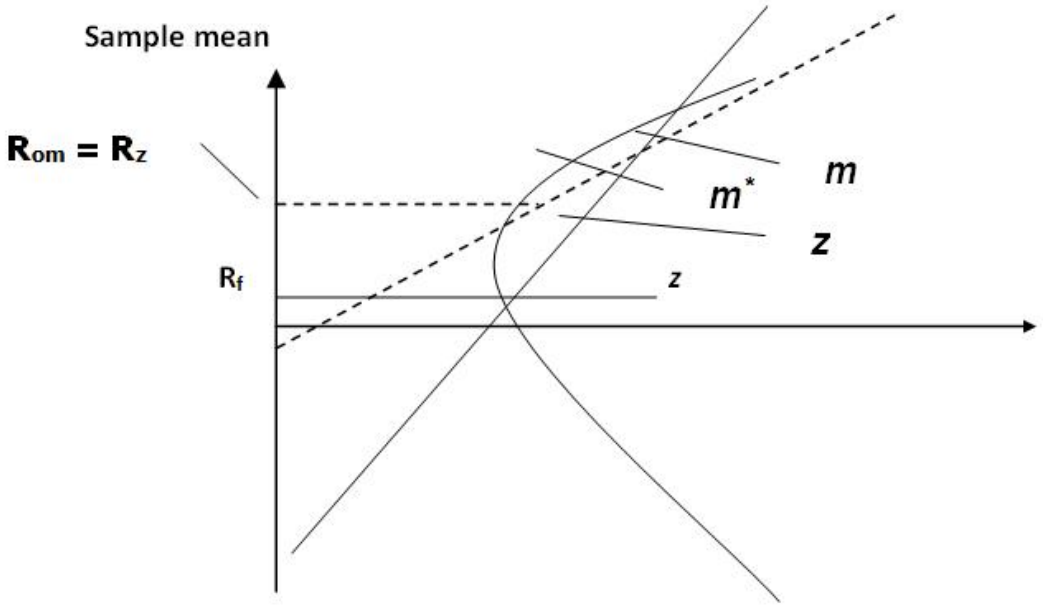
Thus the only testable hypothesis concerning the zero beta CAPM is that the individuals prefer portfolios which are mean-variance efficient and that the market portfolio is ex-ante efficient.

On the contrary, the famous paper of Black, Jensen and Scholes does not even mention the possible efficiency of the market portfolio and concludes that the relationship between expected returns and beta is not linear. This conclusion is enough to prove that the proxy used by BJS does not lie on the sample efficient frontier. If on the other hand, the proxy had been on the efficient part of the frontier than BJS would have found a linear relationship between mean returns and beta. This is all in accordance with efficient set mathematics. The relevant testable implications of the Sharpe-Lintner CAPM can be illustrated by means of the figure below. In the figure, m^* is the tangent portfolio. If m is used as the proxy, then the return on the asset is given by $R_j = R_z + (R_m - R_z)\beta_j$ (a)

On the other hand, if m^* is used as the proxy, then the return on the asset is given by

$$R_j = R_f + (R_m^* - R_f)\beta_j^*$$

It should be noted that since efficient orthogonal portfolios are unique, β_z^* should be non-zero.



Since each individual will invest partly in the riskless asset and partly in the tangent portfolio m^*, thus the principle testable hypothesis of the Sharpe-Lintner CAPM is that the ex-ante efficient tangent portfolio is the market portfolio. On the other hand, as already mentioned, BJS by using a market proxy estimated the following regression:

$$R_j - R_f = \alpha + \gamma\beta_j + \varepsilon_j$$

They found that α was not only greater than zero but was also highly variable. Moreover, they found that γ was less than $R_m - R_f$. On the basis of these results, they rejected the standard CAPM.

However, Roll showed that unless BJS were successful in choosing the tangent portfolio m^* as their proxy, their results are actually in accord with the standard CAPM. Suppose, BJS chose *m* as their proxy, then substituting *j* = *z* in (b), we have $R_z = R_f + (R_m^* - R_f)\beta_z^*$

Substituting the above equation in (a) we get:

$$R_j - R_f = \beta_z^*(R_m^* - R_f) + [R_m - R_f - \beta_z^*(R_m^* - R_f)]\beta_j \quad \text{(d)}$$

Comparing (c) with (d) we see that if the Sharpe-Lintner CAPM is true then α should be equal to $\beta_z^*(R_m^* - R_f)$. Thus, since β_z^* is not equal to 0, α should in fact be not equal to zero and further since the return on the tangent portfolio m^* is a random variable, hence α should also be variable. Thus, it can be seen that the results of BJS are fully compatible with the standard CAPM!

Roll in his paper also shows that the proxy used by BJS was not even close to the tangent portfolio. However, even if BJS had found that the intercept was equal to zero, their result would not have invalidated the CAPM, simply because of the fact that they were not using the true market portfolio.

Fama and MacBeth (1973) in their study use the Fisher's Arithmetic index (an equally weighted portfolio of all the stocks in the NYSE) as their proxy. This portfolio is not even close to the value-weighted portfolio and thus should not have been used as a market proxy. Thus the conclusions of Fama and MacBeth (1973) are also not immune to suspicion. It is clear that there will always exist a portfolio in the tangency position but it is not clear at all whether this portfolio is the value-weighted average of all assets, i.e. the market portfolio.

Furthermore, as shown by Roll, the situation is aggravated by the fact that both the Sharpe-Lintner CAPM and the Black's version of CAPM are liable to a type II error, i.e. likely to be rejected when they are true. This is true even if the proxy is highly correlated with the true market portfolio. Thus the efficiency or the inefficiency of the proxy does not imply anything about the efficiency of the true market portfolio.

4 CONCLUSION

Considering the arguments above, there is no doubt that it is not easy to give an unambiguous conclusion. On the one hand, there is strong empirical evidence invalidating the CAPM and on the other hand it is clear that the empirical findings themselves are not sufficient to discard the CAPM.

Indeed, as noted by many authors including Fama and French in their recent article, "The CAPM is wanted, dead or alive", the empirical tests have been undermined by the inability to observe the true market portfolio. In effect, even though the 'synthetic' CAPM based on the proxy market index can be rejected, nevertheless it is virtually impossible to reject the original CAPM.

Nonetheless, since the true market portfolio cannot be observed it is fair to say that the CAPM is of little use for practical purposes. It cannot be used for estimating the cost of capital, to evaluate the performance of fund managers or as an aid in event-study analysis. This does not imply, however, that its substitute, the synthetic CAPM be used instead because as already seen there is a host of evidence against this form of the CAPM.

Given that we will have to work with the proxy index in the foreseeable future, thus for practical purposes, Merton's intertemporal CAPM or some form of the APT would have to be resorted to for the purpose of explaining expected stock returns.

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The Effect of Change Management on Operational Excellence moderated by Commitment to Change: Evidence from Malaysia

Oon Fok-Yew and Hartini Ahmad

School of Business Management,
College of Business,
Universiti Utara Malaysia,
Sintok, Kedah, Malaysia

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ABSTRACT: The objective of this study is to investigate the relations between soft factors in the change management (i.e. leadership, human resource & culture) and operational excellence (OPX), and employee' affective commitment to change (ACTC) as a moderating variable. Based on the literature review, the authors develop a linkage that the change management factors are likely to contribute positively to the OPX of the organization. A survey of a sample of Malaysia's manufacturing leading sector, electrical and electronics (E&E) industry was conducted between February 2013 and June 2013. More than 100 organizations responded to the questionnaire survey. Data were analyzed using multiple regressions and hierarchical regression. The theoretical framework was guided by resource-based view perspective. The analysis found significant, positive relationships between transformational leadership style, human resource practices and involvement cultural trait on achievement of OPX. The research had mixed findings, partially supports the moderating effect of ACTC on relationship between the change management and OPX. The contribution to a body of knowledge in terms of promoting better understanding of the operational excellence in Malaysian E&E industry. Practical adoption of change management may improve infrastructural decision areas of manufacturing strategy such as benchmarking, best practices, quality practices and human resource policies. Therefore, it has implication on activities concerning organization and managing change.

KEYWORDS: Operational management; Operational excellence; Change management; Leadership; Electrical and Electronics (E&E) industry.

1 BACKGROUND

Recent studies on operational excellence focused on industrial context such as security [1], oil and gas [2], and university [3]. On a contextualized perspective, the Electrical and Electronics Industry is crucial to be revealed particularly on the soft issues which have been neglected in many ways by the previous studies. This is in line with [4] stressed the failure of system implementation such as ERP is because of the lack of attention to the soft issues. Hence, the latest development on the change management and operational excellence has evolved. The focus is on the enhancing of the customer value and ensures the sustainability (for example, [4], [5]). [5] stated the departure from the status quo to a desirable state in accordance to the challenges and opportunities faced by the companies. Furthermore, the alignment is necessary in the hard and soft factors with the company strategy.

How firms achieve and sustain competitive advantages and pursue business excellence is one of the fundamental questions in the field of business performance ([6], [7]). Most organizations that have not reached the excellence levels may not have done so due to management that does not have a profound understanding what it really means to be excellent. To guide organizations on their journey towards excellence, investigations have largely focused on the identification of critical variables that might better explain how organizational change can be managed to the best effect [8]. Therefore, this study will provide an insight in understanding the contemporary influential systems that affect business excellence, particularly

excellence in operations. The influential systems may serve as pre-conditions for any companies before embarking on the management of organizational change.

The influential systems could be categorized either a 'soft' or a 'hard' [9]. [9] recognised the important of soft dimension in terms of skills, staff, style, system and shared values along with structure and strategy of hard dimension. Furthermore, [10] described hard system have precise objectives that can be expressed in mathematical terms while soft systems are used in relation to human activities where there is unlikely to be agreement about the precise objectives of the system. Additionally, the implementation of change may need commitment from the employee himself. [11] pointed out that employee attitudinal commitment such affective commitment to change is associated with employees' capacity to deal with organizational changes.

When review the development in the world business market such as the issues of globalization, fierce competition and technology advancements, [12] suggested that manufacturing organisations in Malaysia need to have an ability to adjust and change to survive the challenging business environment. Organizations need to have a new set of capabilities to ensure their survival and growth in the market. Managers in a firm need to build its own internal competencies to deal with organization issues, change, and strategizing. Even through E&E manufacturing sector is an important contributor to Malaysia's economic with manufacturing output, exports and employment, however, Malaysian E&E industry faces significant challenges in maintaining growth with growing competition from Taiwan, Singapore, China and other Asian countries. The E&E's share of Malaysia's exports has gradually declined from 59 percent in 2000 to 41 percent in 2009 [13]. Therefore, Malaysia E&E's organizations need to have a new set of capabilities to ensure their survival and growth in the market. Managers in a firm need to build their own internal competencies to deal with organization at issues, changes, and strategies.

2 LITERATURE REVIEW AND THEORITICAL FRAMEWORK

2.1 RESOURCE-BASED VIEW (RBV)

The RBV is one way of viewing the firm form inside out from a strategic perspective. The RBV theory emphasized the use of its internal resource and its developing capability within the firm as a source of competitive advantage. Numerous of its capabilities and resources on which competitive advantage are based, live entirely in its operational function [14]. The RBV deals with the competitive environment facing the organization but takes an '*inside-out*' approach. Its starting point is the organization's *internal* environment. Thus, its internal capabilities determine the strategic choice it makes in competing in its external environment. For example, build up a high performance team for a company to remain competitive and long term success in both economic and social aspects.

On the operational excellence, RBV is found appropriate, presenting internal resources as a crucial element to gaining a sustained competitive advantage and superior performance that is the operational excellence ([15], [16]). The current study corresponds to the soft factors in E&E to the operational excellence. The core competencies explain the companies' competitive success based on their competencies. Furthermore, RBV points to intangible resources as the main drivers of the sustainability of performance differences across firms. In fact, such assets that are scarce, specialized and difficult to trade, imitate, or appropriate are viewed as intangible [15]. A variety of definitions have been offered when refer to these resources. Therefore, the argument established in this study is focus on the managing firm's resources as determinants for operational excellence. The changes of the firm internal resource were identified through the operational excellence indicators.

2.2 OPERATIONAL EXCELLENCE

European Foundation for Quality Management [17] defines excellence as ''outstanding practice in managing the organization and achieving results". [18] argued that operational excellence is not just a matter of cost reduction and quality improvement, but also being smart about how to handle people and resources. It requires solid change management capability and strong leadership to become operational excellence. Operational excellence is also very much dependent on employees' empowerment, ownership and a culture of continuous improvement. Its adoption and introduction usually confronts a company with the need to change the way its employees think and act.

[19] conducted an investigation the use of business excellence in Asian organizations. Organizations in the manufacturing sector accounted for more than 40 percent of the total survey population. Even through organizations believe that deploy business excellence is important in helping them reach key objectives but the Asian region still suffers from some barriers including lack of development of a business excellence culture, a lack of resources and a failure to fully train the staff in

business excellence. This study has examined the deployment of business excellence in five Asian countries (Japan, India, China, Thailand and Singapore) would be a gap undertake future study on other Asian counties which maybe at different stages of business excellence maturity.

[20] analyzed the success rate factors of company in achieving the excellence of business subjects in the Slovak Republic. The results showed that success rate factors do not lie in monetary values but in the overall functioning of the company. In other words, in de facto non-economical factors which reflect the level of innovations, employee's satisfaction, customer's satisfaction, and social responsibility. Therefore, identification of correct factors of success rate serves more and more for the needs of looking for correct decision of organization. In view of this, non-economical factors of success rate, also known as non-monetary factors are substantiated for the needs of a business company. On the other hand, [21] analyzed the meaning of sustainability and its relation to excellence in an era of management transformation, integration and evolution. They found that sustainability and excellence are two interrelated concepts. These two interrelated concepts have contributed in shifting the national, corporate and sometimes individual mentality to include the world and the society. The rapid enlargement and intensity of environmental and social consequences of the dominant global model push organizations towards an adoption of sustainability challenges and maintain their competitiveness through excellence.

In recent study, [22] examined factors that lead to sustained excellence whether they are "evergreen" or stayed the same over time. The eight factors included organizational design, process, strategy, technology, leadership, individuals and roles, culture, and external orientation. The finding shown that nearly 90 percent of the factors that create excellence found in studies done in and before 1995 are also found in studies done after 1995. Although the characteristics of factors may shift from time to time, however, those factor found to seem qualify as "evergreen of excellence" that are always crucial for creating and maintaining a high performance organization. In this respect, the research into factors that create excellence, as found in the earlier or recent literature, are constant over time.

In this study, results from application of operational excellence are focused operational performance and organizational sustainable performance. Operational performance reflects the performance of internal operations of a company in terms of quality improvements, flexibility improvement, delivery improvement, productivity improvement, cost and waste reduction. The organizational sustainable performance indicator measures in present study are environment performance and social performance, while the financial measures such as sales growth, profit growth, return on equity (ROE), return on assets (ROA) and gearing [23] will be ignored. In fact, many E&E manufacturing firms in Malaysia are owned by foreign investors and may listed in the their home country, thus the respondents may not be privy to the information and data related to financial performance. Although performance can be measured either as financial performance or as operational performance, operational priorities are more relevant than financial goals at the plant level [24]. It is therefore the discussed performance indicators (quality, time, flexibility, cost and sustainability) will be used to measure firm performance in achieving operational excellence. More specific, the dependent variable, operational excellence will be operationalized by quality, flexibility, speed, cost, social and environmental in present study.

2.3 CHANGE MANAGEMENT

Due to the fact that the future and success of every organization depends on how well manager handle change [25], therefore, discussion on this research is assessing the relationship between change management and operational excellence. In addition, the integration of soft factors to predict operational excellence may not have a profound understanding by both academic and practitioners. This paper focuses on the soft factors in the E&E industry.

In the past organizational changes processes, many organizational only focus their efforts on hard factors. However, [9] argued that most successful companies work hard at the soft factors. Indeed, the soft factors can make or break a successful change process simply because we cannot impose hard systems on the organization without considering the effect on people [10]. With this approach, the researcher attempt to integrate the 'soft' factors under the change management. Based on literature review, three soft factors were identified in this study were included leadership style, human resource and organizational culture.

2.3.1 LEADERSHIP STYLE

Leadership is the other key component of successful change. Leadership is the first criterion of the European Foundation for Quality Management (EFQM) Excellence Model, a model of organizational excellence which is used by more than 30,000 organizations across Europe [26]. While change management depends on leadership to be enacted, specifically, the leadership style that is primarily concern with the capabilities required enacts change successfully ([27], [28]). Recent study by [29] further addressed the importance of success in enacting change is a crucial issue faced by today's organizational

leaders. Indeed, most of the research on the leadership paradigms has focussed on its relationship to followers ([30], [31]); organizational outcomes such team performance ([32], [33]); and financial performance [28]. Based on researchers' knowledge, there were limited literatures done on leadership styles and its impact on operational excellence in manufacturing industry, especially in the Malaysian setting.

Leadership has been recognized as a major factor on organization success and this has been empirically validated throughout many fields. However, a leadership style in the context of change management and its impact on operational excellence in manufacturing industry has not been as widely research. Moreover, a transformational style of leadership is perceived can produce positive organizational change and create exceptional performance than transactional and laissez-faire leadership ([34], [35], [27]). In the present study, we are interested in examining the positive impact of transformational leadership style on operational excellence.

2.3.2 HUMAN RESOURCE

Any change program would revolve around people, changing their mind set, behaviour and motivational level. Human resource has always been central to organizations, to-day it has taken on an even more central role in building a firm's competitive advantage. Success increasingly depends on "people-embodied know-how". Thus, includes the knowledge, skills, and abilities imbedded in an organization's member. [25] argued that Human Resource is an intellectual asset, the sum total of the knowledge, skills and competencies that an organization processes and channelizes for sustained organizational excellence. Excellence is surpassing on outstanding achievement, achievable by the use of Human resource strategies and practices as tool.

[36] suggested that the future role of the Human resource function should focus on helping their organization to learn how to build a capability to change. In authors view, the human resource practices are Human resource tools use by organization to achieve excellence. It helps to develop human capabilities and organizational competencies to achieve success. However, very little attention has been paid to address the impact of managing human resource change on operational excellence. The universal use of Human resource practices such as recruitment and selection, training and development, performance appraisal, and compensation and benefits ([37], [25]) could be explored in present study to predict operational excellence. New knowledge generate from this study could inform theory building efforts in the Human resource field, particularly as it related to human resource-based view to meaningful organization outcomes and in due course excellence. Therefore, we hypothesize that human resource practices lead to positive impact to operational excellence.

2.3.3 ORAGNIZATIONAL CULTURE

Operational excellence is an enterprise culture that improves the way a corporation delivers products and services to its customers. Operational excellence calls for more than subject matter expertise and a talented internal team. It requires a deep commitment and a culture of change. Changing to a culture of continuous improvement usually requires a paradigm shift. This change requires taking risks, opening up the firm culture and a great capacity to learn [38]. [39] suggested that a link between corporate culture traits such as consistency, mission, involvement, and adaptability and business performance exits. These four different aspects of culture can be stressed by different functions. Its *consistency* and *mission* either tend or to encourage or promote stability. However, the *involvement* and *adaptability* allow for change. Furthermore, consistency and involvement see culture as focusing viewpoint on internal dynamic of the organization. It mission and adaptability see culture as a way of life in addressing the relation between the organization and its external environment.

The present study embraces on managing change and focus on internal organization, therefore, the *involvement trait* (Internal Focus) is the best dimension to evaluate its effecting desired change within organization ([39], [40]). This trait is measured by the three indices namely empowerment, team orientation and capability development. In addition, [41] found empirical support for the involvement view of culture, higher levels of employee participation were correlated with better organizational performance. Whilst organizational culture has been researched worldwide, little research has been done in Malaysia, with its unique culture and concentred business environment.

2.3.4 COMMITMENT TO CHANGE

Past studies have found that many significant organizational change initiatives fail to meet expectations although people are increasingly aware of the need for change [43]. In addition, one commonly cited cause for the lack of success of

organizational change is "resistance to change" [44]. Because of this resistance, it is unsurprising that change is a phenomenon encouraging strong visceral responses. Employee commitment to change can impact organizational change either positively or negatively ([45], [54]). Thus, a firm cannot afford to ignore its employees' commitment to change which may have an effect upon the operational performance of that organization.

Commitment is arguably one of the most vital factors concerned with employee's support for change initiatives [45]. [46] found that the most prevalent factor contributing to failed change projects is a lack of commitment by the people. For instant, strategy implementation may need a commitment from the employee himself. Despite its presumed importance and common identification as an essential factor for the effective implementation of organizational change, little empirical evidence exists to support this claim ([45], [47]). Hence, the moderating effect of affective commitment to change (ACTC) will be examined in this study. Yet, previous study on change management has not included the effect of ACTC per se as a factor that is able to moderate operational excellence. On this basis of such arguments, the researcher expects to see greater effect of affective commitment on the relationship between change management and OPX.

Overall, literatures indicate that firm managing change is vital in ensuring competitive advantage to the firms [48]. In essence, effective approaches in organizational change will involve not only one factor but also have to understand other relevant factors of entire organization. Moreover, change management and these soft factors have not being integrated in any research which develop new knowledge in the study of operational excellence. Integrating change management maturity with associated soft factors in order to remain competitive, is absent in most Operational Excellence initiatives.

2.4 HYPOTHESES AND THE RESEARCH MODEL

Based on the previous literature, four main hypotheses and three sub-hypotheses were proposed. The relationship among the various factors discussed in this literature is depicted in a framework as showh by Fig. 1 below. Based on the literatured syntheses, the authors develops a linkage that the change management factors are likely to have impact on operational excellence of the organization only in situations where change management practices are implemented. In addition, the moderating influence of ACTC on the relationship between change management and OPX are examined.

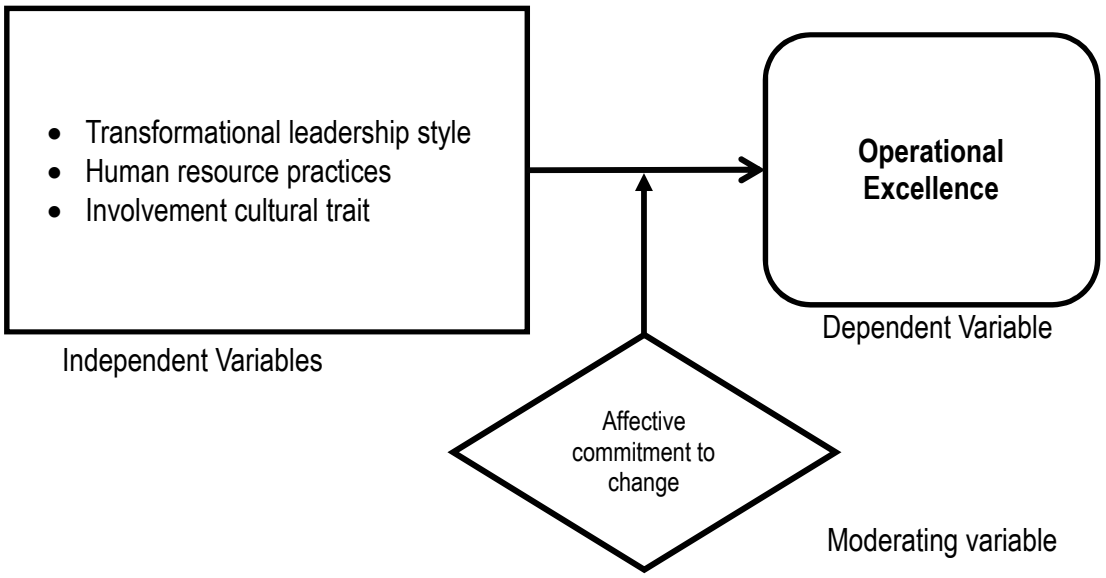


Fig. 1. Theoretical framework

H_1: The inclination towards the transformational leadership style leads to achieving operational excellence.
H_2: Effectiveness of human resource practices leads to an impact on achievement of operational excellence.
H_3: Higher levels of individual involvement cultural trait leads to an impact on operational excellence.
H_4: Employees' affective commitment to change will moderate the relationship between the change management and achievement of operational excellence.

Specially:

$H4_a$: Employees' affective commitment to change will moderate the relationship between transformational leadership style and achievement of operational excellence.
H_{4b}: Employees' affective commitment to change will moderate the relationship between human resource practices and achievement of operational excellence.
H_{4c}: Employees' affective commitment to change will moderate the relationship between involvement cultural trait and achievement of operational excellence.

3 RESEARCH METHODOLOGY

3.1 POPULATION AND SAMPLE SIZE

The nature of the problem in this study determines that it leans more towards a causal. The main goal of causal research is to identify cause-and-effect relationship among variable [49]. The literature review was carried-out in sufficient details to provide the understanding on the change management, affective commitment to change and operational excellence. The researchers also investigated how the previous studies done in order to study the relationship of change management, affective commitment to change and operational excellence. Therefore, the researchers believed that it is appropriate to consider the manager who involved in the manufacturing operations to give inputs on the subject matter. In this context, samples of the population are drawn from the FMM-MATRADE Industry Directory Electrical and Electronics Malaysia 2007/08 [50] and Federation of Malaysian Manufacturers (FMM) Industry Directory 2012 of Malaysian Manufacturers [51]. The sampling frame of this study is the manufacturing companies from electrical and electronics industry situated in Malaysia. By using systematic random sampling method, 321 firms were identified from population of 1952 firms. All questionnaires were distributed to the respondents using postal mail. The unit of analysis for this study was organizational where one respondent represent one organization. Between February 2013 and June 2013, a total of 121 usable questionnaires were obtained which yielding a response rate of 37.7 percent. Therefore, the response rate was normal and acceptable as compared with past studies in Malaysia.

3.2 INSTRUMENT DEVELOPMENT AND MEASUREMENT

The survey questionnaire was developed based on early studies ([23], [39], [40], [45], [52], [53], [55], [56]). The Table 1 summarizes the reliability test of the measures. The results showed that all the Cronbach's Alphas measures were above the lower limit of acceptance (α >.70). Therefore, all the measures were highly reliable [57].

Table 1. Summary of Variable Measurement

Variables Names	Cronbach's Alpha	N of Items	Authors
Operational excellence	.942	23	[23], [52], [53].
Transformational leadership style	.915	12	[55].
Human resource practices	.843	12	[56].
Involvement cultural trait	.772	9	[39], [40].
Affective commitment to change	.892	6	[45].

In a Likert scale, each respondent will be asked to indicate the extent of each statement on a five-point. The options given in the questionnaires for Section A are "strongly disagree (1)"; "disagree (2)"; "Neutral (3)"; "agree (4)"; and finally "strongly agree (5)". For Section B, respondents are requested to rank their answers to 5-points Likert-type interval scale, ranging from 1 for "worst in industry (1)"; 2 for "bad in industry"; 3 for "average in industry"; 4 for "good in industry" and 5 for "best in industry". Thus, researchers were able to solicit answers about the given statement through a set of response keys.

3.3 RESPONDENT'S PROFILE RESPONDENT'S PROFILE

3.3.1 PROFILE OF THE RESPONDENT COMPANIES

The E&E industry is further breakdown to four sub-sectors which included (1) consumer electronics (2) electronic components (3) industry electronics and (4) electrical products [58]. As presented in Table 2, the majority of the

manufacturing firms that responded to the survey were under the electronic component sector which comprised 43.8 percent of the number of respondents, followed by those in industrial electronics (24.8%), consumer electronics (15.7%) and electrical products (15.7%).

Table 2. Respondents by Sub-sector

Sub-sector	Frequency	Percent	Valid Percent	Cumulative Percent
Electronic components	53	43.8	43.8	43.8
Industrial electronics	30	24.8	24.8	68.6
Consumer electronics	19	15.7	15.7	84.3
Electrical products	19	15.7	15.7	100.0
Total	**121**	**100.0**	**100.0**	

3.3.2 PROFILE OF THE RESPONDENTS

For ease of understanding is a tabulation of the profiles of the respondents as per Table 3. In terms of gender, the majority of the respondents were male which comprised of 71.9 percent as compared to their counterparts at 28.1 percent. Generally, 45.5 percent of the respondents are from the age between 36 and 45 followed by age above 46 (34.7%), then age between 18 and 35 with a response if 19.8 percent. This showed that majority of the questionnaire were answered by the middle and senior management from manufacturing companies. Most of the respondents (33.1%) have less than 5 year's tenure employment to their current companies. In contrast, 31.4 percent of the respondents have more than 16 years attaching to their current companies. The remaining respondents were between 6 to 10 years are 21.5 percent and between 11 to 15 years are 4.0 percent respectively. Almost half of the questionnaires are answered by the middle management (50.4%). Other respondents, which represent 24.8 percent of lower management, 20.7 percent of senior management and 4.1 percent of professional. The professional group includes Consultants and Advisors. The results imply that majority of the E&E manufacturing companies have followed the requirements as stated in the cover letter which attached with the questionnaire.

Table 3. Profile of the Respondents

Characteristics		Frequency (n = 121)	Percent (Total 100%)
Gender:	Male	87	71.9
	Female	34	28.1
Age:	Between 18 to 35 years	24	19.8
	Between 36 to 45 years	55	45.5
	Above 46 years	42	34.7
Number of years working in this company:	Less than 5 years	40	33.1
	Between 6 to 10 years	26	21.5
	Between 11 to 15 years	17	14.0
	More than 16 years	38	31.4
Position held:	Lower management	30	24.8
	Middle management	61	50.4
	Top management	25	20.7
	Professional	5	4.1

3.4 FACTOR ANALYSIS

The factor analysis was based on principal component analysis (PCA) with Varimax rotation for all components. In determining the factorability of the dimensions, the Bartlett's test of Sphericity had to be significant and the Kaiser-Meyer-Olkin (KMO) Measure of sampling adequacy had to be more than 0.50 in order to be acceptable [57]. The following Table 4 shows the results of all variables. The Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy from 0.692 to 0.906 which

all above 0.5 acceptable level [59]. All results indicate that factor analysis can be conducted on the data ([57], [60]). Moreover, there is a sufficient correlation among the analyzed items when Bartleet's test was significant (Sig.0.000).

Table 4. KMO and Bartlett's test

		OPX	TLS	HRP	ICT	ACTC
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.881	.906	.797	.692	.851
Bartletts's Test of Sphericity	**Approx. Chi-Square**	1590.599	757.645	555.269	410.166	394.277
	Df	190	66	66	36	15
	Sig.	.000	.000	.000	.000	.000

OPX=Operational excellence; TLS= Transformational leadership style; HRP= Human resource practices; ICT=Involvement cultural trait

3.5 DATA ANALYSIS

The data analysis tools such as Statistical Package for Social Science (SPSS) software will be used to process the data obtained from this survey. Responses on all parts of the questionnaire will be analyzed using frequency, means, standard deviations, reliability, and inter correlations to calculate different characteristics of the data. Factor and reliability analyses to test the goodness of measures, descriptive statistics to describe the characteristic of respondents, and correlation analysis to describe the inter correlation among the variables. Moreover, multiple regression and hierarchical regression analysis were used to achieve the objective with testing the hypothesis.

4 RESULTS AND DISCUSSION

4.1 DESCRIPTIVE ANALYSIS

The means and standard deviations of each variable were shown in Table 5. The results of Pearson's correlation test for independent variables and dependent variable was shown in Table 6. This result revealed that all the independent variables and dependent variable were positive and significant at a level of 99 percent. The strength of relationship varies from lowest at 0.417 and to the highest at 0.611. These findings support the notion that change management factors as predictor variables had a positive correlation and linear with operational excellence. On the other hand, the correlation was also further evidence of validity and reliability of the measurement scales used in this study.

Table 5. Means and Standard Deviations

	N	Mean	Std. Deviation
Transformational leadership style	121	3.6515	.56765
Human resource practices	121	3.7576	.48233
Involvement cultural trait	121	3.7530	.41857
Affective commitment to change	121	3.6501	.70165
Operational excellence	121	3.7373	.48899

Table 6. Pearson's Correlation Test for Independent Variables and Dependent Variable

	Transformational leadership style	Human resource practices	Involvement cultural trait	Affective commitment to change	Operational excellence
Transformational leadership style	1				
Human resource practices	.524**	1			
Involvement cultural trait	.559**	.587**	1		
Affective commitment to change	.431**	.417**	.417	1	
Operational excellence	.611**	.607**	.561**	.480**	1

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

4.2 TESTING OF HYPOTHESES

Three steps of hierarchical regression analysis were performed. The first step or Model 1 in Table 7 indicates the relationship between the three independent variables and dependent variable. The Beta value of transformational leadership style (.296), human resource practices (0.323) and involvement cultural trait (.211) with R square 0.505, which indicated that those independent variables significantly ($p < 0.05$) related to the dependent variable. The data showed that concern for human resource practices has a greater effect on operational excellence rather does than transformational leadership style and involvement cultural trait. In this step, these elements explained 50.5 per cent of variance of operational excellence. In sum, results from the analysis of first step shows that among soft factors of change management which were proposed to have a significant relationship with operational excellence, all of them namely transformational leadership, human resource practices and involvement cultural trait were significantly supported.

The second step showed that the Beta value of transformational leadership was .263; human resource practices was .291; all were significant at $p < 0.05$. The finding indicated that the add-on moderating variable, affective commitment to change was also significant ($p < 0.05$) with Beta value at .115. In a similar step, the R square was 0.526, which meant that 52.6 per cent of variation could be explained by the model. If these 2 models are compared, Model 2 has greater effect than Model 1. In sum, two independent variables including transformational leadership style and human resource practices remained positive and were significantly related with operational excellence. Affective commitment to change was also positive significantly related with operational excellence

At the final step or Model 3, when the interaction terms were entered, an increase in R square by another 3.1 per cent was observed. The result also revealed that the adjusted R square increased from 50.5 per cent under Model 1 to 52.6 per cent in Model 2 and reached 55.7 per cent in Model 3. This shows that more was explained with the additions of moderating variables. There is a significant F change of 2.636 that indicates a moderate effect from the moderating variable in the relationship between the predictors and criterion variables. The interaction term used to compute regression coefficients was the product of scores of the two predictor variables. In this study, only one interaction produced a significant relationship, which was interaction between transformational leadership style and affective commitment to change, with B was -.213. However, the Beta values in the third step cannot be interpreted as there is bound to be the problem of multicollinearity. Therefore, the researcher plotted line graphs to see the interaction effect.

Table 7. Summary of Hierarchical Regression Analysis

	Model 1	Model 2	Model3
Variables	**B**	**B**	**B**
Transformational leadership style	**.296***	**.263***	**1.031***
Human resource practices	**.323***	**.291***	.377
Involvement cultural trait	**.211***	.178	.061
Affective commitment to change		**.115***	**.783***
Transformational leadership style X Affective commitment to change			**-.213***
Human resource practices X Affective commitment to change			-.029
Involvement cultural trait X Affective commitment to change			.064
R square	.505	.526	.557
Adjusted R square	.493	.509	.529
R square changed	.505	.020	.031
F	39.839	32.130	20.266
F Change	39.839	4.958	2.636
Std. Error of the Estimate	.34778	.34205	.33503
Durbin-Watson	1.971		

*Note: B = Beta (Unstandardized Coefficient); * Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed)*

As show in Fig. 2, the graph indicate that, with high ACTC, there is slightly positive relationship between OPX and transformational leadership style but a positive linear relationship occurs for firms with low ACTC. Thus, high ACTC does not have much effect in the situation of an inclination towards the transformational leadership style in the achieving operational excellence. Conversely, high affective commitment is required in the situation of low transformational leadership style implementation. When affective commitment is low, the highest level of transformational leadership style practice is associated with the highest achievement of OPX. The hierarchical regression test was statistically significant (B = -.213, significant at .017).

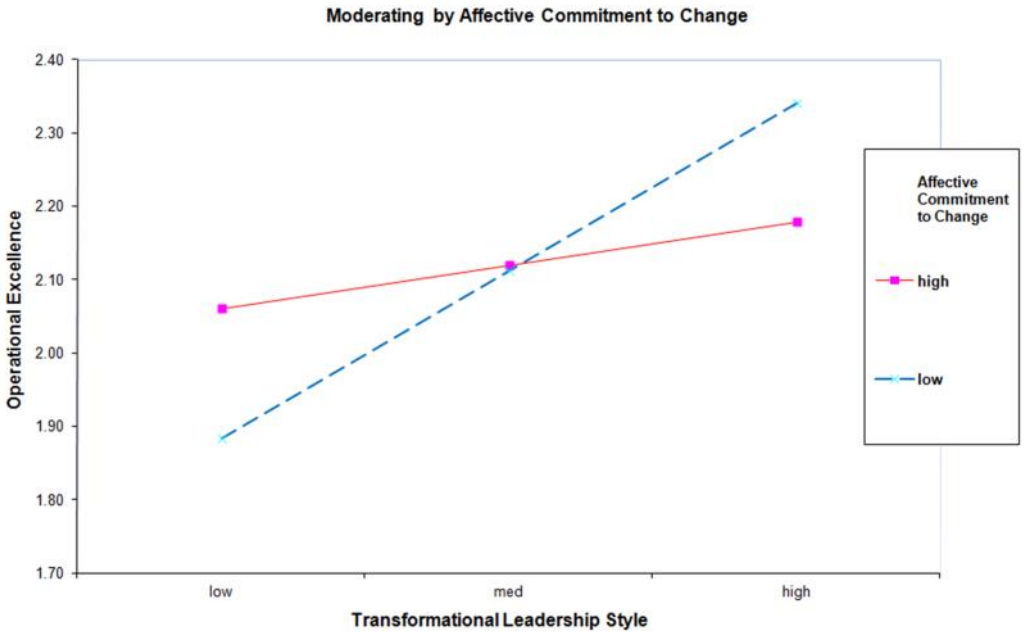


Fig. 2. The Relationship between Transformational Leadership Style and Operational Excellence with Affective Commitment to Change as a Moderator

The plotted graph for Fig. 3 shows high ACTC has a slightly positive effect on the relationship between human resource practices and OPX. Implementation of human resource practices becomes effective when a high degree of ACTC is present in the work place. Similarly, a low degree of ACTC would have slightly increased in achieving OPX when implementing human resource practices. This finding aligns with the fact that if an organization put more efforts into human resource practices, they also need higher affective commitment of employees to achieve higher OPX. However, the hierarchical regression test statistically showed no significant (B = -.029, significant at .778).

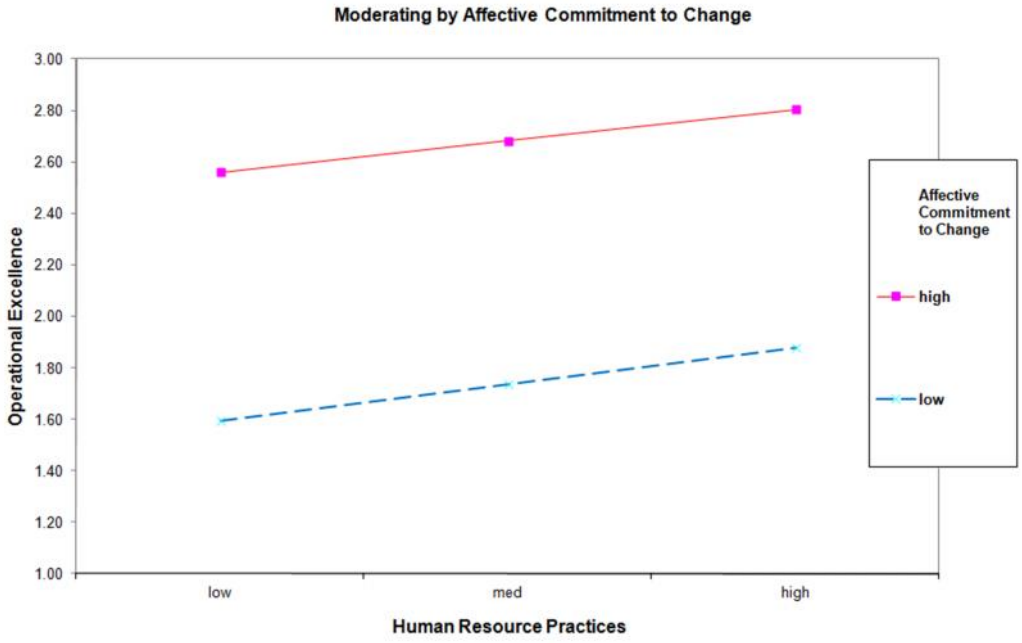


Fig. 3. The Relationship between Human Resource Practices and Operational Excellence with Affective Commitment to Change as a Moderator

Finally, is ACTC effect a moderator in the relationship between involvement culture trait and the achievement of OPX? As shown by plot graph in Fig. 4, a positive relationship between involvement cultural trait exists with the presence of either low or high ACTC. Low ACTC will be achieved slightly better excellence performance of firms even with the increase of the level of involvement cultural trait. In contrast, high ACTC will lead to achieving a firm's excellence performance even with the presence of low involvement cultural trait. The hierarchical regression test showed no significant (B = .064, significant at .538).

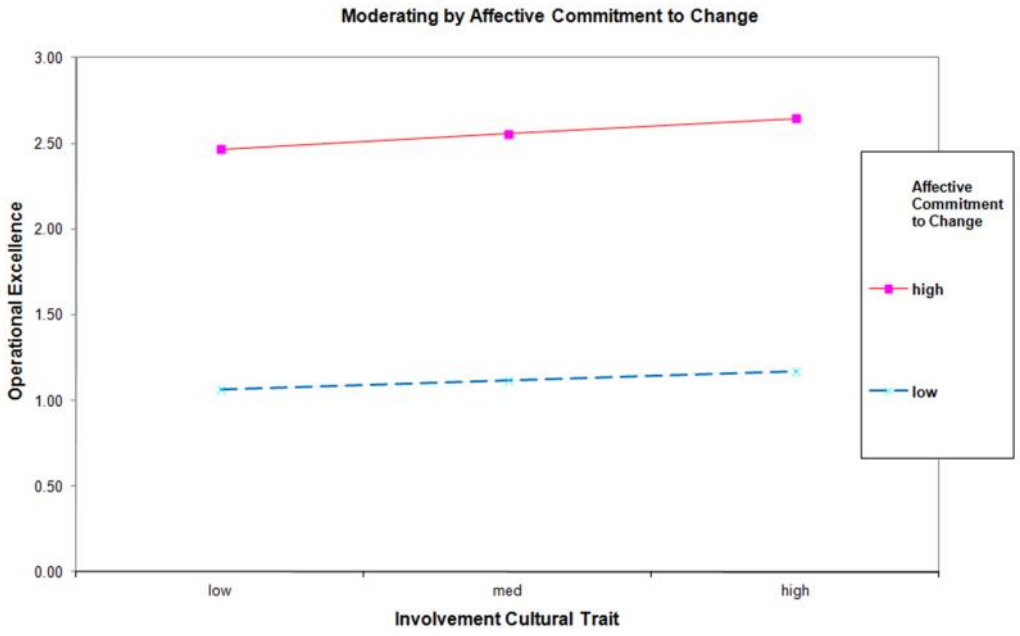


Fig. 4. The Relationship between Involvement Cultural Trait and Operational Excellence with Affective Commitment to Change as a Moderator

H_4 hypothesized a moderating effect of moderator on the relation between interaction (independent variable and moderator) and dependent variable. Interaction effects represent the combined effects of variables on the criterion or dependent measure. The effect of one variable depends on the level of the other variable when an interaction effect is present. From hierarchical regression analysis, it can be concluded the interaction between transformational leadership style and affective commitment to change was statistically significantly ($p < 0.05$) related to the achievement of operational excellence. An affective commitment to change is a quasi moderator moderating this relationship. Other interaction terms such as human resource practices and affective commitment to change, involvement cultural trait and affective commitment to change were not statistically significant at a 0.05 confidence level related to operational excellence. Hence, they are pure moderators in this relationship. Thus, the researcher summarized hypotheses H_{4a} was supported, where H_{4b} and H_{4c} were not supported. Overall, H_4 was partially supported.

4.3 DISCUSSIONS

This paper is focused on linking between the change management to operational excellence, and employee' affective commitment to change (ACTC) as a moderating variable within E&E companies of Malaysia. Furthermore, the paper organises the burgeoning change management literature soft factors, which are transformational leadership, human resource, and organizational culture. The purpose of this study is to give an increased understanding of the operational excellence in Malaysian manufacturing industry and its implication on activities concerning organisation and managing change.

The respondents were top managers and those identified as responsible in running the companies which closely linked to manufacturing operations including General Manager, Operation Manager, Factory Manager, Production Manager, Engineering Manager, Manufacturing Manager, Planning Manager, Materials Manager, Lean Manager and Project Manager (involve in Change Management or Continuous Improvement programs). So this study cannot be used to represent the operational of others industry because the effect of change management to operational excellence could be different.

Responding to the hypotheses, this study found all three soft factors of change management have effect on the achievement of the company's operational excellence. In respond to the findings, transformational leadership style, human resource practices and involvement cultural trait were found to have an effect on the achievement of operational excellence for Malaysian E&E manufacturing companies. The hypotheses were positive and significant and thereby confirmed.

This study has provided evidence that transformational leadership style have a significant positive effect on operational excellence. The hypothesis, H_1 accepted is not surprising because strong theoretical and practical support transformational leadership is enacting change successful. Present study also concur with the findings of past study by [34], and [35] who claimed that the transformational leadership style can produce positive organizational change and create exceptional performance. Furthermore, transformational leadership is directly correlation to long-term high performance [61], therefore, towards business sustainability.

This study adds another perspective into the earlier findings conducted in Malaysia, [28] found that the transformational type of leaders will give impact to company performance if best practices management takes place. Under these argument, transformational leader who promote the adoption of best practices leads to superior performance. This finding is consistent with the results from prior studies ([52], [62], [63]) on companies that adopted best practices showed better operation performance. In this study, the effect of transformational leadership style on achieving operational excellence is supported. In other word, lower and middle management of Malaysian E&E manufacturing companies perceived their top management use transformational leadership style in pursuing excellence.

The statistical result also revealed that the human resource practices have effect on operational excellence of Malaysia E&E manufacturing companies in this study. Therefore, the hypothesis, H_2 is fully supported. This finding is consistent with earlier studies by [25] who argue human resource is an intellectual asset that channelizes for sustained organizational excellence and has a positive effect on the firm's performance [64]. This study also support past studies that the human resource practices included recruitment and selection, training and development, performance appraisal, and compensation and benefits, are human resource tools use by organization to achieve excellence ([37], [25]).

The aforementioned results have also provided the required empirical support that influence of human resource practices indicating positive and significant relationship on organizational performance in the area of research for the past 25 years [65]. The finding of present study provides empirical evidence again on the role of human resource practices on the achievement of operational excellence. Obviously, the human resource has taken into account as a crucial factor in E&E organizations to develop internal capabilities for better fit with changing environment.

The result indicates that the involvement cultural trait, H_3 does significantly have impact in achieving operational excellence. This finding appears to be consistent with previous study that argued involvement as the most important dimension of culture for firms whose focus was employee satisfaction and overall performance [66]. Past studies by [67] stated that organizational culture is a key foundation for the high-performance work practices, and employee involvement such as teamwork, capability development and empowerment positively influence outcomes measures. For example, high performing E&E firms motivate their employees to achieve superior results by making decisions at the lower level. In addition, high performing E&E firms have organizational structure based on teams, therefore they encourage teamwork. Moreover, E&E firms continually invest in improving their employees' skills. Hence, the high levels of employee involvement in the company's activities did play an important and integrated role in achieving operational performance outcomes.

The success of organization lies on how well the employees are empowered to take decisions through building their capabilities and harnessing their skills. Indeed, an organization with a high level of employee involvement will develop the employees' capability at all levels and create a sense of ownership, responsibility, and loyalty toward their organization. Another plausible reason of significant relationship between involvement cultural trait and operational excellence was in the way the culture trait was measured. Past research showed that internally focus traits involvement is generally better predictors of operating performance measures such as quality, flexibility, employee satisfaction ([41], [42]) and change [40]. The finding of present study pointed to high involvement of employees as relatively important influential culture traits in determining operational excellence in the context of the Malaysia E&E industry.

In this study, hierarchical regression analysis was utilized to test the effects of moderators on OPX. The moderator effect was identified so that the results could add insights into its usefulness with respect to the relationship between each of the change management factor and OPX. Obviously, the test was used to achieve the final objective of this study concerning whether the variable is a moderator and whether it interacts with the predictor as a moderator.

These findings disclosed that transformational leaders who encourage their followers to think creatively and critically could have an influence on their followers' commitment [68]. Moreover, [30] noted that transformational leaders focused on traditional needs to fulfill higher levels of human needs such as trust, integrity, delivers true value, actualization, rather than on having merely an eye for exchanging one thing for another. Hence, it logically stands to reason that in the workplace, a transformational leader has an ability to motivate followers effectively to engage in behaviors known to have positive outcomes for the organization. For example, once employees are motivated towards accomplishment of an end, ACTC will play a moderating role to effect the relationship.

In hierarchical regression analysis, the result indicated that ACTC does not significantly moderate the relationship between human resource practices and operational excellence. Because employees' affective commitment ('want to') has no moderating effect between human resource practices and operational excellence, the normative commitment because employee 'need to', and continuance commitment because employee feel they 'ought to' do so (suggested by [45]) which were omitted from this study could be further investigated. That is because the mind-sets of the perceived cost of leaving with respect to continuance commitment, and mind-sets of perceived obligation to remain with respect to normative commitment are more aligned with performance appraisal and compensation systems under human resource practices.

The final moderated relationship, the results did not support the role of ACTC as a moderator in the positive relationship between the involvement cultural trait and achievement of OPX in change organization. Based on this positive relationship, a reasonable argument could be made that the involvement cultural trait is a company or corporate culture [40] that has been embedded in the organization a long time ago, which shapes employee behaviour and involvement, participation in change. Moreover, employees' affective commitment is likely to be required to ensure a willingness to work cooperatively with others and to exert extra effort to achieve the objectives of the change [45]. Corporate culture has an indirect influence on employees' decision-making, team orientation, and capability development ([39], [40]). Thus, a high level of individual involvement cultural trait did require higher employee's ACTC in achieving better performance.

In overall, present study supports resource-based view (RBV) theories. The RBV on inimitable recourses and dynamic capabilities suggest that organizational should have their own competence according to knowledge resources. These competencies must be rare and unique. Moreover, researchers also found many of resources and capabilities on which competitive advantage is based reside in the operations function [14]. Firstly, RBV may assist operations reach up to the leadership of excellence. Secondly, RBV helps to providing clear rules to develop and train human resource and retain talents in a systematic manner. Thirdly, the involvement cultural trait that is originated from organizational culture is unique and hard to imitate by any rival firms. Thus, the argument established in this study was transformational leadership style, human resource practices and involvement cultural trait. Lastly, the affective commitment to change has little influence on organizational change if internal resources are utilized fully.

5 CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

5.1 SUMMARY OF FINDING

This study is on the relationship among the change management and operational excellence. The multiple regression results revealed that the transformational leadership style, human resource practices and involvement cultural trait statistically significantly and positive relation with the achievement of operational excellence. The results of hierarchical regression indicated that only one interaction item, transformational leadership and affective commitment to change (moderator) had a moderating effect on the relationship between change management and achievement of operational excellence. Approaches to theory uses, this study utilize resource-based view.

5.2 LIMITATION AND DIRECTIONS FOR FUTURE RESEARCH

The conclusions drawn from present study should be interpreted in a limited way, which would potentially represent opportunities for further exploration in future research. First, this study is a cross sectional study, as it is carried out once and represents the issue at a specific time. Therefore, future study may look into a longitudinal study in order to expand the findings that are pre-changes and post-changes. Second, this study used the Electrical and Electronics (E&E) manufacturing firms that have high foreign ownership but also many restrictions in responding to the study. It is suggested that using Malaysian local owned firms like small-medium enterprise (SME) or small-medium industry (SMI) may add more insight. In addition, future study in service industry will add richness to the area of interest. Third, this study had proven the important of few change management factors in affecting the achievement of operational excellence. In contrast, further studies could focus on others factors or dimensions which have been excluded in this study. Fourth, future study can also investigate the change management due to external environment. Perhaps it will be able to provide a new insight on how firm react to external force and also improve the operational performance.

5.3 IMPLICATION AND CONCLUSION

An evident in the data analysis findings above, this study has provided several contributions to practice, methodology and theory. The practical implications for E&E manufacturing organization is success in change initiatives depends on proper

integration of transformational leadership style, human resource practices and involvement cultural trait. On the other hand, understanding all three components of commitment to change also helps a firm in ensuring that operational excellence is well taken care of.

Hence, management is advised to establish policy, systems and process that integrate three soft factors in their planning and strategic direction. On the other hand, the finding is hoped to provide the managers with the insight in order to assist them to identify the appropriate operational excellence model based on organizational needs. As for methodology contribution, this study was add-on sustainability performance metrics (non-economic measure) on top of the conventional performance metrics (economic measure) in a composite performance index by averaging scores across the six performance indicators. Since sustainability is very important aspects of today business environment [23], therefore, this methodology can be validated in future research to measure operational excellence or business excellence. The new measurement method in this study also could fill up the perceived performance gaps by merging both economic and non-economic measures. From the theoretical perspectives, it is discovered the originality in terms of the model to reflects a growing interest in extending operational management paradigms to emerging in developing country context, particularly on the knowledge on the insight of change management and operational excellence. In contrast to most previous studies identified each of factor separately, this paper will be among the first few studies that examine the soft factors of change management to predict operational excellence. The integration of soft factors in this study has developed new knowledge that could assist theory building efforts particularly in the operation management field and organizational change management. The researcher might use the findings for further research.

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Factors Influencing Procurement Performance in Private Sector in Kenya

Haron Barsemoi[1], Patrick Mwangagi[1], and Benard Odero Asienyo[2]

[1]Department of Entrepreneurship and Procurement, School of Human Resource Development, Jomo Kenyatta University of Agriculture and Technology, Kenya

[2]Organizational Development and Project Management Consultant, Bistech Systems, Nakuru, Kenya

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ABSTRACT: The study examined factors influencing procurement performance in the private sector in Kenya. The study adopted descriptive research design. Target population was 169 employees working in Henkel Chemicals (E.A) from all levels of management. The study used systematic random sampling technique in selecting the 117 participants. A structured questionnaire was used as method of data collection. Data analysis was done using qualitative and quantitative analysis methods. The relationship between the independent variables (staff competence, organizational structure, and quality management and information technology) and procurement performance was tested using the regression analysis. The study established that application of IT in Henkel Chemicals (E.A) Procurement process was the most related factor affecting procurement performance measured in terms of service delivery compared to staff competence, organization management, whereas quality management was the least related factor affecting procurement performance.

KEYWORDS: Procurement Performance in Private Sector, Staff Competence in Procurement, organizational structure in procurement, Quality Management in Procurement and Information Technology in Procurement

1 INTRODUCTION

In Africa, challenges that engulf private sector procurement are skill development; effective recruitment and retention of procurement professionals. Another challenge is the management of global sourcing strategies. That is also a challenge in terms of processes, a linkage between the global sourcing offices (Jason, 2006). Juma (2010) asserts that, even in private sector as in the government tenders, bribery and corruption is rife in procurement field. The author states that the problem is that integrity has never been a guarantee from professionals. Banda (2009), however observes that factors affecting procurement performance in developed and in developing countries are different. “Private sectors in Africa are grappling with setting up the operational framework of procurement processes while developed countries as United States and European Countries the problem is how to make it efficient”.

In Kenya, private sector procurement functional unit suffers from different challenges drawn from internal and external factors in organization. Attracting and retaining talent in the procurement space is among the top concerns for companies already dealing with today's complex pricing pressures Berger & Humphrey (2007). According to Dale (2010), for most of organizations, procurement is still seen as *add on* rather than core to business operations. This therefore affects the level of investment and resource allocation towards procurement function in the private sector. In today's complex global economy, the procurement function in private sector in Kenya must respond to a number of difficult issues, in no small part compounded by the recent economic turmoil and the changing dynamics of the global supply chain (Jason, 2006). With so much at stake it obviously makes sense to fill key procurement roles with seasoned employees that have a keen understanding of how the commoditization process works in today's environment of increasing complexity across the supply chain. Overall, inhibiting factors to procurement performance in Kenya must be looked into holistically by private sector and other stakeholders if value is to be added in procurement processes and activities (Jason, 2006).

Corresponding Author: Haron Barsemoi

According to Migai (2010), many private sector organizations are losing out much because of their inability to develop quality preventive and quality assurance models within the supply chain. Juma (2010) also found that lack of quality systems in the private sector contributes to increase of defect and wastes. The author went further to link the increase of loss due to lead time and inability of the private sector in Kenya to compete with other players globally as based on poor investment in information communication technology. This significantly reduces procurement performance in the private sector in Kenya.

Procurement performance is the backbone of an organization success since it contributes to competitive purchase and acquisition of quality goods that puts the organization products or services in the competitive edge in the market. However, on several occasions, poor procurement performance has caused private sector financial loss due to delivery of poor quality work materials, loss of value for money and inflated prices. Poor procurement performance also contributed to decrease of profitability of private sector (Juma, 2010). According to (Migai, 2010), poor procurement performance is a major hindrance to private sector organizations growth since it causes the delay of delivery, increase of defects, delivery of low quality goods or non delivery at all. Poor procurement performance in the private sector has been a problem due to incompetent staff, traditional procurement procedures, and inability to embrace e-procurement, poor coordination of procurement activities, lack of quality assurance policies and lack of proper regulations Juma (2010). According to Canon, (2000), lack of established procurement laws in Kenya contribute to 61 percent of losses made in procurement bids. In addition, procurement is a new field and issues such as training and ethical policies are yet to be fully developed in this field. This has worsened the situation especially in the private sector necessitating a study to examine factors influencing procurement performance in the private sector in Kenya with the view to improve procurement performance.

2 LITERATURE

2.1 STAFF COMPETENCE IN PROCUREMENT

According to Banda (2009), many procuring organizations do not have staff with the right competence critical to good procurement process management. There is need for authorities to give much greater emphasis to developing such competence and to adopt best practice more widely. For big projects the cost of employing advisers is very high and in many cases exceeded budgets by a substantial margin.

Procuring organizations need to drive down advisers' costs and ensure that sensible budgets are adhered to through staff competence development. Monitoring and enforcement of Quality standards is sometimes weak sometimes the failure can be traced back to problems in human resources capacity to monitor procurement process, poor determination of specifications, weak definition of requirements and/or inadequate budgets, and failure to enforce the conditions of the contract is due to inadequate supervision from within the private sector as well as weak enforcement of regulations. Regulatory agencies rarely manage to enforce standards due to lack of capacity (Banda, 2009). According to Berger & Humphrey (2007), a procurement function that is carried out professionally is the heart of delivery of any service on value for money principle. In the study, it was noted that most of personnel carrying out procurement functions in the local authorities in Kenya have not been sensitized on procurement regulations. In emphasis, the law requires that each procuring entity establishes a procurement unit with the professionals. This was not the case in 15 out of 27 surveyed local authorities in Kenya. According to the report, it was observed that there are serious challenges in staffing of procurement professionals in the local government institutions. Some of the personnel carrying out those duties do not have any certification in procurement and most have never been sensitized and have little knowledge if any of procurement function.

In order to sustain economic growth and effective performance, it is important to optimize the contribution of employees to the aims and goals of the organizations. Technological developments and organizational change have gradually led some employers to the realization that success relies on the skills and abilities of their employees, and this means considerable and continuous investment in training and development. (Sultana, 2012)

Current educational systems, do not necessarily impart specific knowledge for specific job positions in organizations. As a result of this the labour force comprises of few people with the right skills, knowledge and competencies needed for positions in the job market. There is therefore the need for extensive external training for human resources to be able to improve and also contribute to the productivity of organizations (Appiah, 2010).

Seleim (2007) explains that training is a key element for improved organizational performance through the increasing level of individual competences. This means that training will help employees to master knowledge, skills, behaviors, sense of self worth and confidence upon which they are able to perform efficiently to improve on the performance of the organization.

Boyan (2003) reveals that there are clear benefits in ensuring that staff who handle suppliers are professionals and approaches are handled well. Competence can ensure that the benefits of new products and services are brought to the attention of the right person in the organization. It can protect the organization, keep work to a minimum, avoid souring relationships and add to the organization's reputation for efficiency and good management. According to the author, in procurement, it is not what you do but how you do it that matters. "For big projects the cost of employing advisers is very high and in many cases exceeded budgets by a substantial margin. Procuring organizations need to drive down advisers' costs and ensure that sensible budgets are adhered to. They also need to be mindful of costs to bidders. Imposing excessive costs on bidders is likely to result in higher charges in the long run and risk deterring firms from bidding" (Boyan, 2003)

2.2 ORGANIZATIONAL STRUCTURE AND PROCUREMENT PERFORMANCE

According to study by Yasuhiko (2003), a system theoretic law insists that system must have at least the same degree of behavioral variety as its environment does in order to survive. The study asserts that a surviving organization has functions to decrease the variety of environmental input by some market research mechanism to reduce information input according to organizational objective and to increase the variety of organizational behavior by appropriate market means. Chandan (2006) indicated that, rules, operating procedures and performance standards are set for employees to enable understand what is expected of them. Procedure of collecting and evaluating information to help managers make decisions and solve problems are defined through the organizational structure.

An organization structured that is appropriate to the task of an organization encourages creativity and enhances quick decision making concerning new business opportunities, products, customers suppliers, market and technical development enable the organization to survive and compete in dynamic and competitive situations (De Anis & Haggins 2001)

2.3 QUALITY MANAGEMENT AND PROCUREMENT PERFORMANCE

According to Berger and Humphrey (2007), quality management can be considered to have four main components: quality planning, quality control, quality assurance and quality improvement. Quality management is focused not only on product/service quality, but also the means to achieve it and whether motivation plays significant role in its achievement. Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality. In quality work, where consumer responsibilities are very important and non-negotiable, customers recognize that quality is an important attribute in products and services. Procurement employees therefore must be provided with all tools and motivated in order to deliver quality services (Berger & Humphrey, 2007).

In Africa, in the past two decades quality gap has been greatly reduced between competitive products and services. This is partly due to cases where procurement employees have lost their lives after consuming some fake products from the market. As a result, countries amongst many others have raised their own standards of quality in order to meet international standards and customer demands. The ISO 9000 series of standards are probably the best known international standards for quality management that some many countries associate with (Zeithaml, 2000).

According to Armstrong (2001), the study reveals that the most important functions of procurement management in quality work is being able to motivate procurement employees and promote their morale in organization. In fact, the extent of your success depends on it. To inspire extraordinary performance you must foster a positive environment and discover what motivates procurement employees in quality work. Motivating yourself and others isn't easy. You must work on it daily or it won't last in procurement employees or you in organization. Tangible ways in which job satisfaction benefits the organization in quality work include reduction in complaints and grievances, absenteeism, turnover, and termination; as well as improved punctuality and worker morale. Motivation is also linked to a healthier work force and has been found to be a good indicator of longevity. And although only little correlation has been found between job satisfaction and quality work, Armstrong (2001) notes that some employers have found that satisfying or delighting procurement employees is a prerequisite to satisfying or delighting customers, thus protecting the "bottom line".

In Kenya, a number of organization use motivation to help procurement employees achieve organization targets and objectives. DHL limited for instance has cultivated the practice of procurement employees' motivation in order to help them achieve international quality standards. Products that consumer use must meet standard fitness of purpose and quality and thus the need for motivation in quality work, to ensure they achieve the threshold and standards required for inspection of goods that are consumed in the market (Waters, 2004**)**.

2.4 APPLICATION OF IT IN PROCUREMENT PERFORMANCE

According to Campbell (2005), technology is the change or integration of means of processing a product or service from what is perceived not be a good version to a better one. It is also change of system or way of operation from inefficient or manual to automatic operations. Private sector procurement activities have evolved from orders, systems to nowadays E-procurement. If you always remember that technology is a tool and that you need to know how to use it, for it to be productive, the money that you spend will never appear to be wasted. The emergence of Internet Technologies has changed the way that governments and organizations operate. The majority of organizational spending consists of purchasing. In order to decrease the total costs spent on purchasing process, internet technologies are used and E-Procurement has become popular to implement in the latest era by both governments and enterprises. Several researchers studying in this area says E-Procurement is named as the "Revolution" due to its potential to reduce the total costs of acquisitions (Campbell, 2005).

The one thing to always remember about technology it's just a tool to assist you in getting your sourcing and procurement related activities done in the organization. During the course of the 1990's, the development of information technology has proved decisive for the network society that has evolved in recent years. Today, Internet technology is relatively cheap and flexible technology which not only has held significant importance for communication in society, but also for the development of the interplay between one procurement units of an organization to another (Monrove, 2002).

According to Rusek (2006), the digitalization of information and data, as well as the opportunities offered by the Internet, provides the basis for rationalization and improved efficiency in administrative processes for private sector procurement companies. The digitalization of the administrative and procurement functions of public sector companies provides a number of advantages, for example, the opportunity to establish new and more efficient work processes and to communicate and co-operate in new ways. Traditional paper-based work processes in procurement can be made more efficient, changed or rendered superfluous when data and data-communication become electronic. Via this path, resources can be transferred from administration to service. Digitalization does not only bring advantages with it. The risk element in procurement changes radically along with technical development, for example, when traditional paper documents disappear and are replaced by digital information that easily can be stolen (copied), changed, deleted, etc., without trace. In future, security surrounding digital systems will be allocated important priority in all fields of society (Rusek, 2006). Development also requires an important technical redirection and comprehensive further training for users. For procurement officers, development will mean the need for further training, amended procurement methods and new IT-based in procurement tools. In the latest era, the significant usage of E-Procurement systems by governments and enterprises led to significant savings in government procurement costs. It has been shown theoretically and empirically that these savings are mostly caused by increased competitive environment, thus by increased number of bidders in government procurement auctions (Rusek, 2006).

The success of E-Procurement systems mostly depends on the increases in number of bidders (suppliers) that participate to procurement auctions. So, the implementation of E-Procurement has some restrictions namely technology adoption and usage of E-Procurement systems by suppliers. Some public institutions have not embraced e-procurement. Again, e-procurement has high maintenance costs and required level of professionalism that needs to be investigated in terms of sustainability (Rusek, 2006).

Berger and Humphrey (2007) states that, use of technology has not been fully embraced in the practice of undertaking procurement activities in Kenya. Berger and Humphrey observe while there are up to date systems such as reverse auction for undertaking bidding process in procurement, in most private and public sector the process is still being undertaken manually giving room for manipulation and corruption. Manual process also takes longer thus thereby affecting procurement activities. The same view is also recorded by Dale K. , (2010) that states that manufacturing industry performance in Kenya is hampered by lack of investment in technology that helps to reduce lead time, improve efficiency and efficacy, and eliminate quality default and corruption in the processes.

2.5 CONCEPTUALIZATION

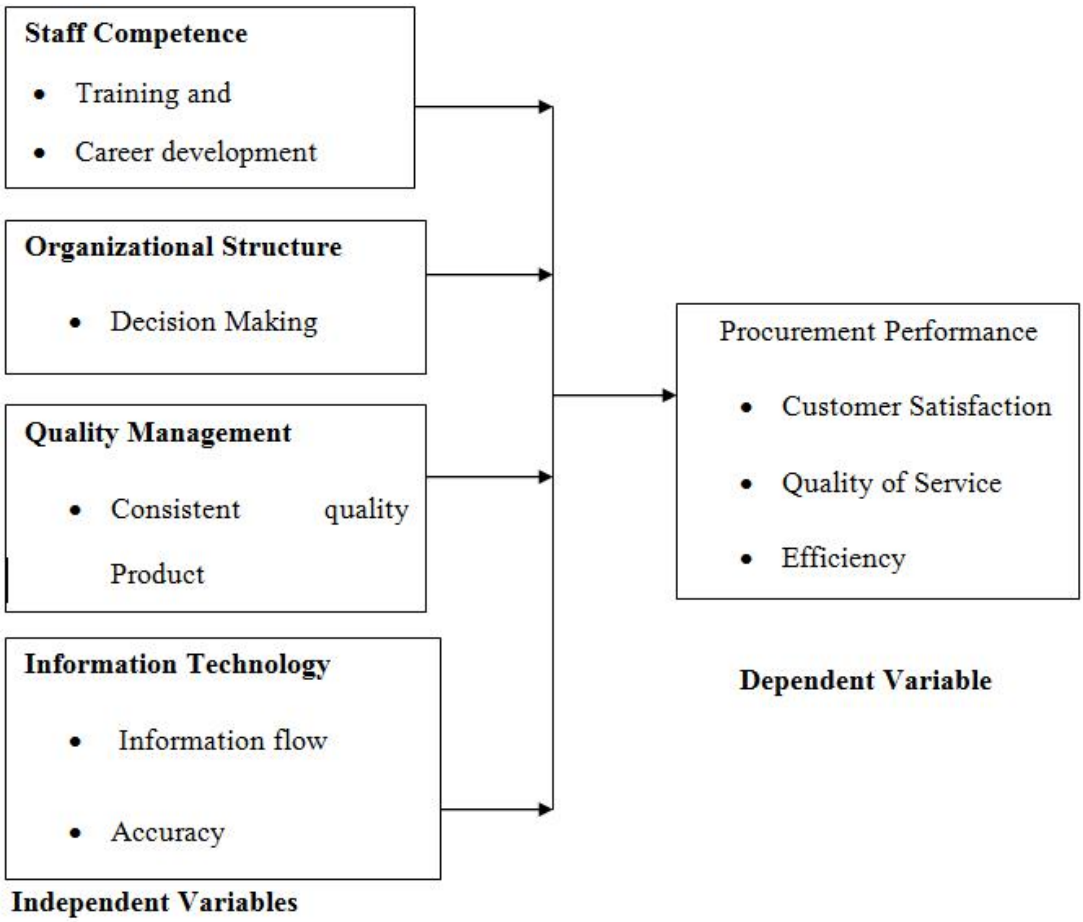


Figure 1: Factors Affecting Procurement Performance

The conceptual framework shown in figure 2.1 describes the relationship between the variables in the study. The independent variables are staff competence, organizational structure, quality management systems and information technology. If these factors are aligned with the procurement operations of private sector it will improve performance of procurement system by enhancing information flow and reducing delays in order processing. Organization that invests in staff competencies will likely to have competitive advantage over the other as this may result to quality product and variety reduction. Procurement performance, the dependent variable is defined as accomplishment of employees task that result to customer satisfaction, efficient information flow and quality procurement management. This study seeks to establish the effect of such mentioned factors on performance of procurement in private sector in Kenya. Performance improvement will be assessed in terms of quality reliability, reduced human error judgment, consistency of policy framework to facilitate effective and efficient undertaking of the procurement process and the ability of the potentials and benefits of information technology to be applied in every buying process. The study assumes that procurement performances are not affected by the Henkel products, human resource management systems in place and organization culture which are control factors.

3 METHODS

The study adopted descriptive survey research design. The target population was the 169 employees of Henkel Chemicals (E.A) as defined by (Peil, 2003) as the entire group that is of interest to the researcher for study and analysis. A systematic random sampling technique was used to select the respondents. Sample size formula as provided in an article by James E. Bartlett and Joe W. Kotrlik titled Organizational Research (2001) was used to determine 117 sample size for this study. The study used structured questionnaires to collect information from employees of Henkel Chemicals (East Africa) at their places of work. The relationship between the independent variables (staff competence, organizational structure, quality

management and information technology) and procurement performance measured in terms of service delivery was tested using both Pearson Correlation and the regression model.

4 RESULTS

Table 1: Elements of Staff Competence at Henkel Chemical Industries

Elements of Staff Competence	N	Min.	Max.	Mean	Std. Dev.
Staff training	103	1	5	3	1.4
Improved inventory management	103	2	5	4	0.8
Staff understand procurement procedure	103	1	5	3	1.1
Organization motivate staff	103	1	5	3	1.2
Organization value skills and experience	103	1	5	3	1.1
Negotiated term for procurement process	103	1	5	3	1.1
Procurement negotiation skills and creativity	103	2	5	4	1.0
Organization deploy staff based on their skills	103	1	5	3	1.1

The study used descriptive statistics to analyze part of the first objective where N represented the sample size, Min was minimum value in the Likert Scale representing Strongly Disagree, N was the sample size of the study, Max was maximum value representing Strongly Agree, Mean was the assumed mean between 1 for Strongly Disagree and 5 Strongly Agree and Std. Dev was the standard deviation of assumed mean from the actual mean. The study established that the employees agreed that training help to improve inventory management and also Henkel Chemicals (E.A) had staff with competence in negotiation that promoted negotiation skills and creativity both of which had mean of 4 representing the respondents level of agreement according to the Likert Scale used. On the other hand, the study established the respondents were neutral meaning that they were undecided on the following competence; training competence in procurement, product procurement competence, motivation competence, competence to value skills and experiences, procurement process competence and deployment competence, this was represented by 3 which meant that employees were undecided on these competences.

The study established that staff working at Henkel Chemicals (E.A) had inventory management competence and procurement negotiation competence yet it was not clear in the understanding of the employees whether the organization had the following competence; training competence in procurement, product procurement competence, motivation competence, competence to value skills and experiences, procurement process competence and deployment competence.

Table 2: Correlation Coefficient of Staff Competence and Procurement Performance

Correlations	competence	Delivery
Competence	1	0.70
Delivery	0.70	1

*** Correlation is significant at the 0.01 level (2-tailed).*

The study establish a strong positive correlation of 70% between staff competence and procurement performance indicating that staff competence positively affect procumbent performance of Henkel Chemicals (E.A), that is to say that when staff competence improves, it automatically improves procurement performance measured through the company's service delivery.

This finding was related with Kiage (2013) that found that procurement staff competencies affect procurement performance both for procurement unit and to the whole ministry in other words the study reveals that experienced staff carries out duties in a professional manner and reduces wastage of resources. Moreover, competent staff are effective, efficient and provide solutions to the procurement problems while incompetent staff would be ineffective and inefficient thus contributing to poor performance for the ministry. Finally the respondents indicated that effective and efficient procurement process can only be achieved by proper planning by competent staff else there would be flaws in the process. Competent staff would ensure that items services are procured as and when the need is expected.

Table 3: Aspects of Organization Structure at Henkel Chemicals (E.A)

Aspects of Organization Structure	N	Min.	Max.	Mean	Std. Dev.
The structure is flexible	103	1	5	2	1.2
Decision making is not conflicting	103	1	5	4	1.1
Procurement department reports directly to CEO	103	1	5	4	1.0
Procurement department is autonomous	103	1	5	2	1.1
There is team spirit	103	1	5	2	1.1
Staff follow chain of command	103	1	5	4	1.2
Performance appraisal system is transparent	103	1	5	2	1.2

The study established that the respondents agreed that decision making was not conflicting, procurement department reports directly to CEO and that staff follow chain of command. The respondents contrarily disagreed that the organization structure was flexible, and that procurement department was autonomous. This finding shows that although decision making at Henkel Chemicals (E.A) was not conflicting, procurement department reports directly to CEO and that staff follow chain of command, organization structure was inflexible which affected autonomy of procurement process at the company.

Table 4: Correlation Coefficient of Organization Structure and Procurement Performance

Correlations	Organization Structure	Delivery
Organization Structure	1	0.68
Delivery	0.68	1

*** Correlation is significant at the 0.01 level (2-tailed).*

The study establish a strong positive correlation of 68% between organization structure and procurement performance indicating that organization structure positively affect procurement performance of Henkel Chemicals (E.A), that is to say that when organization structure operates effectively and smoothly, it automatically improves procurement performance measured through the company's service delivery. This findings agrees with research study done by Lagaan (2011), analyzed the relationship between organizational structure and procurement performance and he found that there is a positive relationship between organizational structure and procurement performance as organizational structure determined level of coordination and decision making in procurement activities.

Table 5: Aspects of Quality Management at Henkel Chemicals (E.A)

Aspects of Quality Management	N	Min.	Max.	Mean	Std. Dev.
On time delivery	103	1	5	3	1.1
Impressed timely delivery	103	1	5	3	1.1
Reduced wastage and damages	103	2	5	3	0.8
Reduced quality complaints	103	1	5	4	0.9
Competent inspection team	103	2	5	4	0.8
Effective inventory management	103	2	5	4	0.9
Consistent product quality	103	1	5	4	0.9

The respondents in the study agreed that Henkel Chemicals (E.A) achieved quality management in the following aspects; reduction in quality complaints, putting in place competence inspection team, installing effective inventory management and consistent product quality. This was proved by these aspects of quality management scoring a mean of 4 that represented that the respondents agreed on these aspects. The respondents were undecided on the following aspects of quality; on time delivery, impressed timely delivery and reduction on wastages and damages represented by mean score of 3 representing neutrality in their responses which showed their level of indecision on the aspects.

This finding indicated that although the company was successful reduction in quality complaints, putting in place competence inspection team, installing effective inventory management and consistent product quality, there were still quality management challenges on; on time delivery, impressed timely delivery and reduction on wastages and damages.

Table 6: Correlation Coefficient of Quality Management and Procurement Performance

Correlations	Quality Management	Delivery
Quality Management	1	0.60
Delivery	0.60	1

*** Correlation is significant at the 0.01 level (2-tailed).*

The study establish a strong positive correlation of 60.3% between quality management and procurement performance indicating that organization structure positively affect procurement performance of Henkel Chemicals (E.A), that is to say that when the organization adopts effectively quality management systems, it automatically improves procurement performance measured through the company's service delivery. This finding agree with Le Grand (2007) who argues that there are three principal arguments in favour of competition as a model for service delivery: "It fulfills the principle of autonomy and promotes responsiveness to users' needs and wants; it provides incentives for providers to provide higher quality and greater efficiency; and it is likely to be more equitable than the alternatives". However, he admits that to achieve this outcome provider competition relies upon user choice.

Table 7: Aspects of Information Technology use in Henkel Chemicals (E.A)

Aspects of IT	N	Min.	Max.	Mean	Std. Dev.
Organization embraces IT	103	1	5	3	1.0
Organization practice e-procurement	103	1	5	4	1.0
Procurement process is easy	103	1	5	3	1.0
e-procurement improved transaction time and accuracy	103	1	5	3	1.0
IT achieved smooth co-ordination of departments	103	1	5	3	0.9
e-procurement has enhanced information flow	103	1	5	4	0.9

The respondents in the study agreed that through the application of IT the company was able to organize e-procurement which made it to enhance its information flow. This was so because of mean score of 4 representing respondents' agreement. On the other hand the respondents were undecided on the following aspects application in the company; whether the company embraced Information Technology as a catalyst to procurement performance, whether the application of Information Technology made procurement process easy, whether e-procurement improved transaction time and accuracy and whether Information technology achieved smooth co-ordination of departments. This was so because of mean score of 3 representing neutrality interpreted as respondents' indecision on the aspects of application of Information Technology.

This finding indicated that although the application of IT in the company made it to organize e-procurement which made it to enhance its information flow, the company was not able to totally embraced Information Technology as a catalyst to procurement performance, the application of Information Technology did not made procurement process easy, e-procurement did not improve transaction time and accuracy and that the application of Information technology did not achieve smooth co-ordination of departments.

Table 8: Correlation Coefficient of Application of IT and Procurement Performance

Correlations	Application of IT	Delivery
Application of IT	1	0.70
Delivery	0.70	1

*** Correlation is significant at the 0.01 level (2-tailed).*

There was strong positive correlation of 70.3% between application of IT and procurement performance indicating that the application of IT positively affect procurement performance of Henkel Chemicals (E.A), that is to say that when the organization applied IT in its business enterprise including procurement, it automatically improves procurement performance measured through the company's service delivery.

This finding supports Waldan (2009), examined the relationship between information technology and procurement performance and he established that there is a positive relationship between information technology and procurement performance as the adoption and use of information technology improved the effectiveness and efficiency of organization performances.

Table 9: R Square

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.75	0.56	0.55	0.43

The R square was 0.56, the adjusted R square was 0.55 and standard error was 0.43. Since the R square was 0.56 which was significant enough, there was evidence that the data used in analyzing the relationship between the factors and procurement performance was closely related.

Table 10: Analysis of Variance in the Factors

ANOVA(b)	Sum of Squares	df	Mean Square	F	Sig.
Regression	27.2	4.0	6.8	36.0	0.0
Residual	21.1	112.0	0.2		
Total	**48.4**	**116.0**			

Analysis of Variance (ANOVA) was used to establish whether there was difference between the factors and procurement performance. Since P<0.05, there was evidence that there was statistically significance between the factors and procurement performance.

Table 11: Regression Analysis of Factors and Procurement Performance

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
Staff competence	0.18	0.12	0.20	1.42	0.16
Organization structure	0.22	0.13	0.23	1.67	0.10
Quality Management	0.02	0.10	0.02	0.17	0.86
Application of IT	0.33	0.11	0.36	2.99	0.00

Staff competence significance level was 0.16 (P>0.05), for organization structure was 0.10 (P>0.05), quality management was 0.86 (P>0.05) and that for application of IT was 0.00 (P<0.05) which was interpreted that application of IT in Henkel Chemicals (E.A) Procurement process was the most related factor affecting procurement performance measured in terms of service delivery compared to staff competence, organization management, whereas quality management with P=0.86 was the least related factor affecting procurement performance.

5 CONCLUSIONS AND RECOMMENDATIONS

The aim of this study was to examine factors influencing procurement performance in the private sector in Kenya. The study established that application of IT in Henkel Chemicals (E.A) Procurement process was the most related factor affecting procurement performance measured in terms of service delivery compared to staff competence, organization management, whereas quality management was the least related factor affecting procurement performance.

First, the study recommends that Henkel Chemicals (E.A) should promote the following competence as a way of improving procurement performance; training competence in procurement, product procurement competence, motivation competence, competence to value skills and experiences, procurement process competence and deployment competence. Second, the study recommends that the company should enhance its employee's competence as a way of achieving service delivery as a means of improving procurement performance. This can be achieved by creating awareness through training on the following aspects of procurement; state of the order up to date and also those employees had superior knowledge in entire procurement process. The company should also evaluate the entire procurement process in order to identify service delivery point of breakdown with a view to re-engineer the process in order to achieve required level of efficiency and effectiveness. Third, the study recommends that the company should enhance decision making to make it continuously less

conflicting so that it allows the procurement process to be more effective and efficient. The company should deliberately re-organize its organization structure through appropriate change management so that it is flexible enough to support improved performance of procurement process and also to make it more autonomous. Four, the study recommends that the company should continue enhancing reduction in quality complaints, putting in place competence inspection team, installing effective inventory management and consistent product quality. In order to address the above challenges identified as far as quality management was concern, the company should use effective procurement automation that will make it achieve on time delivery and also reduce on wastages and damages by informing procurement staff to avail the goods and services as per when and where they are required in both production cycle and customer service delivery. Six, the study recommends that the company should enhance the application of IT in the entire business process which are inter-linked to procurement. Enterprise Resource Planning System that would integrate e-procurement into the entire business operations of the organization which would create benefits as; making procurement process not only easy but also transparent to all the clients require procurement information output for decision making, this in turn will improve transaction time and accuracy.

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Performance of Hrp2 Based Malaria Rapid Diagnostic Test (Sd-Bioline) in Whole Blood and Saliva in Patient's in Lagos State

Judith Anurika Elendu and Wellington Oyibo

Department of Medical Microbiology and Parasitology, College of Medicine, University of Lagos, Nigeria

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ABSTRACT: The study assessed the performance of SD Bioline Histidine Rich Protein 2 (HRP2) based rapid diagnostic test in blood and saliva samples in order to assess the usefulness of saliva as an alternative sample to blood in malaria diagnosis. A total of 1026 blood samples and 186 saliva samples (total RDT positive sample) were collected from patients who attended the clinic, and fell within the inclusion criteria at St Mathew's Hospital, Amukoko, Lagos State.
Microscopy and rapid diagnostic test were carried out on the whole blood samples and saliva, the RDTs tested demonstrated a high sensitivity 96.7% for SD Bioline, and a high specificity 98.7% for SD Bioline at a 95% confidence interval(p=0.445). Saliva samples demonstrated a low sensitivity of 12.7% for SD Bioline whilst a high specificity of 99.9% for SD Bioline HRP-2 RDT.
There was no significant difference between microscopy and SD Bioline HRP 2(χ^2, P=0.05) and as such it is a good diagnostic tools for malaria, while saliva serves as a promising possible means of non-invasive technique in malaria diagnosis.

KEYWORDS: Malaria, Histidine rich protein 2, sensitivity, specificity, diagnostic tool, microscopy.

1 INTRODUCTION

Malaria rapid diagnostic tests are a group of commercially available tests, that allows the rapid diagnosis of malaria by, laboratory technicians, those who are unskilled in traditional laboratory techniques for malaria diagnosis or, in situations where such equipments are unavailable, especially in endemic countries, where malaria is a major cause of morbidity and mortality (1) with a prevalence of 225 million and a death rate of about 730 thousand (18).

Prompt diagnosis and treatment are vital keys to address morbidity and mortality due to malaria (18). A major obstacle to effective malaria control is the lack of affordable and accurate malaria diagnostics and treatment, which has led to misuse, and abuse of anti-malaria drugs and the development of drug resistance in parasites. Microscopic examination of blood smears is the gold standard for *Plasmodium* specie detection and is currently being augmented with antigen rapid diagnostic test (RDT) and PCR-for blood. However, microscopy does need well qualified and supervised laboratory workers, maintenance of the microscope and regular supply with consumables, conditions which are difficult to sustain in developing an under developed countries (12).

Malaria rapid diagnostic test (MRDT), detect parasite within a threshold of 100 parasites/µl of blood. They are easy to perform and do not require extensive training or equipment (15). Malaria antigens currently targeted by RDTs are the histidine rich protein 2(HRP2), Parasite Lactate Dehydrogenase (PLDH) (8) and Aldolase. RDTs are currently being used to detect antigens of *Plasmodium* species in blood, serum, plasma, etc, to supplement microscopic evaluation of blood smears, to manage tropical febrile disease (11).

However, there is continued negative impact to malaria diagnosis due to; inaccurate microscopic evaluation of blood smears, which have resulted in misdiagnosis and misclassification of malaria severity (8), blood taboos and increased risk of accidental infections (albeit minor) due to needle pricks. In non specialized laboratories, microscopic evaluation of blood smears is slow and may lead to late diagnosis and treatment, which contributes to high mortality rates (7).

Corresponding Author: Judith Anurika Elendu

One alternative is the use of saliva, which has been in use in the surveillance of vaccine preventable diseases such as measles, mumps, rubella and for individual diagnosis of human immune virus (HIV/AIDS) by detecting antibodies against the target pathogens (14,13,5). *Plasmodium falciparum* HRP2 antigen has been detected in erythrocytes, serum, plasma, cerebrospinal fluid and even urine and saliva (4, 13). Saliva has also been shown to contain high levels of immunoglobulin gamma (IgG) and immunoglobulin miu (IgM) (3).

Saliva collection, is a non invasive method, as it does not require the use of sharp objects, it is easy to collect and store, and could be used to access communities with blood taboos. It will be more ethically acceptable for repeat sampling of the same individual (13) especially children and pregnant women who are most susceptible to malaria (8, 17).

Thus, the objectives of this research are to evaluate the performance of HRP2 RDT as a diagnostic tool, in saliva and whole blood, and determine the usefulness of saliva in malaria diagnosis.

2 MATERIALS AND METHOD

2.1 STUDY AREA

The study was conducted during November 2010 – May 2011 at St Mathew's primary health centre/ hospital, Amukoko, in Apapa / Iganmu Local Council Development Area in Ajeromi Ifelodun Local Government Area, in Lagos State, Nigeria, West Africa.

2.2 STUDY PARTICIPANT

Case report forms were used to recruit participants at the hospital, after obtaining informed written consent from individuals, parents/ guardians of children below 18 who presented with clinical symptoms of malaria such as fever on site or within the past three days, body pain/ joint pain, head ache, vomiting, loss of appetite, weakness, e.t.c. ranging from children below 5 years of age to adults. The exclusion criteria were those with other complaints unrelated to malaria and complicated malaria.

2.3 SAMPLE COLLECTION

Venous blood (approximately 3ml) was collected from each patient and placed into a properly labelled (with patient's identity number) EDTA container, for malaria diagnosis by 2 methods: microscopy and RDT; immediate slide containing both a thick smear and a thin smear was provided (according to the world health organization standard) to the clinical staff for immediate staining and observation, while the remaining blood samples was transported to the microscopy laboratory at the Department of Medical Microbiology and Parasitology, College of Medicine, Idi-Araba for further testing.

Saliva samples (approximately 1 ml) were collected by spitting, in properly labelled sterile bottles, from patients who were positive for malaria by rapid diagnostic test, done immediately, at the site of collection; A total of 1026 whole blood samples and 186 saliva samples (total number of positive sample by rapid diagnostic test) were collected.

2.4 SAMPLE PROCESSING

2.4.1 MALARIA RAPID DIAGNOSTIC TESTS (RDT)

Malaria diagnosis by commercial RDT SD Bioline Malaria Ag (Standard Diagnostic Incorporation, Hagal-Dong, Korea) ® catalogue no 082043 and 082065 with expiry date march, 2012 and September, 2012 respectively; was performed on all blood samples using the methods/ procedure described by the manufacturer.

In saliva samples, no further processing was done; the saliva was properly mixed and the same MRDT kits were used (SD Bioline Malaria Ag (HRP2)) following the manufacturer's instruction. All RDT kits were stored as directed by the manufacturer and underwent quality assurance testing at the World Health Organization quality assurance testing center at the Department of Medical Microbiology and Parasitology ,College of Medicine ,Idi-Araba.

2.4.2 RESULT INTERPRETATION

The presence of control line and test lines indicated a positive result for *P. falciparum* while, the presence of only the control line indicated a negative result. The absence of a control line was interpreted as invalid and the test was repeated.

Positivity of the samples were graded as 1+, 2+, and 3+, depending on the intensity of the test line when compared to the control line.

2.4.3 MICROSCOPIC EXAMINATIONS

Two slides were prepared designated read and archive for the study purpose, excluding the one done at the study site for the clinical staff; each slide having both a thick and thin blood smear and stained with 3% giemsa stock solution, for 45 minutes according to study protocol (WHO, 2010). Slides were examined independently by two microscopist (A and B) who were blinded to each other's interpretations, as well as, to the results of the Rapid Diagnostic Tests. One hundred thick film oil immersion high power fields were examined before a slide was interpreted as negative for malaria. The interpretation was determined to be positive if asexual *Plasmodium sp* stages were observed. The presence of gametocytes in the absence of asexual parasite forms was interpreted as a negative result for the purpose of assay evaluation.

In cases were *P. falciparum* was observed during microscopic examination the number of asexual forms with a concomitant enumeration of white blood cells (WBC).If after 200 WBCs were counted,10 or more asexual parasite stages were counted then the total number of asexual parasites were recorded. If malaria parasites were present but numbered fewer than 10 parasites per 200 WBCs, then the microscopists continued to examine the smear counting asexual stage parasites and WBCs until at least 500 WBCs had been counted.

For all positive smears, the number of asexual parasites counted was multiplied by the patient's total WBC count, and the resulting value divided by the number of WBCs counted during the microscopic examination. The final result was a calculated parasitemia expressed as the number of asexual stage parasites per microliter of whole blood.

2.5 VALIDATION AND CONTROL

2.5.1 BLINDING OF RESULTS

While performing the RDTs, I and reader 2 were blinded to each of the other measurements collected during the study. Care was taken to ensure that technicians using the rapid diagnostic device were blinded to patient histories and examinations, WBC determination and patient demographics. In all cases the results of the RDTs (SD Bioline HRP2) were determined prior to diagnostic microscopy with strict blinding between the rapid test results and technicians performing the microscopy

2.5.2 MICROSCOPY

The independent readings for read slide, determined by the microscopists were compared for concordance in three areas : i) agreement about the presence of asexual forms of plasmodium ii) agreement about the species of *Plasmodium* when present and iii) agreement on the calculated level of parasitemia within a factor of 2. When all three conditions for concordance are met, the mean parasitemia value from the two independent readings was recorded as the true diagnostic outcome. In events of discordant value between the microscopists for any of the three criteria cited, a third senior microscopist, examined both study slides (read and archive) using the same procedure sited above. The cumulative findings of the senior microscopist for both slides were then considered the true diagnostic outcome for the specimen without regard to the previous result of the previous two microscopists (19).

2.6 DATA ANALYSIS AND ETHICAL APPROVAL

This study was approved by the Ethics and Experimental Committee of the College of Medicine of the University of Lagos, Lagos, Nigeria. Data were entered and verified using the Microsoft excel format and analysed using SPSS version. Over all agreement of reliability of RDT readings was calculated. Using microscopy as the reference, Proportions were assessed for statistical significance using the Pearson chi-square test. A p- value <0.05 was considered significant.

3 RESULTS

Of the 1026 patients sampled during the study, 402 (39.2%) of them were males while, 624 (61%) were females; with a mean age of 25.6 (SD=16.7, range 0.1- 80 years).

181 of the study sample (17.6%) {95% CI 15.4-20.1%) were positive for malaria by microscopy with *Plasmodium falciparum* being the most predominant specie (97.8%) and 2.2% represented other species of which *P.malariae* consist of 25%. The trophozoite stage was the most frequent (93.1%) while gametocytes represented 6.0%.

186 (18.1%) whole blood samples were positive for malaria by SD Bioline RDT. 24 out of 186 (12.9%) saliva samples were positive for malaria by SD Bioline RDT.

The performance of the individual test (SD Bioline) varied in blood and saliva (table 1)

Table1: Performance of sd bioline using blood and saliva

Blood				Saliva			
SD Bioline	**Microscopy**		**Total**	**SD Bioline**	**Microscopy**		**Total**
	Negative	**Positive**			**Negative**	**Positive**	**(n=1026)**
	No (%)	**No (%)**	**No (%)**		**No (%)**	**No (%)**	**No (%)**
Negative	834(81.3)	6(0.6)	840(81.9)	**Negative**	844(82.3)	158(15.4)	1002(97.7)
Positive	11(1.1)	175(17.1)	186(18.1)	**Positive**	1(0.1)	23(2.2)	24(2.3)
Total	845(82.4)	181(17.6)	1026(100)	**Total**	845(82.4)	181(17.6)	1026(100)

The comparative performance characteristics of SD Bioline HRP2 in blood and saliva showed a sensitivity of (96.7% and12.7%), a specificity of 98.7%, 99.9%, a positive predictive value of 94.1% and 95.8% and a negative predictive value of 99.3% and 84.2% respectively at a 95% confidence interval (p=0.445).

226 (22.0%) of the 1026 samples were diagnosed as febrile (>37.5^{o}C), with a mean temperature of 36.9^{o}C (SD 0.96, range 33.6^{o}C - 41.0^{o}C), of which 59(26.1%) were positive by microscopy, 60(26.5%) were positive for malaria by SD Bioline for blood, 12 (5.3%) were positive for saliva by SD Bioline.

Age group 10-19, showed the highest prevalence {45(24.9%), 45(24.2%)} in blood by microscopy, and SD Bioline HRP2 respectively but the difference was not significant, whereas, the highest prevalence {9(37.5%)} in saliva samples was seen in age group 20-29 by SD Bioline HRP2.

Parasitemia levels ranged from 3 to 217,135, with a mean of 9,316.6. SD Bioline RDT proved highly sensitive at low levels of parasitemia as sensitivity in detecting *P. falciparum* was 95.1% when parasite density between 1-200 parasites/µl of blood in SD Bioline RDTs. A sensitivity of 9.8% was observed in saliva samples at a low parasite density; which increased as parasite density increased, although this difference was not statistically significant (p=0.3852).

4 DISCUSSION

Over time, alternative tests for malaria diagnosis have been developed in order to support the performance of microscopy and to facilitate prompt and accurate diagnosis and timely intervention.

This study demonstrated a low prevalence (17.7%); SD Bioline HRP2 demonstrated a high sensitivity (96.7%,) and specificity (98.7%,) in blood, respectively; which is in agreement with previous studies (9, 2) and the WHO standard for all RDTs (18).

The false negative observed by SD Bioline RDT was attributed to very low parasite density and presence of other *Plasmodium species*, while the false positive was attributed to cross reaction with auto antibodies /rheumatoid factors, or persistence of circulating HRP2 antigen either due to sequestration or incomplete treatment. Blood specificity was high, showing that the test is reliable in detecting the absence of *Plasmodium falciparum* antigen which agreed with past studies (6, 16), issues concerning over diagnosis and waste of therapeutic drugs (ACT) did not arise.

SD Bioline HRP2 RDT also demonstrated high frequency (95.8%) at detecting *Plasmodium falciparum* antigen at low parasitemia.

Evaluation of saliva as a possible means of diagnosis with HRP2 based RDTs has revealed a high specificity (99.5%), a very low sensitivity (9.4%), a high negative predictive value (83.7%) and a positive predictive value (100%) SD Bioline HRP2 RDT; which re affirms the results gotten from other research (2, 13) with slight deviation. Saliva is able to detect the absence of *Plasmodium falciparum* effectively, thus reducing the possibility of false positive result.

Low sensitivity of the HRP2 RDT (SD Bioline) in saliva was due to limitations of the commercially available kit used, which is designed to detect higher levels of *Pf*HRP2 in whole blood or plasma, than is found in saliva. However, the result showed that the antigen can be detected in saliva, which is a non invasive method.

Saliva is not yet a reliable alternative in the diagnosis of *Plasmodium falciparum,* but is still a potential alternative and as such, the development of a test kit that is highly sensitive to detect lower levels of the antigen present in saliva and standardization of the sample collection and processing will be a more appropriate approach to malaria diagnostic and in epidemiological surveys.

SD Bioline HRP2 RDTs is a good diagnostic tool for malaria diagnosis as it augments malaria microscopy and ensures prompt diagnosis, and timely treatment; thereby reducing the morbidity and mortality associated with malaria.

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Seasonal distribution of *Aedes aegypti* in southern Benin: a risk of dengue virus transmission to urban populations

A. Yadouléton[1-2], R. Agbanrin[1], C. Vodounon[2], G. padonou[1-3], K. Badirou[1], R. Attolou[1], F. Ursins[1], J. Zola[1], H. Allagbé[1], and M. Akogbéto[1-3]

[1]Centre de Recherche Entomologique de Cotonou (CREC), 06 BP 2604 Cotonou, Benin

[2]Ecole Normale Supérieure de Natitingou-Université de Parakou, Benin

[3]Université d'Abomey-calavi, Faculté des Sciences et Techniques, Benin

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ABSTRACT: *Background: Aedes aegypti* is present year round in several cities of the Republic of Benin. This study aims to assess the seasonal distribution of this mosquito at Dandji, in southern Benin.
Method: A cross seasonal entomological study on larvae and adults of *Ae. aegypti* was carried out from May 2013 to April 2014 in southern Benin (Dandji). The study was based on sampling *Ae. aegypti* immature stages (larvae/pupae) from domestic, peri-domestic and natural water sources and were reared to adults. The collections were made during the dry and rainy seasons. Addional *Ae. aegypti* were collected by Human Landing Catches (HLC), Indoor Pyrethrum Spray Catches (PSC), Biogents (BG) sentinel trap and Gravid traps (GT).
Results: During the year of study, a total number of 18,658 mosquitoes were collected where 15,204 were collected by HLC; 303 with BG trap, 3,038 with PSC, 48 with the GT. Among the 18, 593 of *Ae. aegypti* collected, the female populations (13,834) was significantly higher than the male populations ($p<0.05$). From the 13,834 females, 1,380 were blood-fed.
Adult's collection was high during the two rainy seasons (June to July and October to November) but declined in the two dry seasons (December to March and August to September).
At Dandji, the average of Human Biting Rates (HBR) obtained during the rainy seasons (79.6 bites/p/n) was significantly higher than those obtained during the dry seasons (58.62 bites/p/n) ($p < 0.05$).
Conclusion: These findings showed the presence of *Aedes aegypti* year round at Dandji in southern Benin. This presence is strengthening with the trade of second hand tires which are good breeding sites for the development of *Ae. aegypti*. Data on blood feeding patterns of *Ae. aegypti* collected during this study will certainly provide valuable information about potential Dengue virus (DENV) hosts others than humans and will help to get a greater understanding about DENV ecology in Benin. It is therefore crucial for health authorities of Benin to develop a program to fight against this mosquito in order to avoid an outbreak of DENV as it was the case in many sub Saharan Africa countries recently.

KEYWORDS: *Aedes aegypti*; season; traps; tires; Benin.

1 INTRODUCTION

The incidence and distribution of dengue-related illness has grown dramatically in recent decades [**1**]. With more than 50 million cases reported to the World Health Organization (WHO) each year, Dengue virus (DENV) is now regarded as the world's most important mosquito-borne virus (mobovirus) [**1**]. It's a silent viral disease spread by the vector mosquito *Aedes aegypti* which belongs to the family *Culicidae* and order *Diptera*.

Ae. aegypti mosquitoes are the most important and the primary domestic vectors of urban dengue and yellow fever virus [**2-3**]. It can transmit Chikungunya [**4**], Murray valley encephalitis and Ross River [**5**] viruses in addition to Chandipura virus (*Rhabdoviridae*) experimentally [**6**].

Corresponding Author: A. Yadouléton

Aedes spp mosquitoes are widely distributed in Africa and can serve as vectors of DENV. When their distribution is combined with rapid population growth, unplanned urbanization, and increased international travel, extensive transmission of DENV is likely in Africa [**2**]. DENV infection is caused by one of four DENV serotypes (DENV 1, DENV 2, DENV 3, and DENV 4). All four DENV serotypes have been isolated in Africa [**2;7**]. The knowledge about DENV epidemiology and its impact on public health in Africa, is poor. Because of low awareness by health care providers and lack of diagnostic testing and systematic surveillance, the epidemiology and effect of dengue in Africa has not been defined.

Environmental factors including weather variables may play a significant role in the transmission of dengue which is a mosquito-borne disease with seasonal distribution [8-9]. Temperature, rainfall, and relative humidity are major parameters influencing the incidence of dengue fever [10]

Recently, outbreaks of dengue have been reported in many African countries. In fact, in 2009, 696 suspected cases were recorded in Senegal with 196 confirmed [11]. In Cape Verde, an estimated 210,000 clinical cases were documented of which 174 fitted the WHO definition of dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) and six were fatal [11]. This re-emergence of dengue fever has been observed also in Mauritius [12], in Cameroon [13], and in Senegal [11]. However, in West Africa, most available data on dengue fever and *Ae. aegypti* date back more than 30-40 years [14]. In order to implement effective and sustainable arbovirus vector control measures in southern Benin, particularly at Cotonou, the economic capital, there is an urgent need to determine the prevalence and seasonal distribution of dengue mosquito, *Ae. aegypti.*

2 METHODOLOGY

2.1 STUDY AREAS

The study was carried out in southern Benin at Cotonou, the economic capital from Mai 2013 to April 2014. The choice of the study area is based on the weak level of urbanization. Additionally a lot of second hand tires from Europe and Asia, which are good breeding sites for *Ae. aegypti,* are stored and sold in this area.

This part of southern Benin (Figure 1) is characterized by two rainy seasons (April- July and October- November) and two dry seasons (December-March and August-September).

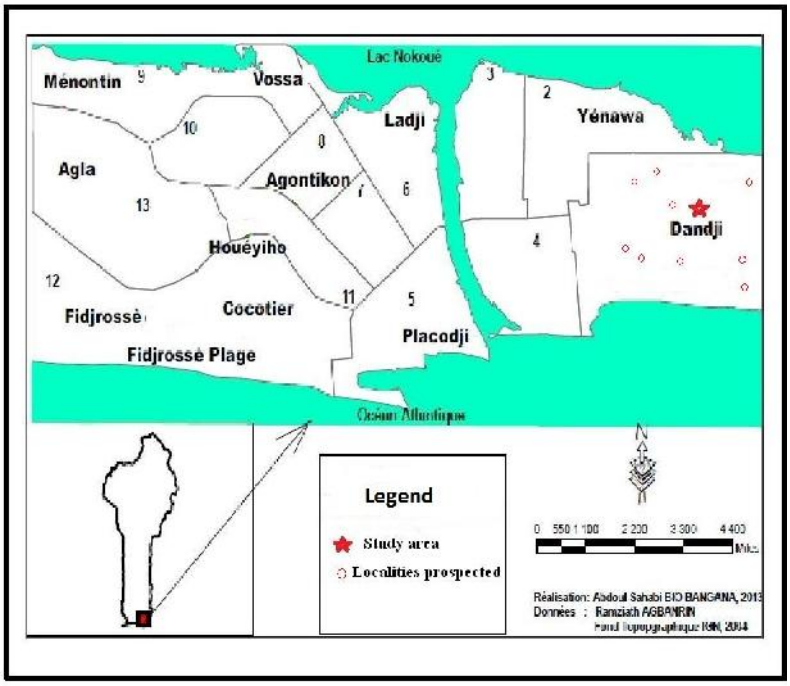


Figure 1: Map of Benin showing the study site

2.2 MATERIAL AND METHOD

MOSQUITO SAMPLING

Field mosquito collection

Indoor collections of adult mosquitoes were carried out monthly from May 2013 to April 2014. Adults collection were organized in households where old tired from Asia and Europe are stored. These mosquitoes were collected using four sampling methods:

(1) Indoor and outdoor Human Landing Catches (HLC) were performed monthly over two consecutive days (11:00 AM to 6:00 PM), in 4 randomly selected compounds;

(2) Indoor Pyrethrum Spray Catches (PSC) in 4 other selected compounds; the same compounds in each sampling method being consistently used throughout the study.

Collectors gave prior informed consent and received anti-malaria prophylaxis and yellow fever immunization. They were organized in teams of two for each collection point and they rotated between locations within houses every two hours. These mosquito populations of *Ae. aegypti* were completed with those collected from Biogents (BG) sentinel trap and Gravid traps (GT). These mosquito populations were identified base on several keys [15-16].

Moreover, *Ae. aegypti* immature stages (larvae/pupae) were sampled from domestic water sources (e.g. jars, tanks), peri-domestic (e.g. tires) and natural sources (e.g. tree holes) during the dry and rainy season. Ten points located at the study sites were chosen (Figure 1). For each sampling site, larvae or pupae from 2-6 larval breeding places were collected, stored in plastic boxes and transferred to the laboratory for rearing to adults. Once specimens are positively identified as *Ae. aegypti*, they were pooled according to location and collection source.

ENTOMOLOGICAL PARAMETERS

Entomological indicators of DENV transmission intensity at the study area were evaluated

(1) the mosquito fauna composition, which is the number of mosquitoes collected during the cross seasonal entomological study from Mai 2013-April 2014

(1) the human biting rate (HBR), which is the number of mosquitoes biting a person during a given time period (bites/p/t) (time being night, month or year)

(3) the physiology status of *Ae. aegypti* populations collected, which was evaluated by looking at the abdomen of the mosquitoes if it was blood-fed or not

ETHICAL CONSIDERATIONS

Ethical approval for this study was granted by the Ethical Committee of the Ministry of Health in Benin. Verbal consent was asked to the head of each household for the spray catches and consent of collectors was obtained prior to HLC. In case of refusal, permission was sought from the next household.

3 RESULTS

3.1 MOSQUITO FAUNA COMPOSITION

A total number of 18,593 mosquitoes were collected from Mai 2013 to April 2014. Among these populations of mosquitoes, 15,204 were collected by HLC; 303 from BG, 3,038 from PSC and 48 from the GT traps (Figure 2).

The mosquito populations collected by HLC was significantly higher than those collected from others methods of catching ($P<0.05$) (Figure 2). Among the 18,593 of *Ae. aegypti* collected, female populations (13,834) was significantly higher than male populations ($p<0.05$) (Table 1)

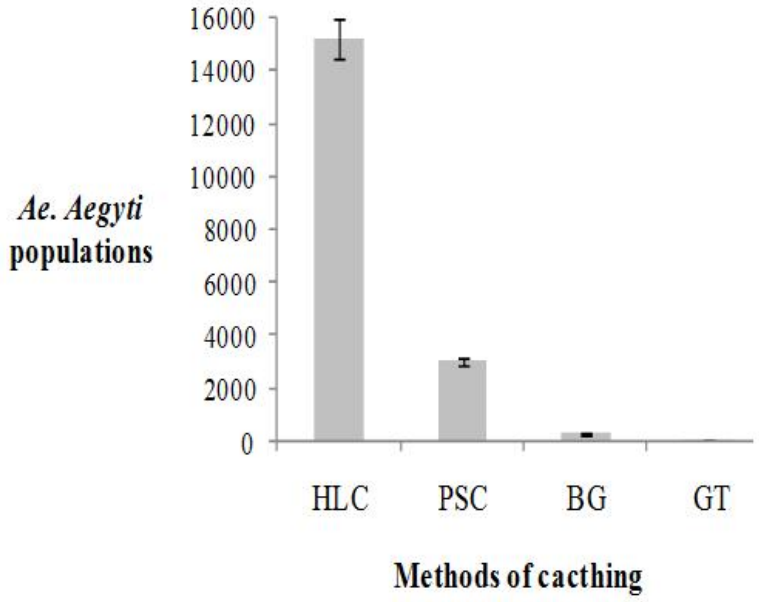


Figure 2: Number of Ae. aegypti collected from various methods of catching

Table 1: Ae. aegypti populations collected from Mai-2013 to April 2014

	Dandji												
	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Marc	Apr	Total
Female	760	1444	2395	1162	921	1412	1630	839	825	1675	206	565	13,834
Male	0	0	1028	687	701	225	778	304	0	0	592	444	4,759

3.2 SEASONAL ABUNDANCE OF *AE. AEGYPTI* POPULATION AT DANDJI

Adult's collection (Table 1) was high during the two rainy seasons (June to July and October to November) but declined in the two dry seasons (December to March and August to September). In fact, the highest bites of *Ae. aegypti* was found during the rainy seasons in July (149.69 bites/p/n) and the lowest during the dry seasons in March (12.89 bites/p/n) (Figure 3). At Dandji, from Mai 2013 to April 2014, the average of Human Biting Rates (HBR) obtained during the rainy seasons (79.6 bites/p/n) was significantly higher than those obtained during the dry seasons (58.62 bites/p/n) ($p < 0.05$).

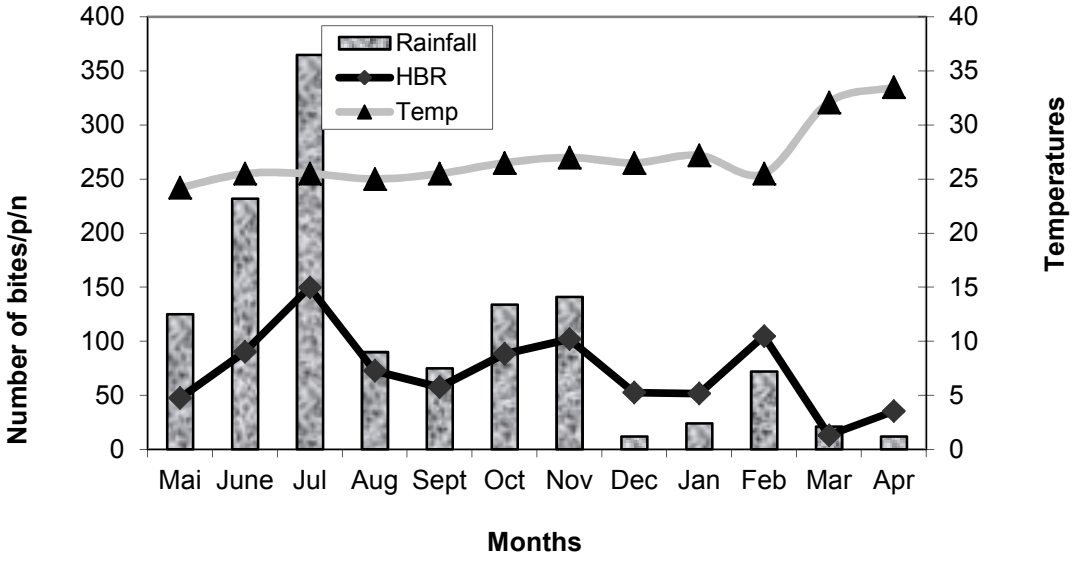


Figure 3: Seasonal variation of the number of human bites/person/night and temperature at Dandji from Mai 2013 to April 2014

3.3 PHYSIOLOGY STATUS OF *AE. AEGYPTI* POPULATIONS COLLECTED

From the 13,593 *Ae. aegypti* collected, 1,334 females were blood-fed.

The highest populations of *Ae. aegypti* blood meals were collected by human landing Catches (HLC (Table 2).

Table 2: Ae. aegypti blood meal populations collected

Dandji	
Method of catching	***Number of blood meal mosquitoes caught***
HLC	***772***
PSC	***599***
BG	***9***
Total of blood meal mosquitoes caught	***1,380***

4 DISCUSSION AND CONCLUSION

The cross seasonal entomological survey on larvae and adults of *Ae. aegypti* conducted in southern Benin has shown a presence of this mosquito year round in this part of the country. Several factors certainly contribute to it spatial distribution. Among theses factors, anthropological factors play an important role. Results from our study showed that most of adults of *Ae. aegypti* were collected from second hand tires from Europe and Asia which were kept in many stores and sold in this area. These tires were the most productive *Ae. aegypti* larvae breeding sites and this, independently of season. This result confirmed what was found in the Central African Republic [17] and in southern Cameroon [18].

In fact, the advantages of this second hand tire trade of are considerable. They contribute to the improvement of living conditions by supplying income and employment to urban populations. However, the economic and social impact of this trade is limited by a number of factors particularly these tires which are good breeding sites for *Ae. aegypti.* Despite their massive presence in the tires, some larvae were found also in abandoned peri-domestic containers and discarded tanks. This finding is in agreement with observations made in Cameroon [18], [19], [20], where peri-domestic containers represented the bulk of the containers infested by *Ae. aegypti* or *Ae. albopictus*, thus differing from the situation in other parts of the world, particularly in Asia, where domestic containers such as water storage tanks were most commonly infested with *Ae. aegypti* [21], [22].

Moreover, in many sub-Saharan towns, unplanned urbanization and lack of waste management lead to widespread water collection, thus favoring the proliferation of *Aedes* spp [7]. Dandji, our study area site, is located in a weak level of urbanization. This factor added to the presence of second hand tire trade can explain the high populations of *Ae. aegypti* in this area and can trigger the transmission of dengue and yellow fever.

Adult's collection was high during the two rainy seasons (June to July and October to November) but declined in the two dry seasons (December to March and August to September). However, the increase of the populations of *Ae. aegypti* in February 2014 (Figure 2) can be explained by the increase of the rainfall during this period of dry season; certainly an effect of climate change [23].

In Benin, there is an increasingly attention being given to malaria vector control [24-26] while *Ae. aegypti* is an important nuisance that often condition community acceptance of vector control tools [27]. Because of low awareness by health care providers and lack of diagnostic testing and systematic surveillance, DENV infections only have been reported from travelers returning to France and Japan [28-29]. These findings are supposed to be a ringing for planning vector control programs on *Ae. aegypti* in Benin. Moreover, data on blood feeding patterns of *Ae. aegypti* collected, could provide valuable information about potential DENV hosts others than humans and will help to get a greater understanding about DENV ecology in Benin.

It is therefore crucial for health authorities of Benin to develop a program to fight against this mosquito and avoid an outbreak of DENV as it was the case in many sub Saharan Africa countries cited above.

COMPETING INTERESTS

The authors declare that they have no conflict of interest.

AUTHORS' CONTRIBUTIONS

AY carried out field experiments, collected, analysed, interpreted data and wrote the first draft of the manuscript. **AR**, VC, **PG, BK, AR, UF, ZJ, HA** helped with the field activities. **AY** and **MA** conceived and designed the study, supervised fields collection, data analysis and interpretation, revised the manuscript and gave final approval for the version to be published.

All authors read and approved the final manuscript.

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Neck pain and hand grip strength in dentists of Saudi Arabia

Eman Samir Fayez

Assistant professor in department of Physical Therapy,
Faculty of Applied Medical Science, University of Dammam, KSA

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ABSTRACT: Hand grip is the functional unit of dentists used in firm holding of instruments and tools. Muscles of hand grip supplied by cervical nerves. Dentists put their neck in high physical load for prolonged time that lead to neck pain. 54.4% of dentists in K.S.A. have neck pain and 21% drop out of their job. *Objective:* The main objective is to correlate neck pain intensity with hand grip strength in dentists of Saudi Arabia. *Methodology: Subjects:* 25 chronic neck pain dentists (suffering from neck pain more than 3 months) in both gender, were selected. Their ages ranged from 25 to 40 years with normal BMI (18.5-25).they were divided into 3 subgroups according to neck position during their work. *Procedures: Pain* intensity will be determined by visual analog scale (VAS), hand grip strength will be measured by Jamar hand dynamometer in kilogram (Kg) unit. *Result:* Among 25 dentists the result showed extremely significant correlation between neck pain intensity and hand grip strength (direct proportional). *Discussion and conclusion:* the findings of this study denote presence of direct proportional correlation between neck pain intensity and hand grip strength which may be attributed to deficits in sensory motor integration and neuro hyper excitability found in neck pain victims.

KEYWORDS: neck pain, dentist, hand grip strength, sensory motor integration.

1 INTRODUCTION

Neck pain is an ache or discomfort in anatomical area between occiput and 3rd thoracic vertebra and laterally between middle margin of scapula [(1)].Neck pain is considered to be chronic if the patient suffered more than 3 months [(2, 3)]. The prevalence for neck pain varies between 16.7%and 75.1% in the general population [(4)]. Neck pain may be caused by; spondylosis, spinal stenosis, disc herniation, stress, poor posture, prolonged posture [(5, 6)]. Symptoms of neck pain may include; neck soreness and headache, pain around shoulder blades, arm complaints (pain, numbness or weakness).

Dental profession is one of the occupational risk factors of neck pain[(1, 7)]. Studies showed that neck pain starts early in dental career even during educational training[(8, 9)]. In a recent study, 54.4%of dentists in K.S.A. had neck pain, 21.69% of them drop out of job[(10)].

Recently, it was shown that there is a strong relation between work duration and neck pain in the staff of dental school [(11, 12)]. Another study reported that increasing weekly work hours has little effect on neck pain[(10, 13)]. The most common cause of neck pain in dentists is prolonged work posture which makes high load on muscles of neck and shoulder region (trapezius more than splenius)[(12)]. The main working posture of dentist is in sitting, with neck flexion, shoulder elevation and upper extremity abduction and his patient supine[(10, 11, 13, 14)].

Hand is the functional unit of the dentist and is used in keeping firm holding of instruments and tools[(15)]. Hand grip is the amount of static force that the hand can squeeze around dynamometer or an index of the power which the hand can exert[(16, 17)]. Grip strength can be affected by gender (male >female), age(peaked at 4th decade), dominant more than non-dominant hand[(16-20)]. Different positions may also affect hand grip strength: elbow during measurement (extension >flexion90%), supported forearm more than unsupported and standing position more than sitting[(15, 21)]. Grip strength used to assess functional activity of hand[(22)]. The measurement of hand grip strength used to detect whole upper arm strength [(23)]. Studies

Corresponding Author: Eman Samir Fayez

show that persons with unilateral upper limb chronic pain have strength reduction of hand grip 20-30%less than non-painful side. In addition to that, unilateral musculoskeletal pain cause delay grip initiation and relaxation [24, 25].

From these literature reviews we conclude that neck pain is in high prevalence in dentists and most of them take neck flexion during their work which leads to compression of nerves supply upper limb. The hand grip is a functional unit of their carrier, No previous studies show the correlation between neck pain and hand grip of dentists. So, the purpose of our study is to correlate between neck pain and hand grip strength in dentists of K.S.A.

1.1 THE PURPOSE OF THE STUDY

The purposes of the present study were to determine the relationship between neck pain intensity and hand grip strength in dentists of Saudi Arabia.

2 PROCEDURES

2.1 SUBJECTS SELECTION

25 chronic neck pain dentists in both gender (13 male and 12 female) were recruited from dental clinic of university of Dammam and several private clinics.

2.2 INCLUSION CRITERIA

Twenty five dentists suffered from neck pain more than three months. Both genders. Their age range from 25 to 40 years with mean age 31.32 ± 4.87 years. Normal Body mass index (18.5-25 $Kg/cm)^2$

2.3 EXCLUSION CRITERIA

The participants were excluded if they had a history of either orthopedic or neurologic diseases causing functional defect of the hand strength like: fracture, surgery of upper limb or hand, carpal tunnel syndrome, De Qurvain's syndrome or diabetes mellitus.

2.4 INSTRUMENTS

1. Data collection sheet which include (personal data, main neck position during working). It was used for gathering data from dentists.
2. Visual analog scale (VAS) to measure the intensity of pain [26, 27].

3- Jamar hand dynamometer to measure hand grip strength [16,17,19].



Figure 1



Figure 2

2.5 PRE ASSESSMENT INSTRUCTION

Cease taking analgesic drugs 2-3 days before examination.

2.6 STEPS OF ASSESSMENT

1-Intensity of pain was determined by VAS rating from (0= no pain, 10= unbearable pain).

2-The main neck position mainly used by each dentist during work was determined and mentioned in the data collection sheet.

3-Grip strength for each dentist was measured in sitting position on chair with back support and armrest, shoulder adducted, elbow 90 degree flexed, forearm and wrist in mid position. The participant held the dynamometer by dominant hand (figure 2). Therapist gave the command "squeeze around dynamometer as much as you can''. Therapist was stand in front of dentist to read the amount of force. The mean of three measurements was taken in Kg unit, with one minute rest between each squeeze to overcome fatigue [15, 16, 20].

2.7 DATA ANALYSIS

1. Data was collected from the sheet and the result of assessment and entered to SPSS program.
2. Descriptive analysis (mean, standard deviation and P value).
3. Regression analysis to find the correlation between intensity of neck pain and strength of hand grip.
4. One way ANOVA to compare the intensity of pain and grip strength in different neck position.

3 RESULT

The results of this study showed extremely significant correlation between neck pain and hand grip strength (direct proportional)with p-value (0.0001)and the slope is significantly different from zero as seen in table" 1" and figure" 3". The mean of grip strength is (33.42 ± 13.05) kg. The mean of pain intensity is (3.58 ± 1.88).

Table" 2" and figure "4" showed that there was no significant difference between pain intensity in different neck positions during working of dentists by using one-way ANOVA with p-value (0.662), but neck rotation combined with flexion took the highest pain intensity (4.33±3.3).

Table "3" and figure " 5 " showed that there was no significant difference between hand grip strength in different neck positions by using one –way ANOVA with p-value (0.196). Neck rotation also took highest hand grip strength (45.42 ± 8.67).

Table1. Correlation between neck pain and hand grip strength.

Grip strength	Neck pain	p-value
33.42 ± 13.05	3.58±1.88	0.0001

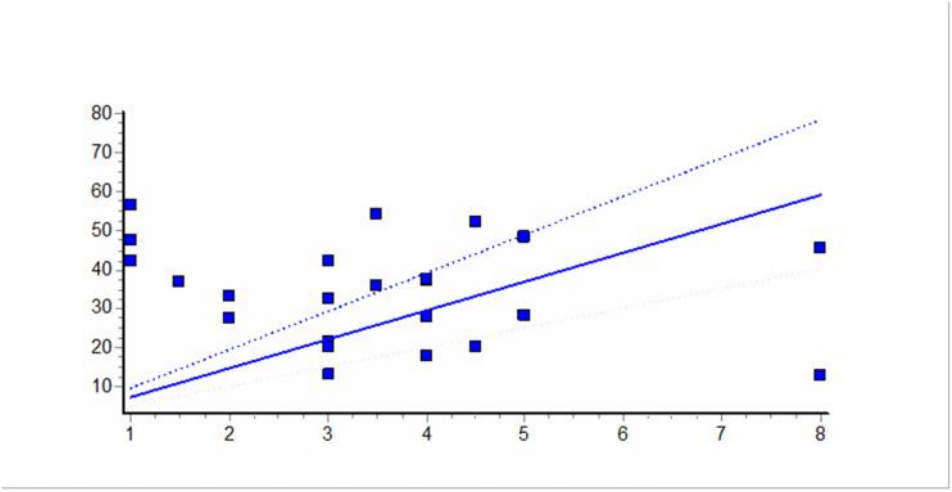


Figure 3.Correlation between neck pain and hand grip strength.

Table 2. comparison between mean value of pain intensity in different neck position.

	Flexion	Side bending	Rotation with flexion
Pain intensity Mean±SD	**3.55**±1.7	3.14±1.5	4.33±3.3
	***p* -value**	0.662	

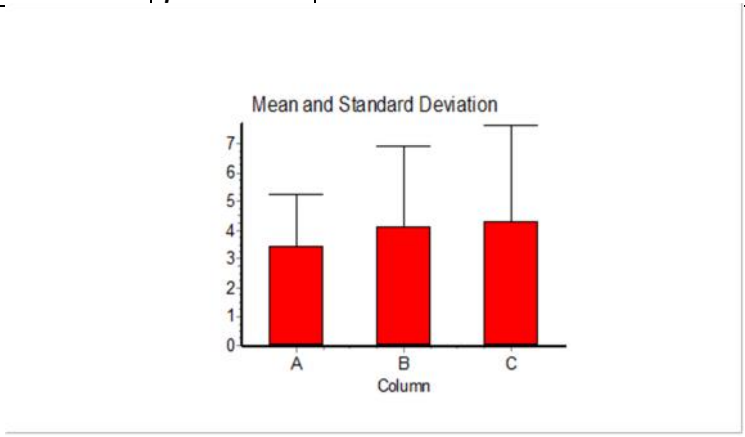


Fig4. comparison between mean value of pain intensity in different neck position.

Table 3. comparison between mean value of hand grip strength in different neck position

	Flexion	Side bending	Rotation with flexion
Hand grip strength Mean±SD	**31.35**±12.04	38.28±15.56	45.42±8.67
	***p* -value**	0.197	

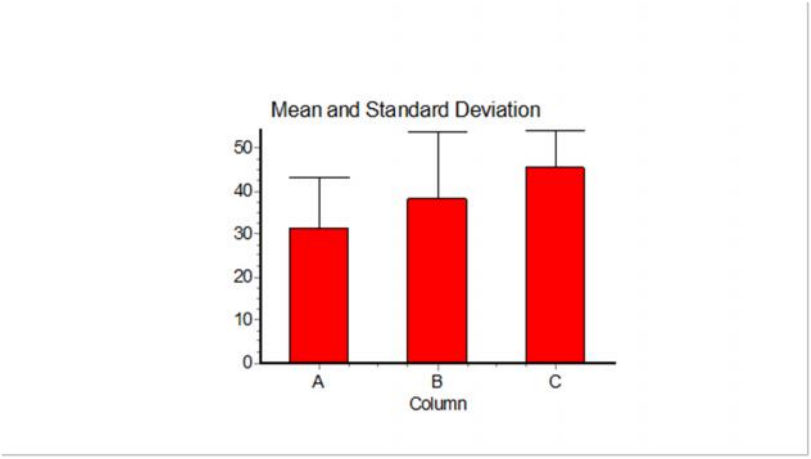


Figure 5 comparison between mean value of hand grip strength in different neck position

4 DISCCUSION

In this study we examined the relationship between neck pain intensity and the hand grip strength in dentists. The results revealed that there was a significant positive correlation between neck pain and hand grip strength. As increase in intensity of neck pain lead to increase grip strength. This findings may be attributed to abnormality of sensory motor integration found in neck pain lead to deficit in the quality of sensory information that generate motor output. Also, it can be attributed to sensory hyper excitability. This result agreed with(MaaikeA. etal)[28].They measured the grip strength in neck pain subjects and control group while carrying a 300g weight connected to dynamometer which measured forces applied to the object. They found that subjects with neck pain used significantly higher grip forces as compared to subjects without pain. After the initial lift object, all subject groups adapted to the lifting task by lowering their grip force level but grip force levels were still significantly higher in the subjects with pain.

Our results disagree with (Michael. O. etal)[(29)] who found that the grip strength decrease significantly in patients with spondylosis compared with those control group in dominant and non-dominant hand.

They clarified that increased tissue pressure arising from degenerative changes compromises myoneural conduction velocity and tissue blood flow and oxygenation. These factors interfere with the ability of the nervous system to activate hand muscles.

The results of our study showed that most pain intensity was found in rotation combined with flexion position compared with flexion and side bending positions taken by dentists. These results may be due to strain on ipsilateral facet joint which increase the risk of facet joint injury found in neck rotation. [(30, 31)] Other study demonstrated that at 20° and 40° of rotation of the head decrease the ipsilateral neuro foraminal size up to 15% and 23%, compared with the neutral position.[(32)]While in neck flexion they found that increase in posterior tensile force on spinal canal and soft tissue structure[(33)].The combination of two movements make much load on the cervical structure which cause more pain.

5 CONCLUSION

It was concluded that there was a significant direct proportional correlation between neck pain and hand grip strength in dentists.

RECOMMENDATIONS

It was recommended that the same study have to be conducted on larger sample size, and on different degrees of neck positions.

We recommended the dentists that avoid taking same position during work for long time and take rest in between to prevent the consequences on their hand grip strength during different dental procedures.

ACKNOWLEDGMENT

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Short term effects of chicken manure application on soil physicochemical properties cropped with silage maize

Rachid Aboutayeb[1], Mohamed Elgharous[2], Zhor Abail[2], Badr Faouzi[3], and Yahya Koulali[1]

[1]Department of biology, health and Environment,
Faculty of Sciences and Techniques, University Hassan 1th,
Settat, Morocco

[2]Regional Center of Agricultural Research, Settat, Morocco

[3]National Office for Food Safety, Service Plant Protection, Settat, Morocco

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ABSTRACT: The main objectives of this study were to evaluate the short-term effect of chicken manure on soil properties of cultivated horizon (0-20 cm) under silage maize. The field experiment was conducted using a randomized complete block design. In total, twelve plots were arranged; it consisted of four treatments and three repetitions. Applied treatments included a control (C) and spreading of chicken manure at 5 t / ha (T1), 10 t / ha (T2) and 15 t / ha (T3). The results obtained showed that the application of chicken manure improves several soil properties. It induced a significant increase in the soil electrical conductivity (EC), the phosphorus and nitrates content (NO3-) depending on the amount applied. A slight acidification was recorded after manure application. This acidification is probably due to mineralization of organic matter activated after incorporation of manure into the soil. Trends of increasing soil organic matter (OM) were registered. Its contents ranged from 4.60%, 5.65%, 5.57% and 5.66% for C, T1, T2 and T3 respectively. The total nitrogen and potassium content were higher after application without marking a significant difference. The nitrogen contents varied from 0.20 to 0.23% and those of potassium from 277 to 350 ppm. The production of corn silage was significantly higher in plots (T3), with a production of 17.8 t/ ha. For other treatments, production has not registered a significant difference. They ranged from 10.7 to 13.4 ton per hectare.

KEYWORDS: Spreading, chicken manure, physicochemical, soil properties, amendment.

1 INTRODUCTION

The Region of Chaouia-Ouardigha produces approximately 200,000 tons of chicken litter each year. These wastes present environmental and Health Risks Because of their high contents of nitrogen and high density of pathogens [1]. Agricultural intensification and livestock have a negative impact on soil quality. High inputs of chemical fertilizers contribute to soil degradation, damage to the environment and loss of biodiversity [2].

Soil is one of our most precious natural resources. Careful soil management is the key to sustainable agriculture [3]. In arid and semi-arid areas, low soil organic matter (SOM) content and water availability are often the main limiting factors for plant growth and production [4]. The organic amendments are increasingly used for their potential to restore biological, physical and chemical soil properties [5].

Application of organic manures such as poultry manure is important for maintaining soil quality. It is a relatively cheap source of both macronutrients and micronutrients [6]. These manures show promising effects on improving soil properties.

Assessing physical, chemical and biological soil properties is very important to studying soil quality [7]. This quality can be defined as the capacity of the soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality and promote plant, animal and human health [8].

Corresponding Author: Rachid Aboutayeb

The objective of this study is to evaluate the short-term impact of chicken manure on soil physicochemical properties and yield of maize silage.

2 MATERIALS AND METHODS

2.1 SITE DESCRIPTION AND EXPERIMENTAL DESIGN

The study was conducted at the center of agricultural qualification Ouled moumen, Settat, Morocco in North West of Africa. The region has a semi arid climate. The area is situated at 32°57'54"N - 07°39'42"W.

The field experiment was conducted using a randomized complete block design with three replications. Poultry manure was collected from poultry farm at Settat. There were 4 treatments: control (unfertilized plots) (C), 5 t/ha (T1), 10t/ha (T2) and 15t/ha (T3). Poultry manures were incorporated in soil.

In total, twelve plots were arranged. On each elementary plot of 30 m2 (3*10m), the maize was sown with a 45 cm row spacing and 15 cm between plants within each row.

2.2 POULTRY MANURE AND SOIL ANALYSIS

Soil samples were obtained and analyzed for some characteristics before the initiation of the experiment (Table 1). Soil samples were collected from each plot at 0 to 20 cm depth from 6 different locations and mixed well.

After sampling, a sample of about half kg of soil was taken, air dried and passed through 2mm sieve and used for the determination of physical and chemical characteristics.

Bouyoucous' densimeter method was used to determine soil texture, which was obtained by fitting the percentages of clay, silt and sandy fractions. The texture of soil was loam clay sandy. pH and electrical conductivity (1:2 w/v Sample-water extract) were measured using a pH meter electrode (McLean, 1982)[9] and a conductivimeter respectively.

Organic carbon (OC) was determined by titration using potassium dichromate. The Walkley-Black Wet digestion method was used for the determination of soil organic matter [10]. The latter was calculated according to the equation (OM = 1,724 OC). Organic nitrogen concentrations for soil and manure were determined according to the Kjeldahl method. Nitrates are determined by complexation with chromotropic acid and measuring the absorbance in a spectrophotometer at 410 nm [11]; ammounium was determined colorimetrically at 636 nm; phosphorus was determined by colorimetry at 882 nm [12] and potassium by extraction with ammonium acetate and determination using a flame photometer [13].

Table 1. Properties of soil at depth (0-20 cm) before experimentation.

Property	Valeur	Standard deviation
Clay (%)	18	0,17
Silt (%)	57	0,39
Sand (%)	25	0,23
CaCO3 (%)	15.1	0,77
Organic matter (%)	4.77	0,02
Total nitrogen (%)	0.18	0,02
Nitrates (ppm)	40.5	0,00
Phosphorus (ppm)	12.3	2,73
Potassium (ppm)	196.6	4,81
pH	7.47	0,61
Electrical conductivity (dS/m)	0.28	0,18

The chicken litter used in the present study was collected from two poultry farms located in Settat (a province of Chaouia-Ouardigha region). The litter was transported to the Center of Agricultural Qualification Ouled Moumen (CAQ), the site of the experiment, where mixed homogeneously. We have taken five composite samples air-dried for physicochemical analysis (Table 2).

Table 2. Composition of chicken manure applied on soil experimentation.

Property	Mean	Standard deviation
PH	7,80	0,20
MS (%)	66,52	0,25
CE (mmhos/cm)	5	0,00
CO (%)	35,46	2,90
MO (%)	61,14	5,00
N total (%)	4,04	0,10
C/N	8,78	0,52
NO3 (ppm)	964,32	37,54
NH4 (ppm)	6373,25	569,57
NH4/NO3	6,61	0,90
Phosphore (ppm)	6581,25	850,30
Potassium (ppm)	1419,17	69,87

3 RESULTS AND DISCUSSION

Addition of broiler litter to soil has an effect on several soil properties. The impact of the application of manure on soil properties is quite difficult to assess. This difficulty is due to the fact that the soil has a complex dynamic [14].

3.1 PH

Soil pH in the top 20cm of the soil profile registered a slight acidification without registering a significant difference between treatments (Figure 1). The initial pH was 8.37 while at the end of the experiment, it varied between 7.70 and 7.80 depending on the treatment applied. The decrease of soil pH may have been due to nitrification of NH4 + [15].

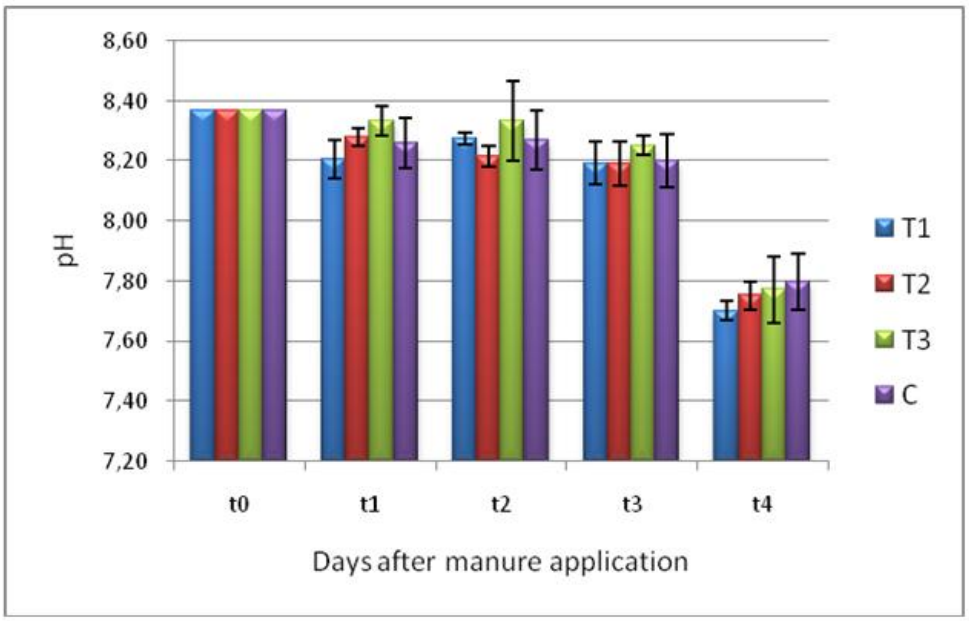


Fig. 1. Effect of chicken manure treatments on soil pH at depth of 0-20 cm.

t0: 1st, t1: 20th, t2: 47th, t3: 82th, t4: 143th days.

3.2 ELECTRICAL CONDUCTIVITY (EC)

The EC is significantly affected by manure application (Figure 2). This effect can be explained by the contribution of manure salts which led to the rise of the EC. This elevation also indicates the accumulation of salts in the soil surface [8].

In contrast with soil pH, soil EC values at 0-20 cm depth were significantly higher after spreading the manure. It could be concluded that EC increased while soil pH decreased [8].

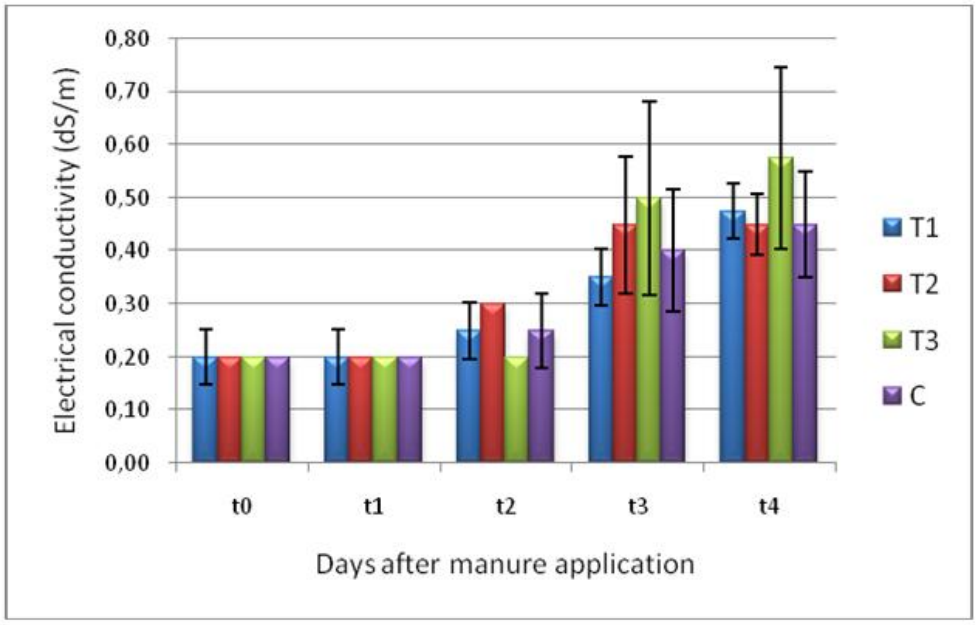


Fig. 2. Effect of chicken manure treatments on soil Electrical conductivity at depth of 0-20 cm

3.3 ORGANIC MATTER

Raw manure amendment was significantly affected the content of soil organic matter (SOM). These contents ranged from 4.60%, 5.65%, 5.57% and 5.66% for C, T1, T2 and T3 respectively. Soil organic matter concentration was higher in the manured plots than other treatments (Figure 3).

Soils that received farmyard manure application or straw had statistically higher amounts of SOM compared with the unfertilized soil [15]. The spreading of manure on agricultural soils improves soil properties such as content of organic matter [2]; [16]; [17]. Several authors showed the presence of a correlation between the amount of organic amendment applied annually and increasing the organic matter content in the soil [18].

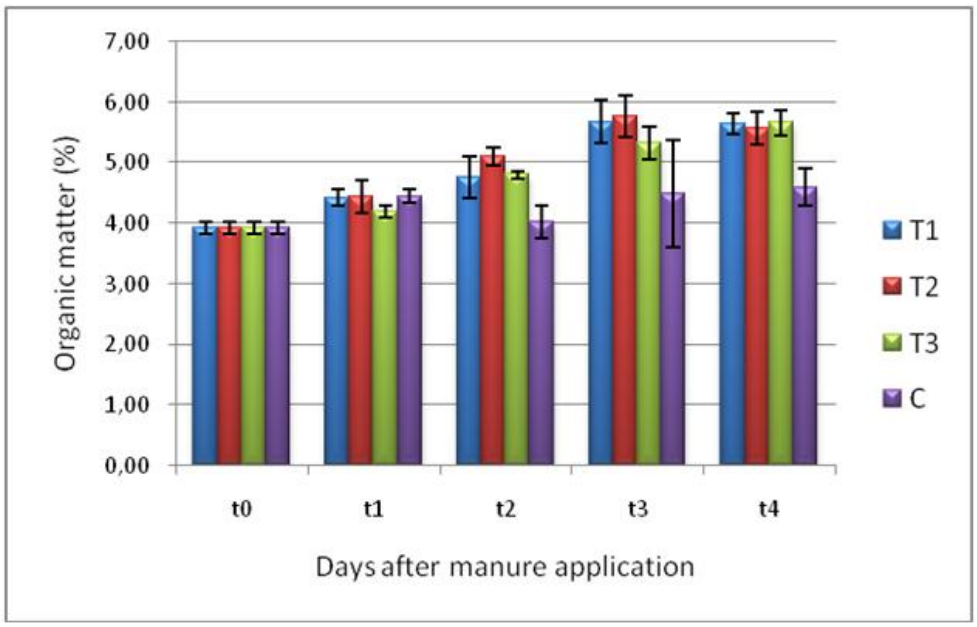


Fig. 3. Effect of chicken manure treatments on soil organic matter content at depth of 0-20 cm

3.4 TOTAL NITROGEN

Soils amended with poultry manure show a higher level of nitrogen than unamended soil [19]. The content of total nitrogen varies between 0.20% and 0.23% in control and T3 respectively (Figure 4). This slight increase was shown by reference [5] which confirmed that the application of farmyard manure at the rate of 40t/ha did significantly increase the content of total nitrogen.

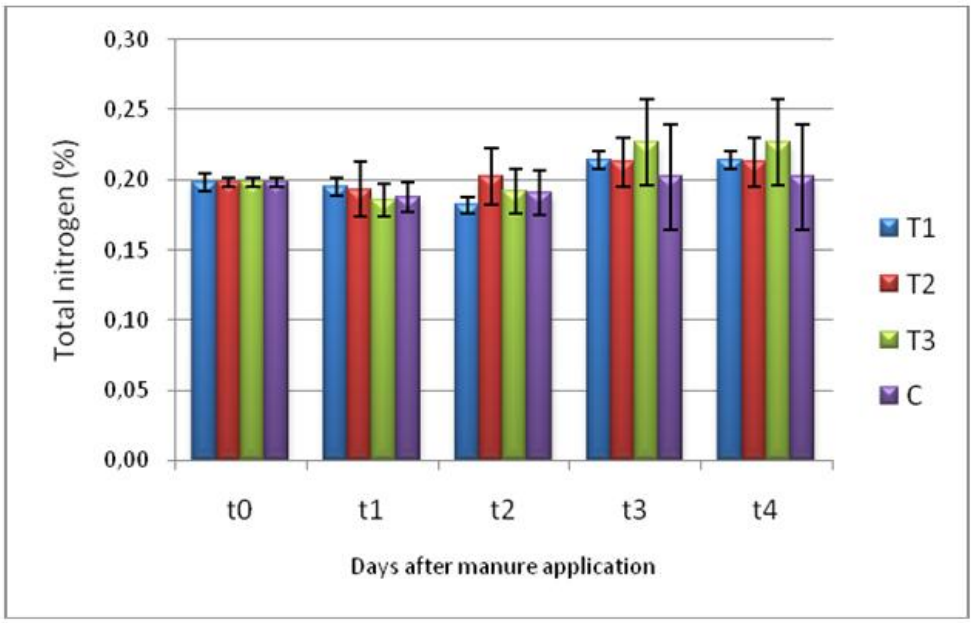


Fig. 4. Effect of chicken manure treatments on soil total nitrogen content at depth of 0-20 cm

3.5 NITRATES (NO3-)

After 5 months of manure application, the nitrates (NO3-) content in the top 20 cm of elementary plots was significantly higher in plots amended at 10 and 15 ton per hectare than those unmanured or manured at 5 ton per hectare (Figure 5). According to reference [19], soil treated with poultry manure registered a higher nitrogen mineralization and nitrification which implies production of mineral nitrogen such as nitrates.

The accumulation of nitrates in the topsoil is significantly different between amended and control plots. These levels have increased by 40% between control and T3, they have spent from 49 to 69 ppm. This indicates that the soils had high potential for nitrification [8].

Other studies have shown that between 15 and 74% organic nitrogen content, in poultry manure, was mineralized between 42 and 120 days after application [4], [20].

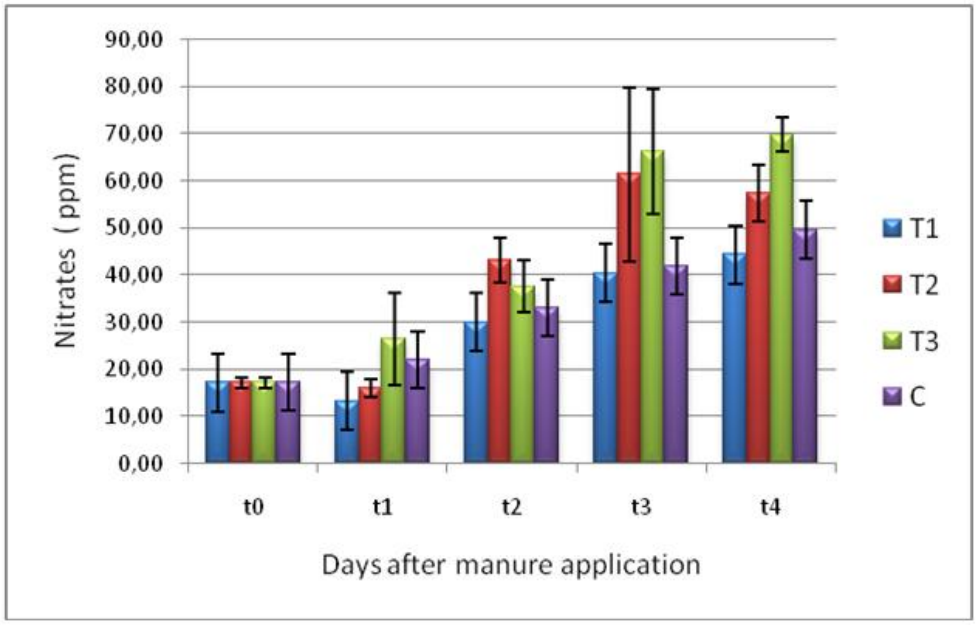


Fig. 5. Effect of chicken manure treatments on soil nitrates content at depth of 0-20 cm

3.6 PHOSPHORUS (P)

Soil available phosphorus (0-20 cm) in amended plots (T2 and T3) was significantly higher than in plots (C and T1). The phosphorus level in the soil has increased from 18 ppm to 36 ppm between control (C) and T2 (Figure 6).

According to reference [21], the application of manure to the soil increases significantly the levels of phosphorus content. Other authors confirm that 15-17% of the phosphorus content is released after 60 days of application [4], [22].

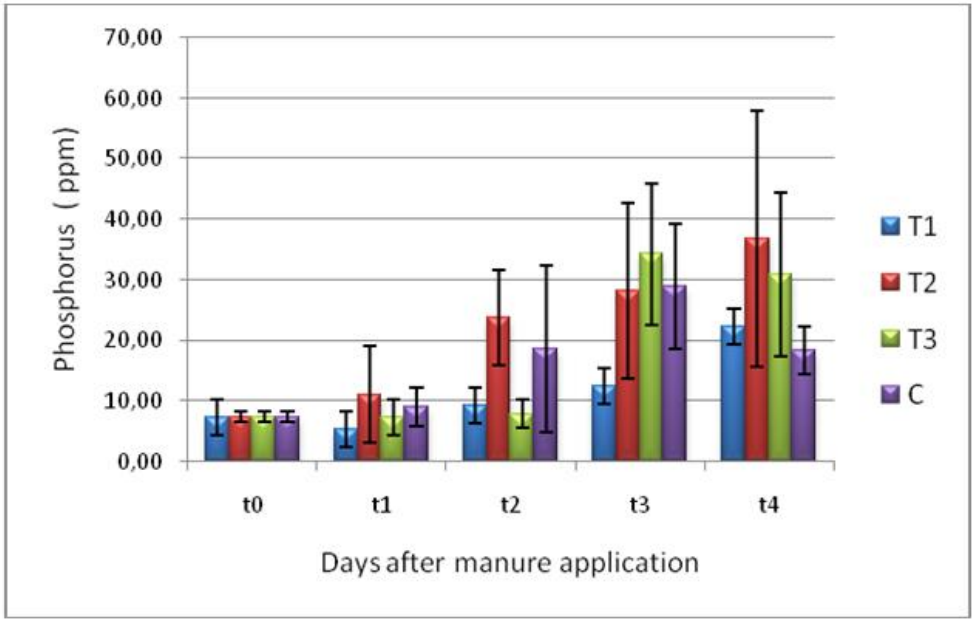


Fig. 6. Effect of chicken manure treatments on soil phosphorus content at depth of 0-20 cm

3.7 POTASSIUM (K)

Soil available K increased with spreading of poultry manure. It should be noted that the levels of K in the control treatment (C) and treatment (T3) have increased from 277 to 350 ppm respectively (Figure 7). The substantial accumulation of potassium in the soil of experiment results from inputs of potassium manures [8].

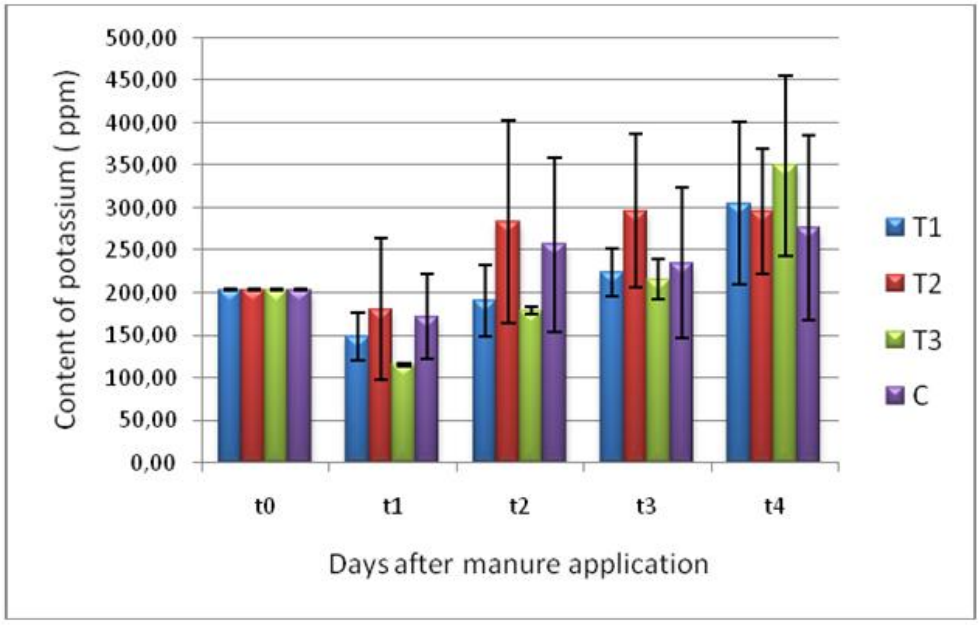


Fig. 7. Effect of chicken manure treatments on soil potassium content at depth of 0-20 cm

3.8 CORN SILAGE PRODUCTION

Maize (Zea mays L.) is one of the most common crops in the world [23]. Application of chicken manure had a significant impact on the production of corn silage. In T3 plots, the production reached 17.8 t/ha while the other treatments recorded productions ranging between 10.7 and 13.4 t/ha (Figure 8).

Among different manures, use of poultry manure (PM) as soil amendment for agricultural crops provides appreciable quantities of all important plant nutrients [24]. The positive yield response to broiler litter is in part due to high N and P contents in this manure. Maize aboveground biomass (AGB) dry weight was significantly greater in fertilized soils with broiler litter than in the control soils [4].

The application of 225 kg N ha−1 resulted in the highest amount of aboveground biomass for silage in arid and semi-arid areas [4]. Silage maize was harvested at physiological maturity in this trial, after which dry matter no longer accumulated and grain humidity changed from 45-50% to 15-25% [23].

Manures are Typically Applied to soil at rates designed to supply a crop's nitrogen requirement. It was mentioned that the increase in corn biomass was associated with increased levels of nitrogen. This latter element is known to be readily available for plant uptake in Poultry manure [25], [26], [27].

Among organic manures, the application of poultry manure can particularly increase the growth and production of maize [26]. The application of manures is a desirable practice for improving plant growth in arid conditions and semi-arid. Application of organic manures result of several environmental benefits such as restoration and maintenance of soil organic matter and increase crop yields [4], [28].

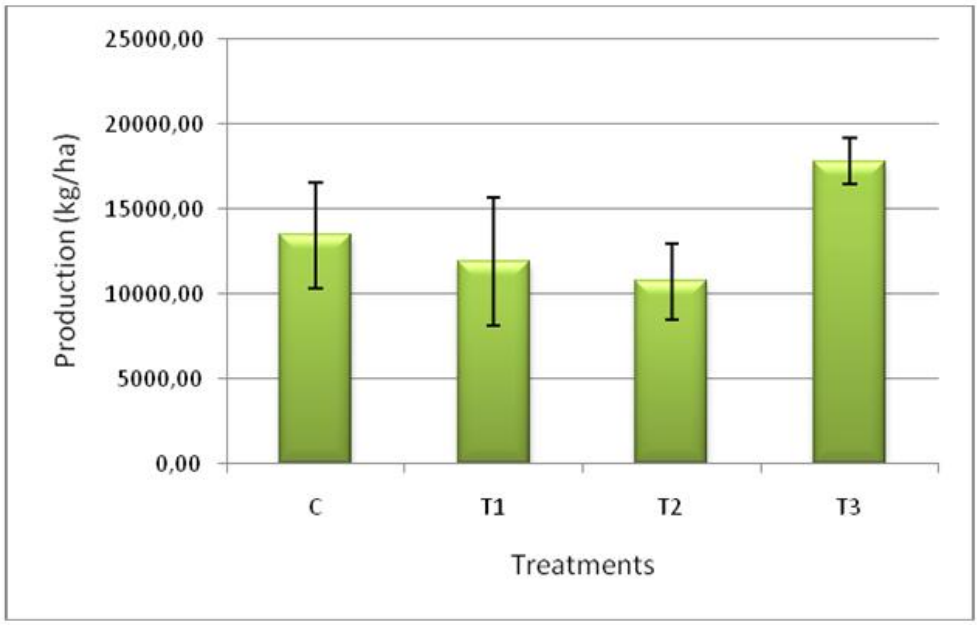


Fig. 8. Total aboveground biomass production of silage maize

4 CONCLUSION

Animal manures have traditionally been applied to soil to maintain levels of soil organic matter, reclaim degraded soils and supply plant nutrients to agricultural soils [29], [30]. Application of organic materials in crop production has been strongly encouraged in many places as a replacement for part or all of the mineral fertilizer [31].

The application of organic manures could be an effective alternative to maintain an adequate input of organic matter [28], [21]). Which improve soil properties, fertility and resistance to water and wind erosion [32], [33].

Chicken manure is a rich source of organic matter and provides large quantities of important nutrients for plant growth. Use of broiler litter resulted in the greatest increased maize and corn yield [4], [34].

The application of organic fertilizers is indeed a desirable practice for ecological restoration of degraded cropland soils and alleviating the constraints to sustainable cropping systems in arid and semi-arid environments [28].

The broiler litter is characterized by good quality carbon and a good amount of nitrogen [4]. The spreading of chicken manure improves several properties of soil such as organic matter, pH, content of nitrogen and other nutrients, and improves agricultural yields compared to the unamended soil.

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تقويم انتشار الفطار الظفري وعلاقة العمر والجنس في حدوث المرض

[EVALUATED ONCHOMYCOSIS DISTRIBUTION INCIDANCE WITH AGE AND GENDER]

حيدر حبيب الغالبي[1] و زيدان خليف عمران[2]

[1]جامعة القادسية /كلية التربية، العراق

[2]جامعة بابل كلية علوم البنات، العراق

Haider Habib Al-Galibi[1] and Zaidan Khlaif Imran[2]

[1]University of Al-qadissia, Iraq

[2]Babylon University, Iraq

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ABSTRACT: Onychomycosis infection is considered as one of the main diseases that most of male and females are severing from this infections, The aim of this study was to survey the fungi contraction with clinical cases undergo Onychomycosis infections, and identification by phenotypic biochemical test, this study was performed from May2010 to May2011., clinical samples of Onychomycosis of at different age groups and sex were collected from Al-Dewania province.

The results showed (88.48%) of patients undergo Onychomycosis and based on Occupations in house wives 41.81%, workers ،19.4% farmers, 13.9%and followed by employments and students respectively, the age groups females were 51.32 % and males were 48.67%.Isolated 30 filamentous fungal species: *Trichophyton rubrum, T. mentagrophytis, Geotrichum capitatum, Aspergillum fumigates, Asp. niger*, *Asp. oryzae, Asp. tamarri*, and 14 isolates of *Candida* :*C. albicans, C. tropicalis, C. kyfer, C. parapsilosis* and *C. krusei* representative. Most fungi showed variable degrees in their susceptibilities to the antifungal agents.

The CHROM agar medium and others tests were facililating the primary diagnosis for most *Candida* isolates.

KEYWORDS: onchomycosis, age, gender.

ملخص: تعد اخماج الفطار الظفري من مشاكل الصحة العامة اذ ان عددا كبيرا من السكان يعانون اخماج الفطار الظفري خلال أي مرحلة من مراحل الحياة، واستهدفت الدراسة مسح وعزل الفطريات من عينات اظافر لمرضى اخماج الفطار الظفري من حالات سريرية وتشخيصها اعتمادا على تقنيات الزرع المختبري على اوساط زرعية وتقيم ضراوة بعض العزلات من خلال تقيم انتاجها للأنزيمات وتشخيص الفطريات الخيطية والخمائر ولتحقيق هدف الدراسة تم جمع 165 عينة أظافر تم الحصول عليها من المرضى المراجعين لاستشارية الإمراض الجلدية التابعة لمستشفى الديوانية العام للفترة من آيار 2010 لغاية آيار 2012 وشخصت العينات بأنها إصابات فطرية للأظافر او انها تبدو كذلك من قبل أخصائي الجلدية. وسجلت البيانات المتعلقة بالجنس والحاله الاجتماعيه والامراض المرافقه للاصابه باخماج الفطار الظفري.

أظهرت نتائج الدراسة أن نسبة عزلات الفطريات بلغت 88.48% أي 165/146 من المرضى الذين يعانون من داء الفطار الظفري والتي شملت الإصابات بالاعفان الجلدية (Dermatophytes fungi) والخمائر (Yeasts) والاعفان الخيطية غير الجلدية(Non-dermatophytes fungi)) والتي تعتبرمن الأعفان المسؤولة بشكل رئيسي عن الإصابة بداء الفطار الظفري ومن اهم الاعفان الجلدية هي *Trichophyton rubrum* إذ بلغت عدد العزلات 14 عزلة وبنسبة تردد 7.40%، أما بالنسبة للنوع الثاني فهو *T. mentagrophytis* وبواقع 12 عزلة وبنسبة تردد 6.34% . اما الاعفان غير الجلدية فقد شملت على 16 جنس وكان أكثرها ترددا جنس .*Aspergillus* sp ومن بين الأنواع النوع *Asp. niger* و *Asp. oryzae* و *Asp. flavus* و*Asp. fumigatus*، و*Asp. tamari* . كما تم عزل وتشخيص

ستة أنواع من الخمائر (Yeasts) والتي تنتمي إلى جنس .*Candida* sp وشملت الأنواع المعزولة كل من *C. albicans* و *C . tropicalis* و *C. parapsilosis* و *C.kyfer* و *C. krusei* وكان أكثرالأنواع تكراراً هو النوع *C. albicans*.
وبشكل عام تعد الإناث هم أكثر عرضة للإصابة بالفطريات المسببة لداء الفطار الظفري من الذكور وبنسبة إصابة بلغت 51.32% وللذكور 48.67%. واستنتجت الدراسة ان للفطريات والخمائر المبيضات دور امراضي مبني على اساس ترددها وما ابدته من معايير الضراوة من انتاجية انزيم البروتيز وتكوين الاغشية الحيوية.

كلمات دلالية: الفطار الظفري، العمر، الجنس، المرض.

المقدمة :

توصف الأظافر عبارة عن زوائد كيراتينية متخصصة وظيفتها حماية أطراف الأصابع والمساهمة في تحسين حاسة اللمس، ومهارة اليد والتقاط الأشياء الصغيرة، ولإكساب الأيدي والأرجل مظهر جمالي(Rich and Scher, 2005).تعد الإصابة بالفطار الظفري (Onychomycosis) واحدة من أكثر الأمراض الجلدية التي تصيب الأظافر بدون غزو الأنسجة الحية (Suhonen *et al,*.1999)، وتحصل الإصابة، إما عن طريق مصادر خارجية (Exogenous) مثل الإصابة بالفطريات الجلدية (Dermatophytes) التي تحصل بواسطة التماس مع المرضى المصابين (Anthropophilic) أو بالحيوانات المصابة بالفطريات (Zoophilic) أو التعرض للقشور والابواغ أو قشطات الأظافر أو أرضيات الحمامات والمغاسل والغرف التي تحوي السبورات المتطايرة (Geophilic), أما المصادر الداخلية (endogenous) كما هو الحال في المبيضات الجلدية والنخالية المبرقشة أو الخمائر التي تعيش بوصفها جزءاً من الفلورا الطبيعية للجلد والأغشية المخاطية للجسم (Hay,2001).

تصاب الأظافر بالعديد من المسببات المرضية من أهمها البكتريا، الفايروسات، الفطريات والخمائر. وتعد الإصابات الفطرية من أكثرها شيوعاً والتي قد تكون إصابات أولية أو ثانوية، ومن أهم المسببات المرضية الفطرية التي تسبب داء الفطار الظفري هي بعض الأنواع التابعة للفطريات الجلدية (Dermatophytes fungi) مثل *Trichophyton rubrum*، *T. mentagrophytes* حيث ازداد انتشار الفطار الظفري في السنوات الأخيرة في كل أنحاء العالم إذ بلغت نسبة الإصابة 10-40% بين سكان العالم والذي يزيد من ذلك هو التقدم في العمر وبعض العوامل المهيئة مثل التاريخ العائلي، داء السكري، مرضى الكبح المناعي ورضوض وصدمات الأصابع (Rich and Scher, 2005).

تهاجم الفطريات الجلدية بكل سهولة كل من الجلد، الشعر والأظافر اعتمادا على الأنزيمات المحللة للكيراتين (Keratinolytic enzymes) ويحدث الغزو حسب نوع الفطر المسبب، ففي حالة المبيضات (*Candida* sp.) مثلاً يحصل ثقب لصفيحة الظفر وتحصل إصابة ثانوية تنتشر الى الأنسجة الرخوة التي تحيط بالأظافر وبعد إصابة منبت الظفر تظهر أخاديد وخطوط وبالتالي تصبح صفيحة الظفر فيما بعد بشكل مقوس وغير منتظم أو خشن و بالنهاية تتهشم وتتحطم (Cohen and scher, 1992).

تفاوتت نتائج انتشار الفطار الظفري في المجتمعات، إذ تقدر بـ 2-3% وقد تصل الى 13% في بعض المجتمعات الغربية (Elewski and Charif, 1997). كما ذكرت دراسة أمريكية بان نسبة انتشار هذا المرض في أمريكا بلغت تقريباً 14% بين عامة السكان(Sobera and Elewski, 2005).

اما بالنسبة للخمائر فقد كانت أكثر تردداً في كل من اسبانيا (Velez *et al.,* 1997)، ايطاليا (Suhonen *et al.,* 1999)، والأمارات العربية المتحدة (Nsaze *et al.,* 1995). اما الاعفان غير الجلدية فقد ذكرت العديد من الدراسات التي أجريت في عدة بلدان على أنها قد تسبب الفطار الظفري، ومن هذه البلدان هي استراليا (Ellis *et al.,* 1997)، ايطاليا (Piraccini and, Tosti, 2004)، وبريطانيا(Botek, 2003) وغيرها.

لا يؤثر داء الفطار الظفري على جميع المجاميع العمرية بالتساوي ولكنه يزداد مع تقدم العمر ففي دراسة أجريت في الولايات المتحدة لوحظ بان فرصة الإصابة بداء الفطار الظفري تزداد مع تقدم العمر(Gupta and scher, 2000). كما اظهر دراسة مسحية أجريت في أوربا وشرق آسيا بأن هناك أكثر من 50% من المرضى ممن كانت أعمارهم 65 سنة أو اكبر والذين يعانون من أمراض الأقدام هم مصابين بالفطار الظفري (Haneke & Roseeuw, 1999). كما ان احتمالات الإصابة بهذا المرض بين الأفراد في سن 50 سنة فأكثر هي أعلى بـ 2.71 مرة من الفئات العمرية الشابة (Sigurgeirsson & Steingrimsson, 2004).

اما الجنس فله تأثير في تعجيل حدوث الإصابة بالفطار الظفري فقد اظهرت النتائج بان الرجال أكثر عرضة للإصابة بالفطار الظفري من النساء فقد أوضحت دراسة Effendy *et al.* (2005) بأن 45.2% من المرضى كانوا من الرجال من خلال إجراء مسح لحوالي 44972 مصاب بالفطار الظفري من 16 بلد مختلف، إلا أن دراسة أخرى أشارت إلى أن انتشار المرض بين النساء كان بنسبة 1.8% مقارنة بالرجال إذ بلغ 0.8% (Jain and Sehgal, 2000). كما لوحظ من خلال الدراسة التي قام بها(2004) Alvarez *et al.,* في كولومبيا على 299 حالة مرضية وجد ان 183 منهم مصاب بداء الفطار الظفري، وقد كانت النساء أكثر عرضة للإصابة بهذا المرض من الرجال، فمن بين 183 إصابة وجد أن 141 حالة إصابة كانت في أصابع القدم 97 منها في النساء و 44 في الرجال، في حين 38 إصابة كانت في أصابع اليد 29 منها في النساء و9 منها في الرجال، وأربع حالات كانت في كل من أصابع القدم واليد وجميعها في النساء, وقد كانت أعلى نسبة إصابة بداء الفطار الظفري بفعل الخمائر بنسبة 40.7% من المسببات الفطرية، الفطريات الجلدية بنسبة 38%، والفطريات الخيطية غير الجلدية بنسبة 14% و7.3% منها كانت إصابات مختلطة، ومن بين أهم الخمائر المسببة كانت *C. albicans*، اما الفطريات الجلدية فكانت *T. rubrum*، والاعفان الخيطية غير الجلدية هي *Fusarium* و *Scytalidium dimidaiatum*.

المـــواد وطرائق العمل MATERIEL AND METHODS

1- زرع العينات (Culture of samples)

بعد إجراء الفحص المجهري المباشر أخذت العينة المتبقية وقسمت أيضا إلى جزأين زرع الأول على طبق بتري يحتوي على وسط السابرويد دكستروز أكار (SDA) وزرع الجزء الثاني على وسط سابرويد دكستروز أكار المضاف إليه السايكلوهكسمايد والكلورامفنيكول، ثم حضنت الإطباق بدرجة 30م° لمدة7-14 يوماً وكانت تفحص باستمرار لملاحظة النمو, وعدت النماذج غير النامية سالبة بعد أسبوعين من الحضن (Odds, 1991).

2- الفحص المظهري للمستعمرات (Morphological Examination of colonies)

يعد من الفحوصات الأساسية في التفريق بين أنواع الفطريات، أولى الملاحظات التي سجلت هي عدد الأيام التي استغرقها الفطر لظهور أول نمو، كما تم فحص المظهر الأمامي للمستعمرات أن كان مسطحا (Flat) أو بشكل القبة(comb) أو حاوياً على أخاديد أو لا، وتم تسجيل لون المستعمرات من المنظر الأمامي ولونها من الجهة المعاكسة على أساس الصبغات التي تنتجها، كما لوحظت نسجة المستعمرات كونها دقيقية المظهر (Powdery) أو قطنية أو صوفية (cottony or wooly) أو زغبية (Mildew).

3-الفحص المجهري للمستعمرات (Microscopic Examination of colonies)

تم التحري عن الصفات المجهرية للفطريات المعزولة من حيث صفات الخيوط الفطرية وإنتاجها للوحدات التكاثرية اللاجنسية والجنسية، ودراسة صفات الكونيدات من حيث أنواعها وأشكالها وعددها وسمك الجدار فيها وطريقة ترتيبها على الخيوط الفطرية وكذلك ملاحظة تكون الابواغ الكلاميدية (Chlamydospores) والابواغ المفصلية (Arthrospores)، وتم أنجاز الفحص المجهري من خلال تحضير الشرائح الزجاجية على النحو الآتي:

أ- بصمة الفطر في المستعمرة بالشريط الشفاف Adhesive Tape preparation:

استخدم شريط لاصق شفاف تم ملامسته مع سطح المستعمرات الفطرية، ثم لصق الشريط على شريحة زجاجية تحتوي قطرة من صبغة القطن الزرقاء مع اللاكتوفينول.

ب- أخذ جزء من المستعمرة الفطرية معه جزء من الوسط الزرعي الذي تنمو عليه بواسطة إبرة تلقيح معقمة ووضعه على شريحة زجاجية تحتوي قطرة من صبغة القطن الزرقاء مع اللاكتوفينول ثم وضع غطيت بغطاء الشريحة.

ج- فحصت الشرائح تحت القوة الصغرى (10X) أولاً ثم تحت القوة الكبرى (40X) و (100X).

تم تشخيص الفطريات بالاعتماد على الخصائص المجهرية والصفات المظهرية للأبواغ والمستعمرات على الوسط الغذائي واعتماداً على المصادر الآتية (Ellis *et al.,* 1997; Simpanya, 2000)

4- اختبارات تشخيص الخمائر (Tests of Yeasts Identification)

4-1: تكوين الأنبوب الجرثومي (**Germ tube formation**):

اجري هذا الاختبار بتلقيح أنابيب اختبار حاوية على 0.5 مل مصل دم الإنسان بجزء صغير من مستعمرة المبيضات، حضنت الأنابيب في الحاضنة بدرجة 37م° لمدة 4 ساعة، أخذت قطرة من العالق ووضعت على شريحة زجاجية وفحصت بالمجهر لملاحظة تكوين أنبوب الإنبات (Odds, 1988).

4-2: تكوين الابواغ المندثرة **(Chlamydospores formation)**:

يعد هذا الاختبار من الصفات التشخيصية المميزة للمبيضات حيث لقح وسط خلاصة الذرة (Corn meal agar) بطريقة التخطيط، ثم حضنت الإطباق بدرجة 37 م° لمدة 48 ساعة، بعدها اخذت لقاحة من المستعمرة وعلقت في قطرة من صبغة اللاكتوفينول ازرق القطن على شريحة زجاجية وفحصت بأستخدام المجهر الضوئي لملاحظة الابواغ البلاستولية (Blastospores)، والكلاميدية (Chlamydospores) فضلا عن الخيوط الفطرية الكاذبة (Konemam and Robert, 1985).

4-3: النمو على وسط الكرومو اكار (**Chromoagar medium**)

تم في هذا الاختبار اخذ جزء من مستعمرة الخميرة النامية على وسط SDA لمدة 24 ساعة وزرعت على وسط الكرومو اكار وحضنت لمدة (24-48) ساعة بدرجة 37°م ، استخدم هذا الوسط في تشخيص المبيضات اعتماداً على التغاير في الألوان وفقا لـ Horvath *et al.* (2003) كالأتي:

اللون	العزلة
اللون الأخضر الفاتح	*C. albicans*
اللون الأزرق المعدني	*C. tropicalis*
اللون الأبيض	*C. parapsilosis*
اللون ارجواني او الوردي	*C. kruse,C.gabratai*

5- التحليل الإحصائي

استعمل التصميم في التجارب المختبرية، وحللت النتائج باستخدام مربع كاي(X^2 square) وقورنت المتوسطات الحسابية باختبار اقل فرق معنوي Least Significant Difference(LSD) تحت مستوى معنوي 0.05(الراوي وخلف الله،1980).

النتائج والمناقشة RESULTS AND DISCUSSION

1- عينات الأظافر المفحوصة خلال مدة الدراسة:

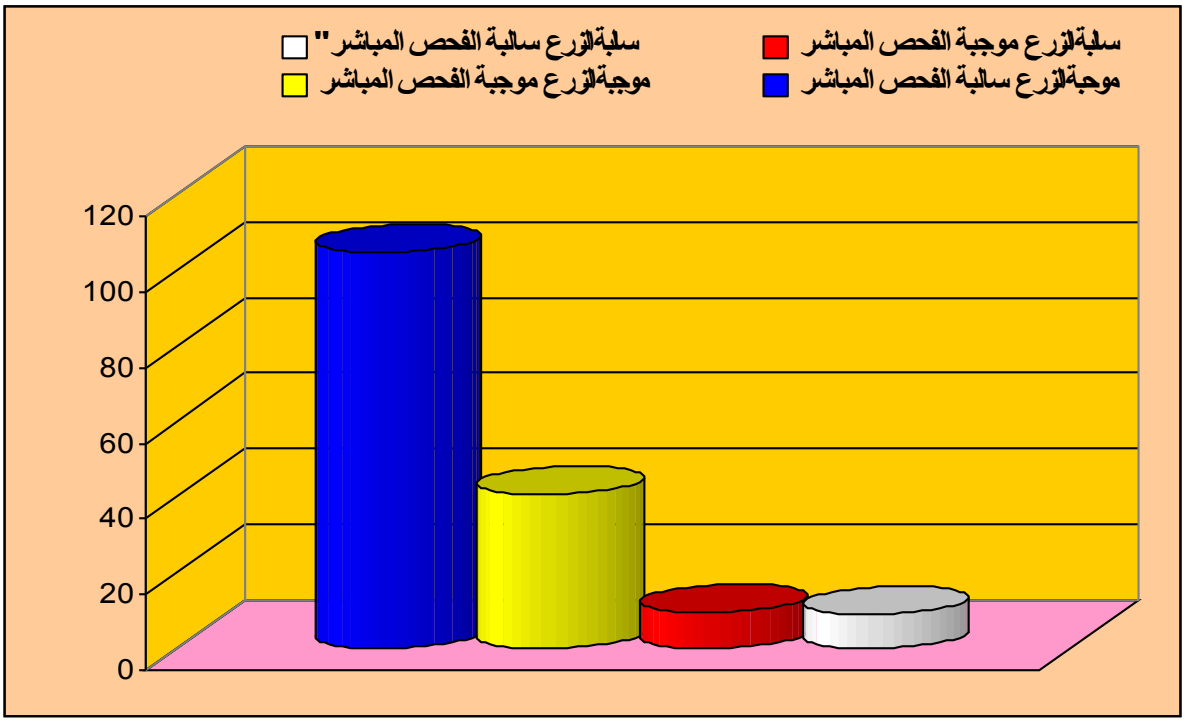
جمعت خلال هذه الدراسة 165 عينة أظافر تم الحصول عليها من المرضى المراجعين لاستشارية الإمراض الجلدية التابعة لمستشفى الديوانية العام والتي شخصت على إنها إصابات فطرية للأظافر او انها تبدو كذلك من قبل أخصائي الجلدية للفترة من آيار 2010 ولغاية آيار 2012 شكل(1). وقد أظهر الفحص المجهري المباشر بأن 51 عينة سريرية لعينات الأظافر باستخدام هيدروكسيد البوتاسيوم بتركيز 10% (KOH) شخصت على أنها مصابة بداء الفطار الظفري من المجموع الكلي كانت موجبة للفحص وبنسبة بلغت 30.90% (51/ 165)، في حين بلغت العينات الموجبة في الزرع المختبري 146 عينة من المجموع الكلي والبالغ 165 عينة وبنسبة بلغت 88.48% ، فيما بلغت العينات التي كانت موجبة للفحص المجهري المباشر وسالبة للزرع المختبري 10 عينات وبنسبة بلغت 6.06%، وقد وجد أن عدد العينات التي كانت موجبة للزرع المختبري وسالبة للفحص هي 105 عينة وبنسبة بلغت 63.63%، أما بالنسبة للعينات التي كانت سالبة للفحص المجهري المباشر وسالبة للزرع المختبري كانت 9 عينة وبنسبة بلغت 5.45% الجدول (1) شكل (2). وقد جاءت هذه النتيجة متوافقة مع نتائج دراسة Ibrahim (2006) والتي أشارت إلى ان 24 حالة من أصل 100 حالة إصابة كانت موجبة للفحص المجهري المباشر وبنسبة بلغت 24%، وبلغت الحالات الموجبة للزرع 89 حالة من أصل 100 حالة إصابة وبنسبة بلغت 89%، فيما بلغت عدد الحالات الموجبة للفحص المجهري المباشر وسالبة للزرع 5 حالات وبنسبة 20%، وكانت عدد الحالات الموجبة للزرع والسالبة للفحص المجهري 70 حالة وبنسبة 70%، وكانت 6 من الحالات سالبة للكلا الفحصين. وقد وجد Zaini *et al.* (2009) بان من بين 549 عينة ان 263 حالة من أصل 549 حالة إصابة كانت موجبة للفحص المجهري المباشر وبنسبة بلغت 47.9% وبلغت الحالات الموجبة للزرع 230 حالة من أصل 549 حالة إصابة وبنسبة بلغت 41.9%، فيما بلغت عدد الحالات الموجبة للفحص المجهري المباشر وسالبة للزرع 33 حالات وبنسبة 6.01%، وكانت عدد الحالات الموجبة للزرع والسالبة للفحص المجهري 0 حالة وبنسبة 0%، وكانت 286 من الحالات سالبة للكلا الفحصين وبنسبة بلغت 52.1%. كما ذكر Nada *et al*., (2005) ان من بين 54 عينة أظافر وجد بان 36 منها موجبة للفحص المجهري المباشر وبنسبة 66.7%، بينما اظهر 18 عينة نتيجة سالبة للفحص وبنسبة 33.3%، وقد بلغ عدد العينات الموجبة للفحص المجهري المباشر والموجبة للزرع المختبري 25 عينة وبنسبة 46.29 % وبلغت العينات الموجبة للفحص المباشر والسالبة للزرع المختبري 11 عينة فقط بنسبة 20.37%، أما بالنسبة للعينات السالبة للفحص المجهري المباشر والموجبة للزرع المختبري فقد بلغت 4 حالات فقط وبنسبة بلغت 7.40%، وكانت نتائج العينات السالبة للفحص المجهري المباشر والسالبة للزرع المختبري 14 عينة من أصل 54 عينة والنسبة بلغت 25.92%. وتعزى النتائج السالبة سواء بالفحص المجهري المباشر أو بالرزع المختبري إلى احتمالية تعاطي المرضى للمضادات الفطرية بشكل غير صحيح أو متقطع مما أدى إلى اكتساب المريض مرحلة الشفاء من الفطريات أو ما يسمى طبياً (Mycological cure)، او من الممكن أن يكون المسبب للإصابة غير فطري (Milne, 1996). أو أن يكون حجم العينة المأخوذة قليلة، إذ وجد بان 30% من العينات المأخوذة تكون سالبة للفحص المجهري المباشر وللزرع المختبري (Scher and Baran, 2003). وقد أكدت الدراسات بأن حساسية الفحص المجهري المباشر هي 86.2% في حين تبلغ خصوصية هذا الفحص 56%. وقد ذكر Nada *et al*., (2005) إن الفحص المجهري المباشر قد يكون سالباً في الكثير من عينات الأظافر، في بعض الحالات التي تكون فيها العينات موجبة للفحص المجهري المباشر قد تعطي نتائج سالبة في الزرع المختبري. والسبب في هذا التناقض بان البقايا الفطرية في العينة قد تكون غير حية وبالتالي فإنها قد لا تنمو على الوسط الزرعي على الرغم من وجود بقايا المسبب.

الجدول (1):نتائج الفحص الروتيني للعينات الفطار الظفري بطريقة الفحص المباشر والزرع على الأوساط الزرعية.

العينات		الزرع المختبري		العدد الكلي
		الموجبة	السالبة	
الفحص المباشر	الموجبة	41 (%24.84)	10 (%6.06)	51 (%30.90)
	السالبة	105 (%63.63)	9 (%5.45)	114 (%69.09)
	العدد الكلي	146 (%88.48)	19 (%11.51)	165 (%100)



الشكل (1):نماذج من الفحص للعينات السريرية للفطار الظفري.



2- معدلات انتشار مسببات الفطار الظفري

تم عزل وتشخيص 39 نوعاً من الاعفان والخمائر التي تنتمي إلى 20 جنسا فطريا عزلت من عينات الأظافر،والتي شملت الإصابات بالاعفان الجلدية (Dermatophytes fungi) والخمائر (Yeasts) والاعفان الخيطية غير الجلدية (Non-dermatophytes fungi) الجدول(2).

واظهرت نتائج الدراسة الحالية عزل وتشخيص نوعين من الأعفان الجلدية والتي تعتبر من الأعفان المسؤولة بشكل رئيسي عن الإصابة بداء الفطار الظفري وهي *Trichophyton rubrum* إذ بلغت عدد العزلات 14 عزلة وبنسبة تردد 7.40%، أما بالنسبة للنوع الثاني فهو *T. mentagrophytis* وبواقع 12 عزلة وبنسبة تردد 6.34% .

وكان الفطر *T. rubrum* أكثر ترددا من النوع الثاني وقد أشارت العديد من الدراسات أن *T. rubrum* من أكثر الاعفان الجلدية التي تسبب داء الفطار الظفري انتشاراً (Vinod *et al.*, 2000)، ويعزى السبب الى القابلية العالية لهذا الفطر على إصابة الظفر بسبب قدرته على استهلاك الكيراتين الصلب كمصدر للكاربون والنتروجين والتي تعد من المواد البروتينية غير القابلة للذوبان في الماء والتي تتوفر بكثرة في الشعر والجلد والأظافر بسبب امتلاكه للعديد من عوامل الضراوة المتمثلة بالفعالية الأنزيمية المحللة للبروتين والكيراتين (Kunert, 2000).

وجاءت نتائج هذه الدراسة مطابقة لنتائج العديد من الدراسات التي أجريت في هذا المجال ومنها دراسة Gerami shoar *et al.*, (2002) والتي عزل فيها النوعين *T. rubrum* بنسبة تردد بلغت1% و *T. mentagrophytis* بنسبة تردد بلغت 8.3% . ودراسة Zaini *et al.*, (2009) التي عزلت فيها كلا النوعين أيضاً *T. rubrum* (4.94%) و *T. mentagrophytis* (10.26%). وفي دراسة قام بها Mashkoor *et al.*, (2010) في مصر تم عزل الأنواع من الاعفان الجلدية التي تسبب داء الفطار الظفري ومنها *T. rubrum* بنسبة تردد بلغت44.44%و *T. mentagrophytis* بنسبة تردد 25% ، *T. tonsurans* بنسبة 4.16% و *T. schoenleinii* بنسبة1%.

تم خلال هذه الدراسة عزل وتشخيص ستة أنواع من الخمائر (Yeasts) والتي تنتمي إلى جنسين هو شكل جنس *Candida* sp. وشملت الأنواع المعزولة منه كل من *C. albicans* و *C . tropicalis* و *C. parapsilosis* و *C. dubliniensis* و *C. krusei* و *C. krusei* وبنسب بلغت(12.69%، 6.34%، 4.23%، 2.11%و1.58%) على التوالي، وكان أكثر الأنواع تكراراً هو النوع *C. albicans* بينما احتل النوعين *C. kyfer* و *C. fomata* اقل نسبة تردد بلغت 1.05% لكل منهما الجدول (2). ويعزى السبب في انتشار هذه الخميرة لتواجدها بشكل طبيعي في اوعلى جسم الإنسان وبالتالي فهي متكيفة لدرجة حرارة الجسم وكونها انتهازية السلوك، كما تمتاز بقابليتها على التحول إلى ممرضة عند حدوث اي نوع من الاجهاد في الجسم مثل داء السكري أو بسبب التعاطي الواسع للمضادات الحياتية (Vincent *et al.*, 1998). وتعد الـ *C. albicans* واحدة من أكثر أنواع *Candida* خطورة وذلك لامتلاكها العديد من عوامل الخطر المتمثلة بتكوين أنبوب الإنبات و القابلية على الالتصاق والقابلية على التحول من شكل الخميرة المفردة إلى الشكل الخيطي وامتلاكها الإنزيمات المحللة (Calderone & Fonzi, 2001).

جاءت هذه النتائج مطابقة الى حد ما مع نتائج دراسة Nada *et al.*, (2005) والتي أظهرت بان المبيضات من أهم المسببات المرضية المسؤولة عن داء الفطار الظفري في الوقت الحاضر، وان *C. albicans* كانت مسؤولة عن نسبة عالية من هذا المرض وبنسبة وصلت إلى72.4%، وتلاها في المرتبة الثانية النوع *C. parapsilosis*وبنسبة بلغت 20.7% و *C. guilliermondii* بنسبة بلغت 6.9%. وقد أكدت دراسة Asadi *et al.*, (2009) بان من أهم المسببات لداء الفطار الظفري هي *C. albicans* إذ بلغت عدد العزلات لهذا النوع 7 عزلات من المجموع الكلي البالغ 26 وبنسبة بلغت 26.9%، كما تم عزل 4 أنواع أخرى تابعة لنفس الجنس وبنسبة بلغت 15% . اما بالنسبة لبقية الأنواع من غير المبيضات البيضاء، فقد أظهرت الدراسات بان*C. parapsilosis*، *C. krusei* و *C. guillermondii*من أكثر الأنواع تكراراً والتي تسبب هذا الداء .(Odds, 1988)

أما الجنس الثاني من الخمائر فهو *Geotrichum* والذي ضم نوعاً واحداً هو *G. candidum* بواقع 3 عزلات وبنسبة بلغت 1.58% من المجموع الكلي للعزلات الجدول (2). هذه النتائج تتفق مع نتائج دراسة Bassiri-Jahromi and Khaksar (2010) والتي عزل فيها خميرة *Geotrichum* spp. وبنسبة بلغت 4.2%. وتتفق مع نتائج(2008) Negroni *et al.,* في دراسته التي أجريت في الأرجنتين، إذ عزل عزلة واحدة من *G. candidum* من عينات الأظافر، وعلى الرغم من ان *Geotrichum* لا تعد من المسببات المرضية فهو يعد من الملوثات للمنتجات الألبان ويتواجد أيضاً في القناة الهضمية والتي تكون بتماس مع أظافر أصابع اليد إلا إنها ممكن ان تتحول إلى ممرضة في حالة الإصابة ببعض الأمراض الخبيثة في الدم وإلى المرضى الذين يتعاطون العلاجات الكابحة للمناعة (Garbino, *et al*., 2002) . فقد ذكر Pottier *et al*., (2008) بان هذه الخميرة تمتلك القابلية للإصابة الجلد والأظافر.

أما بخصوص الاعفان الخيطية غير الجلدية (Non-dermatophytes fungi) فقد كانت من أكثر الفطريات المعزولة تردداً في هذه الدراسة وقد شملت على 16 جنس وكان أكثرها تردداً جنس *Aspergillus* sp. ومن بين أكثر الأنواع تردداً كان النوع *Asp. niger* وبنسبة 14.83%، واقلها تردداً النوع *Asp. oryzae* بنسبة 0.47%، أما بالنسبة للأنواع الأخرى*Asp. flavus* و*Asp. fumigatus*، *Asp. nidulans* و*Asp. terreus* و*Asp. tamarri* و *Asp. egyptiacus* و *Asp. candidus*و *Asp. parasiticus* ، فقد بلغت نسب التردد لها3.82% و 3.34%و 1.91% و 1.91% و 1.43% و 2.39% و 2.87% و 0.95% على التوالي. ويفسر تردد هذه الاعفان على اساس تواجدها في التربة بشكل واسع كمترممات على بقايا النباتات أو مسببات مرضية للنبات، وهي قد تشابه الاعفان الجلدية من حيث قابليتها على تحليل الكيراتين أو نتيجة حدوث الصدمات أو الأمراض الأخرى للأظافر مثل الصدفية، لهذه الأسباب تعد هذه الفطريات مسببات مرضية ثانوية (El Batawi *et al*., 2006). أن السبب في الاختلافات في انتشار الاعفان الخيطية غير الجلدية هو قد يعود إلى الاختلافات الجغرافية في توزيع الاعفان أو في اختلاف المعايير المستخدمة في تشخيص الاعفان المسببة للفطار الظفري أو ربما استعمال الطرق غير الملائمة لتنمية الاعفان (Kenna and Elewski 1996).ان هذه النتائج متوافقة مع نتائج Hilmiog *et al*., (2005) في الدراسة التي أجريت في تركيا كل من*Asp. niger* (22%)، *Asp. flavus* (3%)، *Asp. fumigatus* و *Asp. terreus* (3%).

وجاءت هذه النتائج مطابقة لما ذكره Negroni (2010) بان الأعفان الخيطية غير الجلدية وخصوصاً *Aspergillus* sp. مسؤولة عن إحداث داء الفطار الظفري، كما ذكر بأنه عزل العديد من الأنواع التابعة لجنس الـ *Aspergillus* sp. مثل *Asp. fumigatus* و *Asp. flavus* و *Asp. terreus* و *Asp. nidulans*و *sclerotiorum* ووتوافقت النتائج مع العديد من الباحثين الذين ذكروا بان *جنس Aspergillus* sp. يعد من أكثر المسببات لداء الفطار الظفري، إذ تشكل7-100% من الحالات(Moreno and Arenas, 2010) . وهو من الأجناس التي لها دور متزايد في إحداث الإصابة بداء الفطار الظفري ومن أهم الأنواع التي تسبب هذا المرض هي *Asp. niger* و *Asp. flavus* و *Asp. terreus* و *Asp. nidulans* و *Asp. fumigatus*و *Asp. versicolor* (Chadeganipour *et al.,* 2010).

ومع دراسة Asadi *et al.*, (2009) عزل نوعين من الاعفان التابعة لجنس *Aspergillus* في الدراسة التي أجريت في إيران وهي *Aspergillus flavus* و *Asp. fumigatus* بنسبة بلغت 7.7% لكلا النوعين. وكذلك مع دراسة Gerami shoar *et al.,* (2002) والتي أجريت في إيران أيضاً إذ عزل نوعين وهما *Aspergillus flavus* بنسبة 2.9% و *Aspergillus niger* بنسبة 1.5%. ومن الدراسات الحديثة التي تؤكد الدور الكبير لهذا الجنس على إحداث الإصابة بداء الفطار الظفري هي دراسة Zotti *et al.,* (2011) إذ أشاروا إلى قدرة جنس *Aspergillus* على استعمار أنسجة الإنسان، كما أنهم وصفوا فطر *Asp. nomius* كمسبب لداء الفطار الظفري .

وفيما يخص أعفان *Paecilomyces* sp. و *Curvularia lanuta* و *Acremonium* sp.، *Scopulariopsis brevicaulis* و *Fusarium oxysporum* و *F. solani*، فقد بلغت نسب التردد لهذه الفطريات 0.47%، 2.39% ، 1.43%، 0.47%، 1.91% و 0.47%، على التوالي .تعد هذه الاعفان من أهم المسببات المرضية لداء الفطار الظفري وجاءت النتائج مطابقة مع Hilmioglu-Polat *et al.*, (2005) في الدراسة التي أجريت في تركيا، إذ عزل كل من (18%) *Acremonium* spp.، *Fusarium* spp. (18%)، *Cladosporium* sp. (3%) ، *Paecilomyces* sp. (3%) و *Scopulariopsis* sp. (3%).

وتوافقت نتائج هذه الدراسة مع كل من Gupta *et al.,* (2007) الذي عزل في دراسة أجريت في الهند عدة أنواع من الاعفان الخيطية غير الجلدية منها *Aspergillus* sp. (6.1%)، *Acremonium* sp. (4.1%)، وكل من *Curvularia* sp. ، *Fusarium* sp.، *Scopulariopsis* sp. و *Penicillium marneffei* بنسبة بلغت (2.1%). ومع Efuntoye *et al.*, (2011) في دراسة عن الفطريات المسببة لداء الفطار الظفري بين العوائل الريفية في نيجريا تم عزل العديد من الأنواع الاعفان الخيطية غير الجلدية ومن ضمنها(10.4%) *Fusarium oxysporum* ، *F. solani* (3.8%)، *F. moniliforme* (17.9%).

أما بالنسبة لبقية الأجناس التابعة للأعفان الخيطية غير الجلدية فقد تراوحت في نسب عزلها، فقد بلغت نسبة التردد للأعفان *P. notatum* و *Rhizopus stolenifer* و *Ulocladium alternata* 3.34% لكل منهما، فيما سجلت الأنواع *Cladosporium cladosporioids* و *Cladosporium* sp نسب تردد بلغت 1.43% و0.47% ، على التوالي، فيما تساوت نسبة التردد للاعفان *Cephaosporium* sp. و*Humicola* sp. و*Tritirachium* sp. و *Nigrospora* sp.، إذ بلغت 0.95% لكل منها. فيما كانت نسبة التردد لـ *Bipolaris hawaiiensis* هي1.91%. وبخصوص الأنواع *Alternaria longipes* و *Alt. alternata* و *Alt. triticina* فقد كانت نسب التردد لهذه الاعفان 0.47% ، 0.95% و0.47%، على التوالي (جدول 2).

وقد جاءت نتائج هذه الدراسة متوافقة نوعا ما مع نتائج الدراسة التي قام به El Batawi *et al.*, (2006) في مصر، إذ تم عزل أربعة عزلات من *P. notatum* بنسبة عزل بلغت 12.5 % و عزلة واحدة من *Alt. alternata* بنسبة بلغت 3.13% فضلاً عن عزله لبعض الأنواع التابعة لجنس *Aspergillus* .

الجدول (2) : أنواع الاعفان و الخمائر المعزولة من أظافر المرضى المصابين بداء الفطار الظفري.

ت	الفطريات المعزولة	التردد	النسبة المئوية
1	*Candida albicans*	24	%12.69
2	*C . tropicalis*	12	%6.34
3	*C. parapsilosis*	8	%4.23
4	*C. dubliniensis*	4	%2.11
5	*C. krusei*	3	%1.58
6	*C. kyfer*	2	%1.05
7	*C. famata*	2	%1.05
8	*Candida* spp.	3	%1.58
9	*Geotrichum candidum*	3	%1.58
10	*Asp. niger*	21	%11.11
11	*Asp. flavus*	8	%4.23
12	*Asp. fumigatus*	7	%3.70
13	*Asp. nidulans*	4	%2.11
14	*Asp. terreus*	4	%2.11
15	*Asp. tamarri*	3	%1.58
16	*Asp. egyptiacus*	5	%2.64
17	*Asp. candidus*	6	%3.17
18	*Asp. oryzae*	1	%0.53
19	*Asp. parasiticus*	2	%1.05
20	*P. notatum*	4	%2.11
21	*Trichophyton rubrum*	14	%7.40
22	*T. mentagrophytis*	12	%6.34
23	*Cladosporium cladosporioids*	3	%1.58
24	*Cladosporium oxysporum*	1	%0.53
25	*Bipolaris hawaiiensis*	4	%2.11
26	*Paecilomyces* sp.	1	%0.53
27	*Fusarium oxysporum*	4	%2.11
28	*Fusarium chlamydosporum*	1	%0.53
29	*Humicola* sp.	2	%1.05
30	*Alternaria longipes*	1	%0.53
31	*Alt.alternata*	2	%1.05
32	*Alt. triticina*	1	%0.53
33	*Curvularia lunata*	3	%1.58
34	*Tritirachium* sp.	2	%1.05
35	*Nigrospora* sp.	1	%0.53
36	*Rhizopus stolenifer*	4	%2.11
37	*Acremonium* sp.	4	%2.11
38	*Scopulariopsis brevicaulis*	1	%0.53
39	*Ulocladium alternata*	2	%1.05
	Total	189	%100

3- علاقة الجنس في توزيع الإصابة بداء الفطار الظفري.

أظهرت نتائج التحليل الإحصائي لهذه الدراسة بان هناك فروق معنوية عالية جداً ($P\leq0.05$) بين نوع المسبب المرضي (خمائر، أعفان جلدية وأعفان خيطية غير جلدية) والجنس تحت مستوى احتمال 0.05، أي توجد هنالك علاقة بين نوع المسبب المرضي والجنس. وقد أوضحت النتائج وبشكل عام ان الإناث هم أكثر عرضة لإصابة بالفطريات المسببة لداء الفطار الظفري من الذكور وبنسبة إصابة بلغت 51.32% وللذكور 48.67% الجدول(4-3) وبالرغم من ان العديد من المصادر أشارت إلى ان داء الفطار الظفري هو أكثر شيوعاً في الذكور منه في الإناث (Sigurgeirsson & Steingrimsson, 2004; Neupane *et al.*, 2009)، إلا إن الدراسات الحديثة تؤكد ارتفاع معدلات الإصابة بين الإناث أكثر من الرجال ومنها دراسة Gerami shoar *et al.*, (2002) حيث لوحظ بان أكثر الإصابات كانت بين النساء. كما أشارت دراسة برازيلية إلى ان داء الفطار الظفري كان أكثر انتشاراً بين الإناث منه بين الذكور وبنسبة 72.25% Souza *et al.*, 2010). كما أكدت دراسة في اندونسيا أجريت من قبل Bramono and Budimulja (2005) ان الإناث أكثر عرضة لإصابة من الذكور إذ بلغت نسبة الإصابة لدى الإناث 67.14% مقارنة مع الذكور 32.85%.

وربما يعزى سبب ارتفاع الإصابة بداء الفطار الظفري بين الإناث مقارنة بالذكور إلى حقيقة كون هذه المرض يعد من المشاكل الجمالية التي قد تؤثر على المظهر وبالتالي تتطلب هذه الحالة المراجعة لغرض تلقي العلاج وبكثرة من قبل النساء(Neupane *et al*., 2009).

كما أوضحت نتائج الدراسة الحالية بان الذكور أكثر عرضة إصابة بالاعفان الخيطية غير الجلدية بنسبة بلغت 34.39% مقارنة مع الإناث والتي بلغت نسبة 19.54%. وكذلك الحال بالنسبة للاعفان الجلدية فقد كانت أكثر إصابة للذكور مقارنة مع الإناث، إذ بلغت نسبتهما 10.05% و 3.70%، على التوالي من المجموع الكلي الجدول(3). ولا تتفق نتائج هذه الدراسة مع نتائج دراسة Bramono and Budimulja (2005) والتي ذكرت بان بأن الإناث أكثر إصابة بالاعفان الخيطية غير الجلدية والاعفان الجلدية مقارنة مع ذكور إذ بلغت النسبة للاعفان الخيطية غير الجلدية 2.33% و0.71% والأعفان الجلدية 16.15% و 10.05%. وقد ذكر Zaini *et al*., (2009) ان نسبة الإصابة بالاعفان الخيطية غير الجلدية 15.5%، إذ جاءت بالمرتبة الثانية وكان الإناث أكثر عرضة للإصابة من الذكور بنسب بلغت 16.72% و 13.16%، ثم تلتها وبالمرتبة الأخيرة الاعفان الجلدية وبنسبة بلغت 10.55%، قد كان الذكور أكثر عرضة للإصابة بهذه الاعفان مقارنة بالإناث بنسب بلغت 5.57% و 20%، في حين كانت الإناث أكثر عرضة لإصابة بداء الفطار الظفري الذي تسببه الخمائر مقارنة مع الذكور، إذ بلغت نسبة الإصابة بالخمائر للإناث 28.04%، بينما بلغت للذكور 4.23% من المجموع الكلي الجدول(3). وهذا ما أكدته دراسة Gerami shoar *et al*., (2002) والتي أشارت إلى أن الخمائر هي أكثر المسببات المرضية انتشاراً بين الإناث بنسبة بلغت 71.9% مقارنة مع الذكور بنسبة بلغت 28.1%. كما ذكرت الدراسات الحديثة ان الخمائر من أكثر المسببات شيوعاً التي تسبب داء الفطار الظفري في أظافر أصابع اليد للإناث حيث أيدت هذه النتيجة دراسة Bramono and Budimulja (2005) إلى ان الإناث أكثر إصابة بالخمائر مقارنة مع الذكور وبنسب 36.80% و 13.28%.

كما أن هذه النتائج هي قريبة نوعاً ما من النتائج Zaini *et al*., (2009) والتي أشارت إلى أن الخمائر هي المسبب الرئيسي، إذ جاءت بالمرتبة الأولى بنسبة بلغت21.85% وكان الإناث أكثر إصابة بالخمائر من الذكور وبنسب بلغت 26.18% و 13.68% على التوالي.

الجدول (3) : أنواع الفطريات المعزولة من أظافر المرضى المصابين بداء الفطار الظفري بحسب الجنس.

المسببات الفطرية	الجنس		العدد الكلي
	ذكور	إناث	
خمائر (Yeast)	8 (%4.23)	53 (%28.04)	61 (%32.27)
الأعفان الجلدية (Dermatophytes)	19 (%10.05)	7 (%3.70)	26 (%13.75)
الأعفان غير الجلدية (Non-dermatophytes)	65 (%34.39)	37 (%19.57)	102 (%53.96)
العدد الكلي	92 (%48.67)	97 (%51.32)	189 (%100)

مربع كاي(X2) (بين الجنس ونوع المسبب الفطري)= 52.8 $P<0.05$

4- العلاقة بين الإصابة بداء الفطار الظفري لكلا الجنسين حسب المجاميع العمرية.

أظهرت نتائج الدراسة الحالية المتعلقة بعلاقة الإصابة بداء الفطار الظفري وبين الفئات العمرية، أن الفئة العمرية (41-60) سنة كانت أكثر الفئات العمرية تأثراً بالإصابة بداء الفطار الظفري وبجميع أنواع المسببات(خمائر، اعفان جلدية واعفان خيطية غير جلدية)، إذ بلغت نسبة الإصابة 39.15%، تلتها وبفارق قليل الفئة العمرية(21-40) سنة وبنسبة إصابة بلغت 24.33%، وجاءت الفئة العمرية (61-80) سنة بالمرتبة الثالثة بنسبة بلغت 23.28%، ثم الفئة العمرية (1-20) سنة بنسبة إصابة 11.64%، واحتلت كل من الفئات العمرية (أكبر من 80) و(أقل من 1) سنة المرتبة الأخيرة بنسب إصابة 1.05% و 0.53% الجدول(4).

وقد يعزى السبب انتشار هذا المرض بكثرة بين الفئات العمرية(41-60) سنة و(21-40) سنة إلى اعتبار هذا المرض من المشاكل الجمالية التي تسبب إحراج لهذه الفئات العمرية وخصوصاً بين النساء مما يتطلب المراجعة لتلقي العلاج، فضلاً عن ذلك فأن هذه الفئة العمرية تعد من الفئات العاملة لذا فإنها تتعرض إلى الأذى الناتج عن ممارسة المهن المختلفة، والتي تعد من عوامل المهيئة لحدوث الإصابة بالفطار الظفري. وتشير الدراسات إلى ان نسبة تردد الإصابة بداء الفطار الظفري تزداد مع تقدم العمر، فهي تكون نادرة عند الأطفال وشائعة في الأعمار الشابة ولكنها كثيرة التردد في الفئات العمرية الكبيرة (Baran *et al*., 1999) فضلاً عن ان هذه الفئات العمرية أكثرا وعياً فيما يتعلق بالتغيرات في لون الأظافر وتشوهها مقارنة مع كبار السن. أما سبب انخفاض الإصابة في الفئات العمرية الصغيرة فيعزى إلى الاختلاف في تركيب صفيحة الظفر وقلة الصدمات وزيادة معدل النمو لصفيحة الظفر بالمقارنة مع التلف الناتج عن الإصابة بالفطر (Philpot and Shuttleworth 1989).

وقد جاءت نتائج هذه الدراسة متوافقة مع دراسة Zaini *et al*., (2009) التي إن الفئة العمرية(41-50) سنة أكثر الفئات العمرية إصابة وخصوصاً بالخمائر و الاعفان الخيطية غير الجلدية وفيما كانت الفئة (61-70) سنة أكثر إصابة بالاعفان الجلدية. وذكرت دراسة أجريت في اندنوسيا بأن أكثر الفئات عرضة للإصابة هي الفئة العمرية (25-45) سنة تلتها الفئة العمرية (45-65) سنة (Bramono and Budimulja 2005). كما أظهرت دراسة Ahmad *et al*., (2010) بان أكثر الفئات العمرية تأثراً بالإصابة كانت الفئة (20-40) سنة وبنسبة وصلت إلى 60%. كما وجد في الدراسة التي أجريت في إيران بان أعلى نسبة الإصابة بداء الفطار الظفري سجلت ضمن الفئة العمرية (40-50) سنة وبنسبة بلغت 67.4% (Gerami shoar *et al*., 2002). ولا تتوافق هذه النتائج مع نتائج دراسة Neupane

(2009) ,.*et al* والتي أشارت إلى أن أكثر الفئات العمرية إصابة هي الفئة العمرية (10-40) سنة وبنسبة إصابة 70.0%. كما أشارت دراسة Kaur and Puri (2012) إلى ان الفئة العمرية (31-40) هي الأكثر إصابة بداء الفطار الظفري وبنسبة 37.2%.

الجدول (4):العلاقة بين الإصابة لكلا الجنسين حسب المجاميع العمرية

المجاميع العمرية	خمائر (Yeast)	فطريات جلدية (Dermatophytes)	الأعفان غير الجلدية (Non-dermatophytes)	العدد	النسبة المئوية
أقل من 1	**1**	**-**	**-**	**1**	**%0.53**
20-1	**6**	**4**	**12**	**22**	**%11.64**
40-21	**15**	**2**	**29**	**46**	**%24.33**
60-41	**27**	**12**	**35**	**74**	**%39.15**
80-61	**12**	**8**	**24**	**44**	**%23.28**
اكبر من 80	**-**	**-**	**2**	**2**	**%1.05**
المجموع	**61**	**26**	**102**	**189**	**%100**

5- التشخيص المظهري لشبه جنس المبيضات باستخدام الطرق التقليدية.

تم عزل 58 عزلة خمائر من عينات الأظافر المأخوذة من المرضى المراجعين لاستشارية الجلدية في مستشفى الديوانية التعليمي والتي شخصت على أنها إصابات فطرية، شخصت هذه المبيضات بإتباع الطريقة التقليدية المظهرية والطريقة الجزيئية.

اعتمدت الطريقة التقليدية المظهرية على الصفات الزرعية المجهرية والبايوكيميائية والفسيولوجية وذلك من خلال ملاحظة شكل و لون المستعمرة على وسط السابرويد دكستروز أكار كإجراء أولي، كما أجريت اختبارات تكوين أنبوبة الإنبات بتنميتها على مصل الدم لمدة(2- 3 ساعة) و اختبار تكوين الابواغ الكلاميدية على وسط طحين الذرة وتقيم النمو على درجة الحرارة 45مْ للتميز بين النوعين *C. albicans* و *C. dubliniensis* عن باقي أنواع المبيضات. وقد أظهرت نتائج الدراسة بان المستعمرات المبيضات وبشكل عام كانت بيضاء إلى كريمية اللون، ناعمة، لماعة، وطرية، دائرية على وسط السابرويد دكستروز أكار(SDA). وقد أظهرت النتائج الفحوصات المظهرية بأن *C. albicans* كانت أكثر المبيضات تردداً في الإصابة وبنسبة بلغت 41.38% تلتها كل من *C. tropicalis* و *C. parapsilosis* وبنسبة تردد 20.69% و 13.79% على التوالي من المجموع الكلي للمبيضات والبالغ 58 عزلة اما باقي انواع المبيضات فقد احتلت نسب تردد قليلة مقارنة بالانواع الثلاثة جدول (4-6) وتؤكد اغلب المصادر بان النوع *C. albicans* والنوع *C. parapsilosis* من اكثر الانواع تكرارا المسببة لداء الفطار الظفري (Asadi *et al*., 2009; Nada *et al*., 2005; Odds, 1988).

جدول (4-6): النسبة المئوية لعزلات جنس المبيضات باستخدام الطرق التقليدية.

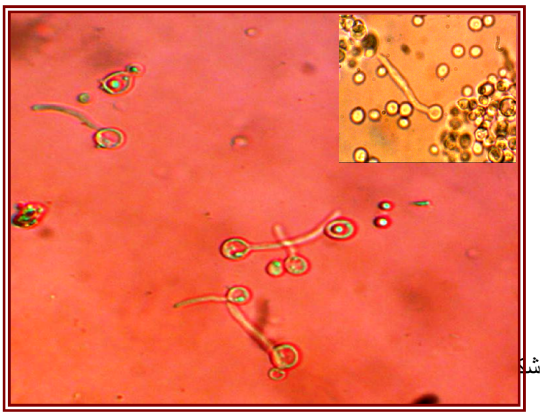
النوع	التشخيص بالطرق التقليدية	
	العدد	(%)
C. albicans	24	41.38
C . tropicalis	12	20.69
C. parapsilosis	8	13.79
C. krusei	3	5.17
C. kyfer	2	3.44
C. famata	2	3.44
C. dubliniensis	4	6.89
Candida spp.	3	5.17
المجموع الكلي	58	%100

6- الاختبارات التشخيصية للخمائر (Tests of Yeasts Identification)

6-1: اختبار تكوين الأنبوبة الجرثومية **Germ tube formation**

بينت نتائج الدراسة بان العزلات التابعة للنوع *C. albicans* امتلكت القابلية على تكوين الأنبوبة الجرثومية (Germ tube)، مقارنة مع بقية الأنواع من المبيضات والتي لم تمتلك هذه القدرة عند الحضن في الوسط الحاوي على 0.5 مل مصل الدم لأرانب وخلال مدة 2-3 ساعة في درجة حرارة 72 ساعة الشكل(3).

وتتفق هذه النتيجة مع نتائج دراسة Mosaad *et al*., (2010) التي ذكر فيها ان جميع عينات *C. albicans* كونت الأنبوبة الجرثومية فيما لم تكون بقية الأنواع الأنبوبة الجرثومية خلال ثلاث ساعات من الاختبار. وتعد الأنبوبة الجرثومية واحدة من العوامل المسؤولة عن إحداث الامراضية بفعل المبيضات (Yang, 2003). والأنبوب الجرثومي أنبوب رفيع يمتلك جدران مستقيمة، بدون حواجر أو تخصرات عند تقاطع بين الخلايا, وهو مؤشر تشخيصي مظهري لكل من *C. albicans* و *C. dubliniensis* (Marinho *et al*., 2010). وعلى الرغم من ذلك، فان بعض النتائج الخاصة بهذه الطريقة تخضع للتفسيرات الشخصية للعاملين في هذا المجال والتي تحتاج إلى تكرار الفحص والتدريب والخبرة للتميز بين الأنبوبة الجرثومية والخيوط الفطرية الكاذبة الذي تكونه المبيضات مما يؤدي إلى حدوث خطأ في تشخيص المبيضات بشكل صحيح (Carrillo-Muñoz *et al*., 2001).

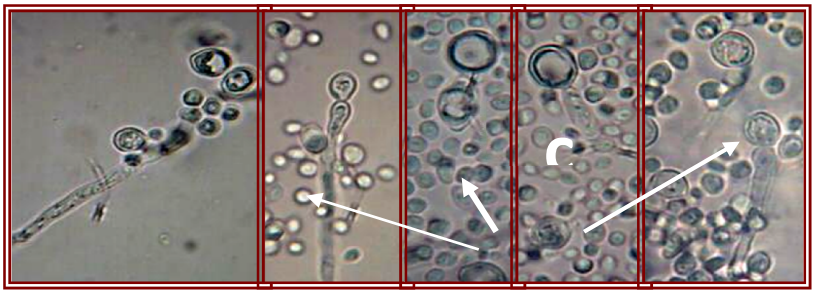


شك

6-2: تكوين الابواغ الكلاميدية Chlamydospores formation

بينت النتائج بان جميع عزلات *C.albicans* كونت الابواغ الكلاميدية (Chlamydospores) عند تنميتها على وسط طحين الذرة الصلب (corn mail agar) شكل (4)، في حين لم تكون بقية أنواع المبيضات الابواغ الكلاميدية، تعد هذه الصفة من الصفات المظهرية المهمة التي تعد كمؤشر تشخيصي مظهري لكل من النوعين *C. albicans* و *C. dubliniensis* .

وهذه النتيجة متوافقة مع نتائج Marinho *et al*., (2010) الذي أكد إن الـ *C. albicans* تكون هذا التركيب وهو من الصفات المظهرية المهمة في تشخيص هذه الخمائر. كما أشار دراسة Mosaad *et al*., (2010) إلى أن *C. albicans* تكون هذا التركيب، كما أظهرت نتائج بان تكوين كل من أنبوبة الإنبات و الابواغ الكلاميدية تعتبر من صفات التأكيدية لنوع *C. albicans*. وهذا ما أكده أيضا Zaini *et al*., (2009) بان *C. albicans* المعزولة تكون أنبوبة الجرثومية و الابواغ الكلاميدية. وعلى الرغم من أهمية هذا الاختبار في تشخيص *C. albicans* الا ان بعض الدراسات أشارت إلى إمكانية بعض السلالات التابعة للنوع *C. tropicalis* من ان تكون الكونيدات الكلاميدية، كما ان النوع *C. dubliniensis* في الغالب لايكون هذا التركيب إلا انه إذا كون الكونيدات الكلاميدية فإنها تكون غزيرة مرتبة على هيئة ثلاث كونيدات أو أزواج من الكونيدات متجاورة على حوامل متفرعة قصيرة على الخيوط الفطرية الكاذبة، وهي شبيهة لما يكونه النوع *C. albicans* وبالتالي يصبح من الصعب التمييز بين النوعين(Tintelnot *et al*., 2000). كما وجد بان بعض السلالات التابعة لـ *C. albicans* لا تكون الكونيدات الكلاميدية إذ أشارت دراسة Marinho وجماعته (2010) التي أجريت في البرازيل لتشخيص المبيضات بواسطة الخصائص المظهرية وتفاعل البلمرة المتسلسل (PCR) المعزولة من بطانة الفم، بان هنالك سلالات من الـ *C. albicans* لا تكون الكونيدات الكلاميدية بالرغم من أنها تمتلك الخصائص المظهرية الأخرى لهذا النوع مثل تكوينها للأنبوبة الجرثومية واللون الأخضر الفاتح على وسط الكروم أكار وتمثيلها للكاربوهيدرات وتشخيصها بالاعتماد على الطريقة تفاعل البلمرة المتسلسل.



شكل(4): السبورات الكلاميدية (Chlamydospores) التي تكونها خميرة C. albicans على وسط أكار طحين الذرة (CMA).

3-6: اختبار الكروم أكار Chromagar test

أجري هذا الاختبار وذلك لتأكيد التشخيص المبيضات المعزولة من عينات الأظافر وذلك من خلال التقييد بتعليمات الشركة المجهزة Himedia الهندية، ويعد هذا الاختبار كوسيلة سريعة لعزل وتشخيص أنواع المبيضات وخصوصا الأنواع *C. albicans*، *C. tropicalis*، *C. krusei* و *C. glabrata*. ويعتمد هذا الاختبار على التغاير اللوني بين أنواع المبيضات، مما يسهل عملية التمييز بين الأنواع المختلفة، وقد أظهرت نتائج الدراسة بالاعتماد على وسط الكروم أكار ألواناً مميزة للنوع، إذ تميز النوع *C. albicans* باللون الأخضر الفاتح (Light green)، فيما تميزت عزلات الـ *C. tropicalis* باللون الأزرق المعدني (Blue-metallic blue)، أما بالنسبة للعزلات النوع *C. krusei* فقد ظهرت باللون الأرجواني المشوش(Purple fuzzy). كما امتازت جميع المستعمرات بأنها ذات حافات شاحبة اللون، فيما لم تظهر الأنواع *C. parapsilosis* و *C. kyfer* و *C. famata* أي تغاير لوني إذ كان لون المستعمرات التابعة لها بيضاء إلى كريمية اللون، كما أظهرت عدد من العزلات تغايراً لونياً تراوح ما بين الأبيض الكريمي واللون البني الغامق شكل (5).

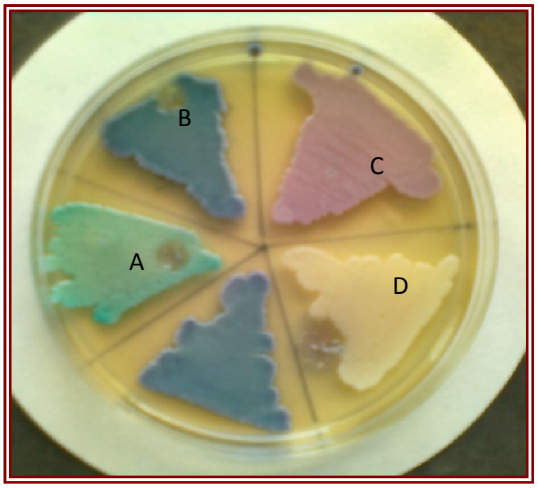
وتعتمد آلية العمل على احتواء الوسط على مواد أساس مولدة للون (Chromogenic substrates) والتي تتفاعل مع الإنزيمات المختلفة التي تفرزها الأنواع المختلفة من المبيضات مما يؤدي إلى إنتاج مستعمرات متغايرة لونياً وبالتالي تشخيص المبيضات إلى مستوى النوع عن طريق اللون وخصائص المستعمرة (Adam *et al*., 2010

إن هذه النتائج هي مطابقة لنتائج دراسة Baradkar *et al.,* (2010) والتي أجريت في الهند لتقييم كفاءة هذا الوسط في تشخيص أنواع المبيضات، وقد أشاروا إلى أن هذا الوسط يعد وسطاً تفريقياً بين أنواع معينة، إذ تميزت *C. albicans* باللون الأخضر الباهت، و *C. tropicalis* باللون الأزرق المعدني، و*C. krusei* باللون الأرجواني المشوش و *C. parasilosis* باللون الأبيض الباهت الى الوردي الفاتح.

كما توافقت مع نتائج دراسة Bose *et al*., (2011) التي أجريت في الهند لعزل المبيضات التي تسبب التهاب المجاري البولية في وحدات العناية المركز والتي استخدم فيها وسط الكروم اكار في تشخيص أنواع المبيضات، إذ ظهرت الـ *C. albicans* باللون الأخضر الباهت والـ *C. dubliniensis* باللون الأخضر الداكن مع نمو مشوش والـ *C. tropicalis* باللون الأزرق المعدني و الـ *C. parasilosis* باللون الأبيض الكريمي.

وقد أشار Baradkar *et al.,* (2010) إلى إن استعمال وسط الكروم أكار تعتبر طريقة سهلة ومعتمدة لتشخيص اغلب الأنواع الشائعة من المبيضات وخصوصاً الأنواع *C. albicans*، *C. tropicalis*، *C. krusei* و *C. glabrata* وبحساسية مقبولة. ويمكن ان يستخدم هذا الوسط كوسط انتخابي للتشخيص المباشر للأنواع السريرية من المبيضات خلال اقل من 48 ساعة من خلال التغاير اللوني بين أنواع المبيضات المختلفة، كما ان هذا الوسط أصبح بديلا لوسط طحين الذرة و اختبار أنبوبة الجرثومية والطرق التشخيص الكيميوحيوية التقليدية، مثل تخمر و تمثيل السكريات.

ان استعمال وسط الكروم أكار للتشخيص السريع لأنواع المبيضات يمكن ان يستعمل كبديل للطرق التقليدية. ويمكن لهذه الطريقة ان تقلل من الوقت الذي يتطلبه تشخيص أنواع المبيضات(Eraso *et al*., 2006). وعلى الرغم من بروز هذا الوسط كوسط انتقائي وتفريقي يسمح بعزل الخمائر وتشخيصها في نفس الوقت من خلال التفاعل اللوني وشكل المظهري للمستعمرة، كما انه يسهل الكشف والتشخيص للمبيضات في المزارع المختلطة خلال 24-28 ساعة أسرع من الطرق القياسية, إلا انه لايمكن ان يكون بديلا للطرق القياسية للتشخيص بل مكملا لها، إذ من الممكن ان يستخدم للتشخيص المبدئي للمبيضات ومن ثم تأكيد التشخيص بالاعتماد على الطرق التقليدية الأخرى، وذلك بسبب كونه محدد في تشخيص الأنواع الثلاثة *C. albicans* و*C. tropicalis* و *C. krusei* بدرجة عالية من الدقة مقارنة مع التنوع الهائل للمبيضات التي أخذت تبرز كمسببات مرضية مهمة وخصوصاً في مرضى الكبح المناعي (Odds and Bernaerts, 1994).



شكل(5): التغاير اللوني لأنواع المبيضات المعزولة من عينات الأظافر على الوسط التشخيصي الكروم أكار (Chromagar). (A): *C. albicans* ، (B) *C. tropicalis*، (C): *C. krusei*، (D): *C. parapsilosis*.

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Assessment of factors influencing employee retention in Tanzania's work organisations

Jackson M.E. Muhoho

Assistant Lecturer,
Department of Project planning and Management,
Tengeru Institute of community development (TICD), Arusha, Tanzania

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ABSTRACT: This paper assessed the factors influencing employee retention in Tanzania's public and private sector workplaces. The purpose of the study was to reveal and assess the factors perceived by employees as forces influencing retention at the workplace in each sector and investigating employers' psychological factors and different methods used by the organizations in retaining their best employees in each sector. The study used semi-structured, closed and open ended questionnaires, Focus Group Discussions, Key informants as well as review of documents from various libraries and online resources. This study used a sample of 60 respondents drawn from ten (10) selected organizations .software Package for Statistical Science (SPSS) version 20.0 and excel. The study findings revealed that there is a high rate of turnover in Tanzania's work organizations and that those who stayed in the same organization were from public organizations particularly higher learning institutions. The study also revealed that, low salaries and benefits were the main reason for leaving. Furthermore, employer psychological factors including organizational justice and prestige were mentioned as influence to employee retention. Increasing salaries was mentioned to be the strategy used by the most companies in retaining their employees. The study, therefore, recommends that the selected organizations and others should conduct regular review of the remunerations, structure good retirement plans and foster a congenial or conducive work environment that provide and create opportunities for further development, continuous renewal and learning, and deepening of employee motivation to contribute stupendously to the organization's performance, workplace excellence, and competitive advantage.

KEYWORDS: Employee, employee retention, HRM, motivation strategy, talent management.

1 INTRODUCTION

This study mainly focused on the assessment of the factors influencing employee retention at work with a special attention to the Tanzania's work organizations. The retention of employees has been shown to be significant to the development and accomplishment of the organization's goals and objectives (Alkandari and Hammad, 2009). Retention of employees can be a vital source of competitive advantage for any organization (Mullins, 2010; Amstrong, 2005; Ngozwana and Rugimbana, 2010). Today, changes in technology, global economics, trade agreements and the like are directly affecting employee/employer relationships. The loss of talented employees may be very detrimental to the company's future success (Terence, brooks, and Thomas, 2001; Carney, 1998). Outstanding employees may leave an organization because they become dissatisfied, under paid or unmotivated (Coff, 1996).

Dyer,L. and Ericksen,J. (2005) argued that better employees may move to other organizations for better opportunities; the coworkers who cannot improve their positions are more likely to stay. This is especially possible when outstanding performance for high performers is not distinctively rewarded; Workplace managers are compelled to improve skills in decision making pertaining to retaining of best talents and employees (Murphy, 1985; Hong and Kaur, 2008; Abdullah, 2009). To achieve this, all this study findings suggest is to nurture and maintain conducive environment and climate that guarantee the employee stay, loyalty and highly degree of connectedness and performance in the organization which is in line with the propounding of Kotler J.P and Heskett,J.L.(1995) on the role of strong culture and workplace climate .Managers must improve their decision making and leadership styles to ensure improved work climate that fosters employee commitment

and engagement at work and to the organization overall cause and mission (Abdullah,2009;Chiboiwa ,Samuel, and Chipunza,2010;Khatri,Fern, and Budhwar,2001)

2 RESEARCH DESIGN AND METHODOLOGY

2.1 INTRODUCTION

This section covers details the sample determination and data, data collection instruments and data analysis methods

2.2 SAMPLING AND DATA

The research was undertaken within two main groups of people in the selected organizations. First group comprised company management teams and the second group comprised the remaining employees who were neither in senior nor junior management positions. The research collected the data from sixty (60) people of selected organizations management teams and employees who were not in any management cadres. 60 respondents were distributed as follows. 40 respondents filled questionnaires. 8 respondents were involved in focus group discussions (FGDs) and 12 respondents were the key informants. The selected target population was stratified basing on age and sex. They were randomly selected and clustered according their status. The sample elements selected were based on the representation of population of the interest group (Bryman, 2004). Both primary and secondary data were collected at the qualitative and quantitative levels .

2.2.1 PRIMARY DATA

Primary data were directly obtained from the surveyed organizations. It was collected from the sample population through survey, employing questionnaires, FGDs as well as interviews held with some informants in the selected organizations. Primary data was expected to be obtained from the main groups of selected organizations senior management teams and other employees including those with junior positions.

2.2.2 SECONDARY DATA

Secondary data for this study were collected from books, journals, reports and newspapers, both published and unpublished, as well as from online sources. As a matter of principle the secondary data was used to support the research findings.

2.3 POPULATION OF THE STUDY

Population means all the individuals or objects that meet certain requirements for membership in the overall group (Churchill and Brown, 2007). The population of the study included all public and private work organizations in Tanzania. However, because of limitation on time and other resources including finance, the study focused on ten (10) selected organizations that formed the sample.

2.4 DATA COLLECTION INSTRUMENTS

In this study, structured and unstructured questionnaires were used in data collection. Most importantly; the questionnaires were carefully designed to avoid responses that might be biased in favor of the study objectives. They were also prepared according to the status of the targeted group. Questionnaire was chosen by the researcher because of the following reasons: - it encouraged great honest, possibilities of enquiring absent attitude and opinions, they could be written for specific purpose, within a short time, one could collect a lot of information as well as its possibilities of mailing them made them economic in term of costs(Kothari,2010)

2.5 DATA ANALYSIS METHODS

Both qualitative and simple quantitative approaches were used during the data analysis. Statistical Package for Social Sciences (SPSS) was used in data analysis. Simple frequency tables were produced as outputs from SPSS and then analyzed based on their figures. The researcher interpreted data in accordance with the quality of arguments made rather than quantity of the respondents with the same opinions. The questionnaires were classified in terms of the answers that were

similar so as to reduce the work of analyzing each questionnaire. The aim of interviewing was to allow the researcher to elicit into person's perspectives and opinions over various aspects or factors influencing retention at work

2.6 UNIT OF ANALYSIS

Under this study the unit of analysis was individuals/employees who filled questionnaires, formed the focus group discussions (FGDs) as well as those who were key informants

2.7 RELIABILITY AND VALIDITY OF THIS STUDY

The validity and reliability of information collected from the field or study points was ensured through effectively designed and administered questionnaires, interviews, focus groups discussions, data processing and analysis

3 STUDY FINDINGS, ANALYSIS AND DISCUSSIONS

3.1 INTRODUCTION

This section examines the research findings with the view to understand the characteristics and nature of respondents, opinions, and to assess the factors for employee retention in Tanzania's public and private work organizations. Specifically, the study assessed factors perceived by employees' retention in organizations in each sector; assessed employer psychological factors on their influence to retention in each sector (Cawe, 2006); it investigated different methods used by the organizations in retaining their best employees in each sector. Lastly, the study identified constraints facing selected organizations in retaining their best employees. The information presented in this section relied heavily on questionnaire, key informant interviews and various documents on what has been done to curb the situation as well as field data from Barclays bank offices.

3.2 DATA PRESENTATION

3.2.1 STATISTICAL DESCRIPTION OF THE RESPONDENTS

This section aims at discussing the respondents' profile to enable the researcher establish the extent of judgment one might have in the area of the study. Among the researched respondents' characteristic include sex, age, marital status, education level, and experience with the organization as well as the number of the employees left the organization within the past ten years.

3.2.2 PRESENTATION OF FINDINGS ON RESPONDENTS' INSTITUTION

The study aimed to investigate a number of institutions with different mechanisms used in motivating their employees. The study found that 3 (7.5%) respondents were the Tanzania Postal bank, 4(10%) respondents were from National Social Security Fund, 3 (7.5%) respondents were from Parastatal Pension Fund, 6 (15%) respondents were from the Open University of Tanzania and 5 (12.5%) were from Kinondoni Municipal Council. Also, the study found that 5 (12.5%) respondents were from TANESCO, 3 (7.5%) were from Tumaini University, 5 (12.5%) were from Zantel, 3 (7.5%) were from DAWASCO while other 3(7.5%) were from AirTel Tanzania. This statistics above indicate that organizations of different nature, different services they offer to their clients were represented. However, the majority of respondents were from the Open University of Tanzania. This was possibly contributed by the nature of the organization and therefore, organization offered cooperation in filling the questionnaires.

Table 3.2.2 Respondents' institution (N=40)

Organization of the Respondents	Frequency	Percentage (%)
Tanzania Postal Bank	3	7.5
National Social Security Fund	4	10.0
Parastatal Pension Fund	3	7.5
The Open University of Tanzania	6	15.0
Kinondoni Municipal	5	12.5
TANESCO	5	12.5
Tumaini University	3	7.5
ZANTEL	5	12.5
DAWASCO	3	7.5
AirTel Tanzania	3	7.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.3 PRESENTATION OF FINDINGS ON RESPONDENTS' AGE

Age was considered as an important variable in assessing Factors influencing employees' retention in public and private sector work organizations in Tanzania. The study findings shows that 4 (10%) respondents were from the age group between 20 and 30 years. 22 (55%) respondents were from the age between 31 to 40 years. 5 (12.5%) were from the age group between 41 and 50 and 9 (22.5%) were from the age group between 51 and 60 years. The statistics signify that all age groups were considered during employments process of the selected organizations. However, a large number of employees who were more than half were from the age group between 31 to 40 years. This implies that the age group between 31 and 40 years are the one who is at the product level and available in the labor market. Therefore, many organizations prefer this age group. Table 3.2.3 illustrates.

Table 3.2.3 Respondents' age (N=40)

Age of the Respondents	Frequency	Percentage (%)
Between 20 to 30 years	4	10.0
Between 31 -40 years	22	55.0
Between 41-50 years	5	12.5
Between 51-60 years	9	22.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.4 PRESENTATION OF FINDINGS ON RESPONDENTS' SEX

The study involved 40 (100%) respondents who filled the questionnaires. 21 (52.5 %) of total respondents were male and 19 (47.5 %) were female. The results in the table below reveal that there was a slight difference between male and female respondents. Therefore, gender was seriously taken into consideration to collect data from the respondents (Table 3.2.4).

Table 3.2.4 Respondents' sex

Sex of the Respondents	Frequency	Percentage (%)
Male	21	52.5
Female	19	47.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.5 PRESENTATION OF FINDINGS ON RESPONDENTS' MARITAL STATUS

Marital status was considered as an important element to consider during this study. The findings revealed that 6 (15%) of total respondents were single. 34 (85%) were married respondents. No respondents were from the group of divorced and widows. These figures revealed that there was huge difference between married and single respondents during this study. Therefore, this statistics implies that the selected organizations recruited more married employees than from other groups of marital status (Table 3.2.5).

Table 3.2.5 marital status of the respondents

Marital Status	**Frequency**	**Percentage (%)**
Single	6	15.0
Married	34	85.0
Divorced/divorcee	0	0
Widow/ widower	0	0
Total	**40**	**100.0**

Source: research findings, (2013 /2014)

3.2.6 PRESENTATION OF FINDINGS ON RESPONDENTS' EDUCATION LEVEL

Again education level was considered as an important attribute to consider when assessing the factors influencing employees' retention in public and private sector work organizations in Tanzania. This was because, education was assumed to have a crucial role in enabling respondents to understand different questions on the factors influencing employee retention in both public and private work organizations. The study found that 2 (5%) had a qualification of certificate. 3 (7.5%) were a diploma holder. 20 (50%) of respondents were university graduates and 13 (24%) were masters' degree holders. only 2 (5%) of the respondents were having PhD and postgraduate diploma respectively. Therefore, the statistics indicate that all categories of education were considered by the selected organizations during recruitment processes. However, many respondents were those who had bachelor and masters' degree**.** Table, 3.2.6 illustrates.

Table 3.2.6 Respondents' education level

Education Level	**Frequency**	**Percentage (%)**
Certificate	2	5.0
Diploma	3	7.5
University degree	20	50.0
Master degree	13	32.5
Others	2	5.0
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.7 PRESENTATION OF FINDINGS ON RESPONDENTS' EXPERIENCE WITH THE ORGANIZATION

Respondents were asked to state their work experience with their current organizations. The study statistics indicate that 18 (45%) worked with their current organizations for the period of less than four years. 11 (27.5%) worked between five and ten with their current organizations. 2(5%) worked with their employer between 11 and 14 years. 9 (22.5%) worked with their employer for more than 14 years. Therefore, the statistics shows that most of the respondents were new to their employer. The study revealed that those who had long experience with their employer were from public organizations particularly higher learning institutions. Table 3.2.7 illustrates the above findings.

Table 3.2.7 Respondents work experience

Work experience	Frequency	Percentage (%)
Less than 4 years	18	45.0
Between 5 and 10 years	11	27.5
Between 11 and 14 years	2	5.0
Above 14 years	9	22.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.8 PRESENTATION OF FINDINGS ON THE NUMBER OF EMPLOYEE LEFT THE ORGANIZATION

The study was interested in understanding the number of employees quitted the selected organizations within the past ten years. The study findings revealed that 5 (12.5%) respondents pointed out that, less than 5 employees had left their organizations. 7 (17.5%) respondents reported that, employees between 5 and 10 had left the organizations. 5 (12.5%) respondents reported that employees between 11 and 15 had left the organization. 2(5%) respondents reported turnover rate between 16 and 20 employees while 21 (52.5%) reported that more than 20 employees had left the organizations within the past 10 years. Therefore, the study findings imply that there is a high rate of turnover in Tanzania work organizations. Employees tend to change organizations with different goals including looking for a greener pasture. Table 3.2.8 illustrates the above findings.

Table 3.2.8: Turnover rate

Turnover rate	Frequency	Percentage (%)
Less than 5 employees	5	12.5
Between 5 and 10 employees	7	17.5
Between 11 and 15 employees	5	12.5
Between 16 and 20 employees	2	5.0
Above 20 employees	21	52.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

During the FGDs held with some respondents from public institutions, respondents in responding to the question on the number of employees quitted within the past 10 years they indicated that more than twenty had left. Similarly, in the private work organizations, respondents indicated that turnover rate within past ten years was less than twenty. Therefore, their response indicates the significance difference in turnover between private and public work organizations in Tanzania.

3.2.9 INTENTION OF QUITTING THE ORGANIZATION

The study was interested in understanding whether the employees ever considered quitting their current employer. The study found that 28 (70%) considered quitting once in their organizations. 12 (30%) never thought quitting from their organizations. The statistics implies that due to different reasons, there were huge turnover intentions in most selected organizations. Information received from the departments of human resource of the organizations indicated that intention of quitting was possibly attributed by human nature of not being satisfied from what receive as advocated by the Maslow's (1943) hierarchy of needs theory. The statistics is illustrated in the table 3.2.9.

Table 3.2.9 Intention of quitting the organization

Considering quitting the organization	Frequency	Percentage (%)
Yes	28	70.0
No	12	30.0
I don't know		
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.2.10 PRIMARY REASON FOR LEAVING THE ORGANIZATION

The study was interested in understanding what the respondents thought to be the primary reasons for quitting the organizations. The study findings revealed that 15 (37.5%) respondents indicated that insufficient salaries were the primary reason for employee turnover. 24 (60%) pointed out that pursuing other career goals were the primary reason for employee turnover in the selected organizations. 1 (2.5%) pointed out other reasons for employee turnover in the selected organizations. No respondents mentioned insufficient retirement plans, physical working conditions, high stress working conditions as well as work hours to be the primary reasons for employee turnover in the selected organizations. Therefore, the study findings signify that people leave the organizations mostly to pursue their other career goals. Table 3.2.9 illustrates the above statistics.

Table 3.2.10 Primary reasons for leaving the organizations

Primary reason for leaving	Frequency	Percentage (%)
Insufficient salary	15	37.5
Insufficient retirement plans	0	0
Pursue other career goals	24	60.0
Physical working conditions	0	0
High stress working conditions	0	0
Work hours/shift work	0	0
Others	1	2.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.3 DISCUSSION OF THE STUDY FINDINGS

This part discusses the findings based on the factors by the employees' retention in the organizations, employers' physiological factors influencing employee retention, methods used in retaining employees as well as constraints facing the organizations in retaining their employees.

3.3.1 DISCUSSION OF THE FINDINGS ON THE FACTORS PERCEIVED BY EMPLOYEES' RETENTION IN ORGANIZATIONS

3.3.1.1 IMPROVED SALARY AND BENEFITS

A well structured salary and benefits may have a positive influence on the employee retention. Contrary, when they are poorly structured they may lead to the employee turnover. The respondents were asked to rank different issues in relation to their influence on retention. The findings revealed that salaries and other benefits had influence on the employee retention. The statistics shows that 19 (47.5%) respondents pointed out that salaries very strongly determined retention in the organization. 10 (25%) argued that salaries strongly determined retention in the organizations. 11 (27.5%) fairly influenced the retention in the organizations. No respondents rejected salaries for being the influence in retaining employees. The study findings revealed that 12 (30%) respondents pointed out that benefits strongly influenced employee retention. 13 (32.5%) respondents indicated that benefits strongly influenced employee retention. 13 (32.5%) pointed out that benefits fairly

influenced retention and 2 (5%) indicated that benefits had no influence at all on employee retention. Therefore, the findings indicate that, both salary and benefits had a strong influence on the employee retention.

Table 3.3.1.1 below illustrates the study findings.

Table 3.3.1.1 Salary and benefits

Improved salary	**Frequency**	**Percent**
Very strongly	19	47.5
Strongly	10	25.0
Fairly	11	27.5
No influence at all	0	0
Total	**40**	**100.0**
Improved benefits		
Very strongly	12	30.0
Strongly	13	32.5
Fairly	13	32.5
No influence at all	2	5.0
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.3.1.2 GOOD RETIREMENT PLANS AND OPPORTUNITIES FOR FURTHER DEVELOPMENT

The study aimed to find how good retirement plans and opportunities for further development played a role in retaining employees in the selected organizations. The study findings revealed that 5 (12.5%) pointed out that good retirement plans very strongly influenced the employee retention in the selected organizations. 11(27.5%) respondents indicated that good retirement plans of the organizations selected. 17 (42.5%) indicated that good retirement plan had a fairly influence on the employee retention in the selected organizations and 7 (17.5%) respondents showed that retirement plans did not have any influence in the selected organizations. The statistics above implies that retirement plans practiced by the organizations played fairly role in influencing the retention of employees as illustrated in the table 3.3.1.2. Furthermore, the study investigated on the influence of opportunities for further development on employee retention. The findings shows that 9 (22.5%) indicated that employee opportunities for further development very strongly influenced their retention in the organization. 15 (37.5%) respondents revealed that employee opportunities for further development strongly influenced their retention in the organization. 13(32.5%) respondents revealed that employee opportunities for further development fairly influenced their retention in the organization and 3 (7.5%) did not see any influence of employee opportunities for further development on employee retention in the selected organizations as illustrated in the table 3.3.1.2 below.

Table 3.3.1.2 Good retirement plans and opportunities for further development

Good retirement plans	**Frequency**	**Percentage (%)**
Very strongly influenced	5	12.5
Strongly influenced	11	27.5
Fairly influenced	17	42.5
No influence at all	7	17.5
Total	**40**	**100.0**
Opportunities for further development		
Very strongly influenced	9	22.5
Strongly influenced	15	37.5
Fairly influenced	13	32.5
No influence at all	3	7.5
Total	**40**	**100.0**

Source: research findings, (2013/2014)

3.3.2 DISCUSSION OF THE FINDINGS ON EMPLOYER PSYCHOLOGICAL FACTORS INFLUENCING EMPLOYEE RETENTION

The study findings revealed that 15 (37.5%) respondents indicated that insufficient salaries were the primary reason for employee turnover. 24 (60%) pointed out that pursuing other career goals were the primary reason for employee turnover in the selected organizations. 1 (2.5%) pointed out other reasons for employee turnover in the selected organizations. However, in the questionnaires no respondents mentioned insufficient retirement plans, physical working conditions, high stress working conditions as well as work hours to be the primary reasons for employee turnover in the selected organizations. But they pointed out that physiological factors were their secondary factors for their reasons for leaving or staying in the selected organizations. Therefore, the study findings signify that people leave the organizations mostly to pursue their other career goals as substantiated and propounded by **Armstrong** M.(2005). To capture more relevant information from the respondents on what they thought to be psychological factors influencing employee retention, various other methods were used. These included FGDs as well as the key informants. The findings reveal that respondents from the FGDs indicated organization justice and prestige which employee felt influenced the retention. The organizations which provided to the employees high security to their jobs and feeling proud of being the organizational members played an important role in retention.

Furthermore, when key informants were asked on what they thought to be employer psychological factors influencing employee retention. They pointed out that employee engagement made them feel as a part and parcel of the organizations businesses. Therefore, they felt being valued by the employer and therefore, they had no intention of leaving their organizations. They also noted that this boosted their psychological commitment they had with their employers.

3.3.3 3DISCUSSION OF THE FINDINGS ON METHODS USED BY THE ORGANIZATIONS IN RETAINING EMPLOYEES

The study findings revealed that the increased salaries, improvement of employee relations as well as improved benefits were the methods used in employee retention.

3.3.4 DISCUSSION OF THE FINDINGS ON CHALLENGES FACING ORGANIZATIONS IN RETAINING THEIR EMPLOYEES

The study was interested in understanding challenges which were facing the organizations selected. The FGDs and the key informants were used to tap the required information on the challenges facing the selected organizations in retaining their potential employees. In the group of 8 members, 6 revealed that most of the respondents in the questionnaires pointed out to the competition among the pension schemes, law guiding pension scheme which force employer to contribute which effect regular review of employees salaries as a serious challenge towards employee retention in the selected organizations. Likewise the key informants from the departments and directorates of the visited organizations contended that meeting the demands of every employee expectations in terms of salary and career growth were among the challenges facing them. They further noted that finding the best way of keeping their potential employees considering competition in the labour markets were also alarming.

4 CONCLUSION AND RECOMMENDATIONS

4.1 INTRODUCTION

This part presents the conclusion, recommendations and areas for further study. The main objective of the study was to investigate and assess the factors influencing employees' retention in public versus private sector work organizations in Tanzania and recommend strategies for improving employee retention accordingly

4.2 CONCLUSION

Since employee retention is a critical and vital force to both the organization performance and gaining competitive advantage in today's workplace market, and business environment ,companies and employers should work hard towards achieving a highly teamed up workplace and organizations through integrating and alignment of organizational goals with individual employee or personnel goals. They need to be engaged with the company at the same time being equitably remunerated and treated well accordingly. Organizations failing to equitably remunerate and treat well their employee are likely to suffer a high employee turnover rate that can, in turn, cost employers a great deal of financial distress .Managers especially in the twenty first century must inevitably sufficiently plan and invest to maintain sound employee retention climate and optimize employee engagement in order to foster retention of competent, and talented workforce

4.3 RECOMMENDATIONS

The internal barriers that arise within the organization may be resolved within the organization, but most of the times an appropriate retention strategy must take into consideration of the external factors /constraints especially those requiring macro-level interventions in the form of government intervention. Based on these study findings the following recommendations are made hereunder:

i. Because of availability of large turnover intentions in most selected organizations, there is a compelling need for the respective organizations to find the right and more effective ways of satisfying employees;
ii. There should be a clear efforts by the organizations selected to work towards developing individual career of their employees. By so doing, people degree of leaving the organizations mostly to pursue their other career goals will be heavily minimized.
iii. Salary and benefits as an important attribute should be competitive and should also be reviewed on regular basis to reflect the prevailing labor market rate;
iv. The organizations selected should structure for a good and better retirement plans and create opportunities for further development to employees;
v. Justice and prestige to the employees should be considered in reducing the turnover. The organizations should provide employees high security to their jobs and hence feel proud of being the organizational members.

4.4 AREAS FOR FURTHER STUDY

The findings of this study did not cover comprehensively all factors which influence employees' retention in the Tanzania work organizations. The study provides other areas for the further research including:-

i. Specific study to assess the contribution of the incentive schemes in employees satisfaction;
ii. Study to investigate into strategies used by the charity based organizations in retaining their potential employees.

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Les déterminants des activités d'innovation et de coopération : Une analyse empirique des entreprises innovantes marocaines

[The determinants of innovation and cooperation activities: An empirical analysis of Moroccan innovative firms]

Rachid Sadgui

Sciences économiques et de gestion,
Université Moulay Ismaïl, Faculté des sciences juridiques, économiques et sociales,
Meknès, Maroc

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ABSTRACT: This research aims to analyse the determinants of innovation and cooperation activities. Based on a sample of 364 Moroccan companies, we highlight the importance of the impact of cooperative relations allowing the company to access the knowledge and skills necessary for innovation that they couldn't acquire if they remained isolated. We particularly focus on the determinants of innovation of Moroccan companies, taking into account their cooperation leads to innovation in an innovation system. To respond to our question, we will develop the different theoretical approaches to innovation and a review of empirical literature on the innovative behavior of firms. Our results suggest that the probability of innovation is determined by internal and external firm attributes (size, industry, group membership and technological watch, etc.). On the other hand, it was found that the probability of innovation has increased more if the company launches simultaneously in research and development and cooperative relations for innovation.

KEYWORDS: Innovation, Cooperation, Research and Development, Intellectual property rights, Technological monitoring, Logistic regression, Morocco.

RESUME: Notre étude s'interroge sur les déterminants de l'activité d'innovation et de coopération pour l'innovation à partir d'un échantillon de 364 des entreprises marocaines, tout en mettant en exergue l'importance de l'impact des relations de coopération, permettant à l'entreprise d'accéder aux connaissances et compétences nécessaire à l'innovation et dont elles n'auraient pas disposé en restant isolées. Il s'agit plus précisément d'étudier les facteurs déterminant l'innovation des entreprises marocaines, en prenant en compte leurs coopérations menant à l'innovation dans un système d'innovation. Pour répondre à notre problématique, nous développerons les différentes approches théoriques de l'innovation et une revue de littérature empirique sur le comportement innovant des entreprises. Nos résultats suggèrent d'une part, que la probabilité d'innover est déterminée par les attributs internes et externes de l'entreprise (taille, secteur d'activité, appartenance à un groupe et veille technologique, etc.). D'autre part, il s'est avéré que la probabilité d'innover est intensifiée plus si l'entreprise se lance simultanément dans des activités de Recherche et développement et dans des relations de coopération pour l'innovation.

MOTS-CLEFS: Innovation, Coopération, Recherche et développement, Propriété intellectuelle, Veille technologique, Régression logistique, Maroc.

Corresponding Author: Rachid Sadgui

1 INTRODUCTION

Dans un contexte économique instable marqué par l'évolution rapide des technologies, l'innovation qui accentue le raccourcissement de la durée de vie des produits et la menace du marché local par les pays émergents et développés plus innovants et compétitifs. Les entreprises sont amenées à innover pour faire face à l'intensification de la concurrence et à préserver leurs parts de marché aussi bien au niveau local qu'à l'international pour celles qui sont exportatrices. Deux constats peuvent justifier l'intérêt croissant envers les entreprises dans le développement économique des économies de marché. D'une part, les entreprises constituent une source majeure d'innovation [1], [2], d'autre part, elles permettent la création de nouveaux emplois [3], [4].

L'importance d'une compréhension de l'innovation comme un processus, se justifie par le fait qu'il façonne la manière dont nous essayons de la gérer. Cette compréhension a beaucoup changé au fil du temps. Les premiers modèles ont vu l'innovation comme une séquence linéaire d'activités fonctionnelles basée principalement sur l'investissement en recherche et développement et la recherche scientifique [5]. Aujourd'hui, l'innovation n'est plus abordée comme un processus linéaire [6]. La nature du processus d'innovation a évolué à partir de modèles linéaires simples à des modèles interactifs de plus en plus complexes [7], [8], [9], [10], [5]. La complexité de ces processus provient de la forte interaction demandée entre les processus internes de l'entreprise et les processus externes de l'environnement de l'entreprise.

Dans notre étude, nous adopterons cette vision interactive et élargie de l'innovation qui reflète bien la réalité d'aujourd'hui [6]. Dans cette lignée, l'innovation est caractérisée par un essor des relations de coopération entre les entreprises et leur environnement. Cette situation dépasse l'opposition entre marché et firme sur laquelle se base la théorie des coûts de transaction [11] et rajoute un nouveau mode de coordination des activités à savoir la coopération correspondant à la théorie des compétences. Donc, pour mieux comprendre le processus d'innovation, il faut prendre en compte l'environnement externe de l'entreprise comme déterminant des activités d'innovation. Il s'agit de croiser des de la théorie des compétences avec la théorie évolutionniste [12], [13].

Notre papier s'inscrit dans ce champ de recherche qui s'interroge sur les déterminants de l'activité d'innovation tout en mettant en exergue l'importance des relations interentreprises sur la création des connaissances et la stimulation de l'innovation.

Avant d'entamer notre analyse sur le comportement innovant des entreprises marocaines, nous définissons au préalable cette notion d'innovation. Selon une le manuel dit d'Oslo [14] : « une innovation est la mise en œuvre d'un produit (bien ou service) ou d'un procédé nouveau ou sensiblement amélioré, d'une nouvelle méthode de commercialisation ou d'une nouvelle méthode organisationnelle dans les pratiques de l'entreprise, l'organisation du lieu de travail ou les relations extérieures». Le manuel d'Oslo [14] propose aussi une définition de la firme innovante : « Une firme innovante est une firme qui a mis en œuvre une innovation pendant la période considérée dans l'enquête ».

Un deuxième concept qui doit être défini est la coopération pour l'innovation. Pour ce faire, nous prenons une définition proposée par le manuel d'Oslo [14] : « La coopération en matière d'innovation implique une participation active à des projets d'innovation conjoints avec d'autres organisations. Ces dernières peuvent être d'autres entreprises ou des institutions non commerciales. Il n'est pas nécessaire que les partenaires tirent un profit immédiat de l'opération. Le fait d'externaliser purement et simplement le travail sans qu'il y ait collaboration active n'est pas considéré comme une coopération. La coopération se distingue des sources d'information en libre accès et de l'acquisition de savoir et de technologie en ce que tous les acteurs prennent effectivement part au travail ».

Notre problématique est la suivante : « Quels sont les déterminants empiriques de l'innovation dans les entreprises marocaines et les facteurs qui les poussent à coopérer pour l'innovation? ». De cette problématique découle la série d'interrogations suivantes :

Quelles sont les caractéristiques (internes et externes) de la firme qui influencent la capacité d'innovation ?

Quels sont les paramètres qui jouent sur la décision de coopération pour l'innovation de la firme ?

Le papier se présente de la façon suivante : la deuxième section présente une les données utilisées et la méthodologie de la recherche. La troisième section expose les résultats des estimations économétriques. La discussion des résultats est présentée dans quatrième section. Enfin, la cinquième section est consacrée à la conclusion.

2 DONNÉES ET MÉTHODES

Ce travail de recherche est basé sur un échantillon de 364 observations provenant de l'enquête nationale de l'innovation, réalisée par l'association marocaine de la recherche et développement (R&D Maroc), couvrant la période 2008-2010 et l'enquête innovation qui couvre la période 2010-2012. Ces enquêtes nous ont permis de résoudre des problèmes de mesure de l'innovation et de présenter un modèle qui prend en compte la nature qualitative des données et l'endogénéité des décisions d'innovation.

2.1 ÉCHANTILLON ET STATISTIQUE DESCRIPTIVE

Pour s'assurer de la meilleure représentativité de l'échantillon, R&D Maroc a eu recours aux services du Ministère du Commerce, de l'Industrie et des Nouvelles Technologies. Ils ont bien voulu mettre à sa disposition un échantillon représentatif à l'image du tissu industriel marocain d'une liste de 988 entreprises sur la base des 500 entreprises demandées. Les entreprises ayant bien voulu répondre à ces deux questionnaires sont au nombre de 364 unités.

L'échantillon est composé d'entreprises marocaines. Il compte 988 entreprises industrielles réparties sur toutes les grandes villes du Maroc avec une dominance de la ville de Casablanca (64%).

Les entreprises questionnées sont représentatives de plusieurs tailles. En terme de chiffre d'affaires elles ont, pour 37,1 % réalisé un CA compris entre 10 et 50 millions de dhs. Par contre celles qui ont un CA de plus de 100 millions de dhs représentent 16,5% de l'échantillon. Les entreprises ayant un CA de moins d'1 million de dhs représentent 18,1%.

Tableau 1. Taille des entreprises en termes de chiffre d'affaires

Fourchette CA	Effectifs	Pourcentage	Pourcentage cumulé
Moins de 1million Dhs	66	18,1	18,1
De 1 à 10 millions Dhs	70	19,2	37,4
De 10 à 50 millions Dhs	135	37,1	74,5
De 50 à 100 millions Dhs	33	9,1	83,5
Plus de 100 millions Dhs	60	16,5	100,0
Total	364	100,0	

Les entreprises de l'échantillon appartiennent à tous les secteurs d'activité avec une dominance des secteurs du textile (14%), de l'agroalimentaire (16,2 %) et de la mécanique et métallurgie (18,7%).

Tableau 2. Secteurs d'activités des entreprises

Secteur d'activité	Effectifs	Pourcentage	Pourcentage cumulé
Agriculture et agroalimentaire	59	16,2	16,2
Textile	51	14,0	14,0
Chimie et parachimie	31	8,5	8,5
Mécanique et métallurgie	68	18,7	18,7
Électronique et électricité	26	7,1	7,1
Technologie de l'information et de communication	12	3,3	3,3
Industries diverses	117	32,1	32,1
Total	364	100,0	100,0

Pour ce qui des variables endogènes de notre étude, nous remarquons que sur l'ensemble des entreprises de notre base de sonnées, 37,6% ont coopérer pour innover (soit 137 entreprises). Parmi ces entreprises qui coopèrent 72,3% sont innovantes (99 entreprises) contre 38 entreprises qui coopèrent mais n'innovent pas. Plus précisément, plus de 85% des entreprises innovantes de notre échantillon coopèrent pour y parvenir. Elles sont, seulement, 17 entreprises (soit 14,7%) avoir innover sans coopération.

Tableau 3. La coopération et la décision d'innovation

La coopération pour l'innovation		Entreprise innovante		Total
		Non	Oui	
Non	Effectif	210	17	227
Oui	Effectif	38	99	137
Total	Effectif	248	116	364

Un nombre très important des entreprises innovantes coopèrent pour réaliser leurs projets d'innovation. Le graphique ci-après nous présente l'identité des partenaires avec lesquels coopèrent les entreprises pour innover.

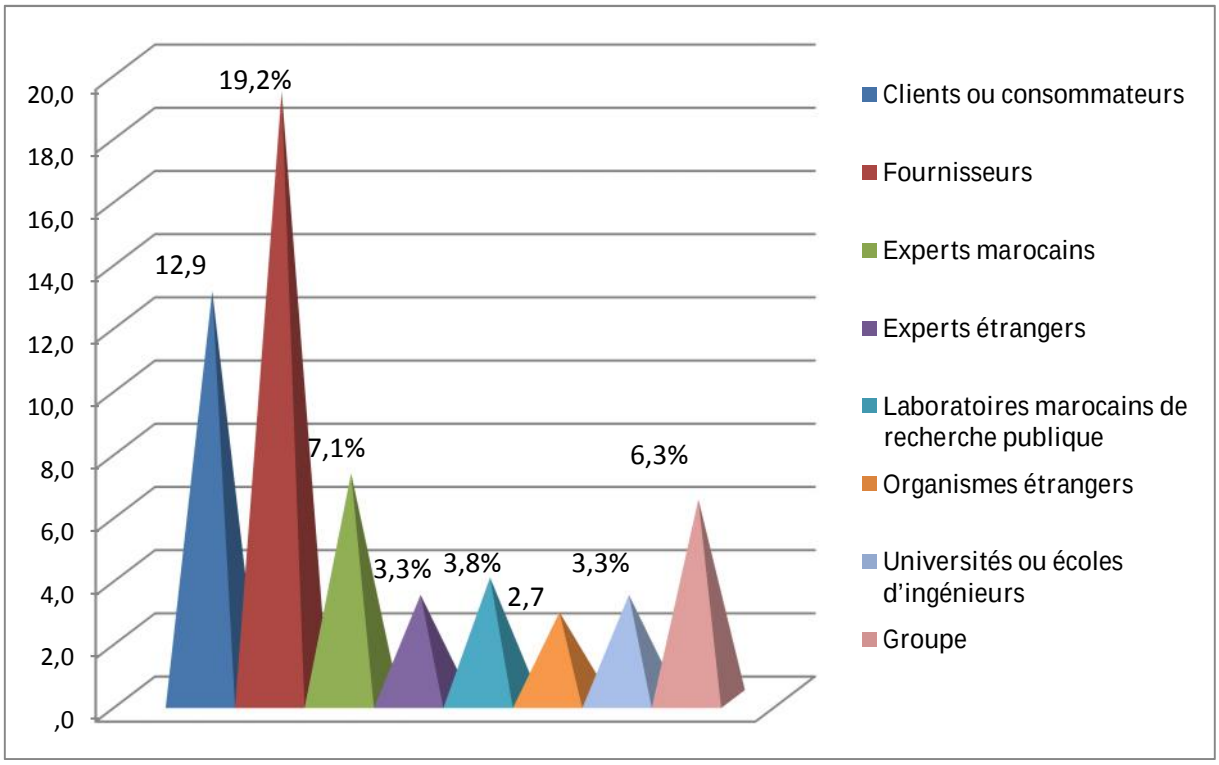


Fig. 1. Les partenaires de coopération des firmes innovantes

D'après le graphique, les fournisseurs sont le premier partenaire des entreprises innovantes (19,2% des entreprises) ; les clients arrivent au deuxième rang (12,9%) ; au troisième rang nous retrouverons les experts marocains (7,1% des entreprises) ; les entreprises de même groupe viennent au quatrième rang (6,3%) ; 3,8% des entreprises coopèrent pour l'innovation avec les laboratoires marocains de recherche publique ; le sixième rang est partagé entre les experts étrangers et les universités marocaines et le rang le plus bas revient aux organismes étrangers.

2.2 Traitements De La Base De Donnees

Après fusion des deux bases de données, nous avons dû procéder à des traitements à la fois de clarification et de création de variables, afin de corriger certaines anomalies et réaliser des estimations économétriques en adéquation avec la nature des modèles que nous spécifierons par la suite.

Dans notre base de données, nous avons remplacé les valeurs manquantes des variables qualitatives par la valeur zéro, en supposant que la réponse de l'entreprise à la question est négative c à d « non ». Ce cas concerne, entre autres, les entreprises n'ayant pas répondu à une question, ou dont la variable n'a pas d'importance dans l'activité de l'entreprise.

D'autres variables ont été regroupées afin que nous puissions effectuer des comparaisons entre les entreprises en termes de secteurs d'activité. En effet, les modalités de la variable «Secteurs d'activité » ont été regroupées de telle sorte de tenir compte l'intensité technologique de secteur.

2.3 DEFINITION DES VARIABLES ET HYPOTHESES DE L'ETUDE

Nous nous intéressons, dans les paragraphes suivants, à présenter les variables utilisées afin de tester les hypothèses de notre étude.

2.3.1 LES VARIABLES ENDOGÈNES

- **La variable innovation (INNOV)**

Nous mesurons la capacité d'innovation par la variable endogène Innovation (modèle M1). Elle représente la propension à innover des entreprises, est codée comme suit :

INNOV = 1 Si la l'entreprise a introduit au moins une innovation c'est-à-dire si la variable innovation est égale à 1.

INNOV = 0 Sinon.

- **La variable coopération (COOP)**

Pour le modèle M2, nous utilisons la variable coopération comme variable dépendante. La coopération pour l'innovation est définie à l'aide de la variable endogène suivante :

COOP = 1 Si l'entreprise a déclaré coopérer pour innover.

COOP = 0 Sinon.

2.3.2 LES VARIABLES EXOGÈNES

Nous expliquerons la propension à innover et de coopérer des entreprises (Yi) par une régression logistique avec les variables explicatives (Xi) suivantes :

- **La taille de l'entreprise (SIZE)**

La taille est une des variables classiques dans les études sur la nature et le comportement des activités innovantes [15], [16], [17]. Il faut bien noter que la taille de l'entreprise comme déterminant de l'innovation, a été introduite dans la littérature par Schumpeter, mais de façon contradictoire. La référence [18] soutient que l'innovation est du ressort des entreprises de petite et moyenne taille, celles-ci sont caractérisées par le dynamisme et la flexibilité. Huit ans plus tard, il explique que les innovations augmentent de façon proportionnelle à la taille de l'entreprise [19]. Mais la majorité des études soutiennent la deuxième hypothèse schumpetérienne [20], ainsi, plus la taille de l'entreprise augmente plus l'entreprise est innovante et plus la propension à coopérer est élevée [21], [22]. En outre, les grandes entreprises leur est plus facile d'obtenir du financement [19], et elles peuvent amortir ou étaler les coûts fixes liés à l'innovation sur un plus grand volume de ventes et tirer parti des économies de diversification ainsi que de la complémentarité entre la R&D et les autres activités de fabrication. Nous escomptons que la taille ait un effet positif sur la propension à innover et à coopérer. Une première hypothèse peut être alors avancée :

H1 : Plus la taille de l'entreprise augmente plus l'entreprise est innovante et plus la propension à coopérer est élevée.

- **Nouvelle création de l'entreprise (NOUVESE) et l'appartenance à un groupe (GROUP)**

Les entreprises qui viennent de rentrer sur le marché ont plus de difficultés à innover à cause de leur manque de ressources internes [23]. C'est la raison pour laquelle le fait d'appartenir à un groupe ou à un réseau donne un accès plus facile à la base des connaissances et ressources du groupe grâce à la présence de diverses formes de proximité (proximité organisationnelle, sociale, cognitive etc.) qui permettent aux entreprises d'innover plus rapidement [24], [25]. Ainsi, les entreprises appartenant à un groupe sont plus innovantes que les firmes indépendantes. Nous émettons les hypothèses suivantes :

H2 : La nouvelle création de l'entreprise à un effet positif sur la coopération, mais négatif sur la propension à innover.

H3 : Les entreprises appartenant à un groupe sont plus innovantes que les firmes indépendantes.

- **Intensité technologique du secteur d'activité (HIGHTECH)**

Le secteur d'activité de l'entreprise est un déterminant classique de l'innovation dans les entreprises. Il ressort de la littérature empirique que les firmes des secteurs à forte intensité technologique, sont généralement plus novatrices que celle des secteurs traditionnels, à forte intensité de main d'œuvre [20], [26], [27]. Bien que l'innovation est censée être plus forte dans les secteurs industriels à forte intensité technologique telles que l'électronique et la biotechnologie, elle est stimulée et accrue grâce aux ressources allouées à la R&D [28]. Nous essayerons alors de vérifier l'hypothèse suivante :

H4 : Les firmes des secteurs à forte intensité technologique sont plus novatrices.

- **La capacité d'absorption (réalisation interne et externe de R&D, dépenses totales de R&D etc.)**

Bien que la R&D ne constitue pas une condition suffisante à l'innovation, son apport est important dans le processus d'innovation [29]. Les entreprises qui se sont dotées d'un programme de R&D efficace sont plus susceptibles d'innover, et ce, pour plusieurs raisons. Premièrement, la R&D crée directement de nouveaux produits et procédés. Deuxièmement, les entreprises qui font de la R&D sont également mieux disposées à utiliser les percées technologiques d'autrui [30]. Également, la propension à coopérer pour l'innovation est influencée positivement par la R&D qui permet d'augmenter la capacité de l'entreprise à absorber les nouvelles technologies qui apparaissent sur le marché, attirer des partenaires potentiels [31], [32].

Les références [33], [34] distinguent à cet égard, dans le concept de capacité d'absorption, deux éléments : les « inward looking » désignent la capacité d'absorption au sein d'une même organisation comprenant de nombreuses unités et les « outward looking » qui s'adressent à la capacité d'absorption de la firme vis-à-vis de l'extérieur. Il existerait donc une capacité d'absorption à l'intérieur et/ou à l'extérieur de l'organisation [35].

L'hypothèse la plus fréquemment évoquée au niveau des entreprises est que l'environnement externe est le plus susceptible de constituer une source d'innovation [36]. Néanmoins, la capacité d'absorption repose sur la capacité interne à innover (dépenses internes de R&D, relativement difficiles à apprécier dans les PME). Nombre d'auteurs ont démontré que, malgré le fait que les grandes entreprises sont plus impliquées dans la recherche interne que les PME, les PME ne sont pas désavantagées de façon significative par rapport aux grandes entreprises quand les dépenses totales de R&D sont prises en compte [17], [37].

La capacité d'absorption des entreprises ne repose pas seulement sur un effet de taille. Elle est habituellement associée au niveau de compétences au sein de l'entreprise ou avec l'investissement en recherche de développement réalisé par l'entreprise. Pour cette raison, nous incluons dans l'équation les cadres supérieurs affectés aux activités de recherche et développement (STFCS), l'existence d'un budget consacré aux activités de R&D (BDGTRD), la réalisation des activités de R&D en interne (RDINT), ainsi que les activités R&D réalisées en externe (RDEXT). Un niveau élevé de ces variables est de nature à faciliter le processus d'innovation et la capacité absorptive de l'entreprise. Toutefois, il améliore également la capacité des entreprises d'innover à l'intérieur.

H5 : Plus la capacité d'absorption d'une entreprise augmente, plus elle innove et plus elle coopère pour innover.

- **La coopération pour l'innovation (COOP & INTCOOP)**

L'innovation est de plus en plus critique pour la survie et la croissance des entreprises, mais les entreprises ont souvent du mal à innover [38] en partie parce que leurs ressources et capacités internes deviennent inadéquats pour s'engager dans des explorations technologiques durables et de recombinaisons de ressources [39]. Les entreprises cherchent donc des ressources de leurs réseaux d'alliances stratégiques [40], [41], [24], [42].

La capacité d'interaction entre les partenaires mobilise des processus internes pour assimiler et intégrer les connaissances recombinées avec les sources externes d'innovation [43], [44], [45], [46]. Nous supposons que le choix du partenaire pour l'innovation est fait à partir du degré de complémentarité ou de similarité des compétences mobilisées dans le cadre de cette relation. Les entreprises recherchent plutôt des compétences complémentaires et différenciées propices à l'innovation que des compétences similaires qui restreignent ces opportunités.

D'où, malgré l'abondance des études faites sur les coopérations inter-firmes, la littérature investiguant l'interaction des compétences spécifiques de chacun des partenaires et des changements organisationnels opérés pour la création de nouvelles ressources et compétences reste encore très restreinte. Cependant, la réussite et la fructification des relations de coopération surtout en R&D sont conditionnées par la bonne identification des types de compétences crées en commun et des formes organisationnelles les plus adaptées au développement des nouvelles compétences [47]. Ainsi, la coopération inter-firmes est vue comme un moyen pour acquérir et internaliser les ressources ou compétences d'entreprises partenaires. Il peut s'agir d'une mise en commun de connaissances et d'informations complémentaires ou du développement d'un

processus d'apprentissage [48]. Ces relations permettent ainsi la stimulation de l'apprentissage d'une entreprise et son innovation [49], [50] par le concept de la capacité d'absorption. D'où l'engagement de l'entreprise dans une relation de coopération augmente ses compétences pour innover. Nous formulons l'hypothèse suivante :

H6 : La coopération pour l'innovation à un impact positif sur propension à innover

- **Disponibilité d'une structure de veille technologique (VTECH)**

La veille technologique consiste à s'informer de façon systématique sur les dernières évolutions technologiques et de surveiller avec attention des nouvelles technologies pour répondre aux besoins de l'innovation [51]. Face au développement technologique, l'information interne (issue de la R&D) n'est pas suffisante pour l'entreprise, il faut qu'elle élargisse son champs de recherche vers l'extérieur et reste à l'écoute afin d'obtenir des nouvelles informations qui seront ensuite évaluées et ajustées aux besoins des activités de recherche et développement. La référence [52] définit La veille est un processus par lequel l'entreprise s'informe de façon volontariste et organisée sur l'évolution de son environnement en vue de mieux s'adapter aux changements de celui-ci. La promotion de la capacité de l'innovation des entreprises est l'une des missions de la veille technologique [53], [54], [55]. Elle consiste en l'accumulation et le tri d'information, en partie ciblée, l'analyse de l'information en particulier par des relations de confiance et de vérification auprès de différentes sources, la diffusion de l'information scientifique au sein de l'organisation, et l'utilisation de cette information au moment convenable. Nous essayerons alors de vérifier l'hypothèse suivante :

H8 : La propension d'innovation et de coopération est positivement influencée par la veille technologique.

- **Appropriabilité et droits de propriété intellectuelle (BREVET & LICENCE)**

Les brevets ont pour objet de stimuler la recherche dans le secteur privé en permettant aux inventeurs de profiter de leurs réalisations. Si les concurrents peuvent facilement copier leurs inventions, les entreprises ne seront guère tentées d'innover. Pour se protéger de la contrefaçon, elles ont recours à diverses formes de protection de la propriété intellectuelle, par exemple les brevets, les secrets commerciaux, les droits d'auteur et les marques de commerce.

Les constatations empiriques tendent à prouver l'efficacité des brevets dans l'incitation à innover, sous réserve de quelques variations d'un domaine d'activité à l'autre. La référence [23] a conclu que, même s'il est manifeste que les conditions d'appropriabilité diffèrent d'une industrie à l'autre, on dispose de peu de données empiriques démontrant que ces conditions sont propices à l'innovation dans un large éventail d'industries. En effet, d'autres études empiriques prouvent le contraire. La référence [56] a constaté que les brevets jouaient un rôle important uniquement dans les produits pharmaceutiques et les produits chimiques. D'autres chercheurs ont aussi constaté que les brevets étaient plus importants dans les produits pharmaceutiques et les produits chimiques. La référence [57] présente d'autres conclusions reposant sur des données d'enquête pour le Canada, selon cette étude, d'autres méthodes de protection de la propriété intellectuelle, par exemple le fait d'être le premier sur le marché, l'utilisation de secrets commerciaux et l'élaboration de dessins industriels complexes, s'avèrent plus efficaces que les brevets.

H9 : Les droits de propriété intellectuelle ont un impact positif sur la capacité d'innovation et de coopération pour l'innovation.

Nous synthétisons dans le tableau suivant les différentes variables retenues selon leur catégorie.

Tableau 4. Présentation des variables explicatives

Variables	Nom	Description
Caractéristiques de l'entreprise		
Taille	**SIZE**	Logarithme de l'emploi de la firme
Groupe	**GROUP**	Dichotomique : 1 si l'entreprise appartient à un groupe ; 0 sinon
Nouvelle création de l'entreprise	**NOUVESE**	Dichotomique : 1 si l'entreprise a été créée après l'année 2000 ; 0 sinon
Caractéristiques du secteur d'activité		
Intensité technologique de secteur d'activité	**HIGHTECH**	Dichotomiques : 1 si l'entreprise fait parti de secteurs d'activités hightech ; 0 sinon
Capacités d'absorption		
Réalisation de la R&D en interne	**RDINT**	Modalités : 1 = "Activités permanentes par une équipe dédiée" ; 2 = "Activités aléatoires selon les opportunités" ; 0 = "Pas de recherche"
Réalisation de la R&D en externe	**RDEXT**	Dichotomique : 1 si l'entreprise sous traite ses activités R&D ; 0 sinon
Existence de budget R&D	**BDGTRD**	Dichotomique : 1 si l'entreprise consacre un budget à ces activités R&D ; 0 sinon
Ressources humaines / R&D	**STFCS**	Dichotomique : 1 si cadres supérieurs affectés aux activités R&D (universitaires, ingénieurs) ; 0 sinon
La coopération pour l'innovation		
Coopération pour l'innovation	**COOP**	Dichotomique : 1 si la firme coopère pour l'innovation ; 0 sinon
Intensité de coopération pour l'innovation	**INTCOOP**	Modalités : 1 si l'entreprise coopère avec un partenaire……..8 si l'entreprise coopère avec huit partenaires.
Le recours au droit de la propriété industriel		
Protection par brevet	**BREVET**	Dichotomique : 1 si l'entreprise utilise la protection par brevet et 0 sinon
Achat de licence pour l'exploitation	**LICENCE**	Dichotomique : 1 si l'entreprise a acheté une licence et 0 sinon
Structure de collecte d'information		
Disponibilité d'une équipe interne dédiée à la veille technologique	**VTECH**	Dichotomique : 1 si la firme a une équipe dédiée à la veille technologique ; 0 sinon.

2.4 LE MODÈLE LOGISTIQUE BINAIRE

La régression logistique convient pour la modélisation d'ure variable dichotomique $Y = 1/0$. L'objectif est de modéliser l'espérance conditionnelle de Y sachant les valeurs ce certaine variables explicatives X1, ……Xp :

$$\pi(X) = Prob(Y = 1 X = x)$$

Où : π = la probabilité à modéliser ; Y = la variable dichotomique dépendante ; X = le vecteur des variables exogènes.

Pour estimer la probabilité π, nous nous servirons de l'inverse de la loi logistique :

$$g(x) = \log\left(\frac{x}{1-x}\right)$$

Par conséquent, la probabilité à estimer π pour le modèle logit se déduit comme suit :

$$g(\pi) = x\beta \leftrightarrow \pi = \frac{1}{1 + \exp(-x\beta)}$$

Dans le cas du modèle dichotomique univarié, la construction de la vraisemblance est assez simple. En effet, à l'événement :

$yi = 1$ est associée la probabilité $\pi i = F(xi\beta)$

$yi = 0$ correspond à la probabilité $1 - \pi i = 1 - F(xi\beta)$

Ceci permet de considérer les valeurs observées yi comme les réalisations d'un processus binomial avec une probabilité de $F(xi\beta)$.

$$F(xi\beta) = \frac{\exp(xi\beta)}{1+\exp(xi\beta)} = \pi i$$

La vraisemblance associée à l'échantillon de taille N, noté $y = (y1, \ldots\ldots, yn)$ pour le modèle Logit s'écrit de la façon suivante :

$$L(y,x,\beta) = \prod_{i=1}^{N} \left[\frac{1}{1+\exp(xi\beta)}\right]^{1-yi} \frac{\exp(xi\beta)}{1+\exp(xi\beta)}^{yi}$$

A partir de cette définition, on déduit la log-vraisemblance comme suit :

$$logL = \sum_{i=1}^{N} \{(1-y_i)\log[1+\exp(xi\beta)^{-1}] + yi(xi\beta) - yi\log(1+\exp(xi\beta))\}$$

$$logL = \sum_{i=1}^{N} \{\log[1+\exp(xi\beta)] - yixi\beta\}$$

L'estimateur du maximum de vraisemblance des paramètres β est obtenu en maximisant soit la fonction de vraisemblance $L(y,\beta)$, soit la fonction de log-vraisemblance $logL(y,\beta)$.

3 RÉSULTATS

Les modèles que nous avons construits permettent d'identifier les déterminants de l'innovation et de la coopération pour l'innovation, il s'agit des modèles logistiques binaires M1 et M2 et. Les paramètres des modèles sont estimés par la méthode de vraisemblance.

3.1 ESTIMATIONS ET SPÉCIFICATION DES MODÈLES

Dans ce paragraphe, nous présentons les tests attestant la performance de nos modèles. Dans notre cas, la qualité d'ajustement totale des modèles sera mesurée à l'aide de R2 de Mc Fadden, le test du rapport de vraisemblance, le taux de classification et la statistique « z » les paramètres estimés correspondant au test de nullité associé à chaque variable exogène du modèle.

Nous vérifions la multicolinéarité possible entre les variables indépendantes de nos modèles en recourant à la matrice de corrélation de Pearson. Nous remarquons qu'aucun problème sérieux de corrélation n'est détecté entre les variables (Tableau 5).

La performance de nos modèles expliquant la probabilité d'innover et de coopérer est acceptable. Le pseudo R2 de Mc Fadden est de «0,87» et respectivement «0,46», ce qui est largement satisfaisant dans notre approche dichotomique. Le test de Khi-deux est significatif au seuil de 5% (ratio du maximum de vraisemblance égale à 396,69 et respectivement 225,47). Les indicateurs de performances sont acceptables pour nos modèles, ce qui nous mène à rejeter l'hypothèse nulle pour tous les modèles.

La comparaison de Log de maximum de vraisemblance du modèle nulle (log likelihood null) et celui de modèle final (log likelihood model), nous permet de conclure que les modèles finals permettent de prédire mieux la probabilité d'innover et de coopérer que le font les modèles incluant seulement la constante. Nos modèles prédisent de manière satisfaisante le comportement des entreprises en matière d'innovation et de coopération (respectivement 95.9% et 84,66% des observations sont prédites correctement pour le modèle M1 et M2).

La statistique qui correspond à l'aire au dessous de la courbe ROC, sous STATA, est la « zone ». Plus la valeur de « zone » est grande, plus le modèle est bon.

Dans notre cas, «zone» = 0,9931 pour le modèle M1 et «zone» = 0,9113 pour le modèle M2, nous concluons que les deux modèles proposés sont pertinents et bien spécifiés (Figure 2 et 3).

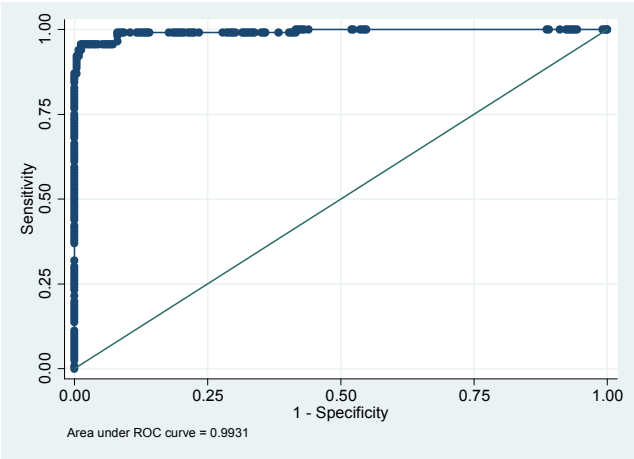


Fig. 2. La courbe ROC du modèle M1

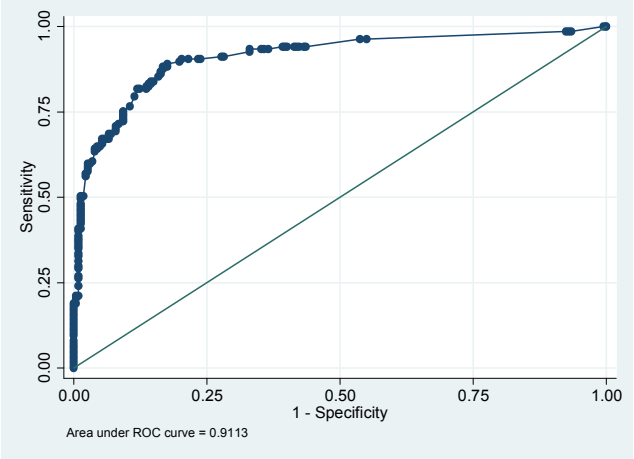


Fig. 3. La courbe ROC du modèle M2

Tableau 5. Matrice de corrélation des variables explicatives

	SIZE	NOUVESE	GROUP	HIGHTECH	RDINT	RDEXT	BDGRD	STFCS	BREVET	LICENCE	VTECH	COOP	INTCOOP
SIZE	1												
NOUVESE	-0.2318**	1											
GROUP	0.0585	0.2010**	1										
HIGHTECH	-0.0886	0.1989**	-0.0445	1									
RDINT	0.0965	0.3035**	0.2429**	0.2034**	1								
RDEXT	0.1216*	-0.0173	0.2205**	-0.0623	0.1402**	1							
BDGRD	0.2813**	0.0624	0.3539**	-0.0658	0.2386**	0.2242**	1						
STFCS	0.1951**	0.1740**	0.3854**	0.0591	0.3865**	0.1721**	0.5313**	1					
BREVET	0.2258**	0.0871	0.2306**	-0.0149	0.0774	0.0989	0.2503**	0.3801**	1				
LICENCE	-0.1021	0.0742	0.1010	0.0135	0.0652	-0.0551	-0.0501	0.1935**	0.1707**	1			
VTECH	0.2940**	0.1970**	0.3126**	0.1143*	0.3115**	0.1646**	0.3868**	0.4856**	0.3438**	0.0380	1		
COOP	0.0878	0.4411**	0.3151**	0.0471	0.4457**	0.1363**	0.4074**	0.5522**	0.3360**	0.1242*	0.4956**	1	
INTCOOP	0.1148*	0.2324**	0.3083**	-0.0539	0.3359**	0.0683	0.3115**	0.3728**	0.3199**	0.1184*	0.3494**	0.6319**	1

*** La corrélation est significative au seuil de 10%* *** La corrélation est significative au seuil de 5%*

3.2 RÉSULTATS DU MODÈLE INNOVATION (M1)

Le but de ce premier modèle est d'identifier les facteurs déterminant l'engagement des entreprises marocaines dans des activités d'innovation. Le tableau suivant résume les résultats des régressions logistiques fournis par le logiciel STATA.

Tableau 6. Résultats des régressions logistiques du modèle Innovation (M1)

Variables		Coef.	Std. Err.	Z	P>z
SIZE		-1.161259	.5376478	-2.16	0.031
NOUVESE		-.3012743	.9712831	-0.31	0.756
GROUP		2.679078	1.060664	2.53	0.012
HIGHTECH		-.4168466	1.689693	-0.25	0.805
RDINT	**1**	1.163518	.561264	2.07	0.038
	2	-.4980036	1.189992	-0.42	0.676
RDEXT		2.516332	1.536387	1.64	0.101
BDGRD		6.157174	3.121565	1.97	0.049
STFCS		4.982552	1.081949	4.61	0.000
BREVET		3.488487	1.312234	2.66	0.008
LICENCE		2.253796	3.435436	0.66	0.512
VTECH		4.088537	1.019659	4.01	0.000
COOP		2.47269	.9882682	2.50	0.012
INTCOOP		.1148991	.3600436	0.32	0.750
Constante		-5.437603	1.541431	-3.53	0.000
Observations = 364 ; LR chi2(14) = 396.69 ; Prob > chi2 = 0.0000 ; Pseudo R2 = 0.87					
log likelihood (null) = -227.81722 ; Log likelihood (model) = -29.470699 ; Taux de prediction = 95,9%					

Il ressort des régressions que l'engagement dans des activités d'innovation varie en fonction de la taille et de l'appartenance à un groupe. En effet, nous trouvons que plus la taille des entreprises augment, plus les firmes sont innovantes. Les entreprises qui appartiennent à un groupe ont plus de chances d'innover que les entreprises indépendantes.

Le fait d'appartenir aux secteurs High-tech n'influence pas la probabilité d'innover des entreprises marocaines, ce qui nous fait penser le comportement d'innovation des entreprises marocaines ne provient pas de leurs caractéristiques sectorielles.

La capacité d'absorption améliore les conditions d'innovation dans une entreprise. Les entreprises qui n'ont pas consacré de budgets R&D en interne ou de recrutement des cadres supérieurs chargés des activités R&D sont moins innovantes que celles qui l'ont fait. De même, les entreprises recourant aux droits de la propriété intellectuelle et celles disposant d'une équipe dédiée à la veille technologique ont plus de chances d'innover que les autres entreprises.

Concernant les coopérations pour l'innovation, nous constatons que les entreprises qui coopèrent ont plus de chances d'innover que les autres entreprises qui ne coopèrent pas. Nous remarquons également que la variable intensité de coopérations n'est pas significative, ce qui nous mène à dire que les entreprises doivent se concentrer plutôt sur le choix des bons partenaires que l'intensification des coopérations. De ce fait, nous élaborons dans la section suivante le modèle M2 pour identifier les déterminants de la coopération.

3.3 RESULTATS DU MODELE COOPERATION POUR L'INNOVATION (M2)

Le modèle M2 s'intéresse aux facteurs qui poussent les entreprises marocaines à s'engager dans des relations de coopération afin d'innover. Les résultats du modèle Coopération sont synthétisés dans le tableau ci-après.

Tableau 7. Résultats des régressions logistiques du modèle Coopération (M2)

Variables		Coef.	Std. Err.	Z	P>z
SIZE		-.1332938	.2170833	-0.61	0.539
NOUVESE		2.555815	.4528109	5.64	0.000
GROUP		1.324903	.4518965	2.93	0.003
HIGHTECH		-1.412517	.7239604	-1.95	0.051
RDINT	1	1.296612	.3794195	3.42	0.001
	2	1.690125	.4661536	3.63	0.000
RDEXT		.0291947	.68058	0.04	0.966
BDGRD		1.116216	.5105748	2.19	0.029
STFCS		1.627794	.4674785	3.48	0.000
BREVET		1.409782	.5486734	2.57	0.010
LICENCE		.3812222	.853294	0.45	0.655
VTECH		1.368935	.3681116	3.72	0.000
Constante		-2.59083	.5364291	-4.83	0.000
Observations = 364 ; LR chi2(14) = 225.47 ; Prob > chi2 = 0.0000 ; Pseudo R2 = 0.46					
Log likelihood (null) = -241.06297 ; Log likelihood (model) = -128.32943 ; Taux de prediction = 84,6%					

Comme attendu, les entreprises nouvellement créée et celles faisant parti d'un groupe sont plus intéressées par les relations de coopération afin d'innover. Cependant, la taille et la variable hightech ne sont pas significatives.

Les indicateurs de la capacité d'absorption se montrent discriminants sur les relations de coopération. La réalisation des activités R&D au sein des entreprises même d'une manière occasionnelle, le recrutement des cadres supérieurs chargés de la R&D et de l'innovation et le budget R&D influencent positivement la propension à coopérer pour innover. La sous-traitance des activités de R&D ne semble pas avoir un effet significatif.

Ainsi les entreprises qui ont une équipe dédiée à la veille technologique et qui ont recouru aux droits de la propriété industrielle coopèrent plus que celles qui ne l'ont pas fait.

4 DISCUSSION

Comme attendu, les résultats du modèle Innovation montrent que la propension à s'engager dans des activités d'innovation varie en fonction de la taille et de l'appartenance à un groupe, alors que la variable indiquant les entreprises nouvellement créées joue un rôle négatif sur la propension à innover. En effet, plus la taille de l'entreprise augmente plus l'entreprise est innovante, ce qui confirme les résultats des études de notre revue de littérature [20], [21], [22].

Pour la référence [23], les entreprises qui viennent de rentrer sur un marché ont des difficultés à cause de leur manque de ressources internes nécessaire à l'innovation. L'appartenance à un groupe permet un accès plus facile à la base des connaissances et ressources du groupe grâce à la présence de diverses formes de proximité qui permettent aux entreprises d'innover plus rapidement [24], [25]. Ces résultats sont confirmés par notre modèle économétrique.

Un résultat qui mérite d'être souligné est que l'appartenance aux secteurs hightech n'a pas d'effet sur la décision d'innovation et de coopération, ce qui démontre que les firmes de moyenne faible technologie ne sont pas désavantagées de façon significative. De même, la variable hightech n'exerce aucun impact sur la décision de coopération des entreprises en vue d'innover. Par conséquent, l'intensité technologique de secteur ne joue pas sur le comportement innovant des entreprises marocaines et l'appartenance à des secteurs à faible intensité de technologie et/ou de connaissance ne constitue en aucun cas un handicap à l'innovation. Ceci contredit la majorité des études [23], [26], [27] qui témoignent d'une influence positive de l'intensité technologique sur la propension à innover. Notre résultat peut être expliqué par le fait que les entreprises de notre échantillon n'interviennent pas dans les premiers maillons de la chaine de production.

L'appropriabilité des droits de la propriété intellectuelle agit positivement et significativement sur le comportement des entreprises en matière d'innovation et de coopération. En effet, ce sont les entreprises qui optent pour une politique de brevetage qui innovent et coopèrent plus. Cependant, l'achat des licences ne semble pas avoir l'effet attendu sur la promotion des activités d'innovation et de coopération.

Les résultats de nos modèles confirment l'hypothèse selon laquelle la promotion de la capacité de l'innovation des entreprises est l'une des missions de la veille technologique [53], [54], [55]. En effet, la propension d'innovation et de coopération est positivement influencée par la veille technologique.

Concernant la capacité d'absorption, Les entreprises qui n'ont pas consacré de budgets R&D en interne ou de recrutement des cadres supérieurs chargés des activités R&D sont moins innovantes que celles qui l'ont fait. En effet, la qualification de la main d'œuvre et la capacité d'émission des connaissances détenues par les entreprises de même groupe ou par les partenaires de l'entreprise jouent sur la décision d'introduire une innovation [29], [31], [32]. Ce résultat témoigne de la nature collaborative de l'innovation, basé sur l'engagement de l'entreprise dans des relations de coopération pour innover et non seulement sur leurs dépenses de R&D. Ce résultat est confirmé par notre étude, au moment où la variable coopération exerce un effet positif sur la propension à innover des entreprises marocaines.

5 CONCLUSION

L'objectif de ce papier a été donc d'analyser l'effet des facteurs d'origine interne (taille, capacité d'absorption etc.) et externe (liés aux connaissances, au marché etc.) sur la propension à innover et de coopérer pour l'innovation des entreprises marocaines. Nous avons utilisé des régressions logistiques binaires sur un échantillon de 364 entreprises. Cette étude a pour ambition de délivrer un ensemble de propositions d'appui aux entreprises en termes de politique d'innovation.

Dans ce sens les pouvoirs publics marocains devraient œuvrer pour :

Favoriser le cadre fiscal incitatif permettant d'encourager les entreprises en matière de R&D. Et ce à travers la mise en place d'un dispositif « Crédit d'Impôt Recherche » (CIR) consistant à faire bénéficier les entreprises d'une réduction d'impôt du montant des dépenses en R&D réalisées au cours de l'exercice, avec un plafonnement.

Accorder l'attention voulue aux secteurs de moyenne faible technologie, les industries à forte intensité de main d'œuvre et les industries traditionnelles généralement, et éviter de se concentrer les secteurs à haute intensité technologique uniquement.

Proposer aux entreprises des mesures d'accompagnement en matière d'innovation et d'instauration d'une démarche d'innovation, en leurs permettant l'accès aux moyens financiers, humains et matériels nécessaires à la mise en œuvre des projets d'innovation.

Favoriser l'innovation collaborative dans le cadre des réseaux facilitant le rencontre avec des partenaires privés ou publics et par la mise en place des coopérations basée sur l'intérêt mutuel et la proximité pour facilité l'action dans des firmes à ressources limitées.

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Analyse des accidents du travail et maladies professionnelles à la Régie des Voies Maritimes de Boma, RD Congo

[Work accidents and occupational illnesses at RVM Industrial Ecosystem (Boma, DR Congo)]

B. M. Bienvenu Wanga[1], D. E. Dieudonné Musibono[2], L. Charles Mafuana[3], M. Sarah Babeki[4], T. Bruno Lukombo[5], N. Eric Diana[6], K. M. Roger Bantodisa[7], N. Hermes Mushayuma[1], and B. Charles Balume[7-8]

[1]Centre de Recherche en Sciences Naturelles/Lwiro, Sud-Kivu, RD Congo

[2]Faculté des Sciences B.P. 190, Université de Kinshasa, Kinshasa XI, RD Congo

[3]Centre de Santé de la RVM/Boma, Bas-Congo, RD Congo

[4]Centre de Recherche en Environnement et Tourisme/Boma, RD Congo

[5]Institut National de Sécurité Sociale/Boma, Bas-Congo, RD Congo

[6]Ministère de la santé, Kinshasa, RD Congo

[7]Institut Supérieur d'Agroforesterie et de Gestion de l'Environnement-Kahuzi Biega/Sud-Kivu, RD Congo

[8]Barreau de Bukavu, RD Congo

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ABSTRACT: Work accidents and occupational illnesses at RVM Industrial Ecosystem (Boma, D R Congo). This paper reports on work accidents and occupational diseases at RVM/ Boma in D R Congo. Our investigations based on direct observations, literature search and interviewes revealed the effectiveness of such accidents and occupational diseases at RVM industrial ecosystem. This paper is for sensitization and awareness raising within professional ecosystem.

KEYWORDS: Work accidents, occupational illnesses, Industrial Ecosystem, INSS, RVM, Boma, DR Congo

RESUME: Analyse d'accidents de travail et maladies professionnelles à la régie des voies maritimes de Boma. Cet article étudie l'écosystème industriel dénommé Régie des Voies Maritimes (RVM) basé à Boma dans la Province du Bas-Congo (R D Congo). Il s'agit de l'analyse d'accidents et de maladies professionnelles y rencontrés. Nos investigations basées sur l'observation directe, la revue des rapports et documents de l'entreprise et l'entretien avec les employés. Les résultats obtenus montrent qu'il y a effectivement des maladies et accidents professionnels sont effectifs dans l'écosystème RVM. Cette publication est une introduction à la sensibilisation des travailleurs et employeurs.

MOTS-CLEFS: accidents du travail, maladies professionnelles, écosystème industriel, INSS, RVM, Boma, DRCongo.

Corresponding Author: B. M. Bienvenu Wanga

1 INTRODUCTION

La Régie des voies Maritimes, c'est une entreprise publique cerveau moteur dans l'entretien du bief maritime. Elle a reçu la mission de s'adonner exclusivement aux travaux de création et de maintien des conditions de navigabilité dans le Fleuve Congo. Par ailleurs, elle dispose dans son sein des engins flottants pour toutes sortes d'opérations, roulants et des structures pour la maintenance de ses unités. Nous notons aussi la présence des équipements et installations assurant la fabrication de certains matériels et ainsi les pièces de rechange pour l'outil de production et le reste du patrimoine. La Régie des Voies Maritime est issue du morcellement de l'ancien service de la Marine et des voies navigables qui était une entreprise d'Etat implantée à Boma par le décret royal du 26 avril 1884 [1].

De ce fait, ayant constaté la dégradation de la voie de navigation maritime entre les années 1961 et 1970, le service de la Voie Navigable ne pouvant plus jouer normalement son rôle dans l'économie, le gouvernement congolais décidera de le scinder en trois entités à savoir :

- La Direction de la Marine et des Voies Hydrauliques devenue actuellement la Direction des Transports Fluviaux, Lacustres et Maritimes.
- La Régie des Voies Fluviales.
- La Régie des Voies Maritimes.

La Régie des Voies Maritimes, RVM a été créée par l'ordonnance loi n°71-003 du 26 janvier 1971. Elle est placée sous la double tutelle du Ministère des Transports et Communications (tutelle technique) et du Ministère de Portefeuille (tutelle administrative et financière).

Elle exerce également la mission lui assignée par le gouvernement sous forme d'entreprise à caractère technique et commercial.

La mission assignée à la RVM et conformément à son cahier de charges à ouvrir, aménager et entretenir la route maritime du bief maritime du Fleuve Congo donnant ainsi accès aux ports de Boma et Matadi, à exécuter les travaux de curage au devant des quais de nos ports et à assurer dans les meilleurs conditions de sécurité de pilotage des navires qui desservent les ports maritimes de la RDC notamment Banana, Boma et Muanda [1].

Les problèmes posés par le milieu de travail en relation avec l'intégrité physique et la santé des agents sont biens connus quant à leur importance. Ainsi, Le risque zéro n'existe pas. Il survient toujours des imprévus, des dysfonctionnements ou des erreurs humaines dans les processus ou les techniques de travail, pouvant être à l'origine d'incidents ou d'accidents du travail. Le suivi et l'analyse régulière des incidents et des accidents de travail permettent d'améliorer les conditions de travail des salariés d'une part, et d'éviter qu'ils se reproduisent d'autre part. On parle alors d'un processus d'amélioration continue de la prévention des risques professionnels, qu'il s'agisse de survenue de pathologies professionnelles, de risques d'accidents (chutes, blessures, intoxications…) mais aussi de risques psychosociaux (harcèlement, stress…). Des incidents ou des accidents peuvent toujours survenir sur le lieu de travail. La règle est d'intervenir vite et systématiquement à chaque incident, de suivre l'évolution du nombre d'incidents et leur gravité, et d'impliquer les acteurs de la prévention dans ce suivi, on peut citer la médecine du travail, l'inspection du travail, le service de sécurité sociale, etc.[**2]**. Et, Une maladie professionnelle est la conséquence de l'exposition plus ou moins prolongée à un risque (vapeurs, poussières, bruit, vibrations, gestes répétitifs…) lors de l'exercice habituel de la profession. Il est souvent difficile d'en établir la cause précise. Une maladie est reconnue d'origine professionnelle si elle est déclarée et si elle figure dans un tableau du Code de la Sécurité sociale [**3].**

En effet, la RVM éprouve encore des difficultés pour doter décemment son personnel technique évoluant dans des différents ateliers du chantier naval en matériel de protection contre les incidents ou accidents ; tels que les lunettes de protection, les bouches nez, les masques d'anti-gaz, etc. Ses agents orientés dans les ateliers, garages, dock et autres unités flottantes sont soumis par l'effort physique ou matériel obligatoire exigé par les conditions ou milieu de travail. Il s'avère que ces derniers sont soit exposés par les substances nocives manipulées lors d'une quelconque activité soit à un risque potentiel par utilisation d'engin diminuant l'effort physique, parfois monotone. De cette description, s'ajoute la problématique d'assainissement et le niveau d'hygiène de certains recoins du site professionnel. Or, certains risques professionnels sont biens connus et sont spécifiques à un travail ou une exposition donnée car ils peuvent être éliminés ou réduits par l'application de mesures de prévention appropriée. Tandis que d'autres sont insidieux, non spécifiques, ou ne se manifestant qu'après des périodes de latence de plusieurs années, il est alors difficile de les dépister à temps et établir des relations des causes et à effets [4]. **Le manque d'une politique réelle dans la prévention des risques de travail à la RVM, expose ses agents aux nombreux dégâts, qui ces derniers sont considérés comme étant le maillot faible du processus professionnel**. Le but de cet article est de pouvoir et de répertorier les cas des accidents de travail par dénombrement, suivi et analyse d'un

côté, et de conscientiser et sensibiliser les autorités de cette organisation que les risques de travail au niveau de la RVM sont une réalité de l'autre côté, et que leur prise en compte va permettre d'en réduire et inverser les tendances [5]. Le mérite de cet article est de susciter un débat franc autour de la gestion des accidents du travail et des maladies professionnelles qui celle-ci constitue parfois un sujet de négligence.

Est-ce que le système d'assurance des risques professionnels via Institut National de Sécurité Sociale garantit-il les salariés de la RVM contre les conséquences des atteintes à leur santé liées à leur travail ? Autrement dit, les cotisations d'assurance versées par la RVM sur les salaires permettent le financement de l'assurance des risques professionnels ?

2 MATERIEL ET METHODES

2.1 MILIEU D'ÉTUDE

Ce travail a été réalisé dans la ville de Boma située dans la province du Bas Congo, à plus ou moins 500 Km de Kinshasa, capitale de la R D CONGO. Cette ville couvre une superficie de 4.332 Km^2. Elle est bornée : au Nord, par la province angolaise de Cabinda et le territoire de Lukula ; au Sud, par la République de l'Angola ; à l'Est, par le territoire de Seke – Banza ; à l'Ouest, par l'Océan Atlantique (Fig. 1). [6].

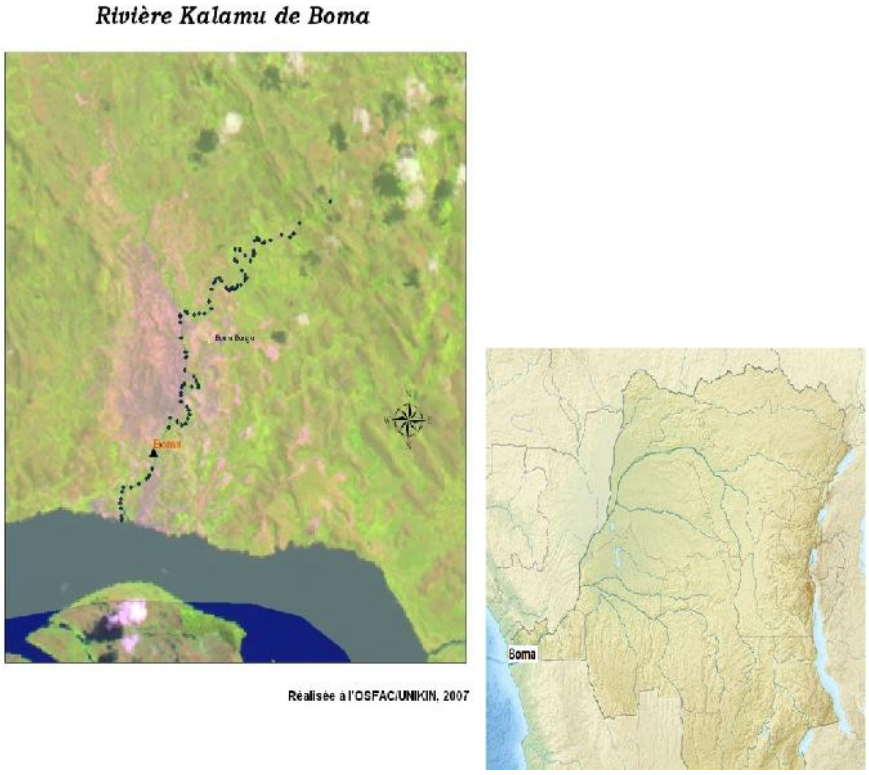


Figure 1 : Image satellitaire de la ville de Boma, au confluent, c'est la RVM/Boma

La Ville de Boma est située le long du fleuve Congo, à 05°55' Sud et 12°10' Est. Boma s'étire de part et d'autre de la rivière Kalamu qui est l'épine dorsale de l'hydrographie de la ville. Elle est limitée à l'Ouest et à l'Est par deux chaînes de collines et jouit d'un climat tropical de type AW selon la classification de Koppen [7]. La ville de Boma regorge dans sa partie Ouest des torrents très encaissés qui, pendant les saisons de pluies, alimentent considérablement la rivière Kalamu en eau et la rend ainsi très agressive pour les inondations que redoute la ville. On pouvait estimer la population à 400.000 habitants en 2006 [8].

Pour réaliser notre enquête, nous avons choisi comme milieu d'étude, la RVM dans la ville de Boma. Le choix de ce milieu a été motivé par l'ampleur des opérations réalisées par elle au niveau du bief maritime. Nous notons que ce bief maritime est de long de 150 km et se subdivise en 3 tronçons compte tenu de sa morphologie qui se différencie d'un tronçon à l'autre. A savoir, le premier tronçon va de Matadi à Boma, long de 60 Km (les profondeurs varient entre 20, 50 et 100 m). Dans cette première partie, le Fleuve Congo possède un seul brin et coule dans une vallée qui se présente sous forme d'un canal. Tandis qu'au deuxième tronçon, c'est un trajet qui part de Boma à Malela, long de 60 Km également. On parle de la zone divagante où le Fleuve Congo s'épanouit véritablement, ainsi dans cette zone, il se crée plusieurs brins (la profondeur varie de 4 à 5 m). Enfin, il s'agit de la zone de l'Estuaire long de 30 m. Elle se caractérise par la présence de la grande fosse géologique qui est un Cancon c'est-à-dire un canal sous-marin (la profondeur varie de 50 à 1000 m, au fur et mesure on remonte vers l'océan, celle-ci ne fait qu'augmenter) [9].

2.2 MÉTHODES ET TECHNIQUES [10] [11]

En vue de bien aborder notre réflexion, nous l'avons délimité dans le temps et dans l'espace à travers les rapports mis à notre disposition via la section hygiène et sécurité de la RVM. Ceci étant, nous avons tenu compte de cas des agents accidentés à la RVM de 1998 à 2002.

a. Techniques

- Technique documentaire : celle-ci a consisté à parcourir la littérature consacrée à notre question d'étude et surtout, les archives de la RVM.
- Technique d'interview : celle-ci a servi dans les entretiens que nous avons eu avec les responsables des directions, des services, sections, équipes et voir même de certains agents de la Régie pendant notre séjour en stage d'un mois soit du 27 juin au 27 juillet 2006.
- Observation directe : c'est grâce à notre séjour de stage que nous avons pu avoir les précisions sur ces faits, que les incidents, accidents et maladies professionnelles au sein de l'entreprise en effectuant ses installations, il s'agit de dock flottant, les garages, les ateliers, les installations hygiéniques, et autres unités flottantes…

En effet, l'analyse a permis ainsi d'imaginer de nouvelles mesures de prévention, afin que le même incident ne se reproduise plus. En outre, le suivi des incidents et des accidents tout au long de cette analyse, permet de connaître un certain nombre d'indicateurs précieux pour la prévention des risques professionnels. Une action peut par exemple être évaluée sur des critères relevant directement de la prévention : nombre d'accidents du travail ou de maladies professionnelles, taux de fréquence, taux de gravité, fréquentation de l'infirmerie… la RVM exploite le bilan annuel de la cellule d'hygiène et de sécurité et le rapport annuel du médecin du travail. Notre étude va plus concerner le paramètre dénombrement d'agents victimes et leur suivi au niveau de l'INSS. Les autres indicateurs feront l'objet d'autres articles.

b. Echantillonnage (critères d'inclusions et d'exclusions)

Notre échantillon a constitué tous sujets agents à la RVM (puisque nous rencontrions certains visiteurs et stagiaires), mais attention, ont été répertoriés les sujets qui souffraient d'une maladie professionnelle quelconque voir les palmarès de l'INSS et certains rapports médicaux du complexe médical de la RVM.

D'où, sont exclus de l'étude, toutes personnes ne répondant pas aux critères ci-haut cités. Les données ont été collectées par une interview orientée aux agents à l'aide d'un mini-questionnaire et d'un entretien. L'interview est couplée à l'observation par la visite et la ronde des services, sections...

c. Technique de cartographie

Dans le souci de ressortir l'image cartographique de la ville d'études, cette démarche a été suivie de la prospection sur le terrain et de la détermination du site d'étude (RVM) et d'observation. Les données satellitaires ont été appuyées par des prélèvements des coordonnées géographiques à l'aide du GPS. L'image satellitaire obtenue a été ensuite numérisée au laboratoire d'OSFAC à l'aide de logiciel de cartographie Arc GIS, laboratoire de la Faculté des Sciences Agronomiques de l'Université de Kinshasa. La Régie de Voie Maritime se trouve à 6 mètres d'altitude par rapport au niveau de la mer et ses coordonnées géographiques sont 05,858 75° de Latitude et 13,048 96° de longitude.

d. Méthode historique

Celle-ci a été d'un apport appréciable dans la connaissance du passé de l'entreprise et de l'application du système d'hygiène et sécurité. Les analyses au laboratoire des eaux où sont accostés les unités flottantes n'ont été effectuées faute des intrants.

e. Instruments juridiques

Il s'agit d'un ensemble de règles de conduite qui, dans une société organisée, gouvernent les rapports des hommes entre eux et s'imposent à eux au besoin par le moyen de la contrainte sociale [12]. Ces règles de droit sont essentiellement écrites et consignées dans les documents (journaux officiels, codes et d'autres instruments juridiques). De là, leur nom de "textes juridiques". Ces textes revêtent diverses appellations, à savoir : constitution, loi, ordonnance, arrêté, code, convention, etc [13].

Bref, ce ne sont que des textes juridiques qui ont servi à témoigner des statuts juridiques de l'INSS et du Droit des travailleurs et leur sécurité sociale. Ainsi, les aspects juridiques des accidents de travail et maladies professionnelles selon le code du travail sont décrits à travers ces textes [14]:

- 12 novembre 1921 – CONVENTION 12 concernant la réparation des accidents du travail dans l'agriculture ;
- 5 juin 1925 – CONVENTION 19 concernant l'égalité de traitement des travailleurs étrangers et nationaux en matière de réparation des accidents du travail ;
- 14 février 1952 – ORDONNANCE 23-60 – Contrôle médical de la silicose. [*B.A.*, 1952, p. 571];
- 10 février 1956 – ORDONNANCE 43-31 – Déclarations d'accidents graves survenus dans les mines, usines métallurgiques, carrières, cimenteries et fours à chaux, ainsi que dans leurs dépendances directes. [*B.A.*, 1956, p. 376];
- 25 juin 1963 – CONVENTION 119 concernant la protection des machines.
- 8 juillet 196 4 – CONVENTION 121 concernant les prestations en cas d'accidents du travail et de maladies professionnelles ;
- 9 juin 1966 – ORDONNANCE 66-370 – Sécurité sociale. – Liste des maladies professionnelles. [*M.C.*, 1966, p. 524];
- 5 mai 1977 – ARRÊTÉ 71/77 fixant les mesures de prévention contre les intoxications par le plomb (le saturnisme professionnel). [*J.O.Z.*, n°22, 15 novembre 1977, p. 695] ;
- 21 mars 1997 – ARRÊTÉ MINISTÉRIEL 12/CAB/MTPS/0147/97 – Conditions d'agrément et de maintien en fonctionnement des organismes privés de prévention des risques professionnels. (*Ministère du Travail*) ;
- **5 mai 1978** – ORDONNANCE 78-186 portant statuts d'une entreprise publique dénommée Institut national de sécurité sociale (INSS). [*J.O.Z.*, n°10, 15 mai 1978, p. 17] ;
- **13 juillet 1966** – ORDONNANCE 66-414 – Conférant à l'Institut national de sécurité sociale le droit de propriété des biens meubles et immeubles de l'OSSOM situés dans la République démocratique du Congo. [*M.C.*, 1966, p. 564];
- **26a août 1966** – ORDONNANCE 66-464 – Statut du personnel de l'Institut national de sécurité sociale. [*M.C.*, 1966, p. 1015] ;
- **25 mars 1971** – ARRÊTÉ 0049/71 fixant la composition des commissions médicales et de la commission médicale d'appel prévues par l'article 80 de l'ordonnance 66-464 du 26 août 1966 fixant le statut du personnel de l'Institut national de sécurité sociale. [*M.C.*, n°11, 1er juin 1971, p. 524] ;
- **1er mars 1975** – ORDONNANCE 75-099 fixant les modalités de désignation des membres et le fonctionnement des commissions nationales et régionales de sécurité sociale et déterminant la procédure de recours et d'appel devant lesdites commissions. [*J.O.Z.*, n°11,1er juin 1975, p. 518] ;
- **28 juin 1952** – CONVENTION 102 concernant la norme minimum de la sécurité sociale. [*J.O.Z.*, no10, 15 mai 1986, p. 11] ;
- **22 juin 1962** – CONVENTION 117 concernant les objectifs et les normes de base de la politique sociale ;
- **28 juin 1962** – CONVENTION 118 concernant l'égalité de traitement des nationaux et des non-nationaux en matière de sécurité sociale.

3 RESULTATS

Dans cette partie, nous allons devoir présenter les résultats sous forme de tableau et les interpréter.

3.1 RESULTATS DES OBSERVATIONS SUR LE TERRAIN

Au niveau de chaque direction présente, il existe différents services et/ou sections, dedans sont effectuées des activités de grande envergure pour la gestion du bief maritime. Et, ce sont ces activités qui influent sur l'état de santé des agents, constituant des risques potentiels pour ces derniers.

Tableau 1. Effets constatés au niveau de la direction d'exploitation

Activité	Site d'altération	conséquences	Mesure d'atténuation
Balisage	Eau	Pollution des eaux par des huiles moteurs et carburants à plomb lors des opérations de dragage.	Utilisation de l'éthanol comme carburant sans Pb pour les engins (dragues).
	Sols	Destructions de certaines espèces végétales surtout endémiques se trouvant au niveau des îles et îlots lors de posage des différents signaux et antennes pour le service de radiocommunication.	Rien à signaler
Pilotage	Eau	Idem pour le balisage	Rien à signaler
Dragage	Eau	Pollution sonore au niveau des espèces aquatiques pendant l'activité. La destruction des bandes des poissons pendant l'activité et d'où, contamination des poissons et de l'homme par le Pb.	Rien à signaler
	Homme	Pollution sonore des agents qui causent l'insuffisance d'écoute.	Prévoir les casques
		Au niveau de la salle des machines (drague), insuffisance lumineuse, d'où problème de vision.	Renforcer la lumière par les tubes et projections
		Aussi les moteurs de la drague chauffent la salle de machine, cela augmente la température interne.	Rien à signaler

Source : Observations effectuées à la RVM par WANGA, juin-juillet 2006

Tableau 2. Effets constatés au niveau de la direction du Chantier naval

Activité	Site d'altération	Conséquences	Mesures d'atténuation
Réparation des appareils électroniques au niveau de la brigade matériels	Homme (agents)	*Inhalation de gaz qui provoque la maladie respiratoire *Au niveau de la salle de machine, insuffisance lumineuse, par conséquent, problème de vision avec la manipulation des petites pièces comme les diodes, etc. *Pendant la saison sèche, il fait extrêmement chaud dans la cellule des appareils (bureaux).	*Prévoir les masques de protection et la prise en charge du lait. *Renforcer la lumière avec les tubes dans la salle. *Prévoir les climatiseurs
Production d'acétylène à l'usine au niveau du Chantier Naval	Homme (agents) Air Sol	*Agents sont exposés au carbure de calcium et de puranctore. d'où, risque d'intoxication de l'organisme par les produits chimiques. *Pollution de l'air par échappement du gaz (fumée). *Contamination du sol par la patte de la chaux éteinte et rendant le sol très basique par son déchet liquide.	*Prévoir les tenues en fonction de cette activité. Chaque 2 ans transférer les agents qui y travaillent dans d'autres services et remplacer d'autres agents. Prévoir le lait et contrôles médicaux pour eux. *Dispositifs pour le traitement de fumée polluante. *Prévoir une petite usine de traitement pour ces déchets liquides (recyclage). Et, usage de la chaux éteinte au repeint des mûres des habitants de Boma.
Menuiserie	Homme (agents) et air	*Agents exposés aux copeaux, d'où maladies respiratoires. Et, dermatose aigue provoquée par le bois kambala, etc. puis s'en suit la pollution de l'air.	*Prévoir les masques, casques et tenues appropriées. Prévoir, le système de ventilation pour l'évacuation des copeaux et prise en charge du lait. Tenir compte des contrôles médicaux.
Révisions moteur d'une drague ou autres engins au niveau de l'atelier mécanique général	Homme (agents) Sol Eau	*Epithéléomas primitifs de la peau causée par les goudrons, les huiles minérales… *Pollution des sols, attaque des sols par les hydrocarbures *Pollution des eaux	*Prévoir les tenues appropriées et la prise en charge du lait. Prévoir les contrôles médicaux. *Prévoir une petite usine de traitement des déchets liquides avant leur rejet dans la nature (recyclage). *Idem
Travaux d'oxycoupage d'une tôle à épaisseur considérable, au niveau de l'atelier entretien naval et général	Homme (agents) Air	*Agents sont exposés aux différents gaz dégagés pendant l'activité : CO, CO_2, S *Pollution de l'air	*Prévoir des tenues appropriées et la prise en charge du lait. Et, les contrôles médicaux.
Travaux en hauteur sur les poteaux ou sur les dragues	Homme (agents)	*Agents peuvent rater et tomber en chute libre. Par conséquent, fracture ou mort.	*Prévoir les tenues appropriées : gilet pour sauvetage, ceinture de sécurité, bottes, etc.
Travaux de l'assemblage, là on fait recours au soudage	Homme (agents)	*Agents sont exposés aux éclats pendant la soudure. Par conséquent, la cécité peut subvenir à longue.	*Prévoir les verres gamma, gants pour soudeurs et chaudronniers, tabliers et bouche-nez, etc.

Source : Données récoltées via RVM par WANGA, juin-juillet 2006

3.2 ANALYSE STATISTIQUE DES DONNÉES [15] [16]

Tableau 3. Présentation des statistiques des accidents de travail et des maladies professionnelles de la RVM déclarés à l'INSS/Matadi

ANNEES / CAS	1998					1999					2000					2001					2002				
	TRIM				TOT	TRIM				TOT	TRIM				TOT	TRIM				TOT	TRIM				TOT
	1e	2e	3e	4e		1e	2e	3e	4e		1e	2e	3e	4e		1e	2	3	4		1	2	3	4	
ACCIDENTS DU TRAVAIL	O3	01	03	-	07	04	02	01	01	08	02	04	03	02	11	02	02	-	02	06	04	06	06	02	18
MALADIES PROFESSIONNELLES																									
TOTAL	03	01	03	-	07	04	02	01	01	08	02	04	03	02	11	02	02	-	02	06	04	06	06	02	18

Commentaires : Au vu de ces données, le constat est qu'il y a exclusivement des accidents de travail qui sont systématiquement bien suivis et enregistrés. Quant aux maladies professionnelles, le manque de suivi et l'indisponibilité des données les concernant, ont fait qu'il a des vides durant toute la période sous étude. Ainsi, de 1998 à 2002, il y a eu évolution des accidents de travail déclarés sauf seulement l'année 2001 où il y a eu un nombre réduit.

B. TABLEAUX SIGNALÉTIQUES DES ACCIDENTS DE TRAVAIL À LA RVM DE 1998 À 2002

Tableau 4. Années 1998

N°	N°MATR.	DATE D'ACC.	A_1	A_2	A_3	A_4	Frais de soins et d'hospitalisons (en $)	Date de transmission INSS/MAT	Suite INSS/MAT	OBS
1	11.980	16/04/98	25/05/98	25/05/98	25/05/98	25/05/98	75	28/07/98	-	8/0065/98
2	10.538	08/06/98	08/07/98	17/07/98	17/07/98	17/07/98	45	22/03/98	-	8/0017/98
3	12.049	23/06/98	07/07/98	17/07/98	17/07/98	02/10/98	52	-	-	-
4	11.209	07/07/98	16/07/98	16/07/98	16/07/98	22/10/98	108	-	-	-
5	VAC	07/08/98	04/10/98	-	-	04/01/98	211	-	-	-
6	16.681	20/10/98	24/11/98	18/12/98	09/03/99	09/01/99	26	-	-	-
7	10.229	24/11/98	27/01/99	27/01/99	27/01/99	09/03/99	131	-	-	-
8	VAC	02/12/98	30/12/98	11/01/99	09/03/99	09/03/99	49	-	-	-

Source : Etablit par nous et collaborateurs sur base des données statistiques recueillis à la section sociale hygiène et sécurité de la RVM.

Commentaires : Le premier constat est que rien que les cas d'accidents professionnels qui sont recensés au détriment des maladies professionnelles. En effet, la prise en charge par l'entreprise des soins médicaux est effective (voir la colonne 8 avec des montants).mais sur 3 cas enregistrés, 2 cas seulement ont été pris en charge par l'INSS (les deux premiers cas). Or, les mentions A_4, tous ces dossiers devraient bénéficier des allocations de l'INSS. Sur base de ces résultats, on comprend qu'il existe encore de problème au niveau de l'INSS.

Tableau 5. Années 1999

N°	N°MATR	DATE D'ACC.	A_1	A_2	A_3	A_4	Frais de soins et d'hospitalisons en ($)	Date de transmission INSS/MAT	Suite INSS/MAT	OBS
1	11.850	13/01/99	27/01/99	19/03/99	27/01/99	19/03/99	52			
2	12.009	05/01/99	19/02/99	09/03/99	19/02/99	12/04/99	69			
3	10.899	06/01/99	I_1	22/01/99	I_2	22/01/99	-			
4	12.787	11/05/99	18/06/99	09/07/99	09/07/99	09/08/99	31			
5	12.088	04/06/99	classé sans	suite par	le Dr	traitant	-			
6	11.130	17/07/99	18/08/99	-	-	27/05/00	4619			
7	10.503	08/12/99	10/01/00	01/02/00	01/02/00	07/03/00	118			
8	12.031	30/11/99	11/01/00	11/02/00	-	-	-			

Source : Etablit par nous et collaborateurs sur base des données statistiques recueillis à la section sociale hygiène et sécurité de la RVM.

Commentaires : Au cours de l'année 1999, sur 8 cas recensés 2 cas ont été classés sans suite pour non gravité de l'accident. Ce qui fait que 5 cas seulement ont été pris en charge par la société. Mais, quant à la compensation de l'INSS aucune trace n'a été signalée. Ce qui fait que l'INSS n'a versé aucune somme ni allocations.

Tableau 6. Année 2000

N°	N°MATR	DATE D'ACC.	A_1	A_2	A_3	A_4	Frais de soins et d'hospitalisons en ($)	Date de transmission INSS/MAT	Suite INSS/MAT	OBS
1	19.609	27/03/00	24/04/00	29/05/00	29/05/00	29/05/00	233			
2	VAC	04/03/00	30/05/00	07/06/00	09/06/00	22/11/02	1332			
3	12.761	14/06/00	26/07/00	20/10/00	20/10/00	20/10/00	134			
4	11.958	13/09/00	26/09/00	17/10/00	14/11/00	27/11/00	6325			
5	11.466	10/10/00	01/09/01	13/02/01	13/02/01	27/05/02	262			
6	11.130	11/10/00	16/11/00	24/01/01	29/05/01	27/05/02	532			
7	VAC	04/05/00			22/11/02	22/11/02	1332			

Source : Etablit par nous et collaborateurs sur base des données statistiques recueillis à la section sociale hygiène et sécurité de la RVM.

Commentaires : La situation de cette année est comparable à celle de l'année antérieure, dans ce sens qu'il n'a aucune signalisation du côté allocations/INSS. Bien que toutes les données ont été enregistrées, aucun dossier n'a été transmis pour disposition pratique de la société à l'institut. Du moins, tous les dossiers ont été pris en charge par la société concernant les soins médicaux.

Tableau 7. Année 2001

N°	N°MATR	DATE D'ACC.	A_1	A_2	A_3	A_4	Frais de soins et d'hospitalisons en ($)	Date de transmission INSS/MAT	Suite INSS/MAT	OBS
1	12.068	12/01/01	12/03/01	16/04/01	-	03/12/02	2212			
2	11.723	11/01/01	12/03/01	03/08/01	03/08/01	03/08/01	100			
3	12.536	12/02/01	10/04/01	27/09/02	27/05/02	27/05/01	46			
4	11.095	12/04/01	31/05/01	13/06/01	13/08/01	17/09/02	-			
5	12.232	21/08/01	18/10/01	27/05/02	27/05/02	27/05/02	49			
6	10.378	13/08/01	09/11/01	27/05/02	27/05/02	27/05/02	45			
7	12.808	13/11/01	12/02/01	27/03/02	27/05/02	02/01/02	144			
8	VAC	04/12/01	04/03/02	28/05/02	28/05/02	02/01/03	620			

Source : Etablit par nous et collaborateurs sur base des données statistiques recueillis à la section sociale hygiène et sécurité de la RVM.

Commentaires: Le constat est toujours le même, ce qui fait que certains cas analysés et traités par le service hygiène et sécurité ne sont même pas connus au niveau de l'institut. Sur les 8 cas inventoriés, seul un cas n'a pas été pris en charge pour non-gravité du risque connu. Il y a donc, des décalages des chiffres entre la situation de l'entreprise et celle de l'institut.

Tableau 8. Année 2002

N°	N°MATR	DATE D'ACC.	A_1	A_2	A_3	A_4	Frais de soins et d'hospitalisons	Date de transmission INSS/MAT	Suite INSS/MAT	OBS
1	11.167	24/01/02	04/03/02	-	-	-	-			
2	11.996	05/03/02	04/04/02	22/11/02	-	22/11/02	80			
3	11.174	03/04/02	17/06/02	-	-	-	-			
4	12.037	16/05/02	04/06/02	-	-	10/11/03	157			
5	11.219	20/02/02	29/03/02	-	-	10/11/03	274			
6	12.072	18/03/02	23/04/02	23/08/02	23/08/02	23/08/02	54			
7	12.705	13/08/02	09/08/02	22/11/02	-	20/11/02	86			
8	11.121	18/03/02	24/04/02	27/08/02	27/08/02	27/08/02	54			
9	VAC	07/07/02	27/08/02	10/09/02	10/09/02	10/09/02	648			
10	12.092	09/07/02	23/08/02	22/11/02	-	22/11/02	91			
11	12.016	10/04/02	09/08/02	10/08/02	19/08/02	14/10/02	86			
12	18.119	10/07/02	03/05/02	03/09/02	03/09/02	14/10/02	71			
13	18.059	13/05/02	04/06/02	-	-	03/12/02	59			
14	18.079	23/09/02	25/10/02	22/11/02	23/12/02	03/12/02	126			
15	VAC	04/05/02	-	-	14/11/02	22/11/02	93			
16	12.040	08/11/02	07/01/03	-	-	-	-			
17	VAC	04/11/02	22/01/03	23/12/03	-	-	-			

Source : Etablit par nous et collaborateurs sur base des données statistiques recueillis à la section sociale hygiène et sécurité de la RVM.

Commentaires : L'année 2002 a enregistré beaucoup plus de cas d'accidents de travail. Et, comme nous pouvons le constater, aucun dossier n'a été envoyé ni couvert par les allocations de l'institut. Sur les 17 cas, 2 cas seulement n'ont pu être pris en charge par la société. Hormis les constats similaires durant toute la période sous étude, il ya une adéquation des données entre l'entreprise et celles de l'institut.

Légende :

- Modèle A.1. : Certificat de la déclaration d'accident ou de la maladie du travail
- Modèle A.2. : Certificat de la première constatation de la victime
- Modèle A.3. : Certificat de prolongation d'incapacité de la victime
- Modèle A.4. : Certificat de guérison ou de décès ou encore de consolidation des lésions
- VAC : Vacataire
- INSS : Institut National de Sécurité Sociale
- RVM : Régie des Voies Maritimes

3.3 DISCUSSION

Le Code de la Sécurité sociale précise que « toute personne salariée ou travaillant, à quelque titre ou en quelque lieu que ce soit, pour un ou plusieurs employeurs ou chefs d'entreprise » bénéficie de l'assurance accidents du travail / maladies professionnelles et ce, dès son embauche.

Le système d'assurance des risques professionnels garantit les salariés du commerce, de l'industrie et d'autres services contre les conséquences des atteintes à leur santé liées à leur travail. En effet, les cotisations d'assurance versées par les entreprises et assises sur les salaires permettent le financement de l'assurance des risques professionnels.

Un **taux de cotisation** distinct est fixé pour chaque établissement employeur, en fonction du niveau de risque évalué pour l'activité exercée par ses salariés, le cas échéant, l'INSS face à la RVM. Qu'il s'agisse d'un accident du travail, d'un accident de trajet ou d'une maladie professionnelle, les formalités à accomplir impliquent le salarié qui en est victime ainsi que son employeur, le médecin traitant et son organisme de sécurité [17].

Par ailleurs, une maladie est dite « d'origine professionnelle » si elle est la conséquence directe de l'exposition d'un travailleur à un risque physique, chimique, biologique ou résulte des conditions dans lesquelles il exerce son activité professionnelle, on peut citer les: maladies de la peau, maladies respiratoires, troubles musculosquelettiques, surdités, cancers, infections, conjonctivites, etc. Si l'affection entre dans le cadre d'une maladie professionnelle, la prise en charge financière des soins est intégrale [3].

En pratique, c'est le salarié de la RVM (ou ses ayants droits) qui doit déclarer sa maladie à l'organisme de sécurité sociale, le cas échéant, Institut National de Sécurité Sociale (INSS/RDC), qui reconnaît ou pas le lien entre la maladie et l'activité

professionnelle de ce dernier. Il est à noter que l'INSS a été institué par le Décret-loi du 29 juin 1961 Sous la garantie de l'Etat Congolais. De ce fait, la déclaration et reconnaissance d'une maladie professionnelle tient compte du [18]:

- médecin qui rédige et remet à la victime un certificat médical en 4 exemplaires dont l'un, dépourvu des mentions relatives à la maladie, est remis à l'employeur.
- victime (ou ses ayants droits) adresse le **formulaire de déclaration de maladie professionnelle ou accident du travail (modèle A.1.)**, accompagné du certificat médical et des attestations de salaires de ses employeurs, à l'INSS dans un délai de 15 jours après la cessation du travail ou la constatation de la maladie **(modèle A.2.)**.
- INSS ouvre alors une enquête administrative et médicale et informe l'employeur, le **médecin du travail** et l'**inspecteur du travail**. Elle fait ensuite connaître sa décision à la victime dans un délai maximum de 3 mois, renouvelable une fois. Cette décision peut être contestée par la voie du contentieux général.

Afin de prévenir la survenue de maladies professionnelles ou accident du travail, l'employeur doit tout d'abord appliquer les principes généraux de prévention du Code du travail, et notamment supprimer ou limiter les expositions des salariés aux risques physiques, chimiques ou biologiques à l'origine de maladies professionnelles ou accident du travail. Il doit d'autre part déclarer à l'INSS et à l'inspecteur du travail les procédés de travail susceptibles de provoquer des maladies professionnelles (voir les dispositions pratiques de l'INSS/RDC).

Avec l'appui des services de santé au travail (Centre de Santé de la RVM/Boma), l'employeur veille également à :

- appliquer les mesures de prévention médicale, et être en mesure de prouver à tout moment à l'inspecteur du travail que les salariés ont bien bénéficié des **visites médicales** prévues par la réglementation selon le code du travail,
- tenir compte de l'éventuel **avis d'inaptitude** temporaire ou définitif qui lui serait transmis par le médecin du travail à la suite de ces examens.

A titre illustratif, les résultats d'une enquête réalisée par (**Sumer, 2003**) sur les maladies professionnelles ont montré qu'après les affections cardiovasculaires, le cancer représente la 2^{e} cause de mortalité en France (30 % des décès). C'est la première cause chez l'homme (34,5 %) et la seconde chez la femme (25 %). Le taux de cancers liés à une exposition professionnelle diffère selon les sources : 4 à 8,5 % selon l'Institut de Veille Sanitaire ; 4 % chez l'homme et 0,5 % chez la femme selon le Centre International de Recherche sur le cancer (CIRC). Près de 13,5 % des salariés ont été exposés à un ou plusieurs facteurs cancérogènes au cours de leur activité professionnelle, soit environ 2 370 000 salariés. Ce sont majoritairement des hommes et des ouvriers. Les principaux secteurs industriels concernés sont la construction (18 % des salariés exposés), le commerce et la réparation automobile (10 %), la métallurgie (7 %), les services opérationnels (7 %) et la santé (7 %) [19].

3.4 CONCLUSION

L'expérience de chaque jour prouve qu'il y a pratiquement pas de métier ou poste de travail qui ne comporte pas des risques potentiels pour la santé et la sécurité des travailleurs. Celle-ci va établir le lien des dégâts ou risques causés par l'entreprise lors de ses nombreuses activités sur l'agent (homme), il s'agit des analyses sur la gestion des accidents du travail et des maladies professionnelles à la RVM. A la lumière de tous les aspects analysés, les critiques suivants peuvent être relevés :

- Absence d'une politique rationnelle de suivi des dossiers par le Service Hygiène et Sécurité du jour de l'accident jusqu'à sa prise en charge par l'Institut National de Sécurité Sociale de la RDCongo. Ce phénomène fait que les soins sont dans la plupart des cas exclusivement supportés par l'Entreprise et sans que les concernés bénéficient les allocations et rentes de l'Institut suivant les normes préétablies et les cas spécifiques ;
- Passivité de la médecine du travail sur les mesures techniques de protection contre les risques menaçant la santé par des examens médicaux préventifs pour ceux occupant des travaux comportant des risques évidents notamment les travailleurs du Chantier Naval de la R.V.M., du dock flottant, ateliers de menuiserie, etc.
- Non identification et non prévention des aspects biophysiques du milieu du travail tels que le microclimat, les poussières, les rayonnements ionisants et non ionisants, les bruits et vibrations, présence des nombreuses substances chimiques sous forme de vapeur et de gaz, présentant un **haut risque potentiel d'intoxication**.
- Limitation du champ d'activités de la section communément appelé cellule hygiène et sécurité, ce qui justifie l'absence du plan d'intervention en matière des risques professionnels, et absence des experts dans ledit

domaine (environnementaliste de l'Université de Kinshasa, Faculté des Sciences département de l'environnement ayant travaillé ou qui mène ses recherches dans l'actuel thématique).

- Absence d'une banque de données informatisées permettant de faire le suivi et l'évaluation dans le temps et dans l'espace pour une meilleure prise en charge des victimes (agents), considérés comme étant le maillot faible du système, écosystème professionnel.
- Confusion entre la médecine du travail qui doit faire son travail normalement selon les normes de l'Organisation Mondiale de la Santé, et celle dite la médecine classique c'est-à-dire de tous les jours.
- Manque d'une initiative de mise en place d'un projet de réforme d'installation ou de création d'un service d'hygiène et sécurité environnementale des travailleurs, qui ce service devrait avoir mission d'élargir son champs d'activité sur toutes les questions d'ordre sanitaire au profit des agents et du cadre professionnel, il s'agit de la gestion des risques infectieux et environnementaux d'une part, et la prise en compte de la complexité des problèmes environnementaux et leurs interactions avec les agents (homme) d'autre part.

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Les eaux usées de la plateforme de l'aéroport Mohammed V (Casablanca, Maroc): Caractérisation physico-chimique et traitement par boues activées

[Wastewater of the airport Mohammed V platform (Casablanca, Morocco): Physico-chemical characterization and treatment with activated sludge]

Zahra Moutaib[1], Soumia Hebabaze[1], Christoph Brand[2], and Mohamed Chlaida[1]

[1]Laboratoire d'Ecologie et d'Environnement (LEE), Université Hassan II-Casablanca, Faculté des Sciences Ben M'sik, BP 7955-Sidi Othman, Casablanca, Maroc

[2]Chair of Chemical and Process Engineering, Technische Universität Berlin, Germany

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ABSTRACT: The platform of the airport Mohamed V in Casablanca constitutes a showpiece of the development in the area of Nouaceur because of its socio-economic role related on the air traffic and the industrial and commercial activities installed in the "aéropôle". In order to respond to the development of the airport in the 2020 horizon and especially in the management of wastewater, the Moroccan Airports Authority being integrated sustainable development into its whole strategy launched since 2006 a project of a new purification plant of domestic and industrial effluents. Our study aims to make a diagnosis physicochemical of the wastewater produced in the area and analyze the first results of the treatment plant obtained in 2013. The platform of the airport generate a total volume of about 4000 m3/day for domestic effluents and 1500 m3/day for industrials effluents. On the qualitative level, the domestic waste water produced are characterized by a slightly acid pH (6,3 - 6,8), BOD5 (about 530 mg/l), COD (914 mg/l) and a relatively high content of Nitrogenizes KTN (50 mg/l). However, the industrial effluents produced are more polluted and have a pH varying between 6,1 and 6,4, a BOD5 of 1700 mg/l, a COD of 3700 mg/l and a KTN of 66 mg/l. In term of treatment of domestic effluents, the purifying efficacy of the new treatment plant with activated sludge is demonstrated by a reduction yield superior than 90% for all pollution parameters except the KTN whose the yield is about 83%.

KEYWORDS: Effluent, diagnosis, purification, efficacité, platform of the airport, Nouaceur.

RESUME: L'aéroport Mohamed V de Casablanca constitue une pièce maitresse du développement de la région de Nouaceur vu son rôle socio-économique lié au trafic aérien et aux activités industrielles et commerciales installées à l'aéropôle. Afin de répondre au développement de la zone aéroportuaire à l'horizon 2020 et plus particulièrement en matière de gestion des eaux usées, l'Office National des Aéroports, ayant intégré le développement durable dans sa stratégie globale, a lancé depuis 2006 le projet de construction d'une nouvelle station d'épuration des effluents domestiques et industriels. Notre étude a pour objectif de réaliser un diagnostic physico-chimique des eaux usées produites dans la zone et d'analyser les premiers résultats du fonctionnement de la station d'épuration escomptés en 2013. La plateforme aéroportuaire génère un volume total de 4000 m^3/j d'effluents domestiques et de 1500 m^3/j d'effluents industriels. Sur le plan qualitatif, les eaux usées domestiques produites se caractérisent par des pH légèrement acides (6,3-6,8), une DBO5 de 530 mg/l, une DCO de 914 mg/l et une teneur en azote total relativement élevée (50 mg/l). Les effluents industriels produits sont, au contraire, plus pollués avec un pH variant entre 6,1 et 6,4, une DBO5 de 1700 mg/l, une DCO de 3700 mg/l et un NTK de 66 mg/l. En terme de traitement des effluents domestiques, l'efficacité épuratoire de la nouvelle station à boues activées est prouvée par des rendements d'abattement supérieurs à 90% pour tous les paramètres de pollution sauf pour l'azote total dont le rendement est d'environ 83%.

MOTS-CLEFS: Effluents liquides, diagnostic, épuration, efficacité, plateforme aéroportuaire, Nouaceur.

Corresponding Author: Zahra Moutaib

1 INTRODUCTION

Depuis plus d'une décennie, le Maroc connait un développement socio-économique accéléré et la cadence d'urbanisation a nettement augmenté avec l'apparition de plusieurs centres urbains et périurbains. Au même moment, diverses activités anthropiques (industrielles, commerciales, touristiques, etc.) se sont multipliées et installées dans plusieurs zones à proximité des grandes villes et aussi en plein milieu rural. Cet accroissement s'accompagne d'une grande consommation d'eau et d'une production excessive d'eaux usées qui génèrent des déséquilibres sérieux des écosystèmes des milieux récepteurs.

Pour remédier à cette situation, le Programme National d'Assainissement Liquide et d'Epuration des Eaux Usées (PNALE) a été élaboré en 2005 [1] en vue d'améliorer le raccordement au réseau d'assainissement pour atteindre 80% à l'horizon 2020 et de rabattre, en parallèle, la pollution domestique de 80 %.

C'est ainsi qu'à l'échelle de la région du grand Casablanca, la Lyonnaise des eaux Casablanca (Lydec,) qui s'occupe, depuis 1997, de la gestion déléguée de l'eau et de l'électricité, a projeté dans son schéma directeur global d'assainissement [2] la réalisation de plusieurs stations d'épuration littorales et périurbaines. L'objectif, et comme le stipule le plan d'aménagement urbain du grand Casablanca élaboré par l'agence urbaine en 2008 [3], est de hisser le développement de la ville au rang des grandes métropoles internationales.

Dans ce contexte, la plateforme de l'aéroport Mohammed V (Nouaceur), constituée initialement de l'aéroport proprement dit et de quelques secteurs d'activités annexes (unités industrielles aéronautiques, dépôts de carburants, cité de l'air, caserne militaire, etc.), a connu une grande extension avec l'arrivée d'autres projets d'activités socio-économiques (urbanistiques et résidentielles, industrielles, commerciales et touristiques). Un tel développement de la zone pourra s'accentuer dans les années à venir puisque le plan de développement urbain du grand Casablanca [4] et sa stratégie de développement pour 2030 visent à faire de la région de Nouaceur une ville satellitaire et un pivot d'émergence du corridor industriel reliant Mohammedia à l'aéroport Mohammed V.

Un tel développement exige une prise en charge de la zone de l'aéroport sur le plan environnemental et plus particulièrement le volet relatif à la gestion des eaux usées. En conséquence, l'Office National des Aéroports (ONDA), ayant opté pour une stratégie de développement durable, a lancé depuis 2010 un projet de construction d'une nouvelle station d'épuration (STEP) des eaux usées répondant aux exigences et aux besoins de développement de la plateforme à l'horizon 2020 [5].

Notre étude, qui s'inscrit également dans le cadre du projet d'Agriculture Urbaine à Casablanca [6], consiste à faire un diagnostic physico-chimique des eaux usées produites par la plateforme de l'aéroport Mohammed V et d'analyser les premiers résultats du fonctionnement de la nouvelle STEP amorcé en 2013.

2 ZONE D'ETUDE ET DESCRIPTION DE LA STATION D'EPURATION

2.1 LA ZONE D'ÉTUDE

La zone de l'aéroport Mohammed V /Nouaceur est localisée à presque 30 km au Sud du centre ville de Casablanca. Elle fait partie de la municipalité de Nouaceur (province de Nouaceur) et comporte :

- Une zone résidentielle avec une population de plus de 8000 habitants [7].
- Une zone industrielle dite « Sapino ».
- La plateforme de l'aéroport Mohammed V (figure 1) qui s'étend sur une superficie totale de 1295 ha et qui comporte des infrastructures aéroportuaires (terminaux, bâtiments divers, caserne militaire, etc.) et un parc d'activités industrielles et de service (aéropôle) hébergeant plus 70 entreprises commerciales et d'industries mécanique et métallurgique, agroalimentaires et pharmaceutiques, électronique et électrique et chimie-parachimie.

La zone de l'aéroport est caractérisée, topographiquement, par une grande planéité (0 à 5%) et constitue le début de la plaine de Berrechid et la fin des cordons dunaires et des sillons inter dunaires qui caractérisent la morphologie du littoral du grand Casablanca [8].

Les terrains géologiques font partie de la meseta côtière marocaine et sont formés d'un socle paléozoïque de quartzite et de schiste fracturés d'âge Cambrien et Ordovicien surmonté de formations de marnes et de calcaires crétacés ainsi que des dépôts Plio-Quaternaires de grès calcaires, limons et sable [9].

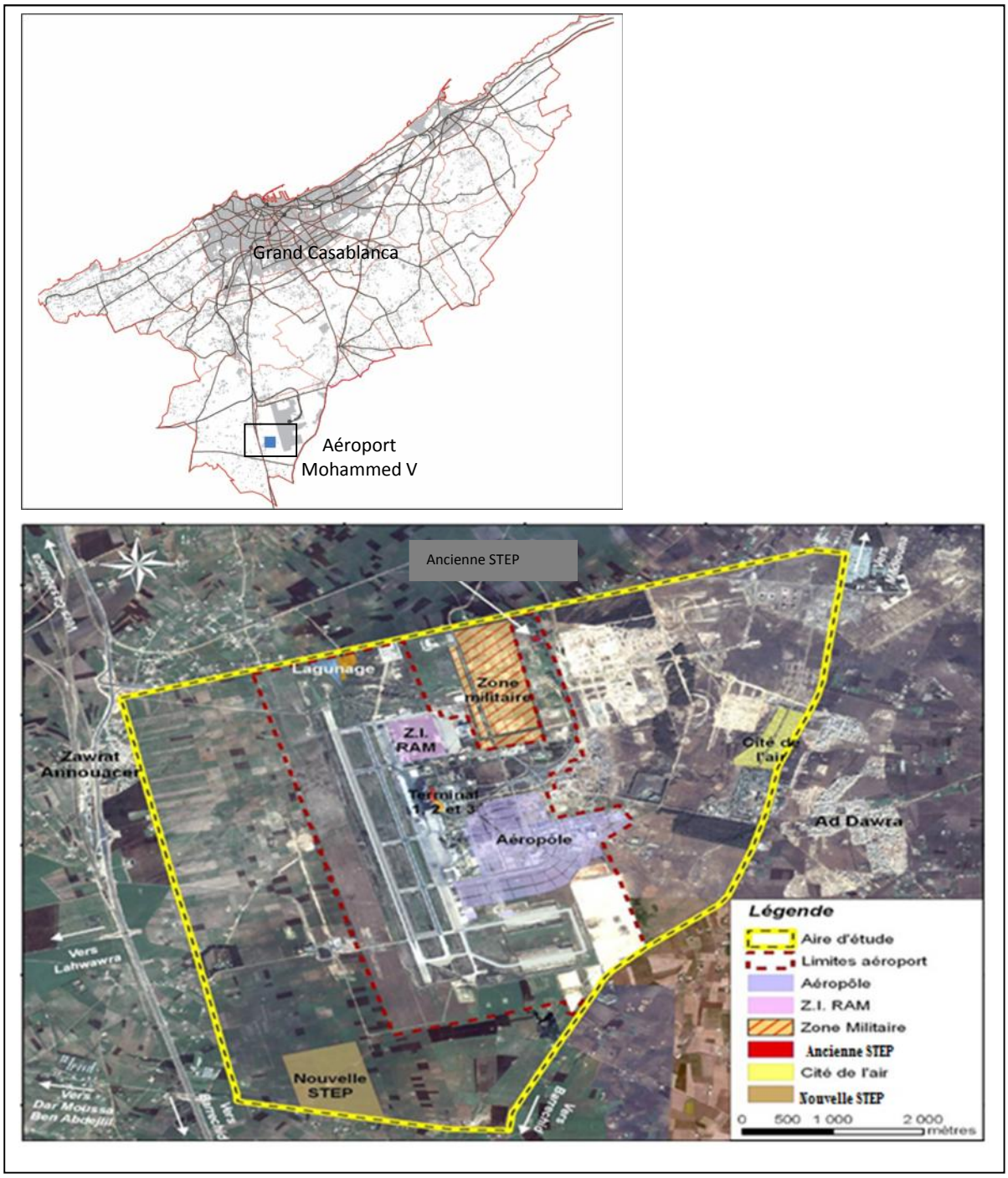


Fig. 1. Situation des centres d'étude au niveau du périurbain du grand Casablanca (in [5])

Sur le plan pédologique, les principaux sols de la région sont du type calcimagnésique formés d'argile noire (Tirs) dispersée et assez importante dans le secteur ou de sols silico-argileux de couleur rouge (Hamri) très fertiles. Ces terres sont remplacées, par endroits plus au Nord Est, par des sols (Hrach) présentant des cailloux, des graviers et des débris de schistes et de quartzites [10].

Le climat de la région est du type méditerranéen semi aride à influence atlantique méridionale qui se manifeste par un hiver tempéré à doux et un été sec et chaud. La pluviométrie est de l'ordre de 400 mm/an et la température reste modérée d'environ 20°C en moyenne (variant ente 13 °C enregistrée en Janvier et 23 °C enregistrée au mois d'Août avec des valeurs extrêmes dépassant rarement les 30 °C [5]. La direction dominante des vents est sud sud-ouest durant l'hiver et de direction nord nord-ouest pendant l'été.

Sur le plan des ressources en eau, l'hydrologie de surface de la région est très peu développée et se limite uniquement à quelques dépressions d'eau qui se remplissent d'eau de pluies pour former des Dayas durant les saisons d'hiver et de printemps. L'hydrogéologie, par contre, offre plus de ressources en raison de la présence de la nappe de Berrechid qui offre des quantités appréciables en eaux souterraines. En effet, les eaux de la nappe se trouvent à des niveaux piézométrique allant de 10 à 30 m. Le faciès des eaux de cette nappe est bicarbonaté calcique avec une dureté élevée et une salinité totale variable de 1 à 3 g/l [5].

2.2 ALIMENTATION EN EAU POTABLE ET DESCRIPTION DE LA STATION DE TRAITEMENT DES EAUX USÉES

2.2.1 CONSOMMATIONS EN EAU POTABLE ET PRODUCTION DES EAUX USEES

Les différentes activités de l'aéroport proprement dit et les zones annexes accomplissent leurs besoins en eau à partir du réseau de la Lydec pour ce qui est de l'eau potable et à partir de la nappe phréatique pour ce qui est des eaux de certains services industriels (lavage, refroidissement, etc.). La plateforme est alimentée en eau potable par la Lydec à partir d'une adduction principale de 200 mm. Cinq branchements répartissent cette eau sur les différentes entités. Durant l'année 2009, la consommation journalière moyenne en eau potable de la zone aéroportuaire a été de 3380 m^3/j avec un maximum de 3800 m3/j enregistré au mois d'août. Les secteurs les plus consommateurs d'eau sont les services internes de l'aéroport, la cité de l'air et l'aéropôle [11].

Les eaux usées générées par la plateforme sont collectées dans un réseau d'assainissement séparatif. Le volume total des eaux usées est de l'ordre de [12] :

- 4000 m^3/j d'eaux usées domestiques (EUD) provenant des bâtiments et des infrastructures des terminaux de l'aéroport ainsi que de la caserne militaire et la cité de l'air au niveau du village du Nouaceur.

- 1500 m^3/j d'eaux usées industrielles (EUI) générées par l'aéropôle et la zone industrielle de la compagnie Royal Air Maroc (RAM).

A l'horizon 2016-2025, l'Office National des Aéroports (ONDA) prévoit un débit moyen d'EUD d'environ 7 200 m^3/j et un débit moyen d'EUI de l'ordre de 1 920 m^3/j.

Les eaux pluviales, quand à elles, sont collectées dans un réseau spécifique et dirigées vers des talwegs et des fossés aménagés dans la zone.

2.2.2 LA STATION D'ÉPURATION

Depuis 2010, l'ONDA a lancé l'opération de construction de sa nouvelle STEP répondant aux besoins de traitement des eaux usées de toute la zone de l'aéroport Mohammed V/Nouaceur jusqu'à l'horizon 2020. Cette station à boues activées, mise en route au mois d'Août 2013, comporte deux filières de traitement [13]:

L'une pour les EUD avec possibilité de réutilisation des eaux traitées et l'autre pour les EUI avec une perspective de réutilisation des eaux épurées (figure 2). Au même moment, l'ONDA a commencé à inciter et à obliger les industriels de l'aéropôle à traiter leurs eaux usées avant de les rejeter dans le réseau d'assainissement.

Dans le cas de la filière domestique, les eaux usées domestiques subissent un prétraitement (dégrillage, dessablage et dégraissage), passent dans un bassin circulaire tri-concentrique de traitement biologique (aération) et subissent ensuite la clarification dans un décanteur lamellaire. Une partie des boues extraites du décanteur lamellaire sont recyclées/réinjectées dans le bassin d'aération assurant son réensemencement en biomasse bactérienne. Le reste des boues est traitée par déshydratation et chaulage. Les eaux traitées sont ensuite stockées dans un bassin d'eau pour subir, éventuellement, une stérilisation avant leur valorisation (lavage, arrosage, etc.).

Dans le cas de la filière industrielle, l'effluent à traiter doit satisfaire à des conditions requises pour protéger les installations de la STEP et garantir le bon fonctionnement du traitement biologique. A cet effet, les eaux usées industrielles subissent une neutralisation de leur pH et un traitement physico-chimique par coagulation/floculation pour éliminer les matières minérales floculantes. Par la suite, l'effluent industriel est soumis au même traitement que le domestique.

Dans les deux cas de filières domestique et industrielle, le niveau de qualité des eaux épurées doit respecter les objectifs de dépollution suivants :

DBO5 : 30 mg/l; DCO : 90 mg/l; MES : 30 mg/l; NTK : 10 mg/l; Pt : 3 mg/l

Pour cette mise en route de la station d'épuration, seule la filière des EUD a été ouverte en attendant que le système de traitement préliminaire (physico-chimique) des EUI soit opérationnel.

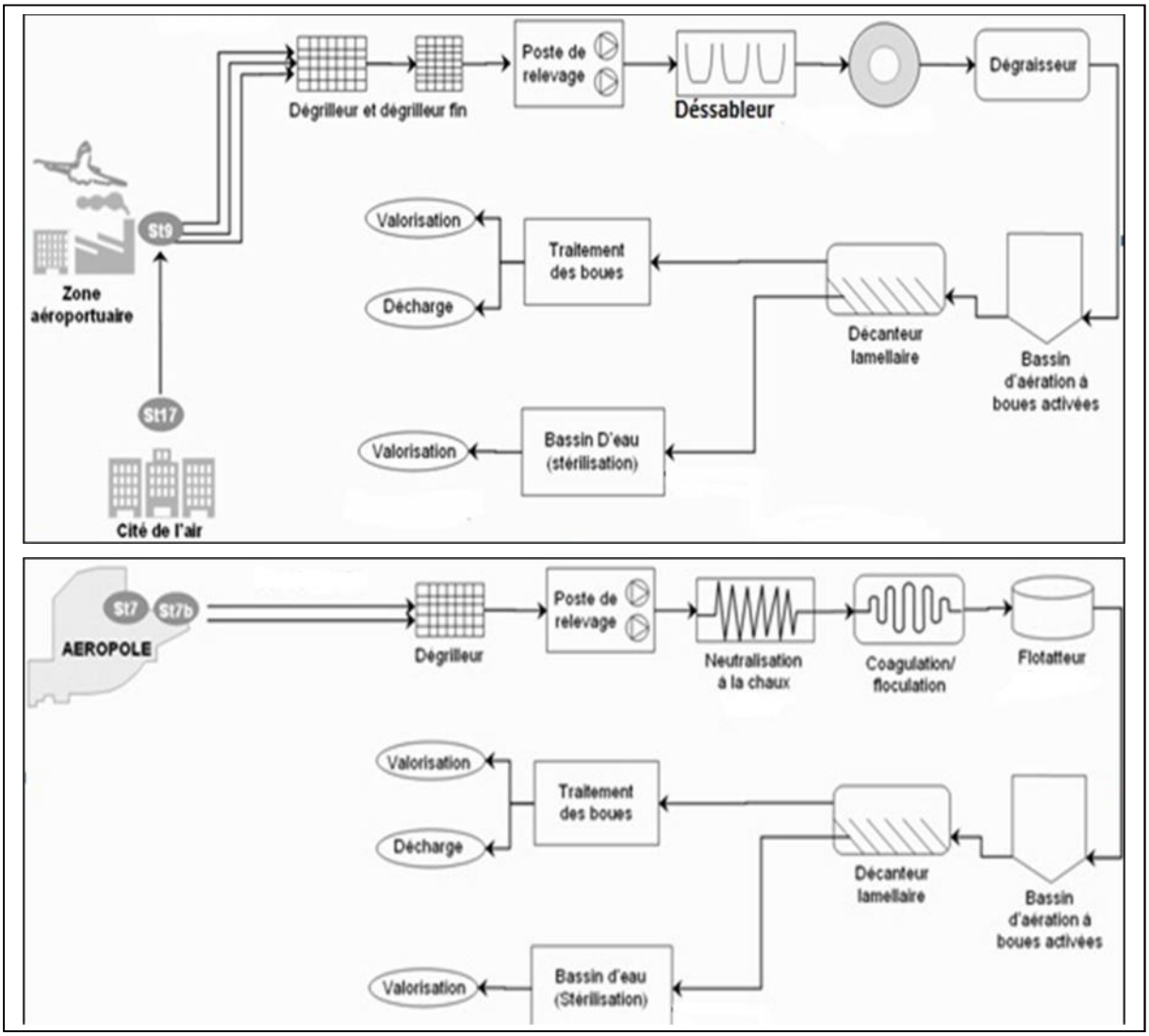


Fig. 2. Schéma des installations des filières de traitement des EUD (en haut) et des EUI (en bas) [in 5]

3 METHODES ET TECHNIQUES DE MESURE ET D'ANALYSE UTILISEES

Durant la phase de caractérisation des eaux usées brutes de l'aéroport effectuée durant les 4 saisons de l'année hydrologique 2008/2009, trois (3) points de prélèvements ont été échantillonnés: Deux (2) points au niveau des regards de collecte des eaux industrielles de l'aéropôle et un (1) point au niveau du regard du réseau d'assainissement des eaux usées domestiques provenant de l'enceinte de l'aéroport et de la cité de l'air.

Pour l'étude de l'efficacité épuratoire de la STEP (filière des EUD), deux points de prélèvements ont été fixés : l'un à l'entrée de la STEP et l'autre à la sortie de l'effluent du bassin de clarification.

Les mesures in situ de la Température, du pH, de la conductivité électrique ont été réalisées (au 1/10) à l'aide d'un multi-paramètre portatif (Consort type C 535).

Pour les analyses physicochimiques, les échantillons d'eau sont prélevés sur le terrain dans des bouteilles en polyéthylène et transportés à froid (4°C) dans une glacière jusqu'au laboratoire. Les analyses physicochimiques de détermination des paramètres globaux (Tableau 1) ont été réalisées à l'aide de méthodes préconisées par [14]).

Tableau 1. Méthodes d'analyse des différents paramètres physico-chimiques

Paramètres	Méthode utilisée	Unité	Référence
DCO	Oxydation par le bichromate de potassium	mg/l	NF EN ISO 8467
DBO_5	Dilution avec incubation dans des flacons Oxytop	mg/l	NFT 90-103
Matières en suspension (MES)	Méthode de filtration	mg/l	NF EN 872
Azote Kjeldhal NTK	Minéralisation et en sulfate d'ammonium puis en ammoniac	mg/l	EN 25663

4 RÉSULTATS ET DISCUSSIONS

Sur le plan de la caractérisation physico-chimique des eaux usées produites par la plateforme, les résultats de nos mesures et de nos analyses, exprimés en termes de gamme de variation ou en tant que teneurs maximales (tableau 2), montrent un profil global de qualité qui diffère selon le type d'eaux usées domestiques et industrielles. Les EUI paraissent, évidement, plus chargées que les EUD et par comparaison aux valeurs limites préconisées par les normes marocaines des rejets indirects "NMRI" [15], les EUD se caractérisent principalement par des pH légèrement acides, des DBO_5 à peine conforme et des teneurs en azote NTK relativement élevées. Les EUI s'avèrent, au contraire, largement non conformes en matière de pH, de DBO_5, de DCO, des MES et d'Azote NTK.

Tableau 2. Profil de la qualité globale des eaux usées brutes de l'aéroport Mohammed V-Nouaceur (NMRI : Normes Marocaines des Rejets Indirects)

	Eaux usées domestiques	Eaux usées industrielles	Valeur limite des NMRI
Température (°C)	18 – 24	19 – 27	35
Potentiel redox (pH)	6,3 – 6,8	6,1 – 6,4	6,5-9
Conductivité à 20 °C (µS/cm)	1800-3100	2700-7000	-
DBO_5 (mg/l)	530	1700	500
DCO (mg/l)	914	3700	1000
MES (mg/l)	584	614	600
NTK (mg/l)	50	66	30

Par comparaison à d'autres eaux usées produites dans la grande région de la Chaouia, les eaux usées de la plateforme de l'aéroport Mohammed V s'avèrent plus chargées, en matières oxydables organiques et minérales, que celles des villes de Settat, Berrechid, Ben Ahmed, El Gara et Had Soualem [16]. En effet, ce dernier a rapporté que les effluents urbains de ces cinq centres urbains sont très minéralisées (jusqu'à 4000 (µS/cm) et se caractérisent par une DCO maximale de 1651 mg/l, une DBO_5 de 858 mg/l au maximum et des pH proches de la neutralité mais au même moment, leurs teneurs maximales en MES sont plus importantes soit 1008 mg/l. Le même constat de surcharge de nos eaux usées est également noté par comparaison avec les résultats signalés par [12] et [17] au niveau des eaux usées de la localité de Mediouna située à 12 Km au Nord de notre zone d'étude.

Le rapport DCO/DBO_5 est égal à 1,72 pour nos EUD et 2,17 pour les EUI donc compris entre 2 et 3 ce qui montre que les eaux usées globales de la zone sont biodégradables. Toutefois, la DCO reste assez élevée au niveau des EUI en raison des grandes quantités de matières oxydables générées par les différentes unités industrielles de l'aéropôle. Ces rapports s'avèrent supérieurs à ceux enregistrés dans la localité voisine de Deroua [12], en revanche, ils restent inférieurs à ceux rapportés par ce même auteur au niveau de Mediouna (1,96) et par [16] au niveau de la Chaouia (2,07 à 2,87). Par comparaison à d'autres villes marocaines plus lointaines, nos rapports restent également inférieurs à ceux raportés par [18] au niveau de la ville de Tanger (DCO/DBO5< 2,5) et par [19] au niveau des eaux usées d'Oujda où le rapport est inférieur à 2,5 ou encore par [20] pour les eaux usées de Marrakech (rapport égal à 2,4).

Sur le plan du traitement des EUD de la plateforme aéroportuaire Mohammed V, les résultats préliminaires de l'efficacité épuratoire de la nouvelle STEP (tableau 3) montrent que les teneurs des différents paramètres globaux au niveau de l'effluent domestique sont largement inférieures aux valeurs limites préconisées par les normes marocaines de rejets directs "NMRD" [15]. Les rendements d'abattement dépassent les 90 % pour tous les paramètres à l'exception de

l'azote NTK qui reste aux environs de 83 %. Ces rendements arrivent même jusqu'à des valeurs de 97-99 % pour la DCO et la DBO_5.

Tableau 3. Résultats préliminaires de l'efficacité épuratoire de la nouvelle STEP de l'aéroport Mohammed V (NMRD: Normes Marocaines des Rejets Directs)

28 août 2013						
Paramètre	**pH**	**T°**	**DCO**	**DBO_5**	**MES**	**NTK**
		°C	**mg/l**	**mg /l**	**mg/l**	**mg/l**
Entrée STEP	6,70	26	868	535	251	19,6
Sortie STEP	8,00	25	58	1,9	16,6	6,16
Rendement	-	-	93,3	99,6	93,3	68,5
19 mai 2014						
Entrée STEP	6,62	25,7	709,1	620	150	12,89
Sortie STEP	7,69	25,2	18	6	10	2,23
Rendement	-	-	97,4	99	93,3	82,6
Valeur limite des NMRD	6,5-9	30	500	100	50	30

Ces résultats démontrent bien que le système de traitement adopté est performant pour épurer les EUD de la plateforme. Ces rendements élevés du système à boues activées ont été également signalés par [18] au niveau de la STEP de Boukhalef à Tanger mais avec des taux d'abattement légèrement plus faibles (entre 80 à 89 %). Cette différence est liée au fonctionnement du bassin d'aération qui s'est bien déroulé dans notre cas contrairement à celui de la STEP précité qui a enregistré un léger manque d'oxygénation. Par comparaison à la station d'épuration de Mediouna, qui fonctionne suivant le même modèle de bassin biologique, mais avec une filtration membranaire à la place du bassin de clarification, nos rendements en termes de DBO_5 et de DCO s'avèrent assez proches de ceux rapportés par [21] mais ils restent légèrement inférieurs pour ce qui est des MES et de l'azote total. En revanche, nos taux d'abattement sont largement supérieurs à ceux signalés par [22] au niveau du groupe de stations à lagunage naturel de la chaouia.

5 CONCLUSION

A l'heure de la prise en compte des contraintes de développement durable, l'office national des aéroports marocains (ONDA) a, depuis quelques années, inscrit la plateforme de l'aéroport Mohammed V dans une démarche environnementale en vue de réussir et de maintenir la certification ISO 14001 version 2004 dans une optique de supprimer ou d'atténuer les impacts environnementaux significatifs de son fonctionnement.

C'est ainsi que la question des effluents liquides a été reconsidérée au vue de l'accroissement des différentes activités locales et de la saturation qu'a connue l'ancienne station d'épuration de l'aéroport. En effet, le diagnostic des eaux usées produites révèlent des volumes pouvant dépasser les 5000 m3/jour entre EUD (4000 m3/jour) et EUI (plus de 1500 m3/jour). Le profil physico-chimique de ses eaux usées se caractérise globalement par un pH légèrement acide (6,1–6,8), des DBO5 et des DCO atteignant respectivement presque 600 mg/l et 1000 mg/l au niveau des EUD alors qu'elles enregistrent 1700 et 3700 mg/l au niveau des EUI.

Le faible rapport DBO5/DCO, l'augmentation rapide des volumes d'eaux usées produites et la contrainte sécuritaire vis-à-vis du péril aviaire ont été à l'origine du choix du système intensif de traitement de ces eaux usées par boues activées. Les premiers résultats de l'efficacité épuratoire de la filière domestique de cette STEP sont très prometteurs puisque les rendements d'abattement frôlent les 99; 98 ; 94 et 83 % respectivement pour la DBO5, la DCO, les MES et l'Azote NTK. Au même moment, l'effluent à la sortie de la filière domestique, et selon les résultats élémentaires des analyses parazitogiques non présentés dans cet article, ne contient presque pas d'œufs d'Helminthes. En attendant les résultats des analyses microbiologiques et du phosphore total, les eaux domestiques épurées offrent d'énormes opportunités de leur valorisation en arrosage des espaces verts et en irrigation agricole. En revanche la filière des EUI n'est actuellement qu'aux premiers essais de son démarrage en raison de quelques problèmes techniques du compartiment du traitement physico-chimique et du retard accompli par certains industriels au niveau du processus de neutralisation de leurs eaux usées avant leur déversement dans le réseau d'assainissement.

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Source of Photon Pairs Using Spontaneous Parametric Down-Conversion Process

Mubarack Ahmed[1], Alfred Amponsah[1], Akweittey Emmanuel[2], and Haruna Issaka[3]

[1]Lecturer Information Technology Department,
Garden City University College,
Kumasi, Ashanti, Ghana

[2]Lecturer Mathematics Department,
Presbyterian University College, Ghana

[3]MPhil (Hons), Department of Mathematics,
Kwame Nkrumah University of Science and Technology,
Kumasi, Ashanti, Ghana

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ABSTRACT: The importance of photon pair generation can never be overemphasized. It has formed the basis of most fundamental quantum optical experiments like Bell-experiments, quantum teleportation and entanglement swapping. However for considerable number of years Quantum Mechanics in general has remained largely theoretical and within the four corners of laboratories. Quantum Key Distribution is one of the first quantum applications to break this barrier. It provides us with unconditionally secured communication by providing us with efficient alternative to classical cryptography. This study forms part of the effort in realizing efficient way of generating photon pairs through the Spontaneous Parametric Down-Conversion process using a nonlinear crystal cut for type-I phase matching. After generating the photon pairs, the paper examined how they can be detected efficiently. We measured the rate of single photon generation (up to 200 kHz) as well as the rate at which they are detected in coincidence (150 coincidences per second). We further investigated a quantum interference effect (the Hong-Ou-Mandel effect) which classical wave theory has failed to describe. This effect has numerous applications in scalable quantum networks and in linear quantum computing. Finally, a remarkable conversion efficiency of 2.2×10^{-9} was obtained. The results in this paper compares favorably with previously reported schemes.

KEYWORDS: photon pair, spontaneous, down-conversion, quantum interference, phase matching, nonlinear, crystal.

1 INTRODUCTION

Since the realization of Quantum Key Distribution (QKD) there has been a surge of interest in the field of Quantum Mechanics. Many organizations and national government agencies have spent and continue to spend so much money in that field. Some of these future technologies are quantum lithography [1], [2] quantum metrology [3], [4] and the most intriguing amongst them all, is the implementation of a Quantum Computer [5]. The need to fabricate devices with smaller and smaller features has been one of the key challenges faced by semiconductor industry. Classical optical lithography is fast approaching its limit imposed on it by the Rayleigh criterion. However quantum lithography could use entangled photon-number states to overcome this limit and therefore could make it possible to fabricate devices smaller than is achievable with classical lithography. Similarly quantum metrology can also provide us with an increase in measurement precision than is possible using its classical counterpart. A quantum computer on the other hand will guarantee an amazingly faster computation and processing power [6], [7]. All these and many more novel technologies have, at their very foundation, one thing in common – single photons.

Single photon generation and detection is therefore imperative if all these technologies are to be realized. It is also necessary that these sources must be highly efficient, indistinguishable (in some cases), and have low loss. Several researches have been carried out in order to make available ways of generating these photons efficiently and in large numbers [8], [9], [10], [11], [12], [13].

We present, in this paper, how to build a source of photon pairs using the process of Spontaneous Parametric Down-Conversion (SPDC) which are very useful as seen in [1], [2], [3], [4], [5], etc. We also present how to detect these photons efficiently. We further measure the rate at which these photons are detected in coincidence. Finally, we investigate a quantum interference effect popularly known is the Hong – Ou – Mandel effect which has found many application in Scalable Quantum Networks (SQN) and Linear Quantum Computing (LQC).

2 PRINCIPLE

2.1 PHOTON GENERATION

There are many ways of generating photon pairs depending on the experiment or the application they will be used for. We have chosen to use the process of SPDC because it has the capability of generating larger number of photons and with appropriate technique it is possible to achieve high conversion efficiency.

2.2 SPONTANEOUS PARAMETRIC DOWN-CONVERSION (SPDC)

SPDC is a quantum optical process where a nonlinear $\chi^{(2)}$ crystal is used to down convert a pump photon of higher energy into a pair of photons (signal and idler) of lower energies. Fig. 1 depicts the process using bulk crystal configuration.

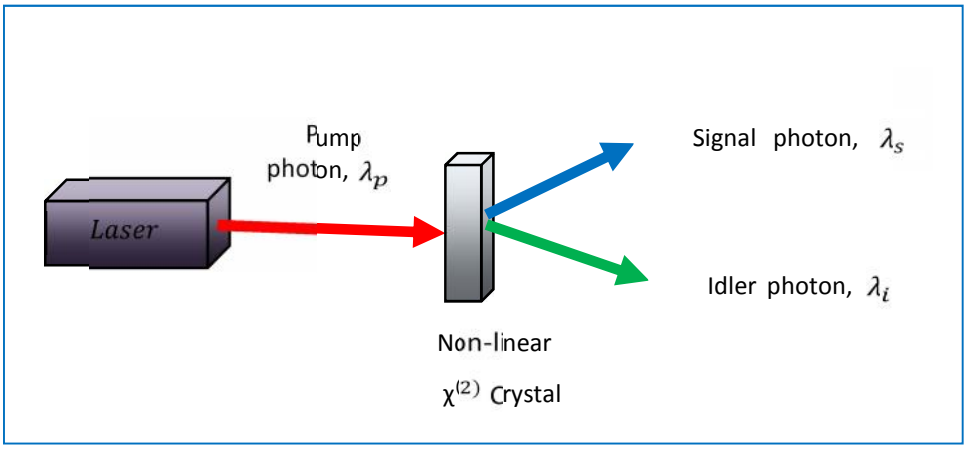


Fig. 1. Spontaneous Parametric Down-Conversion Process

A laser source (which could be continuous or pulsed) is used to pump the nonlinear crystal as in [8], [10], [13]. The pump photon is then split into a pair of photons with total energy and momentum equal to that of the pump photon. If the signal and idler photons both have the same energies, then we have what is called the degenerate case:

$$\varphi_{signal} = \varphi_{idler} = \frac{1}{2}\varphi_{pump} \tag{1}$$

φ_{signal}, φ_{idler} *and* φ_{pump} are the energies of the signal, idler and pump photons respectively. The photon pairs generated through the SPDC in this paper were of this type. For all other combinations of signal and idler photons we have the non-degenerate case. Whether degenerate or otherwise, both energy and momentum must be conserved.

$$\varphi_{pump} = \varphi_{signal} + \varphi_{idler} \tag{2}$$

$$\overrightarrow{k_p} = \overrightarrow{k_s} + \overrightarrow{k_i} \tag{3}$$

$\overrightarrow{k_p}$, $\overrightarrow{k_s}$ *and* $\overrightarrow{k_i}$ are the k-vectors of the pump, signal and idler photons respectively.

The following equation together with equation (3) represents the general phase matching condition:

$$\omega_p = \omega_s \pm \omega_i \quad (4)$$

The nonlinear crystal in an SPDC process may be cut for either type-I or type-II birefringent phase matching. In type-I phase matching, the down-converted photons emitted will have the same polarization. For instance the pump photon may be polarized in the extraordinary axis while the *signal* and *idler* photons are both polarized in the ordinary axis. In this case the photon pairs will not be directly entangled and therefore further optics has to be employed to make them entangle if the need arise. One of such methods is to use two-crystal geometry as was published in [13]. In that paper, a beam from Ar^+ laser (polarized at 45^0) was used to pump two BBO crystals each cut for type-I phase matching and arranged such that their optic axis are mutually perpendicular. Fig. 2 shows how the technique was achieved.

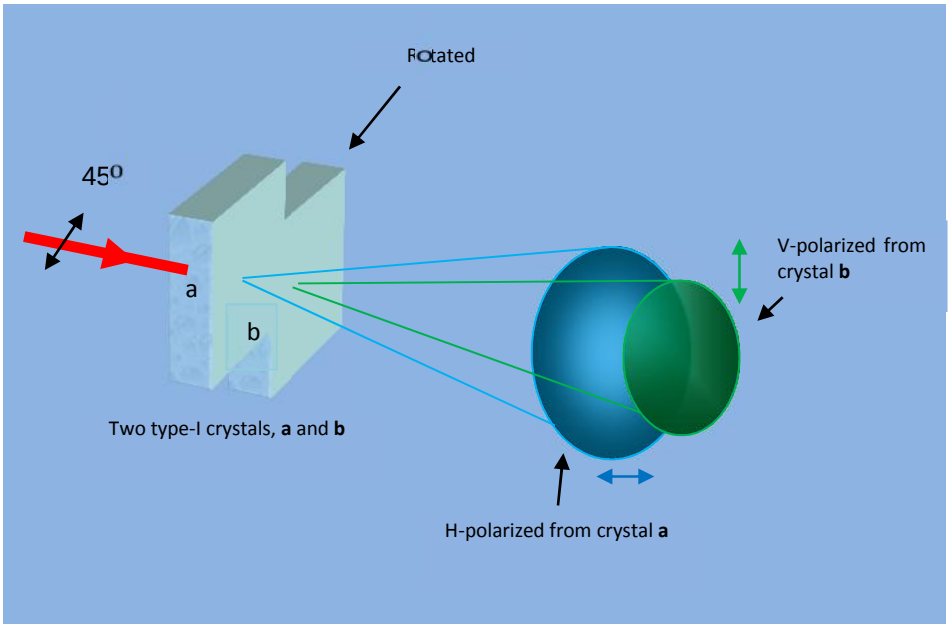


Fig. 2. Polarization-entangled photons from two crystal configuration

The first crystal (a) generates the horizontally-polarized photons while the second rotated crystal (b) produces the vertically-polarized photons. However if the crystal is cut for type-II phase matching as in Fig. 3, then polarization-entangled photons can be directly realized. This makes the type-II SPDC [14], [15] very popular when it comes to experiments requiring the production of polarization-entangled photons. The disadvantage, as seen in [8], is however in the low number of photons usually generated. Fig. 3 shows how type-II SPDC is generally implemented.

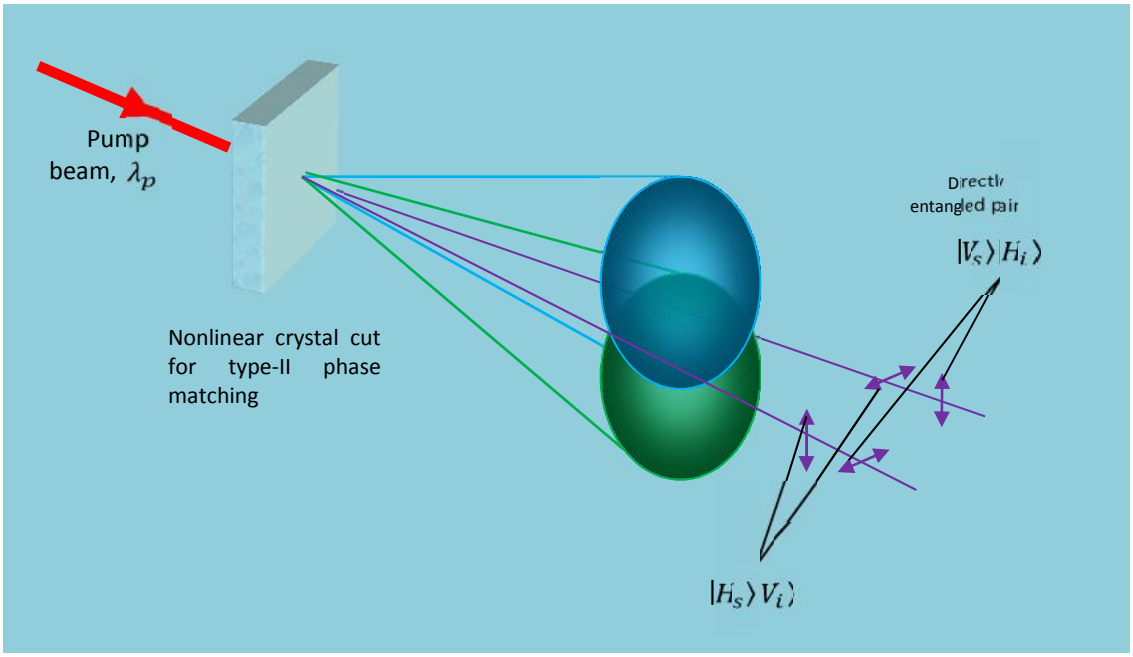


Fig. 3. Type-II SPDC

The crystal in Fig. 3 is pumped by an *e*-polarized pump beam which then creates pairs of photons, one e-polarized and the other *o*-polarized. These pairs are collected from the intersection of the two spatially tilted cones as illustrated in Fig. 3. In theory it is possible to collect the down converted photons exactly at the degeneracy wavelength $2\lambda_p$. However, in real experiments a set of the down converted photons are normally collected through an interference filter centred at the degeneracy wavelength. The emission pattern may be represented as in Fig. 4.

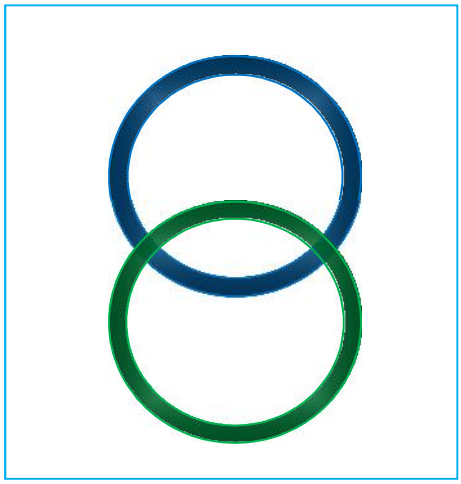


Fig. 4. Set of Collected photons through a band pass filter centred at $2\lambda_p$

2.3 Quantum Interference Effects And Visibility Of A Source

Generally the operation of quantum optical networks at one point may require photons to pass through the two inputs of a beam splitter (BS). This necessarily results in quantum interference of the photons at the BS. Fig. 5 shows a typical BS.

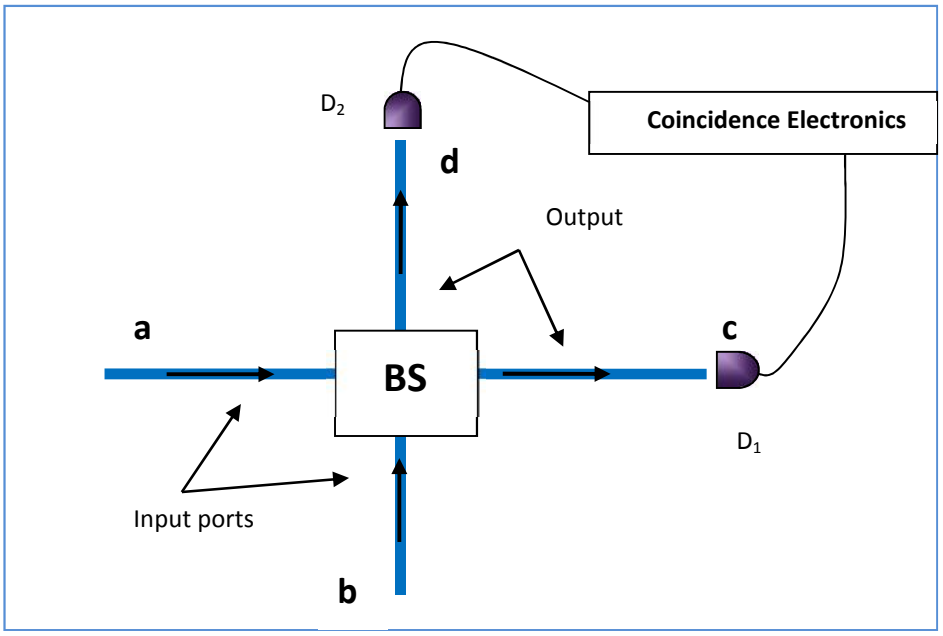


Fig. 5. Schematic diagram of a Beam Splitter

Two indistinguishable photons arriving from the two input ports simultaneously at the BS, lead to both emerging through one of the output port with a certain probability. The photons interfere at the BS and may lead total cancellation of the coincidence rate. In our experiment for instance (See Fig. 7) the signal and idler photons generated were coupled into Polarization Maintaining Fibers (PMF) which was subsequently directed to the input ports of a 50/50 fiber-optic BS. The BS mixes the two beams and thus removes the spatial distinquishability. A motorized translation stage was used to vary the length of the optical path (and thus introduce a relative delay) from the crystal to the BS. The output ports are connected to the two APDs D_1 and D_2 for detection. The outputs of D_1 and D_2 provided the start and the stop signals which were used by the Time to Amplitude Converter (TAC) to record the coincidence histogram. Using a time-window of approximately $1ns$ a Channel Analyser counts the rate of the coincidences.

The expected number of coincidences N_c is mathematically related to the correlation time $g(\tau)$ and the relative optical time delay $\delta\tau$ between the two channels from the crystal to the BS by

$$N_c = K\left[R^2 + T^2 - 2RT\frac{\int_{-\infty}^{\infty} g(\tau)g(\tau-2\delta\tau)d\tau}{\int_{-\infty}^{\infty} g^2(\tau)d\tau}\right] \quad (5)$$

R and T are the reflectivity and the transimittivity of the BS and K is a constant. It can be easily seen from equation 5 that when there is no relative delay between the arrival of the photon pairs (i.e. $\delta\tau = 0$), then N_c will simplify to $N_c = K(R-T)^2$. A 50/50 BS has $R = T = \frac{1}{2}$ and therefore N_c will be equal to zero (the reason why it is sometimes called null coincidence counting rate). Theoretically we should expect no coincidence count at all for a perfect 50/50 BS and perfectly indistinguishable photon pairs; but in practice we see a sharp dip close to $\delta\tau = 0$. The width of the dip depends on the coherence time of the down-converted photons. Fig. 8 shows a graph of the number of coincidence per second plotted against the relative delay in one of the channel. The delay in the other channel was kept constant. The visibility of the source could be determined by the formula

$$V = \frac{N_{cmax} - N_{cmin}}{N_{cmax}} \quad (6)$$

N_{cmax} and N_{cmin} are the maximum and minimumnumber of coincidences per second respectively. In theory

$$V = \frac{N_{cmax} - N_{cmin}}{N_{cmax}} = \frac{N_{cmax} - 0}{N_{cmax}} = 100\%$$

Another way of obtaining the visibility as seen in [9], [16] is to use the measured coincidence detection probability P which could be approximated as

$$P \cong C\left[1 - Ve^{-\frac{c^2\delta\tau^2}{2}}cos\{(\omega_s - \omega_i)\delta\tau\}\right] \quad (7)$$

V is the visibility of the source, ω_s and ω_i are the frequencies of the signal and idler photons respectively and C is a constant. The frequency response of the band pass filters is assumed here to be Gaussian with rms width of σ. Fitting the measured coincidence count with the above equation, it is possible to find the visibility.

2.4 Other Photon Pair Sources

Several sources [17], [18], [19], [20], [21], [22] have been reported. In [17], [18] four-wave mixing in (single mode micro-structured) fibers was reported where the fiber is pumped with pulsed laser to generate the photon pairs. This approach seemed to have some advantages over the conventional three-wave mixing. In [19], a single semiconductor quantum dots was used. InP and CdSe quantum dots were used in [20], [21]. There are still other sources like those involving diamond NV-defect centers [22], [23], molecules [24] and even atomic systems [25], [26].

Periodically Poled Lithium Niobate (PPLN) has also been used as a substrate in [11]. The PPLN substrate is the type where by the ferroelectric polarization of the material involved is inverted periodically.

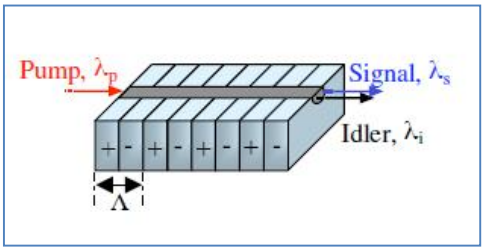


Fig 6. The PPLN Waveguide [27]

Fig. 6 shows the PPLN Waveguide where λ_p, λ_s and λ_i are respectively the pump, signal and idler wavelengths. Λ also denotes the poling period while the '+' and '-' represent the alternating signs for the second order nonlinear coefficient (i.e. the $\chi^{(2)}$ coefficient).

2.5 Photon Detection

The detection stage is very important since inefficient detection would ultimately leads to poor source of photons in general. There is therefore the need for highly efficient detectors.

When the signal and idler photons exit through the output port of their respective APDs (see Fig. 5) they are directed to a counting machine which counts the rate at which the photons are detected. For the coincidence counting, the machine works as follows:

If one of the pairs (say the signal photon) is detected by the first detector D_1 then the second pair (the idler) is also expected to be detected at the same time by the second detector D_2. Suppose the pairs arrived simultaneously, as expected theoretically, with accuracy better than their coherence time, then they are countered as detected in coincidence. In practice however the arrival of the first pair is used to signal the start of a time window ($1ns\ in\ our\ case$) within which the other pair is expected to arrive. If it does arrive then they are counted as coincidence; otherwise they are not in coincicence.

3 EXPERIMENTAL SETUP

Fig. 7 depicts how the experiment was setup in the laboratory.

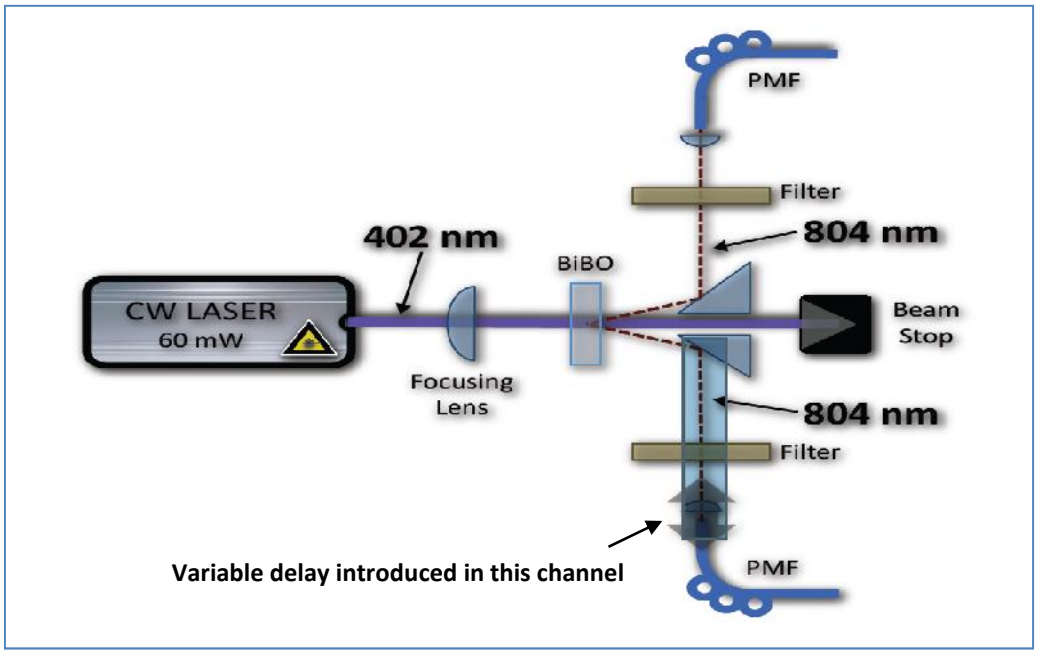


Fig. 7. Schematic diagram of the experimental set up for generating photon pairs using SPDC

A continuous wave (CW) laser emitting at a wavelength of 402nm and operating power of 60mW was used through the focusing lens to pump a BiBO (BiB_3O_6) nonlinear crystal. The crystal is cut to have non-collinear degenerate type-I phase matching when the pump beam is nearly orthogonal to the crystal surface. The down-converted photons (signal and idler) produced through the process of SPDC were directed by the prisms through the band pass filters. The filters, centered at 804 nm wavelengths with bandwidth of 2nm, were used to cut off the background fluorescence. A fiber-optic collimator mounted on a motorized XY translation stage was used to scan the resulting spatial distribution of the down-converted light. The photons were then sent via the Polarization Maintaining Fiber (PMF) to be detected by APDs of 70% efficiency. The detectors are in turn connected to a photon counter which counts the number of photons generated per second as well as the coincidence rate.

4 EXPERIMENTAL RESULTS AND ANALYSIS

4.1 RESULTS

We have recorded **150** coincidences per second with singles reaching up to a remarkable **200,000** counts per second.

4.2 EFFICIENCY OF OUR SOURCE

The conversion efficiency (in terms of photon pairs generated per pump photon) of the source is normally related to the rates of the singles S_1 and S_2 and the coincidence rate R_c by the equation reported in [28].

$$\eta = \frac{S_1 S_2}{R_C} \frac{hc}{P_p \lambda_p} \quad (8)$$

P_p and λ_p are the pump power and wavelength respectively; h and c are the usual Plank's constant and the speed of light in vacuum. Using this formula we obtained a remarkably high efficiency of 2.2×10^{-9} in our experiment. This result is significantly better than what was reported in [8], [10], and [13]. The table below shows the comparison between the efficiency of our source (shown in the table in red) and other published works.

Table 1. Comparison of our source with other published papers

	Type-I BiBO Bulk [our work]	Type-I LBO Bulk [10]	Cascade BBO Bulk [13]	Type-II BBO Bulk [8]
Pump power, (mW)	60	615	150	400
λ – λ)	402 - 804	775 - 1550	351 - 702	775 - 1550
APD detection efficiency (%)	Silicon (70%)	InGaAs/InP (10%)	Silicon (65%)	InGaAs/InP (10%)
Single count rates,	200,000	2,800	40,000	20,000
Net coincidence rate, (c/s)	150	29	2000	75
Conversion efficiency, η	2.2 × 10	1.1 × 10	3.0 × 10	3.4 × 10

4.3 VISIBILITY

A novel mechanism was devised to facilitate reaching as high visibility as possible. To do this the positions of the fiber-optic collimators must be chosen such that as many indistinguishable phot are collected ed i s po positio ssible. Several couplin fins of the e chosen by the aid of the two translation stages a ed each bers wer sitio the vis ion of the HOM Dip an s a bility wa After checking ne the olarization and spectrum o the do nalyzed. el pl they a hotons and making sur he e right, osition (i.e. the converton the two stages) of the (1 2 left ch initial p t ch (18.50 annel] was recorded a 30 μm, 30. highest visibi el, righ 93.36 ± 1.2% was recor ed at μm). The ic do positio kwise from the initi f n (0,0) channel and 10 μm ant lockwise from that of the right cha the left 8 shows the result of that particular position. nel. Fig

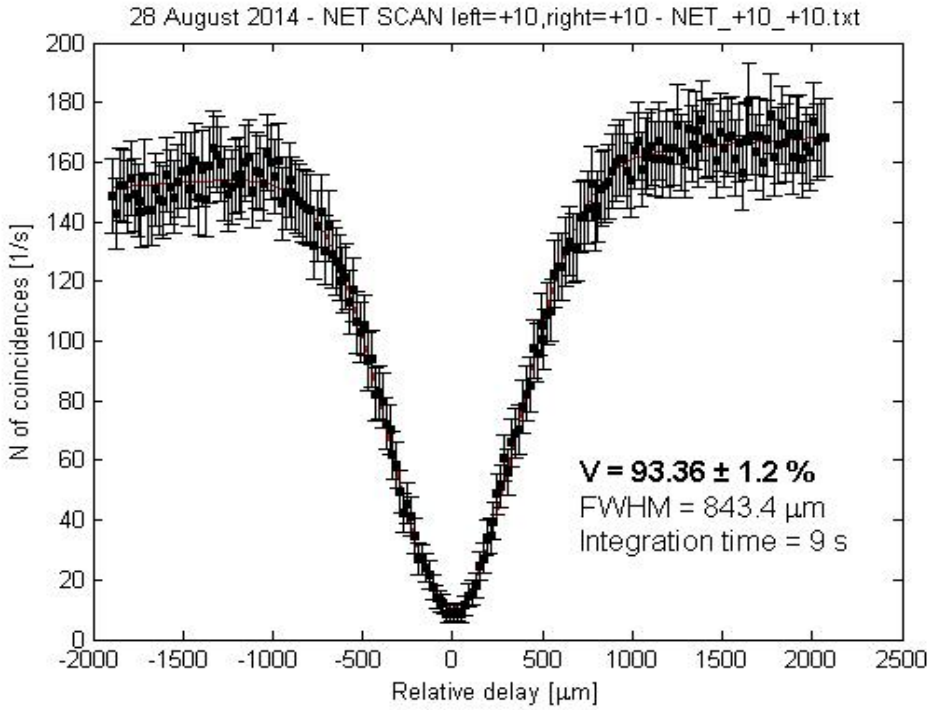


Fig. 8. Two photon quantum interference pattern (HOM Effect)

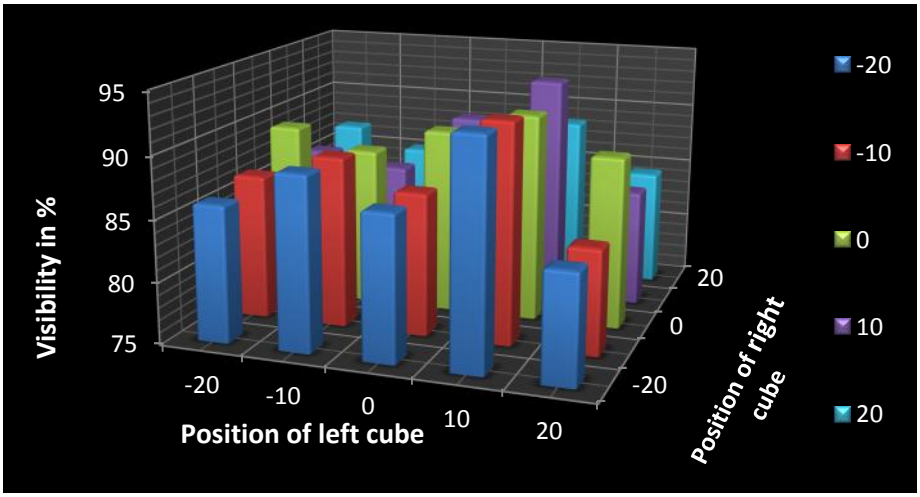


Fig. 9. 2D Position scan of Visibilities

Fig. 9 shows various positions of the cubes relative to an initial position $(0,0)$ with the observed visibilities as the height. This confirms the results in Fig. 8. It can be seen that the highest visibility was achieved at position $(10,10)$.

5 CONCLUSION

We have presented a source of photon pairs using SPDC process. The source compares favorably with previously reported schemes.

Future work could be for instance to further enhance the visibility of the source by replacing the bulk crystal configuration with Periodically Poled Lithium Niobate (PPLN) waveguide and also using more efficient detectors (super conductors could be strong candidates). Also, the source could be made in the 1550nm telecommunication band so that is compatible with the existing fiber-optic networks.

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Etude des performances d'un réacteur biologique séquentiel "SBR" pour le traitement des effluents d'une entreprise agroalimentaire marocaine

[Performance of a Sequencing Batch Reactor for the Treatment of Food Industry Wastewater in Morocco]

Soumia Hebabaze[1], Christoph Brand[2], Zahra Moutaib[1], Carsten Riechelmann[2], Sylvain Raffy[3], Matthias Kraume[2], and Mohamed Chlaida[1]

[1]Laboratoire d'Ecologie et d'Environnement (LEE), Université Hassan II-Casablanca, Faculté des Sciences Ben M'sik, BP 7955-Sidi Othman, Casablanca, Maroc

[2]Chair of Chemical and Process Engineering, Technische Universität Berlin, Germany

[3]Naturex Maroc, Aéropôle / Aéroport Mohammed V, 20240 Nouacer – Casablanca, Maroc

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ABSTRACT: The increase of activity in the food industries is often accompanied by higher emissions of wastewater. Due to Moroccan discharge standards a treatment is mandatory for direct or indirect discharge.
This study evaluates the treatment performance of a sequential batch reactor (SBR) set up by a Moroccan food industry company (Naturex Morocco). The results obtained during the second year of operation of the system shows that the elimination rates reach 98% for COD, 99% for BOD5, 74% for TSS and 68% for total nitrogen. The effluent complies with Moroccan standards for indirect discharge. However, the treated water has some color substances (probably vegetable tannins) which would require additional treatment.

KEYWORDS: Sequencing batch reactor, wastewater, treatment, quality, food industry, Morocco.

RESUME: L'accroissement des activités industrielles agroalimentaires est souvent accompagné d'une production accrue des effluents liquides. Ces eaux usées nécessitent un traitement avant leur rejet direct au niveau du réseau d'assainissement ou dans le milieu naturel. Cet impératif de traitement constitue aujourd'hui une contrainte réglementaire au niveau du Maroc pour protéger l'environnement et la santé de la population.
Cette étude se propose d'évaluer les performances épuratoires d'un réacteur biologique séquentiel (SBR) mis en place par une industrie agroalimentaire marocaine (Naturex Maroc). Les résultats obtenus, durant la 2ème année de mise en service de ce système, montre que les taux d'abattement moyens mensuels atteignent 98 % pour la DCO, 99 % pour la DBO_5, 74 % pour les MES et 68 % pour l'azote total. L'effluent d'eau épurée s'avère conforme aux normes marocaines de rejets indirects. Toutefois, les eaux épurées restent chargées en certaines matières jaunâtres (tanins d'origine végétale) qui nécessiterait probablement un complément de traitement plus approprié.

MOTS-CLEFS: Réacteur biologique séquentiel, eaux usées, traitement, qualité, industrie agroalimentaire, Maroc.

1 INTRODUCTION

Au Maroc, l'industrie agroalimentaire représente un secteur d'activités vital et dynamique dans le tissu économique du pays. Ce secteur compte, en effet, environ 2000 entreprises soit 25 % du total des établissements industriels à l'échelle

nationale. Il regroupe les branches industrielles relatives aux boissons, fruits et légumes, viandes, poisson, lait, céréales, huile d'olives et autres industries d'extraction de produits d'origine végétale (plantes naturelles, algues…).

En dépit d'une production industrielle représentant 30 % à l'échelle nationale, ce secteur consomme énormément d'eau et génère d'importants volumes d'eaux usées. Ces eaux usées sont souvent déversées dans le réseau d'assainissement sans traitement préalable ou parfois rejetées directement dans les hydrosystèmes naturels lorsque l'unité industrielle se trouve en milieu rural ou dans des sites non desservis par le réseau d'assainissement.

Actuellement, compte tenu des impacts 'environnementaux de ces effluents liquides et des contraintes de la réglementation en vigueur, la mise en place de stations de traitement des eaux usées industriels est devenue une exigence dans le fonctionnement et la conception des unités industrielles en particulier agroalimentaires (Huileries, brasseries et limonadières, raffineries de sucre, laiteries, abattoirs, etc….). Parmi les techniques de traitement les plus adaptées aux rejets industriels agroalimentaires, figure le réacteur biologique séquentiel ou SBR (Sequencing Batch Reactor) dans lequel, les étapes de réactions biologiques et de séparation liquide-solide ont lieu au sein d'un même bassin et s'y effectuent séquentiellement (figure 1).

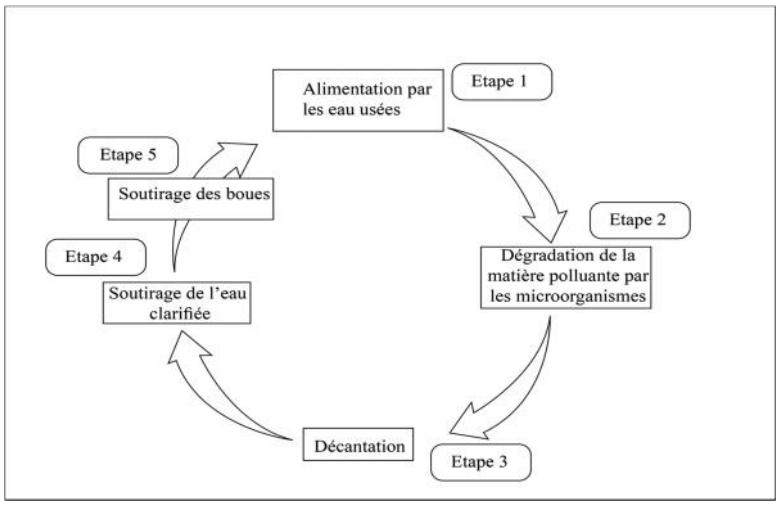


Fig. 1. Cycle de différentes étapes de fonctionnement par un SBR

En effet, le SBR a été déjà appliqué avec succès par [1], [2], [3], [4], [5], [6], [7], [8],[9] sur des effluents de fromageries et de laiteries et par [10] et [11] sur les effluents de limonadières. La comparaison des différents procédés biologiques utilisables pour le traitement des eaux agroalimentaires a montré que le SBR est le plus performant [8].

Notre étude a eu lieu au sein de la société Naturex Maroc, une unité d'industrie agroalimentaire installée à Casablanca (Maroc) spécialisée dans l'extraction des substances naturelles à partir des plantes médicinales et aromatiques (agents naturels de conservation à partir du Romarin, huiles essentielles d'abricot, etc….). Le volume d'eau potable consommé par l'entreprise varie entre 50 à 220 m3/jour utilisés dans le lavage, rinçage, process, etc…..

Dans le but de respecter les normes marocaines de rejets dans le réseau d'assainissement, Naturex Maroc a construit depuis 2010 une station d'épuration (STEP) de type SBR, d'une capacité de 350 m3/jour, en vue de traiter les eaux usées issues de ces différentes activités industrielles. Le projet a été lancé sur la base des caractéristiques physico-chimiques suivantes (tableau 1):

Tableau 1. Qualité physicochimique des eaux usées de l'unité industrielle Naturex Maroc [12]

Paramètre	Valeur
T (°C)	27 à 28 °C
pH	5,7 à 6,15
Matière En Suspension "MES" (mg/l)	100 à 300 mg/l
Demande Chimique en Oxygène "DCO" (mg/l)	11300 à 11700 mg/l
Demande Biologique en Oxygène en 5 jours "DBO_5" (mg/l)	7800 à 8200 mg/l
Azote total (mg/l)	46,5 mg/l
Phosphore total (mg/l)	146 mg/l

Le but de ce travail, qui s'inscrit dans le cadre du projet d'Agriculture Urbaine à Casablanca [13], consiste à évaluer les performances épuratoires de cette STEP au cours de l'année 2011, soit une année après sa mise en état de fonctionnement.

2 MATERIELS ET METHODES

2.1 DESCRIPTION DE LA FILIERE DE TRAITEMENT SBR

La station SBR, objet de cette étude, fonctionne selon le schéma de la figure 2 avec les ouvrages suivants [12]:

- Un poste de relevage et de filtration (tamisage) ou fosse toutes eaux: C'est un bassin creusé à raz du sol ayant une profondeur de 3 m et un diamètre de 2 m. Il est muni d'un filtre rotatif permettant de débarrasser les eaux usées des matières ayant une taille supérieure à 200 µm de diamètre ;
- Un bassin tampon des eaux brutes (BT1): Construit en béton armé sur sol avec une capacité de 350 m3, un diamètre de 9 m, une hauteur totale de 6 m et une hauteur maximale des eaux de 5,5 m. Il a pour rôle d'assurer une homogénéisation et une préneutralisation des eaux usées filtrées avant leur évacuation vers le bassin SBR;
- Un bassin de traitement biologique (SBR): D'une capacité utile de 3400 m3, diamètre de 28 m, hauteur totale de 6 m et hauteur utile de 5,5 m. Il fonctionne en cuve biologique à boues activées à faible charge (4 g/litre), avec un temps de séjour important (environ 10 h) et une aération discontinue au niveau du bassin;
- Un bassin tampon (BT2) : D'une capacité de 250 m3, un diamètre utile de 9 m, une hauteur totale de 4,5 m et d'une hauteur utile de 4m. Il sert à stocker les eaux épurées et à ajuster leur débit avant d'être déversées dans le réseau d'assainissement à travers un canal de comptage (CC).

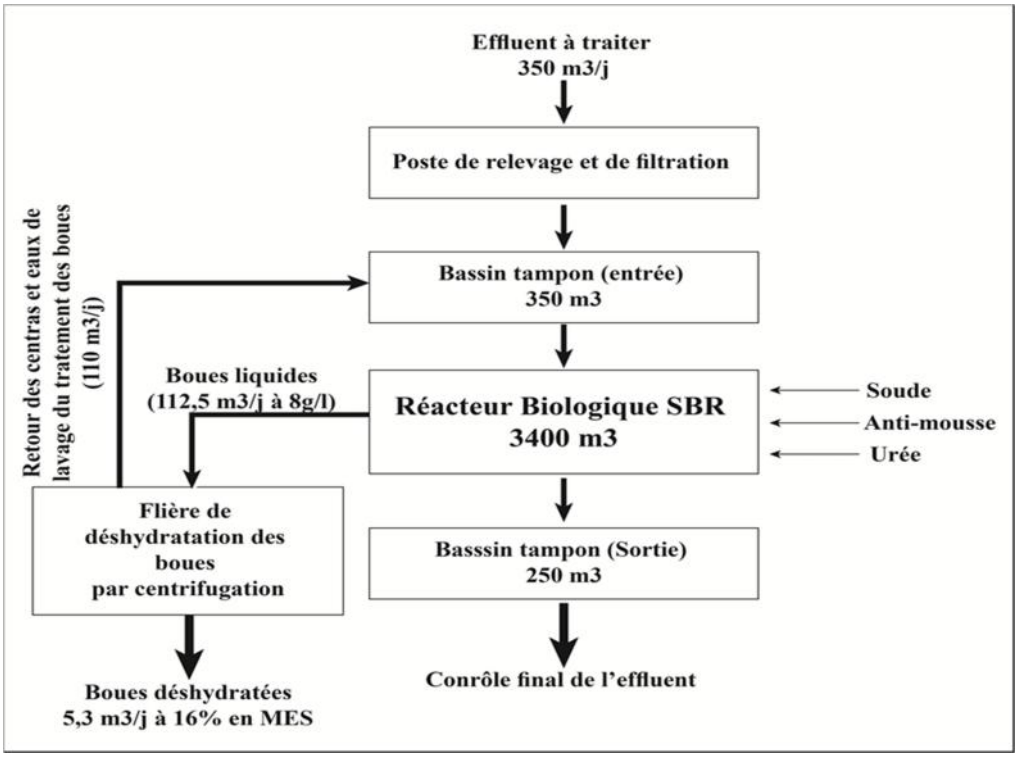


Fig. 2. Schéma des installations de la STEP de Naturex Maroc [12]

Le cycle de fonctionnement du SBR de Naturex Maroc comporte cinq phases de traitement :

- Phase de remplissage: le bassin est alimenté en eau pendant 1h 30 mn.
- Phase d'aération et d'agitation: Cette phase dure environ 6,5 heures avec un apport en oxygène de 0,5 à 2,5 mg/l et d'azote sous forme d'une solution d'urée technique à 33 % (500 litres/jour soit un apport d'azote de 82 kG/jour) nécessaires aux microorganismes pour assurer le processus de dégradation biologique des matières organiques. La soude technique à 33 % et l'anti mousse sont rajoutés en cas de nécessité respectivement pour assurer un pH convenable au traitement et pour éviter la formation de mousse à la surface des eaux dans le bassin SBR.
- Phase de décantation: Elle dure en moyenne 90 minute (1h 30 mn) avec arrêt total d'aération et d'agitation.
- Phase de soutirage des eaux traitées (clarifiées): Elle dure 1h 30 mn.
- Phase de soutirage des boues : Elle a lieu pendant 1h.

Au niveau de la STEP de Naturex Maroc, Il y a globalement 2 cycles de traitement par 24 heures. Les boues liquides sont stockées avant centrifugation dans une cuve en béton d'une capacité de 60 m3. Les boues déshydratées sont stockées dans une benne avant d'être transportées en dehors de la station d'épuration.

2.2 ECHANTILLONNAGE ET CARACTERISATION PHYSICOCHIMIQUE DES EAUX

Les prélèvements d'eau ont été réalisés régulièrement, à raison de 3 fois par semaine, à l'entrée de la STEP au niveau de bassin tampon 1 (BT1), dans le bassin biologique (SBR) et à la sortie du bassin BT2 au niveau de canal de comptage (CC). Les échantillons d'eau sont prélevés dans des flacons en polyéthylène de 500 ml puis transportés immédiatement au laboratoire pour les différentes analyses.

Les mesures directes de température et du pH sont relevées, respectivement au 1/10 et au 1/100, à l'entrée de la STEP (BT1) et à la sortie des eaux épurées au niveau du CC à l'aide de deux sondes de T° et de pH de type Endress+Hauser «Lyquisis M».

Les analyses des eaux au laboratoire ont porté sur les paramètres physicochimiques suivants: la demande chimique en oxygène (DCO), la demande biologique en oxygène en 5 jours (DBO5), les nitrates, l'ion ammonium (NH4+), l'azote total (Nt), le phosphore total (Pt) et les matières en suspension (MES). Les différentes méthodes utilisées lors de ces analyses sont présentées dans le tableau 2. Mis à part la DCO qui a été déterminée par analyse des eaux filtrées, toutes les autres analyses ont été effectuées sur des eaux brutes.

Tableau 2. Méthodes d'analyses des paramètres physico-chimiques

Paramètres analysés	Méthodes d'analyse
MES (mg/l)	Méthode de filtration sur un filtre Wattman référence NF EN 872
DCO totale (en mg/l)	Oxydation au dichromate de potassium à l'aide de kits LCK et lecture au spectrophotomètre DR2800.
DBO_5 (en mg/l)	Respirométrie à l'aide d'un respiromètre type Hach BOD track TM II.
Phosphore total "Pt" (mg/l)	Méthode colorimétrique aux Kitx LCK350 (solutions A, B, C et D) et lecture au spectrophotomètre type DR 2800.
Azote total "Nt" (mg/l)	Méthode colorimétrique par minéralisation aux Kits LCK 338 (solutions A, B, C et D) et lecture au spectrophotomètre type DR 2800.
L'azote ammoniacal "NH_4^+" (mg/l)	Méthode colorimétrique aux Kits LCK 303 et lecture au spectrophotomètre type DR 2800.
Nitrates "NO_3^-" (mg/l)	Méthode colorimétrique aux Kits LCK 340 (solutions A, B, C et D) et lecture au spectrophotomètre type DR 2800.

Le calcul du rendement épuratoire du système de traitement SBR a été effectué à l'aide de la formule suivante [14] :

$$\frac{\text{Valeur à la sortie - Valeur à l'entrée}}{\text{Valeur d'entrée}} \times 100$$

Afin de vérifier la significativité de nos résultats au seuil de 0,05 (5%) et de se prononcer sur la validité du traitement SBR, nous avons soumis nos données à un traitement statistique paramétrique par le test de Student. Le choix de ce dernier a été justifié par le faible nombre de paramètres testés qui est inférieur à 30.

3 RESULTATS ET DISCUSSIONS

Les différents résultats de mesures et d'analyses hebdomadaires (3 fois par semaine soit 12 fois par mois) enregistrés pour chaque ont été transformés en moyennes mensuelles en vue de simplifier leur interprétation.

3.1 LE POTENTIEL HYDROGÈNE

Le potentiel Hydrogène (pH) mesure l'acidité de l'eau et joue un rôle important dans la définition de son caractère agressif ou incrustant [15]. Le pH joue également un rôle important dans le développement bactérien au niveau des systèmes de traitement biologique puisque la nitrification optimale ne se fait qu'à un pH compris entre 7,5 et 9.

Le pH des eaux au niveau de notre STEP varie en fonction de la phase du traitement parcourue et reste également lié au processus de production au niveau de l'entreprise. En effet, ce paramètre varie globalement entre un minimum de 6 et un maximum de 7 au niveau des eaux du BT1 respectivement en Décembre et Mars 2011, entre 7 et 7,4 dans celles de SBR au cours de toute l'année d'étude et entre 7,1 et 7,7 au sein des eaux de CC respectivement en Décembre et Janvier 2011. On remarque donc une augmentation du pH de 6,5 en moyenne à l'entrée vers un pH légèrement alcalin à la sortie de la STEP. Cette augmentation consécutive à une libération des ions OH- dans les eaux serait due à plusieurs processus notamment une diminution de la concentration moyenne de l'azote total dans l'effluent traité suite au phénomène de nitrification biologique [16].

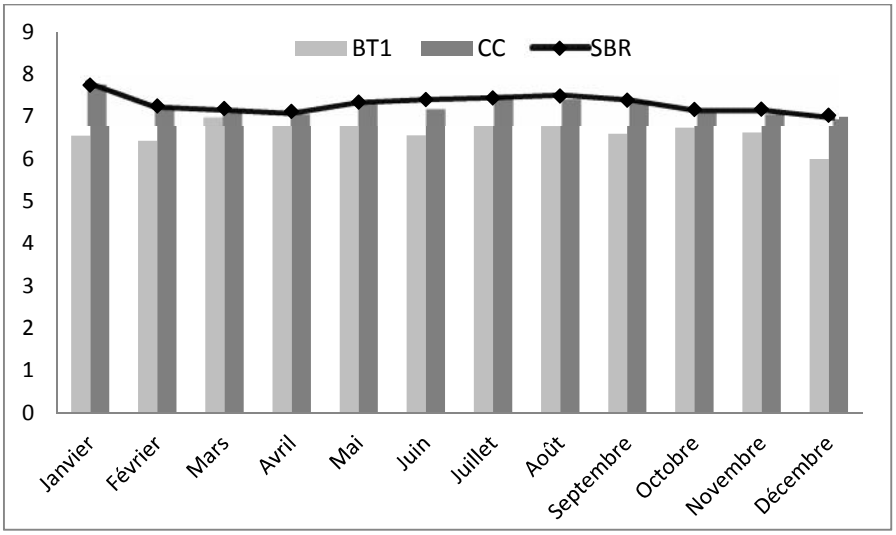


Fig. 3. Variation des moyennes mensuelles du pH au niveau des eaux de la STEP de Naturex Maroc

3.2 LES MATIERES EN SUSPENSIONS (MES)

Les MES constituent une partie de la pollution carbonée liée aux particules organiques et minérales non dissoutes. L'évolution des MES résulte de l'évolution simultanée de la fraction insoluble de l'effluent et de la biomasse proprement dite [8].

Dans notre cas, les teneurs moyennes mensuelles en MES des eaux varient d'un compartiment à un autre de la station d'épuration. Elles se situent entre 500 et 1430 mg/l au niveau du BT1 enregistrées respectivement en décembre et juillet 2011; entre 3650 et 7710 mg/l au cours de l'année au niveau du SBR et entre 128 et 600 mg/l signalées respectivement en Décembre et juillet 2011 au niveau du CC (figure 4). On note également que depuis le mois septembre, les teneurs en MES diminuent sensiblement dans le bassin SBR probablement à cause de la dilution due aux précipitations importantes au cours de cette période.

Les taux d'abattement enregistrés pour les MES sont de l'ordre de 66,02 % en moyenne avec un minimum de 58,04 % et un maximum de 74 %. Ce taux d'élimination de MES est largement supérieur à celui trouvé par [11] soit 10%. Cette différence pourrait être attribuée à la durée de la phase de décantation dans le SBR favorable à la formation des flocs bactériens qui contribuent à la décantation des boues, et par conséquent, faciliteraient la séparation des MES. Toutefois, les teneurs de ces dernières augmentent parfois accidentellement, comme aux mois de mai et juillet 2011 au niveau du CC, probablement à cause d'un mauvais accomplissement du processus de décantation et de soutirage des boues.

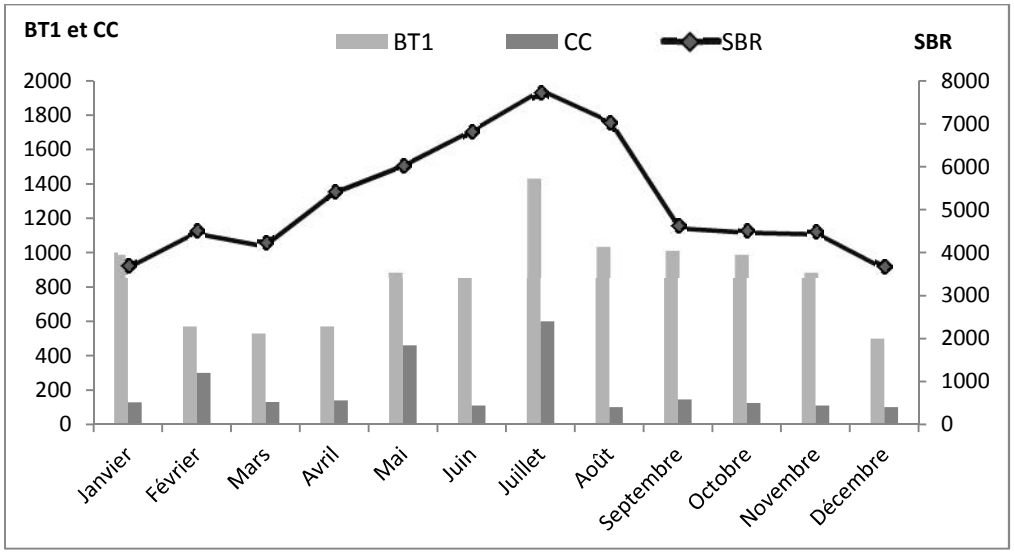


Fig. 4. Evolution des teneurs en MES (en mg/l) au niveau des eaux de la STEP de Naturex Maroc

3.3 LA DEMANDE CHIMIQUE EN OXYGENE TOTALE (DCOT)

La Demande Chimique en Oxygène constitue un paramètre déterminant dans le processus d'épuration des eaux usées. Dans notre cas, les valeurs moyennes mensuelles de la DCO varient, au niveau du BT1, entre 5000 et 10750 mg/l signalées respectivement aux mois de janvier et juillet 2011 au niveau du SBR, et entre 112 et 900 mg/l obtenues respectivement aux mois janvier et juillet 2011 au niveau des eaux du CC.

Au même moment, les rendements épuratoires et d'élimination des matières oxydables des eaux usées de l'entreprise peuvent atteindre un maximum de 97,8 %. Ces taux d'abattement concordent avec les valeurs rapportées par [6], [17] et [18] qui ont signalé que le procédé SBR élimine environ 98% de la DCO. En revanche, nos rendements épuratoires sont supérieurs à ceux trouvées par [16] et [19]. Ces meilleurs taux d'abattement de la DCO seraient liés, comme l'a rapporté [20], au fait qu'au niveau du système SBR, la biomasse forme des granules décantables ou bioflocs correspondant à des agrégats de microbes biofloculés constitués de microbes, particules inertes, particules biodégradables et de polymères extracellulaires qui adsorbent les composés organiques. Ces bioflocs assurent une bonne séparation solide/liquide et donc une augmentation de la performance du procédé SBR en termes d'élimination de la DCO et de la DBO5. Toutefois et malgré cette importante élimination des matières oxydables par notre système SBR, les eaux épurées gardent une certaine coloration jaunâtre probablement due à des pigments organiques de type tanins libérés lors du procédé d'extraction des huiles et d'autres produits à partir des essences végétales traitées par l'entreprise.

Signalons enfin que l'évolution de la DCO dans le SBR suit celle du BT1 en rapport avec l'activité de l'unité industrielle qui est plus importante au printemps jusqu'au début de l'été et qui diminue légèrement en automne et en hiver. Toutefois, dans certains cas, on assiste à une augmentation de la DCO au niveau du réacteur SBR, comme en octobre et novembre, et qui pourrait être dû, comme l'a signalé [8], à un relargage des composés solubles contenus dans les MES.

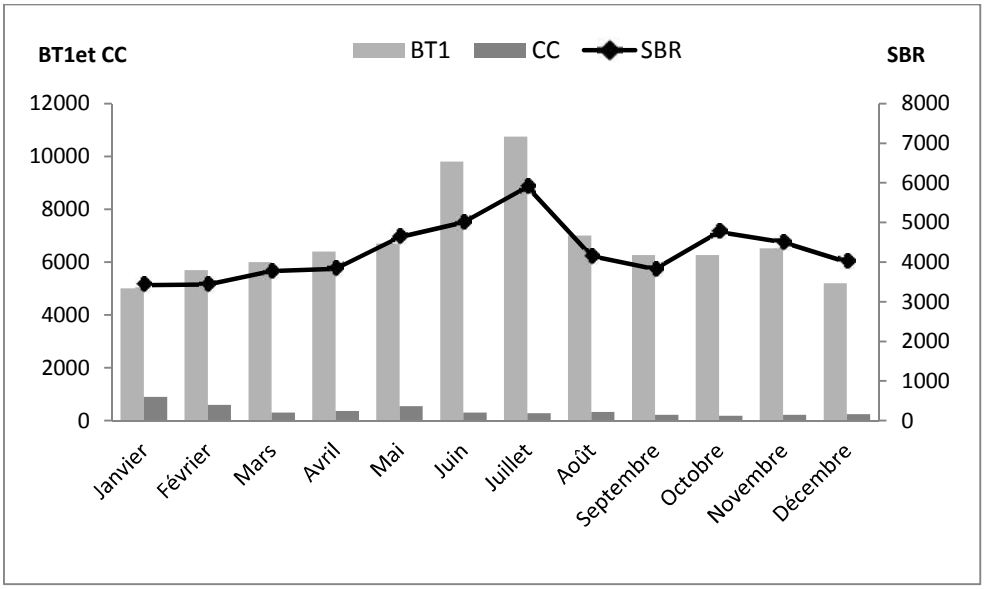


Fig. 5. Evolution des moyennes de la DCO (en mg/l) au niveau des eaux de la STEP de Naturex Maroc

3.4 LA DEMANDE BIOLOGIQUE EN OXYGENE EN 5 JOURS (DBO5)

Au cours de notre période d'étude, les valeurs de la DBO5 varient, au niveau du BT1, entre un minimum de 4300 mg/l enregistré en décembre 2011 et un maximum de 8500 mg/l atteint en juillet de la même année. Dans le bassin SBR, la DBO5 fluctue globalement autour de 720 à 2000 mg/l au cours de la majorité des saisons (automne, hiver et printemps) mais elle augmente sensiblement en été pour atteindre les 3200 mg/l au mois de Juin. La DBO5 des eaux traitées (CC) reste souvent assez faible et ne dépasse pas une moyenne maximale de 120 mg/l signalée au mois de juin 2011. C'est ainsi que les rendements épuratoires de notre SBR en terme de DBO5 atteignent au maximum environ 99 % et concordent avec ceux obtenus par [18].

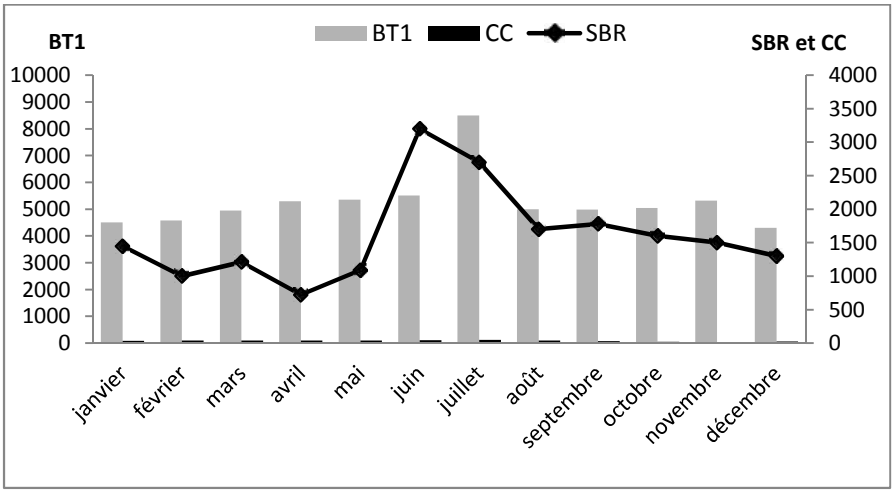


Fig. 6. Evolution des moyennes de la DBO_5 (mg/l) au niveau des eaux de la STEP de Naturex Maroc.

3.5 LES ÉLÉMENTS AZOTÉS

3.5.1 L'AZOTE TOTAL (NT)

La présence des sels azotés dans les rejets liquides est indésirable plus particulièrement en industrie agroalimentaire souvent caractérisée par des effluents avec des teneurs élevées en éléments nutritifs et particulièrement l'azote [21].

Au niveau des eaux des différents compartiments de notre station, les teneurs en azote total varient entre un minimum de 37 et un maximum de 524 mg/l pour le BT1 enregistrées respectivement aux mois de décembre et juillet 2011. Au niveau du bassin SBR, ces teneurs moyennes mensuelles se situent entre 10,58 signalée en novembre et 355 mg/l mesurée en juillet 2011 alors qu'elles varient respectivement aux mêmes mois entre 8 et 81 mg/l au niveau des eaux du CC (Figure 7).

Ces résultats ont abouti à des taux moyens d'élimination d'azote total dépassant les 84 % et qui ne diminuent jamais en dessous de 40 % malgré l'addition d'urée à 33 % au niveau du bassin SBR. Par comparaison à d'autres travaux, nos rendements d'élimination d'azote total sont supérieurs à ceux obtenus par [11] qui a rapporté un taux d'abattement de l'ordre de 39%. Cette différence par rapport à nos résultats pourrait être expliquée par la durée du cycle du traitement global au niveau de notre SBR (12 h environ) qui reste supérieure aux 10 h rapportées par [11].

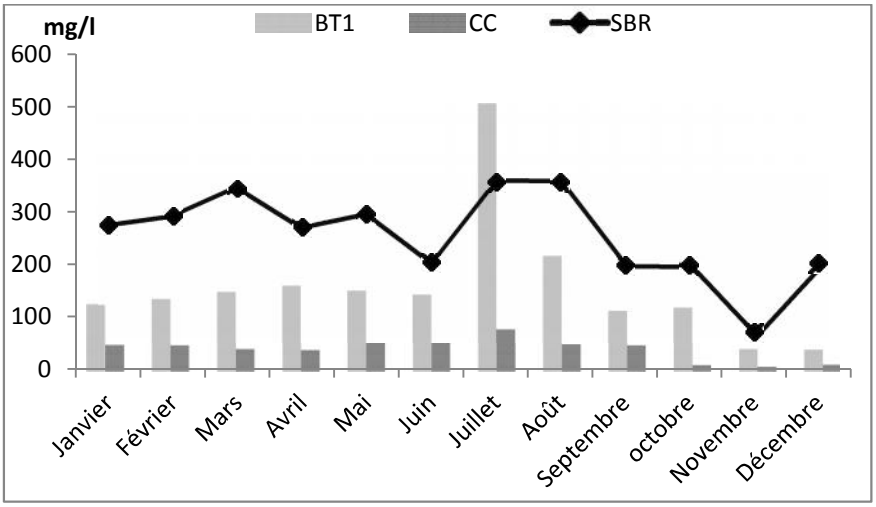


Fig. 7. Evolution de la teneur en Azote total au niveau des eaux de la STEP de Naturex Maroc.

3.5.2 LES NITRATES

Les nitrates constituent la forme minérale soluble de l'azote produit final de la nitrification, processus biologique lié à l'activité des microorganismes (Nitrosomonas, Nitrobacter, Nitrosolobus, etc….) qui oxydent l'azote ammoniacal en nitrites puis en nitrates.

Les teneurs en nitrates des eaux au niveau de notre STEP se situent entre 0,9 et 4 mg/l au niveau du BT1; 0,28 et 3,7 dans le SBR et entre 0,24 et 0,86 mg/l au niveau du CC (Figure 8). Ces teneurs varient sensiblement selon les saisons avec des valeurs plus élevées en hiver-printemps (janvier à juin) et faibles lors de la période été-automne (juillet à décembre). Cette chute coïncide avec la diminution du taux d'azote total dans les effluents bruts sous l'effet de l'élévation de la température qui engendre une baisse de la quantité d'oxygène dissous qui favorise la nitrification. Toutefois, le taux d'abattement des nitrates des eaux dépasse globalement les 78 % (78,46 %) ce qui confirme l'efficacité de notre pour ce qui de l'élimination de cet élément.

Comparés au taux d'abattement des 60% rapporté par [11], nos rendements sont plus élevés. La durée du cycle de traitement, et notamment l'aération, au niveau de notre SBR serait à l'origine de ce résultat. En effet, cette aération prolongée favorise l'oxydation de l'ion ammonium et augmente sa transformation en nitrites puis en nitrates par les microorganismes nitrificateurs de la boue. Lors de la phase de décantation, une bonne partie d'azote est éliminée par ces microorganismes pour assurer leur propre métabolisme, alors qu'une autre partie d'azote est éliminée sous forme d'azote molaire gazeux par une flore banale anaérobie facultative telle que celle des Pseudomonas denitrificans. Cette dénitrification nécessite une source de carbone pouvant provenir soit de l'effluent à traiter (dénitrification exogène) [22], soit d'une source de carbone associée aux microorganismes dénitrificateurs (dénitrification endogène) [23]. En effet, dans notre cas, la richesse des effluents bruts en matières oxydables (source exogène en carbone) pourrait expliquer le taux élevé d'élimination des nitrates

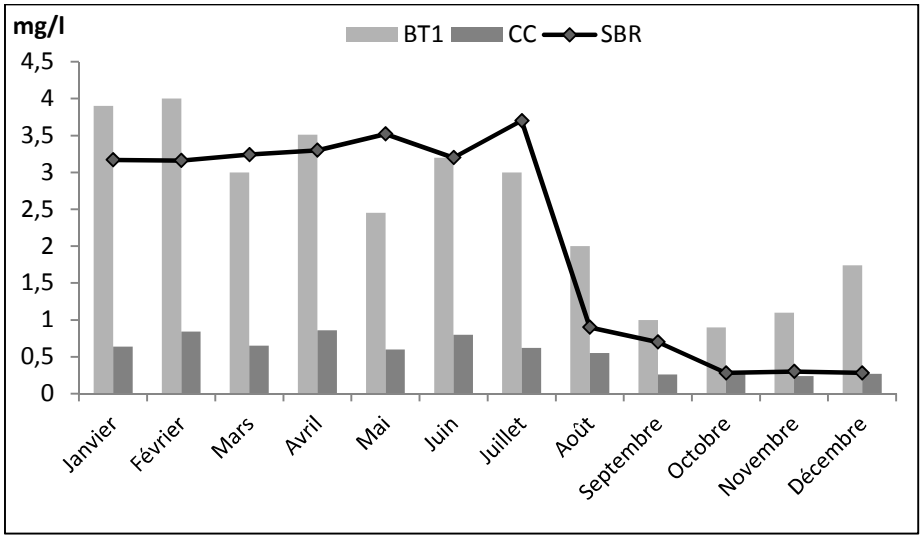


Fig. 8. Evolution de la teneur en nitrates des eaux de la STEP de Naturex Maroc.

3.5.3 L'ION AMMONIUM « NH4+ »

Au niveau des eaux de notre station, l'ion ammonium se présente à des teneurs relativement faibles qui varient entre 0,31 et 5,68 mg/l au niveau du BT1 ; 0,05 et 2,3 dans les eaux du SBR et entre 0,02 et 0,68mg/l au niveau des eaux du CC (Figure 9).

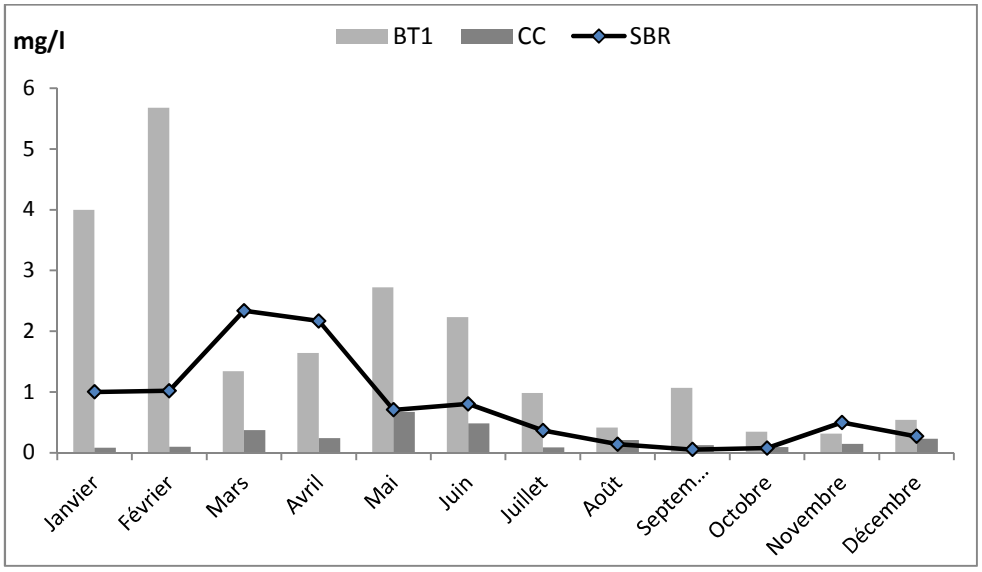


Fig. 9. Evolution de la teneur de l'ion ammonium NH_4+) dans les eaux de la STEP de Naturex Maroc.

Les rendements moyen d'élimination de l'ion NH4+ des eaux dépassent les 80 % au maximum et ne diminuent pas en dessous de 50 %. Ces taux d'abattement sont supérieurs à ceux signalés par [11] soit un rendement d'élimination de l'ordre de 20% seulement. Ces meilleurs rendements sont liés à l'efficacité du processus d'aération qui oxyde massivement l'ion ammonium en nitrites au cours de la réaction de nitritation effectuée notamment par les bactéries du genre Nitrosomonas.

Signalons enfin que les eaux à la sortie de SBR (CC) présentent globalement des teneurs très faibles en nitrates (0,55 mg/l en moyenne) et en ion ammonium (0,35mg/l) et que la plus grande partie de l'azote est du type organique avec une

teneur moyenne de 44,5 mg/l. Ceci pourrait être expliqué par l'apport de l'urée au niveau du SBR et en partie par une insuffisance de son élimination par le procédé biologique aéré.

3.6 TRAITEMENT STATISTIQUE

L'application du traitement statistique par le test de Student à un niveau de significativité de 5 % a montré que les différences entre les valeurs moyennes "μ" (μavant traitement et μ après traitement) sont significatives. Les échantillonnages réalisés au cours de notre étude sont conformes sur le plan de leur représentativité et par conséquent le système SBR s'avère efficace pour l'élimination des pollutions contenues dans les effluents industrielles traités.

Tableau 3. Résultats des paramètres étudiés au seuil de 0,05 selon le test du Student

paramètres	Moyenne avant traitement par SBR	Moyenne après traitement par SBR	P(T<=t) unilatéral
Azote total	152,4	39,33	0,00148625
Nitrates	2,48333333	0,55	7,1181E-06
Ammonium	1,6845	0,21916667	0,00225911
Phosphore	400,4	315,041667	0,00091582
DCO	7363,5	260,833333	7,7969E-06
DBO_5	5361,83333	84,5833333	1,5736E-08
MES	705	124,583333	1,1738E-08

4 CONCLUSION

Les résultats obtenus au cours de cette étude montrent que le système de traitement SBR choisi par l'unité industrielle Naturex Maroc est globalement efficace pour l'épuration des effluents liquides avant leur déversement dans le réseau d'assainissement. En effet, ce système parvient à éliminer une grande partie de la pollution relative aux composées carbonées et azotées avec des taux d'abattement atteignent 98% pour la DCO, 99% pour la DBO5, 74 % pour les MES et 68 % pour l'azote total.

A leur sortie du système SBR, ces effluents sont conformes aux normes de rejet indirects préconisées par la législation marocaine (500 mg/l pour la DBO5 ,1000 mg/l pour la DCO, 600mg/l pour les MES) [31]. Toutefois, une amélioration plus marquée de la qualité de ces eaux épurées est souhaitable pour ce qui est de certaines matières oxydables non biodégradables (tanins d'origine végétale) qui persistent au niveau de l'eau épurée et lui confèrent une couleur jaunâtre. Une telle amélioration nécessiterait probablement un complément de traitement (membranaire ou autre traitement spécifique par charbon actif, etc…) qui permettrait la réutilisation des eaux épurées dans l'arrosage des espaces verts de l'entreprise ou encore leur recyclage interne comme une ressource alternative pour les eaux de refroidissement et de lavage ou nettoyage.

REMERCIEMENTS

Au terme de ce travail, nous tenons à remercier la direction et le personnel de la STEP Naturex Maroc pour leur soutien durant toute la période de l'étude ainsi que le professeur A .Belhouari pour son aide au traitement statistique de nos resultats.

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Etude statistique et physico-chimique des margines d'extraction d'huile d'olive de la ville Sidi Kacem

[Statistical and physic-chemical study of the wastewater olive mill of Sidi Kacem city]

Omar El Rhaouat[1], Mostafa Fareh[1], Bouchaib Sarhan[1-2], Samir Ait Benyouf[1], Hamid Chiguer[1], Meriem Rochdi[1], Cheikhna Ould Abdlkader[2], Khadija El Kharrim[1], and Driss Belghyti[1]

[1]Laboratoire d'Environnement et Energies Renouvelables, Faculté des Sciences, Université Ibn Tofail de Kenitra, Maroc

[2]Institut National d'Hygiène, Ministère de la santé, Maroc

[3]Ministère de l'environnement, Mauritanie

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ABSTRACT: The objective of this study is to evaluate the degree of pollution of oil extraction olive waste water discharged directly to the receiving environment (Wadi R'dom the Sidi Kacem city). And the problems posed qualifies them as liquid material polluting the environment the case of surface waters and low-flow land application, the results of some physic-chemical parameters in terms of conductivity, salinity, biological demand oxygen (BOD5), chemical oxygen demand (COD), the rate of sediment dissolved (TDS) and suspended solids (SS) are respectively significant mean values of the four study sites 22.61 ± 12.43 g / l, 12.63 ± 8.35 mg/l, 24.87±9.55 g/l, 103±16.21 g/l, 13.66±9.27 g/l and 9.37±7,62 g/l exceeding standards designed.

Measuring parameters pH, redox potential, conductivity, salinity, dissolved oxygen, and temperature of the water, was made by a multi-parameter analyzer Consort kind C535 and Hanna Instruments HI 98280. The chemical demand oxygen, total nitrogen, chloride and nitrate are recorded by a multiparameter photometer HANNA Type C 214 (HI 83214) and BOD5 BOD unit. Statistical analysis is accomplished by principal component analysis in XLSTATsoftware. Like these results, Wastewater olive mill pollute the environment effect of acidic pH and antibacterial polyphenols where ground application and direct discharge to the river at low flow, which requires proper treatment to save the ecosystem and water resources.

KEYWORDS: Wastewater olive mill, pollution, ACP, surface water, Sidi Kacem, Morocco.

RESUME: L'objectif de cette étude est d'évaluer le degré de pollution des margines d'extraction d'huile d'olive rejetées directement au milieu récepteur (Oued R'dom de la ville Sidi Kacem). Et la problématique posée qualifie les margines comme matière liquide polluant l'environnement le cas des eaux superficielles à faible débit et l'épandage au sol, les résultats obtenus de quelques paramètres physico-chimiques en termes de conductivité, la salinité, la demande biologique en oxygène (DBO_5), la demande chimique en oxygène (DCO), le taux des sédiments dissous (TDS) et la matière en suspension (MES) sont respectivement des valeurs moyennes significatives des quatre sites d'étude 22,61±12,43 g/l, 12,63±8,35 mg/l, 24,87±9,55 g/l, 103±16,21 g/l, 13,66±9,27 g/l et 9,37±7,62 g/l dépassant les normes conçues.

La mesure des paramètres pH, potentiel redox, conductivité électrique, salinité, l'oxygène dissous, et la température de l'eau, a été faite par un analyseur multi-paramètre de type Consort C535 et Hanna Instruments HI 98280. La demande chimique en oxygène, l'azote total, le chlorure et le nitrate sont enregistrés par un multiparamètre photomètre HANNA type C 214 (HI 83214) et la DBO_5 par DBOmétre. L'étude statistique est réalisée par analyse des composantes principales sous logiciel XLSTAT. A l'instar de ces résultats, les margines polluent l'environnement par effet de pH acide et des polyphénols

Corresponding Author: Driss Belghyti

antibactériens le cas d'épandage au sol et rejet direct à la rivière à faible débit, ce qui exige un traitement convenable pour sauvegarder l'écosystème et les ressources en eau.

MOTS-CLEFS: Margines, pollution, ACP, eaux superficielles, Sidi Kacem, Maroc.

1 INTRODUCTION

Au Maroc, le secteur de l'huile végétale génère environ 72 000 tonnes / an de déchets liquides [1], et la production de déchets solides, appelée grignon, est estimé à 30 000 tonnes / an. L'effluent liquide de moulins, appelés «eau olive", ne subit aucun traitement et est souvent versé dans la ville draine, stocké dans des bassins d'évaporation, ou transmis directement sur le terrain [2].

L'objectif de ce travail est d'étudier le degré de la pollution produite de ces rejets par quelques paramètres physico-chimiques au cours de l'année 2013. Ces problèmes environnementaux sont attribués à la richesse des effluents en matière organique [3] et en particulier en polyphénols qui sont responsables d'effets phytotoxiques et antimicrobiens [2] [4] [5].

En effet, les eaux superficielles et souterraines sont touchés en plein fouet par une pollution de plus en plus accrue, cette dernière est à l'origine de différentes maladies pouvant altérer gravement la santé humaine et l'équilibre des écosystèmes [6].

Alors, une fois rejetées sans avoir subi des traitements préalables, ces margines auront un impact négatif sur l'environnement, dû à leur pouvoir d'inhiber le développement des plantes et de certains microorganismes [7].

Cet état préoccupant exige une gestion de ces eaux usées d'extraction des huiles d'olive par traitement soit biologique soit chimique ou mixte.

2 MILIEU D'ÉTUDE

Les sites d'étude sont situés au bord de l'Oued R'dom de la ville Sidi Kacem et d'autres loin, là ou il est rejeté, notre étude a été menée sur le rejet direct des margines dans l'oued R'dom et épandage au sol. Cette rivière traverse une partie de la province de Sidi Kacem qui est son chef-lieu crée en 1981 [8]. Cette dernière se situe dans la région du Gharb Chrarda Béni Hssen, possédant une superficie de 4060 km², représentant 5,7 % de la superficie du territoire national, la population atteint 701.000 habitants dont 74.062 habitants de la ville de Sidi Kacem [9]**.**

Sur le plan hydrologique, Le bassin versant de l'Oued Beht a une superficie de 9000 km^2, reçoit l'oued R'dom avant de rejoindre le Sebou dans la plaine du Gharb. [10]. Le climat est de type méditerranéen semi-aride à hiver tempéré. La pluviométrie annuelle est de 445 mm .La période sèche est relativement longue et s'étale de Mai à Septembre avec une température moyenne variant de 11°C en Décembre à 29°C Aout [8].

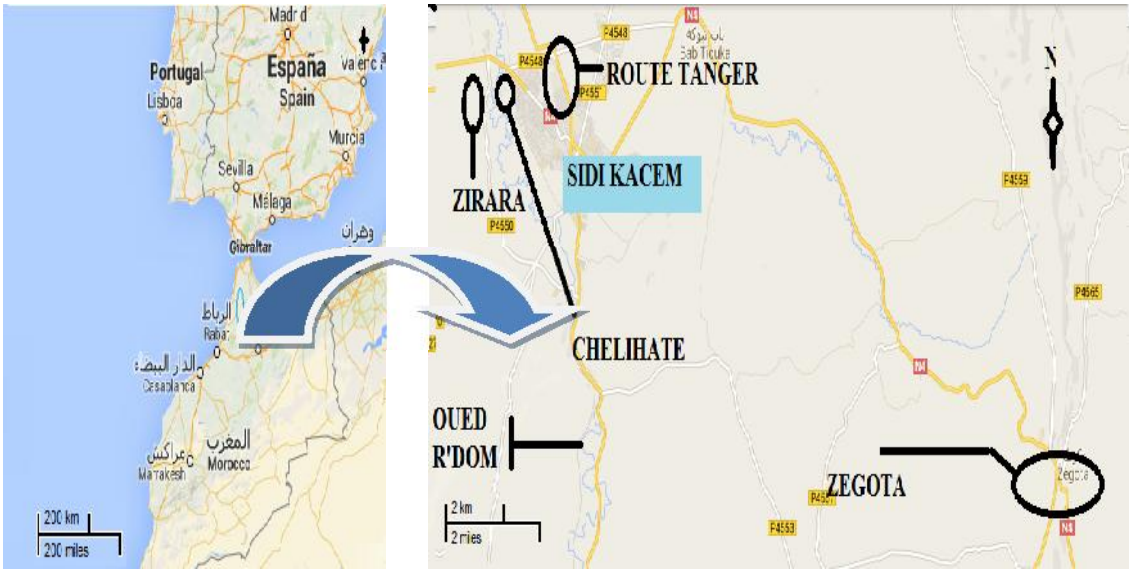


Figure1. Localisation des sites d'extraction d'huiles d'olive de Sidi Kacem, Maroc [11].

3 METHODES D'ETUDE

Les prélèvements d'échantillons ont été réalisés périodiquement l'an 2013. La plupart des analyses a été réalisée in situ et au laboratoire d'Environnement et Energies Renouvelables de la Faculté des Sciences, Université Ibn Tofail de Kenitra.

La turbidité est mesurée par un turbidimètre optique Hach 2100N. Les matières en suspension sont déterminées par filtration d'un volume d'eau usée sur un filtre cellulosique (de 0,45 µm) et pesé après passage à l'étuve à 105°C selon Rodier [12].

Ainsi la mesure du pH, du potentiel redox, de la conductivité électrique, de la salinité, de la concentration d'oxygène dissous, de la résistivité et de la température de l'eau a été faite par un analyseur multi-paramètre de type Consort C535 et Hanna Instruments HI 98280.

La demande biologique en oxygène pendant cinq jours (DBO_5), à température de 20°C, est mesurée par l'appareil OxiTop et la demande chimique en oxygène par un multiparamètre photomètre HANNA type C 214(HI 83214) ainsi que l'azote total, le chlorure et le nitrate.

La conservation des prélèvements des eaux usées a été faite selon le guide général pour la conservation et la manipulation des échantillons d'après [13].

4 RESULTATS

Les résultats physico-chimiques représentent les valeurs moyennes des quatre sites d'études de la province de Sidi Kacem, suivis d'une analyse statistique des composantes principales.

Tableau 1. Résultats physico-chimiques des margines à système à pression

	T	ppH	C.E mS/cm	P.A mbar	TDS g/l	MES g/l	S mg/l	Redox mV	O.D mg/l	DBO_5 g/l	DCO g/l	A.T g/l	Cl^- g/l	NO_{3^-} g/l
Site 1 Jerar	17,8	5,6	17,05	1012,4	8,54	6,3	10,11	28,97	0,41	18,6	106	0,94	0,28	3,13
Site 2 Zagouta	19,4	5,58	40,6	1013,9	26,39	20,76	25	79	0,4	37,8	124	1,14	0,35	4,44
Site 3 Chelihate	18,17	5,45	12,4	1013,2	5,34	5,76	6,86	28,2	0,35	26,3	86	1,03	0,24	4,34
Site 4 R.T	20,2	5,22	20,4	1013	14,4	4,68	8,56	27,01	0,33	16,8	96	0,88	0,38	2,78
Moyenne	18,89	5,46	22,61	1013,12	13,66	9,37	12,63	40,79	0,37	24,87	103	0,99	0,31	3,67
Ecart type ±	1,11	0,17	12,43	0,53	9,27	7,62	8,35	25,48	0,038	9,55	16,21	0,11	0,06	0,84

CE : conductivité, PA : pression atmosphérique, TDS : taux de sédiments dissous, DBO_5 : demande biologique en oxygène, DCO : demande chimique en oxygène, S : salinité, O.D : oxygène dissous, A.T : azote total. R.T : route Tanger R413 (quartier industriel).

Tableau 2. Résultats de Matière oxydable et Ratios de DCO, DBO_5, MES

	M.O g/l	DCO/DBO_5	DBO_5/DCO	MES/DBO_5
Site 1 Jerar	47,73	5,69	0,17	0,34
Site 2 Zagouta	66,53	3,28	0,30	0,55
Site 3 Chelihate	46,20	3,27	0,31	0,22
Site 4 R.T	43.20	5,71	0,17	0,29
Moyenne	50,91	4,48	0,24	0,35

M.O : matière oxydable

$$MO = \frac{2DBO_5 + DCO}{3}$$

ANALYSE EN COMPOSANTES PRINCIPALES :

Tableau3. Valeurs propres

	F1	F2	F3
Valeur propre	8,133	3,419	1,448
Variabilité (%)	62,564	26,301	11,136
% cumulé	62,564	88,864	100,000

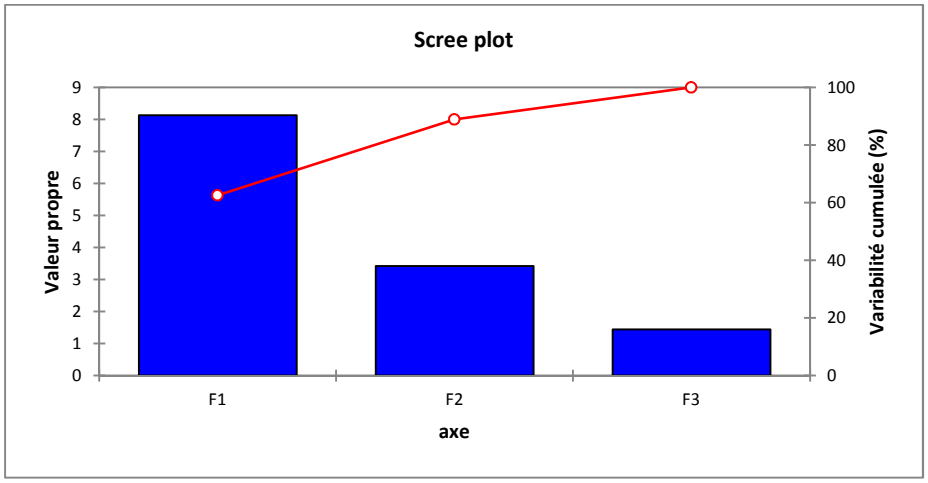


Figure2.Valeurs propres et variabilité cumulée (%)

Tableau.4 Corrélations entre les variables et les facteurs

	F1	F2	F3
T	0,189	**0,961**	-0,204
pH	0,561	**-0,750**	0,352
C.E	**0,944**	0,325	0,066
TDS	**0,875**	0,481	0,050
MES	**0,999**	0,024	-0,046
Sal	**0,990**	0,118	0,080
Redox	**0,995**	0,078	-0,066
O.D	0,584	-0,520	0,623
DBO5	**0,901**	-0,199	-0,386
DCO	**0,893**	0,120	0,433
Azo.T	**0,856**	-0,363	-0,369
Cl-	0,309	**0,934**	0,182
NO3 -	0,618	-0,499	-0,607

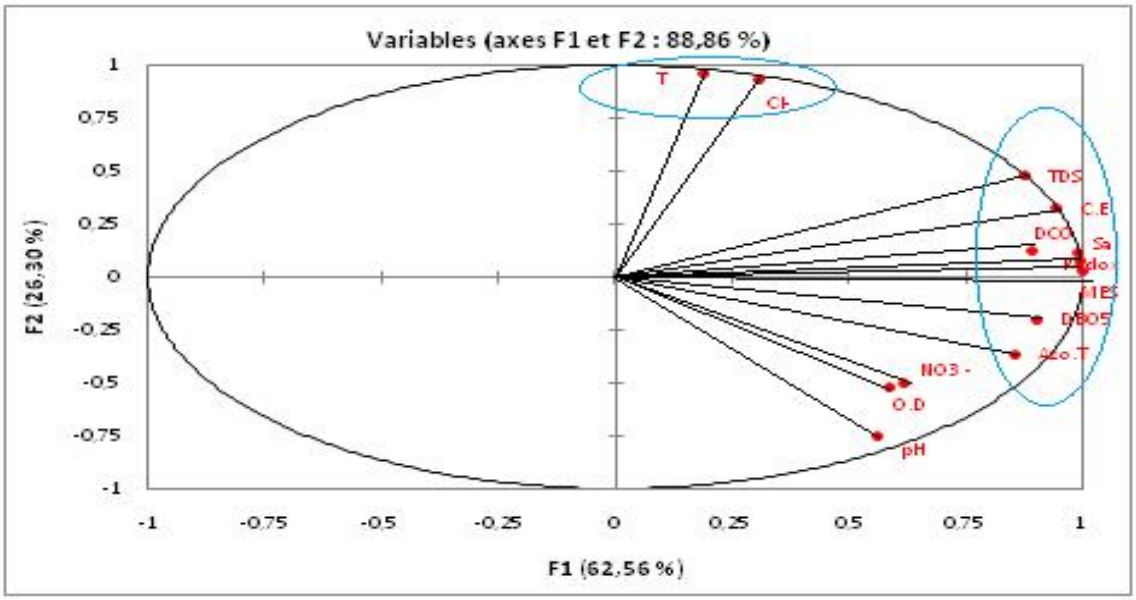


Figure.3 Projection des variables sur le plan factoriel (F1x F2 : 88,86 %)

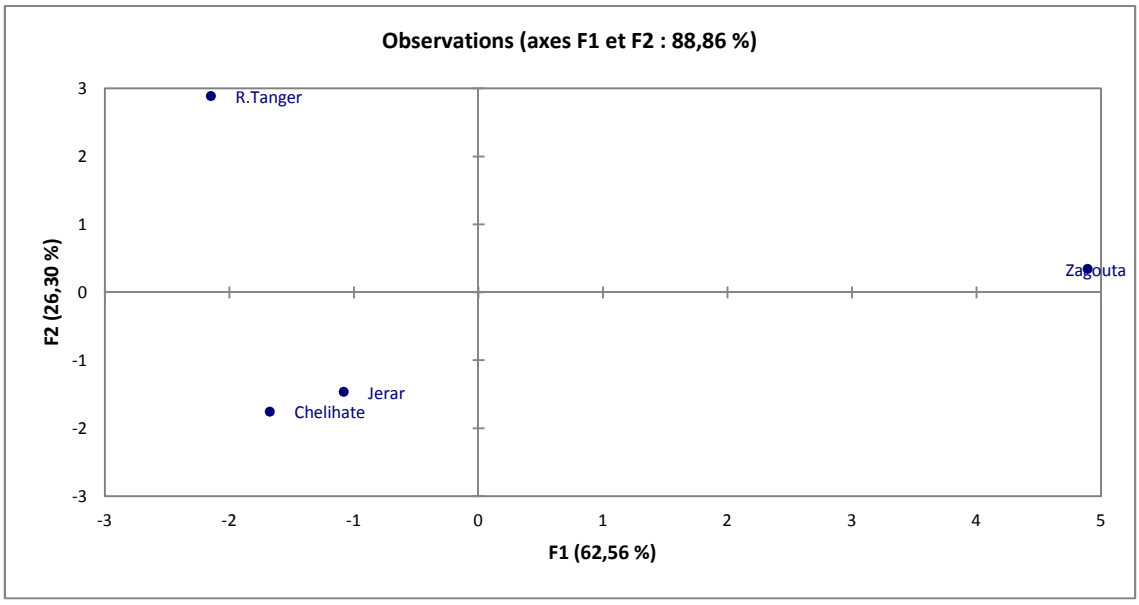


Figure.4 Projection des observations sur le plan factoriel (F1x F2 : 88,86 %)

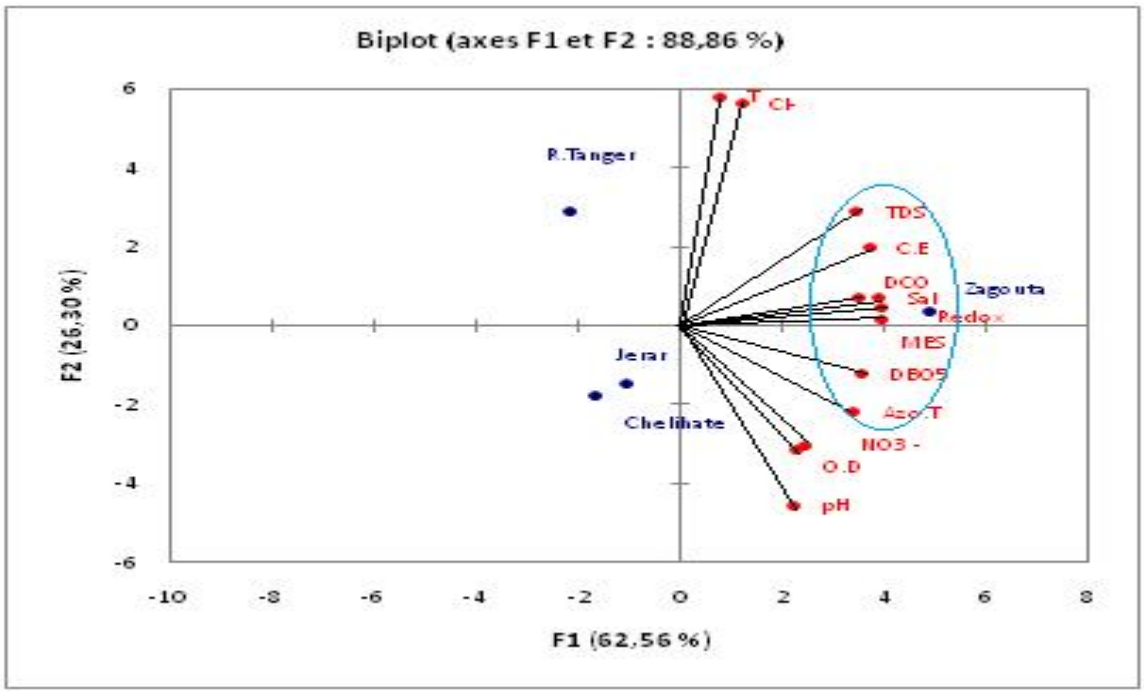


Figure.5 Projection des variables et observations sur le plan factoriel (F1x F2 : 88,86 %)

5 DISCUSSION

La température moyenne des quatre sites vaut 18,45± 0,83°C mais le pH est acide de l'ordre de 5,54± 0,08 marquant l'état du système d'extraction discontinu à pression des trois sites Jerar, Zagouta et Rmail de la ville de Sidi Kacem, la conductivité moyenne est de l'ordre de 23,35± 15,11g/l dépassant les normes nationales et internationales (valeurs limites 1500 µS/cm ; la conductivité ne doit pas toutefois dépasser 4000 µS/cm s'il y a eu augmentation) et inferieure aux résultats [14] malgré un système a trois phases (44,3 mS/cm), la salinité moyenne est de l'ordre de13,99 mg/l de même le Redox est de l'ordre de 45,39 ± 29,11mV et l'oxygène dissous moyen est inferieur au norme de 1 mg/l (0,38 ± 0,03 mg/l) similaire aux résultats[14].

On constate que la DBO5 est de l'ordre de l'ordre de 24,87± 9,55 g/l dépassant la norme conçue 8 g/l ainsi que la DCO de l'ordre de 103± 16,21g/l (25 g/l) qui sont des valeurs limites pour les eaux usées des industries d'extraction de l'huile d'olive.

En ce qui concerne la valeur moyenne de l'azote total, celle du chlorure et celle de nitrate sont respectivement de l'ordre de 0,99± 0,11 g/l, 0,31± 0,06 g/l et 3,67± 0,84 g/l, et celle du chlorure enregistrant 0,29 g/l est inferieure aux résultats[14] et supérieure aux travaux [15]; la valeur moyenne des quatre sites de nitrate NO_3^- dépasse la limite des eaux usées destinées à l'irrigation (50 mg/l).

La matière oxydable est de l'ordre de 53,48 mg/l et le ratio de DCO/DBO_5 est 4,08 dépassant 3 [16] ce qui indique que la matière organique est difficilement biodégradable en exigeant un traitement chimique, les résultats de ce rapport constituent une indication de l'importance des matières polluantes peu ou pas biodégradables [17]. De même le ratio DBO_5/DCO 0,24 est inferieure aux résultats enregistrés [6].

Cependant à des taux de DBO_5/DCO inférieurs à 0,30, les procédés de traitement physico-chimiques sont plus efficaces que ceux biologiques [18].

L'ACP permet spécialement la mise d'association entre variables, donc de réduire le dimensionnement de la table des données. Cela est accompli par la diagonalisation de la matrice de corrélation des données qui transforment un grand nombre de variables à un plus petit nombre de facteurs sous-jacents (principaux composants (PCs)) sans perdre beaucoup d'information [19][20][21].

Le cercle de corrélation formée par les axes F1 et F2 fournit 88,86 % de l'information totale. Sur l'axe F1 on a corrélation de quelques paramètres comme TDS et MES, ainsi que la matière organique en termes de DBO5 et DCO représente une corrélation positive indiquant une forte pollution au niveau du site de Zegota par rapport aux autres sites d'étude de même pour la matière azotée. Il y a aussi une très forte corrélation sur l'axe F1 entre la salinité et la conductivité positivement ce qui induit un impact environnemental négatif par épandage des margines au sol a l'inverse des autres sites d'étude rejetant leurs effluents directement à l'Oued R'dom de la ville de Sidi Kacem.

Par contre sur l'axe F2 la température est corrélée positivement avec le chlorure et négativement avec le pH et l'oxygène dissous induisant une pollution accrue, quand la température augmente l'oxygène dissous diminue

Pour ce faire, la moyenne du ratio DCO/DBO_5 des quatre sites étudiés impose un traitement chimique convenable et la mise d'une stratégie nationale et internationale pour la sauvegarde de l'écosystème et les ressources en eaux avec arrêt de l'acidification des sols et l'extermination des microorganismes présents dans les sols.

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Relationships between lightning and rainfall intensities during rainy events in Benin

A. Joseph Adechinan, B. Etienne Houngninou, and Hilaire Kougbeagbede

Département de Physique,
Faculté des Sciences et Techniques, Université d'Abomey-Calavi, Benin

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ABSTRACT: This study aims at examining the impact of spatial resolution and the time lag on the relationship between the rainfall intensities and the cloud-to-ground lightning rate during rainy events that occurred in North of Benin in 2006. The lightning data used of this experiment have been collected by LINET network and the rain data are provided by a network of 23 rain gauges. The results obtained show that the temporal scales between the beginning of the electrical activity and precipitations are optimal when these letters are synchronized. The average optimal radius is identified at 8 km around the rain gauges location. In most cases (59 %), the maximum of electrical activity precedes the maximum of precipitations. The heavy rainfalls to ground are offset in time with regard to a peak of electrical activity with an average of 5 minutes.

KEYWORDS: rain event, cloud-to-ground lightning, rainfall intensity, time lag, Benin.

1 INTRODUCTION

Several studies have been conducted in order to correlate the electrical activity and the precipitation parameters [1], [2], [3]. These experiments have shown that the rainy and electrical phenomena have a common origin. However, there exists a time lag of a few minutes between the beginning of the electrical activity and the precipitations [4] or between the maxima of electrical activity and the precipitations [5], [6], [7]. This shows clearly that the life phase (development, maturity and dispersion) of the rains cores and the electrical activity are shifted out of line in time and space [8].

In the related literature, different time lags have been fund. For instance, in the United States (USA), [9] has fund that the CG lightning maximum occurs from eight to ten minutes after the cloud has reached its maximal vertical growth. In Mexico, [10] has demonstrated that the maximum of precipitations appear five minutes after the maximum CG lightning. [7] have obtained in Florida, some temporal scales that could sometimes reach 20 minutes. This variability of the results shows that the time lag between the occurrence of heavy rains and the peak of electrical activity originates from the mechanism of stormy cells occurrence [11].

As per the temporal scales between the beginning of the electrical activity and precipitations, the results achieved through the different experiments vary. For instance, [12] have discovered that the optimal temporal scale between the beginnings of electrical activity and precipitations is 5 minutes. [13] have demonstrated in Island that the optimal time lag between the beginnings of electrical activity and precipitations are respectively 15 min and 25 min for the rainfall events associated with floods and not.

In fact, the correlation between two series of data, varying in time and space can be influenced by the time lag existing between them. Since the lightning and the precipitations are parameters characterized by a heavy spatio-temporal variability [14], the analysis of the relationship between these two phenomena can be dodged when these latter's are taken in a synchronized way. The time lag appears as an important factor while looking for the relationship rain-lightning since one of the phenomena can have a delayed answer on the other.

Beyond temporal considerations, current studies have shown that the relation between the lightning rate and the intensity of precipitations can not only be influenced by the time lag but also by the choice of the spatial resolution. Most of these experiments are based on individual storms (or specific rainfall events). For instance, [12] have studied the relationship between the CG lightning intensity and the one of precipitations over nineteen rainfall events in Cyprus. They've discovered that the correlations are really significant for an average spatial resolution of 10 km radius around the location of rain gauges.

Corresponding Author: A. Joseph Adechinan

To their mind, this value corresponds to the typical size (horizontal scale) of the stormy cells which grow in the studied area. [13] have undertaken a similar study over sixteen rainfall events in Island and discovered average optimal radius of 15 km.

This study stands in the same vain of these former experiments. It aims on the one hand, at estimating the time lag existing between the beginning (and the peak) of precipitations and the one of electrical activity and, on the other hand, evaluating the effect of spatial resolution on the relationship between the precipitations intensity and the lightning rate on the scale the rainfall event.

2 DATA AND METHODOLOGIE

2.1 DATA

This study is based on the Hydrometeorological Observatory of Ouémé Upper Valley (OHHVO). This study area situated on the East on the Greenwich Meridian in the center of Benin (fig 1), covers roughly a surface area of 15 000 km^2 [15]. The climate of this region Sudanese with an interannual rainfall average close to 1200 mm from 1954 to 2005 [16]. The relief of the OHHVO is less sharp with a slope of almost 200 m between Djougou region and Bétérou out let [17]. This area is essentially characterized by a dry season that goes from November to October with a maximum of rain in August [15]. The set of data used in the frame of this study is essentially constituted of precipitations and lightning data.

The lightning data used in this study are obtained from LINET network (Lightning Detection Network). This network was almost held on for five months (from half-June to half-November 2006) and has permitted to record certain lightning parameters such as: the geographical position (longitude and latitude), the date and hour of the lightning occurrence, the range of field discharge, the type of lightning (intra-cloud or cloud-to-ground lightning) and the height of intra-cloud. [18] informs again on the functioning of this network. In the frame of this study, only CG lightning data (without polarity distinction) have been analyzed.

The rainfall data derive from the base rain gauge network of the OHHVO. This network is composed of 55 rain gauges with tipping bucket in 2006. Proceeding from their irregular distribution over the whole study area and depending on the minimal inter-distance (110 m) between those rain gauges, we have identified a sub-network composed of 23 rain gauges (fig 1). The station for which the inter-distance is inferior to 15 km has not been taken into account. This choice is valid with regard to the constraint of the methodology adopted to analyze the rainfall event selected.

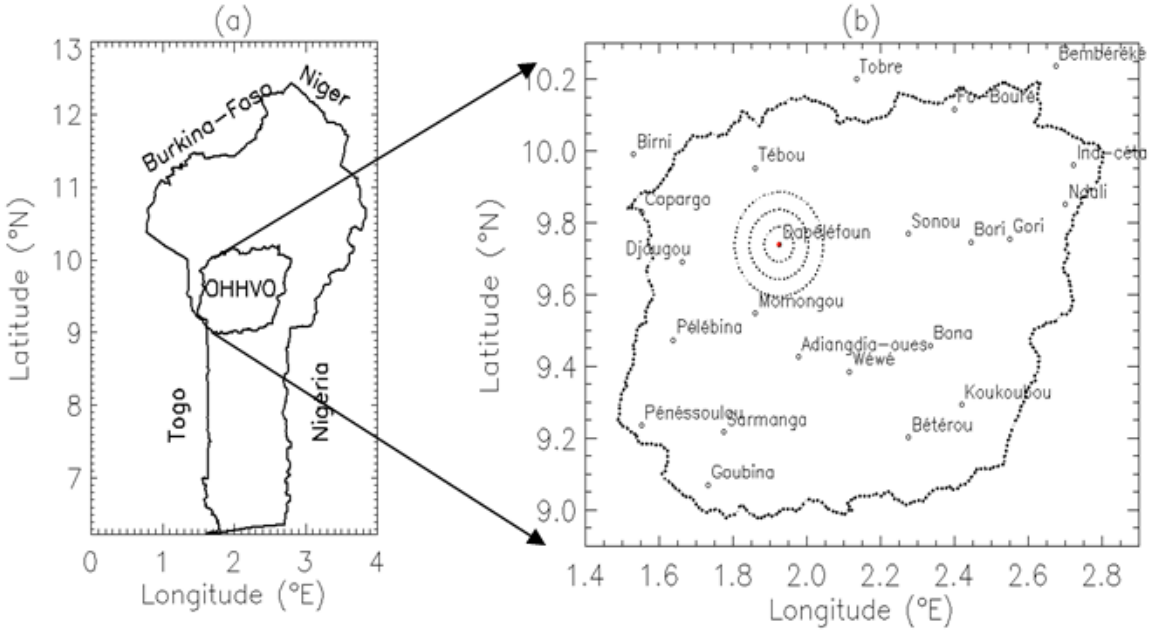


Fig. 1. (a) Geographical situation of Benin with the boundaries of the OHHVO, (b) sub-network composed of twenty three rain gauges used for the study.

The events studied in this paper have been defined on a hydrologic point of view and on three criteria [15]. They are as follows: i) a temporal criterion of no rain interruption on the whole network (rain mustn't stop for more than 30 min on the whole network); ii) a criterion of spatial continuity of the event which is a minimal proportion of the network reached (almost

30% of the rain gauges stations of the network record rain); iii) a quantitative criterion which is a minimal quantity of rain recorded at least on one station of the network (almost 1 mm of water recorded on almost one of the station reached).

Starting from this definition, ninety five rainfall events have crossed the study area in 2006. Among them, sixteen have been chosen in reference to the dates suggested by [19]. Those dates correspond to days of heavy electrical activity. Some characteristics of these events are summed up in table 1. The values written in that table are valid for the sub-network of twenty three rain gauges.

Since the storms are rarely stationary [7], an event can stop at a given station of the network while rain still pours down on other stations. So, we learn from this study that the beginning of any rainfall event on a specific rain gauge corresponds to the timing of the first knocking over of the bucket. In addition, the end of the event on the rain gauge will correspond to the timing of the last knocking over of the bucket, even though the precipitations have continued without causing an extra knocking over of the bucket on the rain gauge.

Table 1. Some characteristics of rainfall events used in the frame of this study.

n°	Start event	End event	Maximal Cumul (mm)	Rain gauge with maximal cumul	Maximal rain intensity (mm/5min)	Rain gauge with the maximal intensity
1	23/06/2006 01h :15min	23/06/2006 08h : 25min	34.58	Birni	6.70	Tobré
2	03/07/2006 13h : 55min	03/07/2006 18h : 40min	42.76	Birni	9.88	Birni
3	04/07/2006 16h : 15min	04/07/2006 20h : 45min	34.09	Koukoubou	8.36	Koukoubou
4	15/07/2006 01h : 15min	15/07/2006 10h : 25min	51.51	Pélébina	11.22	Bembéréké
5	19/07/2006 16h: 20min	20/07/2006 17h: 20min	109.08	Ndali	12.74	Ndali
6	28/07/2006 04h : 35min	28/07/2006 10h : 00min	17.39	Tébou	4.76	Tébou
7	30/07/2006 17h : 20min	31/07/2006 00h : 05min	104.13	Momongou	10.40	Pénéssoulou
8	10/08/2006 15h : 55min	10/08/2006 21h : 25min	83.22	Djougou	12.05	Djougou
9	22/08/2006 14h : 55min	22/08/2006 23h : 10min	77.97	Dapéréfoungou	14.49	Adiangdia-ouest
10	26/08/2006 12h : 30min	26/08/2006 18h : 55min	70.67	Pélébina	17.41	Ndali
11	30/08/2006 11h : 05min	30/08/2006 17h : 50min	210. 06	Ndali	41.80	Ndali
12	11/09/2006 22h : 25min	12/09/2006 12h : 00min	68.82	Gori-bouyerou	10.86	Tébou
13	19/09/2006 14h : 00min	20/09/2006 06h : 05min	44.49	Bembéréké	9.89	Momongou
14	22/09/2006 14h : 55min	23/09/2006 08h : 20min	93.70	Koukoubou	13.18	Tébou
15	18/10/2006 15h : 50min	18/10/2006 18h : 15min	20.73	Tébou	10.64	Ndali
16	23/10/2006 13h : 40min	23/10/2006 20h : 30min	22.42	Tébou	8.32	Ndali

To well receive these events on each rain gauge, some lightning parameters (maximal number of lightning in 5 min per event, total number of lightning per event) have been correlated with some precipitation parameters (maximal rain intensity in 5 min per event, total rain per event).

2.2 METHODOLOGIE

In the present study, the concept of the time scale will be tackled on two folds such as: i) the time lag between the beginning of electrical activity and precipitations; ii) the time lag between the maxima of electrical activity and precipitations.

2.2.1 TIME LAG BETWEEN THE BEGINNING OF ELECTRICAL ACTIVITY AND PRECIPITATIONS

The time lag between the beginning of electrical activity and precipitations during a given rainfall event is defined in this paper like the duration between the moment of the first CG lightning cutting out in circle of radius R focused on a specific rain gauge, and the moment of the first knocking over of the bucket of this rain gauge. The methodology used in this study to analyze the sixteen rainfall events held is based on the one used in the literature [12], [13]. However, some stages have been modified in this methodology due to the nature of the dataset and the duration of the events selected. As it was the case of other experiments [4], [13], the main hypothesis of this methodology is that the electrical activity precedes the evolution of precipitations. The fig 2 shows an illustration of that procedure. It is a diagrammatic representation applied to any event, for a fixed radius R and on a specific rain gauge station.

In fact, during any rainfall event i, we've got after resampling the gross data for each active rain gauge (any rain gauge of the network that has recorded almost 1 mm rain during the event i), the series of rain intensity (mm/5min) during the duration of the event. On this basis we determine in the same way the number of CG lightning corresponding to the inner inside of a circle with radius R centered on the position of the rain gauge used. On looking at the inter-distance between the rain gauges of the sub-network considered, the radius R of the circle demarcated around the position of the rain gauge has been limited on 15 km. We thus make this radius vary between 5 and 15 km on each 5 km (see the example illustrated in fig 1 at the meteorological station of Dapelefoun). As long as this radius increase, the couple of rains without lightning decreases at a regular timing of 5 min for each value radius R. The two series of data set are now gathered in a half hour consecutive time interval (fig 2).

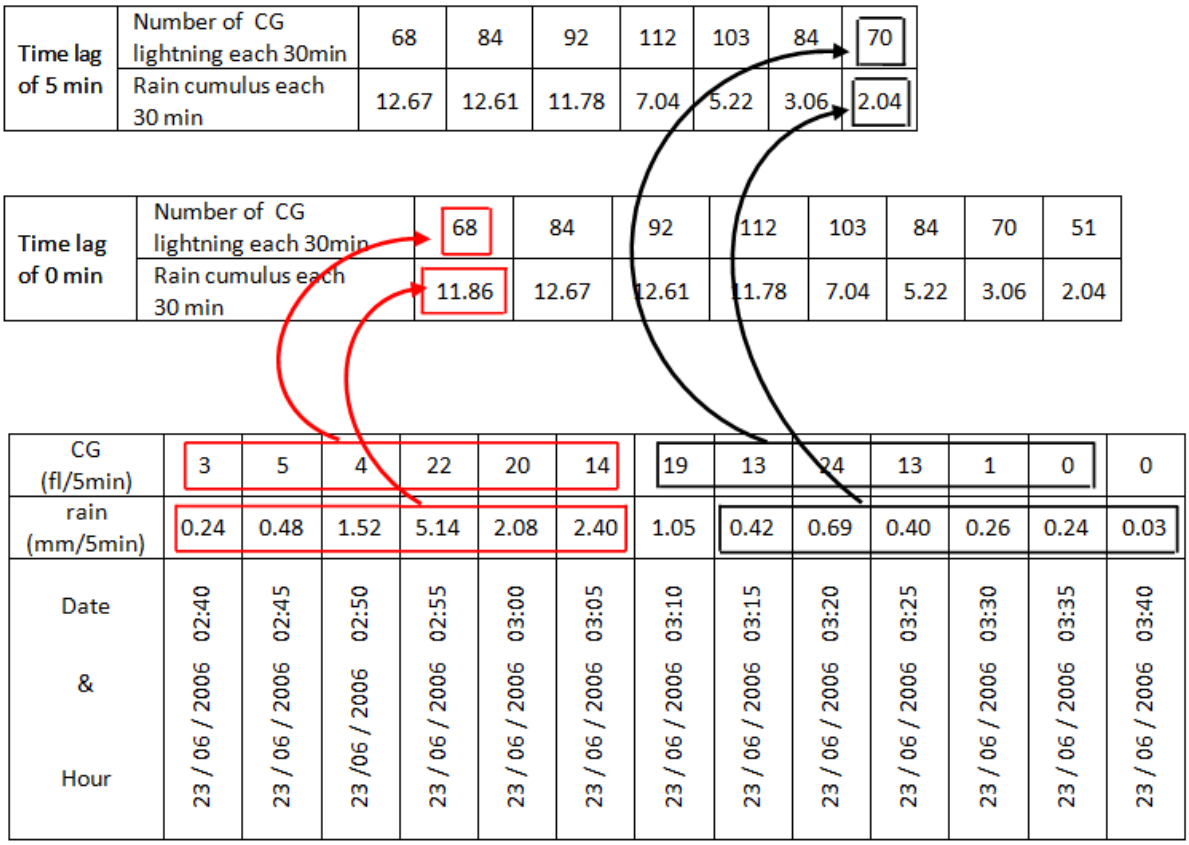


Fig. 2. Diagrammatic representation of the methodology applied to the event n°1 (table 1) for a fixed radius of 5 km around the rain gauge positioned at Bori.

The active rain gauges that have not recorded any CG lightning whatever be the value of the radius during the whole event have not been taken into account. In addition, because of the different time lags tested, the active rain gauges that have a rain accumulation time less than half an hour during the whole event have been cancelled.

Regarding the variability of the number of lightning detected and the volume of water collected during a rainfall event, [14] has mentioned that it is difficult and also impossible to establish a linear relationship between these two parameters. Therefore, [7] have shown that this relationship is possible since the report between the volume of precipitation and the number of CG lightning is globally constant for most of the storms they studied. Recently, [12] have evaluated the relationship rain-lightning with some simple linear regression on nineteen rainfall events in South Korea. [13] have also tackled the problem with the same approaches on sixteen rainfall events in Island and have found statistically significant coefficient. The unanimity on the use of a linear regression to quantify the link between the lightning parameters and the precipitations is far from being accepted. Despite those differences, the linear correlation coefficient from Pearson has been used in the present study to quantify the relation between the intensity of precipitations and the rate of CG lightning for all the events held in the frame of the present study. This coefficient allows measuring the intensity of the variation between two quantitative variables.

Some correlations have thus been calculated in synchronous and asynchronous way. This allows checking whether in shifting from 5 to 5 min the beginning of the series of precipitations of the electrical activity; one can discover a maximal variance between the precipitation and the electrical activity with a temporal scale situated between 0 and 15 min. This technique is advantageous in the sense that it identifies the time lags for which the evolution of precipitations and the electrical activity are similar. The correlation coefficients discovered are significant for a p-value inferior to 0.05 with a trust level of 95 %.

At the end of this procedure, the determination coefficient (r^2) attributable to the event i is the average value of the determination coefficient calculated for the whole active rain gauges during this event. This procedure has been applied to all the sixteen rainfall events and all the rain gauges held in the frame of this study. The table 2 sums up the different combinations of the time lag and the radius R obtained. For each of the combinations, a linear regression line has been adjusted to the lightning data and precipitations.

Table 2. Summary of the different combinations obtained when the procedure puts forth is applied to a specific rain gauge during a given event.

	Time lag			
Radius	0 min	5 min	10 min	15 min
5 km	5-R0	5-R5	5-R10	5-R15
10 km	10-R0	10-R5	10-R10	10-R15
15 km	15-R0	15-R5	15-R10	15-R15

2.2.2 TIME LAG BETWEEN ELECTRICAL ACTIVITY MAXIMA AND THE PRECIPITATIONS

Unlike the temporal scale formerly defined, the time lag between the electrical activity maxima and the precipitations during any rainfall event is written as followed:

$$\Delta t = t_{CG,max} - t_{p,max} \quad (1)$$

where $t_{p,max}$ and $t_{CG,max}$ respectively represent, the cutting out moment of the absolute maxima of precipitations and CG lightning during the event used in the frame of this study. If $\Delta t > 0$, it is supposed that the maximum of precipitation falls before the maximum of CG lightning; if $\Delta t < 0$, so the maximum of precipitation falls after the maximum of CG lightning and when $\Delta t = 0$, then the maximum of precipitations are reached at the same time.

Fig 3 gives an illustration of the time lag between the maximum CG lightning and precipitations observed at the meteorological station of Djougou during the event n°2 (table 1). The application of the relationship (1) to the set of rain intensity and the lightning rate recorded in a radius of 10 km around this station show the existence of positive time lag (Δt = 10 min).

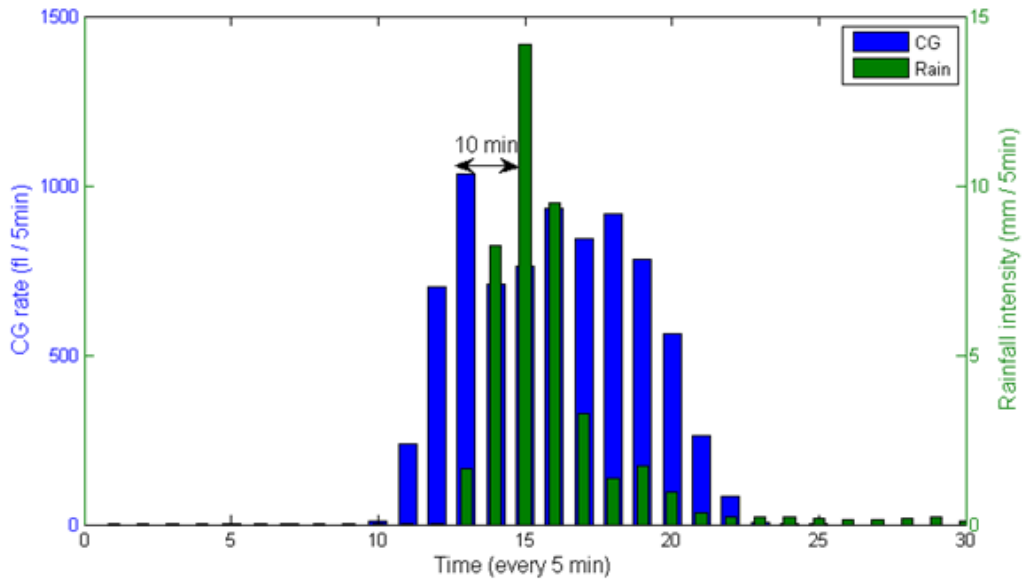


Fig. 3. Temporal evolution of lightning rates and rain intensity show time lag between the maximum CG lightning and precipitation observed at the meteorological station of Djougou during event n°2 (table 1).

The different time lags between the maximum of electrical activity and precipitations have been determined for all the rainfall events on each rain gauge. For these calculations, we have used the average optimal spatial scale and also the average optimal temporal scale reached at the end of the former procedure. Starting from the relationship (1), the active rain gauge during a specific event and for which no lightning has been detected in the field delimitated around them are automatically excluded. The situations in which the series of temporal evolution have been submitted to some irregularities (for example more than one maximum during a same event) have simply been cancelled. In fact, those series could be smoothed down by several methods (for instance the mobile averages method) so as to obtain a remarkable peak, but it would undoubtedly influence our results.

3 RESULTS AND DISCUSSIONS

3.1 CARACTERISTICS OF THE RAINFALL EVENTS USED IN THE FRAME OF THE STUDY

We have written in table 3 the different values of the determination coefficients found between cloud-to-ground lightning and precipitation parameters detected. The determination coefficients obtained are mostly weak but statistically significant (p-value < 0.05 with a trust level of 95 %). This shows that the different lightning parameters chosen have no explication through the precipitation parameters tested. Whatever be the radius, the heaviest values are found at the level of the couple (maximal rain, total CG lightning), whereas the couple (total rain, maximal CG lightning) yield the weakest values. One can also notice the weakening of determination coefficient as long as the radius R increases from 5 to 15 km on each 5 km.

However, we notice a strong linear correlation between the rain maximal intensity per event and the total quantity of water collected during the same rainfall event, no matter what radius R, considered (fig 4). It is the same thing between the maximal CG lightning (number of CG lightning in 5 min) during a rainfall event and the total number of CG lightning recorded during the same event (fig 4).

Table 3. Correlation between the lightning and precipitation parameters during selected events. The values between brackets stand for the p-value for a trust level of 95%.

	Radius		
r^2	5 km	10 km	15 km
(maximal rain intensity, maximal CG lightning)	0.09 (0.0039)	0.07 (0.0037)	0.04 (0.0194)
(maximal rain intensity, total CG lightning)	0.09 (0.0032)	0.08 (0.0022)	0.08 (0.0038)
(total rain, maximal CG lightning)	0.04 (0.0450)	0.04 (0.0385)	0.02 (0.0895)
(total rain, total CG lightning)	0.05 (0.0261)	0.05 (0.0189)	0.04 (0.0220)

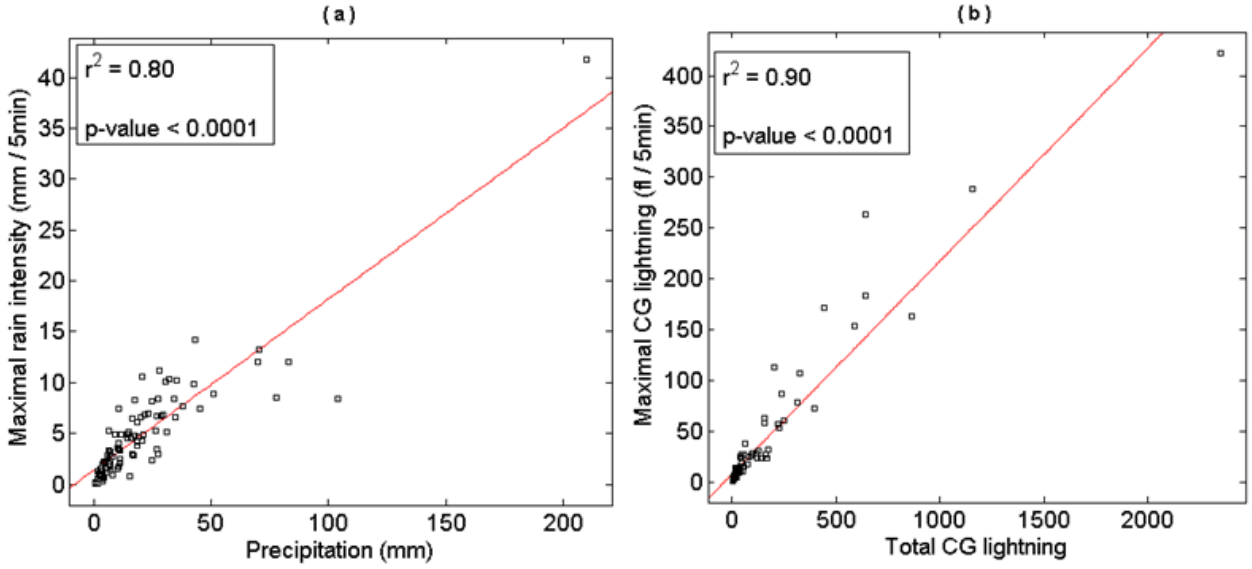


Fig. 4. (a) Correlation between the maximal rain intensity and the total cumulous per rainfall event for the whole selected events; (b) correlation between the maximal rate of CG lightning and the total CG lightning per rainfall event for a 5 km radius around the position of rain gauges.

3.2 IDENTIFICATION OF THE OPTIMAL TEMPORAL SCALE OF THE ELECTRICAL ACTIVITY AND PRECIPITATIONS

For all the rainfall events studied, precipitations have never stopped on a rain gauge before the stoppage of the electrical activity on this latter, no matter what value of the radius R considered. For all the radius tested and on all the rain gauge stations used in the frame of this study, the average determination coefficient vary between 0.19 and 0.58 with an average of 0.28. Whatever be the value of the radius R, the determination coefficients obtained with a temporal scale superior to 10 min are the weakest. Then, as long as the temporal scale between the beginning of electrical activity and precipitation increases, the probability to have a statistically significant correlation between the precipitation intensity and the CG lightning rate decreases.

We've shown on fig 5 the temporal scale corresponding to the maximal determination coefficient obtained on each rain gauge. It is noticeable that this temporal scale varies from a station to another. The number of stations that have had time lags of 0 min, 5 min and 10 min respectively correspond to 74 %, 9 % and 17 % of all the stations used in the frame of this research. On no stations and for all the time lags tested, is the temporal scale corresponding to the maximal determination coefficient superior to 10 min. The longest temporal scales are observed in the South-West of OHHVO whereas the majority of the stations located in the North-East of OHHVO have a relatively short temporal scale.

This variability of temporal scale between the beginning of electrical activity and precipitations is observed on the spatial scale that allows to obtain the maximal determination coefficient between the precipitation intensity and CG lightning rate. In fact, the radius for which the correlation is maximal varies from a situation to another, between 5 and 15 km with an average of 8 km around the location of the rain gauges. This value is not far from the one found in the literature, precisely by [12].

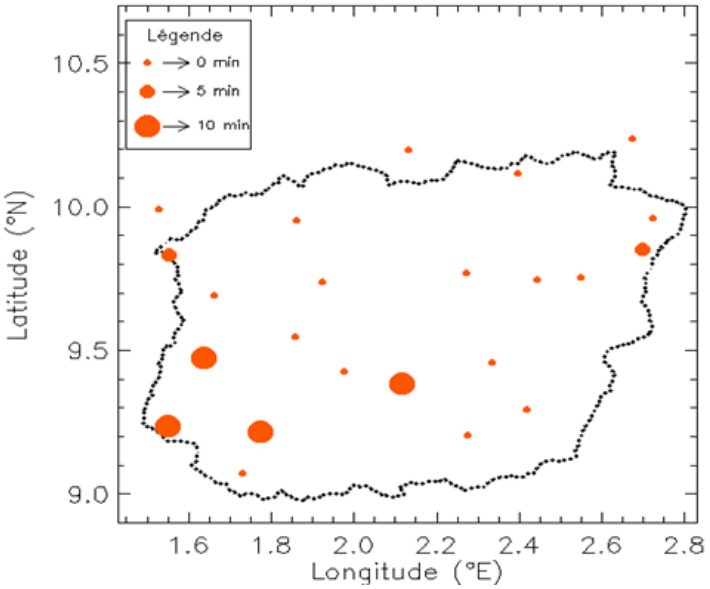


Fig. 5. Time lag between the beginning of electrical activity and precipitation corresponding to the maximal determination coefficient obtained on each rain gauge of the network.

For 52 % of the rain gauges used in the frame of this study, the radius corresponding to the maximal determination coefficient is 5 km. This percentage progressively decreases as long as the radius increases. It is 39% for an optimal radius of 10 km and 9 % for the one of 15 km. This variability of the optimal radius to which weak determination coefficients are added might be explained by the fact of not using threshold value of rain intensity to select the active rain gauges during the events studied. For example on Saturday 26th, August 2006, between 12h:30 and 19 h (UTC), the event n°2 that has yielded important rain cumulous and a particularly intense electrical activity has occurred on OHHVO. During that storm, nine gauges out of the twenty three of our sub-network have recorded heavy rain intensities with cumulous superior to the average cumulous (21.84 mm) of the event. As we can observed on the CG lightning density map (fig 6), the electrical activity has really been intense (96 fl/km^2) in the Western part of the study field. This strong occurrence of CG lightning is obtained at almost four km of the rain gauge that has recorded the maximal rain cumulous during the event whereas the rain gauge station that has recorded the maximal rain intensity stands at ten kilometers.

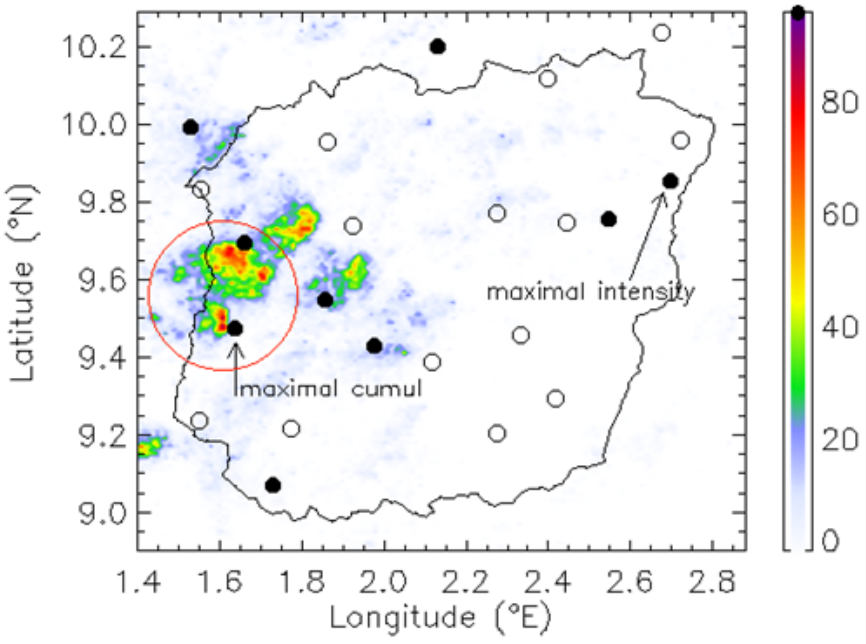


Fig. 6. Cloud-to-ground lightning density map corresponding to event n°2. The close circles indicate rain gauges that have had a rain cumulous superior to the average cumulous of the event and the red circle indicates the area that could be considered as stormy area on looking at it lightning density.

It thus appears that the areas that have had a strong electrical activity are mostly associated with a heavy water volume but the inverse isn't usually verified. This observation matches with the results obtained by [14] at the center and East of Mediterranean. Some active rain gauges during that event and located far from the area of strong lightning occurrence have obtained strong rain intensities associated with very weak CG lightning rates. The correlations obtained on these rain gauges are really weak. This means that the relationship between the rain intensity and the lightning rate is dependent on the position of the rain gauge with regard to the storm but also the storm life span. Thus, it is necessary to establish a lightning density map that will serve as indicator for selecting active rain gauges during the events studied.

The fig 7 shows the evolution of average determination coefficient of each rainfall event for different radius R values when the beginning of electrical activity and precipitations are synchronized. The determination coefficients vary between 0.16 and 0.86 with an average of 0.43. As long as the radius R increases from 5 to 15 km on each 5 km, the average determination coefficient of eight rainfall events decreases, the one of two rainfall events increases and for the remain events, no clear inclination is observed but the correlation is still maximal for a radius of 10 km. The number of rainfall events having statistically significant coefficients is thus increase for a radius inferior or equal to 10 km. These observations are to complete the analysis done on each rain gauge.

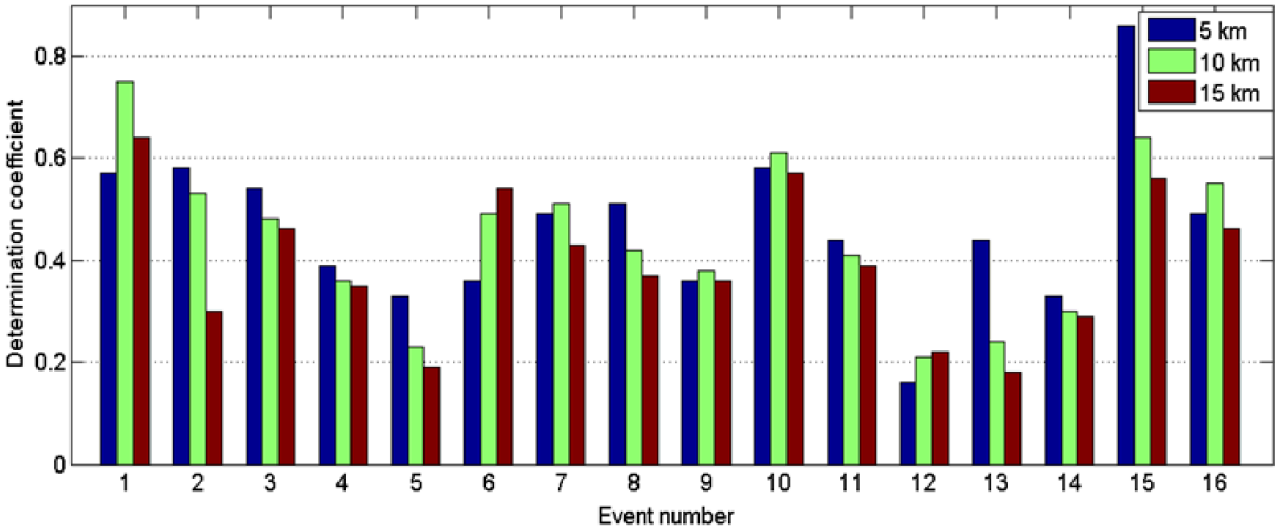


Fig. 7. Average determination coefficients per rainfall event for different values of R when the beginning of electrical activity and precipitations are synchronized.

On looking at the statistics obtained, the analysis of the relation between the precipitation intensity and CG lightning rate on the scale of the rainfall event seems better on the one hand, when the beginning of electrical activity and precipitations are synchronized on other hand, for an average radius of 8 km around the rain gauges.

3.3 TEMPORAL SCALE BETWEEN ELECTRICAL ACTIVITY MAXIMA AND PRECIPITATIONS

Fig 8 shows the frequential distribution of different temporal scales obtained when the relationship (1) is applied to the sixteen rainfall events used in frame of this study and on all the rain gauges of the sub-network. Those time lags between the maximum electrical activity and precipitations on a radius of 8 km around the position of rain gauges. Globally speaking, we notice on this figure that the time lag between the peak of electrical activity and precipitation is negative ($\Delta t < 0$), positive ($\Delta t > 0$) and nul ($\Delta t = 0$), respectively in the proportions of 59 %, 26 % and 15 %. These percentages indicate that for most (59 %) of the events studied, the maximum of electrical activity precedes the one of precipitations in time. This result which is the confirmation of the starting hypothesis matches with the conclusions derived from [7] experiments. These authors have also discovered that on 75 % of the events studied, the maximum lightning usually precedes the maximum of precipitations.

On the OHHVO, the CG lightning peak frequently (17 %) precedes the precipitation peak in time for 5 min. This observation is comparable to the one made in Mexico by [10]. The time lag superior to 20 min are less frequent. However, we record in some situations (4 %), time lags exceeding 1 hour. These time lags are relatively long and can be the result of the life span of certain cloudy systems that are growing in the area. In fact, even after crossing over a rain gauge located on the active part of the cloud, the renewal of new cells due to a heavy located convection can generate in some situations, an increase of the CG lightning rate since the origin of those discharges is associated with ebbing tides [20].

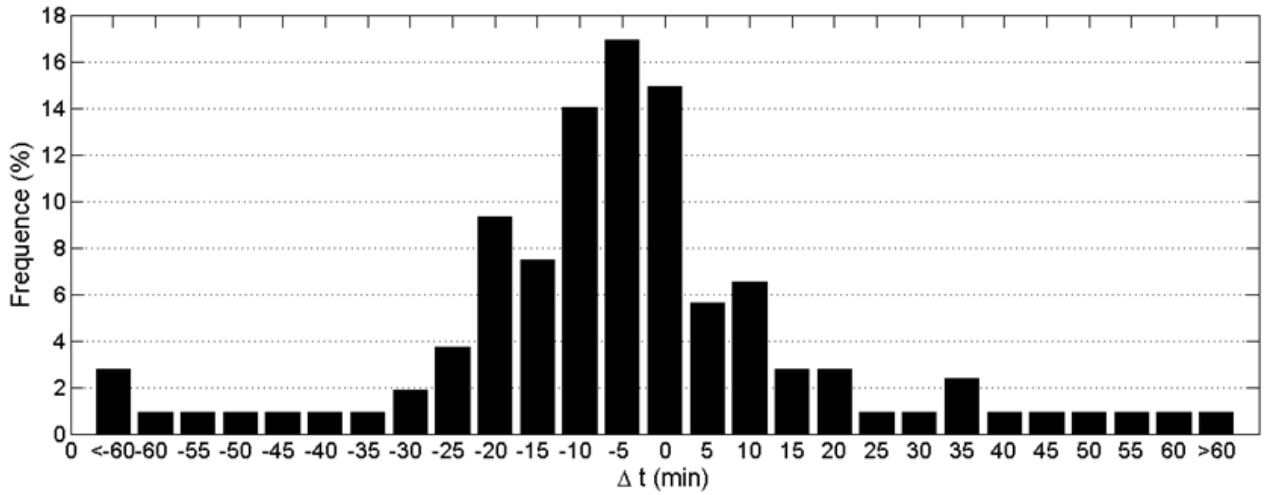


Fig. 8. Frequential spreading of temporal scales between the electrical activity maxima and precipitations for a fixed radius of 5 km around the location of the rain gauges for the overall rainfall events studied.

Table 4 presents the summary of the total of events per station, number of statistically significant events, optimal temporal scale the determination coefficient and the p-value corresponding to each of the rain gauges used in the frame of this work as well. It is clear from the analysis of this table that the optimal determination coefficient obtained at the level of those rain gauges vary from 0.11 to 0.93 with an average of 0.58. The rain gauges (seven in total) for which the optimal temporal scale is negative represented 30 % and have almost relatively weak significant coefficients. The average optimal temporal scale between the electrical activity maxima and precipitations is also 5 min.

Table 4. Number of events occurring on each meteorological station, optimal determination coefficient, temporal scale corresponding to maximal r^2 with p-value corresponding to each rain gauge.

Name of the rain gauge station	Altitude (m)	Number of event per station	Number of Significant event	Optimal Δt (min)	r^2	p-value
Adiangdia-ouest	456	15	14	0	0.93	$1.26\ 10^{-26}$
Bembéréké	420	11	9	0	0.67	$2.13\ 10^{-13}$
Bétérou	287	10	8	15	0.20	$5.55\ 10^{-04}$
Birni	459	13	13	-5	0.84	$3.70\ 10^{-11}$
Bonazuro	386	10	9	5	0.32	$1.13\ 10^{-02}$
Bori	353	14	10	0	0.85	$1.15\ 10^{-07}$
Copargo	532	13	10	5	0.78	$1.22\ 10^{-26}$
Dapéréfoungou	366	13	11	5	0.68	$8.19\ 10^{-05}$
Djougou	454	15	13	5	0.61	$1.35\ 10^{-07}$
Fo-Bouré	425	13	12	-5	0.11	$6.25\ 10^{-02}$
Gori-bouyerou	353	12	10	0	0.84	$8.54\ 10^{-16}$
Goubono	637	15	10	-10	0.36	$2.95\ 10^{-03}$
Ina-Ceta	404	10	5	0	0.82	$6.71\ 10^{-07}$
Koukoubou	321	8	6	5	0.79	$8.23\ 10^{-06}$
Momongou	406	15	12	0	0.25	$2.32\ 10^{-02}$
Ndali	393	8	6	5	0.86	$2.18\ 10^{-02}$
Pélébina	463	10	8	-5	0.36	$1.44\ 10^{-02}$
Pénéssoulou	419	14	11	-5	0.23	$3.74\ 10^{-03}$
Sarmanga	410	13	10	0	0.35	$1.43\ 10^{-11}$
Sonoumou	406	13	10	-5	0.42	$3.76\ 10^{-06}$
Tébou	383	13	12	0	0.80	$1.99\ 10^{-03}$
Tobré	371	12	10	5	0.60	$6.87\ 10^{-12}$
Wéwé	318	10	8	-5	0.78	$1.01\ 10^{-32}$

4 CONCLUSION

We have examined in this study the impact of choice of spatial resolution and time lag on the relationship lightning-rain and the identification of time lag existing between the peak of electrical activity and precipitation during sixteen rainfall events that occurred during the rainy season of 2006 on OHHVO in Benin as well. The lightning data and precipitations used to reach this goal have been collected during the AMMA campaign (Multidisciplinary Analysis of the African Monsoon) respectively through lightning measuring network (LINET) and twenty three meteorological stations. In total, sixteen rainfall events have been selected and analyzed through a statistic method consisting in shedding a global light on to the temporal evolution of the CG lightning rate and precipitation intensity in concentric circles centered on the position of meteorological stations.

On looking at the results achieved, it appears that the relationship between the CG lightning rates and precipitations intensity, not only depends on the position of the rain gauge with regard to the storm, but also on the life span of the storm. The strong values of the statistically significant determination coefficients are recorded when the beginning of the electrical activity and precipitations are synchronized. For most rain gauges used (57 %), the determination coefficient is maximal for a 5 km radius around their locations. This percentage decreases as soon as the radius R of the circle defined around the rain gauges increases. The average optimal radius for the overall events and all the rain gauges is 8 km. As per the temporal scale between the electrical activity maxima and precipitations, we notice that the heavy rain quantities on the ground are shifted in the course of time with regard to the peak of electrical activity with an average of 5 min. In most cases (59 %), the precipitations maximum is preceded by the CG lightning maximum.

These results lead to an important investigation field on the technique that is to be put forth to anticipate on heavy rain by the electrical activity. With regard to the variability of the temporal scales and radius obtained on each rain gauge, we think that the use of a CG lightning density map for the selection of the active rain gauges during a given rainfall event, and by taking into account certain dynamic and thermodynamic parameters (such as temperature, speed and wind direction) will help to better significantly the correlation between precipitation intensity and the CG lightning rate.

ACKNOWLEDGMENT

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Isolement, identification et détermination du profil phénotypique des bactéries *bacilles gram négatifs*, isolées à partir des eaux collectées de bains maures « Hammam »

[Isolation, identification and determination of antibiotic susceptibility profile of bacteria Gram-Negative bacilli isolated from Moorish baths water "Hammam"]

A. Esmail[1-2], N. Chahboun[1], H. Abed[1], Z. Mennane[1], Rachid Ijoub[1], A. Khadmaoui[4], H. Elhartiti[1], M. Ouhssine[1], and E. H. Berny[1]

[1]Laboratoire de Biotechnologie, Environnement et Qualité (LABEQ), Département de Biologie, Faculté des Sciences, Université Ibn Tofaïl, BP 133, 14000 Kénitra, Maroc

[2]Department of medical microbiology, Faculty of Science, Ibb University, 1120 Ibb, Yemen

[3]Département de bactériologie, Institut national d'hygiène, avenue Ibn Batouta, B.P. 769, Agdal, Rabat, 11000, Maroc

[4]Laboratory of Genetics and Biometrics, Faculty of Sciences, University Ibn Tofaïl, Kenitra, Morocco

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ABSTRACT: The Moorish baths "Hammam" are highly visited by Moroccan consumers. The aim of this study is to establish the phenotypic profile of gram negative bacteria isolated from water collected from Moorish baths and test their power of resistance and antibiotic susceptibility. Using the gallery (API bioMérieux ®), we isolated 25 bacterial strains included 10 different genres. The *Escherichia* species are listed 20%, 16% Enterobacter, Klebsiella 16%, 8% Pseudomonas, and other species. The study of the profile of antibiotic susceptibility revealed that all species Enterobacteriaceae showed complete susceptibility to Imipenem (IPM) and Gentamicin (GEN), and resistance from the weak to the strong degree to other antibiotics. While the group of non-Enterobacteriaceae showed complete resistance to Ticarcillin (TIC), Piperacillin + Tazobactam (TZP), Amoxicillin + Clavulanic Ac (AMC), Ceftazidime (CAZ), Ticarcillin + Clavulanic Ac (TIM) and Trimethoprim (W).

KEYWORDS: identification, Gram-negative bacilli, Moorish baths, antibiotics.

RESUME: Les bains maures « hammam » sont hautement visités par les consommateurs marocains. Le but de ce travail est d'établir le profil phénotypique des espèces microbiennes isolées à partir des échantillons d'eau des bains maures et tester leur pouvoir de résistance et sensibilité aux antibiotiques. Par l'Utilisation de la galerie (API ® BioMérieux), nous avons isolé 25 souches bactériennes inclus 10 genres différents. Les espèces répertoriées sont les *Escherichia* 20%, *Enterobacter* 16%, *Klebsiella* 16%, Pseudomonas 8%, ainsi que d'autres espèces. L'étude du profil de la sensibilité aux antibiotiques, révèle que toutes les espèces *enterobacteriaceae* ont montré une sensibilité totale aux *imipénème* et *gentamicine*, et une résistance allant du faible au fort degré aux autres antibiotiques. Alors que le groupe des *non-enterobacteriaceae* a montré une résistance totale aux *Ticarcilline(TIC), Piperacillin + tazobactam (TZP), Amoxicilline + Ac clavulanique (AMC), Céftazidime(CAZ), Ticarcilline + Ac clavulanique(TIM), et Trimethoprim(W).*

MOTS-CLEFS: identification, bacilles gram négatifs, bains maures, l'antibiotique.

Corresponding Author: H. Abed

1 INTRODUCTION

Les bains maures sont fréquemment visités par les marocains. Ce sont des lieux de purification, de relaxation et aussi de contraction de dermatoses. Cela pourrait être un facteur de risque majeur pour la santé des consommateurs. Toutefois, les puits alimentant les bains en eau sont individuels, souvent mal protégés, surtout mal traités et ne font pas l'objet d'une surveillance systématique comme celle des réseaux d'adduction. Par ailleurs, les travaux de recherches menés par Benouis (2008) ont montré que l'eau extraite des puits alimentant ces bains contient des contaminants fécaux qui rendent l'eau impropre. L'analyse des eaux froides et chaudes, émanant directement des puits et alimentant des bains maures de la ville de Marrakech, a révélé l'absence totale de chlore résiduel et la présence de contamination bactérienne d'origine fécale **(Laraqui CE. Et al, 2000).**

Dans ce travail, nous nous sommes proposés d'étudier le profil systématique et phénotypique de certains isolats extraits des eaux des bains maures et tester leur sensibilité aux antibiotiques.

2 MATERIEL ET METHODES

2.1 ISOLEMENT ET IDENTIFICATION

L'identification a été faite selon le type de germes, à partir du milieu de (EMB). Des colonies rose ou vert ont été isolées et purifiés trois fois sur un milieu de gélose nutritif ; suivi d'une coloration de gram et des tests de catalase, oxydase, mobilité et réduction de nitrate. Des colonies de pigmentations vert ou jaune correspondantes aux Pseudomonas ont été isolées, purifiés et identifiés de la même manière comme décrite ci-dessus.

2.2 SENSIBILITE AUX ANTIBIOTIQUES ET DETECTION DES PHENOMENES DE RESISTANCE

La sensibilité des isolats aux antibiotiques est testée sur milieu gélose de Muller-Hinton. Selon la recommandation du CLSI (2008) La méthode utilisée est celle de diffusion à partir d'une culture de 18-24 h sur milieu gélose de Muller-Hinton. Une suspension en solution saline (0,9%NaCl) a été préparée équivalente au standard McFarland 0,5 ($\approx 10^8$UFC/ml). Le tableau (1) représente la liste des antibiotiques à tester.

Tableau1 : Liste standard des antibiotiques à tester.

	Ciprofloxacine	**CIP**
Liste standard des antibiotiques à tester pour *P. aeroginosae* et les autres espèces non-entérobactéries	*Imipenème*	IPM
	Piperacillin 75	PRL
	Tobramycine	TOB
	Netilmicin 30	NET
	Sulphamethoxazole /trimethoprim	SXT
	Gentamicine	GEN
	Piperacillin/tazobactam 85	TZP
	Amoxicilline + Ac clavulanique	AMC
	Céftazidime	CAZ
	Ticarcilline/ Ac clavulanique85	TIM
	Trimethoprim 5	W
	Ticarcilline 75	TIC
Liste des antibiotiques à tester pour Les entérobactéries	*Gentamicine*	GEN 500
	Sulphamethoxazole /trimethoprim	SXT 25
	Tobramycine	TOB10
	Céfotaxine	CTX 30
	Amikacine	AK 30
	Amoxicilline + Ac clavulanique	AMC 30
	Céftazidime	CAZ 30
	Céfalothine	KF 30
	Amoxicilline	AML 25
	Nitrofuranes	F 50
	Ceftriaxone	CRO 30
	Acide Nalidixique	NA 30
	Ciprofloxacine	CIP 5
	Imipenème	IPM 10

2.3 LECTURE ET INTERPRÉTATION

La lecture consiste à mesurer le diamètre des halots entourant les disques d'antibiotique et qui correspondent aux zones d'inhibition de la croissance et les comparer aux limites critiques conseillées par le Comité de l'Antibiogramme de l'Association Française de Microbiologie.

3 RESULTATS ET DISCUSSION

3.1 L'IDENTIFICATION

24 souches ont été isolées à partir des eaux usées de bains maures. L'identification de ces isolats a mis en évidence la présence de 10 genres. La prédominance d'*Escherichia*, était remarquable avec une fréquence de 20% contre 16% pour *Enterobacter* et *Klebsiella, 12% Serratia et Pseudomonas*, 8% pour *Vibrio*, 4% pour *Alcaligenes* et *Ochrobactrum Burkholderia*, et pour *Proteus.*

3.1.1 IDENTIFICATION DES BACTERIES GRAM NEGATIF BACILLES ENTEROBACTERIACEAE

71% des souches isolées appartiennent au groupe des *enterobacteriaceae***.** 5 genres ont été donc identifiés : *Escherichia*, *Klebsiella*, *Enterobacter, Serratia* et *Proteus.,* figure 1.

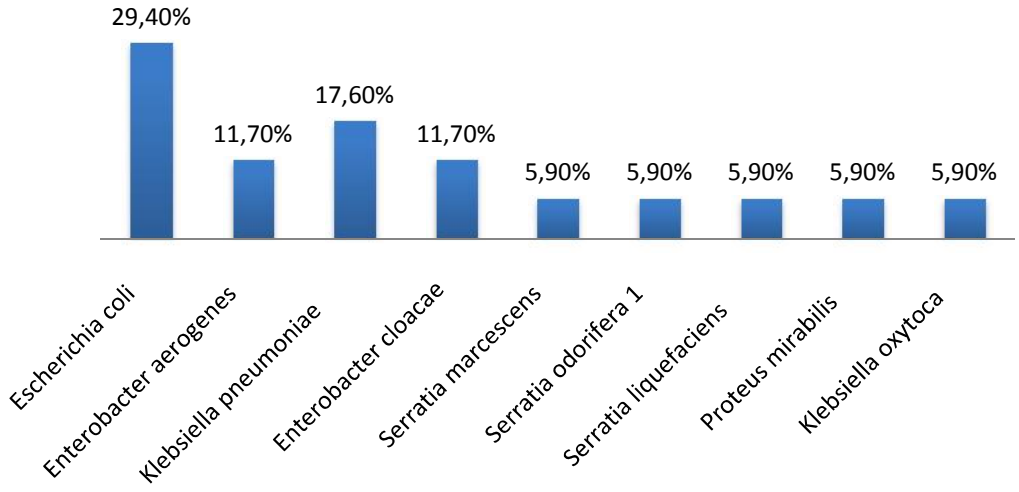


Fig. 1 : répartition des isolats d'entérobactéries

29% de ces genres isolés de la famille des *Enterobacteriaceae sont des Escherichia*, représentée essentiellement par une seule espèce : *Escherichia coli.* Cette bactérie est considérée comme un bon indicateur de la qualité des eaux. Leurs présences reflètent donc la présence possible de microorganismes pathogènes d'origine entérique. Les travaux de recherches menés par *Makoutode et al (1999) et (Cyriaque Degbey et al (2011) ont confirmés la présence* la contamination de l'eau de puits par les bactéries de l'espèce *E. coli*.

23% des *Enterobacteriaceae* isolées appartiennent au genre *Klebsiella*, dont 17% sont des *Klebsiella pneumoniae* et 6% des *Klebsiella oxytoca* . La présence de *Klebsiella* dans les eaux est connue comme un bon indicateur de contamination fécale. D'autres espèces du genre *Enterobacter* ont été isolées et identifiées dans les eaux collectées des bains maures, telles que *Enterobacter aerogenes* et Enterobacter cloacae, 18% des espèces du genre *serratia* telles que *Serratia marcescens, Serratia odorifera* et *Serratia liquefaciens et 6% des espèces du genre proteus à savoir Proteus mirabilis*.

Il reste à noter que sans traitement préalable, La présence de ces bactéries dans les eaux de puits destinées à l'approvisionnement des bains maures représente un danger probable à la santé du consommateur. En quantité importante ces bactéries peuvent causer des dégâts considérables au profit de la vie de l'homme

3.1.2 IDENTIFICATION DES BACTERIES GRAM NEGATIF BACILLES NON-ENTEROBACTERIACEAE

L'analyse des eaux collectées a permis d'identifier 8 souches gram négatifs (gram-) *baccillus non enterobacteriaceae* réparties en 5 genres dont 37,5% sont des *pseudomonas*, 25% des *vibrio* et 12,5% des *Burkholderia, Alcaligenes et Ochrobactrum*.

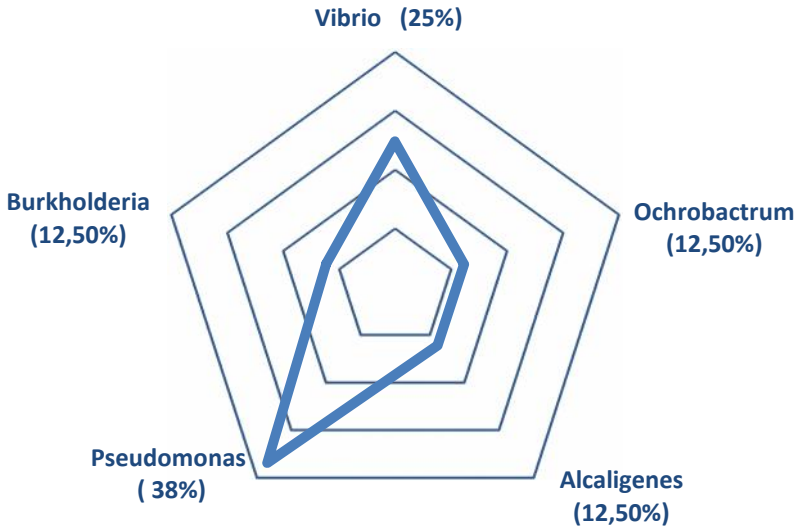


Fig.2 : Répartition des isolats de groupe non entérobactéries

En outre, 75% des isolats de Pseudomonas appartiennent à l'espèces de *Pseudomonas aeruginosa , 25% à l'espèce Pseudomonas testosteroni (Comamonas testosteroni). D'autres espèces ont été identifiées sur nos échantillons. En effet, l'espèce vibrio vulnificus du genre vibrio a été révélée comme la deuxième espèce abondante après P. aeruginosa. Cependant,* le reste des espèces identifiées existent en quantité faible dans les échantillons analysés à savoir *Alcaligenes faecalis* et *Burkholderia cepacia.* La dernière espèce qui a été identifiée dans nos échantillons est *Ochrobactrum anthropi.*

3.2 PROFIL DE RESISTANCE DES SOUCHES GRAM NEGATIFS

3.2.1 PROFIL DE RÉSISTANCE DES SOUCHES *GRAM NÉGATIFS ENTEROBACTERIACEAE*- AUX ANTIBIOTIQUES.

Les résultats de la résistance aux antibiotiques sont présentés dans la figure (3). Toutes les espèces se sont montrées sensible à *l'Imipenème Gentamicine.* Les souches d'*E. coli* ont montré une résistance presque totale vis-à-vis aux *Tobramycine, Céftazidime* et *l'acide Nalidixique.* une résistance importante allant de 50% aux *Céfotaxine, Amikacine, Amoxicilline + Ac clavulanique, Amoxicilline et Céfotaxine à 75% aux Céfalotine*,. Ainsi, tous les isolats d'*E. coli* ont montré une sensibilité totale aux *Ciprofloxacine, Sulphamethoxazole +Trimethoprim et Nitrofuranes.* En 2006 Baylis, et al, ont montré que *E. coli* peut être aussi résistante aux *bêta-lactamines*, *l'acide Nalidixique*, et *l'ampicilline*, et sensible à la *nitrofurantoïne*. Le mécanisme de résistance aux antibiotiques chez les isolats d'*E. coli* est lie à la production de β-lactamase à spectre étendue (BLSE).

Les souches d'*Enterobacter* ont montré une résistance parfaite aux *Tobramycine, Céftazidime Céfalotine, Amoxicilline et aux Amikacine, Amoxicilline + Ac clavulanique, Nitrofuranes et Céfotaxine*. Cette résistance atteint 50% aux *Céfotaxime*; et 25% aux *Sulphamethoxazole +Trimethoprim, Ceftriaxone et Acide Nalidixique*. En plus de *l'imipenème* tous les isolats d'*Enterobacter* ont montré une sensibilité totale aux *Ciprofloxacine et Gentamicine*. Des chercheures ont montré que les espèces du genre *Enterobacter* sont résistantes à *l'ampicilline, aux céphalosporines* de première et de deuxième génération (*Farmer et al 2007 et Russo, T. A. et al 2008).* En 2004, Boyce et al., ont signalé que la majorité des espèces du genre *Enterobacter* sont sensibles *aux fluoroquinolones* et au *triméthoprime-sulfaméthoxazole*.

Le mécanisme de résistance aux antibiotiques chez certains isolats d'*Enterobacter est dû essentiellement* à la production des BLSE *((david.2006 et Holy et al. 2008)*.

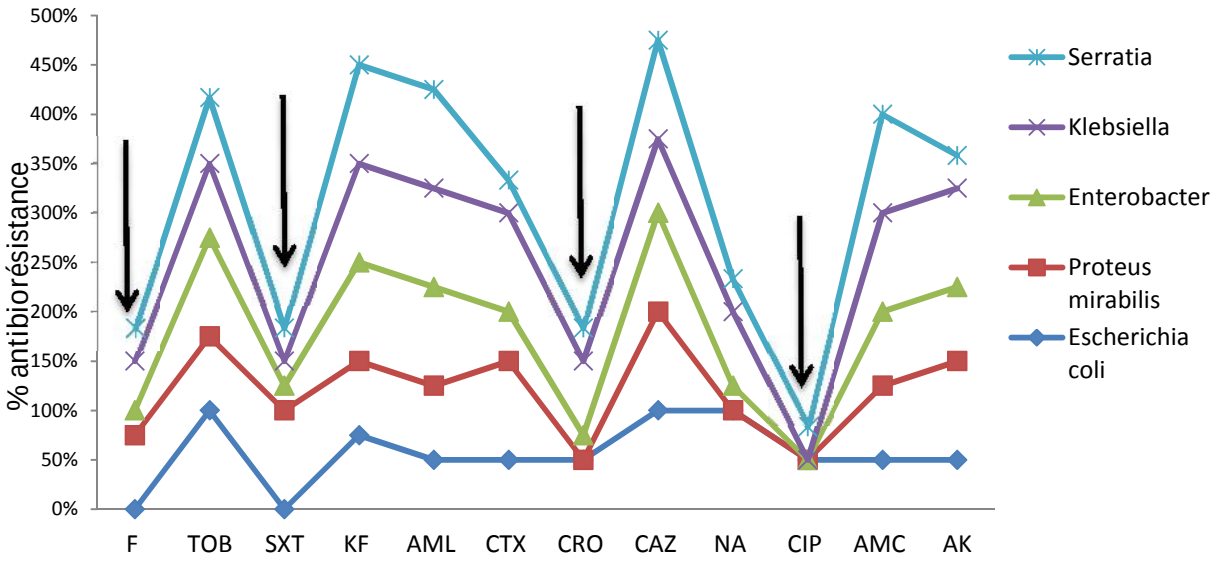


Fig.3 : profil de l'antibiorésistance des souches d'Enterobacteriaceae isolés des bains maures

Les isolats des *Klebsiella* ont montré une résistance totale aux *Céfotaxine, Amikacine*, *Amoxicilline + Ac clavulanique, Céfalotine et Amoxicilline* ; et un taux de résistance jusqu'à 75% pour : *Tobramycine, Céftazidime, Ceftriaxone et Acide Nalidixique*. Mais aussi, tous isolats des *Klebsiella* sont sensibles au *Ciprofloxacine*. En (2006) Janda et al. ont montré que le genre *Klebsiella* présente une résistance aux pénicillines, en particulier l'ampicilline *(Janda et al 2006).* Plusieurs recherches ont montré que le mécanisme de résistance aux antibiotiques chez les isolats de *Klebsiella* est lié à la production de *β-lactamase* (BLSE) (*Bradford, 2001 et Bonnet, 2004).*

Les isolats des *Serratia* montrent une résistance totale aux *Céftazidime, Amoxicilline + Ac clavulanique, Céfalotine et Amoxicilline, 66, 7% aux à Tobramycine* et 33% aux *Sulphamethoxazole +Trimethoprim, Céfotaxime, Amikacine, Nitrofuranes, Ceftriaxone, ciprofloxacine et Acide Nalidixique.* En Australie(2009), Engel et al ont montré que les espèces de *Serratia* sont habituellement sensibles aux *aminosides, aux fluoroquinolones, De nombreux isolats de Serratia spp*. (39-73 %) sont résistants aux *pénicillines* et à la *céphalosporine (Engel et al, 2009).*

Les isolats des *Proteus se sont* montrés totalement résistants aux *Sulphamethoxazole +Trimethoprim, Céfotaxine, Amikacine et Céftazidime et 75% aux Tobramycine*, *Amoxicilline + Ac clavulanique, Nitrofuranes Céfalotine et Amoxicilline*. Mais, une sensibilité totale aux *Ceftriaxone, Acide Nalidixique, ciprofloxacine*.

Abbott, et al. en (2009) ont montré que les espèces du genre *Proteus* sont généralement sensibles aux *céphalosporines, aux aminoglycosides et à l'imipenème* à large spectre. D'autre recherche confirment qu'une résistance aux *β-lactamases* émerge actuellement chez les bactéries du genre *Proteus (Coker, C. et al, 2000).* L'espèce *P. mirabilis* est résistante à *la nitrofurantoïne,* et elle peut aussi développer une résistance à la *ciprofloxacine* lorsque cet antibiotique n'est pas soumis à des restrictions d'utilisation.

3.2.2 PROFIL DE RESISTANCE DES SOUCHES GRAM NEGATIFS-NON ENTEROBACTERIACEAE- AUX ANTIBIOTIQUES

Les résultats de la résistance aux antibiotiques des isolats Gram négatifs *non Enterobacteriaceae* sont illustrés sur la figure (4). Toutes les espèces étudiées montrent une sensibilité totale à *l'Imipenème* et une résistance totale aux *Ticarcilline(TIC), Piperacillin + tazobactam (TZP), Amoxicilline + Ac clavulanique (AMC), Céftazidime(CAZ), Ticarcilline + Ac clavulanique(TIM), et Trimethoprim(W).*

Les souches de *Pseudomonas* montrent une résistance totale aux *Gentamicine et Sulphamethoxazole + trimethoprim* et 25% de ces isolats se révèlent résistante à *Netilmicin*. En revanche, les souches de *Pseudomonas* ont montré une sensibilité totale aux Piperacillin. Tobramycine et Ciprofloxacine. Nos résultats sont presque comparable avec les résultats de Abdelmoula El Ouardi et al (2013), qui ont montrés une sensibilité à *l'Imipenème* jusqu'à (88%), à la *pipéracilline* (78%), à la *Tobramycine* (76%); à *Ciprofloxacine* (66%), à la *Nétilmicine (74%), la résistance à la Ticarcilline* était très élevée. *En effet, P.*

aeruginosa toujours été considéré comme une cible difficile en chimiothérapie antiinfectieuse. La séquence complète de son génome a permis de rationaliser cette observation car (i) 0.3 % des gènes sont directement impliqués dans les mécanismes de résistance; (ii) elle est capable d'acquérir des grands éléments mobiles (intégrons) codant pour des mécanismes de résistance provenant d'autres bactéries *(Stover C.K. et al., 2000 ; Woods D.E. 2004 et Kipnis E. et al., 2006).*

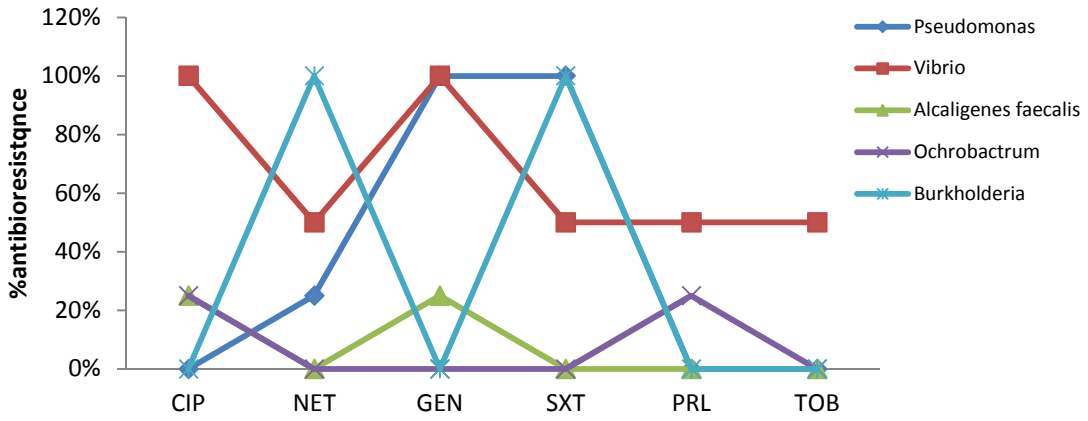


Fig.4 : profil de l'antibiorésistance des souches non Enterobacteriaceae isolés des bains maures

Contrairement à ce qui a été décrit par Elourdi (2013), nos souches se sont montrées très résistantes aux antibiotiques. Par contre, ces souches développent une sensibilité très importante aux antibiotiques suivants : 82% pour *pipéracilline-tazobactam, (67%) pour ticarcilline-acide clavulanique, (76%) Céftazidime(CAZ) et (71%) gentamicine .*

Les isolats des *Vibrio* ont montré une résistance totale aux *Ciprofloxacine et Gentamicine*, et un taux de résistance jusqu'à 50% pour *Piperacillin, Tobramycine, Netilmicin et Sulphamethoxazole + trimethoprim*. Duval et al en 1999 ont pu identifier un nouvel antibiotype résistant au *triméthoprime + sulfaméthoxazole (cotrimoxazole), sulfonamides et triméthoprime*. En 2001, Rakoto Alson et al. ont observé l'apparition d'un phénotype résistant aux Bétalactamines type pénicillinase de bas niveau (résistance à l'ampicilline, à l'amoxicilline, à la ticarcilline avec sensibilité conservée à l'association amoxicilline/acide clavulanique et à la Céfalotine), et d'une résistance croisée entre toutes les cyclines *(Rakoto Alson et al, 2001).* Le principal mécanisme de résistance aux sulfamides se situe au niveau d'une enzyme inactivatrice : la dihydroptéroate synthétase (DHPS) *(Glass RI, et al 1980).*

Les souches de *Burkholderia cepacia* ont montré une résistance totale aux *Netilmicin et aux Sulphamethoxazole + trimethoprim,* et une sensibilité totale aux *Gentamicine, Ciprofloxacine, pipéracilline et Tobramycine*. En 1999, Bonacorsi et al. ont montré que parmi les *bêta-lactamines* les plus actifs, la *pipéracilline* et que la ciprofloxacine est assez rarement active. *Burkholderia cepacia* présente un niveau de résistance intrinsèque assez important contre les *ß-lactamines*, *aminosides et fluoroquinolones*. Ceci est partiellement dû à la présence de différentes pompes MDR comme SmeABC, CeoAB-OpcM, AmrAB-OprA ou BpeAB-OprB ***(Cattoir, 2004).***

En plus de la résistance totale à des antibiotiques énumérés ci-dessus *Ochrobactrum anthropi* a montré une résistance de 25% aux *Piperacillin et Ciprofloxacine. Ochrobactrum anthropi* est résistante à la plus part des céphalosporines et des pénicillines, cette résistance est due à l'expression d'une enzyme résistante à l'acide clavulanique, la *ß-lactamase*. Elle est inductible de type AmpC, en hydrolysant les céphalosporines. L'expression du gène AmpC est inductible via un régulateur AmpR *(Higgins, 2001).*

Alcaligenes faecalis à elle aussi développe une résistance faible de 25% aux *Ciprofloxacine et Gentamicine* plus la résistance aux antibiotiques énumérés ci-dessus, et une sensibilité *aux Netilmicin, Sulphamethoxazole + Trimethoprim, pipéracilline* et *Tobramycine*. En (1993), Bizet C, et al. Ont montré que la plupart des souches semblent afficher une résistance multiple à de nombreux antibiotiques, y compris les *b-lactamines (l'amoxicilline, ticarcilline et aztréonam), les aminosides et les quinolones,* mais étaient sensibles à des combinaisons de *l'amoxicilline ou ticarcilline et d'acide clavulanique et à la cephalosporins*. La seule β-*lactamase* à spectre étendu (BLSE) décrit dans *A. faecalis* était PAR-1, une enzyme précédemment trouvée dans les *Pseudomonas aeruginosa, Salmonella et Acinetobacter (Pereira M, et al 2000)*. Arpin C, et al, en 2003 ont rapporté un type TEM BLSE, fréquemment rencontrées chez les entérobactéries dans la région de Bordeaux.

4 CONCLUSION

La présente étude sur l'isolement et l'identification de certaines bactéries, nous a permis de dresser un profil de souches qui peuvent exister dans les eaux utilisées après la baignade dans des salles de bains maure. Ces germes peuvent menacer la santé des consommateurs, surtout les enfants et ceux qui souffre déjà de maladies immunes. De nombreuses études sur les bains maures ont été menées dans ce sens à travers les différentes régions du royaume. Les résultats des recherches établies montrent une grande diversité des espèces bactériennes isolées de ces bains maures. Les tests phénotypiques de résistance et sensibilité de ces germes aux différents antibiotiques choisis, montrent un polymorphisme assez important.

Par ailleurs, la RAM, source de préoccupations pour l'ensemble de la collectivité met aux points et dans ses priorités une stratégie efficace de lutte contre ce problème majeur de santé public. La présence de souches bactériennes causant des maladies graves résistantes aux antibiotiques, il est donc important de chercher des alternatives sûres, efficaces et naturelles.

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INFLUENCE DU PROCEDE DE FABRICATION SUR LA QUALITE MICROBIOLOGIQUE DU JUS DE «FOLERE» (*Hibiscus sabdariffa*) VENDU DANS TROIS VILLES DU CAMEROUN: MAROUA, MOKOLO ET MORA

[INFLUENCE OF MANUFACTURING PROCESS ON THE MICROBIOLOGICAL QUALITY OF FOLERE BEVERAGE (*Hibiscus sabdariffa*) SOLD IN THREE TOWNS OF CAMEROON: MAROUA, MOKOLO AND MORA]

James Ronald BAYOÏ[4], Darman Roger DJOULDE[2], Justine MAIWORE[3], Daoudou BAKARY[1], Josiane SOPPE ESSOME[3], Barak NOURA[3], Guy TCHEME[3], Rodrigue TCHIO SAH[3], Jean Justin ESSIA NGANG[4], and Francois-Xavier ETOA[4]

[1]Département des Sciences Biologiques, Université de Maroua,
Faculté des Sciences, BP 814, Maroua, Cameroun

[2]Département d'Agriculture, Élevage et produits dérivés (AGEPD) Université de Maroua, Institut Supérieur du Sahel (ISS), BP 46, Maroua, Cameroon

[3]Département des Sciences de la vie et de la terre (SVT), Université de Maroua,
Ecole Normale Supérieur (ENS), BP 55, Maroua, Cameroun

[4]Département de Microbiologie, Université de Yaoundé I, Faculté des Sciences, BP 812, Yaoundé, Cameroun

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ABSTRACT: The "foléré" juice (*Hibiscus sabdariffa)* is one of the most consumed handcrafted drinks in the Far North region of Cameroon. However, an eventual contamination of this drink could significantly affect its quality and severely harm the health of the consumer. It is strong of this observation that a study was performed in order to evaluate the influence of the manufacturing process on the microbiological quality of the drink. To achieve this, a survey was carried out and samples of "foléré" juice were collected at each step of manufacturing process. The physicochemical analyzes showed that the juices were strongly acidic with a pH less than 4.5, regardless of the stage of the manufacturing process. However the microbiological analyzes of samples revealed that microbial loads except standards according to AFNOR ($<10^6$ CFU/ml for the mesophilic flora and $<10^5$ CFU/ml for fungal flora) recorded were mainly linked to the type of extraction. Thus, the juice from the maceration was more contaminated than those from the decoction. Moreover, the critical step would be the addition of water for dilution and / or cooling of the juice after extraction.

KEYWORDS: *Hibiscus sabdariffa,* Handcrafted drink, maceration, decoction, physicochemical and microbiological parameters, health quality.

RESUME: Le jus de foléré (*Hibiscus sabdariffa)* est l'une des boissons de fabrication artisanale les plus consommés dans la région de l'Extrême-Nord du Cameroun. Cependant une éventuelle contamination de cette boisson pourrait fortement altérer sa qualité et porter atteinte gravement à la santé du consommateur. C'est fort de ce constat qu'une étude a été réalisée dans le but d'évaluer l'influence du procédé de fabrication sur la qualité hygiénique de cette boisson. Pour y

Corresponding Author: James Ronald BAYOÏ

parvenir, une enquête a été réalisée et des échantillons de jus de foléré ont été collectés à chaque étape du processus de fabrication. Les analyses physico-chimiques des échantillons ont montré que les jus étaient fortement acides avec un pH inférieur à 4.5, ceci quel que soit l'étape du process de fabrication. Cependant, les analyses microbiologique des échantillons ont révélé que les charges microbiennes hors normes selon l'AFNOR ($<10^6$ UFC/ml pour la flore totale et $<10^5$ UFC/ml pour la flore fongique) relevées étaient surtout liées au type d'extraction. Ainsi, les jus issus de la macération étaient plus contaminés que ceux issus de la décoction. De plus, l'étape critique restait celle de l'ajout d'eau pour la dilution et/ou le refroidissement du jus après extraction.

MOTS-CLEFS: *Hibiscus sabdariffa*, boisson artisanale, macération, décoction, paramètres physico-chimiques et microbiologiques, qualité hygiénique.

1 INTRODUCTION

L'alimentation constitue le point essentiel assurant la vie et englobe tout produit pouvant fournir des éléments nutritifs [1]. Parmi ces aliments, les légumes occupent une place choix dans le quotidien des ménages en Afrique. Au Cameroun, les légumineuses sont largement cultivées et servent de complément alimentaire [2] ou d'ingrédients [3]. C'est le cas d'*Hibiscus sabdariffa* dont les feuilles sont utilisées pour la préparation des sauces et les calices d'ingrédients dans la fabrication des boissons. Encore appelé «foléré» au Cameroun, *Hibiscus sabdariffa* est une plante herbacée cultivée majoritairement dans les régions tropicales et subtropicales [4]. Les calices sont riches en vitamine C, en glucose, fructose, saccharose et en acides organiques [5]. Leur composition minérale renvoie essentiellement à la présence du fer, du phosphore, du calcium, du sodium, du potassium [6] mais aussi à des oligo-éléments tels le cuivre et le chrome [5]. Du fait de ses composantes, *Hibiscus sabdariffa* sert au traitement des hémorroïdes, des blessures et de l'hypertension [7].

Le jus obtenu des calices passe par plusieurs étapes dont la macération ou la décoction, la filtration, la formulation, la désaération, le traitement thermique stabilisateur, le conditionnement refroidissement et le stockage [5]. Ce jus, encore appelé «oyoro» au Nord du Cameroun, jus de «bissap » en Afrique de l'ouest, jus d'«oseille» en français, ou «sorrel drink» en anglais, est une boisson naturelle rafraichissante, de couleur rouge, sucré et légèrement acide [8], facilement accessible et surtout peu coûteuse.

Au Cameroun en général et dans la région de l'Extrême-Nord en particulier, les consommateurs de ce jus se rencontrent dans toutes les couches sociales. Cependant, de part sa richesse en nutriments [5], le jus de «foléré» constitue un terrain favorable au développement des microorganismes tels les levures, les moisissures et les bactéries responsables des toxi-infections alimentaires [9]. De tels aliments sont susceptibles d'entraîner des accidents graves, parfois mortels [10]. Ces agents pathogènes proviendraient des différentes manipulations lors de la fabrication du jus [11]. De ce fait, le procédé de fabrication qui se déroule le plus souvent dans des conditions parfois peu hygiéniques pourrait être à l'origine de la contamination du jus [3]. L'objectif de ce travail sera d'évaluer d'une part le profil microbiologique (flore totale et flore fongique) du jus de «foléré» mis en vente dans les villes de Maroua, Mokolo, Mora et d'autre part de déterminer l'influence des étapes du procédé de fabrication du jus de «foléré» sur ses paramètres physico-chimiques (pH, aciditité titrable totale, teneur en sucres) et microbiologiques.

2 MATÉRIELS ET MÉTHODES

2.1 MATÉRIEL VÉGÉTAL

Les échantillons des boissons de «foléré» issus des préparations aqueuses des calices secs d'*Hibiscus sabdariffa* ont été collectés auprès de vingt une (21) productrices réparties dans différents sites des villes de Maroua, Mokolo et Mora. Toutefois, les différents sites situés dans la région de l'Extrême Nord du Cameroun ont été tirés au hasard à l'aide d'une carte des chiffres aléatoires. Les jus collectés au cours de ce premier échantillonnage ont été étiquetés et acheminés directement au laboratoire dans des conditions aseptiques sous un régime de froid à 4°C (glacière réfrigérante).

2.2 DETERMINATION DE LA QUALITE MICROBIOLOGIQUE DU JUS DE « FOLERE» MIS EN VENTE

Avant les analyses, les trois unités provenant de la même productrice/producteur ont été mélangées et homogénéisées aseptiquement formant ainsi un échantillon unique puis codées (E1 ; E2 ; E3…). Les paramètres microbiologiques évalués

étaient la flore mésophile totale à 30°C (germes totaux ; NF V08-051), et la flore fongique (levures et moisissures ; ISO 7954). Cette évaluation a été réalisée en utilisant comme supports, les techniques standards d'analyses [10].

2.3 DETERMINATION DE L'IMPACT DES ETAPES DU PROCEDE DE FABRICATION SUR LES PARAMETRES PHYSICO-CHIMIQUES ET MICROBIOLOGIQUES DU JUS DE FOLERE

Les enquêtes menées dans le cadre de cette étude nous ont permis de recueillir des informations sur le procédé de fabrication du jus (Figure 1) telles que le type d'extraction utilisée au cours de la fabrication du jus, le matériel et les ingrédients utilisés. En fonction du type d'extraction, nous avons classé les productrices/producteurs en deux groupes distincts à savoir l'un qui procédait par macération (extraction à froid) et l'autre qui utilisait une décoction (l'extraction à chaud) pour recueillir le jus des calices secs d'*Hibiscus sabdariffa.* Ce qui nous a permis d'effectuer un deuxième échantillonnage aléatoire dans chaque groupe. A la suite d'un rendez-vous, nous avons assisté à la fabrication des jus de foléré et nous avons prélevé des échantillons à chaque étape assimilée de clé du procédé à savoir après l'étape d'extraction du jus brute par macération ou par décoction, après celle de l'ajout d'eau et enfin celle après ajout des ingrédients (saccharose, aromes, édulcorants…). Les échantillons prélevés ont été étiquetés et acheminés directement au laboratoire dans des conditions aseptiques et sous un régime de froid (glacière réfrigérante) à 4°C pour les analyses. L'estimation du pH a été effectuée par une lecture directe grâce à un pH-mètre EQ-610 Equip-Tronic [12]. Les références [13] et [14] ont été utilisées pour déterminer l'acidité titrable totale et la teneur en sucres totaux respectivement. Les analyses microbiologiques ont été les mêmes que celle du jus de « foléré » du premier échantillonnage à savoir flore mésophile totale et flore fongique respectivement suivant les normes NF V08-051 et ISO 7954.

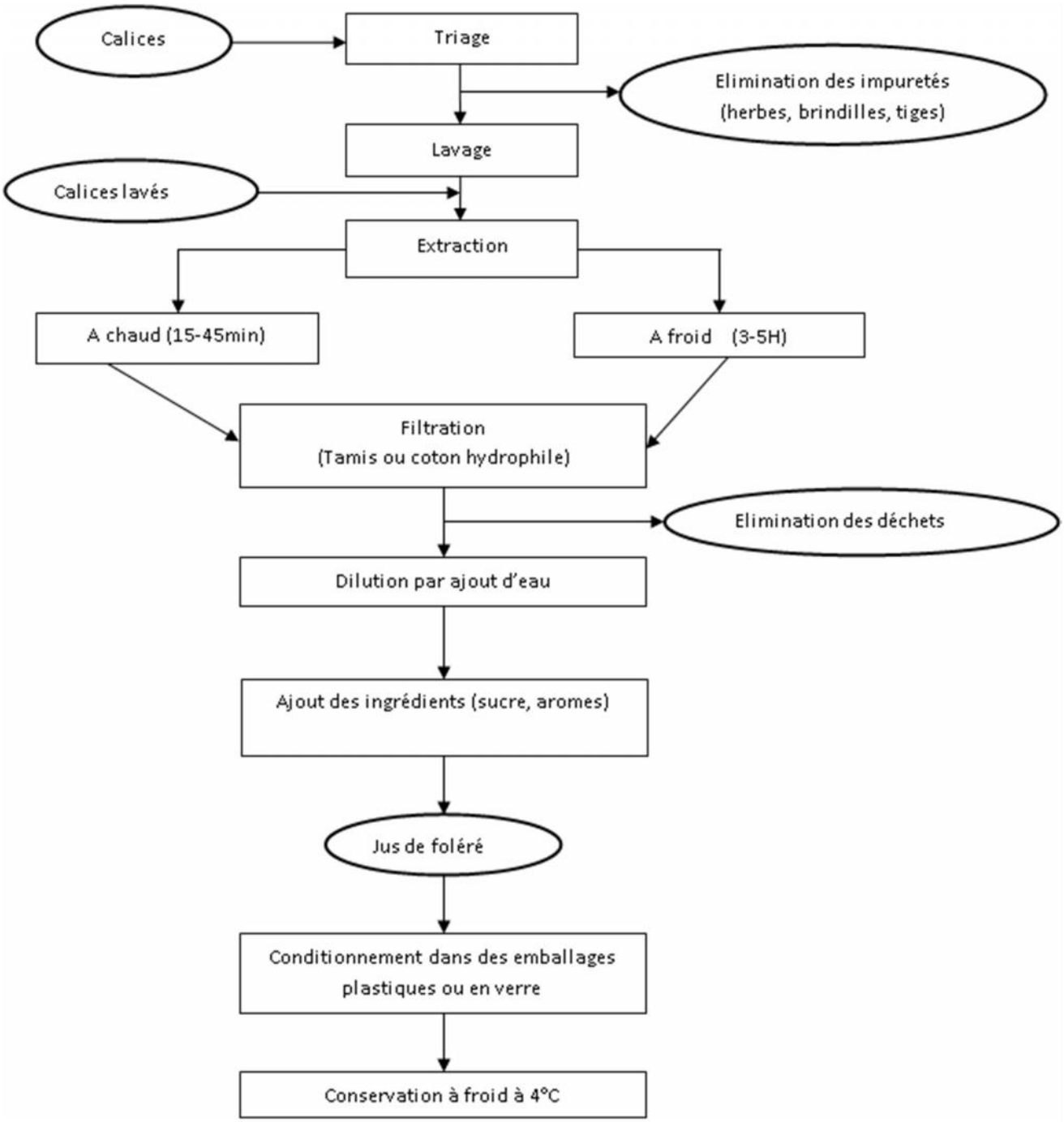


Fig. 1. Diagramme technologique de fabrication de la boisson de « foléré » à l'issu des enquêtes sur le terrain.

2.4 ANALYSES STATISTIQUES

Les résultats issus de notre étude ont été exprimés sous forme de moyennes ±écart-types. Les analyses statistiques ont été réalisées en utilisant l'ANOVA à un facteur, le test de Duncan et le test de Student-Fischer grâce au logiciel statistique SPSS version 16.0 pour *windows* au seuil de significativité de $p< 0,05$.

3 RÉSULTATS ET DISCUSSION

3.1 PROFIL MICROBIOLOGIQUE DU JUS DE FOLERE MIS EN VENTE

Le Tableau 1 compile les résultats de la flore totale issus des différents échantillons de jus de «foléré» prélevés dans les sites de Maroua, Mokolo et Mora. L'analyse de ces résultats montre que les échantillons de jus analysés ont une charge microbienne importante. Excepté les échantillons des sites S1 (Doualaré-Lopéré-Marché abattoir), S5 (Domayo) et S6 (Mokolo), tous les autres ont des charges microbiennes relativement élevées mais en dessous de la norme prévue par l'AFNOR (germes totaux < 10^6 UFC/mL) (NF V08-051). Ces résultats corroborent ceux obtenus par [15] sur les jus de fruit (mangue, papaye, melon, pomme) dans la ville de Dhaka au Bangladesh.

Tableau 1 : Flore totale des différents échantillons de jus de « foléré» mis en vente dans les sites de Maroua, Mokolo et Mora. Les valeurs du même site, suivies des lettres différentes sont significativement différentes (p<5%)

Sites	Productrices	Flore totale (en UFC/mL)	Norme (en UFC/mL)
S1 : Doualaré-Marché-abattoir	P1	$(1,75 \pm 0,07) \times 10^{6\ b}$	$< 10^6$
	P2	$(1,65 \pm 0,35) \times 10^{7\ a}$	
	P3	$(2,25 \pm 0,35) \times 10^{6\ b}$	
S2 : Dougoy	P1	$(1,22 \pm 0,10) \times 10^{3\ b}$	
	P2	$(2,24 \pm 0,20) \times 10^{4\ b}$	
	P3	$(7,00 \pm 1,41) \times 10^{4\ a}$	
S3 : Djarengol-Collège de l'espoir	P1	$(2,72 \pm 0,16) \times 10^{6\ a}$	
	P2	$(2,85 \pm 0,3) \times 10^{3\ b}$	
	P3	$(1,75 \pm 0,48) \times 10^{4\ b}$	
S4 : Bawoliwol-Zokock-Elévage	P1	$(1,45 \pm 0,21) \times 10^{5\ b}$	
	P2	$(8,6 \pm 1,27) \times 10^{5\ a}$	
	P3	$(5,6 \pm 1,2) \times 10^{3\ b}$	
S5 : Domayo-Hardé-Comice	P1	$(2,17 \pm 0,24) \times 10^{5\ b}$	
	P2	$(1,07 \pm 0,35) \times 10^{6\ a}$	
	P3	$(1,27 \pm 0,32) \times 10^{6\ a}$	
S6 : Mokolo	P1	$(1,00 \pm 1,41) \times 10^{6\ b}$	
	P2	$(9,00 \pm 1,41) \times 10^{5\ b}$	
	P3	$(1,82 \pm 2,47) \times 10^{6\ a}$	
S7 : Mora	P1	$(3,14 \pm 0,22) \times 10^{5\ a}$	
	P2	$(1,80 \pm 0,14) \times 10^{4\ b}$	
	P3	$(2,70 \pm 0,42) \times 10^{4\ b}$	

La variation significative de la concentration en germes totaux des différents échantillons de jus de foléré analysés pourrait s'expliquer par la différence des procédés de fabrication utilisés par les productrices et l'environnement sociogéographique de fabrication et/ou de vente des jus [3], [12]. En effet d'après [15], le procédé de fabrication varie fortement en fonction des sites et des productrices. De plus, les fortes charges microbiennes obtenues dans les échantillons de Doualaré (S1) pourraient s'expliquer par l'insalubrité accrue de ce site (enquêtes sur le terrain) qui serait à l'origine d'une pollution de l'air ambiant et des ressources en eau de la localité [16].

Le Tableau 2 présente les résultats de la flore fongique issus des échantillons de jus prélevés dans les villes de Maroua, Mokolo et Mora. Ces derniers montrent que les levures et moisissures sont présentes dans tous les échantillons de jus de foléré prélevés. Leurs charges fongiques varient significativement d'une productrice à une autre dans le même site et entre les différents sites. L'abondance de moisissures et de levures dans les jus bien que dans la norme prévue par l'AFNOR dans la plupart des cas (levures et moisissures <10^5 UFC/mL, NF V08-059) pourrait s'expliquer par le non respect des critères d'hygiène de procédé (CHP) de fabrication [17], ou provenir des calices, de l'eau utilisée, du conditionnement et du comportement lors de la vente [18], [9]. La différence observée entre ces résultats et ceux de [15] sur les jus de fruits s'expliquerait par la nature du matériel végétal utilisé. En effet, le caractère acidophile des levures et moisissures pourrait justifier en grande partie leur prolifération (pH<4), dans les extraits de «foléré» qui sont naturellement acides [19].

Tableau 2 : Flore fongique des différents échantillons de jus de «foléré» mis en vente dans les sites de Maroua, Mokolo et Mora. Les valeurs du même site, suivies des lettres différentes sont significativement différentes à p<5%.

Sites	Productrices	Flore fongique (en UFC/mL)	Norme (en UFC/mL)
S1 : Doualaré-Marché-abattoir	P1	$(1,7 \pm 0,28) \times 10^{4\ b}$	$< 10^{5}$
	P2	$(3,05 \pm 0,35) \times 10^{6\ a}$	
	P3	$(7,65 \pm 0,77) \times 10^{4\ b}$	
S2 : Dougoy	P1	$(6,7 \pm 0,6) \times 10^{2\ c}$	
	P2	$(1,52 \pm 0,31) \times 10^{4\ b}$	
	P3	$(2,5 \pm 0,42) \times 10^{4\ a}$	
S3 : Djarengol-Collège de l'espoir	P1	$(1,70 \pm 0,28) \times 10^{6\ a}$	
	P2	$(9,4 \pm 0,8) \times 10^{2\ b}$	
	P3	$(3,75 \pm 0,35) \times 10^{3\ b}$	
S4 : Bawoliwol-Zokock-Elévage	P1	$(3,25 \pm 0,49) \times 10^{4\ b}$	
	P2	$(6,45 \pm 0,77) \times 10^{4\ a}$	
	P3	$(0,06 \pm 0,005) \times 10^{3\ c}$	
S5 : Domayo-Hardé-Comice	P1	$(1,15 \pm 0,07) \times 10^{4\ c}$	
	P2	$(2,53 \pm 0,04) \times 10^{4\ a}$	
	P3	$(2,07 \pm 0,17) \times 10^{4\ b}$	
S6 : Mokolo	P1	$(1,80 \pm 2,82) \times 10^{6\ a}$	
	P2	$(2,23 \pm 1,41) \times 10^{6a}$	
	P3	$(6,95 \pm 0,35) \times 10^{5\ b}$	
S7 : Mora	P1	$(1,46 \pm 1,97) \times 10^{4a}$	
	P2	$(2,78 \pm 0,21) \times 10^{3b}$	
	P3	$(4,5 \pm 0,1) \times 10^{2\ b}$	

3.2 IMPACT DES ETAPES DU PROCEDE DE FABRICATION SUR LES PARAMETRES PHYSICO-CHIMIQUES ET MICROBIOLOGIQUES DU JUS DE FOLERE

3.2.1 EVOLUTION DES PARAMETRES PHYSICO-CHIMIQUES AU COURS DE LA FABRICATION DU JUS

La Figure 2 présente les valeurs du pH des échantillons de jus de «foléré» prélevés après extraction, après ajout d'eau et après ajout d'ingrédients. Les pH de ces échantillons de jus sont satisfaisant car selon la norme CODEX-STAN 243-2003, le pH des jus de fruits doit être inférieur à 4,5. Les valeurs enregistrées se rapprochent quelque peu de celles rapportées par d'autres études [20], où les pH des jus étudiés y compris ceux de la boisson de «foléré» variaient de 2,67 à 2,77. Toutefois, ces valeurs pour la plupart sont significativement différentes au seuil p<5%. Les pH très acides obtenus après l'étape de macération/décoction (AM/D), se justifieraient par la diffusion des constituants acides des calices au cours de l'extraction. Tandis que l'augmentation du pH à la deuxième étape d'ajout d'eau (AAE) serait due à l'effet de la dilution de ce liquide sur le jus brute acide. Enfin, les ingrédients (citron, jus synthétique…) utilisés par les productrices à l'étape ajout des ingrédients (AAI) auraient un effet acidifiant, ce qui justifierait les légères baisse de pH observée au cours de cette phase.

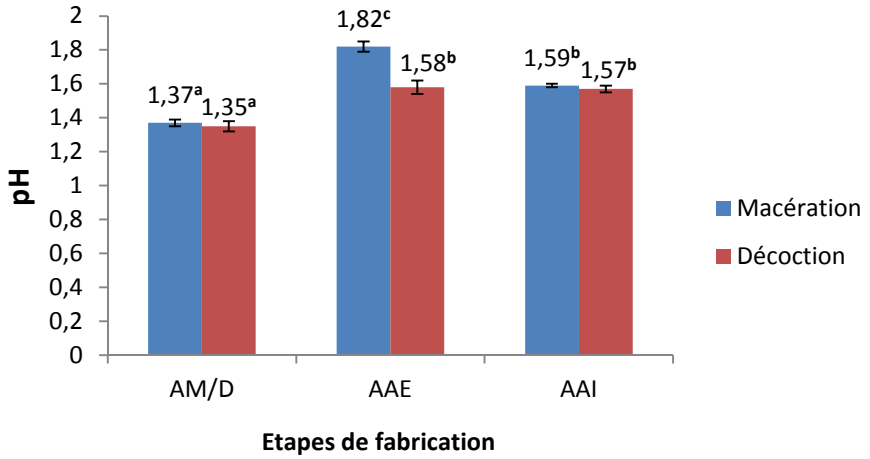


Fig. 2. pH du jus de «foléré» après macération ou décoction (AMD), après ajout d'eau (AAE) et après ajout des ingrédients (AAI).

La Figure 3 compile les résultats de la teneur en sucres totaux des échantillons en fonction du type d'extraction et des deux autres étapes clés de la fabrication du jus de «foléré». L'analyse de ces résultats montre que la concentration en sucres varie en fonction des étapes de fabrication mais plus fortement lors de l'ajout d'ingrédients (AAI). Ces valeurs pour certaines, sont significativement différentes au seuil p<5%. Cette forte teneur en sucres totaux après la phase 3 (AAI) serait la résultante de l'ajout d'ingrédients tels le sucre (saccharose) et les arômes et d'autres édulcorants.

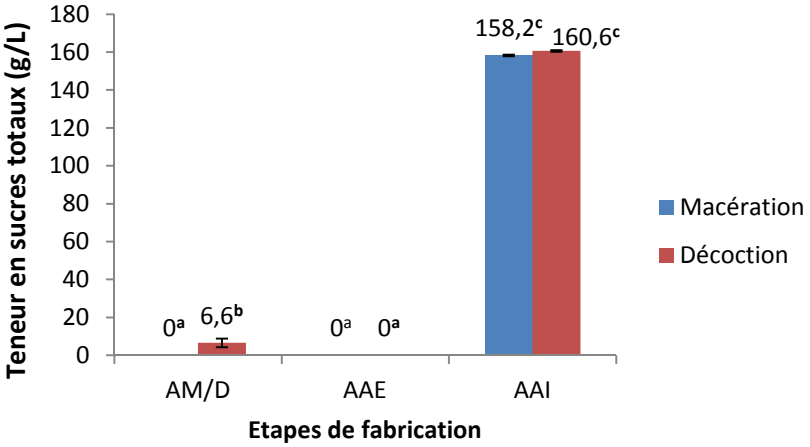


Fig.3. Teneur en sucres totaux du jus de «foléré» après macération ou décoction (AMD), après ajout d'eau (AAE) et après ajout des ingrédients (AAI)

L'acidité titrable totale (TTA) des différents échantillons prélevés après macération/décoction, après ajout d'eau et après ajout des ingrédients, sont portées dans la Figure 4. On note que, les jus issus de l'extraction à chaud sont plus acides que ceux obtenus de l'extraction à froid. Cette différence se justifierait par le fait que la décoction favorise l'évaporation de l'eau et la diffusion des particules acides des calices, ce qui permettrait d'obtenir un jus nettement plus concentré et acide que celui issu de la macération. Cependant la diminution de cette acidité après l'ajout de l'eau (AAE) puis celle des ingrédients (AAI) s'expliquerait par un simple effet de dilution des intrants utilisés (eau et sucres) pour l'obtention de la boisson finale.

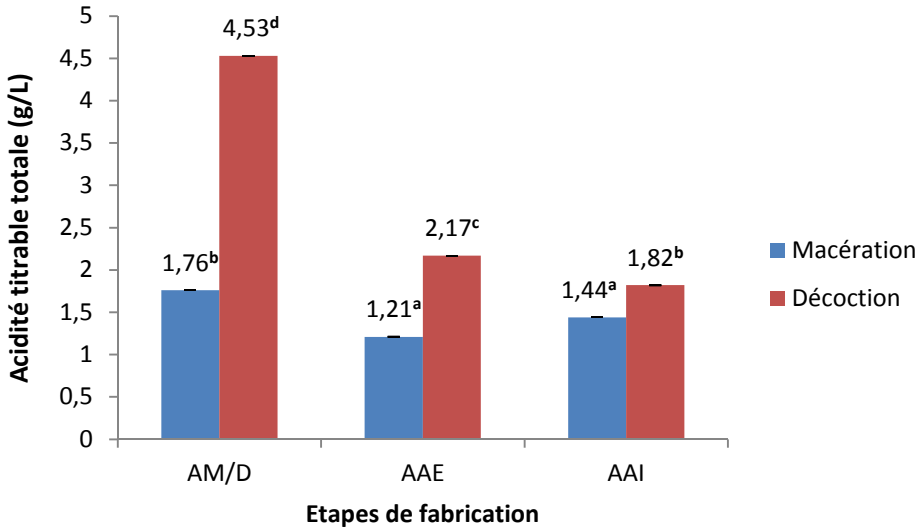


Fig.4. Acidité titrable totale du jus de «foléré» après macération ou décoction (AMD), après ajout d'eau (AAE) et après ajout des ingrédients (AAI)

3.2.2 VARIATION DES PARAMETRES MICROBIOLOGIQUES AU COURS DE LA FABRICATION DU JUS

La Figure 5 recense les résultats de la flore totale des échantillons prélevés après macération/décoction, après ajout d'eau et après ajout des ingrédients. On constate que la charge microbienne augmente entre l'extraction et l'ajout de l'eau puis reste constante jusqu'à l'ajout des ingrédients. Les résultats à l'issu de l'extraction montrent que les échantillons issus de la macération ont une charge microbienne extrêmement importante et significativement plus élevée que celle des échantillons obtenus à l'issu de la décoction dont la qualité microbiologique est acceptable selon la norme AFNOR applicable aux produits végétaux et dérivés qui est inférieure à 10^6 UFC/ml (guide législatif et réglementaire français, N°8155 du 12 décembre 2000). Cette différence s'expliquerait par l'augmentation de la température au cours de l'ébullition des calices lors de la décoction, ce qui aura pour conséquence de réduire fortement les germes présent à la fin de cette extraction [21]. Tandis que pour la macération la contamination pourrait être la résultante de la qualité des calices (calices non lavées au préalable), du degré de salubrité de l'eau et des ustensiles utilisés [18]. L'augmentation importante de la flore microbienne à l'étape 2 (AAE) serait liée à la qualité de l'eau ajoutée pour diluer et/ou refroidir le jus brute. Mais aussi du type de refroidissement utilisé lors de la décoction. En effet, les résultats de notre enquête montrent que 45,07% des productrices refroidissaient leur jus à l'air libre, favorisant ainsi la l'augmentation de la charge microbienne à partir de l'étape d'ajout d'eau. De plus, nous notons l'absence d'un traitement thermique stabilisateur avant le conditionnement (Figure 1). En effet, d'après une étude menée par [6], cette pasteurisation (100°C/10min) était une étape facultative qui variait en fonction des productrices.

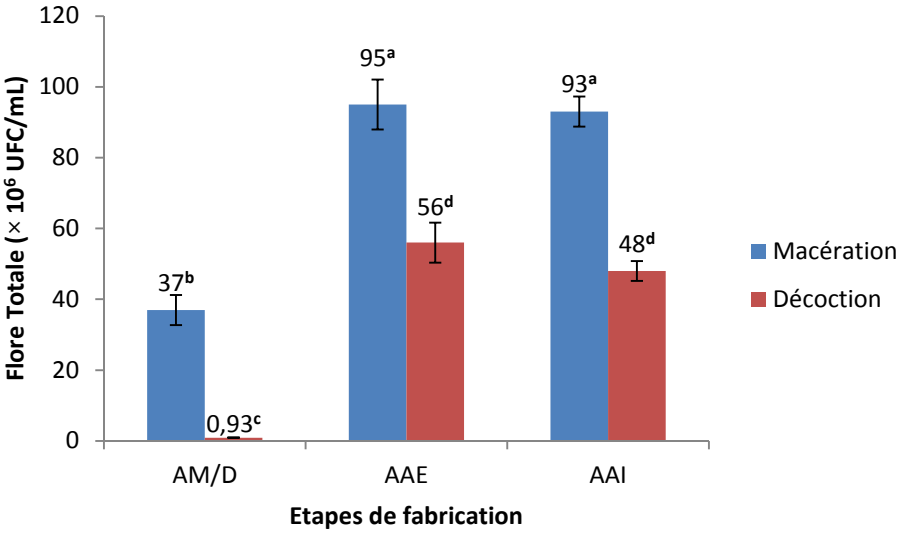


Fig.5. Flore totale du jus de «foléré» après macération ou décoction (AMD), après ajout d'eau (AAE) et après ajout des ingrédients (AAI)

Les résultats du dénombrement de la flore fongique des échantillons prélevés au cours de la fabrication du jus de foléré sont consignés dans la Figure 6. L'analyse de ces résultats montre que la charge fongique des échantillons prélevés varie en fonction du type d'extraction et des autres étapes clés du procédé de fabrication (ajout eau et ajout des ingrédients). La plupart des valeurs obtenues sont supérieures à la norme prescrite par l'AFNOR et applicable aux produits végétaux et dérivés qui est inférieur à 10^5 UFC/mL (guide législatif et réglementaire français, N°8155 du 12 décembre 2000). Ces résultats supérieurs à ceux obtenus par [22] au Nigeria sur le même jus nous amèneraient à revoir dans le présent contexte les conditions hygiéniques appliquées lors des différentes manipulations. L'augmentation de la flore fongique après ajout d'eau, puis des ingrédients nous laisserait penser que certains intrants tel l'eau serait probablement porteurs des microorganismes mais aussi que le sucre ajouté serait utilisé comme un substrat fermentescible des moisissures et levures [23]. Toutefois les valeurs de la flore fongique obtenues après décoction significativement inférieurs à celles obtenues après macération prouvent que le traitement thermique du jus de foléré contribue fortement à améliorer leur qualité microbiologique. Et confirme l'assertion selon laquelle un traitement thermique entre 65°C et 90°C détruirait une grande partie des microorganismes contenu dans un milieu [21].

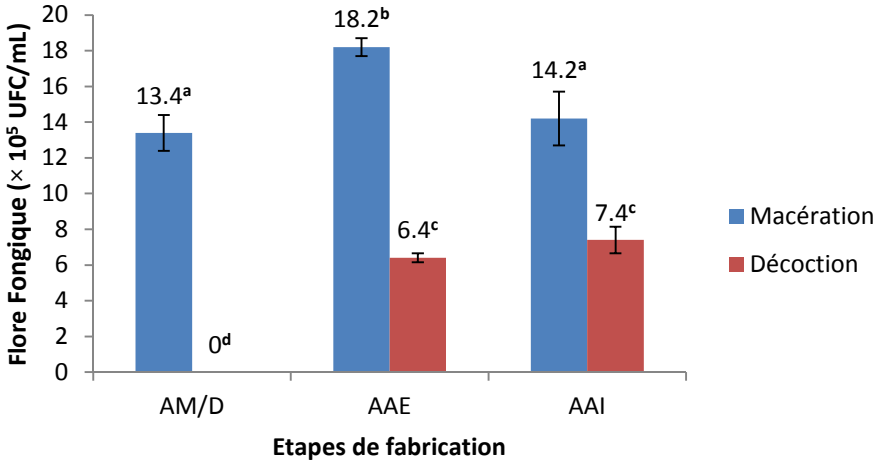


Fig. 6. Flore fongique du jus de foléré après macération ou décoction (AMD), après ajout d'eau (AAE) et après ajout des ingrédients (AAI)

4 CONCLUSION

Il ressort de cette étude que, les jus de «foléré» vendues dans les villes de Maroua, Mokolo et Mora, sont pour la plupart de qualité microbiologique non conforme de part leurs très fortes charges microbiennes. Par ailleurs, on note de l'étude du procédé de fabrication que, les productrices utilisent deux types d'extraction différents. En effet, certaines utilisent la macération (extraction à froid) tandis que d'autres la décoction (extraction à chaud). On note que les jus issus de la macération bien que acides le sont moins par rapport à ceux issus de la décoction, justifiant en partie les fortes charges microbiennes observée dans les jus issus de l'extraction à froid. Ces derniers de part leurs très fortes charges microbiennes seraient plus néfastes sur le plan sanitaire que ceux issus de l'extraction à chaud. Toutefois, l'étape critique du procédé de fabrication à l'origine de la contamination serait probablement celle de l'ajout d'eau pour la dilution et/ou le refroidissement de l'extrait de jus brute. Pour une meilleure connaissance des facteurs de contamination et des types de microorganismes rencontrés dans les jus de foléré vendus dans ces trois villes du Cameroun, une étude de traçabilité de la production à la vente ainsi que l'isolement et l'identification des différents souches microbiennes présentes dans ce jus sont envisagés en perspectives.

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Food Management Strategies for Coping with Food Insecurity in a Changing and Variable Climate by Smallholder Farmers in Kenya

Susan M. Kamuru[1], S.T. Kariuki[2], N.W. Mungai[3], B.O. Bebe[4], W. Chiuri[5], M. Ngigi[6], and F.K. Lelo[7]

[1]Department of Applied Community Development Studies,
Egerton University, P.O Box 536,-20115 Egerton, Kenya

[2]Department of Biological Sciences,
Egerton University, P.O Box 536-20115 Egerton, Kenya

[3]Department of Crops, Horticulture and Soils,
Egerton University, P.O Box 536-20115, Egerton, Kenya

[4]Department of Animal Sciences,
Egerton University, P.O Box 536-20115 Egerton, Kenya

[5]P.O Box, 35074-00100, Nairobi, Kenya

[6]Department of Agricultural Economics and Agribusiness management,
Egerton University, P.O Box 536-20115, Egerton, Kenya

[7]Laikipia University,
P.O Box 1100-20300, Nyahururu, Kenya

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ABSTRACT: Food insecurity in Kenya has been experienced over the years and is getting worse. The phenomenon is partly attributed to accelerating global Climate change and variability. This study investigated smallholder farmers' perceptions on climate change; food access and consumption across seasons, and food management strategies for coping with food insecurity, with the aim of identifying promising cases that can be up-scaled to enhance food security. Five sites representative of Kenya's major agro-ecological systems were purposively selected. Three Participatory workshops and focus group discussions for 30 smallholder farmers were held in each site. The participants' collective views showed that frequent droughts, shift in the rainfall season and unpredictable rainfall pattern were climate change indicators common to all sites. Foods widely accessible and consumed were maize, beans, sorghum and cowpeas, with the former two being increasingly consumed due to their adaptability to various climatic conditions, relatively high yield and comparably cheap. In a favorable season, excess food is added value, preserved and stored for an adverse season, in which food is rationed in order to carry the family through for a longer period. There is therefore, need to equip smallholder farmers with knowledge and skills on food processing and preservation, in order to benefit from favorable seasons, by reducing post harvest food losses and spoilage.

KEYWORDS: Agro-ecosystems Climate change, Participatory workshop, food security.

Corresponding Author: Susan M. Kamuru

1 BACKGROUND

The Kenyan agricultural sector is the mainstay of the Kenyan economy, with 80% of the population deriving their livelihoods from agricultural related activities. The key objective of the sector is achievement of food security, by increasing availability of food with high nutritional status, at affordable prices and providing jobs and incomes that give people the means to access food, [1]. Food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life without *depending* on humanitarian assistance or unethical means like stealing [2]. The Kenya government in its Food Security and Nutrition Policy [3], has embraced four dimensions of food security: Availability, stability, access, and utilization. Food availability refers to the ease with which sufficient food can be obtained. This is mainly through own agricultural production, or from markets, [3]. The second dimension, stability, relates to continuity of food supply to individuals such that they are not at risk of temporarily or permanently losing their access to the resources needed to consume adequate food (5]. The third dimension, access, comprises of availability to individuals adequate food from own production or having incomes or other resources to purchase and /or exchange with suitable foods needed to maintain consumption of an adequate nutrition level. Food access is determined by its affordability or the financial capacity to buy food 6]. Finally, food utilization refers to not only having adequate food of sufficient diversity to meet nutrient needs, but also the knowledge and means to process plant and animal materials into nutritious food, as well having adequate water and sanitation, [7]. Culture determines which foods a given community will eat or not, by making certain communities to stick to certain foods considered as important by that community.

Food diversity is crucial to food security and nutrition. Diversity refers to representation in the diet, a range of foods from each of the nutritional categories, of energy giving foods (Cereals, starchy root crops and fats); proteins from legumes and meats; and vitamins and minerals obtained from fruits and vegetables. Food utilization determines the extent to which a given community can be considered as food secure or insecure. Food insecurity in this case refers to a condition in which a population does not have access to sufficient, safe and nutritious food over a given period, to meet dietary needs and preferences, [8]. The wider the variety of foods the community produce and or can use, the more food secure the community can be and vice versa.

1.1 VULNERABILITY TO CLIMATE CHANGE AND VARIABILITY

Kenya's agriculture is mainly rain-fed and its performance varies with the agro-ecological system. In the humid, high altitude areas, productivity as well as predictability of good crop is high. In the medium altitude and moderate rainfall areas, arable rain-fed farming is moderately suitable. However, there is relatively high risk of crop failure due to increased frequency of dry spells and an uneven rainfall distribution. A large proportion of the country, accounting for more than 80 percent, is semiarid and arid, with an annual rainfall average of 400 mm. In these areas, droughts are frequent and crop fails in one out of every three seasons, [1]. A changing and variable climate therefore, aggravates or becomes a multiplier of climate risks, resulting to declining food production.

1.2 CLIMATE CHANGE INDICATORS

Climate change refers to the change in weather patterns that is attributed directly or indirectly to human activity, that alters the composition of global atmosphere, and that is in addition to natural climate variability for 30 years or longer. Notable global indicators of climate change include: Rise in atmospheric and sea temperatures; decrease in snow and sea ice; increase in precipitation in some regions and decrease in others; unpredictable rainfall patterns; change in frequency of extreme events such as cold and hot days and nights. Moreover, there are increased incidences of heat weaves, frequency of heavy precipitation, droughts, intense tropical cyclones and extreme high sea levels, [9]. Climate variability is the deviations of climate parameter statistics from the long-term climate statistics relating to the corresponding calendar period over a given period of time, such as a specific month, season or year results into (World Health Organization, [10]. As a result of climate change and variability, food and nutrition insecurity has been experienced over the years and is getting worse. Ten million people in Kenya suffer from chronic food insecurity and poor nutrition, and between two and four million people require emergency food assistance at any given time). In addition, nearly 30% of Kenya's children are classified as undernourished, and micronutrient deficiencies are widespread, [11]. However threats posed by climate change to food security and livelihoods are likely to be spatially variable given the diverse agro-ecological zones and their vulnerability. Vulnerability with regard to climate change implies that people are exposed to aspects of climate that are changing in ways

that will either generate or increase risk. For food security, the risk is of poorer nutrition or reduced access to food supplies than would be expected under "normal" climate conditions, [12].

The impact of climate change is most severe on smallholder farmers because of their limited adaptive capacities due to poverty. These cultivate mainly, using farm labor and the farm provides the main income. Pastoralists, who almost all depend on sale of livestock and livestock products to buy staple foods and other necessities, are included in this category, [13]. Impacts such as rising temperatures and increased frequency of extreme weather events put severe pressure on food availability, stability, access, and utilization. Climate change has affected natural systems especially by rising temperatures, [9]. Availability of agricultural products is affected by climate change directly through its impacts on crop yields, crop pests and diseases, soil fertility and water-holding properties. It is also affected by climate change indirectly through its impacts on economic growth, income distribution, and agricultural demand [5]; [12]. Stability of crop and livestock yields and food supplies is negatively affected by variable weather conditions. Access to food is affected negatively by climate change because as agricultural production declines, food prices rise, and purchasing power decreases. Last, climate change poses threats to food utilization through effects on human health and the spread of diseases like malaria in geographical areas which were previously not affected [12].

1.3 CLIMATE CHANGE COPING STRATEGIES

The extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to adapt to change, [9]. Over the years, development of human societies has involved a continuous process of adapting to changing environmental stresses and opportunities. While climate change is seen as a relatively recent phenomenon, individuals and societies are used to adapting to a range of environmental and socio-economic stresses, [14].

However, the rate at which climate is changing is faster than the smallholder farmers' ability to adjust their food security systems, [5]. Impacts such as higher temperature, erratic rainfall and floods are increasing the smallholders' inability to maintain or increase their agricultural productivity leading to loss of a source of livelihood and food insecurity. Due to climate variability, droughts and rainfall have become more unpredictable and traditional food management practices may no longer be sustainable [12]. Consequently, smallholder farmers in different agro-ecological zones of Kenya may have adjusted their food management strategies in different ways to ensure food security but the distinctive adjustments are less understood.

2 MATERIALS AND METHODS

2.1 PURPOSE OF THE STUDY

The purpose of the study was to investigate the smallholder farmers' perceptions of climate change, their food production accessibility patterns and consumption, and food management strategies for coping with climate change and variability. Such strategies are likely to form a sound basis which institutions supporting climate change activities can build upon in developing sustainable climate adaptation strategies for specific locations and communities of practice.

2.2 OBJECTIVES OF THE STUDY

The study aimed at investigating:

1. Smallholder farmers' perception of climate change

2. Foods accessible and consumed across seasons

3 .Food management coping strategies for food insecurity, currently used by smallholder farmers and pastoralists based on seasonal variability

2.3 METHODOLOGY

The study used participatory action research design. This involved focus group discussions of key stakeholders in food security, comprising of the farming community, Government, Non-Governmental and Faith-based community workers. Three participatory workshops and focus group discussions for 30 community smallholder farmers were held in each site, to gather collective views of the respondents. Gender representation was observed in all the workshops because the experiences of men may be different from those of women.

Five (5) sites in Kenya's major Agro-Ecological Systems, representing varying degrees of vulnerability to impacts of climate change and variability were purposively selected. These regions are regarded as climate change hotspots in Kenya and they include:

1. Arid and semi arid pastoral Livestock area of Kajiado County in Southern Kenya
2. Semi arid areas (in transition) of Mbeere Sub-county in South Eastern Kenya
3. Lake Basin High potential food crop/livestock area of Bungoma County in Western Kenya
4. Highland Medium potential crop/livestock area of Nakuru County in Central Rift Valley
5. Coastal lowland crop/livestock area of Kilifi County

The study also involved a desktop survey of the agricultural potential of the purposively selected agro ecological systems sites.

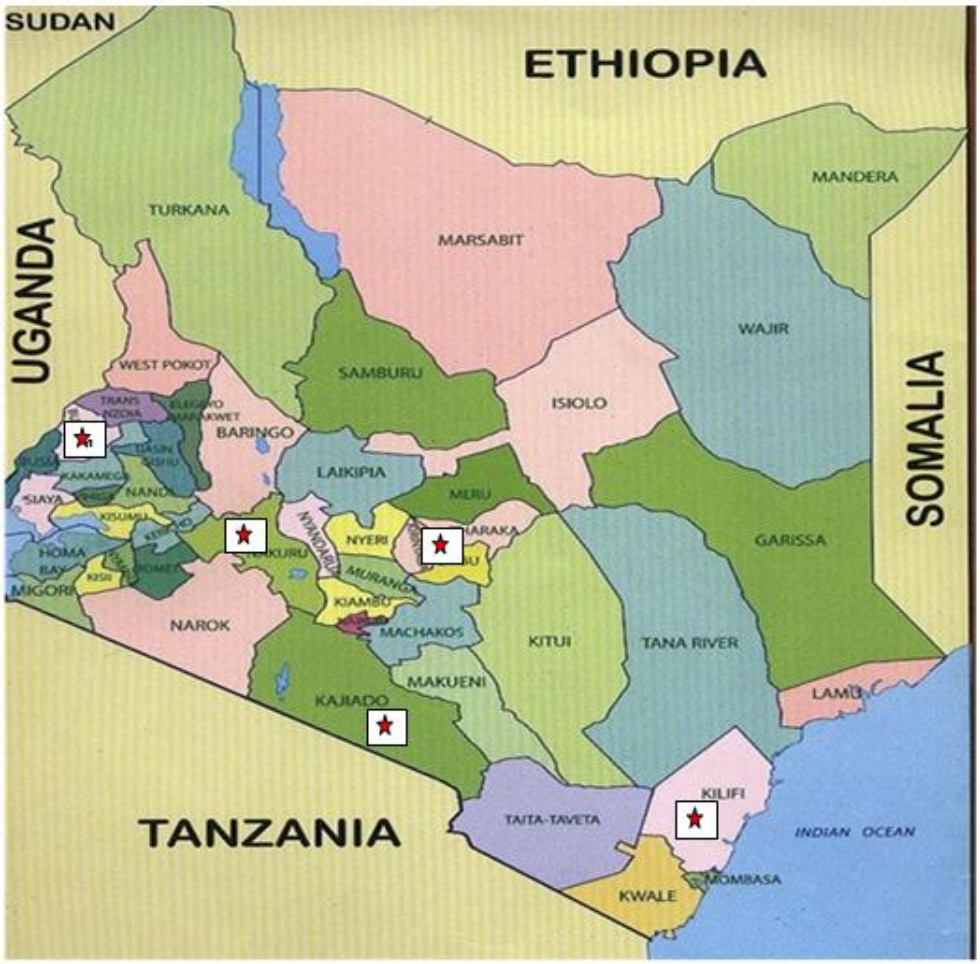


Figure 1: [★] arch Sites of Climate Adaptation Project in Kenya

2.4 STUDY POPULATION

The target population was all smallholder farmers in the five selected counties of Kenya, representative of the major agro- ecological systems, whose vulnerability to climate change varies from one system to another. These included Smallholder farmers and pastoralists.

2.5 SAMPLING PROCEDURE

Purposive sampling was used to ensure that only relevant actors in food security were selected. This involved consultations with the County Agricultural Officers, who provided a list of 30 practicing smallholder farmers in their

respective Counties. The entire population of the selected smallholder farmers who are key players in food security participated in the focus group discussions.

2.6 DATA COLLECTION AND ANALYSIS

Checklists containing various themes of Climate Change, food security and food strategies were used to guide the discussions. Responses were recorded and content analysis done in order to group each response under the relevant theme. The findings were further discussed with the participants in order to validate the responses. The information was then revised to ensure accuracy and representativeness of the data under each sub-theme of the study.

3 RESULTS AND DISCUSSION

3.1 PERCEIVED INDICATORS OF CLIMATE CHANGE BY SITES

The basis of any effective adaptation to climate change requires that the farmers and pastoralists first appreciate that the climate has changed and that it is an environmental, stressful situation that upsets food security. This realization forms the basis of devising food management strategies for coping with food insecurity that may or may not develop into adaptation, [15]. Results in Table 1 indicate that frequent droughts, shifts in the rainfall seasons and unpredictable patterns were climate change indicators common to all sites. Low temperature was only unique for Kilifi in the Coastal Lowland. Unlike other study sites, Nakuru was the only site with less flood occurrences while Mbeere shared all its climate change indicators with at least one other site. Bungoma reported increased frost occurrences and destructive lightning. The observation may be due to the county's location on the slopes and foothill of Mount Elgon and nearness to Lake Victoria, while reduced flood occurrences in Nakuru may be attributed to the relatively high sandy soils that easily allow water to percolate.

Low temperatures at the coastal lowland county of Kilifi can be ascribed to cooling effect of the ocean water as it evaporates due to rising ocean temperatures. Respondents had clear awareness about changes in the climate and the indicators relevant to their locality. This is contrary to the findings of the first comprehensive study of global opinions on climate change of 2007-2008 by Loiserowitz, [16], which showed that, industrialized countries were more aware than developing countries.

Table 1: Perceived Indicators of Climate Change by Sites

	Study Sites				
Perceived Climate Change Indicator	**Kajiado**	**Bungoma**	**Nakuru**	**Kilifi**	**Mbeere**
Livestock disease outbreaks increased	x				x
Human disease outbreaks increased	x	x	x		x
Frequent droughts	x	x	x	x	x
More dry spells within a rainy season	x	x			
Shortened rainy /growing season	x				x
Rainfall season shift	x	x	x	x	x
Rising Temperatures	x				
Low temperatures				x	
Decreasing rainfall amounts	x	x	x		
New crop pests and diseases		x			
Poor spatial rain distribution		x			
Increase in Hailstorms		x	x	x	
Increase in wind storms		x		x	x
Decrease in wind storms			x		
Destructive lightning more frequent		x			
Unpredictable rainfall pattern	x	x	x	x	x
Frost occurrences has increased		x			
Heat stress			x	x	x
Floods occurrences increased	x	x		x	x
Less flood occurrences			x		

x: Presence of indicator

Rainfall data was collected from the weather stations and companies that were keeping their records for many years such as KENGEN in Mbeere, Mumias Sugar Company in Bungoma, MRTC in Kajiado and Nightgale farm in Nakuru.

RAINFALL DATA ANALYSIS

Trends in manual rainfall for at least 30 years were calculated to compare smallholder perceptions with the actual trends in mean rainfall amounts. The results are shown on figure 2.

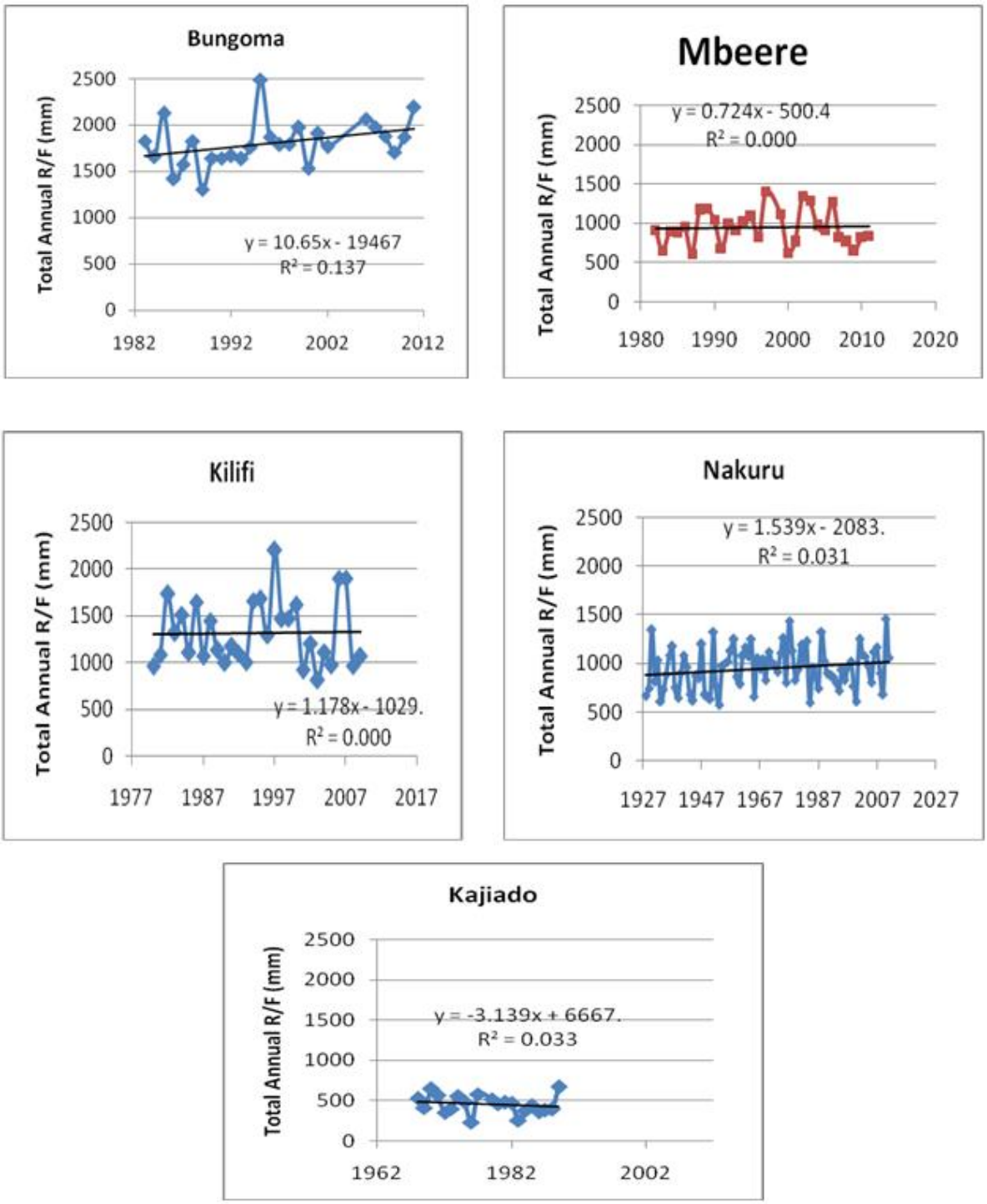


Figure 2. Total annual rainfall (mm) for Bungoma (1983-2011), Mbeere (1982-2011), Kilifi (1962-2011) Nakuru (1928-2011) and Kajiado (1962-2002)

Contrary to the smallholder farmers' perceptions, Actual trends indicate increase in rainfall amounts for Bungoma, and Nakuru, while for Kajiado and Mbeere there is slight decrease. For Kilifi, mean annual rainfall has been constant. Therefore, any adverse impact may be due to variability in mean rainfall, season shift and other climate parameters other than actual amounts. These climate parameter changes have resulted to poor or failed harvests, which in turn have caused food shortages and high prices of the available food as shown on Tables 2 (a) – (c). This is consistent with the Government of Kenya [11b] report that one of the main nutrition challenges facing Kenyans is having consistent access to food of sufficient diversity to meet nutrient needs. Bungoma , Nakuru, Kilifi, Mbeere rainfall trends reveal annual fluctuations in amount and thus the possibility of droughts, confirming the farmers perceptions

Table 2 (a): All Seasons Food Availability and Affordability of Carbohydrates (Cereals and Root Crops) in the Local Markets

	Food Affordability (x-Cheap**; xx-**Expensive**; xxx-**Very expensive**) in Study Sites' Markets**														
Foods Available in all Seasons	**Kajiado**			**Bungoma**			**Nakuru**			**Kilifi**			**Mbeere**		
Cereals															
Maize		xx		x			x				xx		x		
Sorghum	x							xx					x		
Millet								xx					x		
Wheat products			xxx		xx			xx				xxx		xx	
Rice		xx			xx			xx			xx			xx	
Root Crops															
Sweet potatoes				x				xx						xx	
Cassava		xx		x					xxx		xx		x		
Arrowroots/Cocoyam		xx			xx			xx						xx	
Irish potatoes		xx			xx		x					xxx			xx

Maize (*Zea mays*) was available in all the sites in both favorable and unfavorable seasons, and cheap in Bungoma, Nakuru and Mbeere but expensive in Kilifi and Kajiado. The wide and all seasons' availability are explained by the importance the Kenya government places on Maize as the key determinant to Kenya's food security. In case of projected shortage, the government imports or at least facilitates importation to offset any deficit. Millet (*Pennisetum typohides*) and sorghum (*Sorghum vulgare*) were available in Nakuru and Mbeere, and cheap in the latter site where the two cereals are the main staples and thrive under low rainfall conditions. Nakuru being cosmopolitan attract commodities in its market from neighboring Provinces of Rift Valley, Central, and Western, where two cereals are also grown.

Wheat products and rice were also available and perceived as either expensive or very expensive. For the former, the all season's availability is not governed by local production but imports and ease of processing. Cereals can be processed or added value to a form easy to prepare and consumed by all categories of people. For wheat, rice and maize, commercial processing, social acceptability and ease of transportation facilitate distribution and marketing.

Table 2 (a) also indicates that Irish potatoes (*Ipomea batatas*) and cassava (*Manihot esculentum*) were the most widely available root crops although the former was very expensive in Mbeere Sub-County and Kilifi County, while the latter was cheap in Bungoma and Mbeere. In these areas, production of Irish potato is not tenable due to unfavorable agro-climatic conditions. However, Irish potato was cheap in Nakuru, which is one of the main potato producers. In Kenya, potatoes are almost entirely sold in the local market and there is increasing demand for the tuber. The demand is linked to changes in consumption habits, mainly in urban centres, where chips have become a more popular part of the diet. Chips processing has become the major form of value addition for potatoes. Apart from households, restaurants, hotels and canteens are major potato consumers. Cassava was locally grown and generally affordable which may be indicative of its potential to alleviate food insecurity.

In Table 2 (b), beans (*Phaseolus vulgaris*) and cowpeas (*Vigna unguiculat*a) were available in all the sites, and perceived as cheaper in Bungoma, Nakuru and Mbeere, but expensive in Kajiado and Kilifi, hence affordable. The two legumes have a wider ecological adaptability compared to other legumes. Kilifi area had only two legumes available, which indicates a narrow variety- a threat to food security. In Nakuru, most of the legumes available (except beans) were perceived as very expensive. Green grams (*Vigna radiata*), cowpeas, ground nuts *(Arachis hypogea*) and pigeon peas (*Cajanus cajan*) are not locally produced and their availability may have been influenced by the multi-ethnic population with diverse food preferences compared to other sites where one ethnic group comprise the larger population

From Table 2 (b), Meat from cow, goat and sheep was perceived to be very expensive in all seasons, in Nakuru, Bungoma and Kilifi, . These sites practice more of crop farming than livestock. On the other hand, Kajiado is primarily a livestock keeping agro-ecological zone although meat was perceived to be expensive. The Maasai,of Kajiado being livestock herders (cattle, sheep and goats)- rely only on goat and sheep products (such as the animal's meat and milk and blood). This may have created the demand for meat products, making them expensive. Fish and poultry were the only two animal proteins, perceived to be cheap in Bungoma and Mbeere respectively. For fish it is obtained from Lake Victoria which may not be as sensitive to climate change as other larger livestock. Mbeere being a semi arid area produces a lot of goat meat, which the community prefers to poultry. Hence, low demand for poultry and consequently cheap.

Table 2(b). All Seasons Availability and Affordability of Protein Foods (Legumes, Nuts and Animal Products) in the Local Markets

	Food Affordability (x-Cheap**; xx-**Expensive**; xxx-**Very expensive) **in Study Sites' Markets**													
Proteins Available in all Seasons	**Kajiado**			**Bungoma**			**Nakuru**			**Kilifi**			**Mbeere**	
Legumes, Pulses & Nuts														
Beans		xx		x			x				xx		x	
Green Grams		xx			xx				xxx					xx
Cow Peas		xx			xx				xxx		xx		x	
Ground Nuts		xx			xx				xxx					
Pigeon peas			xx						xxx					xx
Livestock Food Products														
Milk		xx			xx			xx						xx
Meat (Beef, Mutton, Goat)		xx				xxx			xxx			xxx		xx
Fish				x					xxx		xx			xx
Eggs					xx			xx				xxx		xx
Poultry					xx			xx					x	
Ghee			xxx											

ALL SEASONS AVAILABILITY AND AFFORDABILITY OF VEGETABLES AND FRUITS IN THE LOCAL MARKETS

Kenya has many indigenous (both wild and domesticated) and exotic edible vegetables. However, Table 2 (c) below reveals that, a relatively few of those grown are available throughout the year and especially during the dry season. It may be that domestication of these is low due to agricultural systems emphasizing production of exotic varieties. Alternatively, the quantities produced may be too little to reach the local market or lack of methods to preserve them. Similar findings were reported by (Ekesa et al. (2009)[17] in a study on "*Accessibility and Consumption of Indigenous and fruits vegetables in western Kenya*"; and Fukushima et al. (2010)[18] in Kilifi. Cowpea leaves and tomatoes were the most widely available and generally affordable. For Cowpea, *(Vigna unguiculat*a), its availability and popularity can be attributed to its ability to withstand harsh conditions and its yield is always higher than that of the other indigenous vegetables. In addition, its leaves and seeds are used as food. The availability of tomatoes in all counties across seasons is accounted for by the wide adoption of greenhouse farming technology, triggered by unpredictable weather conditions, population growth and reduced acreage 19]. The crop also does well during the dry season under irrigation. Although Mbeere does not produce cabbage, there is constant supply from the neighboring Kirinyaga County, where the vegetable is produced under irrigation throughout the year.

Table 2 (c) further shows that Mango (*Mangifera indica*) was the most widely available and cheap fruit in the main producing sites of Mbeere and Kilifi. Domestication and breeding of the mango in Kenya and the resultant promotion of its production by the Ministry of agriculture has led into extension and increase in production beyond the traditional production areas and season. This coupled with improved marketing, may have contributed to all season and wide availability of the mango. Each site had at least one cheap fruit while the rest were either expensive or very expensive.

Table 2(c). All Seasons Availability and Affordability of Vegetables and Fruits in the Local Markets

	Food Affordability (x-Cheap**; xx-**Expensive**; xx-**Very expensive**) in Study Sites Markets**														
Vegetables Available in all Seasons	**Kajiado**			**Bungoma**			**Nakuru**			**Kilifi**			**Mbeere**		
Kale			xxx				x				xx				xxx
Cabbages							x					xxx			xxx
Cowpea leaves		xx		x							xx		x		
Indigenous vegetables			xxx	x					xxx		xx				
Carrots							x								
Tomatoes	x				xx		x				xx				xxx
Spinach							x				xx				
Pumpkin leaves									xxx		xx		x		
Onions	x						x				xx				xxx
Fruits															
Citrus			xxx					xx		x					x
Pawpaw		xx		x				xx							
Avocado	x				xx		x								xxx
Mango		xx			xx			xx		x			x		
Bananas		xx		x					xxx					xx	

COPING STRATEGIES FOR FOOD INSECURITY

Table 3. Food Management Coping Strategies' for Food Security

	Study Site				
Season /Strategy	**Kajiado**	**Bungoma**	**Nakuru**	**Kilifi**	**Mbeere**
Favorable Season (*Production above Normal)*					
Value addition and preservation of excess food e.g. potatoes and vegetables (Drying cereals pulses, meat); ferment milk; Ghee from milk	x	x	x	x	x
Exchange with other commodities e.g. Maize with Livestock or pottery		x	x		x
Restocking livestock herd	x				
Sell excess food for money		x	x		x
Give to relatives and friends	x				x
Eat more frequently and variety of foods	x				x
Preserve and store at home, excess food for adverse season.	x	x	x	x	x
Normal Season (*Normal production due to timely onset and cessation of rain and normal distribution for the site)*					
Eat usual number of meals and buy extra	x		x		x
Eat any available food			x		x
Cereal banks – (Keep some produce with millers and use by piece meal)		x	x		
Adverse Season (*Production below average due to rainfall below or above normal or delayed onset or both**)*					
Share available food and Livestock with neighbors & relatives (Part of the culture)	x			x	
Priority Feeding given to Children & elderly		x			x
Generosity & reciprocity	x				
Food diversification (do not stick to traditional diets)	x		x		x
Food rationing (eat fewer and less amount of meals per day)	x	x	x	x	x
Reduce variety in meals consumed	x	x	x	x	x

To cope with the increasing food insecurity arising from climate change, farmers have devised food management strategies that have enabled them to survive periodic and/or chronic food scarcity situations, as shown on Table 3:

During a favorable season, common strategies to all sites included value addition, preservation and storage of excess food, for use during an adverse season. Kajiado, the only site with pure pastoralism system, restocked the livestock herd.

In a normal season, Nakuru and Bungoma were the only sites that adopted the strategy of cereal banks where the farmers deposit a proportion of their cereal harvests with millers, and use in piece meal. These sites produce relatively high amounts of cereals and there are relatively high number of local millers who provide a market and store for cereals.

In an adverse season, food rationing (reduce portion sizes) and reduction of variety of foods in a single meal were key coping strategies. The other option was food diversification (eat any food available) while sharing of available food through generosity and reciprocity was only unique for Kajiado. This was due to the community's cultural orientation of collectivism.

4 CONCLUSION AND RECOMMENDATIONS

Smallholder farmers were aware of climate change and its indicators in Kenya. Some indicators were common while others were specific to the Agro-Ecological System. They also appreciated that climate change has resulted into decreased agricultural production leading to reduced food availability and affordability. Every site had food categories required to meet dietary needs for an active and healthy life but the general perception of food affordability was that, most of the foods were expensive. Climate change and variability therefore, affects food security in all Agro- ecological systems of Kenya, regardless of the agricultural potential, an indication that the objective of achieving food security for all Kenyans may still remain an elusive goal. In an attempt to cope with food insecurity, smallholder farmers in the different Agro-Ecological Systems basically responded with the same food management strategies with slight variations originating from culture and level of production.

The researchers recommended that:

1. The Kenya government should upgrade the knowledge and skills of Agricultural and health extension workers to include household food processing and proper methods of food storage, who in turn will train smallholder farmers on the same. This may help to curb fluctuations in food supply and the resultant food insecurity due to high food prices.
2. The Kenya government, donors and other stakeholders in Agriculture and food security should extend their financing to local community millers to enable them build appropriate storage facilities especially in the Highland Medium Potential Crop/ livestock and Lake Basin High Potential Crop/Livestock Agro-ecosystems of Nakuru and Bungoma respectively, where cereal banking is a major food management strategy. However, local insurance agencies should provide insurance schemes for community-based millers to cushion them against losses from fire, thefts and environmental hazards.

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Endometrial Adenocarcinoma in a 26-year-old Woman: A case report

Boutaina Lachiri, Ikram Lazrak, Abdoullahi Ibrahim, Jaouad Kouach, Driss Moussaoui, and Mohammed Dehayni

Department of Gynecology-Obstetric, Military Training Hospital Med V, Rabat, Morocco

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ABSTRACT: Endometrial adenocarcinoma usually occurs after menopause. This tumor is extremely rare in women younger than 30 years. Its treatment includes hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy and in same cases, radiotherapy. We report a case of endometrial Adenocarcinoma in a 26-year-old patient. Through this case the authors emphasize the need of endometrial evaluation in young females with abnormal bleeding before starting any medical treatment. Specific problems of endometrial cancer at young age include delay in diagnosis, difficulty in pathologic interpretation of the curetting tissues and the motivation of most patients to preserve their fertility.

KEYWORDS: Endometrial adenocarcinoma; young women; Risk factors; prognosis; treatment.

1 INTRODUCTION

Endometrial adenocarcinoma is predominantly a disease of postmenopausal ladies. However, in 2%–14% of cases, it occurs in young women (less than 40 years old) [1,2]. Especially in women younger than 30 years, the disease is extremely rare. Younger patients present with clinical challenges as far as treatment options are concerned because with standard surgical treatment there is a risk to develop severe complications, which include loss of fertility and surgical menopause. Compared with older women, young women have a similar stage distribution at diagnosis, the majority of cancers presenting as stage I and usually have a good prognosis.

We report the case of a 26-year-old patient with an endometrial cancer diagnosed at Stage IA grade 1 according to the FIGO (International Federation of Gynecology and Obstetrics) 2000 classification of endometrial cancer [3].

2 CASE

A 26-year-old nulligravidia, 1,60 in height, weighing 55 Kg was first presented to her local hospital with 10 months of menorrhagia. She was non-smoker and she had not been taking any hormone treatment or oral contraceptives. Her menstrual period was normal. Neither she, nor any other member of her family had diabetes or hypertension. A transvaginal ultrasound showed uterine fibroid making 6 x 5 cm with submucosal component and a thick endometrium of 18 mm. The ovaries were normal. A recent cervical smear test had been negative. The patient underwent myomectomy by laparotomy. The histopathologic examination revealed a well-differentiated endometrial adenocarcinoma stage IA grade 1 according to the FIGO without myometrial invasion on the resected portion of the myometrium. The patient was then referred to our hospital for further treatment. Physical examination revealed a healthy-looking non-obese female. Pelvic examination was normal and a transvaginal ultrasound revealed a normal size uterus with an endometrium 10 mm in thickness. During the extent's assessment, a MRI scan hasn't objectified anomalies. The other abdominal organs were lesion-free. The surgeon and oncologist decided that patient should undergo surgery. Patient underwent a total hysterectomy with bilateral salpingo-oophorectomy and pelvic lymph-adenectomy. Histopathological examination of the operated specimen revealed no residual tumor or lymph node involvement. The surgery was followed by vaginal curietherapy. She remains well with no evidence of recurrence at 12 months following her operation.

Corresponding Author: Boutaina Lachiri

3 DISCUSSION

Carcinoma of the endometrium is among the most common gynecological malignancies of female genital tract and accounts for 6% of all cancers in women and 2% of cancer deaths. It is primarily a disease of menopausal and postmenopausal females with the peak incidence in women aged 55-65 years. Approximately 75% of patients are aged 50 years and older and only 5% are younger than 40 years. It is rare below the age of 30 years [4].

This case illustrate that adenocarcinoma of the endometrium can occur in young females despite the fact that the disease mainly affects postmenopausal women. It was presented in our case with abnormal vaginal bleeding which posed diagnostic dilemmas, as at this age dysfunctional bleeding is much more likely.

The most reported risk factors of endometrial cancer are anovular cycles associated with polycystic ovarian syndrome (PCOS), hypertension, diabetes, obesity, the sole use of estrogens and the use of tamoxifen [5]. Several authors [6,7-10] have tried to individualize the risk factors of endometrial adenocarcinoma related specifically to women under 40 years. Younger patients with endometrial carcinoma tend to have a history of estrogen use or hormone-related disorders such ovarian dysfunction, chronic anovulation, infertility, obesity and PCOS (odds ratio: 3.1; 95% confidence interval: 1.1–7.3) [8]. Our patient had no one of theses risk factors.

Bokhman has proposed the theory of two pathogenic types of endometrial cancer: estrogen-dependent and -independent [11]. The first type is more common in women with obesity, hyperlipidemia and signs of hyperestrogenism such as anovulatory uterine bleeding, infertility and hyperplasia of the stroma of the ovaries and endometrium. Conversion of adrenal androstenendione to estrone in the adipose tissue is responsible for the higher estrogen levels in obese women. Additionally these women have lower levels of sex-hormone-binding globulin, which in turn leads to a greater bioavailability of estrogens, which contribute to the pathogenesis of endometrial carcinoma. In these cases cancer is usually low grade with little, if any, myometrial invasion with a favorable prognosis. The second type occurs in women who have no evidence of hyperestrogenism and is usually poorly differentiated, deeply invasive with an unfavorable prognosis. It seems that more the woman is young, the more likely the cancer to be estrogen-dependent.

The most important prognosis factors of endometrial adenocarcinomas are the histological grade, the cancer stage and the myometrial invasion. This gives rise to the question whether there are specific prognosis factors in young women with endometrial cancer. According to the studies of Evans-Metcalf et al [12] and Fahri et al [9], it seems that the frequency of Grade 1 tumors was higher in young women, reaching 90%. Another study [8] reports a myometrial invasion rate that was more than 50% lower in young women (24% vs. 49% in older women). Two studies [12,13] have shown that the association of endometrial adenocarcinoma with ovarian one seems to be more frequent in younger women than older ones (29% vs. 4.6%).

The optimal therapy in young patients with endometrial cancer still remains controversial. The dilemma arises of whether to recommend medical management or definitive surgery.

Definitive surgery is the classic treatment for endometrial cancer. It consists of total hysterectomy and bilateral salpingo-oophorectomy, with a pelvic and aortic lymphadenectomy if required. Curietherapy and radiotherapy are indicated when there is a high risk of recurrence. The young women affected by endometrial cancer are often nulliparous with a past history of infertility and thus are very anxious to preserve their fertility. This constitutes a dilemma for the patients as well as their physicians.

Some authors [14,15] have proposed repeated endometrial curettages or hysteroscopic resection of cancerized polyps; however, most conservative treatments are inspired by the hormone-dependence of endometrial adenocarcinomas. In general, the effect of progestins is considered to be mediated through progesterone receptor (PR), because the response rate to progestins in PR-positive carcinoma was higher (70%) compared with PR-negative tumors (16%) [16,17]. It has recently been shown that they express Gn-RH (Gonadotropin-Releasing Hormone) receptors [18], which implies that progestins and Gn-RH agonists are the most useful medicines in the framework of conservative treatment of endometrial cancer (Stage I, Grade 1).

A case of successful pregnancy after conservative surgery for stage IA endometrial cancer was reported in a 33-year-old woman who was diagnosed with stage IA endometrial cancer and had benefited from conservative surgery with chemotherapy [19]. However, given the risk of recurrence or the development of metastasis and the need for rigorous followed, our patient has chosen the definitive surgery.

According to the international literature, it appears that the most important factor for conservative treatment is selecting the “ideal patient” [20]. That is:

- a well-differentiated endometrial carcinoma that does not deeply invade the myometrium,
- absence of suspicious pelvic or pre-aortic nodes.
- absence of synchronous ovarian tumors,
- no contraindications for medical treatment,
- the patient understands and accepts that this is not a standard treatment,
- the patient should show her desire to complete the follow-up protocol.

4 CONCLUSION

The diagnosis of endometrial cancer in young, premenopausal females may present the patient and the physician with question of conservative management or ovarian preservation. Standard treatment for these patients includes hysterectomy with bilateral salpingo-oophorectomy [21]. A conservative treatment for endometrial carcinoma at Stage IA with a low histological grade is possible if a complete pre-therapeutic assessment is achieved and if a rigorous follow-up during and after the treatment is pursued. But, it should be kept in mind that every delay in implementing radical treatment can increase the rate of recurrence or the development of metastasis, which will systematically worsen the prognosis. Radical treatment should be indicated as soon as the desire to carry a pregnancy to term is fulfilled.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest related to this article.

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Power Generation from Alternative Resources with Highest Efficient Device and Control System Reducing Carbon Emission at Lowest Cost: A Simple Plan on hybrid system that supports one another, one step closer to smart power generation system

S.M. Hasibul Hoq, Asif Mahmood Abbas, and Mohsin ahmed

Department of Electrical and Computer Engineering,
North South University (NSU),
Dhaka, Bangladesh

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ABSTRACT: Today's world is very competitive in the field of technological invention. Power generation sector is one of the major sectors in these competitive fields; many researches are undergoing to develop this field to a more and more efficient one. Today's power generation are mostly dependent on non renewable resource, which is why power generation cost is higher, have negative environmental impact, less resources to develop new techniques etc. Considering above facts, we are proposing something different methodology that will replace all these existing difficulties. We design the whole system with generation unit, control unit, storage unit, and distribution unit. An ultra modern solar array device, smallest in size will give so far the highest efficiency. Even little sunlight temperature is enough to get optimum output voltage. We develop a hybrid system including wind turbine unit and fuel cell unit that will give support one another in case of failure. Each unit is independent but all are interdependent in case of emergencies and integrated all way to the existing power system. Our control system is very advance to handle each unit. Overall the whole system will reduce carbon emission, dependency on non renewable source and settle down power sector to a sustainable one. Further discussion of technical terms on each unit, and engineering economics and management in each unit, is discussed throughout the paper.

KEYWORDS: resources, electricity, solar cell, efficiency, hybrid system, controller, grid integration, carbon emission, cost effectiveness, environmental impact.

1 INTRODUCTION

No matter what technology we develop, there is always a question raise, "Is the technology environmental friendly, sustainable, affordable, and reliable one?" Scientist, Engineers, Researcher often have to find solution through these questions. The world day by day face an increasing challenges when it comes to the term of electricity generation using alternative resources. Independent studies show us that technological growth rate is much higher than practical implementation of them. This is due to national budget failure, internal corruption, implementation place shortage, higher cost compare to efficiency. So this is a big challenge for us to build technology in a sustainable, affordable, reliable way. Here we discuss solutions on existing difficulties, so that we can reach to a smart power generation.

2 POWER SECTOR SCENARIOS

Most of the bulk power generation systems are based on non-renewable sources. That's why we see a huge environmental degradation over last few decades. Switching to alternative resources has become mandatory for the upcoming days. Statistics show us that only 16% of global final energy consumption comes from renewable energy of which

Corresponding Author: S.M. Hasibul Hoq

2.8% from solar, wind and other renewable sources. This percentage is below our expectation due to lack of innovation in our technology.

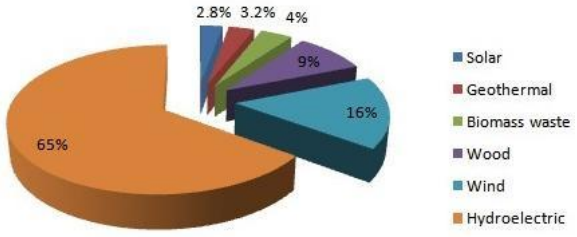


Figure 1: Renewable contribution worldwide 2010.

We see that the lowest percentage is from solar energy. Still we need to put a lot of contribution to increase solar electricity production **[3, 42]**.

3 WORLDWIDE PLAN

Every country, both government and private sectors are planning to meet electricity crisis and ensure mass electricity within 2030. In fact government encourages other private sectors, to come together to meet this goal successfully. A statistics of 2009 says that 79% of the people in the third world, almost 50 poorest nations have no access of electricity even 1.5 billion of world's population have no access of electricity **[1, 2, 3]**.

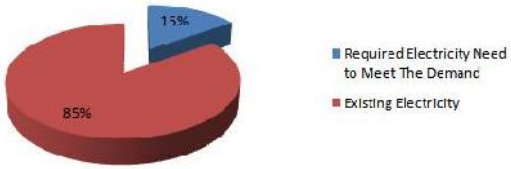


Figure 2: Required power that can be replaced by Alternative source

4 SOLAR ENERGY STATISTICS AND MODELING

We don’t get constant rate of radiation due to earth's rotation and climate changes. Statistics show us average insolation (KWh/m^2/day) of sunlight in our country, also daytime sunlight availability **[5] [7]**.

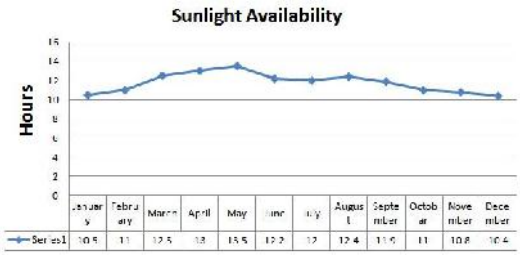


Figure 3: Sunlight duration.

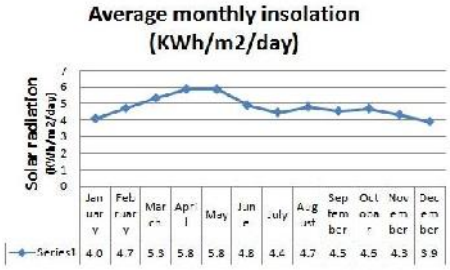


Figure 4: Average sunlight insolation.

There are different kinds of solar cell technology available and here we propose four junction solar cells technology for our solar unit. Basically it's a four junction solar cell that allows sun light to radiate on it with maximum concentration using concentrated photovoltaic technology with updated sunlight tracking and control system **[10]**. The device use wafer bonding as packaging technology on materials of III-V semiconductors to connect two semiconductor crystal at each steps, otherwise it cannot be produced as high quality crystal due to their structure **[11]**. A single sub cells absorb different wavelength ranges of the solar spectrum and produce potential difference at each layer that initiate current (known as dark current according to quantum physics. As efficiency is almost double than conventional outcome, so grid integration of the overall system is much easier in case of mass electricity generation rather than small backup system **[12]**. Let us show a cell wise output graph of this solar cell.

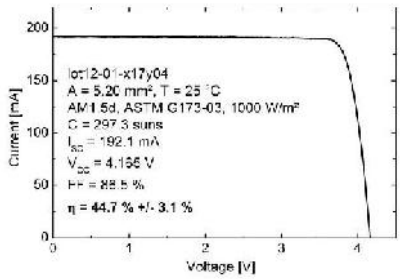


Figure 5: Output response of a single solar cell.

*Source: Fraunhofer Institute for Solar Energy System **[10]***

When sunlight hit cell, it becomes able to take different suitable wavelength due to dispersion of sunlight into different wavelength because of its unique structure. At each junction layer it creates voltage difference and that produce current, overall in one directional current. We can calculate theoretically using quantum physics current vs. voltage equations **[11, 43].**

5 WIND ENERGY STATISTICS AND MODELING

Wind energy system generally converts the wind's kinetic energy into mechanical or electrical energy. From this basic understanding we can get the energy flow rate of wind power which is an equation of energy flow rate per unit area proportional to thrice of the air velocity **[8, 9]**. Another statistics says 5KW generating capacity of wind turbine is good enough on an average for home usage **[6]**. Our independent research suggests the horizontal axis wind turbine for their easy appliance and to achieve the maximum efficiency of 59% to 70% for small house to large wind turbine field especially in the forest area using that fundamental concept; as velocity is multiplied by thrice itself. On an average 10 to 25 feet in diameter rotors stands upwards of 30 feet can supply power for home and small business and they can supply below 50KW. In wind turbine field the size varies depending on the geographical areas. And if we consider the above mentioned things, then we can utilize even small resource available to setup wind firm to produce electricity **[20, 21]**. Let us show an area wise wind speed over a half decade on a particular area.

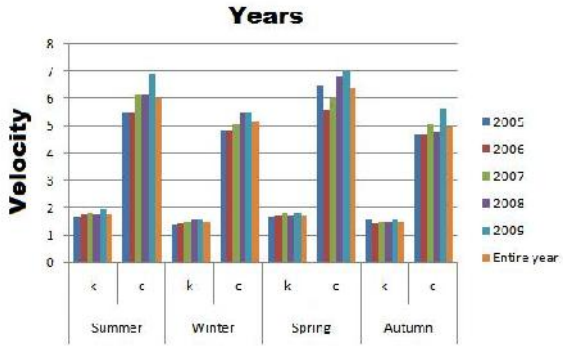


Figure 7: Seasonal shape parameters, standard Deviation (k) and scale parameters, c (m/s) X-Axis and Y-axis-velocity.

*Source: Data collected, wind velocity analysis **[16]***

(2005-2009) WIND SPEED

By properly utilizing these data and through this proposed structure, we can extract significant amount of output.

6 FUEL CELL ANALYSIS AND MODELING

One of one greatest advantage of fuel cell technology is that fuel cells are not limited by Carnot efficiency because of their galvanic nature device. Worldwide in this field, more and more researches are undergoing. Based on our independent study we propose to our overall system, a fuel cell unit that will support the overall power system dynamically depending on control system. Statistics say that fuel cell works more than 85% efficiently comparing to the conventional generator. Based on electrolyte compositions and how efficiently the device can be modeled and integrated each cell, are the factors that define efficiency. In our research, we find that there are many electrolyte compositions like Proton exchange membrane fuel cell, Phosphoric acid fuel cell, Molten carbonate fuel cell, Solid oxide fuel cell. Of them molten carbonate fuel cell has the highest efficiency but we proposed here the Solid oxide fuel cell considering low carbon emission and other facts; also here efficiency is good enough, almost 45% to 55% **[8, 18, 19]**. We get our electrolyte composition using renewable fuels and use it repeatedly as a means of renewable **[22, 23, 24].**

7 CONTROL UNIT

The control unit is the most important part of this proposed technology. Through this unit all the power generating units including conventional units are integrated and communicated each other, to meet the peak demand. In control unit a real time monitoring system is employed, so that if there is any real time fault or over load fault will be monitored before any disturbance occurs, and our hybrid units all together tackle that future fault, future prediction. The whole area, say country; will be divided into many sub area and generation, control, storage and distribution units will be there for each respective area for greater benefits of maintenance. Accompanied with conventional power generation units all together this hybrid system reduces dependency of non-renewable based power plants and easy to handle power distribution as per required. Through this control system transmission and distribution even generation loss will be reduced almost half of the cost as anticipated through engineering economics concept **[25-27, 33-35, 39, 40]**.

8 STORAGE & DISTRIBUTION UNIT

In this unit there will be several electrical energy storage devices, and they will be integrated so that it can store more change in a parallel connection. Our goal is to grid integration of the whole system so that the cost will be lower as usual and that is why we use grid tie inverter for the grid integration purpose**[17]** .Through distribution units, controlled by control section, we can efficiently distributed our generated power as per required through automation. Though Smart grid system is still just a concept but through this proposed technology and management system, we can precede one step closer to smart system. For our modeling purpose, here we designed just solar cell unit's grid integration process and we skipped the control unit for easy understanding of this unit **[25-35]**.

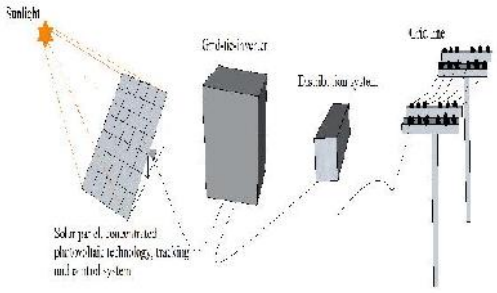


Figure 8: Grid line integration using a grid-tie-Inverter simple block diagram of only one Unit of the whole system. (Independent research i.e. google.com, [13])

Source: Independent research (photo credit self)

9 IMPLEMENTATION

As each unit is renewable resource based, so place selection for implementing these units is a big issue. The solution is not that straight forward. We have to go through a little bit analysis on some facts like solar insolation rate, sunlight availability, wind availability and other matters. We have to analyze statistical data for example for a particular region like mentioned before, to reach to a proper reliable solution to implement this hybrid system economically, efficiently in a long term basis and sustainable way. As electrical power transmission is done by transmission wire, so there is a great possibility of power loss at each unit, and to tackle this loss our control system unit plays an important role, that reduces the power loss, maintain power flow and transfer as per required **[36-38]**.

10 EFFECTS

The major advantage of this whole system is that, the each unit works independently and it's a dynamic system that supports continuously each other and in case of failure of any unit, the storage unit starts contributing to supply through control system by automation, to ensure the continuous flow of electricity. And through engineering economics concepts the implementation cost and other cost will turn into benefits, within half of a decade as extension of both the consumer surplus and producer surplus. Further research on engineering management to afford the implementation cost is undergoing.

11 CONCLUSION

This paper is based on many dependent or independent studies, done over time. Through innovation, we are able to choose selective technologies, methodologies and management system by doing researches and studies, to extend the electric power system to a most sustainable and reliable stage. We analyzed our present scenario of power sector, and gradually we develop a simple practical solution. Further extension on this proposed plan is still undergoing, and very soon this may reach us to a smart power generation in the long run.

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Constraints on Tunisian Arabic Epenthesis

Mounir Jouini

Higher Institute of Languages of Nabeul
University of Carthage
Tunisia

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ABSTRACT: The aim of this paper is twofold. First, it studies the epenthesis of [ɪ] in Tunisian Arabic (TA) in different environments (C+CC and V:C+C), where it focuses on the way the exact site of the epenthetic vowel is determined (e.g. C+CC > CvCC rather than CCvC). It shows that the reason why a CCC cluster is broken into CvCC rather than CCvC owes to the preference of TA to violate juncture contiguity instead of domain contiguity. This discussion is fully set within Optimality Theory and related sub-theories such as Generalized Alignment and Correspondence Theory. Second, the paper argues that the syllable formed by the epenthetic vowel (CvC) should be added to the TA syllable inventory as a separate syllable type. The evidence comes from stress assignment and shows that the syllable, despite its having a CVC shape, has to be considered as light. This subsequent discussion is set within moraic theory and adopts the technique of mora-sharing in order to satisfy both requirements of monomoraic weight and coda moraicity following the principle of Weight-by-Position. By doing so, it solves the long-standing problem of how to interpret the stress shift in derivatives such as [ˈtik.tib] (*you write*) and [tik.ˈtib] (*it was written*).

KEYWORDS: Epenthesis site, Relativized Contiguity, mora-sharing, new TA syllable type, stress shift.

1 INTRODUCTION

Within the Theory of Constraints and Repair Strategies [1], epenthesis is interpreted as a repair strategy that is triggered when an ill-formed structure is to surface. Within Optimality Theory (OT), it refers to an output candidate with an extra segment that has no correspondent in the input form. OT [2] is constructed entirely out of constraints. It holds that at the heart of grammar there are constraints rather than rules. Optimal linguistic forms are the outcome of a harmonic evaluation of different output candidates against a set of hierarchically ranked constraints, with the constraints at the top of the hierarchy overpowering the ones below them. Accordingly, since epenthesis is a necessary operation that languages resort to in order to block the formation of marked structures, this means that some well-formedness (or markedness) constraints are ranked higher than the faithfulness (or correspondence) constraints that militate against the insertion of segments. For instance, TA has a constraint against initial triconsonantal clusters. Whenever such a sequence is to be formed as a result of morphological concatenation, an epenthetic [ɪ] breaks it into CvCC (where the lower-case v indicates the epenthetic vowel as opposed to the upper-case V which represents full vowels). The result is a violation of DEPENDENCE, the constraint that militates against output segments having no correspondents in the input form. Crucial enough is the exact locus of the epenthetic vowel, which is determined by the relative ranking of two constraints of the CONTIGUITY family, namely DOMAIN-CONTIGUITY and JUNCTURE-CONTIGUITY [3]. TA prefers to rank the former constraint higher.

One of the interesting discussions raised in this paper is the status of the epenthetic vowel. Contrary to [4], the argument is made here that the syllable with the epenthetic vowel is moraic, yet it shares a mora with the following coda in accordance with the general phonology of TA, which favors codas to be moraic and to participate in syllabic weight. Accordingly, following the rule of Adjunction-to-mora [5], one mora will dominate the epenthetic vowel and the following coda (that is the second consonant in a CCC cluster). The fact that the syllable is never stressed does not owe to nonmoraicity but rather to the general observation that TA never stresses monomoraic syllables. One of the most telling examples in this respect is

the passive form [tɪkˈla] (*it was eaten*) where stress, which is generally penultimate in TA, falls onto a CV ultima at the expense of the penultimate CvC. This is explained below as a case of a forced violation of NONFINALITY in order to satisfy the higher ranking Weight-to-stress Principle (WSP).

2 EPENTHESIS IN CCC CLUSTERS

Like the other Maghrebi dialects of Arabic, TA is subject to the high ranking constraint REDUCE [6], which is responsible for syncope, among its other effects. Syncope drops short vowels in open syllables, leaving behind the many observable complex margins. TA, allows a maximum of two consonants at word edges and up to three word-medially. The data in table 1. illustrate this observation.

Table 1. TA clusters across the word

Word-initial clusters		Word-medial clusters		Word-final clusters	
ktib	*he wrote*	yiktbu	*they write*	ktibt	*I/you wrote*
žmaʕ	*he gathered*	tažmʕu	*you (pl) gather*	žmaʕt	*I/you gathered*
ʕmal	*he did*	naʕmlu	*we do*	ʕmalt	*I did*

The CCC clusters in column two above are permissible only word-medially. The reason they do occur in such constructions is because they are not tautosyllabic. Their consonants are rather shared between the syllable on the left and the one on the right. When a triconsonantal cluster is to occur at word edges as a result of concatenation, epenthesis is triggered. The data in table 2. below show how the concatenation of the passive formative /t/ to the left of a CC-initial stem calls for [ɪ] insertion.

Table 2. Epenthesis with the passive formative

C-initial stems				CC-initial stems			
šaaf	*he saw*	**tšaaf**	*it was seen*	kti	*he wrote*	**tɪktib**	*it was written*
qaal	*he said*	**tqaal**	*it was said*	kla	*he ate*	**tɪkla**	*it was eaten*
kassar	*he broke*	**tkassar**	*it was broken*	ʕmal	*he did*	**tɪʕmal**	*it was done*

When the passive formative attaches to the verbs in column 1, it creates a CC sequence that is tolerated word-initially, but when it attaches to the ones in column 2, it forms an impermissible CCC onset that triggers epenthesis. Within OT, the fact that the candidate with an extra segment is selected as optimal means that the constraint hierarchy has a markedness constraint against initial CCC clusters that is ranked higher than correspondence constraints against insertion. This constraint conflict is summarized as follows. First, there is the constraint *COMPLEX [2], which bans syllable nodes to branch. With regard to the onset position, this constraint requires that only one consonant be present under the onset node. Knowing that "all consequences of constraints are also constraints" [7], constraints on consonant sequences are also posited.

Table 3. Constraints on TA clusters

Constraint name		Argument
*COMPLEX	[2]	No more than one C or V may associate to any syllable position node
$*_{\sigma}$[CC	[8]	Onsets are simple
$*_{\sigma}$[CCC		Triconsonantal onsets are not allowed

The first two constraints above have the same argument. They both require that onsets be simple. The third constraint is designed following [8]. It is true that a constraint such as *CCC appeared in the literature as early as 1970, with the study of Yawelmani [9], and that within OT, such a constraint is used in works such as [10], [11], and [12], yet it is not deemed satisfactory for the present analysis. The reason is that CCC clusters are allowed in TA (word-medially as shown above), and such a constraint bans all CCC sequences. However, the constraint $*_{\sigma}$[CCC immediately states that the banned structure is a CCC sequence that occurs word-initially. This constraint ranks higher than the correspondence constraints MAXIMALITY (MAX)

and DEPENDENCE (DEP) [13]. MAX requires input segments to be realized in the output form. The reason is that he CCC problem could be solved by the deletion of one of the consonants to render it CC, which is a permissible initial sequence. This is not a possible solution in TA, since the system makes resort to epenthesis to break the cluster. The epenthetic vowel has no correspondent in the input form, thus it violates DEP. TA prefers to epenthesize a vowel rather than to delete a consonant, or in other terms, it prefers to violate DEP rather than MAX. Accordingly MAX ranks higher than DEP but lower than $*_{\sigma}$[CCC.

Table 4. Constraint tableau: $*_{\sigma}$[CCC >>MAX>>DEP

/CCC/	$*_{\sigma}$[CCC	MAX	DEP
a. [CCC]	*!		
b. [CC]		*!	
c. [CICIC]			*!*
d. ? [CICC]			*
e. ? [CCIC]			*

The tableau above shows that other constraints are needed to account for [I]-epenthesis in TA. Candidate (a) is immediately ruled out because it violates the high-ranking constraint $*_{\sigma}$[CCC. Candidate (b) attempts to satisfy $*_{\sigma}$[CCC by deleting one consonant of the cluster, thus fatally violating MAX. The rest of the candidates violate DEP. Candidate (c) is eliminated because it incurs two violation by epenthesizing two vowels (interpreted as gradient rather than categorical, DEP indirectly minimizes epenthesis). The problem arises with candidates (d) and (e) which tie, since they both epenthesize only one vowel, but differ as to the exact locus; between C_1 and C_2 or between C_2 and C_3. This issue can be solved by two constraints of the CONTIGUITY family. Reference [3] uses constraints of this family to account for epenthesis in two groups of Arabic dialects, which he terms the Cairene group and the Iraqi group.

Table 5. Epenthesis in the Cairene and Iraqi groups

Cairene Arabic			**Iraqi Arabic**		
VC#	ka.tab	*he wrote*	VC#	ki.tab	*he wrote*
VC**C+C**	ka.tab**.t***i***.l**u	*I wrote to him*	VC**C+C**	ki.ta.**b***i***t**.la	*I wrote to her*
VC**C#C**	ka.tab.**t***i*. **g**a.waab	*I wrote a letter*	VC**C#C**	ki.ta.**b***i***t**. mak.tuub	*I wrote a letter*

The two dialects of Arabic break the triconsonantal cluster in different ways. In the Cairene group the epenthetic vowel is inserted between the second and the third consonants (CCC → CCiC), while in the Iraqi group it is inserted between the first and the second consonants (CCC → CiCC). The more important generalization is that contiguity is violated in different ways: in Cairene it is violated between morphemes (-btl- > -btil-), while in Iraqi it is violated within tautomorphemic segments (-btl- > -bitl-). Within the theory of *Relativized Contiguity* [3] it is suggested that contiguity constraints be relativized to prosodic domains, such as the syllable, the foot, and the prosodic word. Two of these constraints will account for the difference in the locus of epenthesis.

Table 6. Contiguity constraints

	Constraint name	**Constraint argument**
General schema	Output-CONTIGUITY (O-CONTIG) [2]	The portion of S_2 standing in correspondence forms a contiguous string. Range (R) is a single contiguous string in S_1.
Relativized contiguity	DOMAIN CONTIGUITY (D-CONTIG) [3]	Contiguity between correspondents within a domain D: For some domain D within S_2, all correspondents αβ in D must be contiguous. Where D = {Syllable, Foot, PrWd, etc.}
	JUNCTURE CONTIGUITY (J-CONTIG) [3]	Contiguity between correspondents across identical domains:For two identical domains D and D_{+1} in S_2, where β is the final correspondent in D and α is the first correspondent in D_{+1}, α and β must be contiguous. Where D = {Syllable, Foot, PrWd, etc.}

The relevant domain D for epenthesis here is the syllable. Epenthesizing [ɪ] within a syllable violates D-CONTIG, while epenthesizing it between syllables violates J-CONTIG. The relative ranking of the two constraints relies on whether a given language prefers the structure CvCC or CCvC. Accordingly, CvCC is derived by the ranking J-CONTIG>> D-CONTIG, while CCvC follows from the ranking D-CONTIG>> J-CONTIG. TA obviously prefers to violate J-CONTIG rather than D-CONTIG, since it breaks the CCC cluster into CɪCC. This accounts for the choice of, for instance, [tɪkla]over *[tkɪla](from /t+kla/ (3rd masc. sg. + passive + eat). The hierarchy developed earlier proves to work except for the locus of epenthesis, which is now determined by the relative ranking of the two contiguity constraints. The complete hierarchy is given in table 7 below, along with two additional constraints. The first cares for the realization of morphemic segments and the second governs the alignment of the prefix /t/ with the left edge of the stem. Both constraints rank high alongside *[$_{\sigma}$CCC as any violation of either one of them is fatal.

Table 7. Additional constraints and final constraint hierarchy

Additional constraints	REALIZE-MORPHEME (RM) [14]	Morphemes in the underlying representation must receive some phonological exponence on the surface
	ALIGN AFFIX(ALIGN-AFF)	The edge of an affix and the edge of a stem must coincide PREF|$_{\omega}$ and $_{\omega}$|SUFF
Constraint hierarchy	*[$_{\sigma}$CCC; RM; ALIGN-AFF >> MAX >> D- CONTIG >> J-CONTIG >> DEP	

This hierarchy correctly predicts the site of epenthesis in TA and succeeds in selecting the optimal output. The tableaux below illustrate the constraint interaction with regard to [tɪktib] (*it was written*) from the input /t+ktib/ and [tɪkla](*it was eaten*) from /t+kla/.

Table 8. *Constraint tableau*: /ktib/, t|$_{\omega}$→[tɪktib]

/ktib/, t|$_{\omega}$	*[$_{\sigma}$CCC	RM	ALLIGN-AFF	MAX	D-CONTIG	J-CONTIG	DEP
a. [tktib]	*!						
b. [ktib]		*!		*			
c. [ktibt]			*!				
d. [tkib]				*!			
e. [tkɪtib]					*!		*
f.☞[tɪktib]						*	

Table 9. *Constraint tableau*: /klaa/, t|$_{\omega}$→[tɪkla]

/klaa/, t|$_{\omega}$	*[$_{\sigma}$CCC	RM	ALLIGN-AFF	MAX	D- CONTIG	J-CONTIG	DEP
a [tkla]	*!						
b. [kla]		*!		*			
c. [klat]			*!				**
d. [tla]				*!			
e. [tkɪla]					*!		*
f. ☞ [tɪkla]						*	*

The reason why the input vowel in /klaa/ is long and it surfaces as short has to do with the cross-linguistically attested phenomenon of final-vowel shortening. It is of no immediate concern here.

3 EPENTHESIS IN CC CLUSTERS

Contrary to epenthesis in CCC clusters, epenthesis in CC clusters occurs at the right edge of the word. What is interesting is that biconsonantal clusters are generally allowed in TA, whether in onset or in coda position. There is one context that triggers [ɪ]-epenthesis, which is the affixation of the negative affix in TA is /ma__š/. Compare for instance [ma-ktib-š] (*he didn't write*) and [ma-maat-**ɪ**š] (*he didn't die*), or [ma-qraa-š] (*he didn't read*) and [ma-šriit-**ɪ**š] (*I didn't buy*). When the stem

ends in a VC sequence or in a long vowel, the [š]-particle affixation does not call for epenthesis. On the contrary, when the verb ends in a long vowel followed by a consonant TA resorts to [ɪ]-epenthesis to break the impermissible sequence *V:CC [15]. Within OT, this type of epenthesis is dealt with in a straightforward way, by positing a constraint against the impermissible sequence. Just like the constraint against triconsonantal clusters, constraints involving certain sequences of segments are quite common in OT literature. Examples of them are given in table 10 below.

Table 10. Examples of constraints on segmental sequences

Constraint	Constraint argument
*V:C]$_\sigma$	Against long vowels in closed syllables [16]
*V.V	Against vowel hiatus [17]
*VV	Against long vowels [18]
*V:C:	Against a long vowel and geminate consonants being parsed as one syllable [2]
*VVN	Against long vowels followed by nasal codas [8]

None of the constraints above captures the impermissible sequence at hand. I suggest the constraint *V:CC]$_\sigma$, which bans tautosyllabic sequences of a long vowel and two consonants. This constraint is in conflict with the correspondence constraint DEP, which requires the sequence /V:C+C/ to surface with no additional segments. With the ranking *V:CC]$_\sigma$ >>DEP, epenthesis is possible, yet it is not the only solution. Some of the candidate analyses may resort to shortening the vowel to turn the sequence VVC+C into VC+C, which is permissible as in [makt**ibš**] above. Such a sequence will satisfy *V:CC]$_\sigma$, DEP and MAX (since all the segments in the input form and the output form have their respective correspondents). Shortening the input vowel is an instance of violation of IDENTITY (IDENT), a correspondence constraint that militates for the identity between input and output segments in terms of any given feature F, which is in this case the feature [+long]. This constraint has to be ranked above the other correspondence constraints. The required ranking is *V:CC]$_\sigma$>> IDENT >> MAX >> DEP. This hierarchy is illustrated with two tableaux for [ma-ktib-š]and [ma-maat-**ɪ**š]. The first constraint tableau shows that bases that are not concerned with [ɪ]-epenthesis are not affected by the hierarchy. The second tableau shows that the constraint hierarchy functions in a way that epenthesis is the only permissible process to apply; candidates that resort to vowel shortening or deletion incur a fatal violation of the higher ranked constraint IDENT and MAX.

Table 11. Constraint tableau: /ktib/+ ma|$_\omega$+ $_\omega$|š→ [maktibš]

/ktib/; ma|$_\omega$; $_\omega$|š	*V:CC]$_\sigma$	ALIGN-AFF	IDENT	MAX	DEP
a. ☞[maktibš]					
b. [maktibɪš]					*!

Table 12. *Constraint tableau:* /maat/+ ma|$_\omega$+ $_\omega$|š→ [mamaatɪš]

/maat/; ma|$_\omega$; $_\omega$|š	*V:CC]$_\sigma$	ALLIGN-AFF	IDENT	MAX	DEP
a. [mamaatš]	*!				
b. [mamatš]			*!		
c. [mamtɪš]				*!	
d.☞ [mamaatɪš]					*

4 THE CVC SYLLABLE

What is shared among all the syllables formed by the epenthetic [ɪ] is that they are never stressed, whether they are initial or final. A generalization about stress in TA is relevant at this level. TA stresses a heavy penultimate otherwise a superheavy (CVVC or CVCC) ultima. This means that TA does not prefer stress to fall onto the final syllable unless forced by the weight of a final superheavy syllable. In that case, the preferred penultimate stress is sacrificed in order to satisfy the Weight-to-Stress Principle (WSP). Below are examples of different environments of stress in TA. In the third column the derivations comprise the epenthetic vowel.

Table 13. Epenthesis in CC clusters

Penultimate stress	Ultimate stress		Stress and epenthesis	
ˈθaʕ.lab *a fox*	maž.ˈnuun	*crazy*	tɪk.ˈtib	*it was written*
ˈktib.ha *he wrote it*	bar.ˈmažt	*I/you programmed*	tɪk.ˈla	*it was eaten*

Most of TA stress follows columns 1 and 2. The examples under column 3 are very interesting, not only because they are exceptional but also because they exhibit strange patterns of stress that are not attested elsewhere. In [tɪk.ˈtib], stress falls onto the final syllable even though it is not superheavy, and in [tɪk.ˈla] it even falls onto a final (surface) CV and avoids the otherwise preferred penultimate. Furthermore, the penultimate in both forms has a CVC shape, which always attracts stress in the absence of a following superheavy syllable. Interestingly, in TA there is another example that is very similar to [tɪk.ˈtib], which is [ˈtik.tib] (*you write*). Within CV-theory, this pair of words is very problematic, because in both cases the syllabic structure is CVC.CVC. Such a structure wrongly predicts penultimate stress for *[ˈtɪk.tib], as the penultimate syllable is analyzed as bimoraic. Indicating the syllable with the epenthetic vowel as CvC rather than CVC is just for convenience and does not solve the problem, as in both cases there is a C+V+C sequence. CV-theory misses the point that a CvC syllable never attracts stress because of its weight rather than length. Accordingly, the issue is better tackled within moraic theory [19].

The reason why penultimate CvC in [tɪk.ˈla] and [tɪk.ˈtib] never attracts stress is because it is monomoraic. This makes sense, especially when we know that the epenthetic [ɪ] is the shortest vowel in TA with a duration ranging between 20 and 35ms [15]. There are two ways to interpret CvC as monomoraic. The first one is to consider its coda as nonmoraic, thus the mora will dominate the epenthetic vowel only, as shown in Fig. 1.



Fig. 1. Non-moraic codas

Although this representation is possible, and in fact found in a number of systems such as Khalkha Mongolian and Lardil [20], it does not fit into the generalization that Arabic has 'Weight-by-Position' set to '*on*'. That is, if codas are elsewhere moraic, then how would we account for their non-moraicity in CvC syllables. The second alternative, which is followed here, is to adopt the notion of 'mora-sharing' where two segments share one mora ([5], [21], [22], [23], and [24]) in accordance with an Adjunction-to-Mora Rule introduced in [5].

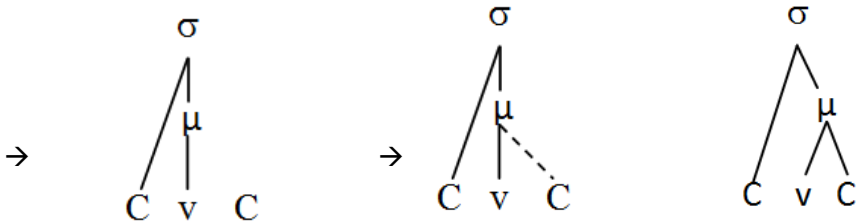


Fig. 2. Adjunction to mora

Interpreting CvC syllables in terms of mora-sharing explains in a straightforward way why they never attract stress. Under Fig. 3 below, there are representations of [tɪk.ˈtib], [ˈtik.tib] and [tɪkˈla].

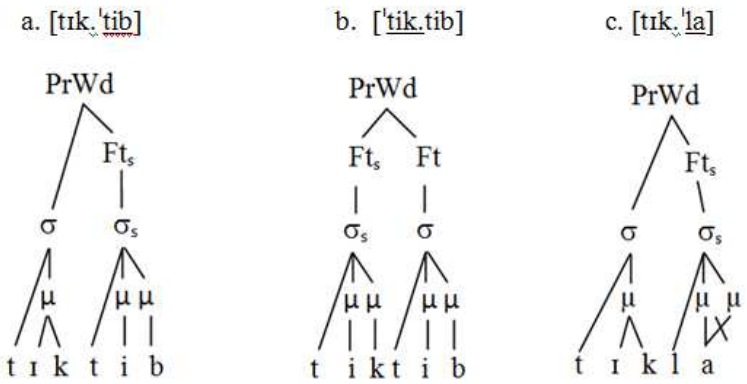


Fig. 3. Stress and monomoraic CvC

In (a), stress falls onto the heavy ultima, as the penult is light. In (b) the initial CVC projects its own foot by virtue of being bimoraic. The final CVC is interpreted as bimoraic in accordance with the representation of [tɪkˈtib]. With two heavy syllables in a sequence, stress prefers to fall onto the penultimate syllable, distinguishing thus between [tɪkˈtib] and [ˈtiktib]. The example under (c), along with all similar passive derivations from CCV stems, is quite strange when it comes to stress. In [tɪk.ˈla], not only is stress final but also it falls onto a CV syllable, while the penult is of the form CvC. The illustration solves the mystery by analyzing the final CV as bimoraic, with a failure to parse the second mora. The preceding CvC is monomoraic, thus unstressable.

Within OT, the interaction between stress and prosodic constituents (mora, syllable, foot, prosodic word, etc.) is captured in terms of constraints. For instance, the fact that the monomoraic CvC never attracts stress reflects the high ranking of the constraint WSP. The fact that TA allows final stress when the word ends in a superheavy syllable means that WSP outranks NONFINality, the constraint that bans final stress. Below, the stress constraints that are *relevant* for the present matter are presented. Following is the ranking argument.

Table 14. Epenthesis in CC clusters

Constraint name	Argument
WEIGHT-TO-STRESS PRINCIPLE (WSP) [2]	Heavy syllables are prominent in foot structure
FOOT BINARITY (FTBIN) [2]	Feet are binary at some level of analysis
PARSE SYLLABLE (PARSE-σ) [25]	Syllables must be footed
NONFINALITY (NONFIN) [2]	No head of PrWd is final in PrWd.

TA prefers to stress a bimoraic syllable, whose presence is guaranteed by the minimal word requirement (PrWd=μμ). Accordingly, WSP will always militate for stressing a bimoraic syllable no matter where it is in the word. It could even be final, and that reflects that WSP outranks NONFIN.FTBIN ranks high, as degenerate feet and ternary feet are banned in TA. PARSE-σ ranks above NONFIN to ensure that syllables are parsed into feet so that NONFIN could evaluate them. Accordingly, the stress hierarchy is WSP; FTBIN >> PARSE-σ >>NONFIN. Combined with the epenthesis hierarchy, it gives the one presented in Fig. 4 below.

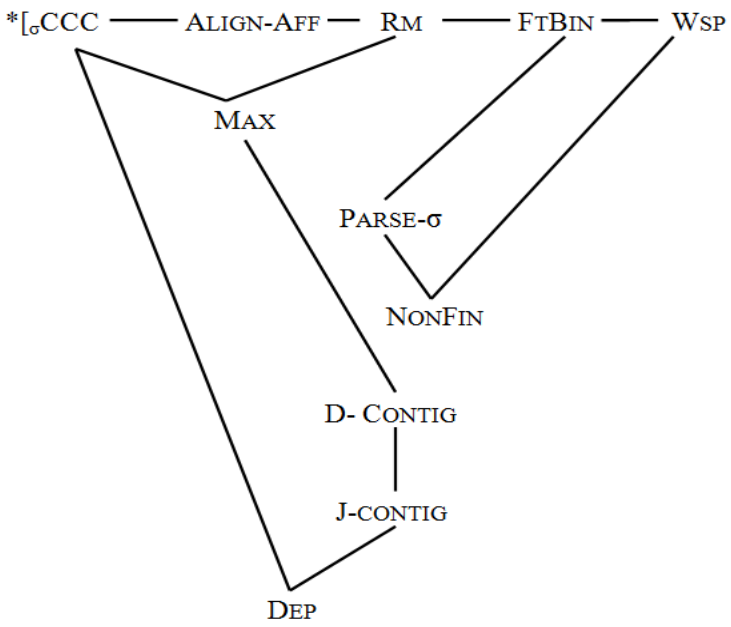


Fig. 4. A combined hierarchy for stress and epenthesis

Constraint tableaux illustrating the distinction between [ˈtik.tib] and [tɪk.ˈtib] are presented under tables 15 and 16. They show how the hierarchy successfully distinguishes between the two forms in terms of stress assignment and syllabification.

Table 15. /ktib/+ t|$_{\omega}$→ [tɪkˈtib] it was written

/ktib/; t|$_{\omega}$	*[$_{\sigma}$CCC	ALLIGN-AFF	RM	FT-BIN	WSP	MAX	PARSE -σ	NON -FIN	D-CONTIG	J-CONTIG	DEP
a. [ˈtktib]	*!							*			
b. [ˈktib]			*!			*		*			
c. [ˈktibt]		*!						*			
d. [ˈtɪk]tib				*!	*		*			*	*
e.☞tɪk[ˈtib]							*	*		*	*

Table 16. /ktib/+ ti|$_{\omega}$→ [ˈtik.tib] you (sg.) write

/ktib/; ti|$_{\omega}$	*[$_{\sigma}$CCC	ALLIGN-AFF	RM	FT-BIN	WSP	MAX	PARSE -σ	NON -FIN	D-CONTIG	J-CONTIG	DEP
a. [ˈtktib]	*!					*$_{(i)}$		*			
b. [ˈktib]			*!			*		*			
c.[ˈktib]ti		*!					*				
d. ti[ˈkib]						*!		*			
e.[tik][ˈtib]								*!			
f.☞ [ˈtik][tib]											

5 CONCLUSION

It has been shown in this paper that TA, like many other systems, resorts to epenthesis to break the impermissible CCC sequences. The exact locus of the epenthetic vowel is governed by the relative ranking of the two contiguity constraints D-CONTIG and J-CONTIG, where it has been argued that TA ranks the former higher than the latter by virtue of prioritizing domain contiguity over juncture contiguity. In other words, it prefers to epenthesize the default [ɪ] between morphemic boundaries rather than domain-internally.

The paper also argued for the need to recognize a new syllable type in the TA syllable inventory, namely the one formed by the epenthetic vowel [ɪ]. This syllable is a monomoraic CvC, where the mora is shared among the nucleic [ɪ] and the following coda, thus satisfying both the required monomoraicity and weight-by-position which is attested in the other syllable types. Among the advantages of the analysis presented here is that it offers a straightforward interpretation of the stress shift in minimal pairs such as [ˈtik.tib] (*you write*) and [tɪk.ˈtib] (*it was written*) by virtue of introducing the monomoraic, hence unstressable, CvC syllable.

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The generalization of using the ICT in the work of the physics teachers in Moroccan schools: Obstacle of training courses and solutions

Khalid Mahdi, Mohammed Chekour, Mohamed Laafou, Rachid Janati Al Idriss, and Mourad Madrane

Laboratoire Interdisciplinaire de Recherche en Ingénierie Pédagogique,
Ecole Normale Supérieure – Tétouan,
Université Abdelmalek ESSAADI,
B.P: 7310, 93030 Tétouan, Maroc

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ABSTRACT: Continuous training courses for the teachers in ICT are essential to integrate it in the practical of teaching. However, teachers in Morocco rarely benefit from continuous training courses, especially in ICT. In this paper, we propose distance learning in ICT based on e-Learning platform. The objective of this distance learning is to generalize the ICT continuous training courses for all the Moroccan teachers of physics sciences. This Training combines by the elements of efficiency effectiveness and flexibility, because our distance learning use some approaches that allow each teacher to preplan their learning activities and collaboration with other teachers, also they can chose any needed courses. The other added value of our distance learning is to offer various advantages: First, updating their knowledge in ICT, Second helping teachers improve their ICT qualifications, Third encouraging teachers to integrate and generalize the use of ICT the their scholar activities.

KEYWORDS: distance training, ICT, physics teachers, continuous training

1 INTRODUCTION

Education and Training is a major challenge for the development of our country's social, economic, cultural. Therefore, they are officially classified in the second national priority after the territorial integrit [1]. Thus, it was necessary to undertake a profound reflection to reform the education and Training systems. The teacher's qualification should be the subject of special attention.

Thence the MEN (Moroccan Minister of Education) launched in 2005 the GENIE program [2] (Generalization of Information Technologies and Communication in Education in Morocco), which aims to improve the quality of education by the integration and generalization of information communication and technology (ICT) in education , based on three important and complementary pillars : The infrastructures pillar, which concerne the equipment of schools with multimedia classrooms connected to the Internet. The content developments pillar, which focuses on the development of digital educational content to support the curriculum. The trainings pillar, which aims to give teachers the necessary foundation for the use of multimedia.

Little research treats the obstacles of the integration of ICT in education in general and in physics sciences in particular, the aims of this integration is to improve quality of teaching and learning (MEN 1999) [3] which is confirmed by several researches.

In this paper, we treat the obstacle of qualification and training of teachers, while the MEN has launched an initial computer training aims to train 230,000 people (teachers, inspectors, technicians, principals ...) durating the period of 2009 – 2013 [4].

Corresponding Author: Khalid Mahdi

2 BACKGROUND AND PROBLEMATIC

Several changes underway in the Moroccan educational system aim to improve the quality of education and training to respond more effectively to the demands of modernization and the challenges of globalization. Formally, the area of teacher training is one of the keys to any kind of reform such as education system. Also, «Teachers have the right to benefit from a powerful initial training and continuing education opportunities, allowing them to continually improve the level of their educational practice and to best perform their missions»[4].

Teachers training, both initial and continuous, can renew their teaching methods to encourage innovation in education, mobilize elements of knowledge and expertise in their teaching practices. Thus, teachers are encouraged to develop their professional skills and even acquire new skills in order to make their teaching more effective.

Little research has addressed the practices and obstacles to the integration of ICT in the physics sciences in Morocco.. Ahaji, El Hajjami, Ajana, El Mokri et Chikhaoui (2008) affirm that the integration of ICT has a positive effect in teaching and learning in geometrical optics [5], On the other hand the results of Alj and Benjelloun show that 94.4% of teachers surveyed expressed great interest in the use of ICT in their teaching practices. However, only 8% of them integrate ICT in the classroom on a regular basis [6]. While Biaz et al. after a survey shows that the percentage of teachers who have received training in ICT "in the context of continuing training courses" does not exceed 20% [7]. This raises the question of generalization of training to all teachers and leads us to think seriously to have an model to generalized the continuous training courses to all the teachers. Indeed, the part relating to evaluate and assisting beneficiaries after completion of training should be considered. From that we propose an efficient flexible continuous distance learning for teachers of physics science in ICT, this proposition gives the teachers the opportunity to have every needed continuous training courses in ICT to initialize and update their knowledge without the obstacles of time and displacement. Thus, this training aims to encourage the integration of ICT in the physics classrooms.

3 METHODOLOGY

3.1 SAMPLE

In this section we present the results of a recent study (September 2013) with 80 physics teachers belonging to 17 high schools of the Academy of Tetouan Tangier. The response rate to the questionnaire was 96,38%.

The aim was to highlight on the one hand, the idea that physics teachers has concerning to the previous ICT training courses. On the other hand, to detect their vital needs in ICT.

3.2 INSTRUMENT

To do this, a survey questionnaire was sent to physics teachers during the month of September 2013, the questionnaire was in Arabic and it was given directly to respondents.A small accompanying word instructed to inform respondents about the goals and the progress and objectives of the survey was attached to the questionnaire. The questionnaire was constructed with a small number of issues closed and semi-closed type. In total, there were 13 questions.

We present below the main results of our investigation.

4 RESULTS

The results of the questionnaire showed that 46% of physics teachers have not received any continuous ICT training. For other teachers, the length of the majority of these training is very short.

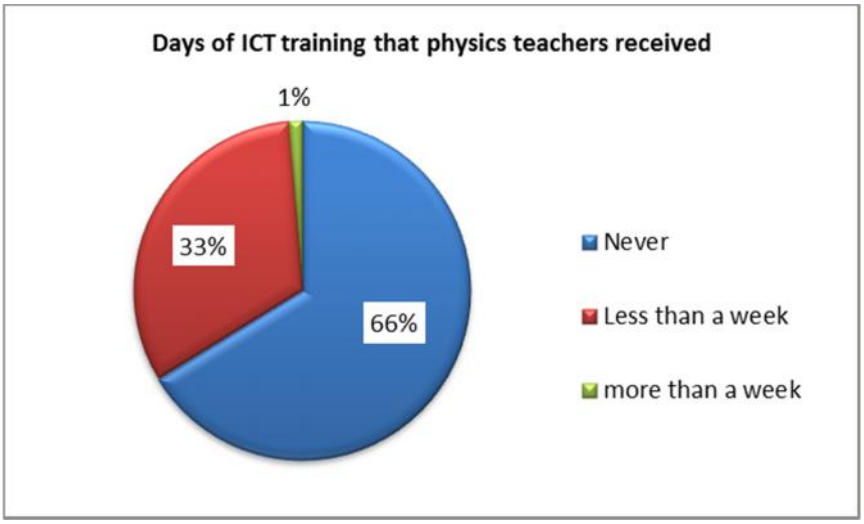


Fig.1. Days of ICT training that physic teacher received

Through the graph above seems clear that more than two-thirds of professors of physics have never benefited from any ICT training, while the remaining one-third of the teachers had benefited from a Short-term training which is less than one week

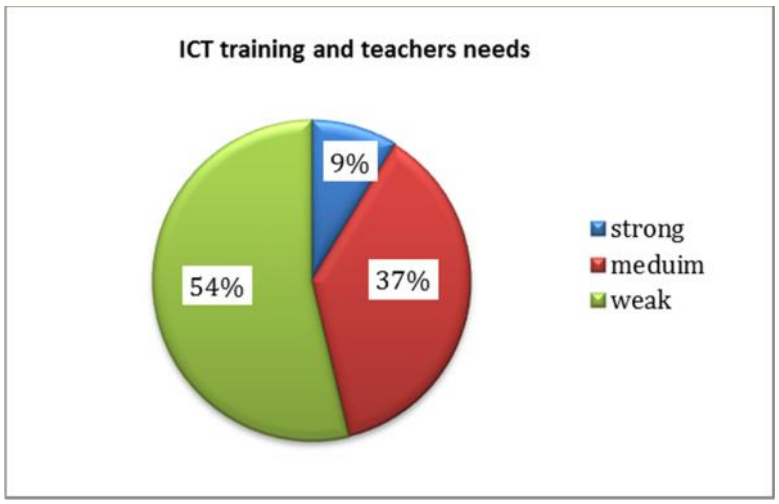


Fig.2 Relation between the previous ICT training and teachers needs

Most of physics teachers who had benifit from the ICT training courses believe that the training followed are not suitable with their specific needs, but only 9% from those teachers are satisfied.

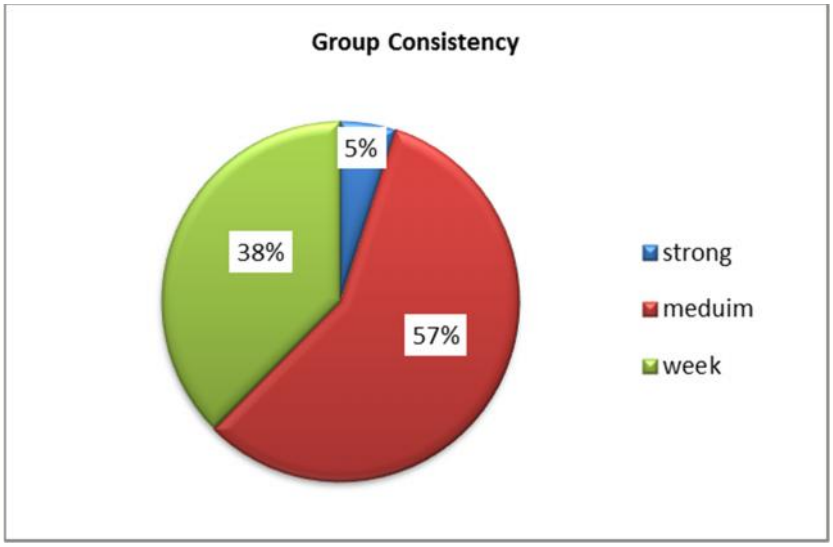


Fig.3 Consistency of the group of physics teachers in the previous ICT training courses

The graph above shows that only 5% of teachers see that the group is consistent in terms of their level of ICT as well as their specialty

The questionnaire also allow the physics teachers to express their needs to the computer softwares and others ICT tools that can be used in their professional practices.

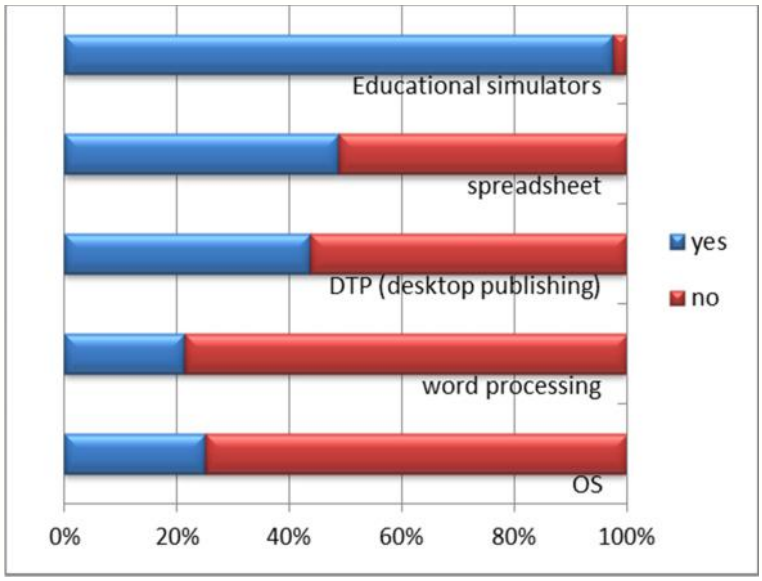


Fig.4 The needs of teachers in ICT tools

With regard to the needs of teachers in training, over than 97% expressed their desire to have special training in the field of education simulato, on the other hand the rate of spreadsheet and DTP (desktop publishing) is almost 50%, regarding to the word processing and operation system the ratio was in the rang of 22%.

In connection with the motivation of the physics teachers to follow online ICT training courses, more than two-thirds of them expressed that they have a big motivation

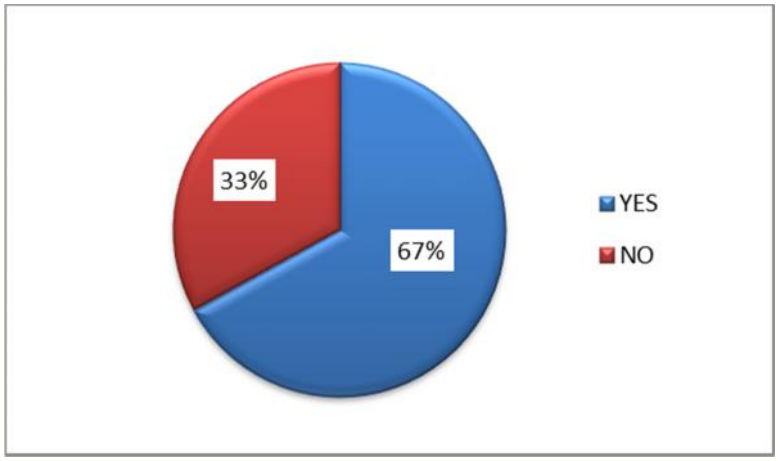


Fig.5 Motivation of physics teachers to follow online training in ICT

5 DISCUSSION

In this section, we discuss the results of the investigation to know the major obstacles of the integration of the ICT in the physics classrooms and we will try to bring a solution to them. Our results show clearly that:

1 The physics teachers rarely receive ongoing training in ICT, and these conventional training courses are limited in time. That's why we should look to generalize the training for all teachers and to have a long term training courses without causing dropout of school while teachers are undertaking training.

2 The previous trainings do not take into account the specific needs of the physics teachers in terms of required computer software's, especially the physics simulation software's.

3 The previous trainings do not take into consideration the material taught of teachers nor their ICT level. Teachers group will be chosen on the basics of their material taught.

4 Focus must be put on the physics software's in the trainings to respond to the needs of all the teachers.

5 On the other hand, we asked teachers about their motivations for a distance continuous training in ICT. The results of our research have encouraged us to offer an online training for those teachers in order to remedy the problems encountered in face to face training. In fact, online courses offer flexibility for teachers in choosing the timing and content of their learning. In addition, online training will last much longer than the duration of face-to-face training.

6 SUGGESTED SOLUTIONS

Our research is targeted at filling the gap of lack of continuous ICT training courses by proposing a distance training courses in ICT for all the physics science teachers. This training is based on an e-learning platform, which is rich, in ICT courses, so the teachers have the opportunity to choose any course at any time depending on their own desires and needs. Then they can start benefiting from those courses any time they like without any obstacles of time or displacement. Each course is divided into chapters, and each chapter consists of file text, videos lessons, animations and simulation software's. The teacher can also go to an online test to assess the skills acquired.

This platform is rich also with the physics science animation and simulation software's, so the teachers can download any needed software to use it in their teaching activities, and it also provides a space for physics science to share courses and discuss problems of physics science learning in order to seek solutions to these problems in collaboration with other teachers using some of synchronous communication (e.g. chat) and asynchronous (e.g. Forum).

In order to encourage and motivate the teachers for this distance training courses in ICT, we suggest distributing a certificate of Merit or mastery in ICT to teachers who complete this training with a score of 70%.

7 CONCLUSION

The research that we conducted with teachers of the delegation of Tangier Tetouan of the country of Morocco, allowed us to put the fingur on the obstacles of the ICT training courses and to conclude that a the best way to solve the luck of ICT training courses is by proposing a continuous distance learning in ICT for the physics teachers this training should be:

1. Flexibile in time and space, so that the physics techears can start reading at any time and at any place without leaving his place of work and causing the wastage of school.
2. The trainig should opened for all the physics teachers without exeption.
3. This continuous trainig courses should be according to teachers desires and needs .
4. This training provide also simulations softwares lessons.

This kind of training can encourage and motivate teachers to integrate in this courses easily and update thier knowlege in ICT, so the teachers will easely integrate the ICT in thier teaching.

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Evaluation of post harvest quality for aflatoxin and microbial loads on the leaves of *Stevia rebaudiana Bertoni* cultivated in Odisha

Ranjan R. Pradhan[1], Shweta Rout[1], Sasmita Rout[2], Bandita Dash[1], and Shailja Rout[3]

[1]Department of Chemical Engineering,
C. V. Raman College of Engineering,
Bhubaneswar, Odisha, India

[2]Mother's Public School,
Bhubaneswar, Odisha, India

[3]Shailja's Organic Products Pvt Ltd,
Bhubaneswar, Odisha, India

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ABSTRACT: Herbs and farm produce are stored after harvest for different durations and have the potential to support microbial growth on them which can lead to shorter shelf life and enhancing food safety issues due to pathogens and allergens. The present study investigated the native microbial loads and aflatoxin contents on *Stevia rebaudiana Bertoni* leaf samples collected from different cultivar in Odisha during various seasonal harvesting processes. There is a clear indication that the total microbial populations in the leaf samples in the monsoon were significantly higher than summer and winter seasons. Therefore, different measures may be needed to handle and process these samples to minimize food safety risks of the product. Determination of AFB1 levels in stevia leaf samples by enzyme-linked immunosorbent assay (ELISA) procedure revealed that there is consistence presence of aflatoxin AFB1 in all most all samples collected from the region. There was no significant difference in contents within the different types of samples collected. The level of microbial population and aflatoxin contents of all the cultivars irrespective of cultivation cycle or duration needs to be reduced and appropriate post harvest measures needs to be taken for further application of the produce.

KEYWORDS: Shelf life, Microbiological quality, Allergens, Natural sweetener, Stevia leaves.

1 INTRODUCTION

Generally, plants constitute a major source of orthodox medicines and the presence of plant secondary metabolites has been attributed for most plants' therapeutic activities [1]. According to a World Health Organization (WHO) survey, about 70 – 80 % of the world's populations, particularly in the developing countries, rely on non-conventional medicines, mainly from herbal sources, for their primary healthcare [2]. As is widely acknowledged that increased consumption of sugar has resulted in several nutritional and medical problems including obesity, alternative sweetness have been entering the market [3]. Historically, low caloric sweeteners have been investigated to substitute sugar; one important class of low caloric sugar substitutes is known as a high intensity sweetener which is at least 50-100 times sweeter than sucrose [4]. Dried leaves of *Stevia rebaudiana* having more than 200 times sweet intensity, has increasingly been accepted as low-calorie sweetener or as dietary supplement of various food and beverages in many countries and therefore the worldwide demand for *S. rebaudiana* expected to increase many folds [5].According to the International Diabetes Federation (IDF) and the Madras Diabetes Research Foundation, India had 62.4 million people with type 2 diabetes in 2011, compared with 50.8 million in 2010 [6]. Due to this high potential demand, various Indian farmers have been encouraged to take up stevia cultivation as alternate method of livelihood [7]. However, consumption of unregulated natural produce has potential to become public

Corresponding Author: Ranjan R. Pradhan

health issue. Poor practices of cultivation, harvest, processing, storage and distribution can contribute to large variety of contaminations, defeating food safety and HACCP (Hazard Analysis and Critical Control Points) protocols. The safety and quality of raw medicinal plant materials and finished products depend on factors that may be classified as intrinsic (genetic) or extrinsic (environment, collection methods, cultivation, harvest, post harvest processing, transport and storage practice [8].Tropical climates with high temperature and humidity are suitable conditions for microbial contamination and the study area in the state of Odisha, India, is in one such climatic zone where stevia cultivation is being adopted as an alternate livelihood measure. Stevia plants in farm are exposed to a wide range of microbial contamination as a result of improper production process, extended drying times and poor storage conditions, stevia leaves being a very sensitive product for harboring micro organisms and accumulation of aflatoxin formation. The level of aflatoxin and pathogenic microbial population of contamination depends on cultivation condition and unsuitable processing conditions [9].The maximum limit for aflatoxin content - AFB1, should not exceed 5 µg/kg (ppb) in most food and feed products [10, 11, and 12].An understanding of the microbial population profile and aflatoxin content profile of various cultivars in the produce for the region can contribute to the successful production and processing of the herbal crop like stevia for public consumption. The profile will also reflect social economic attributes influencing the species traded and impact on trade due to critical quality parameters for effective resources management [13]. The current study is undertaken to evaluate the post harvest quality of the stevia leaves for microbial loads and aflatoxin content different cultivars on the leaves of *Stevia rebaudiana Bertoni* cultivated in the region of Odisha, India.

2 MATERIALS AND METHODS

2.1 SAMPLES COLLECTION

The study was carried out for the local cultivars in the state Odisha, India, grown within latitude 19 – 22 ° north and longitude 83 – 87 ° east. A total of eight cultivars were collected that were cultivated during summer, monsoon and winter seasons of 2012 – 2014. The samples of different cultivars were recorded as sample 1 – 8 for the three identified harvesting seasons. For the purpose of further evaluations some of the samples were further segregates in sets of young and old leaves (old leaves harvested from bottom of the stems and young leaves are harvested from the top 4-6 leaves of the stem) and fresh and dried leaves. These were then processed and packed in sterile polypropylene pouches (0.02mm) sealed and stored at room temperature 25°C (± 5°C).

2.2 MICROBIOLOGICAL ANALYSIS

All samples were analysed for total viable count, moulds, yeasts, coliforms, *E. coli*, *Stephylococus aureus* by HPB Methods for the Microbiological Analysis of FoodsMFHPB-32, 33, 34, 35 [14], using 3M™ Petrifilm™ total plate count petrifilms, coliform count petrifilms, *E. coli* count petrifilms, *S. aureus* petrifilms and yeast and mold count petrifilms (3M Microbiology, St. Paul, MN, USA) according to the instructions of the manufacturer. All the solvents and other chemicals used unless otherwise specified were of analytical grade and the solutions were prepared with bi-distilled water.

Stevia leaves (2 g) were taken aseptically and diluted with 25 ml of 0.1% sterile peptone water. The samples were homogenized by stomacher at high speed for 2 min. Serial dilution were done in the range of 10^{-1} to 10^{-5}. Inoculated Petrifilm™ plates were incubated at 32°C for 48 h for aerobic bacteria count and 42°C for 24 h for *E. coli* count while *S. au*reus, yeast and mold were done as per the procedure stated in the manual.

2.3 DETERMINATION OF AFLATOXIN

Determination of AFB1 levels in stevia leaves were carried out by by enzyme-linked immunosorbent assay (ELISA) procedure. Determination of AFB1 was based on an ELISA using the AFB1 ELISA kit (Euro Proxima, Netherlands, Cat. No.: 5121AFB). Standard sample preparations were done according to the instructions of the kit. The kit was stored at 4°C and all the reagents were brought to room temperature, 2 hours before use. Stevia leaves (2 g) were taken aseptically and diluted with 25 ml of 0.1% sterile peptone water. The samples were homogenized by stomacher at high speed for 2 min. 50 µl of the AFB1 standards and samples were added to 96 wells microplates. 100 µl enzyme conjugate and 50 µl antibody were added to the wells respectively and incubated for 30 minutes at room temperature. At the end of the incubation the liquid was poured from the wells and washed 4 times with the washing buffer (1:10). 200 µl of the developing solution was added to the wells and incubated at room temperature for 20 minutes. 50 µl stop solution was then added to the wells and measured at 450 nm. AFB1 concentrations were calculated according to the guidelines of the kit using the responses of the different standard analyzed.

2.4 STATISTICAL ANALYSIS

After combing the data of each repetition and cultivars for total microbial count within each season during the two year period (2012 – 2014), the data were subjected to F test and single factor analysis of variance (ANOVA). Where the effect was significant in the ANOVA ($P < 0.05$) post-hoc analysis was performed for each paired samples using a Student's t-test for comparison between all mean values with the Bonferroni pair wise alpha to keep the family wise alpha value at 0.05. Student's t-test was also applied for comparing alfatoxin contents for young and old leaves, fresh harvested and dried leaves, and two consecutive summer seasons for two years. Significant differences were determined at $P < 0.05$ to establish significance level of 5%.

3 RESULTS AND DISCUSSION

3.1 MICROBIAL ANALYSIS

Figure 1 presents the microbial count results of the *Stevia rebaudiana Bertoni* when tested for total microbial population count, coliform count, *E. coli* count, Staphylococus count and yeast and mold counts in cfu/gm of sample tested. The figure also presents the content of aflatoxin AFB1 in microgram (mcg) /gm of sample tested. The results revealed that, there are apparent presence of microbial population which includes potential harmful coliform organisms, yeast and molds that can lead to enhanced food safety risk [10,11,12,15]. The contents of afflatoxin AFB1 is also a concern as the presence is above most regulatory limits for the products as per United States Food and Drugs Administration (USFDA) [16]. The findings clearly indicate the need for further detailed investigations for understanding the cultivars of the region to effectively address related issues.

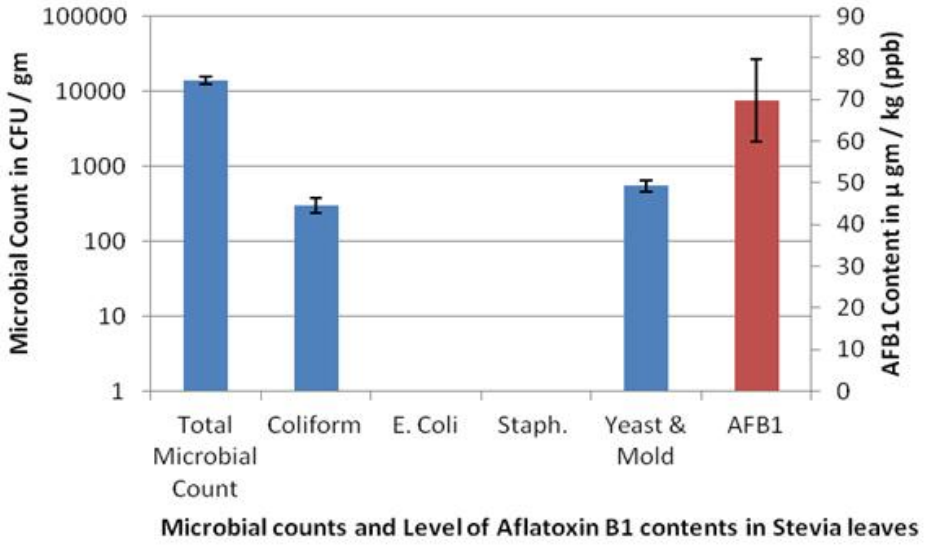


Fig. 1.Mean of microbial populations and aflatoxin contents in the dried leaves of Stevia rebaudiana Bertoni. (Error bars indicate standard error-SEM)

Comparative study to evaluate the variability in microbial population in samples of two consecutive summer seasons and also the variability between freshly harvested leaf samples and the regular dry samples were carried out. T-Test of the both the types of sample pairs were done assuming unequal variances and the summary of the results are as presented in the Table 1. With a two-tail (inequality) t- test, the t Stat > -t Critical two-tail or t Stat < t Critical two-tail, therefore, we cannot reject the null hypothesis. (Critical t-value is 4.3 and is greater than t-stat -2.1).Therefore, we conclude the observed difference between the sample means *2812 (*±2036*) & 7198 (±469)* for year to year count for same season and *13260 (±2642) &, 11341 (±2245)* for fresh and dry sample collections were not convincing enough to say that they differ significantly. This is further confirmed by the fact that the two-tailed P-value was 0.17 and 0.87 respectively, which is more than 0.05; therefore the differences between these values are not significant and the means for all the tests can be considered as equal.

Table 1. Two-tail (inequality) t- test results for total microbial population for samples of two consecutive summer seasons and for freshly harvested leaf samples and the regular dry samples

	Summer of 2013 & 2014	*Fresh & Dry*
μ -Mean (SEM)	*2812 (*±2036*) &7198 (±469)*	*13260 (±2642) &, 11341 (±2245)*
df	2	17
t Stat	-2.1	-0.17
P(T<=t) two-tail	0.17	0.87
t Critical two-tail	4.3	2.11

T-Test of the samples of young leaves and older leaves were done assuming unequal variances and the summary of the results are as presented in the Table 1. As per the results, with a two-tail (inequality) t- test, the t Stat > -t Critical two-tail or t Stat < t Critical two-tail, therefore, we cannot reject the null hypothesis. Therefore, we conclude the observed difference between the young and old leaf sample means for each seasonal were not convincing enough to say that they differ significantly. This is further confirmed by the fact that the two-tailed P-value was 0.28, 0.15, 0.62 and 0.58 for summer, monsoon, and winter for cumulative annual respectively, which is more than 0.05; therefore the differences between these values are not significant and the means for all the tests can be considered as equal.

Table 2. Two-tail (inequality) t- test results for total microbial population for samples of two types of samples collected from the farm young leaves and old leaves during the all seasonal harvesting cycles

	Young & Old leaves of Summer	*Young & Old leaves of Monsoon*	*Young & Old leaves of Winter*
df	10	6	6
t Stat	-1.1	1.6	0.5
P(T<=t) two-tail	0.3	0.2	0.6
t Critical two-tail	2.2	2.4	2.4

Comparative analysis to understand the variance in microbial population in samples of three different harvested seasons was carried out and the ANOVA results are presented in Table 3. The results indicate F > F crit (23.25445 > 3.4668), and P - value is extremely small. Therefore, null hypothesis rejected (P < 0.05) Thus, the test is significant at α = 5%.and microbial count differences between seasons are highly significant.

Table 3. ANOVA results for comparing total microbial population of three different seasons (summer, monsoon and winter)

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.58E+09	2	7.9E+08	23.25445	4.73E-06	3.4668
Within Groups	7.13E+08	21	33958749			
Total	2.29E+09	23				

To further identify the significant differences between the mean of total microbial counts, simple student's t-test was carried out to identify the season responsible for variation in the data. The results of three pair of seasonal t-test are presented in the Table 4. As can be seen the means of summer and winter the P value is > 0.05, indicating their means do not differ significantly where as summer & monsoon and monsoon and winter resulted in P < 0.05 and therefore, means differ significantly. This suggests the monsoon session's microbial population is different from that of summer and winter while the microbial population in summer and winter seasons were same. Similar higher load of microbial populations have been reported and is in consistence with studies conducted by Gasmalla et al on *Stevia rebaudiana Bertonie* [17] and other similar herbs [18]. Efforts are being undertaken to minimize microbial load by physico chemical treatments [19, 20].

Table 4. Students' t-test results of paired samples for comparison between individual seasons mean values and identifying the significant different season's means

	Summer & Winter	*Summer & Monsoon*	*Monsoon & Winter*
μ -Mean (SEM)	6320.8 (± 690.4) & 8240.6 (± 2913.2)	6320.8(± 690.4) & 24015.6 (± 1179.8)	24015.6 (± 1179.8) & 8240.6 (± 2913.2)
df	8.0	24.0	9.0
t Stat	-0.6	-12.9	5.0
P(T<=t) two-tail	0.5	2.57E-12	7.20E-04
t Critical two-tail	2.3	2.1	2.3

3.2 AFLATOXIN AFB1 ANALYSIS

The relative impact on possible aflatoxin AFB1 accumulation was evaluated for the two seasonal hasted samples (summer and monsoon) having significant difference in microbial. t -Test of the both the types of sample pairs were done assuming unequal variances and the summary of the results are as presented in the Table 1. It is evident from the two-tail (inequality) t- test, the t Stat > -t Critical two-tail or t Stat < t Critical two-tail, therefore, we cannot reject the null hypothesis. (Critical t-value is 2.1 and is greater than t-stat -1.4).Therefore, we conclude the observed difference between the sample means 65.4 (±3.3) & 70.3 (±1.1) for two different seasons summer and monsoon were significantly different. This is further confirmed by the fact that the two-tailed P-value is 0.2, which is greater than 0.05; therefore the differences between the means for all the two seasons can be considered as equal. The tropical weather conditions which prevail during most part of the year in India can favour fungal growth and mycotoxin production [18, 20]. Various physicochemical measures may be undertaken to decontaminate aflatoxins to render the produce safe for consumption [10, 11, and 19].

Table 5. F Test and Two-tail (inequality) t- test results for aflatoxin AFB1 contents of samples collected during the two different seasons having highly significant microbial populations (summer, monsoon)

	Summer	*Monsoon*
Mean	65.4	70.3
SEM	3.3	1.1
F	16.9	
F Critical one-tail	3.5	
df	17.0	
t Stat	-1.4	
P(T<=t) two-tail	0.2	
t Critical two-tail	2.1	

4 CONCLUSION

The presence of microbial populations and aflatoxins in the leaves of *Stevia rebaudiana Bertoni* were evident which included some of the possible pathogenic indicator organisms and detectable aflatoxin AFB1 contents.Pathogens like *E. coli* count, *Staphylococus aureus* were bit detected in the entire sample tested. The contents of aflatoxin AFB1 is a concern as its presence is above most regulatory limits for the products as per FDA. The finding clearly suggests the need for further detailed investigations for understanding the sampling methods and evaluating different cultivars of the region to effectively address related issues to enhance the product quality and shelf life of the produce. There was no significant difference in microbial population in samples of two consecutive summer seasons and therefore year to year variability is not a significant than other related parameters, though this may be validated with further studies. The microbial population between freshly harvested leaf samples and the regular dry samples were similar suggesting the collection of different fresh / dried leaf sample for the study will not impact the outcome significantly. The effect of harvesting age of the leaves do not have any significant impact on the microbial load as means for both types of leaves can be considered statistically equal. There is a clear indication that the total microbial population in the leaf samples in the monsoon were significantly higher than summer and winter seasons. Therefore, different measures may be needed to handle and process these samples to minimise food safety risks of the product as has been suggested by Idu *et al* [17]. Though the presence aflatoxin AFB1 content in all the samples collected during different seasons over a year were significant, there is no significant deference in contents within the different samples collected. The level of microbial population and aflatoxin contents of all the cultivars irrespective of

cultivation cycle or duration needs to be reduced and appropriate post harvest measures needs to be taken for further application of the produce.

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Etude comparative entre deux topologies d'onduleurs triphasés, classique à 2-niveaux et NPC à 3-niveaux avec deux différentes méthodes de commande MLI-ST et SWM

[Comparative study between two topologies three-phase inverters, conventional 2-level and NPC 3-level with two methods different of control, SPWM and SWM]

Chirine Benzazah, Mustapha Ait Lafkih, and Loubna Lazrak

Laboratory of Automatic and Energy Conversion (LACE), Electrical Engineering Department,
University of Sultan Moulay Slimane, Faculty of Sciences and Technology,
B.P: 523 Beni-Mellal 23000, Morocco

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ABSTRACT: Production systems of renewable energy are extensively studied because of their major interest in sustainable development. Therefore, the control structures of the inverter connected to the network is an important part of the conversion and transmission of energy, they must be improved to meet the demands of the connection to the distribution network. This article discusses the comparison between two structures of three-phase inverters; NPC three-level inverter (Neutral Point Clamped), and the usual two-level inverter. The comparison is based on the evaluation of harmonic distortion THD for both inverters are controlled by two different strategies, namely sinusoidal pulse with modulation SPWM and control in mode SWM (square-wave mode). All circuits are modeled and simulated using Matlab-Simulink-SimPowerSystems software.

KEYWORDS: Three-Phase Inverter, Neutral Point Clamped (NPC), Sinusoidal Pulse Width Modulation (SPWM), Square-Wave Mode (SWM), Total Harmonic Distortion (THD).

RESUME: Les systèmes de production des énergies renouvelables sont fréquemment étudiés à cause de leur intérêt majeur en matière de développement durable. Par conséquent, les structures de contrôle de l'onduleur connectées au réseau sont une partie importante de la conversion et de la transmission d'énergie, elles doivent être améliorées pour répondre aux exigences de la connexion au réseau de distribution. Cet article traite la comparaison entre deux structures d'onduleurs triphasés ; l'onduleur NPC à trois niveaux (Neutral Point Clamped) ; et l'onduleur usuel à deux niveaux. La comparaison est basée sur l'évaluation du taux de distorsion harmonique TDH pour les deux onduleurs commandés par deux stratégies différentes, à savoir la modulation de largeur d'impulsions MLI-ST et la commande en mode rectangulaire SWM (Square-Wave Mode). Tous les circuits sont modélisés et simulés à l'aide du logiciel Matlab-Simulink-SimPowerSystems.

MOTS-CLEFS: Onduleurs Triphasés, Onduleur clampé par le neutre (NPC), Modulation de Largeur d'Impulsions Sinus-Triangle (MLI-ST), Commande en Mode Rectangulaire (SWM), Taux Distorsion Harmonique (TDH).

1 INTRODUCTION

Les performances et en particulier la rentabilité des onduleurs utilisés pour le raccordement des systèmes de production des énergies renouvelables au réseau électrique de distribution sont des éléments-clés qui influencent fortement la qualité de l'énergie produite et le rendement de l'installation entière. De ce fait, leurs améliorations est, et sera toujours, un objectif recherché.

Corresponding Author: Chirine Benzazah

Les onduleurs sont constitués en grande partie par des interrupteurs. Ces derniers sont soumis, dans la majorité des cas, à de fortes contraintes thermiques puisqu'ils sont appelés à bloquer la pleine tension imposée par la source continu, étant donné que le phénomène est répétitif, le rendement et la durée de vie des composants sont réellement affectés [1], [2].

La structure des onduleurs multi-niveaux, trois-niveaux et plus, permettent de pallier cette problématique. L'utilisation de ce type d'architecture aide à la limitation des contraintes en tension subies par les interrupteurs en fractionnant la tension continue à l'entrée d'onduleur. L'association d'une architecture de type multi-niveau à une commande judicieuse des interrupteurs de puissance permet en outre de supprimer certaines familles de raies harmoniques et par conséquent, d'améliorer le contenu spectral des signaux de sortie (tension et courant). Toutefois, le choix d'un nombre élevé de niveaux et par suite l'utilisation de plus de composants rendra le système plus encombrant donc la structure trois-niveaux semble la mieux adaptée aux exigences spécifiées [3], [4].

Cet article traite deux structures d'onduleurs triphasés ; l'onduleur usuel à deux niveaux ; et l'onduleur NPC à trois niveaux (Neutral Point Clamped). Les deux topologies d'onduleurs seront commandées par la modulation de largeur d'impulsions MLI-ST et la commande rectangulaire SWM (square-wave mode). Enfin, des simulations sont effectuées pour relever les formes d'ondes et les TDH des tensions de sorties.

2 TOPOLOGIES D'ONDULEURS

2.1 ONDULEUR CLASSIQUE À DEUX NIVEAUX DE TENSIONS

L'onduleur classique à deux niveaux de tension est représenté sur la figure (1). Il est constitué de trois bras de commutation à transistors. Chaque bras composé de deux cellules comportant chacune une diode et un transistor qui travaillent en commutation forcée. Tous ces éléments sont considérés comme des interrupteurs idéaux. En mode commandable, le bras d'onduleur est un commutateur à deux positions qui permet d'obtenir à la sortie deux niveaux de tension [5], [6].

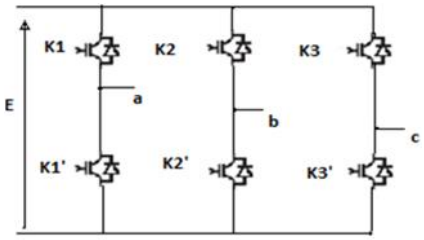


Fig. 1. Schéma d'un onduleur usuel à 2 niveaux

Pour un convertisseur à 2-niveaux de tensions. Nous avons deux séquences de fonctionnement possible permettant de générer les deux-niveaux de tensions:

- **Séquences 1 : Génération du niveau maximum**

Dans ce cas, l'interrupteur K1 est passant et K1' est bloqué comme le montre la figure (2-a). La tension de sortie Va est: Va = +E. La tension inverse appliquée à l'interrupteur K1' vaut: $V_{K1'} = +E$.

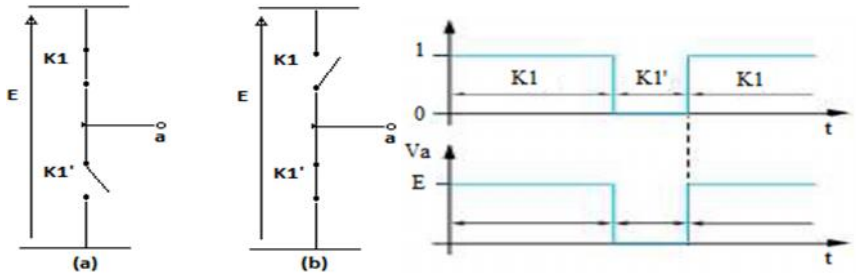


Fig. 2. Séquences de fonctionnement d'un bras de l'onduleur à deux niveaux

- **Séquences 2 : Génération du niveau minimum**

Dans ce cas, l'interrupteur K1 est bloqué et K1' est passant comme le montre la figure (2-b). La tension de sortie Va est: $Va = 0$. La tension inverse appliquée à l'interrupteur K1 vaut: $V_{K1} = +E$.

Les 2 états ou séquences de commutation possibles sont résumés au tableau (1).

Tableau 1. États possibles de l'onduleur usuel à 2 niveaux

K1	K1'	Va
1	0	**E**
0	1	**0**

2.2 ONDULEUR NPC À TROIS NIVEAUX DE TENSIONS

L'onduleur NPC à trois niveaux est représenté sur la figure (3). Le bus continu d'entrée est composé de deux capacités en série (C1 et C2), formant un point milieu noté (O) qui permet à l'onduleur d'accéder à un niveau de tension supplémentaire par rapport à l'onduleur classique à deux niveaux. La tension totale du bus continu vaut E, dans les conditions normales de fonctionnement, celle-ci est uniformément répartie sur les deux capacités qui possèdent alors une tension E/2 à leurs bornes. Chacun des trois bras (a, b et c) de l'onduleur est composé de quatre interrupteurs commandés (K1, K2, K3 et K4 pour le bras a) et deux diodes de maintien connectées au point milieu du bus continu [7], [8], [9].

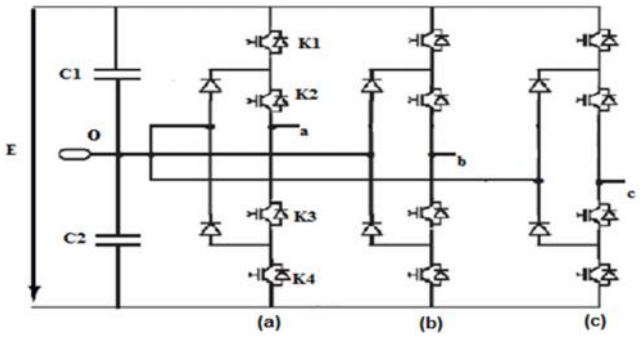


Fig. 3. Schéma d'un onduleur NPC à 3 niveaux

Pour des raisons de simplicité, nous limiterons l'étude à un bras d'onduleur NPC de trois niveaux, l'objectif visé est de déterminer les valeurs que peut prendre la tension Vao pour les différents états possibles des interrupteurs statiques, et de montrer les séquences de conductions des interrupteurs.

Pour un convertisseur NPC à N-niveaux de tensions, nous avons N séquences de fonctionnement possibles permettant de générer les N niveaux de tensions. Et en particulier pour le NPC à trois niveaux on a trois séquences de fonctionnement:

• Séquences 1 : Génération du niveau maximum

Dans ce cas, les interrupteurs K1, K2 sont passants et K3, K4 sont bloqués comme le montre la figure (4-a). La tension de sortie Vao est: Vao = + E/2. La tension inverse appliquée aux interrupteurs k3, k4 vaut: $V_{K3} = V_{K4} = +E/2$.

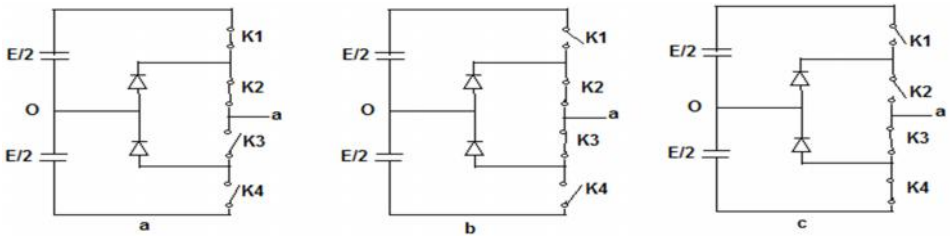


Fig. 4. Séquences de fonctionnement d'un bras d'onduleur NPC à trois niveaux

• Séquences 2 : Génération du niveau intermédiaire

Les interrupteurs K2, K3 sont passants et K1, K4 sont bloqués, dans ce cas le point a est relié directement au point O à travers l'une des diodes de maintien, comme le montre la figure (4-b). La tension de sortie Vao est donc nulle, Vao = 0. La tension inverse appliquée aux interrupteurs K1, K4 vaut: $V_{K1} = V_{K4} = +E/2$.

• Séquences 3 : Génération du niveau minimum

Dans ce cas, les interrupteurs K1, K2 sont bloqués et K3, K4 sont passants comme le montre la figure (4-c). La tension de sortie Vao est: Vao = – E/2. Et La tension inverse appliquée aux interrupteurs K1, K2 vaut: $V_{K1} = V_{K2} = +E/2$. Les 3 états ou séquences de commutation possibles sont résumés au tableau (2).

Tableau 2. États possibles de l'onduleur NPC à 3 niveaux

K1	K2	K3	K4	Vao
1	1	0	0	**E/2**
0	1	1	0	**0**
0	0	1	1	**- E/2**

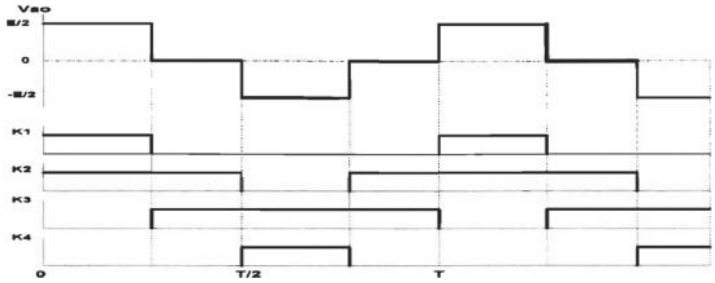


Fig. 5. Séquences de fonctionnement d'un bras d'onduleur NPC à trois niveaux

Nous remarquons que, par rapport à l'onduleur classique à deux-niveaux, les interrupteurs dans l'onduleur NPC à trois-niveaux ont un temps de conduction minimal et une tension à supporter à l'état bloqué aussi minimale.

3 MÉTHODES DE COMMANDES

3.1 COMMANDE EN MODULATION SINUS-TRIANGLE MLI-ST

La M.L.I. sinus-triangle est réalisée par comparaison d'une onde modulante basse fréquence (tension de référence) à une onde porteuse haute fréquence de forme triangulaire (Fig.6). Les instants de commutation sont déterminés par les points

d'intersection entre la porteuse et la modulante. La fréquence de commutation des interrupteurs est fixée par la porteuse [10]. En triphasé, les trois référence sinusoïdales sont déphasées de $2\pi/3$ à la même fréquence f.

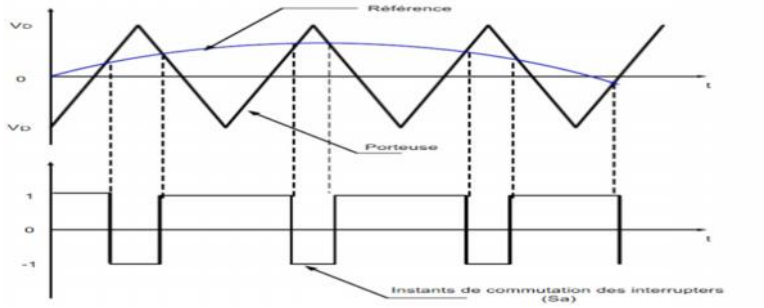


Fig. 6. Le signal de la MLI sinus-triangle

L'indice de modulation m, égal au rapport de la fréquence de la modulation (porteuse) sur la fréquence de la référence (modulante) : $m = \frac{f_p}{f_r}$ avec $m > 1$

Le coefficient de réglage en tension r, égal au rapport de l'amplitude de la tension de la référence sur celle de la porteuse :

$$r = \frac{\upsilon_r}{\upsilon_p} \quad \text{avec} \quad 0 < r < 1$$

3.2 COMMANDE EN MODE RECTANGULAIRE SWM

3.2.1 GÉNÉRATION DES SIGNAUX DE COMMANDE SWM

La commande rectangulaire SWM consiste à prédéterminer l'angle de commutation en fonction des performances souhaitées telles que l'élimination de certains harmoniques indésirables ou la réduction du taux de distorsion harmonique total. Elle est réalisée à partir de la différence et de la sommation d'un signal sinusoïdal de référence sin ($\omega t + \Phi$) à une constante sin δ_n. Cette dernière correspond à un certain angle de commutation δ_n désiré (Fig. 7-a). Le résultat de sortie de la sommation est comparé à la valeur 0, il est à 1 si la sortie est supérieure à 0, à 0 dans le cas contraire comme le montrent les figures (7-b) et (7-c). Le résultat de sortie de la différence est comparé aussi à la valeur 0, il est à 0 si la sortie est supérieure à 0, à 1 dans le cas contraire comme le montrent les figures (7-d) et (7-e).

La différence des signaux de sorties des deux figures (7-c) et (7-e) donne le signal de la commande SWM comme le montre la figure (7-f). En triphasé, les trois référence sinusoïdales sont déphasées de $2\pi/3$ à la même fréquence f.

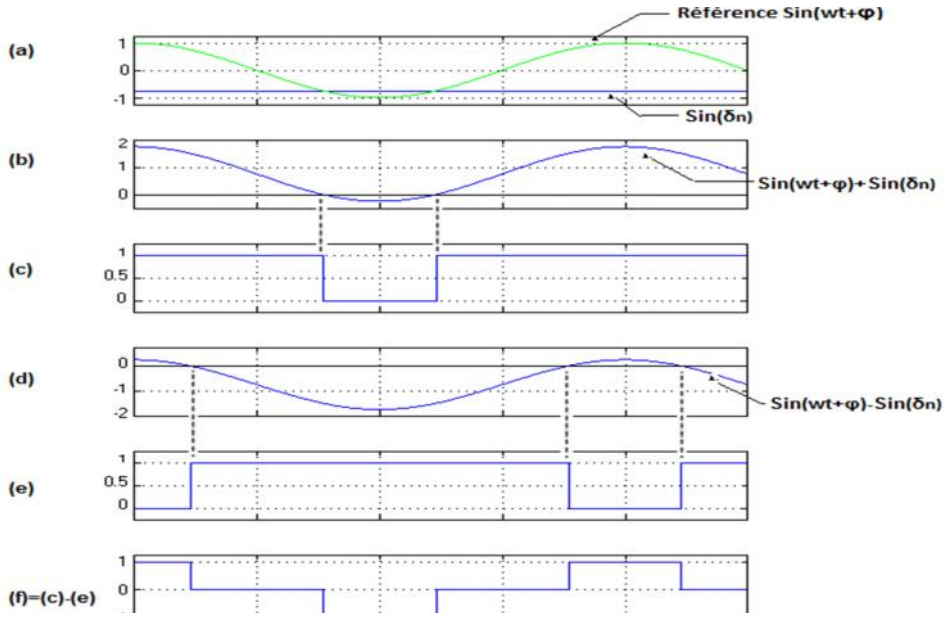


Fig. 7. Le signal de sortie de la commande rectangulaire SWM

3.2.2 CHOIX DE L'ANGLE DE COMMUTATION

La figure (8) représente la tension dans une branche de l'onduleur NPC à trois-niveaux en mode rectangulaire. Dans cette figure, δ_n représente l'angle commutation de l'onduleur à trois niveaux.

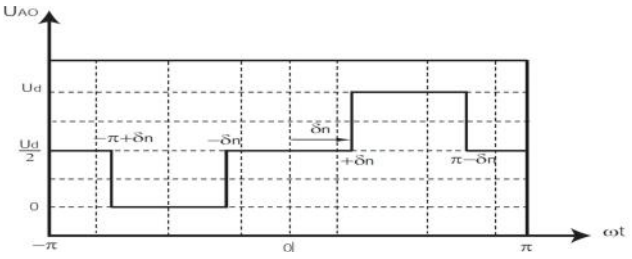


Fig. 8. Tension U_{AO} d'une branche d'un onduleur à trois niveaux en mode rectangulaire

L'amplitude de l'harmonique d'ordre v de la tension de branche U_{AO} dépend de cet angle de commutation δ_n selon la relation (2) obtenue à partir de l'équation (1) [11].

$$^{v}\hat{u} = \frac{1}{\pi}\int_{-\pi}^{\pi} u_{AO} \sin v\omega t d\omega t \qquad (1)$$

$$^{v}\hat{u} = \frac{2}{\upsilon\pi} u_d \cos v\delta_n \qquad (2)$$

La tension fondamentale de sortie est proportionnelle à $\cos\delta_n$. Les harmoniques disparaissent pour $v\delta = k.\pi/2$, pour k un entier impair. Le cinquième harmonique disparaisse pour δ =18°.

Le septième harmonique disparaisse pour δ =12.85°.

Le minimum du taux de distorsion harmonique total est obtenu autour de ces valeurs d'angles.

4 RÉSULTATS DE SIMULATION

Les études de simulation sont effectuées à l'aide du logiciel Matlab Simulink-SimPowerSystems (R2010a). Les méthodes de commandes MLI-ST et SWM sont faites en boucle ouverte. Concernant la stratégie MLI-ST, un coefficient de réglage de 0.85 et une porteuse de fréquence 3000Hz sont choisis. Les sources continues utilisées valent pour les deux onduleurs 400V. Les valeurs de TDH% sont mesurées à l'aide du bloc FFT de Powergui.

4.1 GÉNÉRATION DES SIGNAUX DE COMMANDES

4.1.1 COMMANDE MLI-ST D'UN ONDULEUR USUEL A DEUX NIVEAUX

Pour générer les impulsions de commande MLI-ST du convertisseur à 2-niveaux de tensions, une porteuse triangulaire d'amplitude Ur et de fréquence Fr est nécessaire (Fig.9). Elle est ensuite comparée au signal de référence (sinus) d'amplitude Ur et de fréquence Fr. chaque comparaison donne 1 si la porteuse est supérieure ou égale à la référence, 0 dans le cas contraire. Les signaux de commande des interrupteurs K1 et K2 sont complémentaires.

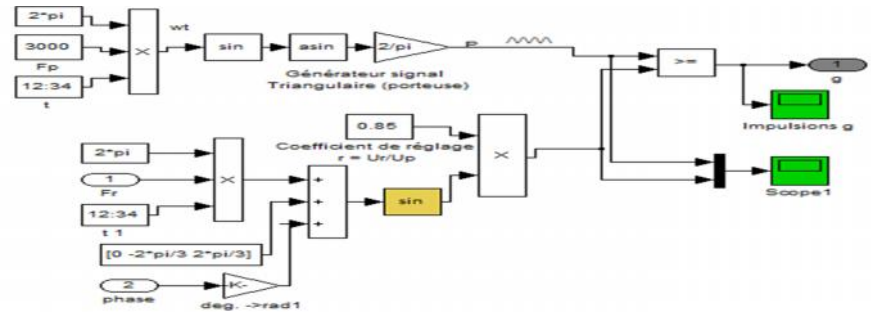


Fig. 9. Génération des Signaux de commande MLI-ST d'un onduleur usuel à deux Niveaux

La figure (10) montre les signaux et les impulsions des interrupteurs de la commande MLI-ST pour un onduleur usuel à 2-niveaux.

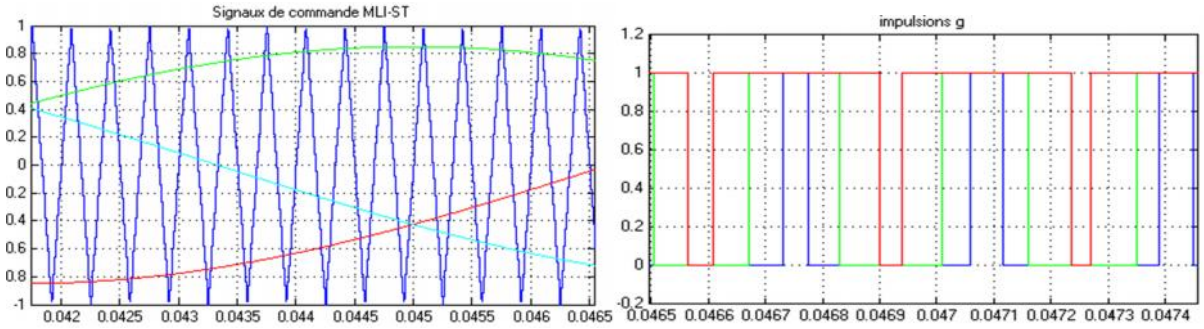


Fig. 10. Signaux de commande MLI-ST d'un onduleur usuel à deux Niveaux

4.1.2 COMMANDE MLI-ST D'UN ONDULEUR NPC A TROIS NIVEAUX

Pour générer les impulsions de commande MLI-ST du convertisseur à 3-niveaux de tensions, deux porteuses triangulaires sont nécessaires. Ces porteuses ont la même fréquence Fp et la même amplitude Up (Fig. 11). Ils sont ensuite comparés au signal de référence (sinus) d'amplitude Ur et de fréquence Fr. Chaque comparaison donne 1 si une porteuse est supérieure ou égale à la référence, 0 dans le cas contraire. Ainsi pour le cas NPC, Les signaux de commande des interrupteurs K1 et K3 sont complémentaires et les interrupteurs K2 et K4 sont aussi complémentaires.

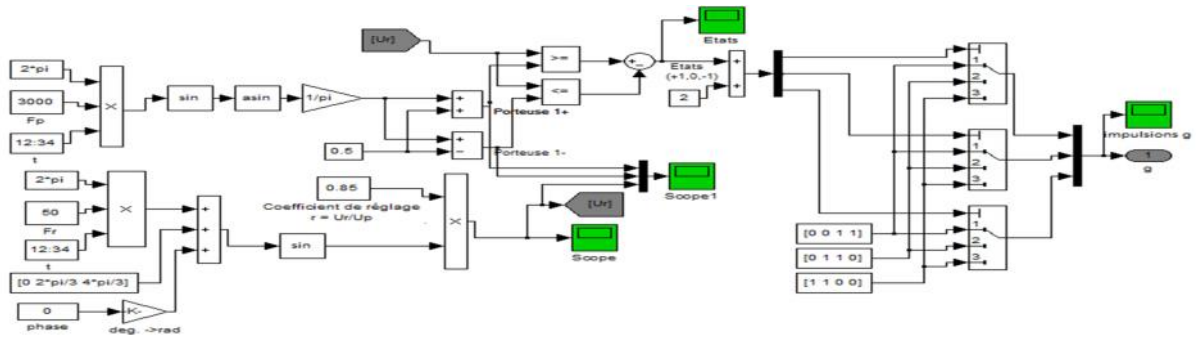


Fig. 11. Génération des Signaux de commande MLI-ST d'un onduleur NPC à trois Niveaux

La figure (12) montre les signaux et les états possibles de la commande MLI-ST pour un onduleur NPC à trois Niveaux.

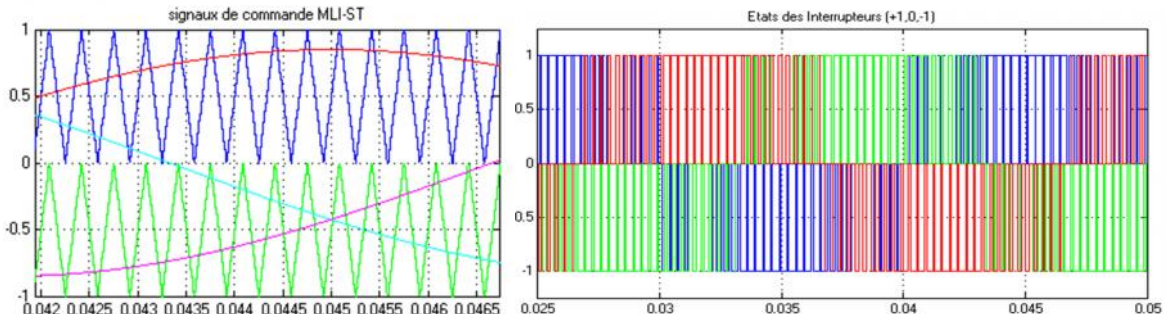


Fig. 12. Signaux de commande MLI-ST d'un onduleur NPC à trois Niveaux

4.1.3 COMMANDE SWM D'UN ONDULEUR USUEL A DEUX NIVEAUX

La commande SWM d'un onduleur à deux-niveaux est réalisée à partir de la comparaison d'un signal sinusoïdal de référence sin ($\omega t + \Phi$) à une constante sinδ_n. Cette dernière correspond à un certain angle de commutation désiré δ_n (Fig. 13).

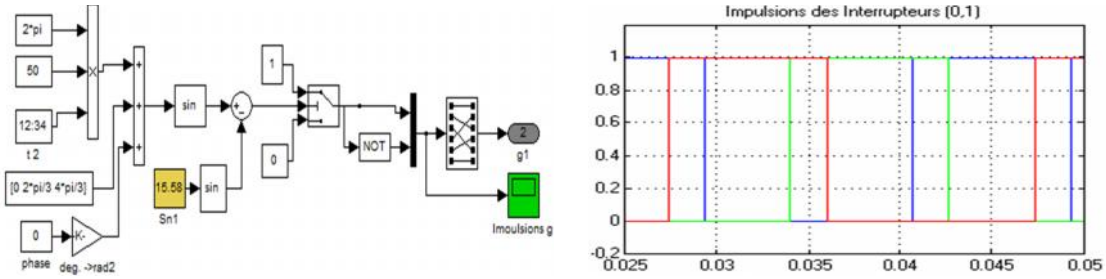


Fig. 13. Génération des Signaux de commande SWM d'un onduleur usuel à deux Niveaux

4.1.4 COMMANDE SWM D'UN ONDULEUR NPC A TROIS NIVEAUX

La Figure (14) représente le schéma bloc du modulateur d'un onduleur NPC à trois niveaux. L'angle de commutation $\delta_n = 15.58°$ est choisi pour avoir un taux minimum d'harmoniques.

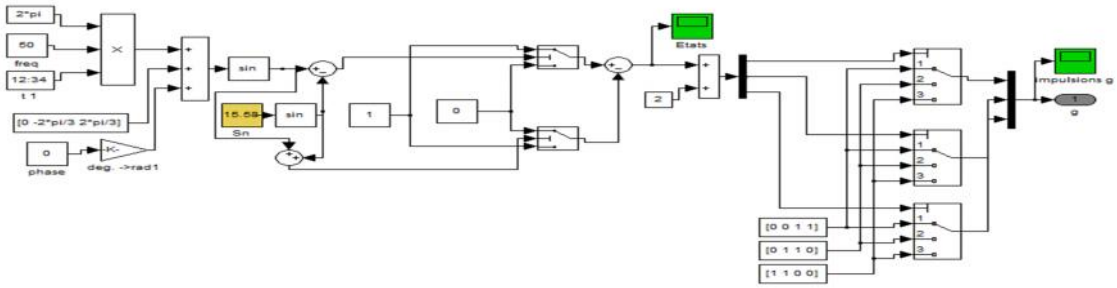


Fig. 14. Génération des Signaux de commande SWM d'un onduleur NPC à trois Niveaux

La figure (15) montre les signaux et les états possibles de la commande SWM pour un onduleur NPC à trois Niveaux.

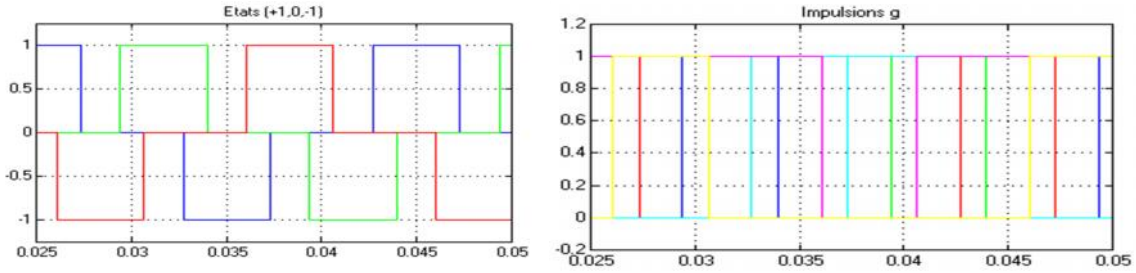
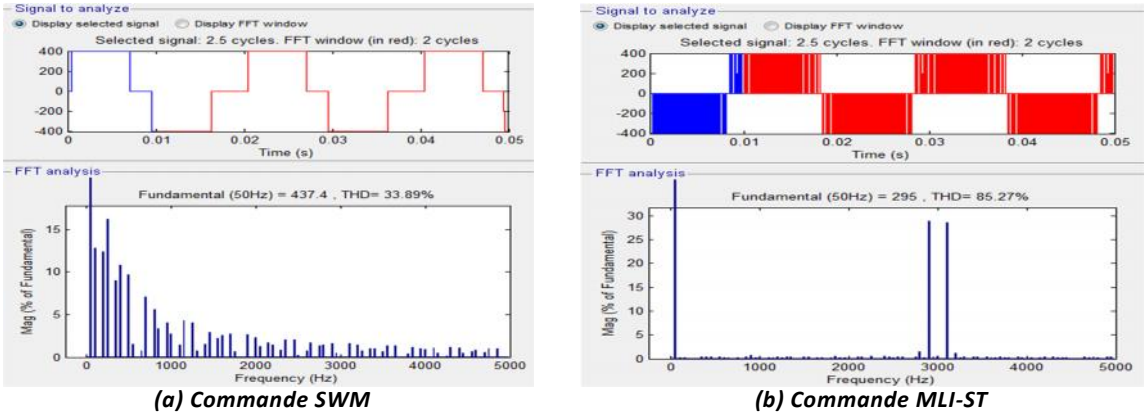


Fig. 15. Signaux de commande SWM d'un onduleur NPC à trois Niveaux

4.2 ANALYSE COMPARATIVE DES FORMES D'ONDES OBTENUES EN SIMULATION POUR LES DEUX MODÈLES D'ONDULEURS

4.2.1 ONDULEUR USUEL À DEUX-NIVEAUX

La figure (16) montre les formes d'ondes et les spectres harmoniques de la tension entre la phase a et la phase b (Vab) obtenus à la sortie de l'onduleur usuel triphasé à deux niveaux pour les deux commandes MLI-ST et SWM.



(a) Commande SWM *(b) Commande MLI-ST*

Fig. 16. Forme d'onde et spectre harmonique de la tension de sortie Vab de l'onduleur usuel à deux Niveaux

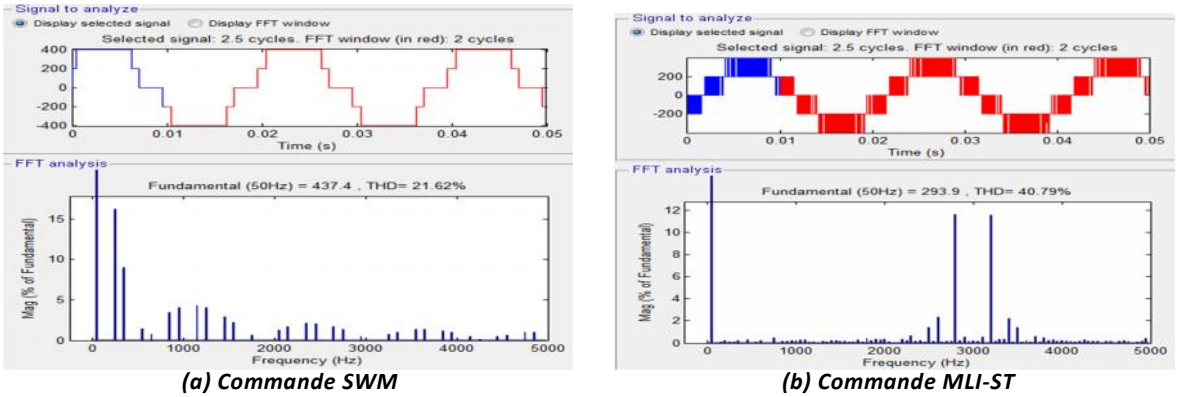
Le spectre harmonique de la tension de sortie Vab pour la commande MLI-ST obtenu (fig.16b) montre que les harmoniques sont repoussées aux hautes fréquences ce qui facilitera le filtrage, Par contre, dans le cas de la commande SWM (fig.16a) la tension de sortie est très riche en harmoniques d'ordres inférieurs ce qui rend le filtrage difficile. Le tableau (3) montre la comparaison entre les deux stratégies de commande proposées pour un onduleur usuel à deux niveaux.

Tableau 3. Comparaison entre les méthodes de commande proposées pour un onduleur à deux niveaux

Type de commande	MLI-ST (2-niveaux)	Rectangulaire (SWM) (2-niveaux)
Valeur crête de la composante fondamentale de la tension (Vab)	295	437.4
Taux de Distorsion Harmonique total TDH (%)	85.27	33.89

4.2.2 ONDULEUR NPC À TROIS-NIVEAUX

La figure (17) montre les formes d'ondes et les spectres harmoniques de la tension entre la phase a et la phase b (Vab) obtenus à la sortie de l'onduleur NPC triphasé à trois niveaux pour les deux commandes MLI-ST et SWM.



(a) Commande SWM *(b) Commande MLI-ST*

Fig. 17. Forme d'onde et spectre harmonique de la tension de sortie Vab de l'onduleur NPC à trois Niveaux

De même, la commande SWM présente une tension de sortie Vab très riche en harmoniques d'ordres inférieurs (fig.17a) en comparaison avec la commande MLI-ST. Le tableau(4) montre la comparaison entre les deux stratégies de commande proposées pour un onduleur à trois niveaux.

Tableau 4. Comparaison entre les méthodes de commande proposées pour un onduleur à trois niveaux

Type de commande	MLI-ST (3 niveaux)	Rectangulaire (SWM) (3 niveaux)
Valeur crête de la composante fondamentale de la tension (Vab)	293.9	437.4
Taux de Distorsion Harmonique total TDH (%)	40.79	21.62

Nous remarquons d'après les résultats précédents, que la technique de commande SWM donne une meilleure performance du point de vue TDH. Par contre, elle fournit un spectre de tension riche en harmonique et ne permet pas le contrôle de la valeur crête de la composante fondamentale de la tension de sortie.

4.2.3 COMPARAISON ENTRE L'ONDULEUR NPC À TROIS-NIVEAUX ET L'ONDULEUR CLASSIQUE À DEUX-NIVEAUX

Le tableau (5) montre la comparaison entre l'onduleur NPC à trois niveaux et l'onduleur classique à deux niveaux.

Tableau 5. Comparaison entre l'onduleur NPC à trois niveaux avec l'onduleur classique à deux niveaux

Type d'onduleurs	Onduleur classique (2 niveaux)		Onduleur NPC (3 niveaux)	
	MLI-ST	SWM	MLI-ST	SWM
Valeur crête de la composante fondamentale de la tension (Vab)	295	437.4	293.9	437.4
Taux de Distorsion Harmonique total TDH (%)	85.27	33.89	40.79	21.62

Nous remarquons à partir du tableau précédent, que les deux types d'onduleurs commandés de la même façon donnent des valeurs de tension de sortie presque identiques, et que l'onduleur NPC à trois-niveaux donne une meilleure performance du point de vue TDH de la tension de sortie.

5 CONCLUSION

Ce travail a été orienté vers une étude comparative de point de vue TDH entre deux onduleurs différents et deux stratégies de commande différentes aussi. L'étude a montré que la commande SWM donne une meilleure performance au niveau du TDH par contre elle présente l'inconvénient d'un spectre de tension très riche en harmoniques d'ordre inférieur et d'une absence du contrôle de la valeur crête de la composante fondamentale de la tension fondamentale de sortie des deux topologies onduleurs.

D'un autre côté, l'onduleur NPC à trois-niveaux présente l'avantage d'une diminution appréciable du TDH et des contraintes que subissent les interrupteurs.

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CLOUD - An Emerging trend in delivering IT services

Junaid Nasir

IBM, Pakistan

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ABSTRACT: This paper explores the framework of cloud environment, models, current technologies & trends in the space of Cloud. The Research elaborates on key benefits and barriers of moving IT Business Services to Cloud. Cloud is a way of delivering IT-enabled services in the form of software (SAAS), platform (PAAS) and infrastructure (IAAS). This research overall examines the definition of cloud computing and cloud services and how it will evolve over the next decade. The research targets to provide a clear understanding of the concepts and strategies around the Cloud technology and prepares readers for future enhancements which have become one of the most discussed IT paradigms of recent year.

KEYWORDS: Cloud, Cloud Computing, Cloud Service Models, Cloud Deployment Models, Hypervisors, Open Stack.

1 INTRODUCTION

With the excessive downsizing and striping organizations of their assets in the past decade, Cloud is an emerging trend in delivering IT Services. Cloud is a source of value and opportunity to achieve and sustain more competitive advantage. Delivering IT Services using Cloud presents untapped potential to achieve optimal performance and remain competitive in the ever changing landscape of boundary **less** business environment. Organizations deciding to move IT services to the Cloud is a paradigm shift as it represents a fundamental change in the way organizations deliver solutions to customers (internal or external). Youseff et al. were among the first who tried to provide a comprehensive understanding of cloud computing and all its relevant components. They regard cloud computing as a *"collection of many old and few new concepts in several research fields like Service-Oriented Architectures (SOA), distributed and grid computing as well as Virtualization"* [11].

With globalization and withstanding environmental pressures comes change and it is about this phenomenon, that Researcher aspires to produce some useful research. Common characteristics of cloud are that it runs across more than one operating system, has an application program interface (API) through which client can access resources and can provision and de-provision resources rapidly using automation.

2 THE DEFINITION OF CLOUD

Cloud

Cloud is essentially a flexible, scalable, pay-per-use model for the way IT services are delivered and consumed, typically through short-term contracts. With its pay-as-you-go model, cloud moves many IT costs from capital expenditure to operating expenditure; its "elastic model" means available IT capability can be flexed to mirror changing business demand; and it enables consumers of IT to have much greater transparency over their costs.

Cloud Computing

Cloud Computing as defined by U.S. National Institute of Standards and Technology (NIST) [1] seems to contain most common ingredients widely used and accepted in IT Industry. *Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction [1].*

3 CLOUD SERVICE MODELS

There are three cloud service models. (IAAS, PAAS, SAAS). The service providers and consumers can opt to use them individually or a full blown cloud model consisting of all three models mentioned above. Now let's see the definitions of all three cloud service models to get more clarity in schema of things.



IAAS (Infrastructure as a Service)

In IAAS, the server, computing, storage, networking responsibility and management lies with the service provider and organizations pay as per usage. Organizations buy the necessary infrastructure resources as needed and on-demand.

PAAS (Platform as a Service)

PAAS provides a platform and environment that allow developers to build applications and services over the internet. This provisioning model allows organizations to buy middleware, development tools and runtime environment as needed with scale-up or down options.

(SAAS) Software as a Service

SAAS applications are deployed in the cloud environment and are accessed by users within organizations. In this cloud model, Software is rented as a service rather than purchasing it. Installations, upgrades, necessary patches are responsibility of service provider.

4 CLOUD DEPLOYMENT MODELS

There are four main types of deployment models. Public cloud, Private cloud, Hybrid cloud and Community cloud.

Public Cloud

Public Clouds are usually available to all, or to large number of groups within an industry. Facebook, google, Hotmail are widely understood examples of public cloud. Public Clouds which are owned by service providers who make IT services available to multiple users over the internet. This offering can be free or there could be some nominal charges for the service usage.

Private Cloud

A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and the networks used are restricted and designated. [12]



Source: Cloud Computing Use Cases, A white paper produced by the Cloud Computing Use Case Discussion Group, Version 4.0, 2 July 2010

Hybrid Cloud

A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non-business-critical information and processing to the public cloud, while keeping business-critical services and data in their control. [12] Hybrid Clouds integrate cloud-to-cloud and/or cloud-to-enterprise to create a seamless IT environment.



Source: Cloud Computing Use Cases, A white paper produced by the Cloud Computing Use Case Discussion Group, Version 4.0, 2 July 2010

Community Cloud

A community cloud is controlled and used by a group of organizations that have shared interests, such as specific security requirements or a common mission. The members of the community share access to the data and applications in the cloud. [12]

5 KEY TECHNOLOGIES SUPPORTING CLOUD

There are some key technologies that complement and support cloud.

Virtualization

In computing, virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments.

Even something as simple as partitioning a hard drive is considered virtualization because you take one drive and partition it to create two separate hard drives. Devices, applications and human users are able to interact with the virtual resource as if it were a real single logical resource. [13]

Hypervisors

A hypervisor is a hardware virtualization technique that allows multiple guest operating systems (OS) to run on a single host system at the same time. [14] The guest OS shares the hardware of the host computer, such that each OS appears to have its own processor, memory and other hardware resources. You can think of a Hypervisor as the kernel or the core of a virtualization platform. The Hypervisor is also called the Virtual Machine Monitor. The Hypervisor has access to the physical host hardware.

Orchestration

Orchestration describes the automated arrangement, coordination, and management of complex computer systems, middleware, and services.

In these systems, a centrally controlled set of workflow logic facilitates interoperability between two or more different applications. A common implementation of orchestration is the hub-and-spoke model that allows multiple external participants to interface with a central orchestration engine. [15] It is often discussed as having an inherent intelligence or even implicitly autonomic control, but those are largely aspirations or analogies rather than technical descriptions. In reality, orchestration is largely the effect of automation or systems deploying elements of control theory [15]

6 OPEN STANDARDS - AS PART OF CLOUD STRATEGY

The hype around cloud has created a flurry of standards and open source activity leading to market confusion. As important as current standards development efforts are, they are not enough. There is a lack of a customer driven prioritization and focus within the cloud standards development process. [8] The Cloud Standards Customer Council separates the hype from the reality on how to leverage what customers have today and how to use open, standards-based cloud computing to extend their organizations. Cloud Standards Customer Council founding enterprise members include IBM, Kaavo, CA Technologies, Rackspace & Software AG. More than 400 of the world's leading organizations have already joined the Council, including Lockheed Martin, SAP, Citigroup, Fujitsu, State Street and North Carolina State University. [8]

In general, the cloud-computing community sees the lack of cloud interoperability as a barrier to cloud-computing adoption because organizations fear “vendor lock-in.” [9] Vendor lock-in refers to a situation in which, once an organization has selected a cloud provider, either it cannot move to another provider or it can change providers but only at great cost.

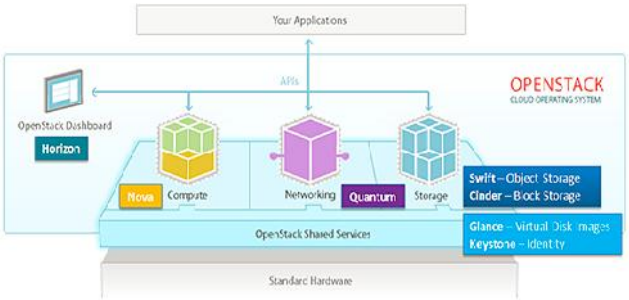
Businesses can take full advantages of Cloud service and deployments models when service providers enable these based upon Open Standards. Only when these have been designed and broadly adopted (and Open Source will massively help here) will we be able to call the Cloud a revolution.

Increasingly, a symbiotic relationship is emerging between open source and open standards. For instance, proponents of emerging open standards often turn to open source to implement the standards as a means of providing a reference, as well as providing a vehicle to drive adoption. As another example, communities developing an open source project formally document their project’s APIs and/or protocols when they feel that things are stable. [10]

7 OPEN SOURCE - AS PART OF CLOUD STRATEGY

OpenStack

Founded by Rackspace Hosting and NASA, OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface. [2]. OpenStack is an open source software for building private and public clouds which delivers a massively scalable cloud operating system.

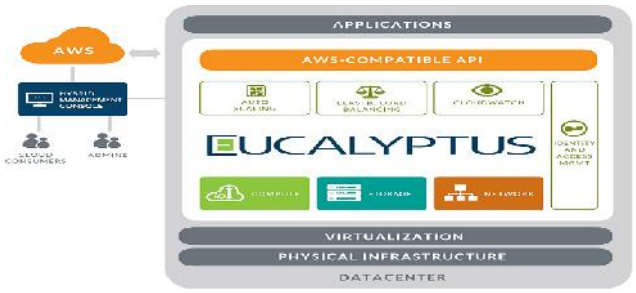


Source: Openstack website [2]

OpenStack has grown to be a global software community of developers collaborating on a standard and massively scalable open source cloud operating system. Their mission is to enable any organization to create and offer cloud computing services running on standard hardware. The project aims to deliver solutions for all types of clouds by being simple to implement, massively scalable, and feature rich. [2].

Eucalyptus

Eucalyptus is open source software for building AWS-compatible private and hybrid clouds. Eucalyptus is a Linux-based software architecture that implements scalable private and hybrid clouds within existing IT infrastructure. Eucalyptus allows you to use your own collections of resources (hardware, storage, and network) using a self-service interface on an as-needed basis. [3],



Source: Eucalyptus Datasheet [4]

Eucalyptus can dynamically scale up or down depending on application workloads and is uniquely suited for enterprise clouds, delivering production-ready software that supports the industry-standard AWS APIs, including EC2, S3, EBS, IAM, Auto Scaling, Elastic Load Balancing, and CloudWatch. The benefits of this open source software for private clouds are highly efficient scalability, organization agility, and increased trust and control for IT.

CloudStack

Apache CloudStack is a top-level project of the Apache Software Foundation (ASF). The project develops open source software for deploying public and private Infrastructure-as-a-Service (IaaS) clouds. CloudStack provides an open and flexible cloud orchestration platform to deliver reliable and scalable private and public clouds. [5] Apache CloudStack is a Java-based project that provides a management server and agents (if needed) for hypervisor hosts so that it can run an IaaS cloud.[5]

Joyent

Joyent uses true cloud-native technologies, like OS virtualization, to maximize the performance of its computing resources. Joyent is the high-performance cloud infrastructure and big data analytics company, offering organizations of any size the best public and hybrid cloud infrastructure for today's demanding real-time web and mobile applications. [6]

OpenNebula

OpenNebula vision is to bring simplicity to the private and hybrid enterprise cloud. OpenNebula combines existing virtualization technologies with advanced features for multi-tenancy, automatic provision and elasticity, following a bottom-up approach driven by the real needs of sysadmins and devops. [7]

8 BENEFITS OF MOVING IT BUSINESS SERVICES TO CLOUD

Cloud computing represents a significant shift in the way that IT resources are managed, operated, and consumed. This change exposes several benefits to enterprises, promoting greater IT efficiency and agility.

Capital expenses (CapEx)

Cloud promotes greater optimization and utilization of IT assets, allowing you to do more with less and achieve significant cost reduction. You can take on IT capital investments in increments of required capacity instead of building for maximum (or burst) capacity. [16]

Operating expenses (OpEx)

Public cloud offerings are billed to the enterprise on a pay-per-use basis and private clouds can be treated as OpEx by consuming business units, although IT would continue to make capital investments. Through automation, cloud reduces the amount of time and effort needed to provision and scale IT resources. [16]

Simplification

Cloud promotes simplification of the underlying IT infrastructure resources to fewer standardized products, technologies, and platforms. This standardization reduces operational complexity and promotes operational consistency. Cloud also encourages IT to develop a catalog of standard services on which to build business capabilities.

Flexibility

Cloud provides flexibility in the way you source, deliver, and consume the IT services you need to build business **capabilities**.

Agility

Cloud can compress the time needed to provision and deploy new applications and services from months to minutes. This increased agility allows you to experience the benefits of new applications and services and bring new capabilities to market sooner, creating a potential competitive advantage.

Overall, cloud offers a way for IT to create a platform for cost-effective and responsive innovation to become a partner for growth within the enterprise.

9 BARRIERS TO ADOPTION OF CLOUD

While most enterprises recognize the potential benefits of cloud, practical concerns and perceived challenges have hampered the widespread adoption of cloud. Many of these barriers can be understood as questions of trust: Can the cloud be trusted to deliver the same capabilities (or even better) at the same service levels in the same controlled way as traditional IT? [16]

Security

Security is one of the major concern for organizations planning to move to cloud. [16] As the usage and more deployments in cloud increases, so does the security threat to it. System and data security becomes prime concern for organizations.

Control

Organizations can be reluctant to handover the control of IT services to the external IT service provider Can application owners still have the same amount of control over their applications and the infrastructure supporting them in the cloud?

Fear of vendor lock-in

As it has already been proven and established fact that IT companies lock the organizations with their offerings. The answer to this question can be cloud but would this allow multi vendors integrations and offering to work seamlessly? There is fear of vendor lock-in.

Jurisdiction over data stored in the cloud?

Question is that where is the data stored in order to comply with privacy laws?. In the cloud, data flows around the globe, ignoring boundaries and time zones. Who has the jurisdictional control over the stored data? e.g. US data being stored in Asia?

Compliance

As cloud models are followed, there is a question which is asked by legal department of organizations i.e Can applications in the cloud meet the same regulatory compliance requirements as with the traditional IT models?

IT Service Provider - Out of business

What happens if the cloud service provider goes out of business and files bankruptcy? What will happen to organizational data?

Reliability

Can the same service-level agreements (SLAs) for reliability be met in the cloud, especially given the multi-tenant use of the underlying IT infrastructure?

Governance

The introduction of cloud computing requires an appropriate IT governance model to ensure a secured computing environment and to comply with all relevant organizational information technology policies.

Storage of Trade Secrets

Does the disclosure of the trade secret to a cloud service provider violate the Uniform Trade Secrets Act requirement to make reasonably effort to maintain secrecy?

Enterprises reluctance to change

Cultural change and resistance to change is one of the main factor affecting adoption of cloud in medium to large organizations. Could this be deciding factor in failure or success in moving IT business services to cloud?

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Conception d'un système de management de sécurité adaptable au contexte marocain

[Design of a Management system of safety adaptable to the Moroccan context]

Mahrat Fahd[1], Lotfi Bouchra[2], and Semma Elaami[1]

[1]Faculté des Sciences et Techniques, Université Hassan 1er,
Settat, Maroc

[2]Ecole Supérieure de Technologie, Université Hassan 1er,
Berrechid, Maroc

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ABSTRACT: Our study aims at studying the problems bound to the management of the Health and Safety in the Work in the Moroccan industrial context which possesses several human, financial and other specificities. Besides, the healthcare and Safety in the Work is very recent in Morocco and does not still present tangible results for the company directors. However, the latter are not enough conscious of business process of this office, nor they stakes and thus ignore the contributions of a good management of the industrial safety. These problems return these vulnerable companies in front of the various risks to the work and even for the certified companies. We noticed that the management systems of safety adapted until now in Morocco are inadequate and do not reach a satisfactory level of efficiency because they deal and do not focus on specificities and contextual problems.

So, we led our exploratory study within several Moroccan industrial companies, to take the real problems regarding health safety in the work. We also led, a comparative study of the various reference tables of the Management systems of Safety in particular the most spread, to be able to be inspired best practice and requirements essential to the performance of the Health and Safety to the Work. We were able to conceive a safety management system adapting, effective and efficient and handling these said peculiarities. We also endowed the various chapters of our proposal of an assessment grid to be able to translate the degree of conformity of companies in our reference table.

KEYWORDS: Health and Safety in the Work; Moroccan industrial context; safety management system; performance.

RESUME: Notre étude vise à étudier les problèmes liés à la gestion de la Santé et Sécurité au Travail au contexte industriel marocain qui possède plusieurs spécificités humaines, financières et autres. En plus, le domaine de la Santé et Sécurité au Travail est très récent au Maroc et ne présente pas encore des résultats tangibles pour les dirigeants d'entreprises. Toutefois, ces derniers ne sont pas suffisamment conscients des processus métiers de cette fonction, ni de ses enjeux et donc ignorent les apports d'une bonne gestion de la sécurité industrielle. Ces problèmes rendent ces entreprises vulnérables devant les différents risques au travail et même pour les entreprises certifiées. Nous avons constaté que les systèmes de management de sécurité adaptés jusqu'à présent au Maroc sont inadéquats et n'atteignent pas un niveau d'efficience satisfaisant puisqu'ils ne traitent et ne se focalisent pas sur les spécificités et les problèmes contextuels.

Ainsi, nous avons mené notre étude exploratoire au sein de plusieurs entreprises industrielles marocaines, afin de prélever les problèmes réels en matière de santé sécurité au travail. Nous avons mené aussi, une étude comparative des différents référentiels des Systèmes de Management de Sécurité notamment les plus répandus, afin de pouvoir s'inspirer des bonnes pratiques et des exigences indispensables à la performance de la Santé et Sécurité au Travail. Nous avons pu concevoir un système de management sécurité adapté, efficace et efficient et traitant ces dites particularités. Nous avons également doté

Corresponding Author: Lotfi Bouchra

les différents chapitres de notre proposition d'une grille d'évaluation afin de pouvoir traduire le degré de conformité des entreprises à notre référentiel.

MOTS-CLEFS: Santé et Sécurité au Travail ; contexte industriel marocain ; Système de Management Sécurité ; performance.

1 INTRODUCTION

La santé et la sécurité au travail représentent une préoccupation majeure pour les entreprises au niveau international. Au Maroc, ce chantier vient d'être ancré dans le milieu professionnel et engage actuellement l'ensemble des acteurs politiques et économiques. Les bonnes pratiques en matière de prévention de la Santé Sécurité au Travail SST deviennent donc nécessaires, non seulement en termes humains, mais également comme un moyen d'assurer la réussite et la pérennisation de l'entreprise ainsi que la prospérité à long terme des économies [1].

La situation de la SST dans les industries marocaines est jusqu'à présent alarmante : près de 200.000 accidents de travail sont enregistrés chaque année dans les entreprises au Maroc. C'est le constat du Groupement interprofessionnel de prévention et de sécurité (GPSI), lors du forum de la santé et de la sécurité au travail organisé à Casablanca le 26 avril par le ministère de l'Industrie [2]. Nous ajoutons que presque 20 milliards de dirhams sont versés aux assurances chaque année à cause des accidents et maladies au travail, soit presque 10% du PIB marocain toujours [2]. Ainsi, nous remarquons que la fonction SST au Maroc est encore marginalisée, surtout dans les PME/PMI qui connaissent beaucoup de difficultés liées à la gestion de cette fonction à cause du manque de conviction et de l'ignorance de la direction générale ou encore à cause du manque de sensibilisation des dirigeants d'entreprise.

Alors, l'implantation et la généralisation des Systèmes de Management Sécurité SMS dans l'ensemble des industries, semblent les remèdes logiques de cette déficience en matière de SST. Cependant, les particularités et les spécificités du contexte marocain, rendent les référentiels des systèmes de management sécurité adoptés jusqu'à présent au Maroc, notamment l'OHSAS18001 le référentiels le plus répandu au Maroc, inadéquats et n'atteignant pas par la suite un niveau d'efficience satisfaisant. Puisqu'ils ne traitent et ne se focalisent pas sur ces dites spécificités.

C'est la raison pour laquelle nous avons étudié d'une part, l'état de l'art des référentiels de SMS afin de pouvoir s'inspirer des bonnes pratiques et des exigences indispensables à la performance de la SST d'une part. D'autre part, pour confronter ces pratiques et recommandations à la réalité du terrain, nous avons mené une étude exploratoire au sein de plusieurs entreprises industrielles marocaines, afin de prélever les problèmes liés à la SST, pour pouvoir par la suite concevoir un SMS simple, adapté, efficace, efficient et traitant les particularités liées au contexte marocain.

2 ETUDE BIBLIOGRAPHIQUE DES REFERENTIELS DES SYSTEMES DE MANAGEMENT SECURITE

Tout d'abord, nous tenons à définir le management sécurité. Pour cela, nous prenons par exemple le modèle de Hollnagel [3], qui modélise ce management sous forme d'un système en boucle de rétroaction ou les variables d'entrée sont les objectifs de SST de l'entreprise et les variables de sortie sont les résultats de SST. Alors, le management de sécurité vise l'établissement d'un équilibre entre ces variables et l'adéquation entre les résultats de la SST et les objectifs déjà fixés.

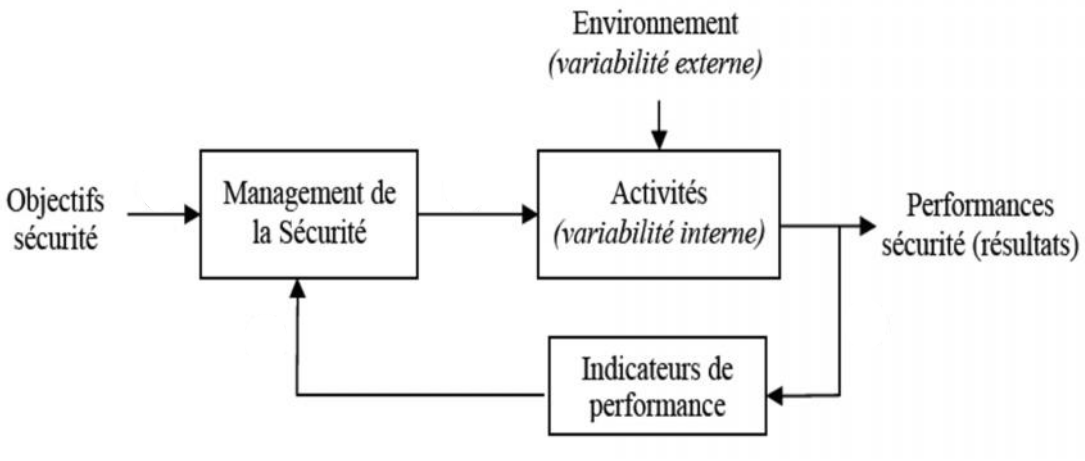


Figure 1 : Management de la Séurité inspiré de [3]

Selon la figue 1, le management SST impose au départ la définition des objectifs, ensuite l'entreprise doit planifier l'ensemble des mesures et plans d'action nécessaires à leur accomplissement. Ces plans d'action sont mise en œuvre par les différents intervenants et acteurs d'entreprise. Pour cela, il va falloir préserver, structurer et organiser l'ensemble des ressources nécessaires humaines, financières et techniques. Après, il faut procéder au contrôle de performance ou de résultats à l'aide d'indicateurs de performance, afin de vérifier l'atteinte d'objectifs, si non il faut revérifier les actions mises en place pour leurs atteintes, et ainsi garantir le réajustement du système et son amélioration continue.

Quant au système de management sécurité, et d'après notre étude bibliographique nous constatons qu'il n'existe pas une seule définition et que les définitions existantes sont assez disparates. Nous prenons comme exemple celle qui le définit comme : « …un dispositif de gestion combinant personnes, politique, moyens et visant à améliorer les performances d'une entreprise en matière de santé sécurité au travail. C'est un outil qui permet de mieux maîtriser l'organisation de l'entreprise, de progresser en continue en intégrant la SST à toutes les fonctions. » [4]. Ainsi, nous pouvons retenir qu'un SMS englobe l'ensemble d'étapes, d'actions, de processus et de moyens techniques et organisationnels indispensables aux bons fonctionnements et à la gestion de la SST.

Nous avons remarqué que depuis plus d'une dizaine d'années, les entreprises sont de plus en plus motivées, pour implanter des SMS, grâce à leur rôle capital dans l'organisation et l'amélioration continue en matière de SST, ce qui a engendré l'accroissement des référentiels de SMS. Ces derniers assistent les entreprises à prendre les dispositions d'organisation et de gestion indispensables au respect, des principes de la SST.

Nous présentons ci-dessous, les référentiels les plus représentatifs et les plus répandus et qui sont l'OHSAS18001 [5], l'ILO OSH 2001 [6] et le MASE [7].

2.1 ILO-OSH 2001

Elaboré et validé en 2001, dans un cadre tripartite (gouvernements, employeurs, employés) par le Organisme Organisation Internationale de Travail, afin d'étendre l'expérience des pays industrialisés en matière de SST à toute la main d'œuvre mondiale. Il se base sur le principe de l'amélioration continue et plus précisément le principe du PDCA ou la roue de deming, et il met les opérateurs au cœur du système, en les impliquant tout au long du processus de mise en œuvre, ainsi il inclue les chapitres suivants :

- Politique

Ce chapitre présente les dispositions pour établir une politique efficace de gestion de la SST au travail. Il met l'accent sur l'importance de la consultation des employés et leurs représentants lors de sa mise en place. Il exige aussi que la politique doit être propre à l'organisation, claire et concise, accessible à toutes les personnes, revue régulièrement et elle doit contenir les principes et les objectifs de l'entreprise en matière de la SST.

- Organisation

Ce chapitre donne des orientations touchant les structures de gestion, notamment la répartition des responsabilités et les attributions des différents intervenants hiérarchiques pour l'exécution des politiques adoptées. Il insiste aussi sur le rôle de la formation et les compétences, en mentionnant que chaque personnel de l'entreprise, de l'opérateur au directeur, doit avoir les compétences nécessaires, lui permettant d'assumer les devoirs et les responsabilités concernant les aspects de la sécurité et de la santé liés à son travail. Il traite aussi, le rôle de la documentation dans le système et il indique qu'en fonction de la taille de l'entreprise, une documentation doit être établie, tenue à jour et doit contenir la politique, les responsabilités, les principaux risques et les mesures de protections, ainsi que les différentes procédures et instructions mises en œuvre dans le cadre du système de gestion de la SST. Finalement, il évoque l'indispensabilité de la communication des informations relatives à la SST entre les différents niveaux et fonctions de l'organisation.

- Planification et mise en oeuvre

Ce chapitre contient des orientations concernant l'examen préalable, en cas d'absence d'un système de gestion de la SST, ou si l'organisation a été récemment créée, l'examen initial doit servir de base à la mise en place d'un système de gestion de la sécurité et de la santé au travail. Il doit être effectué par des personnes compétentes en consultation avec les travailleurs. La planification de mise en œuvre a été aussi abordée dans ce chapitre en mettant en place des dispositions adéquates et appropriées, conformément aux résultats de l'examen initial, des examens ultérieurs ou à d'autres données disponibles. Le chapitre exige aussi des objectifs mesurables, la prévention des dangers où est indiqué comment traiter les risques : l'élimination, la réduction et la maîtrise, les procédures et les actions de préventions associées, la gestion des changements, la préparation aux situations d'urgence, l'acquisition des biens et des services et finalement, la gestion des sous traitants.

- Evaluation

Ce chapitre décrit les méthodes à suivre pour vérifier et mesurer les performances SST, en exigeant des indicateurs qualitative et quantitative de la performance, en surveillant la réalisation des programmes d'action et en assurant l'inspection systématique des procédures de travail, des installations, des sites de production et des équipements . Les enquêtes en cas de lésions, incidents et accident sont aussi abordées dans ce chapitre en mentionnant qu'elles doivent être réalisées par des personnes compétentes et elles doivent relever les vraies causes de ces disfonctionnements. Finalement, ce chapitre exige de procéder à des audits afin de recenser les points à améliorer. Pour cela, il convient d'établir une politique et un programme d'audit qui fournissent des indications sur la compétence de l'auditeur, ainsi que sur la portée, la fréquence, la méthodologie de l'audit et la présentation des rapports. Il est exigé aussi de communiquer les résultats aux personnes responsables des actions correctives et préventives nécessaires. Le chapitre traite finalement l'indispensabilité de l'examen par la direction et qui doit évaluer la stratégie globale du système de gestion de la SST, la capacité du système de gestion à répondre aux besoins globaux de l'organisation et de toutes les parties prenantes et la nécessité de modifier le système de gestion. En ce qui concerne les conclusions de l'examen, elles doivent être enregistrées et formellement communiquées aux personnes concernées.

- Mesures d'amélioration

Ce chapitre exige la mise en place des mesures préventives et correctives, pour améliorer continuellement les performances, en identifiant et analysant les causes profondes de tout aspect non conforme aux réglementations en vigueur en matière de sécurité et de santé au travail et/ou aux dispositions relatives aux systèmes de gestion de la sécurité et de la santé au travail. Finalement, le chapitre traite l'amélioration continue en exigeant des dispositions assurant l'amélioration continue de ces éléments.

2.2 OHSAS 18001

La norme britannique OHSAS 18001 (Occupational Heath and Safety Assessment Series), est un modèle de Système de Management de la Santé et de la Sécurité au Travail. Son objectif est de fournir aux entreprises le souhaitant un support d'évaluation et de certification de leur SMS et de la sécurité au travail par rapport aux normes internationales les plus connu de systèmes de management : ISO 9001 pour la Qualité, ISO 14001 pour l'Environnement. Ce référentiel est né en 1999 à l'initiative du BSI (British Standard Institut) et de divers organismes certificateurs dans l'espoir de création d'une norme ISO en la matière. Elle a été révisée en juillet 2007, en se rapprochant sensiblement du référentiel international ILO-OSH 2001. Il précise les exigences qu'un système de management de la SST, doit satisfaire pour permettre à un organisme de maîtriser ses risques et d'améliorer sa performance en la matière. La mise en œuvre de ce référentiel se divise en six chapitres :

- Exigences générales

Ce chapitre mentionne la nécessité de la mise en place, de la documentation, et de la mise à jour du système de management de sécurité conformément aux exigences du référentiel ainsi que la définition du champ d'application.

- Politique SST

Le référentiel exige dans ce chapitre d'établir une politique sécurité dans le contexte du champ d'application et qui soit appropriée à l'organisme, incluant un engagement envers la prévention des atteintes à la SST, à l'amélioration continue et au respect des exigences réglementaires. Elle doit être aussi documentée et mise à jour, diffusée et mise à la disposition de toutes les parties et finalement revue régulièrement.

- Planification

Ce chapitre traite l'identification, l'évaluation des risques et mesures de contrôle, pour cela il exige la mise en place des procédures spécifiques à la gestion des risques à savoir l'identification, l'évaluation et la mesure et le contrôle. Ces procédures doivent prendre en compte toutes les activités de l'entreprise y compris les activités avoisinantes, ainsi elles doivent réduire les risques selon une hiérarchie bien définie : l'élimination, la substitution, le contrôle d'ingénierie, la signalisation, l'avertissement et la protection individuelle. La veille réglementaire est aussi indispensable en exigeant des procédures d'identification des textes applicables et leur respect. Finalement, le chapitre exige d'établir des objectifs SST, réalisables et mesurables conformément à la politique SST. L'entreprise doit aussi établir des programmes d'action et nommer leurs responsables afin de garantir l'atteinte de ces objectifs.

- Mise en œuvre et fonctionnement

Dans cette phase l'entreprise doit mobiliser les ressources humaines et financières nécessaires pour réussir la mise en place du système de management sécurité. Elle doit aussi définir les rôles, les responsabilités et les obligations de chaque intervenant en matière de santé sécurité au travail. Le deuxième point de cette phase est la formation, la compétence et la sensibilisation ou le référentiel exige que l'ensemble des employés ait les compétences et les connaissances techniques nécessaires à l'accomplissement sécuritaire de leurs tâches. Pour cela, l'entreprise doit identifier le besoin en formation, le planifier, l'évaluer et conserver les enregistrements afférents. La communication est aussi une partie intégrante des exigences en mettant des procédures garantissant la communication interne en matière de la SST entre les différents intervenants de l'entreprise, la communication avec les sous traitants et les visiteurs sur le lieu et la communication avec les parties intéressées externes. L'entreprise doit aussi garantir la participation et la consultation des employés en les impliquant dans l'identification des dangers, l'établissement de la politique SST, les enquêtes en cas de lésion et toute modification affectant leur SST. Ce chapitre traite aussi la documentation et son contrôle et exige que la documentation doive inclure la politique et les objectifs, le champ d'application, les principaux éléments du système de management et les enregistrements jugés nécessaires au bon fonctionnement du processus SST. Quant au contrôle, il porte sur l'approbation des documents, la révision et la mise à jour si nécessaire, en quelques mots il s'agit de la maîtrise documentaire à l'instar de l'ISO 9001. Le point suivant de ce chapitre est la maîtrise des opérations et des activités, qui consiste à déterminer les activités associées aux dangers. Pour ces activités, l'entreprise doit mettre en œuvre des contrôles et des mesures de sécurité intégrées dans son SST. Finalement, le chapitre traite les situations d'urgences, pour cela l'entreprise doit identifier les situations d'urgences potentielles et mettre en œuvre des procédures pratiques pour en faire face. L'entreprise doit également tester ces procédures de manière régulière.

- Vérification :

La première exigence de ce chapitre est la mesure et surveillance de performance pour cela l'entreprise doit mettre en œuvre des procédures afin de prévoir des mesures qualitatives et quantitatives, une surveillance du niveau de réalisation des objectifs, des mesures réactives et proactives de performance de la SST, ainsi que les enregistrements de ses résultats nécessaires à l'analyse de sa performance. Le deuxième point dans ce chapitre est l'évaluation des conformités où il est exigé des procédures assurant l'évaluation de manière périodique de la conformité des textes réglementaires, le référentiel exige aussi la conservation de ces évaluations périodiques. Après, ce chapitre exige une recherche d'incident/accident, en mettant en place des procédures assurant une investigation efficiente afin de révéler et d'analyser les causes sous jacentes des anomalies et en déduire les actions correctives et préventives associées. La maîtrise des enregistrements est aussi exigée en imposant la conservation des enregistrements apportant la preuve de la conformité aux exigences du système de management sécurité. L'audit interne est le dernier point traité dans cette phase où la norme exige des audits à des intervalles planifiés afin de vérifier la conformité aux exigences réglementaires et de la norme OHSAS. Si le système satisfait de manière efficace à l'achèvement des objectifs déjà tracés dans ce sens la norme exige de mettre en place des procédures garantissant l'objectivité et l'impartialité du processus d'audit, en éclaircissant les responsabilités lors des audits, les

compétences nécessaires, les exigences en matière de planification, la réalisation des audits et les enregistrements des résultats.

- Revue de direction

Elle occupe tout un chapitre et il est exigé à la direction de réexaminer le système de management de la SST de l'organisme, à intervalles planifiés, pour garantir la continuité de son applicabilité, son adéquation et son efficacité. Les données d'entrée des revues de direction doivent inclure les résultats des audits internes et des évaluations de conformité aux exigences légales, les résultats de participation et de consultation du personnel, l'état des recherches d'incidents… Finalement, les données de sortie des revues de direction doivent être cohérentes avec l'engagement de l'organisme envers l'amélioration continue et inclues toute décision et action se rapportant à des modifications.

2.3 MASE

Manuel Assurance Sécurité des Entreprises est le nom du référentiel élaboré en 1996 qui a pour objet de promouvoir et d'améliorer la sécurité, l'hygiène et la protection de l'environnement dans les entreprises adhérentes. En 2003, le terme Assurance a été remplacé par le terme Amélioration. Historiquement, conçu pour les sites pétrochimiques de Berre l'étang, ce référentiel d'audit et de certification définit les exigences auxquelles doit satisfaire le système de management des entreprises en ce qui concerne les domaines de la sécurité, de l'hygiène industrielle et de la protection de l'environnement. Le référentiel s'articule autour de 5 axes :

- Engagement de la Direction

Le premier point dans ce chapitre est la responsabilité de la direction, traitant d'une manière générale les différentes obligations de la direction telle que la politique SST, la mise en place d'un SMS, la définition d'objectifs, et la revue de direction. Après, le chapitre traite la politique de la SST qui doit inclure les objectifs, l'engagement au respect de la réglementation, la gestion des risques, la lutte contre les addictions et la maîtrise des sous traitants. Enfin, cette politique doit être exprimée clairement et revue régulièrement. Les indicateurs et la diffusion des résultats sont aussi l'un des exigences traitées dans ce chapitre en imposant des indicateurs chiffrés, comme le nombre d'absentéisme et d'accident, et leur communication au personnel. La planification est aussi exigée par la mise en place d'un système d'analyse des risques, l'attribution des objectifs au personnel d'encadrement et l'établissement des plans d'action, afin d'atteindre les objectifs escomptés. Ensuite, le chapitre exige l'identification des responsabilités et des autorités des différents intervenants et l'allocation des ressources matérielles et humaines nécessaires à la réussite du système de management de SST. Finalement, le chapitre traite le point de l'animation et la communication où il exige d'organiser des causeries et des réunions de sensibilisation du personnel afin de promouvoir l'esprit et le comportement sécurité.

- Compétences et qualifications professionnelles

La formation et la qualification professionnelle est la première exigence dans ce chapitre, en imposant un plan annuel de formation et son suivi, une amélioration des connaissances et des compétences pour les nouveaux embauchés. La norme exige un système d'évaluation formalisé, un système de formation spécifique et systématique ainsi qu'un système de parrainage et ou de compagnonnage. Après, le chapitre traite les exigences liées au personnel d'appoint d'intérimaires qui se résultent par l'identification du besoin du personnel d'appoint et des compétences nécessaires, la fourniture des informations et des formations appropriées, la fourniture des équipements de protection individuelle adéquates et les aptitudes médicales nécessaires. La norme exige aussi que ce personnel doit être distingué par des badges ou des tenues différentes. Ensuite, la norme exige en termes de compétences et d'habilitations une liste de qualifications professionnelle ou encore de personnes habilitées, qui doit être tenue à jour et qui précise les qualifications et l'expérience requises pour chaque poste. Finalement, le chapitre traite un point très intéressant qu'est l'appropriation du SMS par tous les acteurs et à tous les niveaux.

- Préparation et organisation du travail

La préparation consiste à nommer un responsable de planning compétent. La mise en place des moyens et des compétences nécessaires à la réalisation sécuritaire des tâches est aussi obligatoire, ainsi qu'un dispositif de gestion des demandes urgentes. Après, le chapitre traite l'organisation de l'intervention en imposant à chaque entreprise intervenante une liste nominative incluant les personnes et leurs autorités afin de connaître les personnes présentes sur le site et les interlocuteurs responsables. Ensuite, il est exigé aux différents intervenants de communiquer tout changement ou modification de l'intervention. Le point suivant consiste à fournir au personnel les équipements de protection individuelle et l'outillage et le matériel adéquat, à garder aussi les lieux de travail propres et salubres. Il convient aussi à l'entreprise utilisatrice de se conformer aux règles générales du chantier. Après, la norme exige que le matériel des entreprises

intervenantes soit en bon état en imposant les contrôles et les inspections techniques de tous les engins. Une analyse des risques et mesures de contrôles est aussi obligatoire. Le chapitre traite aussi la maîtrise de la sous traitance en imposant une bonne sélection et un bon suivi ainsi qu'une évaluation efficace en matière de santé sécurité au travail. Finalement, le chapitre traite la documentation générale et exige une bonne gestion des documents.

Contrôles

L'audit est le moyen de l'entreprise intervenante pour vérifier l'efficacité de son système de management SST par des contrôles réguliers et planifiés, qui peuvent prendre la forme d'audits, d'inspections, de visites et/ou d'observations sur le terrain. La norme exige au minimum un audit complet du système par an. La norme a même spécifié les sujets sur lesquels les audits doivent se baser à savoir : la politique, la progression dans l'atteinte des objectifs, le respect des procédures et l'avancement des plans de formation. Le deuxième volet dans ce chapitre est l'analyse des incidents, des accidents et des situations dangereuses en imposant une méthode d'analyse d'accident afin de déterminer les vraies causes et de définir les mesures correctives et préventives.

Amélioration continue

Dans ce chapitre la norme exige une analyse des résultats par le comité de direction afin d'alimenter le processus d'amélioration continue en identifiant les causes des dérives constatées et en définissant et planifiant les améliorations nécessaires. La norme précise même les sources d'analyse comme par exemple l'historique des indicateurs de SST, les retours d'informations et d'expériences. Finalement, les décisions issues de cette analyse peuvent être :

- Un nouveau plan annuel de Santé Sécurité Environnement SSE.
- De nouveaux objectifs SSE.
- Un lancement d'actions nouvelles préventives ou correctives.
- Des changements d'affectation des ressources, des méthodes ou des plans.

Nous tenons à rappeler que notre analyse bibliographique a été basée seulement sur le critère de pratiques gestionnaires et non pas sur les modalités de certification, afin d'identifier les processus de gestion les plus pertinents se retrouvant dans ces trois référentiels et pouvoir décliner par la suite une structure type de SMS adaptable au contexte marocain se spécifiant par plusieurs particularités et contraintes**.**

Force est de constater que presque l'ensemble des référentiels en SST repose sur le même principe de l'amélioration continue du PDCA (plan, do, check, améliore) [8] [9] [10]... En débutant par une phase de planification (bilan initial, analyse des risques, veille réglementaire…), puis en entamant la réalisation de ce qui a été planifié (plan et programmes d'action), ensuite en contrôlant ce qui a été réalisé par des processus d'évaluations (inspection, audit…), afin de pouvoir à la fin mettre en place des actions correctives pour l'amélioration du système.

Ainsi, et après avoir analysé le contenu et la structure des différents référentiels de la SST existants, nous présentons dans la partie suivante notre diagnostic du domaine de SST dans des entreprises marocaines afin de pouvoir par la suite concevoir un système de management pratique et plus adapté.

3 CONTEXTE DE LA SANTE ET SECURITE AU TRAVAIL AUX INDUSTRIES MAROCAINES

La Santé Sécurité au Travail SST est un domaine très récent au Maroc et il est encore ignoré par plusieurs dirigeants et patrons d'entreprises. Nous ajoutons à ce constat l'insuffisance de la loi en matière de SST selon l'ensemble des intervenants et experts au Maroc [11]. Le niveau d'instruction très bas des opérateurs et chefs d'équipe et le taux énorme d'analphabétisme ainsi que le manque de conviction de ces derniers. Il s'y ajoute souvent des conditions défavorables de travail tel que les salaires très bas, et l'absence des avantages sociaux… Ces conditions engendrent une situation inquiétante en matière de SST, en faisant apparaître des accidents scandaleux tel que l'incendie de Rosamor qui a provoqué 55 morts dont 29 femmes, l'effondrement d'un centre commercial à Ouled Oujih à Kenitra provoquant 18 morts et 26 personnes grièvement blessées.

Alors, pour cerner les différentes causes adjacentes de l'état défavorable de la sécurité industrielle au Maroc, nous avons établi un diagnostic du terrain au sein de plusieurs entreprises industrielles marocaines, qui a été mené dans le cadre de notre étude du contexte de la SST au Maroc. Nous présentons les entreprises industrielles étudiées :

- **CECI** Centrale d'Equipement et Carrosserie Industrielle, faisant le montage des carrosseries pour camions (bennes, caisses frigorifiques…). La société CECI, est une SARL de droit marocain au capital de 25'000'000.00 de dirhams, crée en 2004. Le siège social de la société se trouve à Casablanca. Il gère une unité de production installée à Ain Sebâa sur une

surface globale de 28 000 m², ainsi que l'unité de service après vente basée à Ain Harrouda sur une surface de 2 500 m². La société peut atteindre jusqu'à 120 opérateurs selon les fluctuations des commandes dont 80 intérimaires.

- **PRODEC** industrie chimique, faisant la production de la peinture pour bâtiment et carrosserie. Elle possède un site situé dans la zone industrielle d'Ain Sebâa Casablanca d'une superficie de 14500 m^2. Ce site est composé de : trois ateliers de peinture bâtiment, de peinture carrosserie et atelier de maintenance, deux magasins de produits finis et des matières premières et un bâtiment pour le laboratoire. Cette unité produit 22 250 tonnes de peinture par an, et peut atteindre jusqu'à 200 opérateurs selon la saisonnalité dont 140 intérimaires.
- **Projet de construction** de la « laverie phosphate elhallassa », qui consiste à la réalisation de la plus grande laverie au monde de phosphate. Elle est composée de deux lignes de lavage d'une capacité unitaire de 1.600 tonnes/heure, d'un atelier de flottation, de six broyeurs, d'une digue sur 120 ha pour l'épandage des boues et la récupération des eaux, de deux décanteurs à boues et de trois décanteurs de produits. La réalisation de ce projet s'inscrit dans le cadre de la stratégie industrielle des mines de l'Office Chérifienne du Phosphate OCP qui est le maître d'ouvrage. Ce projet de situe dans le bassin de Ouled Abdoune, qui mobilise un budget global de l'ordre de 2,2 milliards de USD. Il compte plusieurs contractants opérant dans différents domaines. Nous avons pu diagnostiquer l'état de la SST dans ces entreprises intervenantes dans ce projet :
  - **SGTM** Société Générale des Travaux Marocains opérant dans la construction de bâtiment et des travaux publics, l'une des grandes sociétés du BTP au Maroc et comptant plus de 1000 ouvriers dans le chantier étudié.
  - **STROC** Maroc faisant la charpente et la construction métallique, comptant plus de 200 ouvriers dans le chantier étudié.
  - **Longo Métal** opérant dans la distribution et la transformation des produits métallurgiques, comptant plus de 100 ouvriers dans le chantier étudié.

Notre diagnostic comporte d'abord un constat de la situation de la SST à travers les problématiques majeures liées à cette fonction et plus précisément les problématiques opérationnelles de la gestion quotidienne des différents thèmes de la SST. Ensuite, nous présentons nos hypothèses sur les causes adjacentes de ces problématiques, selon notre analyse du terrain et nos questionnaires et brainstorming avec plusieurs intervenants et experts en SST au Maroc.

3.1 PROBLEMES LIES A LA GESTION OPERATIONNELLE DE LA SANTE ET SECURITE AU TRAVAIL

Nous avons procédé à une recherche ingénierique puisque notre problématique est de type organisationnelle et que les connaissances théoriques disponibles sont peu pertinentes pour apporter des réponses concrètes et adaptables. C'est la raison pour laquelle nous avons accompagné et pendant plusieurs mois les entreprises étudiées citées ci-dessus, afin de conduire des recherches qui soient à la fois utiles pour les responsables d'entreprise et génératrices de connaissances scientifiques nouvelles.

Lors de notre collecte d'information et mise à part notre analyse et constatation du terrain , nous nous sommes basés sur l'outil du focus groupe (groupes d'opérateurs, de chefs d'équipes et de responsables) qui est une forme de recherche qualitative, qui prend forme au sein d'un groupe spécifique culturel, sociétal ou idéologique, afin de déterminer la réponse de ce groupe et l'attitude qu'il adopte au regard d'un produit, d'un service ou d'un concept.

Ainsi, nous présentons dans ce qui suit, l'état des problèmes, des anomalies et d'infractions opérationnelles par thème que connaissent ces entreprises malgré les tentatives de résolution. Alors, les thèmes ci-dessous ne sont pas exhaustifs mais ils sont les plus flagrants et les plus communs et répétitifs de l'ensemble des thèmes liés à la santé sécurité au travail dans le contexte étudié.

- **Port des Equipements de Protection Individuelle (EPI)**

Nous avons constaté que le port des EPI est non respecté dans la majorité des cas à cause de la mauvaise gestion des EPI qui est souvent déléguée aux magasiniers et chefs d'équipes ainsi que l'absence d'une procédure claire de leur gestion (absence d'une matrice des besoins en EPI selon la nature du poste, la non désignation officielle de la personne qui fait le suivi du stock et d'approvisionnement en EPI, l'absence d'une décharge devant être signée par l'opérateur lors de la réception de ces EPI, l'absence d'un système de sanction en cas de perte, l'absence de plan de sensibilisation au port d'EPI…), ce qui entraîne :

- Des ruptures de stock en EPI avant les dates planifiées, et le personnel reste sans EPI jusqu'à la prochaine commande.
- Le non respect du port d'EPI sauf en cas d'inspection ou d'audit,
- La non conservation des EPI par les opérateurs (EPI perdus, vendus ou dégradés à cause de la mauvaise utilisation),
- Le manque de conviction des chefs d'équipes et des opérateurs en prétendant que l'accident est un destin inévitable,

- L'achat des EPI inadaptés ou de mauvaise qualité : des lunettes de protection non médicales empêchant la bonne vision et altérant la santé des yeux, des gants de protection inadéquats aux travaux effectués…

■ **Risques liés aux Circulations internes**

L'ensemble des entreprises étudiées rencontre les mêmes problèmes au niveau de la circulation interne, nous citons en premier lieu, l'absence d'un plan officiel et formalisé de circulation des sites, indiquant les voies piétonnières, les voies de circulation des engins, le passage piéton … ce qui entraîne :

- Des circulations internes aléatoires ;
- Le non respect de la limitation de vitesse presque pour l'ensemble du personnel ;
- Un stationnement aléatoire et un peu partout aux zones de travail des engins et des véhicules ;
- Des activités et des travaux sur les voies de circulations sans autorisation et sans balisage ;
- Un chargement des matériaux dégageant des poussières et des particules gênantes. Ceci se fait par excès par rapport au volume du contenant (bennes…) et sans bâchage ce qui est très nuisible pour l'ensemble des personnes existants sur les zones de travail ;
- La rentrée de pièces volumineuses ou de grande langueur n'est pas traitée par une procédure spécifique ;
- L'insuffisance ou l'absence des panneaux de signalisation et les panneaux existants sont mal entretenus ;
- Absence d'une procédure de gestion des personnes et des matières entrant et sortant (employés, visiteurs, condidats et chercheurs d'emploi, fournisseurs, matières dangereuses…).

■ **Les opérations de levage**

L'ensemble des entreprises de construction étudiées souffre des mêmes problèmes au niveau des opérations de levages. Nous citons en premier lieu, l'état défavorable des équipements de levage (grues, palans, chariots élévateurs…), parfois, sans contrôle technique. Nous ajoutons à cela le manque ou l'absence de formation et d'habilitation des grutiers et élingueurs. Ces deux facteurs proviennent de l'absence de l'inspection étatique d'une part, d'autre part, de l'ignorance des dirigeants de ces entreprises, ce qui engendre plusieurs infractions et mauvaises manipulations. Nous présentons ci-dessous les points les plus flagrants :

- Des opérations de levage incorrectes, répétitives et très risquées. Par exemple : levage des chariots de bouteilles d'oxygène et d'acétylène sans amarrages, levage des tiges de ferraillage sans cerner le centre de gravité ce qui engendre un basculement énorme, levage critique (grand poids ou grand volume) sans plan de levage, tire au renard qui est très connu en jargon de levage et qui veut dire que la grue tire la pièce alors qu'elle est conçue pour la lever, levage des seaux de bétons par manuto ou chariots élévateurs directement sur les fourches…
- Elingueurs non formés sur les techniques et les risques éventuels ce qui les expose aux énormes risques d'écrasements…
- Grutiers et conducteurs d'équipements de levage n'ayant pas des habilitations de conduite et par la suite ignorent les bonnes pratiques de levages et ils sont non responsabilisés sur leurs actes.
- Chevauchement des grues et espaces sécuritaires (entre grues) non anticipé et non respecté
- L'absence et le non respect des vérifications périodiques exigées par le constructeur des équipements de levages

■ **Travaux en hauteur**

Nous avons remarqué que les entreprises de construction étudiées, souffre d'une mauvaise gestion des travaux en hauteur, en négligeant le rôle de la formation des différents intervenants en travaux en hauteurs et en s'intéressant seulement à l'achèvement des travaux quelque soit les pratiques et les méthodes utilisées :

- L'utilisation des échelles pour de longues durées voire comme poste de travail ce qui engendre un risque énorme de chute ;
- Utilisation des échelles en position inverse par la quasi-totalité des opérateurs (opérateurs non formés sur l'utilisation des échelles) ;
- Les opérateurs grimpent sur des panneaux de coffrage pouvant atteindre plus de 9 mètres, sans ceinture de sécurité et travaillent en posant les pieds sur les tiges de fixations de panneaux ;
- Les plates formes sur console ne sont pas inspectées et pouvant atteindre les 8 mètres de hauteur sans accès, ce qui poussent les opérateurs à grimper sur les panneaux de coffrage ;
- La quasi-totalité des plates formes sur console n'est pas munie de garde-corps ;
- Echafaudages utilisés malgré l'étiquette non-conforme ;
- Planchers d'échafaudage mal rangé et passage de circulation non préservé.

- Les conducteurs de nacelles n'ayant pas les habilitations de conduites, et nous avons même témoigné d'un accident mortel d'un conducteur de nacelle qui était au-dessous d'un support rigide et lorsqu'il a voulu faire descendre la nacelle, il a actionné le bouton de l'élévation ce qui a provoqué l'écrasement de son visage contre le support et par la suite sa mort immédiate. .
- Le non respect du port de ceinture de sécurité dans plusieurs cas.

■ **Sanitaires et conditions hygiéniques**

L'ensemble des entreprises industrielles étudiées connaissent des conditions hygiéniques et sanitaires défavorables :

- Stockage des eaux potables dans des cubi-containers (pour matières chimiques) ce qui impacte négativement la qualité des eaux
- Les fontaines d'eau ne sont pas alimentées en permanence (pas d'eau pendant plusieurs heures).
- Les tasses d'eau ne sont pas humaines (bouteilles d'eau en plastique coupée en deux)
- Les toilettes ne sont pas suffisantes pour le nombre du personnel et sont mal entretenues
- Réfectoire insuffisant pour le nombre existant ce qui pousse les opérateurs à manger dans leurs postes de travail
- Déchet débordé partout dans le chantier à cause d'une absence de gestion de déchet

■ **Stockage et manipulation des matières chimiques**

Nous citons ci-dessous les anomalies communes liées à la manipulation des matières chimiques :

- Stockage non-conforme de fûts de matières chimiques (pas de bacs de rétention, pas de balisage, pas de signalisation..),
- Manipulation des produits chimiques sans gants appropriés, et sans masques respiratoires.
- Bacs de rétention des citernes de stockage de matières chimiques non réglementaires (étanchéité, volume…)
- Transvasement de matières chimiques des cubi-containers vers les citernes de stockage se fait (sans pompe) par levage et inclinaison de ces cubi-containers (opération très risquée pour l'opérateur)
- Les opérateurs et surtout les chefs d'équipes ne sont pas formés sur les risques des produits chimiques utilisés et par la suite, ils ne sont pas conscients des risques encourus.
- L'absence d'étiquetage indiquant les dangers sur les containers de matières chimiques
- L'absence de fiches de données de sécurité des matières chimiques utilisées.

■ **Risque d'incendie**

Nous avons observé que l'ensemble de ces entreprises commet les infractions et les anomalies suivantes :

- 80% des extincteurs inspectés sont non-conformes (goupille inexistante, pas de pression, extincteurs inaccessibles, mauvais accrochage…) ;
- Personnel n'est pas formé sur l'extinction du feu et sur la première intervention contre l'incendie ;
- Stockage et cumule des chutes et poubelle (bois, carton, plastique) surtout avec l'élévation de la température ;
- Stockage adjacent des bouteilles d'oxygène et d'acétylène non réglementaire (le non respect de la distance sécuritaire et qui est de 6 mètres) ;
- L'absence d'extincteurs dans plusieurs endroits vulnérables ;
- Le stockage de matières inflammables à côté des armoires électriques.

■ **Ordre et propreté**

Nous avons constaté pour l'ensemble des entreprises étudiées que leurs leaders sont non engagés et les chefs d'équipes ne sont pas convaincus de la nécessité de l'ordre dans leurs postes de travail ce qui entraîne :

- Postes de travail mal rangés en permanence (chute de bois et tiges métalliques, outillages jetés par terre, câbles électriques mal acheminés….)
- Absence d'une procédure de gestion des déchets.
- Absence de pause avant fin de poste pour nettoyage et rangement
- Travail à la tâche ne laisse aucune motivation pour le nettoyage et l'arrangement
- Outillage dispersé et mal rangé dans les zones de travail
- Les opérateurs intérimaires n'ont aucune motivation du maintien d'ordre et de propreté

3.2 LES HYPOTHÈSES SUR LES CAUSES DES PROBLÉMATIQUES DE LA SST AU MAROC

Nous avons mené une étude bibliographique associée d'une étude pratique basée sur des questionnaires et des brainstormings avec plusieurs animateurs, responsables et experts en sécurité afin de dévoiler les causes de ces problématiques de la SST au Maroc. Elles sont généralement liées à l'environnement culturel et social, au contexte réglementaire, ainsi qu'aux mauvaises pratiques de gestion de cette fonction. Alors, nous déduisons ci-dessous un bilan des différents problèmes et causes d'inorganisation, spécifiques au contexte national et favorisant ces mauvaises pratiques en termes de SST.

- Un dispositif législatif et réglementaire défaillant et qualifié selon plusieurs experts d'ancien et inadapté, incomplet et axé sur le curatif plutôt que sur le préventif ou encore inappliqué et méconnu par les patrons et les clients internes (les employés) selon [13].
- L'absence ou le manque de l'inspection étatique, créant par la suite une plateforme fertile d'infraction et d'inorganisation en matière de sécurité industrielle.
- L'absence du rôle syndical au sein de l'entreprise à cause du niveau bas d'instruction des représentants syndicaux.
- La non généralisation de recrutement des cadres techniques assurant cette fonction au sein de l'entreprise et par la suite l'absence entière de l'aspect sécurité.
- La non introduction des systèmes et normes de la SST dans les marchés publics, précisément dans les états estimatifs et les bordereaux de prix, ce qui rend tous les projets de construction étatiques catastrophiques en matière de la SST.
- Le manque de conviction et d'engagement des dirigeants des entreprises, ce qui réduit leur investissement en matière de la SST, en ignorant l'intérêt et la rentabilité d'investir en SST.
- Le niveau très bas d'instruction des opérateurs dû à un grand taux d'analphabétisme et d'une modeste culture relative à la SST (généralement des opérateurs issus du monde rural) contribuent significativement aux croissances des mauvais comportements, aux difficultés de formation et de sensibilisation, ainsi qu'aux difficultés d'implication et de participation ou autrement l'absence ou le manque de conviction et d'appropriation du système sécurité par les opérateurs.
- L'absence totale des canaux de communication avec les employés (opérateurs), notamment l'affichage, l'information, la sensibilisation et la consultation de ces derniers.
- L'absence d'un plan de formation sécurité et de sensibilisation aux règles de sécurité.
- Recrutement des opérateurs intérimaires, ce personnel n'a pas la même implication et le même engagement du personnel titulaire parce qu'il ne bénéficie pas des mêmes conditions.
- L'ignorance des processus métier de la fonction SST ce qui rend sa gestion difficile et aléatoire.
- une culture sécurité défaillante, qui se traduit par: la tolérance de non-conformités techniques et procédurales en sécurité et la priorité à la production au détriment de la sécurité, le climat de travail détérioré…bref une culture fataliste ou la croyance de base est que l'accident est une fatalité, une malchance ou brièvement inévitable, donc on ne fait rien pour l'éviter.
- L'absence de vision sécurité des dirigeants à cause de l'absence d'un guide de management pratique, simple et adaptable. dans ce sens nous avons même prélevé des cas d'entreprises certifiées OHSAS18001 ou important des systèmes de management de la SST très avancés et pourtant ils souffrent d'énormes problèmes en gestion de cette fonction. Cela est dû principalement à la non adaptation de ces référentiels avec les particularités marocaines, entraînant par la suite une mauvaise qualité de mise en œuvre, et une absence de conviction et d'appropriation du système par le personnel pour avoir à la fin des systèmes de management non appliqués et non respectés.

Alors, nous essayons de résumer dans le schéma ci-dessous la répartition de ces problèmes selon la logique des cinq M (Méthode, Milieu, Main d'œuvre, Machine, Matière) :



Figure 2 : Classification des problèmes de la SST au Maroc selon les cinq M

Mise à part le contexte réglementaire défavorable et l'absence de la contribution étatique, nous constatons que ces entreprises souffrent d'un manque de dispositif efficace de gestion de la SST, ainsi que le manque de formation et l'ignorance (de l'opérateur jusqu'au dirigeant) des processus et bons pratiques reliés à cette fonction…ce qui engendre des anomalies, des infractions, et des mauvaises pratiques chroniques et flagrantes liées aux différents thèmes de la santé sécurité au travail et par la suite rendent ces entreprises vulnérables devant les différents risques liés au travail.

Ainsi, nous remarquons un immense besoin des entreprises marocaines à construire une démarche de management de la sécurité simple, efficace et favorisant une **culture sécurité intégrée** basée sur le management et le facteur humain. Alors, pour cette raison nous allons recenser les différents processus majeurs ou métiers, de gestion de la sécurité issus de notre étude bibliographique des différents référentiels de la SST, afin de pouvoir soulever les pratiques et les processus qui nous paraissent indispensables à la performance SST et ainsi, concevoir un SMS adapté aux spécificités du contexte marocain.

4 PRINCIPAUX RESULTATS : SYNTHESE DE L'ETUDE BIBLIOGRAPHIQUE ET CONCEPTION D'UN SYSTEME DE MANAGEMENT SECURITE ADAPTABLE AU CONTEXTE MAROCAIN

Nous tenons d'abord à rappeler, que la mise en place d'un SMS dans n'importe quelle entreprise est un projet nécessitant une approche participative de l'ensemble des intervenants au sein de l'entreprise, et que la motivation et l'implication des leaders sont indispensables à l'implantation et à la réussite de cet outil. Nous devons constituer une équipe incluant les décideurs de l'entreprise et ayant l'influence et l'autorité nécessaires afin de garantir le meilleur déploiement possible, une qualité irréprochable de mise en œuvre et une conviction parfaite de l'ensemble des opérateurs.

Alors, nous avons exigé avant toute étape, de constituer l'équipe responsable de l'implantation du système. Cette équipe doit contenir **obligatoirement** le **chef d'entreprise** ou à défaut son représentant et qui doit piloter, approuver et vérifier l'achèvement des actions et l'affectation des ressources, le directeur ou le **responsable des ressources humaines** est aussi un élément déterminant et qui doit chapoter la planification des formations et des sensibilisations ainsi que la formalisation des responsabilités affectées aux différents intervenants. **Le responsable HSE** (hygiène sécurité environnement) ou à défaut le cadre technique assurant cette fonction et qui représente l'expert technique au sein de l'équipe. Ainsi, il doit préparer à l'avance la planification du projet et les propositions d'action. **Le médecin du travail** est aussi un élément indispensable à l'implantation du SMS en identifiant l'ensemble des activités pouvant altérer la santé des travailleurs comme il doit être impliqué et informé de l'ensemble des modifications et des actions engagées. L'équipe doit aussi contenir à titre **facultatif** tout élément pouvant contribuer à la réussite de la mise en œuvre du système tel que les **responsables de production**, de **qualité de maintenance**…, les **chefs d'équipe**, les **chefs d'ateliers** et les **opérateurs anciens** …

Après notre analyse bibliographique des différents référentiels en SST et notre diagnostic du terrain en la matière, nous présentons le schéma illustrant notre système de management sécurité retenu :

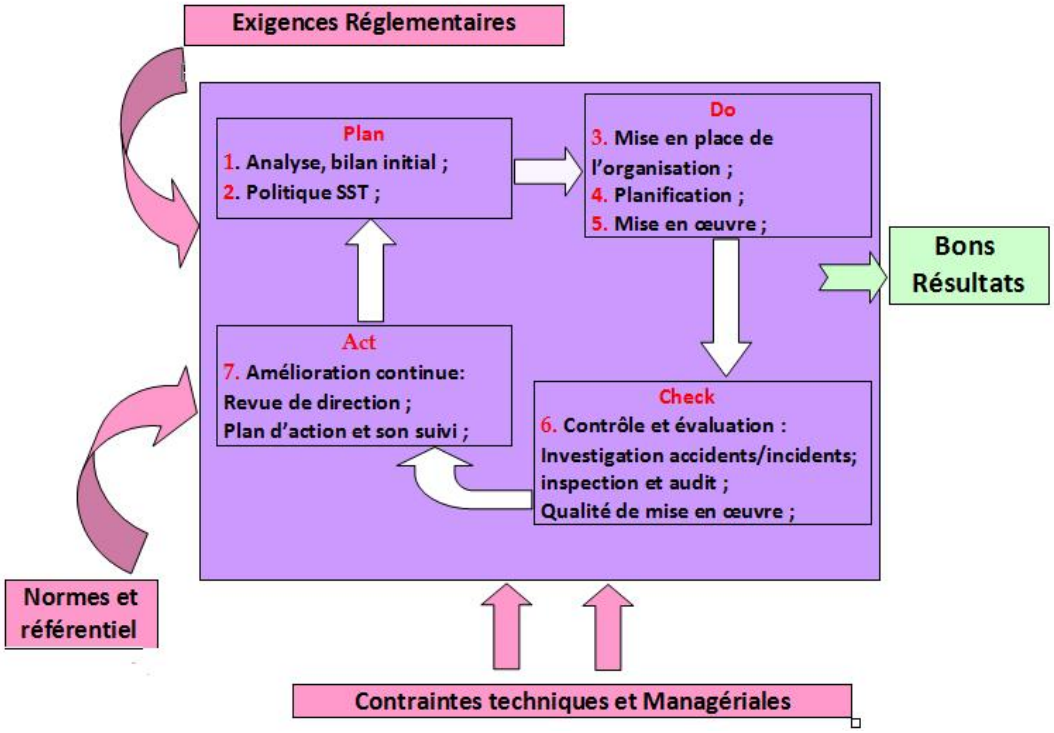


Figure 3 : modélisation du système de management sécurité retenu [8]

Nb : *conformément au modèle retenu du [8], nous explicitons successivement les éléments numérotés dans la figure 3.*

4.1 ANALYSE ET BILAN INITIAL

L'examen ou bilan initial est une spécificité de l'ILO OSH 2001 [9], par la suite il n'est pas adapté par les systèmes de management nationaux puisque l'OHSAS 18001 est presque le référentiel officiel au Maroc. Ce bilan est exigé en cas

d'absence du SMS et doit **servir de base** à sa mise en place. Il doit aussi être réalisé par des **personnes compétentes** en **consultation avec les travailleurs**. Ainsi, nous considérons que ce bilan est indispensable pour les entreprises voulant amorcer cette démarche d'implantation.

Alors, nous exigeons aussi dans notre proposition, un diagnostic général de la santé sécurité au travail afin de relever les points forts et les points faibles de l'entreprise en matière de la SST. Le diagnostic doit inclure même **l'historique des résultats de la SST** et doit également impliquer les opérateurs dans ces différentes phases, afin d'assurer un bilan global et crédible de l'état de la SST.

4.2 POLITIQUE SST

Selon [8] et [9], l'ensemble des référentiels en SST s'accorde sur l'établissement d'une politique SST, reflétant **l'engagement de la direction** et incluant les **objectifs** de l'entreprise en matière de la SST. Ainsi, nous exigeons d'abord de fixer la **stratégie de la santé sécurité** au travail. Il convient après de la **déployer en objectifs globaux**, conformément aux exigences de notre référentiel proposé en se basant sur les résultats du bilan initial, la taille de l'entreprise, le secteur d'activité, la nature des travaux et les risques majeurs. La formulation d'objectifs va nous donner un document que nous allons appeler la politique de la SST. Il doit être **simple** pour garantir une meilleure compréhension des différents niveaux de l'organisation. Il ne faut pas oublier que c'est un document à usage plutôt interne. Alors, il faut qu'elle soit communiquée à **l'ensemble du personnel** avec un langage compréhensif. Il faut éviter d'établir un document général risquant de donner l'image d'une entreprise qui n'a pas de réel engagement en matière de la SST. Il faut éviter aussi d'être trop long, alors il est préférable de se limiter à une page environ, si l'on veut que le texte soit lu et que le message soit passé. Il faut éviter aussi d'utiliser un vocabulaire compliqué qui peut créer des ambiguïtés de compréhension et Il faut penser que tous les niveaux hiérarchiques de l'entreprise doivent se reconnaître dans cette politique si on veut qu'ils se l'approprient. Finalement, la politique doit être signée par le **président directeur général** et **revue régulièrement**.

Nous recommandons que la fixation stratégique soit reposée sur les quatre axes stratégiques du **balanced scorecard** transposés en SST selon [8] et qui sont :

- **L'axe client**, transformé en **axe humain** notamment les employés parce que c'est eux qui profitent des bonnes conditions de la SST, ainsi nous allons déployer cet axe en deux objectifs stratégiques :
  - 100 % des opérateurs formés et habilités.
  - Un bon niveau d'appropriation du système par les opérateurs.

Selon [8] « La logique derrière cette déclinaison, est que si on arrive à former l'ensemble des employés bien comme il faut en matière de la SST, et si on garantie leur conviction et leur implication dans le déroulement et le respect du Système de Management de Sécurité, nous ne pouvons atteindre qu'un très bon niveau de performance de l'axe humain ou des employés ».

- **L'axe financier** sera converti à **l'axe de résultat** incluant tous les indicateurs de résultat comme : le nombre d'accident, le coût des accidents de travail et le coût des maladies professionnelles.
- **L'axe processus interne** va être conservé et il va inclure les processus clés de Management Sécurité et les processus internes de la SST
- **L'axe apprentissage** organisationnel va garder le même sens, ainsi il va rassembler l'ensemble des activités permettant l'amélioration continue de la fonction sécurité ainsi sa déclinaison sera :
  - Contrôle et évaluation efficaces et efficientes. (Une très bonne qualité de mise en œuvre incluse).
  - Actions correctives suivies et réalisées à temps.

4.3 LA MISE EN PLACE DE L'ORGANISATION

Selon [8], l'ensemble des référentiels en SST se met d'accord sur la l'affectation des **responsabilités et des obligations** aux différents intervenants, pour **l'atteinte des objectifs** de la politique adoptée. Pour cette raison, il faut **former** l'ensemble des employés de l'opérateur au directeur, pour qu'ils aient les compétences et les connaissances techniques indispensables à l'atteinte de ces objectifs. La **gestion documentaire** joue aussi un rôle capital dans le système en exigeant tous qu'en fonction de la taille de l'entreprise, une documentation doit être établie et tenue à jour. Toujours selon [8], les référentiels en SST s'accordent également sur la **communication** des informations sur la SST entre les différents niveaux hiérarchiques et fonctions de l'organisation.

Ainsi, cette phase comporte la mise en place de l'ossature du système en mobilisant et en affectant les différents responsabilités, les rôles et les obligations, en identifiant le besoin en formation de l'ensemble du personnel, en implantant

une structure documentaire générale incluant toutes les procédures nécessaires, instructions sécurité, documents d'inspection, permit…etc. Finalement, en établissant un bon canal de communication avec les différents intervenants notamment les opérateurs étant la cible majeure du SMS à travers un système garantissant l'information, la consultation et la participation du personnel, afin d'atteindre une meilleure implication et un bon niveau d'appropriation du système par les employés et ainsi instaurer une culture sécurité intégrée, favorisant le management de la SST et une meilleure contribution des opérateurs.

4.3.1 LA MOBILISATION DES COMPETENCES ET L'ATTRIBUTION DES RESPONSABILITES

Il est indispensable d'attribuer et de dispatcher les différentes responsabilités, les rôles et les obligations à chaque intervenant de l'opérateur jusqu'au PDG en établissant une **liste incluant les différents postes et leurs responsabilités** en matière de la SST, à l'instar du MASE. Ces dits responsabilités doivent être **imposés** et **formalisés** dans des fiches de poste. Ils doivent également être **raisonnables et réalisables** en affectant tous les **moyens** permettant aux employés de les assumer.

4.3.2 FORMATION ET HABILITATION

La prise en compte du facteur humain apparaît aujourd'hui comme un élément indispensable à la réussite de n'importe quelle démarche en SST et spécialement dans le contexte industriel au Maroc qui souffre d'un pourcentage très **élevé d'analphabétisme** au niveau des opérateurs et de leur **ignorance** de cet aspect au travail. Cette réalité rend leur intégration très difficile voir même impossible. Alors, il convient de **doubler les efforts en termes de formation** et de sensibilisation, afin de corriger ce phénomène introduisant au non respect des règles de sécurité et non implication des opérateurs dans la démarche de SST. Le personnel d'encadrement souffre aussi d'un niveau d'instruction très bas et qui ne leur permettent pas d'intégrer et de considérer cet aspect au travail. Quant aux dirigeants, ils sont encore inconscients des processus en SST et leurs enjeux, ce qui se répercute sur l'investissement de ces derniers en matière de la SST.

L'entreprise marocaine doit former alors, l'ensemble des intervenants allant des opérateurs, des conducteurs d'engins, des techniciens et des chefs d'équipe…jusqu'aux **responsables et directeurs** (**100 %.du personnel formé**). Ainsi, nous exigeons de préparer des fiches d'activités pour chaque poste et d'avoir une connaissance profonde des tâches réalisées par les employés et leurs responsabilités. Cette étape va permettre d'identifier l'ensemble des formations nécessaires à chaque poste de travail en fonction des activités réalisées et des responsabilités assumées et par la suite, avoir une **matrice des formations**, formalisant chaque poste et ces formations appropriées (tableau 1).

Tableau 1 : exemple de matrice de formation

	Formation D'induction	Formation poste de travail	Habilitation à la conduite	Formation espace Confiné	Formation Travaux Electrique	Formation travaux en Hauteur	Formation D'encadrement
Conducteurs d'engins	✘		✘				
Personnel D'encadrement	✘						✘
Poste 1	✘	✘			✘	✘	
Poste 2	✘	✘					
Poste 3…	✘	✘				✘	

Nb : le tableau 1 n'est qu'un exemple qu'il faut adapter aux postes existant dans l'entreprise et leurs formations appropriées.

Nous recensons ci-dessous les formations les plus répandues et les plus indispensables :

- **Formation d'induction** : Cette formation vise à former et informer les personnes nouvellement recrutées y compris les stagiaires et toute personne visitant les zones de travail (visiteurs, clients, fournisseurs…) aux risques généraux, aux règles et aux instructions de SST de l'entreprise. Il consiste aussi à les informer sur les conditions de circulation sur les lieux de travail notamment à les montrer les chemins d'accès aux lieux de travail et aux locaux sociaux, à lui préciser les issues et dégagements de secours à utiliser en cas de sinistre.
- **Formation du poste de travail** : Elle fait partie des formations les plus importantes. Elle est spécifique à chaque poste de travail et elle a pour objet d'instruire l'opérateur sur les risques liés à son poste ainsi aux précautions à prendre pour

assurer sa sécurité et celle de ses collègues. Elle doit contenir les informations, les enseignements et les instructions nécessaires aux bonnes conditions d'exécution du travail, ainsi que les dispositions à prendre en cas d'accident ou de sinistre. Nous recommandons qu'elle soit illustrée par des photos simulant les différents risques et les situations dangereuses du poste afin de garantir une meilleure compréhension des opérateurs qui n'ont pas un niveau d'instruction élevé leur permettant de lire des textes.

- **Habilitation des conducteurs d'engins** : Elle comporte la conduite sécuritaire de véhicules, d'appareils de levage ou d'engins de toute nature. Elle s'impose pour l'ensemble des équipements de manutention et de levage. Elle peut être assurée en interne par des formateurs compétents appartenant à l'entreprise ou venant de l'extérieur, comme elle peut être organisée dans un organisme de formation spécialisé. Finalement, nous exigeons d'assurer la conservation des preuves de la réalisation des actions de formation.
- **La formation du personnel d'encadrement** (idem pour les **directeurs et des leaders**) : Elle est indispensable parce que ce type de personnel représente le maillon de liaison entre la direction et les opérateurs. Alors, ils ont un **rôle crucial dans la transmission de politique et de la culture** de la direction générale. C'est la raison pour laquelle il est obligatoire de les former dans les **différents thèmes de la SST** afin de les impliquer et de les rendre aptes à participer dans la mise en place et le fonctionnement du système de management sécurité. La formation des directeurs et dirigeants est aussi déterminante et surtout dans notre contexte, afin de les pousser à adopter et à investir dans cette fonction nouvellement introduite au Maroc.
- **Les formations spécifiques** : Elles sont indispensables. Lorsque les travailleurs sont affectés à des travaux comportant un risque précis, ils doivent ainsi bénéficier d'une formation spécifique. Il en est ainsi notamment dans les cas suivants :
    - manipulation ou utilisation des produits chimiques,
    - emploi de machines, y compris les machines portatives,
    - travaux en hauteur, espaces confinés, habilitation électrique, levage et élinguage...
- **Formation des secouristes :** Dans chaque atelier où sont accomplis des travaux dangereux et dans chaque chantier employant vingt travailleurs au moins pendant plus de quinze jours où sont réalisés des travaux dangereux, 10% du personnel doivent recevoir la formation de secouriste nécessaire pour donner les premiers secours en cas d'urgence.
- **Formation de lutte contre l'incendie :** L'incendie est parmi les risques majeurs qui menacent les biens et les personnes. Il se propage rapidement. Alors, si on n'arrive pas à l'éteindre au début des premières secondes, les conséquences seront très significatives. C'est la raison pour laquelle une formation à la première intervention contre l'incendie est obligatoire afin de garantir l'efficacité de l'intervention des opérateurs en cas d'incendie. Cette formation vise à faire comprendre aux opérateurs ce qu'est un feu, les types de feu (A, B, C, D, E), et les différentes techniques d'extinction.

Juste après l'identification de la matrice de formation, il faut ensuite procéder à l'établissement **d'un plan annuel de formation** en collaboration avec le service des ressources humaines, et contrôler son état d'avancement chaque trimestre. Finalement, nous recommandons d'établir un indicateur trimestriel de performance dans ce sens, tel que le **pourcentage du personnel formé**.

4.3.3 LA MAÎTRISE DOCUMENTAIRE

Il convient dans cette phase d'établir la documentation nécessaire : manuel de sécurité, processus, procédures, instructions, listes, formulaires d'enregistrement, politiques… conformément aux exigences de notre référentiel proposé. Il convient aussi d'établir une procédure garantissant une gestion efficace et efficiente de l'ensemble des documents. A cet effet, nous exigeons la grille d'évaluation suivante :

Tableau 2 : Grille d'évaluation de la maîtrise documentaire

Exigences	Oui	Non	Commentaire
▪ Est-ce que nous disposons d'un manuel de sécurité décrivant la politique de sécurité et les différents processus sécurité ainsi que les dispositions mises en place pour réussir le système de management sécurité ?			
▪ Est-ce que les différents processus et procédures sécurité exigés dans notre référentiel sont formalisés ?			
▪ Est-ce que les différentes activités critiques de l'entreprise sont dotées d'instructions sécurité permettant leurs bons déroulements ?			
▪ Est-ce que les différentes informations nécessaires à l'apprentissage et retour d'information sécurité sont conservées, notamment les analyses d'accidents, incidents, PV de réunions, contrôle des équipements, preuves d'habilitations et formations, rapport d'audit et d'inspection… ?			
▪ Est-ce que l'ensemble des documents sont mis à jour, datés, approuvés, référenciés et diffusés à l'ensemble des personnes impliquées ?			
▪ Est-ce que les documents anciens sont archivés et détruits ?			
▪ Est-ce que les personnes utilisatrices de ces documents, les comprennent et les appliquent correctement ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.3.4 L'INFORMATION, CONSULTATION ET PARTICIPATION DU PERSONNEL

Notre objectif derrière ce chapitre est d'instaurer une vraie culture sécurité, favorisant des pratiques sécuritaires et fournissant un mécanisme effectif de coordination entre les différents acteurs de l'entreprise, car on ne peut pas mettre un superviseur derrière chaque opérateur pour lui dire quoi faire et vérifier qu'il le fasse. C'est alors la culture sécurité qui assure une régulation et un contrôle informel des comportements individuels pour les maintenir dans la norme admise par le groupe ou l'organisation [12]. Il est obligatoire d'établir un système efficace de communication avec les différents niveaux de l'organisation, notamment les opérateurs, représentant le déterminant majeur de la réussite du système de management sécurité. Ce système de communication doit garantir **l'information**, la **consultation** et la **participation** permanente des opérateurs en les impliquant dans les différentes étapes de l'implantation du SMS.

4.3.4.1 L'INFORMATION DU PERSONNEL

Nous distinguons d'après nos études exploratoires et bibliographiques, deux grands outils indispensables à l'information du personnel et qui sont : L'affichage/signalisation et la Sensibilisation.

4.3.4.1.1 L'AFFICHAGE/SIGNALISATION

L'entreprise est tenue d'afficher un certain nombre de consignes, d'adresses, de numéros d'urgence et d'informations sur les lieux de travail. Pour celles, mettant en oeuvre des matières inflammables et/ou chimiques, des consignes d'incendie et/ou du risque chimique doivent être établie et affichée d'une manière très apparente [14]. A cet effet, nous exigeons les grilles d'évaluation suivantes :

Tableau 3 : grille d'évaluation de l'affichage sécurité

Exigences	Oui	Non	Commentaire
▪ Est-ce que les adresses et numéros de téléphone du service de santé au travail sont affichés dans des endroits visités par tout le monde et visibles ?			
▪ Adresse, numéro d'appel et nom de l'inspecteur du travail ou du contrôleur du travail sont affichés dans des endroits visités par tout le monde et visibles ?			
▪ Liste nominative des sauveteurs secouristes du travail (SST) sont affichés dans des endroits visités par tout le monde et visibles ?			
▪ Liste des représentants du personnel au CHSCT, (comité d'hygiène, sécurité et conditions de travail) affiché dans des endroits visités par tout le monde et visibles ?			
▪ Informations de sécurité aux postes de travail concernant les risques, appareils de protection à utiliser, la conduite à tenir en cas d'accident sont affichés dans des endroits visités par tout le monde et visible ?			
▪ Est-ce que les informations affichées sont à jour ?			
▪ Est-ce que les opérateurs comprennent cet affichage ?			
▪ Est-ce que les consignes d'incendie, de matières chimiques et d'opérations délicates tel que réception de matières dangereuses, manutention importante…sont affichées sur les lieux de travail ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

Tableau 4 : grille d'évaluation de la signalisation

Exigences	Oui	Non	Commentaire
▪ Est-ce que les voies piétonnes sont balisées ?			
▪ Est-ce que les zones interdites sont balisées ?			
▪ Est-ce que les trappes et ouvertures sont obturées avec un affichage adéquat ?			
▪ Est-ce que les tuyauteries et les câbles enterrés sont signalés ?			
▪ Est-ce que les armoires électriques sont signalées ?			
▪ Est-ce que toutes les zones où il y a des risques non maîtrisés sont couvertes par un affichage indiquant la nature du risque ?			
▪ Est-ce que les panneaux de signalisation du code de la route sont affichés correctement et selon le plan de circulation ?			
▪ Est-ce que les panneaux d'obligation sont suffisamment affichés (port des EPI) ?			
▪ Est-ce que les panneaux indiquant le sens d'évacuation et de sauvetage sont correctement affichés ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.3.4.1.2 LA SENSIBILISATION

La sensibilisation est l'une des tâches quotidiennes que doit exercer le responsable, l'animateur ou le superviseur sécurité. Il représente le cœur de métier de la SST et nous pouvons même la considérer comme une formation permanente et sur le terrain. Elle est déclenchée suite à tout disfonctionnement, infraction, accident, incident, anomalie ou encore un manque d'attention aux instructions de sécurité et elle vise à faire comprendre l'origine et l'importance des normes de sécurité aux opérateurs parce que leur conviction est la meilleure méthode de garantir leur adhérence au système de la SST.

A cet effet, nous exigeons en parallèle de cette sensibilisation permanente, au moins une séance officielle par semaine. Voici la grille de son évaluation :

Tableau 5 : grille d'évaluation de la sensibilisation

Exigences	Oui	Non	Commentaire
■ Est-ce qu'on a dédié une place convenable pour le déroulement des séances ?			
■ Est-ce qu'on a choisi des personnes compétentes pour mener ces séances ?			
■ Est-ce qu'on prépare les contenus en fonction des activités réalisées et des sujets d'actualités (incidents ou accidents récents) ?			
■ Est-ce qu'on assure la présence de l'ensemble des travailleurs (y compris les sous traitants) ?			
■ Est-ce que les séances sont interactives, et connaissent la participation effective des opérateurs ?			
■ Est-ce que les séances assurent un bon niveau de compréhension des opérateurs ?			
■ Est-ce que les séances déclenchent une bonne prise de conscience des opérateurs ?			
■ Est-ce que les séances commencent et finissent au temps prévu ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.3.4.2 PARTICIPATION ET CONSULTATION EFFECTIVES DU PERSONNEL

C'est un point traité spécifiquement par l'OHSAS 18001 selon [8], en impliquant le personnel dans l'identification des dangers, l'établissement de la politique SST, les enquêtes en cas de lésion et toute modification affectant leur SST. Alors, il nous est évident que pour garantir une meilleure participation et consultation du personnel, il faut d'abord agir sur leur comportement. Pour ce faire, nous avons considéré deux approches comportementales en matière de santé sécurité au travail [12], [14]:

- La première concerne la conformité aux règles SST, c'est l'approche la plus répandue. Elle consiste à canaliser le comportement humain à travers l'application effective de prescriptions telles que : le port des équipements de protection individuelle, le respect des procédures SST, le maintien de l'ordre et de la propreté des zones de travail… Cependant, cette approche n'est pas suffisante parce qu'il reste très souvent un écart entre ce qui est demandé et les pratiques de travail observées. C'est le fameux écart entre le prescrit et le réel parce qu'il est impossible de prévoir toutes les consignes pour toutes les situations.
- La deuxième approche est celle des comportements d'initiative pour la SST et qui peuvent être : Formelles, c'est-à-dire intégrées à la politique sécurité (par ex : lorsque c'est imposé aux employés de signaler toute situation dangereuse rencontrée) ou Informelles, c'est-à-dire propres à des pratiques de métiers (par ex : lorsque les employés récupèrent des situations dégradées qui, sans leur intervention, pourraient basculer vers l'accident). Cependant, laisser un espace d'initiative non contrôlé et non maîtrisé peut conduire à l'inorganisation et par la suite aux situations très dangereuses.

Nous remarquons alors, qu'il convient d'adapter une combinaison des deux approches, une constatation approuvé par [14] et ce dans le but de laisser un espace d'initiative favorisant la conformité aux règles de sécurité parce que les règles provenant des initiatives des employés, sont en général des solutions adaptées à la réalité du travail et par la suite, elles sont plus raisonnables et applicables. En plus, quand les employés sont consultés pour élaborer les règles de sécurité, ils sont plus enclins à les appliquer.

Ainsi, nous allons détailler ce chapitre de la façon suivante.

4.3.4.2.1 PARTICIPATION EFFECTIVE DU PERSONNEL

Une meilleure participation du personnel est indispensable à la réussite de toute démarche de sécurité. Elle se traduit (au contexte marocain) selon nos études exploratoire et bibliographique par le **respect des règles SST**, notamment le **port des EPI** qui représente l'anomalie la plus flagrantes et nous avons constaté même que plus de 90% des blessures provoquées

par les accidents de travail, dans les entreprises étudiées sont causées par le non port des EPI. De ce fait, nous sommes convaincus qu'il est primordial de le traiter séparément, en exigeant :

- D'établir une procédure claire de gestion des EPI ;
- L'approvisionnement et la distribution doivent être faits par le service HSE (hygiène sécurité environnement) et non pas par le magasinier ;
- Une matrice d'EPI, indiquant les EPI appropriés pour chaque poste de travail ;
- Décharge signée par l'opérateur lors de l'affectation d'EPI et sanction en cas de perte ;
- Le choix des EPI de bonne qualité ;
- Une politique d'approvisionnement efficiente des EPI
- Former, impliquer, sensibiliser, responsabiliser et sanctionner si besoin les opérateurs et les chefs d'équipes ;
- Nommer des superviseurs (chefs d'équipe, responsable de zone ou animateurs HSE) sécurité, chargés d'imposer le respect du port d'EPI et d'enregistrer les cas du non port. Ils doivent aussi les corriger et les enregistrer sans prendre le nom de l'opérateur pour assurer une prise d'information fiable.

Nous exigeons aussi l'objectif du «zéro mauvais comportements » et « zéro infractions » ou autrement « 100 % respect aux règles sécurité». Alors, il est clair qu'il faut tout d'abord **identifier les mauvais** comportements et les infractions par une **étude de terrain** car c'est spécifique d'un cas à un autre.

Après l'identification de ces éléments, il faut impliquer le personnel dans cette démarche en lui communiquant les règles de SST et en établissant un système de motivation en cas du respect et de sanction en cas du non respect.

Finalement, nous recommandons de calculer le nombre (mensuel ou trimestriel) des cas du non port d'EPI, et le nombre d'infraction aux règles de la SST, et qui vont se servir comme indicateurs de performance dans ce sens.

4.3.4.2.2 CONSULTATION EFFECTIVE DU PERSONNEL

Il est clair que la consultation du personnel est un paramètre indispensable à leur implication. Alors, il convient d'établir un système garantissant une consultation systématique, en préservant un espace d'initiative assez consistant aux employés pour cela nous recommandons d'établir un formulaire d'observation que nous allons nommer « rapport d'observation sécurité ROS » et qui sera à la disposition de l'ensemble des travailleurs afin qu'ils puissent rapporter toute remarque, infraction ou proposition dans le domaine de la sécurité au travail.

La rédaction du formulaire ne suffit pas. Il convient de motiver le personnel à l'adapter et le remplir à chaque fois il y a une suggestion ou une observation en matière de la SST. Alors, il est évident de mettre en place un système efficace de recueil et d'analyse du dit formulaire pour prendre en considération ces remarques et suggestions, voir même consacrer des primes pour les meilleurs contributions. Finalement, nous recommandons de calculer par exemple le nombre de ROS ayant corrigé ou anticipé des défaillances en matière de la SST, ou encore le nombre de ROS ayant apporté des propositions pertinentes à propos des conditions de la SST. Ces nombres vont servir comme indicateur de performance de la contribution des opérateurs et des employés.

4.4 LA PLANIFICATION

L'identification et l'évaluation des risques constituent un processus majeur et communément admis par l'ensemble des référentiels exigeant tous, la mise en place des procédures spécifiques à la gestion des risques (identification, évaluation et mesures de contrôle). Ces deux actions doivent prendre en compte toutes les activités de l'entreprise, afin de lutter contre l'ensemble des risques selon une hiérarchie bien définie. La veille réglementaire représente aussi un processus indispensable, en exigeant des procédures d'identification des textes applicables et leur respect.

Ainsi, ce chapitre est inspiré de la planification détaillée dans OHSAS 18001 et il comporte les éléments suivants :

4.4.1 IDENTIFICATION ET ÉVALUATION DES RISQUES

L'ensemble des référentiels étudiés (ILO-OSH, OHSAS, MASE…) spécifient qu'un processus d'identification et d'évaluation des risques doit être mis en oeuvre sur l'ensemble des activités.

Il s'agit du noyau de la fonction sécurité. A cet effet, il faut impliquer les différents intervenants et il faut également les accompagner dans leurs postes de travail pour comprendre parfaitement leurs activités qu'il faut découper en tâches

élémentaires, afin de pouvoir relever et identifier l'ensemble des risques. Une fois les risques sont identifiés, il convient de les évaluer. Pour cela, il existe plusieurs méthodes dans la littérature.

Juste après, l'employeur doit formaliser par écrit dans un document unique les résultats de l'évaluation des risques. Si la responsabilité de la mise en oeuvre est celle de l'employeur, ce dernier doit y associer le personnel. Le médecin du service de santé au travail doit également être consulté et impliqué dans la démarche. Nous recommandons dans ce volet de calculer le pourcentage des risques maîtrisés et qui va servir comme indicateur de performance de la maîtrise des risques.

4.4.2 LA VEILLE RÉGLEMENTAIRE

La veille réglementaire est aussi, l'une des roches angulaires de la fonction SST. Elle consiste à se conformer aux prescriptions des lois et des règlementations en vigueur. Elle est aussi exigée par l'ensemble des référentiels internationaux (OHSAS, ILO OSH, MASE…). Pour cela nous fixons l'objectif de zéro non-conformité réglementaire, ainsi nous exigeons le plan d'action suivant :

- Etablir une procédure efficace, garantissant le recensement des textes applicables, l'établissement des plans d'action pour l'élimination des non conformités, ainsi que le suivi des évolutions réglementaires.
- recenser les textes réglementaires qui concernent toutes les activités de l'entreprise. Pour simplifier la démarche, il est recommandé de réaliser ce recensement par une approche thématique : Risques liés aux équipements de travail, risques chimiques, bruit, éclairage, risques liés aux installations électriques, manutention, risque incendie, risque routier, organisation des secours, travailleurs intérimaires, vérifications périodiques, habilitations, etc.
- Vérification de la conformité avec la réglementation en vigueur. Cette étape consiste à évaluer la conformité des activités et des conditions de travail de l'entreprise avec les exigences réglementaires. L'évaluation réglementaire peut se faire par deux approches :
  - Par texte (thématiques bruit, air, machines,….)
  - Par activité (machine, îlot de fabrication, atelier,…).
- Suivi de l'évolution de la législation. Cette étape, nécessite la présence d'une personne compétente en terme de la SST (ex : responsable sécurité) et l'utilisation d'outils gratuits ou payants de communication de textes règlementaires.
- Mettre en place un plan d'action pour éliminer toutes les non conformités et suivre la réalisation en temps fixés.
- Vérifier l'élimination des non conformités après l'achèvement des actions.

Finalement, nous recommandons dans ce volet de calculer le pourcentage des textes clôturés et qui va servir comme indicateur de performance de la veille réglementaire.

4.4.3 PROGRAMMES ET PLANS D'ACTION

C'est la dernière étape dans cette phase et elle consiste à dresser une feuille de route ou un plan d'action afin de se conformer aux textes réglementaires applicables et de maîtriser les risques non acceptables. Ce plan correctif doit contenir l'ensemble des thèmes de la SST. Ainsi, nous recommandons de repartir les risques par rapport aux textes réglementaires et leurs actions correctives selon les thèmes suivants :

- Risques liés aux **infrastructures**, comportant **l'état des sols et équipements** ainsi que les **machines**, **engins, outillages** et **constructions.** Pour cela il convient de conserver l'ensemble des certificats de conformité et de contrôle liés à ces derniers.
- Risques liés à la **circulation interne** : nous exigeons d'établir et de formaliser un plan de circulation correcte et optimal du site, identifiant la limitation de vitesse des véhicules et engins, les accès et circulation du personnel et des visiteurs, les zones de stationnement, les zones de livraisons et d'expéditions, les accès des pompiers, les issues de secours et points de rassemblement, sanitaires et obstacles divers. Le plan contient aussi La signalisation par panneau du code de la route. Elle peut également se traduire par un marquage au sol des voies de circulation afin de différencier celles qui seront réservées aux piétons et celles destinées essentiellement à la circulation des véhicules.
- Risques liés aux **produits chimiques** et leurs manipulation et stockage, y compris les **émissions des produits** en suspension ou les matières en poudre, les gaz, les COV (composés organiques volatiles)…
- Risques liés aux **travaux en hauteur,** traitant la mise en conformité des équipements de travail en hauteur (échelles, échafaudages, nacelles…), la préservation des équipements de protection individuelle et collective (garde-corps, ceinture de sécurité…), les procédures de gestion de ces travaux et les formations appropriées…

- Risques liés aux travaux en **espace confiné**, traitant les procédures et les instructions de sécurité nécessaires lors de ces travaux et la préservation des ressources nessécaires (humaines : personnel habilité ayant les certificats médicaux nécessaires ; matérielles : détecteurs de gaz, masques respiratoires adéquats…).
- Risques liés **à l'électricité,** traitant la mise en conformité de l'ensemble des installations électriques, l'habilitation des opérateurs intervenants, la consignation lors des entretiens…
- Risques **d'incendie et explosion** traitant la formation du personnel à l'extinction du feu, l'installation et mise en conformité des équipements de défense contre l'incendie DCI selon les règles en vigueur, stockage des produits inflammables…
- Risques divers incluant : gestes et **postures**, changement d'**ambiances climatiques**, Risques liés aux **chutes d'objets** Risque **mécanique et d'écrasement** Risques liés aux **manutentions mécaniques** Risques de **chute et trébuchement**, y compris **l'ordre, l'arrangement et la propreté** des zones de travail. Risques liés aux **rayonnements et radioactivité** Risques liés aux opérations de **levage et élinguage…**

Il convient aussi de rassembler les risques de chaque **poste de travail**, et qui doivent être formalisés sous forme de FSP (Fiche de Sécurité au Poste), de préférence en arabe ou en **langage symbolique universel** à cause du haut pourcentage d'analphabétisme des opérateurs. Il convient aussi de former l'ensemble des opérateurs sur leurs FSP et de les afficher sur un endroit visible et assez fréquenté selon **l'article 289** du code de travail marocain.

Nb : cette répartition de thèmes n'est pas exhaustive, mais elle contient les risques les plus rencontrés et les plus répandus.

4.5 LA MISE EN ŒUVRE

Il s'agit de la réalisation des **plans d'action,** l'identification et la **maîtrise des situations d'urgence**, l'établissement d'un système de **gestion des sous traitants** et la **maîtrise opérationnelle** en identifiant les différents opérations critiques de l'entreprise et en mettant les mesures nécessaires de contrôle et finalement en mettant un système favorisant un bon niveau d'appropriation du personnel.

4.5.1 REALISATION ET SUIVI DES PLANS D'ACTION

Pour l'achèvement des plans d'actions, il faut mobiliser et responsabiliser les responsables d'actions afin d'achever leurs actions en temps voulu pour cela il faut que l'ensemble des acteurs soient engagés et impliqués.

4.5.2 MAÎTRISE DES SITUATIONS D'URGENCE

Pour cela, il faut identifier l'ensemble des scénarios possibles de situations d'urgence ou de crise et établir par la suite, les mesures de gestion pour chaque situation ainsi que des exercices de simulation associés. Pour cela nous exigeons les actions suivantes :

- Identifier les situations d'urgence. ;
- Disposer d'une procédure ou d'une organisation pour signaler, avertir et donner l'alerte en cas de situation urgente conformément au plan d'urgence de l'entreprise ou du donneur d'ordre ;
- Disposer d'un plan ou d'une procédure d'urgence et le Faire connaître aux collaborateurs et aux parties intéressées ;
- Pouvoir réagir aux situations d'urgence, aux niveaux interne et externe en prévoyant les premiers soins, l'assistance médicale, les moyens de lutte contre l'incendie et l'évacuation des personnes ;
- Mettre en place des tests pour les plans d'urgence, par des exercices et entraînement et apporter des modifications en cas de besoin.

4.5.3 MAÎTRISE DES SOUS TRAITANTS

Tous les référentiels étudiés ont des exigences relatives à cette problématique, prenons le cas de L'OHSAS 18001 qui exige dans le cadre de la maîtrise opérationnelle, que des procédures soient établies pour l'achat et/ou l'utilisation de biens, des équipements et des services et que les procédures et les exigences pertinentes que devront respecter les fournisseurs et sous-traitants leurs soient communiquées. Pour cela nous exigeons les actions suivantes :

- Etablir une procédure dédiée à cet effet, incluant le système de sélection, de contrôle et d'évaluation des sous-traitants, et garantissant la communication et la coordination avec ces derniers ;

- Former ou imposer une formation du personnel intervenant sur les lieux de travail ;
- Imposer la documentation nécessaire avant le commencement de l'intervention (certificats médicaux, habilitation des conducteurs d'engins, assurances et contrôles techniques…
- Imposer une identification des risques et mesures de contrôle avant de commencer le travail ;
- Inspecter et accompagner les activités des sous traitants en permanence.

4.5.4 MAÎTRISE OPÉRATIONNELLE

La maîtrise opérationnelle consiste à maîtriser l'ensemble des activités critiques de l'entreprise : opérations délicates tel que la réception de matières premières dangereuses, la manutention d'objets lourds ou volumineux, etc. c'est une spécificité de la norme OHSAS 18001. Un processus retenant notre entier intérêt à cause des risques énormes émanant de ces activités surtout lorsqu'ils sont non prévues. Alors, il faut **recenser et prévoir** l'ensemble de ces activités (ex : travaux critique en hauteur, travaux en espace confiné, levage critique, réception de matières dangereuses…). Après, il faut établir toutes les **dispositions et mesures** de contrôle pour garantir le déroulement sécuritaire de ces opérations.

Ce point nous parait très indispensable en gestion de la santé sécurité au travail, parce que chaque entreprise a recours à des travaux délicats, ne faisant pas parti de ses tâches quotidiennes, telles que la réception de matières premières dangereuses inflammables ou explosives, l'implantation d'objets lourds et/ou volumineux, les travaux en hauteur pour réparation ou soudage de la charpente… Alors, il convient d'établir et de prévoir les mesures de contrôles et de protection de toutes ces situations dangereuses. Nous exigeons donc, le plan d'action suivant :

- Identifier les opérations délicates ou dangereuses qui peuvent être réalisées en entreprise ;
- Mettre en place un système d'exigences pour chaque opérations (mesures de contrôle, permit de travail…) ;
- Former l'ensemble des intervenants, surtout le personnel d'encadrement, à ces instructions et les afficher dans les endroits convenables ;
- Procéder à une identification des risques pour pouvoir mettre en place les mesures de protection nécessaires, avant le commencement des travaux. Cette opération doit être illustrée par une fiche dédiée à cet effet affichée sur le lieu de l'intervention et doit également impliquer tous les intervenants.
- Accompagner ces opérations en permanence par le responsable sécurité ou à défaut un agent de sécurité ;

A cet effet, nous exigeons une grille d'évaluation, voila un exemple :

Tableau 6 : grille d'évaluation des opérations critiques

Exigences	Oui	Non	Applicable ou non (A ou NA)	Commentaire
Documentation				
▪ Est-ce que le permit de travail est obtenu avant le commencement des travaux ?				
▪ Est-ce que les instructions liées à l'opération sont affichées et comprises par les opérateurs ?				
▪ Est-ce que la fiche d'identification des risques et des mesures de contrôle est affichée sur le lieu de travail ?				
▪ Est-ce qu'on dispose de tous les documents nécessaires (habilitation des conducteurs, certificat d'aptitude physique, contrôles techniques et assurances des engins…) ?				
Réception de matières dangereuses				
▪ Est-ce que le camion livrant la matière est en bon état (extincteur, roues en bon état, arrimage ou charge stable…) ?				
▪ Est-ce qu'un accompagnement est assuré pendant toute l'opération (au moins par un agent de sécurité)				
▪ Est-ce que le camion est calé, moteur arrêté, et moyen de manutention adapté ?				
▪ Est-ce que la charge est étiquetée, dans des conteneurs hermétiques, poids mentionné ?				
▪ Est-ce que la mise à la terre est respectée lors du transvasement des liquides inflammables ?				
▪ Est-ce que les matières chimiques sont livrées avec leurs FDS (fiche de donnés de sécurité) ?				

Equipements de protection individuelle				
▪ Les casques portés par les employés sont ils conformes par rapport aux normes en vigueur ?				
▪ Lunettes de sécurité portées par tous les employés ?				
▪ Chaussures de sécurités portées par tous les employés ?				
▪ Gants appropriés pour le travail portés par tous les employés ?				
▪ Bouchons de protection auditive disponibles et utilisés en cas de besoin ?				
▪ Lunettes de sécurité ou visières fournies et utilisées lors du meulage ?				
▪ Autres équipements de protection individuelle, comme les respirateurs, utilisés en cas de besoin par les conditions de travail (comme le travail avec l'amiante)?				
L'outillage de travail				
▪ Tous les outils vérifiés et en bon état?				
▪ Utilisation appropriée par des opérateurs qualifiés?				
▪ Carter en place pour tout outillage dont l'utilisation avec un carter de protection est obligatoire ?				
▪ Les outils portatifs électriques ont une mise à la terre ou sont équipés d'une double isolation?				
▪ Clips de sécurité utilisés avec des outils pneumatiques				
Travaux en hauteur				
■ Harnais de sécurité en bon état, utilisé et attaché correctement.				
▪ Est-ce que les ouvertures en hauteur sont protégées par des barrières.				
▪ Est-ce que les bords de toits sont protégés par des gardes corps ?				
▪ Est-ce que la ligne de vie est mise en place si besoin ?				
▪ Est-ce que les opérateurs sont formés aux travaux en hauteur ?				
▪ En présence d'un échafaudage, est ce qu'il est monté correctement selon sa notice de fabrication ?				
▪ Est-ce que l'échafaudage a été monté par une équipe de monteurs formés et habilités				
Zones de travail et de circulation				
▪ Nettoyage et rangement bien maintenu ?				
▪ Est-ce que La zone de travail a été rangée et nettoyée pour éviter le risque de glisser ou de trébucher ?				
▪ Ouvertures, y compris les ouvertures temporaires, protégés par des couvertures ou garde-corps avec garde pieds?				
▪ Garde-corps prévus pour les passerelles de 1,20 m (4 pieds) au-dessus du plancher ou du niveau du sol ?				
▪ Escaliers (y compris les escaliers provisoires) de 4 marches ou plus fournis avec une main courante?				
Soudage et travaux à chauds				
▪ L'équipement d'extinction d'incendie immédiatement disponible à tous les emplacements de soudage?				
▪ Les personnes exposées à une flamme ou un arc de soudure utilisent une protection oculaire?				
▪ Les zones de soudage ou de brûlure sont bien aérées et exempt de matériaux combustibles?				
▪ Bouteilles de gaz comprimé sont entreposées à la verticale, sécurisées et identifiées ?				
▪ Bouteilles d'oxygène et carburant (vides et pleins) stockés à au moins 6 m (20 pieds) écartées ou séparées par des barrières non-combustibles d'au moins 1,5m (5 pieds) de haut?				
▪ Tous les appareils de soudage à l'arc mis à la terre?				
▪ Fosses d'égouts sont couvertes lors de travail à chaud?				
▪ Écrans incombustibles ou ignifugés utilisés chaque fois que possible afin de protéger d'autres personnes de rayons de l'arc direct?				

Levage critique				
▪ Balisage de l'aire de levage et manutention?				
▪ Les cordes de guidage sont utilisées pour les charges balançant ?				
▪ Les stabilisateurs et les cales sont utilisés correctement ?				
▪ Personne ne se trouve au dessous de la charge?				
▪ Dégagement maintenu de toute partie de la grue ou de la charge des lignes électriques?				
▪ Élingues, câbles, crochets, manilles et autres accessoires en bon état?				
Risque électrique				
▪ Toutes les armoires temporaires, y compris les rallonges, sont munies d'une mise à la terre?				
▪ Toutes les sorties, interrupteurs, boites de jonctions, tableaux de control, …, en service sont couvert?				
▪ Tous les circuits identifiés sur le tableau de control?				
▪ Les rallonges sont tous de type trois fils et sont homologués pour un usage intensif?				
▪ Les câbles des rallonges sont en bon état (pas effilochés, pas brisés) avec des marques d'inspection actuel?				
▪ Les rallonges et autres câblages temporaires protégés contre les dommages et disposées de manière à ne pas créer des risques de trébuchement?				
▪ Feux temporaires équipés avec des gardes pour empêcher tout contact accidentel avec l'ampoule?				
▪ Les signes d'alerte affichés là où une partie quelconque d'un circuit électrique sous tension, exposé ou caché, est placée de façon que l'exécution du travail peut apporter à toute personne, outil ou machine en contact physique ou électrique avec elle?				

Nb : ce tableau n'est pas exhaustif et il convient de l'adapter en fonction des opérations critiques de l'entreprise.

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.5.5 MAITRISE DU PERSONNEL D'APPOINT (INTERIMAIRES)

C'est un point très important et qui a retenu notre entière attention par ce qu'il représente un problème spécifique au contexte industriel marocain**,** car presque toutes les entreprises nationales et mêmes multinationales au Maroc, font appel au service des cabinets d'intérim en permanence. Ce personnel ne s'intègre pas généralement, dans les démarche d'implantation des systèmes de management par ce que :

- Personnel ayant des salaires très bas (le SMIG généralement pour les opérateurs)
- Personnel ne bénéficiant pas du système de motivation comme le personnel titulaire (primes de rentabilité, congés, titularisation, et autres avantages)
- Manque de politique d'intégration de ce personnel dans le système et culture de l'entreprise.
- Absence d'un système de sélection et de recrutement.
- Absence de formation et d'accompagnement.

A cet effet nous exigeons la grille d'évaluation suivante :

Tableau 7 : la grille d'évaluation du personnel intérimaire

Exigences	Oui	Non	Commentaire
▪ Est-ce que nous disposons d'une procédure d'intégration du personnel intérimaire ?			
▪ Est-ce que les compétences nécessaires du personnel intérimaire ont été identifiées, exprimées et exigées aux sociétés d'intérim ?			
▪ Est-ce que le personnel intérimaire a benificié des formations nécessaires a l'accomplissement sécuritaire de ces tâches ?			
▪ Est-ce qu'un système de motivation et d'implication de ce personnel a été mis en place ?			
▪ Est-ce que les nouveaux rentrants bénéficient d'accompagnage d'anciens opérateurs ?			
■ Est-ce que les tenues et les équipements de protection individuelle nécessaire ont été fournis ?			
▪ Est-ce que ce personnel dispose du matériel et d'outillage adéquats ?			
▪ Est-ce que les certificats médicaux et les habilitations nécessaires ont été fournis ?			
▪ Est-ce que ce personnel est identifié par des badges ou des tenues spéciales ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.5.6 BONNE APPROPRIATION DU SYSTEME PAR LE PERSONNEL

Nous avons constaté que le référentiel MASE, se distingue par l'élément de **l'appropriation du système** par le personnel, un point constaté par [12] et retenant notre entier intérêt. Puisqu'il représente un problème majeur de la totalité des entreprises marocaines, ayant des certificats et des systèmes de management sécurité, mais ne possédant pas une bonne implication et ni une appropriation du système par le personnel. Ce qui rend ces SMS prisonniers dans les papiers et les documents. Alors, il convient surtout dans le contexte marocain d'élaborer des procédures qui incluent des solutions assurant un bon niveau d'appropriation du système par le personnel.

Alors, d'après notre étude exploratoire et bibliographique, ainsi que plusieurs brainstormings avec plusieurs responsables et experts en la matière, nous sommes convaincus que pour atteindre un bon niveau d'appropriation, il convient de fournir d'une part, les formations nécessaires et suffisantes au personnel, afin qu'il soit conscient des bonnes pratiques en matière de la SST. D'autre part, il faut qu'il **accepte le système** (SMS) et soit convaincu de son application, ce qui peut ce décliner en deux sous objectifs et qui sont une **meilleure information du personnel** permettant une sensibilisation permanente, un affichage des instructions sécurité aux postes de travail et des numéros de téléphone des secouristes, etc. Quant au deuxième sous objectif, il peut être exprimé par une **meilleure participation et consultation** du personnel, en établissant des canaux de participation efficaces pour recueillir des remarques et des propositions du personnel pour l'amélioration des conditions de la SST et en se focalisant sur les deux aspects reflétant l'engagement et la conviction du personnel au respect du SMS aux entreprises industrielles marocaines. Ces deux aspects sont le **respect du port des équipements de protection individuelle** (EPI) et le **respect des règles et instructions** en matière de santé sécurité au travail.

Nous ajoutons à ces éléments, déjà abordés dans le chapitre 3.4, la nécessité d'établir un **système de motivation** rémunérant les employés exemplaires et l'implantation d'un système (procédures et instructions) **optimal**, ayant une **bonne qualité de mise en œuvre** et n'engendrant pas des efforts pour l'opérateur sans valeurs ajoutée. Pour cela, il faut les impliquer dans l'établissement des différentes procédures et instructions de la SST relatives à leurs tâches et activités de travail, afin d'assurer leur conviction.

Finalement, nous recommandons l'établissement d'un questionnaire vérifiant la conviction et l'appropriation du système par le personnel et qui doit être renseigné périodiquement auprès de plusieurs échantillons d'opérateurs, chefs d'équipe, technicien, responsable… et réagir en cas de réclamation ou d'insatisfaction.

4.6 CONTRÔLE ET ÉVALUATION

Nous avons constaté que tous les référentiels exigent l'enquête et **l'analyse des incidents** et des accidents en imposant de mettre en place des procédures, assurant une investigation efficiente, afin de révéler et analyser les causes sous jacentes et en déduire les actions correctives et préventives associées. **L'audit interne** est aussi exigé partout, en spécifiant que des audits à des intervalles planifiés doivent être établis, afin de vérifier la conformité aux exigences, ainsi que l'atteinte des objectifs déjà tracés. Dans ce sens, il va falloir mettre en place des procédures garantissant l'objectivité et l'impartialité du processus d'audit, en éclaircissant les responsabilités lors des audits, les compétences nécessaires et les exigences en matière de planification, de réalisation et d'enregistrements des résultats.

Ainsi, ce chapitre met en place un dispositif de contrôle et vérification du système de management sécurité en planifiant des audits et des inspections à intervalles réguliers et en mettant un système d'investigation systématique des accidents et incidents.

4.6.1 AUDITS INTERNE

L'audit est parmi les moyens les plus efficaces de contrôler l'efficacité de notre système, pour cela il faut planifier des audits à intervalles réguliers et nous exigeons au minimum un audit complet du système par an. A cet effet, nous exigeons le plan d'action suivant :

- Établir une politique et un programme d'audit qui fournissent des indications sur :
  - La compétence de l'auditeur qui doit être une personne compétente et indépendante de celles qui ont la responsabilité directe de l'activité auditée ;
  - Le plan annuel, la portée, la fréquence, et la méthodologie de l'audit qui doit prendre en considération la nature et l'importance de l'activité soumise à l'audit ;
  - La présentation des rapports et les résultats des audits qui doivent être enregistrés et portés à la connaissance des personnes qui ont la responsabilité du domaine soumis à l'audit ;
  - Le suivi d'audit qui doit comprendre la vérification et l'enregistrement de la mise en oeuvre et de l'efficacité des actions correctives engagées.
- Former et habiliter les personnes devant mener et participer à des audits :
  - Responsable d'audit : Personne désignée pour diriger un audit qualité s'appelle un "responsable d'audit" ;
  - L'observateur : Personne accompagnant une équipe d'audit et n'ayant aucune responsabilité dans l'audit ;
  - L'expert technique : personne possédant des connaissances spécifiques ou une expertise spécifique sur le domaine à auditer ;
- Etablir une réunion avec les différents intervenants du domaine audité à l'issu des résultats, afin de mettre en œuvre les actions correctives et préventives adéquates ;
- Les responsables de ce domaine doivent engager et achever ces actions correctives en temps utile pour remédier aux déficiences trouvées lors de l'audit.

4.6.2 L'INSPECTION SÉCURITÉ

L'inspection est un ensemble d'activités visant l'identification systématique des risques reliés aux équipements, aux tâches, à l'environnement et à l'aménagement des lieux de travail. Alors, il s'agit d'une action de surveillance et de contrôle indispensable à la performance en matière de la SST. Ainsi, nous exigeons les actions suivantes :

- Etablir une procédure garantissant la réalisation régulière d'inspection et déterminant les différentes responsabilités reliées à son bon déroulement ;
- Etablir une grille d'inspection regroupant les points à vérifier par catégories ;
- Déterminer une fréquence adéquate d'inspection, généralement hebdomadaire, (un choix spécifique à chaque entreprise en fonction de la taille, du secteur d'activités…) ;
- Diviser les lieux de travail en plusieurs zones pour mieux inspecter chaque fois une zone ;
- Déterminer les personnes compétentes pouvant mener ces inspections ;
- Rédiger à la fin un rapport récapitulant les anomalies prélevées ;
- Déterminer les actions correctives et préventives, afin d'éviter la survenue de ces anomalies ;
- Faire un suivi de la réalisation de ces actions dans les échéanciers prévus.

4.6.3 ANALYSE DES ACCIDENTS ET INCIDENTS

L'ensemble des référentiels exigent que les enquêtes sur l'origine et les causes intrinsèques des lésions, des dégradations de la santé, des maladies et des incidents liés au travail doivent disposer d'une méthodologie efficace permettant d'identifier toute déficience du système de gestion de la sécurité et de la santé au travail et être consignées. Un point indispensable à l'amélioration continue de notre système SST. Mais **difficile à appliquer** surtout dans les entreprises marocaines ou règne un esprit de sanction et de punition en entreprise, donc les chefs d'équipe obligent les opérateurs de ne rien signaler (surtout lorsqu'il s'agit des cas des erreurs humaines), afin d'éviter toutes sanction et enquête. Nous allons alors, prendre en considération cette constatation, confirmée par l'étude de Shannon et Lowe [15], en exigeant de sensibiliser l'ensemble des employés qu'il ne s'agit pas de sanctionner, mais de déterminer les causes profondes de tous disfonctionnement au niveau de la SST. Ces enquêtes doivent aussi être effectuées par des personnes compétentes, avec la participation appropriée des travailleurs et de leurs représentants. Les mesures correctives résultant de ces enquêtes doivent être mises en oeuvre afin d'éviter que des cas de lésions, de dégradations de la santé, de maladies et d'incidents liés au travail ne se répètent. Les conclusions de ces enquêtes doivent être soumises au comité de sécurité et de santé, qui devrait vérifier l'achèvement des actions correctives ou formuler des recommandations appropriées.

A cet effet nous exigeons les actions suivantes :

- Etablir une instruction assurant la déclaration immédiate d'accident en mettant en place un formulaire de déclaration et en identifiant qui fait quoi.
- Etablir une procédure efficace d'investigation de conservation des enregistrements et du suivi des actions issues des enquêtes.
- Sensibiliser l'ensemble du personnel sur l'obligation de déclarer tous les accidents et incidents et qu'il ne s'agit pas de sanctionner mais de cerner les causes sous jacentes de la survenu de ces disfonctionnements afin qu'il y ai un retour d'expérience.
- Nommer une liste de personnes habilitées (formées) à réaliser ces enquêtes (des personnes compétentes).
- Etablir à la fin un plan d'action pour éviter la survenu de ces disfonctionnements, en indiquant les responsables d'actions et en assurant leurs achèvements en temps voulu.

Nous exigeons aussi la grille d'évaluation des enquêtes réalisées :

Tableau 8 : Grille d'évaluation des enquêtes des accidents/incidents au travail.

Exigences	Oui	Non	Commentaire
▪ Est-ce que les personnes rencontrées sont déterminées auparavant ?			
▪ Est-ce que l'enquêteur a procédé à une observation détaillée des lieux de l'accident illustrée par des photos ou croquis ?			
▪ Est-ce que les questions posées ont été préparées à l'avance ?			
▪ Est-ce que l'endroit de discussion a été bien choisi (doit être sur les lieux de l'événement s'il est possible) ?			
▪ Est-ce que les personnes ont été rencontrées individuellement ?			
▪ Est-ce que les buts de l'enquête et de l'entrevu ont été présentés ?			
▪ Est-ce que la personne a été mise à l'aise en créant une atmosphère détendue ?			
▪ Est-ce que la version de la personne a été obtenue sans l'interrompre ?			
▪ Est-ce qu'il y avait une prise de note des circonstances de l'accident ?			
▪ Est-ce que la personne qui mène l'entrevu a relis ces notes afin d'éviter les interprétations ?			
▪ Est-ce que la personne qui mène l'entrevu a demandé à la personne rencontrée des suggestions des pistes de solutions. ?			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.6.4 QUALITÉ DE MISE EN ŒUVRE

Nous constatons finalement, que l'ensemble des référentiels n'exige pas un dispositif permettant d'assurer la qualité de mise en œuvre du système de SST, un problème abordé par [12] et constaté en entreprises ayant un SMS, formalisé et entretenu mais physiquement, il est très rigide et engendre des pertes de temps et d'effort sans valeur ajoutée. Alors, nous allons introduire une procédure d'évaluation de la qualité d'implantation du SMS afin de garantir une meilleure mise en place.

En effet, beaucoup d'entreprises se concentrent sur la formalisation de leurs SMS et négligent par la suite leurs qualités de mise en œuvre ce qui pousse les intervenants à ne pas les respecter. Alors, il convient de mettre un système optimal, facile à appliquer et n'engendrant pas des efforts supplémentaires sans valeur ajoutée pour les employés et ce en adoptant une approche participative lors de son établissement. Pour cela, il faut impliquer le personnel dans l'établissement des différentes procédures et instructions de SST relatives à leurs tâches et activités de travail, afin d'assurer leur conviction et leur respect. Nous exigeons aussi d'établir en permanence, des questionnaires et des consultations, auprès des différents intervenants sur l'applicabilité des exigences et des procédures du système et de réagir en cas de réclamations.

4.7 APPRENTISSAGE ORGANISATIONNEL

Il est exigé par la majorité des référentiels à la direction, de réexaminer le système de management de la SST de l'organisme à intervalles planifiés, pour garantir la continuité de son applicabilité, son adéquation et son efficacité. Pour cela, elle doit établir une revue ou examen de direction. Les données d'entrée de la dite revue, doivent inclure les résultats des audits internes, les résultats de participation et de consultation du personnel, l'état des recherches d'incidents… Finalement, les données de sortie des revues de direction, doivent être cohérentes avec l'engagement de l'entreprise envers l'amélioration continue et doivent inclure toute décision et action se rapportant à des modifications.

Il s'agit donc, dans ce chapitre de la révision de l'ensemble des écarts et des erreurs pour qu'il y ait un retour d'expérience, garantissant ainsi la correction une bonne fois pour toute des anomalies analysées.

4.7.1 REVUE DE DIRECTION

Il est exigé à la direction de réexaminer le système de management de la SST de l'organisme, à intervalles planifiés, pour garantir la continuité de son applicabilité, son adéquation et son efficacité. Les données d'entrée des revues de direction doivent inclure les résultats des audits internes, des inspections, des évaluations de conformité aux exigences légales, des suggestions du personnel et toute autre information pouvant contribuer à l'amélioration du système, après la direction peut définir de nouveaux programmes d'action si nécessaire. Pour cela, nous adoptons le plan suivant :

- Etablir une procédure garantissant le bon déroulement de la revue et identifiant les différents rôles et obligations ;
- Former les différents intervenants sur cet outil ;
- Imposer un compte rendue ou procès verbal du bilan de la revue incluant les différents sujets abordés et les décisions qui en découlent ;
- Suivre la réalisation et l'achèvement des actions qui en découlent.

Et nous exigeons la grille d'évaluation des séances de revue de direction :

Tableau 9: Grille d'évaluation des revues de direction.

Exigences	Oui	Non	Commentaire
▪ Est-ce que les participants ont reçu une convocation incluant l'ordre du jour de la revue ?			
▪ Est-ce la revue a été bien préparée au préalable ?			
▪ Est-ce que la revue a été commencée à l'heure prévue ?			
▪ Est-ce que touts les documents nécessaires ont été mis à disposition lors de la revue			
▪ Est-ce qu'il y avait une discussion ouverte et constructive			
▪ Est-ce que toutes les personnes convoquées ont été présentes			
▪ Est-ce que tous les membres se sont mis d'accord sur les actions et les décisions de correction			

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

4.7.2 ACTIONS CORRECTIVES ET PREVENTIVES ET SUIVI

Il s'agit du plan d'action issu de la revue de direction pour corriger les erreurs et les écarts par rapport aux objectifs escomptés. Alors, il convient de responsabiliser l'ensemble des intervenants sur le respect de l'achèvement de leurs actions en temps voulu. Dans cette optique, nous nous fixons l'objectif suivant : **Un système efficace de suivi des actions et de la résolution effective des anomalies**. Pour cela, nous exigeons le plan d'action suivant :

- Rassembler l'ensemble des actions issues des investigations, audits, inspections, enquêtes d'accident et incidents et revues de direction, dans un plan d'actions détaillé ;
- Responsabiliser les responsables d'actions sur le respect de réalisation selon les échéanciers prévus ;
- Vérifier la résolution du problème après l'achèvement de l'action associée pour clôture.

A cet effet, nous exigeons le tableau d'évaluation suivant :

Tableau 10 : Grille d'évaluation des actions correctives.

Actions	Responsables D'actions	Date de réalisation	Action achevée ou non en temps voulu	Anomalie résolue ou non après achèvement de l'action
Actions issues d'audits				
▪			**Oui = 100% ; non = 0%**	**Oui = 100% ; non = 0%**
▪				
Actions issues d'enquête accidents et incidents				
▪				
▪				
Actions issues d'inspections				
▪				
▪				
Actions issues de la revue de direction				
▪				
▪				
Score final (valeur moyenne) des :			**% actions achevées**	**% anomalies résolue après achèvement de l'action**

Cette grille peut être munie d'un système de scoring calculant le score de l'ensemble de ces points, en affectant 0 % si le critère n'est pas satisfait et 100 % dans le cas contraire, ainsi le score global sera la valeur moyenne de l'ensemble des critères et qui va servir comme indicateur de performance dans ce sens.

5 CONCLUSION

Notre système de management sécurité traite les différentes particularités du contexte marocain, en exigeant la formation de l'ensemble des intervenants de l'opérateur jusqu'au dirigeant, l'établissement d'un système d'intégration du personnel intérimaire, un meilleur niveau d'appropriation du système par le personnel, une bonne qualité de mise en œuvre, un système garantissant la déclaration des accidents/incidents et leur enquête.

Toutefois, nous tenons à préciser, qu'il s'agit d'un projet nécessitant une approche participative de l'ensemble des intervenants au sein de l'entreprise, et que la motivation et l'implication du leadership sont indispensables à l'implantation et la réussite de cet outil. Ainsi, nous devons constituer une équipe du projet incluant les décideurs de l'entreprise ayant l'influence et l'autorité nécessaire afin de garantir le meilleur déploiement possible, une qualité irréprochable de mise en œuvre et une conviction parfaite de l'ensemble des opérateurs.

Nous avons muni les différentes exigences de notre référentiel de grilles d'évaluation, que nous pouvons par la suite les doter par un système de scoring, afin d'évaluer concrètement le degré de conformité des entreprises, à notre référentiel afin de pouvoir nuancer leurs niveaux de performance en matière de la santé sécurité au travail. Finalement, nous tenons à indiquer qu'il faut renseigner ces grilles d'une manière crédible afin, d'éviter des résultats trompeurs, erronés et ne concordant pas avec la réalité de l'entreprise.

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Sex Difference in Putty-Nosed Monkey (*Cercopithecus nictitans stampflii*) Locomotor Behavior in the Taï Forest, Côte d'Ivoire

Eloi Anderson BITTY[1-2], Jean-Claude Koffi BENE[2-3], Kouadio Benoit KASSE[1], Marie Louise Berthe AHUI[4], and Philippe Kouassi KOUASSI[1]

[1]Laboratory of Zoology andAnimal Biology,
Felix Houphouet-Boigny University,
Abidjan, 22 BP 582 Abidjan 22, Côte d'Ivoire

[2]Centre Suisse de Recherches Scientifiques en Côte d'Ivoire,
Adiopodoumé, 01 BP 1303 Abidjan 01, Côte d'Ivoire

[3]University Jean Lorougnon Guédé Daloa,
Daloa, BP 150 Daloa, Côte d'Ivoire

[4]Laboratory of Nutrition and Pharmacology,
Felix Houphouet-Boigny University,
Abidjan, 22 BP 582 Abidjan 22, Côte d'Ivoire

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ABSTRACT: We conducted 15 months field study on one (*Cercopithecus nictitans stampflii*) of the eight guenons species in the Taï National Park. Because this taxa shows a great sexual dimorphic we aimed to test whether there is difference between male and female locomotion behavior. Locomotor behavior of adults was recorded at 5 min time points and the same individual was not sampled within 20 min of itself to ensure sampling independence. On every time point, we recorded the following information: locomotor maintenance activity (travel = long, directed movement usually between distant endpoints, or forage = movement during feeding usually within single or contiguous trees), locomotor mode (walk, run, leap, or climb); forest stratum (ground, shrub layer, understory, lower main canopy and the upper main canopy); support type: (ground, vertical trunk, bough, branch, twig and liana). Our results showed that there is significant difference between male and females during foraging and travelling regarding the frequencies of the locomotor modes used while they revealed that there is no significant difference in term of the concurrency in the different forest layers. Furthermore our results showed a significance difference between male and female during foraging and the medium-sized support (branches) were more used by females than the male while during travelling large-sized support (boughs) and branches are more used by both sexes but at different level.

KEYWORDS: nictitans, male, females, foraging, travelling.

1 INTRODUCTION

Within the Taï forest live eight monkey species among which seven are under a long term field study by the Taï Monkey Project as all well as their positional behavior. However *Cercopithecus nictitans stampflii* is the one that behavior is ignored because of it low distribution in the Taï forest [1], [2]. While this species is common throughout northern Democratic Republic of Congo, Congo, Central African Republic, Cameroon, Gabon, and its behavior has been the subject of several long term studies in Gabon [3], [4]. Among the eight guenon monkey species living in the Taï forest, *Cercopithecus nictitans stampflii* exhibits a high sexual dimorphic. In general the male weighs 1.5 times more than females and that weigh swing

between 5 and 8 kilos for the males and 2.7 and 4.1 for the females [5], [4] (Haltenorth *et al.,* 1985; Gautier-Hion *et al.,* 1999). This difference in body size is a good reason to test the influence of body size within the species locomotion behavior. Indeed, in their influential work on Surinam monkeys. "Reference [6] examined" the relationships between a suite of locomotor and habitat variables. These authors sought answer to fundamental questions such as: (1) is there a general relationship between body size and locomotion? (2) Do locomotor patterns vary predictably with habitat? (3) Is there a functional relationship between body size and support size? Their conclusion served as working hypotheses that could be tested across all primate groups and many previous researchers have investigated at least some of the relationships between locomotion and body size [7], [8], [9], [10], [11], [2].

Size is unquestionably a major influence on locomotion this allows to hypothesis that different-sized primates confronted to the same arboreal architecture will move in different way [11]. One goal of anthropological primatology is to establish predictive relationships among body size, locomotion, and habitat use in extant taxa to make more informed inferences about fossil primate behavior [12], [13], [14]. For several primate groups, these attempts have generally been successful and body size is known to be a reliable predictor of locomotion, support use and canopy preference [6], [15].

Based on that opinion in addition to the great difference in body size of the Putty-nosed (*Cercopithecus nictitans stampflii*) monkey we expect an intraspecific variation on the male versus females in: firstly the locomotion categories frequencies, secondly the locomotion and maintenance activity, and thirdly the support use by both sex classes. Whether this is true even within the same species the locomotion profile could be quite different between male versus female. Therefore, we suspect that the locomotion behavior of the male putty-nosed monkey in the Taï forest would be likely different from those of the females.

This paper aims to highlight the relationships between locomotion, body size and habitat use in a group of a less known Ceropithecid monkey, *Cercopithecus nictitans stampflii* in the Taï National Park.

2 METHODS

2.1 STUDY SITE

The study was conducted in the Ivory Coast's Taı¨National Park located between 68 200 N to 58 100 N and 48 200 W to 68 500 W. The 457,000 ha park is the largest block of continuous, protected forest in West Africa. Vegetation is largely dense evergreen ombrophilous forest of a Guinean type with a continuous canopy of between 25 and 40 m and emergent trees up to 60 m. Average annual rainfall is 1,830 mm and daily temperatures vary between 24 and 28°C. Because of the diversity and the abundance of the primate species hosting by the park, the Taï forest has been identified as high priority for primate conservation.

2.2 DATA COLLECTION

The method used in this study is described as well in previous papers [11], [16], [2]. We studied the positional behavior and habitat use of one group of Stampflii's putty-nosed monkeys from February to September 2002 and from July 2003 to March 2004. At the project's outset, the group contained one adult male, three adult females, two subadults, and two juveniles. No significant changes to the structure of the forest canopy were known to occur between the present study and earlier studies of Tai monkeys.

Locomotor behavior of adults was recorded at 5 min time points and the same individual was not sampled within 20 min of itself to ensure sampling independence. The sampling interval of 5 min is more conservative than the 3-min interval used in previous positional studies at Tai [17], [11], [18], [16] and, therefore, provides a more rigorous control of temporal autocorrelation. On every time point, we recorded the following information: Locomotor maintenance activity (travel = long, directed movement usually between distant endpoints, or forage = movement during feeding usually within single or contiguous trees), locomotor mode (walk, run, leap, or climb); forest stratum: [ground (stratum 0), shrub layer = between ground and ≤ 5 m (stratum 1), understory = small tree and half grown canopy trees between 6 and 15 m (stratum 2), main canopy divided into lower main canopy between 15 and 23 m (stratum 3), upper main canopy between 24 and 40 m (3), and emergent layer ≥ 40 m (stratum5)]; support type: [ground (support 0), vertical trunk (support 1), bough large su = supports > 10 cm in diameter (support 2), branch = medium-sized supports ≤ 2 cm ≤ 10 cm in diameter (support 3), twig = small, flexible supports < 2 cm in diameter (support 4), and liana (support 5)].

2.3 DATA ANALYSIS

The G-test analysis was performed to compare the frequencies of locomotor modes, support types and forest strata used by the male and females [19].

3 RESULTS

3.1 MAINTENANCE ACTIVITIES OF MALE VERSUS FEMALES

The amount of time male and females engaged in each locomotor activity is shown in Table 1. During foraging regardless of male or females walking is the locomotion mode very often used (respectively, 68.6% and 70%), followed by climbing (respectively, 12.8% and 18.9%), leaping (respectively, 10.5% and 8.3%) and running (respectively, 8.1% and 2.8%). Furthermore during foraging the G test shows that there is no significant difference between male and females in term of locomotion modes used by both male and females ($G = 5.44$; $P > 0,05$). The frequencies of locomotion used by male and female were similar.

During travelling females walked more (67.3%) than the male (53.2%) while the male leaped more (14.4%) than females (9.9%), the male climbed more (23%) than females (16.7%). In addition the male ran more often than the females (respectively, 9.4%% and 6.1%).

Furthermore the G test shows a significant difference between the locomotion modes used by the male and females during travelling ($G = 22.59$; $P < 0,001$).

Table 1. Frequency of locomotion profile during overall locomotion, travel and foraging

	Run	Leap	Climb	Walk	N
Forage					
Overall	4.3	8.9	17.2	69.6	303
Female	2.8	8.3	18.9	70	217
Male	8.1	10.5	12.8	68.6	86
Travel					
Overall	14	12	13.3	60.8	301
Female	6.1	9.9	16.7	67.3	162
Male	9.4	14.4	23	53.2	139

3.2 SUPPORT USE BY MALE VERSUS FEMALES

The amount of time male and females used support types is presented in Table 2. During foraging regardless of both male and females branches and boughs are the main supports very often used. However when comparing the frequencies of support used by each sex our results reveals that during foraging females used more branches (47%) than did the male (45.3%) while boughs are more used by the male (31.4%) than females (30.9%). Moreover the male used more twigs (15.1%) than females (7.8%) while females used more the liana (10.6%) than the male (2.4%). The ground and vertical supports are very less used by both male and females. Here also the G test shows that there is a significant difference between male and females regarding to the support used ($G = 11.74$; $P < 0,05$).

During travelling branches and boughs are the preferred supports used by both male and females. However during travelling the male used very often large-sized supports (boughs) than females with 69.1% against 48.8% while the female used more branches (32%) during travelling than the male (21.6%). In addition our results indicate that smaller-sized support (twigs) and liana are less used by both sex and trunks and the ground are use occasionally by both sexes. Moreover, the G test shows a significant difference between the male and females in term of supports used ($G = 14.95$; $P < 0,05$).

Table 2. Frequency of support use during overall locomotion, travel and foraging

	Ground	Vertical	Bough	Branch	Twig	Liana	N
Forage							
Overall	1.7	2.6	31	46.5	9.9	8.3	303
Female	0.9	2.8	30.9	47	7.8	10.6	217
Male	3.5	2.3	31.4	45.3	15.1	2.4	86
Travel							
Overall	0.3	2	27.2	27.2	5.6	6.6	301
Female	0.6	3.1	32.1	32.1	6.8	8.6	162
Male	-	0.7	21.6	21.6	4.3	4.3	139

3.3 FOREST STRATA USE BY MALE VERSUS FEMALES

Regardless of both male and females foraging occurred more often in the upper main canopy layers (respectively, 57% and 56.2%) and lower main canopy layers (respectively, 23.2% and 14.7%) followed by the understory (respectively, 16% and 27.7%). During foraging both sexes were never seen in the shrub layer while the ground was used occasionally (Table 3). The G test shows that there is no significant difference between male and females regarding to forest strata used during foraging ($G = 8.82$; $P > 0,05$).

In contrast, during travelling male and females used more often the lower main canopy (respectively 67.6% and 64.8%), followed by the understory (respectively, 18.7% and 26.6%) and the upper main canopy (respectively, 13.7% and 8%). No observation was made during travelling on the underground. However, the G test shows that there is no significant difference between male and females in term forest strata used ($G = 5.59$; $P > 0,05$).

Table 3. Frequency of strata use during overall locomotion, travel and foraging

	0	2	3	4	5	N
Forage						
Overall	1.7	24.4	56.4	17.2	0.3	303
Female	0.9	27.7	56.2	14.7	0.5	217
Male	3.5	16.3	57	23.2	-	86
Travel						
Overall	0.3	22.9	66.1	10.6	-	301
Female	0.6	26.3	64.8	8	-	162
Male	-	18.7	67.6	13.7	-	139

0: ground; 1 (shrub layer): 0 m < stratum ≤ 5 m; 2 (understory): 5 m < stratum ≤ 15 m; 3 (lower main canopy): 15 m < stratum ≤ 23 m; 4 (upper main canopy): 23 < stratum ≤ 40 m; 5 (emergence): stratum > 40 m; (-): no observation; N: number of observation

4 DISCUSSION

During travelling male and females Putty-noesed monkey, *Cercopithecus nictitans stampflli* showed different ways in the use of the different locomotor profile. Indeed, the male leaped and run more often than did the females while the latest walked and climbed more than the formers. However during foraging, no difference between both sexes was observed in the frequencies of the locomotion modes used by that species. This difference in the locomotion of the male and females could be attributed to the great difference in the body size. Previous researches showed that primates locomotion behavior is very influenced by the body size and different body-sized primates could exhibit difference in locomotion behavior [20], [21], [22], [6], [23], [15], [2].

Furthermore, its known that the more body size increase the more often that species would leap while in contrast smallest body-sized species would tend to climb more [6], [9]. However our results with the Stampflii's putty-nosed monkey in the Taï Forest seem to fail to respect that theory during the foraging. In opposite, during travelling our results corroborated this opinion. Indeed, the greater body-size male *Cercopithecus nictitans stampflii*, leaped more than the females while the latest climbed more than the male.

Regarding the use of the forest layers, several answers have given to explain the occurrence of monkeys at different strata of the forest. That behavior seems to be an anti-predatory strategy to escape the predators within the same habit [23], [25] or to avoid interspecific competition for food [3], [26]. In addition to these reasons gradually the presence of the monkeys at the different forest layers is explained by the abundance of certain type of support. Indeed, previous studies showed that because the high availability of larger support in the main canopy, then greater body-sized monkeys should be found within that forest stratum [11]. However, with *Cercopithecus nictitans stampflii* that show a great sexual dimorphic between male and females, both sexes are found similary at the different forest layers during foraging and travelling.

Frugivory mammals as well as leaves and flowers consumers face difficulties to access these items which are generally located on flexible branches and this situation reduces the access to fruits to great body-size animals [27]. Then we expected *C. nictitans* females to use much often smaller and median supports than male. However, whether our results revealed that during foraging, females used more median supports than male in contrast during that activity the twigs are more often used by male than did the females.

Whether it's true that the guenons of the Taï Forest exhibit an interspecific competition for food, this completion is rarely found within the same species. However the male C. nictitans very often constitute a barrier for females and other sub classes during feeding on fruit trees and this could explain the difference in support use during foraging.

During travelling even though male used more boughs than the females while the latest use more branches than the male during that activity both sexes preferred big-sized supports during travelling because offered a better body stability during travelling. Monkeys are able to choose larger, more stable support to keep the balance and the center of gravity of the body at the top of these supports.

5 CONCLUSION

Finally with regard to the locomotor modes and the supports use, *Cercopithecus nictitans stampflli* showed sex difference in their behavior. Indeed during foraging although walking and climbing are the locomotor modes more used by both male and females, females walked and climbed more than male while the male leaped and ran more often than did females. Again during travelling females walked more than the male while the male leaped and climbed more frequently than the females. Furthermore during foraging females used more often branches than did male while during travelling the male used very often large-sized (boughs) than females. However no significant difference was seen in the strata used by both sex.

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BOOSTING THE BOLGATANGA BASKETRY INDUSTRY: INPUTS FROM THE INDIA-AFRICA CRAFT DESIGN INITIATIVE

Rolland Wemegah

Industrial Art Department, Bolgatanga Polytechnic,
P. O. Box 767, Bolgatanga, U/E Region, Ghana

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ABSTRACT: The Upper East Region of Ghana is home to myriads of authentic handicraft products. Majority of the indigenes however, depend heavily on basket weaving to earn extra income to supplement gains made from subsistence farming, petty trading, and rearing of animals. Over the years, sales of the basket wares have fallen drastically, largely due to stale products. This is precariously affecting the earnings of the artisans. The India-Africa craft design initiative therefore aims at developing a range of innovative woven products to boost the fortunes of the industry.
The study was an output from the various India-Africa craft design project phases in Ghana. Data was collected using interviews, semi-structured questionnaires, observations and focus group discussions of the participating artisans, project consultants, technical experts, exporters and exhibition attendants. The study was also supported with photographs of some of the newly designed products. From the findings obtained, it is quite apparent that with the relevant artistic and technical inputs, the grass woven products from Bolgatanga and its environs, popularly known as "Bolga baskets" could be restyled and integrated with materials such as leather, wood, calabash, metal and bamboo, to become an acceptable export commodity, which could generate substantial income for the artisans, the region and the nation as a whole.

KEYWORDS: Basketry, baskets from Ghana, Bolga baskets, integrated woven wares, woven guinea grass products

1 INTRODUCTION

Basket weaving is one of the oldest handicraft traditions known to man. It is believed to precede pottery production. These woven items showcased "people's perceptions of the environment, conceptions of the self and modes of economic interaction, social hierarchy, and division of labour" [1].

The art of creating woven objects especially containers using plant-based materials such as twigs, grasses, osiers, bamboo, rushes, or man-made materials such as plastics, is referred to as basketry [2] , [3]. According to reference [2], archeological evidence from Egypt, Peru, Southern Spain, Switzerland and Jarmo indicates that the art of basketry was known to civilizations of the Neolithic period. Reference [4] details that the term "basket" is etymologically derived from the Greek word *kophinos*, meaning "basket woven from plaited branches and twigs". The source adds that Sumerians produced and utilized baskets to bury their dead as early as 4,000 BC, and that the use of baskets was mentioned extensively in the Bible, giving us a fair idea of its production and usage over the years.

Typically, it is documented that in Africa, Asia, Oceania, Europe, Middle East, Mediterranean regions and the Americas, spiral coiling, sewed coiling, knotted coiling , twining, plaiting, check weaving, twilling, stake and strand, wicker work, crossed-wefting, diagonal weaving, twisting, looping, assemblage and half-hitch construction techniques were used by craftsmen around the world to produce woven objects [5], [2], [1], [3], [6].

Materials employed by skilled weavers around the world in fashioning basketry objects comprised assorted leaves, grasses, stalks, bamboo strips, tree barks, split rattan lengths, rashes, roots, acrylic threads, polyurethane strips, and plastic-

Corresponding Author: Rolland Wemegah

coated wires [5], [1], [2]. Reference [5] expatiates that dyes made from roots, leaves, fruits, vegetables, spices, animal waste as well as synthetic sources were used by artisans in Africa to pigment their materials.

Since the discovery of basket fragments and pollens in entombed graves by archeologists, many scholars have speculated on the usage of basket objects by past civilizations. The consensus is that the basket wares were used for everyday activities such as storing and serving of food, harvesting and transporting, liquid containers, sieves, strainers, filters, granaries, mats, snares and fish traps. Woven materials were also employed as; ornaments, children's toys, boats, assorted furniture, fashion skirts, loincloths, raincoats, shoes, hats, helmets, amours, shields, purses, combs, headdresses, jewelries and even as special containers for boiling and cooking food, as found among the Hupa Indians of northwest California [2], [4].

Africa is endowed with tremendous basketry products designed and crafted to meet the various needs of the societies that evolved them. Chad, Ethiopia, Ghana, Cameroon, Somalia, Congo regions, central and eastern Sudanese districts and the cultures of the Great Rift Valley are all reputed for crafting exquisitely fine and subtle basket wares, with complex decorations for diverse uses [5] [2]. Reference [5] elaborates that African basketry possesses some lesser known functions which include its usage as currency by the Mbun people of the Democratic Republic of Congo, fertility objects in Ghana, and as a sling in Somalia. The source exposits further that in Ethiopia; basketry items crafted as plates and lidded containers, played an important role in the traditional and ceremonial rites of the Harari ethnic group, who used these items as dowries, ceremonial gifts, as well as ornamental objects for decorating homes. Among the Zulus of South Africa, reference [7] writes that 'Pear-shaped *ilala* palm baskets with lids were crafted specially for newly married women, to be sent to their father-in-law's compound. The Zulus of South Africa are reputed for developing their basketry industry collectively to aid in lifting the rural poor from the doldrums of poverty and to promote African identity [8].

2 RESEARCH PROBLEMS

The handicraft industry in the Upper East Region of Ghana centered on the weaving of baskets and hats, vegetable tanning , production of leather articles such as bags, puffs, bracelets as well as textile weaving and its subsequent sewing into smocks. These craft articles were usually sold by the artisans to supplement gains made from subsistence farming, petty trading, and rearing of animals. Even though all the above products have assisted in varied ways to draw attention to Bolgatanga and the Upper East Region as a whole, the woven grass products affectionately referred to as 'Bolga baskets' could be said to have played a greater role in putting Bolgatanga on the world handicraft and tourist map. The industry which has a great potential for self-employment and livelihoods melioration in the region, is predominantly a cottage-based preoccupation of the indigenes of Bolgatanga, Talensi Nabdam and Bongo, all in the Upper East Region of Ghana. Reference [9] cited the Centre for National Culture in Bolgatanga, explaining that the basket weaving tradition could be traced to the 16th century. The first historical record of the industry, according to the source, dates to the 19th century; prior to the commercialization of the products, the basket wares were mainly used by indigenous households to strain *pito* beer during the preparation of the beverage, the source adds. It is estimated that about 10,000 natives of the Upper East Region actively practice the art form [9].

For more than 20 years, basket products from Bolgatanga have been exported to Europe, USA and Japan [9]. Reference [9] cites the Ghana Export Promotion Council, explaining that the export of "Bolga baskets" peaked in 2001 with an annual sale of USD 4,766,737, but declined to USD 225, 270 in 2004; this decline in export earnings, the source adds, is more than 89% within four years. Generally, most of the exporters of "Bolga baskets" interviewed by the author have lamented about the low volume of exports over the years. Even though various reasons could be assigned to the downturn of the industry, some of the exporters attributed the worsening situation to the absence of trendy products which could compete favourably with similar products from other parts of the world. It is known that buyers from large retail outlets such as Cost Plus, World Market, Target and Pier 1, are always on the lookout for new and stylistically innovative products that conform to modern trends [10]. It is worth noting, however, that "Bolga baskets" are reputed for their excellent strength and plasticity, giving the products some superior advantage on the world market [11]. Equipping the weavers therefore to evolve new products constantly to feed the export market, would really go a long way in boosting the fortunes of the industry. Indeed, it is the above constraints that necessitated the intervention from the internationally reputed National Institute of Design, from Ahmedabad, India, with assistance from the Indian Government, and supported by the Department of Industrial Policy Promotion, Ministry of Commerce and Industry and the Ministry of External Affairs to empower the artisans from the Upper East Region of Ghana, to come out with innovative and voguish products to boost the fortunes of the industry, under the India-Africa Craft Design Initiative.

The objectives of the study are;

i. To document the practical and artistic assistance given by the design experts from the National Institute of Design, India;
ii. To showcase some of the products that would be created during the training programme;
iii. Identify challenges that might ensue during the workshop; and
iv. To assess the impact of the new products on spectators who would be participating in the end of programme exhibition.

This study would greatly help in fully appreciating and replicating the design experience among the wider artisanal communities in the Upper East Region.

3 RESEARCH METHODS

To be able to ascertain and describe the aspects of the phenomena under study and offer ideas for subsequent investigations, the descriptive research design was adopted [12]. The population of the study comprised all participating stakeholders of the India-Africa Craft Design programme in Ghana. A sample size of 73 respondents was obtained using both convenience and judgmental sampling techniques. Accessibility and expertise were the major considerations for arriving at the above sample size. The primary data for the study was collected during the various phases of the product design and development training workshop at the Head office of Aid to Artisans Ghana, in Accra, through interviews, semi-structured questionnaires, observations and focus group discussions. The judgmental sampling method was used in sampling the six design professionals from India's National Institute of Design, who mainly facilitated the training activities. Equally, two project consultants from Aid to Artisans Ghana and the New Basket Workshop (South Africa-based NGO), an officer from Center for National Culture (Bolgatanga), four exporters of Bolga baskets, as well as the 25 artisans who participated in the training workshop were selected using the judgmental sampling methods. The convenience sampling techniques was however, the ultimate choice adopted in sampling the 38 exhibition participants for data extraction. The study was supported with secondary materials from books, journals and online articles. The data was analyzed using Microsoft Word Table structure [13]. This was done by transcribing, reducing (selecting, focusing, simplifying, abstracting and transforming) and displaying the data. Throughout the entire qualitative data analysis process, momo-ing was done to record reflective notes. Emerging patterns were identified based on the objectives of the study; enabling conclusion drawing and verification [13].

4 RESULTS

The India-Africa Craft Design Initiative was a special intervention developed and packaged by the Indian Government in May 2011 during the India Africa Summit-II programme, with the aim of enhancing income generation opportunities. The project largely targets rural craftswomen in Ghana, Ethiopia, Zimbabwe, Malawi and Zambia. The scope of the project includes; training of trainers, collaboration on product development, product range diversification and brand building. The project was mainly implemented by the reputable National Institute of Design, from India with assistance from other local and international experts.

In Ghana, the project spans seven months (October 2013 – April 2014). It commenced with a familiarization and assessment study in October 2013, to the Upper East Region by the consultants and design experts. This was to study the basketry industry in the region and to tailor appropriate design interventions suitable for the artisans in the industry. In December 2013, a team comprising 25 artisans from selected communities in the Upper East Region, the project coordinator from Aid to Artisans Ghana (NGO), a lecturer from the Integrated Rural Art Department, Kwame Nkrumah University of Science and Technology, and an officer from the Upper East Regional branch of Centre for National Culture travelled to India to participate in a workshop at the National Institute of Design, Ahmadabad campus. The two-week workshop created the relevant platform for the visiting Ghanaian team to exchange views, marketing experiences and expertise with Indian artisans, academics, non-Governmental organizations, retail specialists and design students. As explained by some of the artisans who embarked on the trip, the visit broadened their creative experiences and challenged their design capabilities. The trip, the artisans add also conditioned them for the intensive practical workshop they participated in on their return to Ghana.

4.1 RAW MATERIALS, TOOLS AND EQUIPMENT

The main raw material used in the Upper East Region for weaving is the dry stalk of the guinea grass (*Panicum maximum*), popularly called "straw" by many people in the Bolgatanga basketry industry. This is a perennial tufted grass with creeping

rhizome [14]. Other grass species such as *Vetiveria nigritana* are also sometimes used [11]. During the training workshop however, the researcher observed that guinea grass was the sole grass species used in weaving the articles. Other materials used during the workshop includes; wood, bamboo, rattan canes, calabashes, leather, iron rods, electrical fixtures, basic dyes, acetic acid, sodium chloride, wood polish, detergent, and antirust paint. All the above materials were sourced locally, with the exception of some of the leathers, which were brought from India.

Various tools and equipment were used during the workshop. These comprised; welding machines, electric grinders and drills, gas burners and cylinders, weighing scales, as well as vices and clamps. Others are; rubber gloves, nasal masks, stainless steel pots and spoons, plastic containers, working tables, awls, punches, tape measures, styrofoam and wooden moulds as well as cutters.

4.1.1 MATERIALS PREPARATION

Many materials were specially prepared prior to the actual weaving and integration processes. The specific and relevant preparation methods used are captured below.

4.1.2 GUINEA GRASS STALK

The first step in the grass stalk preparation is splitting. This was done by biting a channel in the middle of each stalk and pulling it apart with the hand (Fig. 1.). The divided parts were then twisted together on a rubber slipper positioned on the thigh of the artisan (See Fig. 2.). It was observed that some of the grasses were also used whole without splitting them.

4.1.3 DYEING

The twisted materials were dyed in different colours using basic dyes. Prior to the dyeing process, the twisted materials were soaked in water overnight. Subsequently, the materials were thoroughly washed with detergents and rinsed in clear water the following morning before dyeing. The design experts explained that the cleaning process was a crucial procedure which removes dirt and other natural coatings from the grass, enabling high dye absorption.

The grasses to be dyed were initially weighed on a scale to determine their weight. Subsequently, about three gallons of water (enough to cover the goods to be dyed) was heated on a gas burner to a boiling state, and five table spoonfuls of sodium chloride was dissolved and poured into it. Just after that, a levelled tablespoon (This quantity was used to dye a bundle of grass) of the desired direct dye was mixed with a small quantity of water and added to the boiling water. The grass was then lowered into the dye-bath and dyed for about 15 minutes. The grass was briefly removed from the dye bath and about one-fifth part of a litre of acetic acid was measured and poured into the boiling dye-bath. The goods were again lowered into the dye-bath, weighed down with sizeable stones and dyed for another 20 minutes. The goods were then removed and rinsed rigorously in clear water and dried. After the grasses have been adequately dried, samples were collected for the preparation of a colour recipe booklet.

4.1.4 LEATHER

The leathers used during the workshop were moulded on a pre-designed wooden blocks, cut into assorted geometric shapes and laces (thongs) or punched out with various punches and awls for the purposes of grass integration.

4.1.5 BAMBOO

The bamboos used during the workshop were generally dried ones. Most of the culms were split into the desired strips manually, dressed with sharp knives and sanded down smoothly with sand paper. Some of the culms were also processed whole by just scraping off the outer surfaces and sanding them smoothly.



Fig. 1. Splitting of guinea grass.



Fig. 2. Twisting of grass.

4.1.6 IRON RODS

Largely, half-inch and quarter iron rods were used. They were fabricated into armatures for lamp shades, chandeliers, frames for window blinds and other assorted stands. The rods were manually shaped and welded. The fabricated items were grinded with an electric grinder and coated with antirust paint.

4.1.7 WOOD

Assorted wood species were used. The wood was cut to the desired sizes and lathed or just finished-off with a jack plane, and then sanded smoothly and coated with wood polish. Various holes were bored on some of them to enable grass integration or the passage of electrical wires.

4.1.8 CALABASH

Varied sizes of calabashes were used. These were rigorously cleaned with detergents and thereafter, holes were bored on their edges or in the middle of some of them to enable integration of grass or electrical wiring. Some were also dyed with basic dyes into different colours.

4.2 WEAVING, MATERIAL INTEGRATION AND FINISHING OF PRODUCTS

All the products were woven based on predesigned sketches and dimensions created by the design consultants and the artisans. In some instances, moulds were used to aid the artisans in getting the required shapes and forms. Severally, the researcher has observed some of the weavers un-weaving and re-weaving their products just to ensure that they conform to the agreed specifications. The two main weaving methods used during the workshop were “twinning” and the “stake and strand” techniques, which the weavers specialized in. The twinning method involves the pairing of two horizontal (weft) strands around vertical ones (warp), while the stake and strand technique consists of interweaving two sets of strands (a vertical stable strand with horizontal movable ones).

Entirely grass-woven products were started by knotting strands of straw into warp and weft spider-like forms and skilfully woven upwards, incorporating warp straws and geometric motifs as required. The integrated products were largely commenced by looping the vertical strands of the grasses through bored holes on the integrating materials - wood, calabash and leather. In some cases, thongs of leather were woven into the body of the products and subsequently braided around pilled grasses to form handles for the baskets (fig. 6. (right). Woven grass was also integrated with punched-out leather buttons to serve as necklaces (see fig. 5. (left).

The rims of the products were finished-off by lashing them into round, flat or looped edges. The looping techniques were specifically used in finishing woven floral products and some hats. The method used for integrating bamboo with the grass was mainly through sandwiching. The vertical walls of the woven grass trays were firmly sandwiched between two circular strips of bamboo manually (fig. 3. (left). Some woven lamp shades were also mounted on prepared bamboo culms. Slender rattan canes were also incorporated into woven floral works to form the stems of these daintily woven articles (figure .5 (middle). Generally, rolled, moulded or woven handles, made from straw, wood and leather were affixed to some of the products to serve as shoppers, carriers or just to serve as hand-holds.

The products were finished by trimming loose strands of grass and sometimes leather off the body, rim and handles of the woven products using sharp cutters. After wards, electrical fixtures such as lamp holders were incorporated into some of the products.

4.3 IMPROVEMENTS

The artisans interviewed at the close of the workshop generally agreed that there were innovative improvements on their artisanal practices. They believed the introduction of acetic acid in the dyeing mix; grass soaking and cleaning processes; preparation of colour recipe manuals; the ability to sketch; leather weaving and its unique integration into the body of some woven products; new techniques of weaving complex shapes and forms, as well as the creative integration of calabash, bamboo, metal, wood, leather and rattan with grass, were novel stimulants that would impact positively on their work.

4.4 SOME SELECTED PRODUCTS FROM THE WORKSHOP

At the close of the training programme, 36 new product lines were developed. The total number of articles produced, however, stands at 108. These comprised lighting objects, furniture, puffs, shoppers and carriers, jewelry, hats and other personal and lifestyle accessories. Captured below are some selected products created at the workshop.



Fig. 3. Assorted Table Wares



Fig. 4. Lampshades &Chandeliers



Fig. 5. Necklace (Left), Flowers (Middle), Bracelet (Top Right) & Utility Basket (Bottom Right)



Fig. 6. Shopping Baskets

5 DISCUSSIONS

Findings from the study revealed that complex multi-shaped integrated products could be fashioned from grass and other materials by artisans from the Upper East Region into attractive and utilitarian products for both the domestic and international markets, with a bit of assistance. It is also evident that even though guinea grass alone could be woven into wonderful products, integrating it with materials such as leather, wood, calabash, rattan, bamboo and metal could greatly improve the allure and value of the products.

Holistic product design and development paradigms were adopted by the design experts during the training workshop. The artisans were strongly encouraged to learn and gain appreciable control over basic design and production principles such as sketching, colour harmony, symmetry, colour recipe development, adherence to measurements, and neat finishing of products. Armed with the above principles, it is anticipated that the artisans could inject the above artistic and production ideals into the basketry industry to ensure that products created meet very high quality standards and expectation of buyers.

The programme provides an opportunity for the artisans to travel and interact with design experts, other artisans and marketing experts from India. This cross-cultural experience is expected to broaden the artisan's perspective of the handicraft industry as a whole.

A cross-section of the exhibition attendants (Ghanaians and expatriates) interviewed said they were impressed by the new products developed by the artisans, and would be happy to buy and use some of the products. This shows that the new products have good market potentials and could compete if well promoted. The exporters were however of the view that unless more artisans were trained to weave the new products, it might be very difficult to meet export deadlines.

6 CONCLUSIONS & RECOMMENDATIONS

The project has really helped in broadening the horizon of the weavers from the Upper East Region of Ghana. Findings ensuing from the workshop showed that with a bit of assistance, the artisans could design and produce trendy products to sustain the basketry industry and improve on their living conditions. Generally, it was realized during the training workshop that integrated woven products could really be more alluring than crafting with the guinea grass alone.

There is an urgent need to organize further training programmes in the Upper East Region to train other artisans in the industry to master the new products. This would enable the artisans to quickly produce appreciable quantities to meet both local and international demands.

There is the need for the Government of Ghana to see the basketry industry as an important income generating sector worthy of capital injection, in order to transform it into an organized, competent and viable commercial sector to attract the youth.

The Bolgatanga Municipal assembly should consider collaborating with the Ministry of Food and Agriculture to cultivate guinea grass (*panicum maximun*) along the river banks and other water bodies in the region, to provide the needed raw materials to feed the industry. The matured grasses could be harvested and sold to the artisans at a reduced cost.

There should be an annual regional bazaar to promote the creative works of the artisans. This, apart from attracting tourists to the region, would also assist in offering an appropriate platform for marketing the basket wares produced by the weavers.

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Preventing the surprise attacks by warning and others indications provided by the intelligence

Dr Dicko Abdourahamane

Université de Zinder, Niger

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ABSTRACT: The warnings provided by intelligence are the backbone of any antiterrorist device, as it seeks to remove the element of surprise on which terrorism draws to hit and hurt. By definition, terrorism is effective in the abruptness and unpredictability of its shares, more than in its destructive capability. The effectiveness of an attack is based primarily on the shock set up within a group or society. We will go even further by saying that direct damage caused by the terrorist act (victims, destruction) are less important than the psychological impact it generates. Regarding Threats of warning, the central analytic task is to peel back substantive Uncertainty about the Meaning of Past Developments and the prospects for future world Developments That Could Endanger interest. Prescient, timely, convincing analysis imminent and potential dangers Regarding Can Be important year for the world Officials multiply force by Reducing the likelihood, first, of incident surprise and, second, of inadequate defensive Preparedness for Effectively dealing with high-impact potential Threats. The notion of warning is responsible for interpretations, and that the wave warning system plays its full role we have already mentioned above, it is important to make a semantic distinction between tactical warning and Strategic warning. The tactical covers everything or dangers that threaten the security of the world (military attack, terrorism, WMD developments, illicit transactions, and political crises abroad). How to analyze and assess risks is the central question that the tactical warning should provide clear answers.

KEYWORDS: terrorism warnings, indications, surprise attack, intelligence, prevention.

1 INTRODUCTION

The end of East-West antagonism accompanying the fall of the Berlin Wall in 1989 and the terrorist attacks against the United States September 11, 2001, bring the world in new era. The confrontation between the two blocks where each of the protagonists knew and his enemy against whom and what it fought, has given way to a situation largely disturbed by the emergence of new dangers, from actors ever more numerous and very difficult to predict. New forms of economic rivalry, transnational criminal organizations, violent extremists, appeared at the same time that globalization and today represent a major threat internationally. But in recent years, it is Islamic terrorism become our central concern. This represents the threat with the strongest power to harm. The 3000 deaths of the attacks of September 11, 2001, and the hundreds of victims to mourn over the world each year, terrorism make this element of destabilization potentially the most formidable, as the most newsworthy. This diffuse opponent, ill-defined and properly using all possibilities offered by globalization in the broadest sense (including those from the revolution in information technology), evolves into a new environment, characterized by either the ideological confrontation but by the overlap of issues and the proliferation risk. The break with the Cold War period is complete. Today, the first threat is primarily asymmetrical and it requires reconsidering the means obtained in defense and security of States, to continuously adapt. Thus, the fall of the Berlin Wall, but even more since the attacks in New York and Washington in 2001, states and international organizations, have undertaken to upgrade their devices to fight against terrorism.

The adaptability of Islamic terrorism is very fast, it is his greatest strength, and is an ongoing challenge for those who fight it. Anticipation is key and vital intelligence to prevent terrorist operations and thwart. It is virtually the only effective way to

prevent these actors take action. Intelligence agencies, responsible for collecting, analyzing and transmitting useful information to policymakers, therefore become very important. They have to adapt, to emerge from decades of Cold War that had seen them grow and take shape under and around their original mission, namely a function of defense, turned on the outside and military purposes. But what place the intelligence occupies in the fight against terrorism? What is its role? What changes have occurred since September 11, 2001 and globally since the end of the bipolar world in 1989? What are the desirable and possible prospects for intelligence in the fight against transnational terrorism? At first, we'll see a general point of view what is intelligence, what are his means, his organization but also its specific countering. We focus on the post-September 11, 2001, which marks a real acceleration in the evolution of intelligence, to adapt to the threat of Islamic terrorism. Understand the measures implemented by the United States and international organizations to change the intelligence cycle, how have organized international cooperation, will some of our topics for discussion in this second stage. Finally, we will try to take stock and to create opportunities. What solutions can be envisaged to continue to advance the collection, analysis and transmission of information, as part of the fight against terrorism? Finally we discuss the ethical issues raised by the intelligence, but also its institutional control by its privatization, or future pathways offered by open source or the Intelligence-Led Policing.

2 THE INFORMATION AND WARNINGS: PILLARS OF THE COMBATING TERRORISM.

OVERVIEW OF INTELLIGENCE

DEFINITION OF INTELLIGENCE

Intelligence gathering is not new. It can even be considered one of the oldest human activities, knowing that it could take many different forms over time. This activity satisfies a need for knowledge or even curiosity about a thing, person, and group. However intelligence is distinguished from simple information from the moment it becomes an issue of power, and gives rise to the creation of methods, tools and services specific to its collection and operation. It is primarily an aid to decision making in various fields and varied: Economy, Industry, Diplomacy, Security, Defense, etc.., All are likely to use the information as part of their activities. Intelligence informs about the intentions of someone or an organization to have the autonomy and knowledge necessary for decision making and therefore the action.

2.1 INTELLIGENCE CYCLE AND THE NOTION OF WARNINGS

There are different types of approaches, but the intelligence cycle is organized around four major phases: definition of research. This is the expression of a need that in the case of counter terrorism emanates from political authority. The intelligence, especially the agent (or agents) therefore knows what to search for and in what direction. The action or the collection: This is the time of the search for the information itself, and various means by which it occurs (activation sources, illegal search). The exploitation / analysis: This is the work of analysts who must sort information useful, relevant and separate from the rest. Dissemination: This is the last phase of the cycle, or that the information collected is transmitted to policy makers who decide to run (or not) a share. It is in this phase that the information truly becomes a tool for decision. The information may be obtained from a variety of tools, methods, sensors from two main types of sources: the sources said open and closed source. The former are all means of information available to all, free or not. Today it is estimated that nearly 80% of useful information to intelligence agencies in the fight against terrorism, comes from these open sources, primarily the Internet. Sources closed to encompass all means of clandestine collection of information they are illegal or not. The essence of this closed source based on the secret, the discretion is important and is not spotted by the target. The ways of research have dimensions: technical and human.

The technical information consists essentially of two areas: signals intelligence (SIGINT Signal Intelligence) which includes both electronic intelligence (ELINT, electronic intelligence) and intelligence community (COMINT Intelligence community); Imagery intelligence (IMINT, Image Intelligence). Inside each of them, it is possible to establish other categories employed by the specifically means: Intelligence laser signatures electromagnetic, optical, acoustic, photographic, radar. The technical information most commonly used aircraft, satellite systems (satellites, UAVs), cryptography and wiretapping COMINT (Communication Intelligence). Most nations of the Western world have a special department of technical information, or an interception system. Like examples, we can note the GCHQ (Government Communications Head Quarters) in Britain, the NSA in the U.S. and the FAPSI in Russia. The benefits of information technology are manifold: it provides concrete information, reliable, near real time and anywhere in the world while avoiding the difficulties inherent in the political, geographical or environmental context. Especially the collection of information can be done without endangering human lives, and without being detected by enemies (Human Intelligence (HUMINT or HUMINT). It’s obtained through intelligence agents using the

methods of collecting legal or illegal. It encompasses both the information acquired by a conversational mode in which a human sensor interrogates a source, and the information obtained by observation without contact with the opponent. Human intelligence includes the name MICE: Money, Ideology, Forced, and Ego by reference to four main methods of collection used by HUMINT: Money describes the purchase of information by paying money. Ideology refers to obtaining information by sympathy or ideological conviction. An individual agrees to transmit information to the enemy because he rejects the values of society or government. The force requires the use of methods of blackmail, intimidation or torture (though it concerns specific cases), to obtain information. Ego means an individual lure by flattering his ego, his megalomania by maintaining and / or promising him a large personal recognition.

2.2 SPECIFIC INTELLIGENCE IN THE FIGHT AGAINST TERRORISM

Intelligence is the lifeblood of every anti-terrorism system because it seeks to remove the element of surprise on which terrorism draws to hit and hurt. By definition, terrorism is effective in the abruptness and unpredictability of its shares, more than in its destructive capability. The effectiveness of an attack the first is based primarily on the shock set up within a group or society. We will go even further by saying that direct damage caused by the terrorist act (victims, destruction) are less important than the psychological impact it generates. As its name implies, terrorism means terrorize, cause doubt and fear in a population. It's a multifaceted and diffuse threat that accounts the post-bipolar world; it's probably the most emblematic. Today the main challenge for security forces and defense policy is to first find the enemy, even before to consider obtaining more precise information on it, to take action to counter it. The threat is not only unpredictable, it's transnational. At a time when terrorism knows no borders as well as its targets for its locations, the concept of sanctuary land is no longer relevant and intelligence gathering, but also cooperation between the departments concerned, whether within the state or between states themselves, has become an absolute necessity and priority. It has also greatly expanded since the end of the Cold War and since September 11, 2001. In this context intelligence, information transmission is absolutely central. Regarding the fight against terrorism, intelligence has to understand the networks, in order to know their capabilities, motivations, operations preparation, potential targets, etc. It's the center of any action against terrorism, and any judicial or police operation can be initiated without the input of intelligence, whose primary mission is to find that invisible opponent.

The information acts upstream of terrorist action, in logic of prevention, to allow police to break up operations in preparation, disrupt networks. But it's also present downstream that support action against armed groups (military intelligence plays a central role), assist police in investigations for the condemnation of criminal's actors. The strengths and intelligence unlike its weaknesses in fighting terrorism, compared to other types of actions that can be taken against terrorism (police, judicial, military).Technical intelligence overcomes the impossibility almost total infiltration of terrorist networks, are structures extremely tight. But it requires the acquisition of technology often expensive and highly specialized that few States in the world are able to fund. In addition, it delivers information frozen in time from which it's difficult to extrapolate and obviously it cannot reach the underground area in which many terrorists find refuge. But the major drawback comes from the amount of information, which is now far greater than the analytical capabilities of the intelligence services; Communications are too many each day.

Human intelligence is based on means of raising humans who can anticipate the intentions and explain the actions of the opponent. They provide access to factual information which, contrary that one obtained technically can fit into a global environment and then allow a better view and an assessment in situations of crises or problems whose complexity and dispersion have become the dominant features. In addition, as part of the fight against terrorism specifically human intelligence proves relevant to the technical information. Indeed, many network members have returned in recent years the use of basic communication modes based on oral transmission or through present standard technologies (eg walkie-talkie). They understood that they would benefit from an option allowing them to protect their activities, without being spotted by the intelligence services, who themselves have largely tended to focus on technical means of interceptions in the last decade. But human intelligence also has significant weaknesses. Firstly it involves men and women in sometimes very dangerous situations. More importantly, the collection of information by the infiltration of networks is virtually impossible, especially for Western officers. Indeed the Islamist terrorist networks, including work in an extremely narrow. The members have known for years and often they come from the same regions or even the same villages, speak the same dialect, infiltration is practically impossible for intelligence agents and especially extremely dangerous.

3 WARNINGS FACING THE EMERGENCE OF NEW THREATS AND NEW ACTORS

The fall of the Soviet Union ended the ideological confrontation that had endured for nearly 50 years. But the desired stabilization of the world is not achieved and contrary, crises and conflicts are developed. The economy emerged as the major area of competition between nations and new non-state actors emerge on the margins of the States (there are rather

non-governmental actors who assist the State, NGOs in the first place). During the history, the United Nations has always been disputed whether by religious group's opposition movements. These new threats disrupt deep international politics and therefore the practice of intelligence.

3.1 THE TYPES OF THREATS

The new threats that disrupt international politics and the practice of intelligence are:

Islamic terrorism: personified by Al-Qaeda terrorist organization, is a new type which is not supported by any state. But Al Qaeda is primarily a central support, in which there is no hierarchy nor truly concerted strategy, and showing no territorial claim. Only targets and inspiration of the fight against the West are common to different cells or subsidiaries claiming the organization worldwide. Some experts even argue that it fulfills a symbolic role for apprentice's terrorists. The fact is that Al Qaeda is present in over 60 countries, and its power to harm indisputable

Transnational crime: As Islamic terrorism, it took advantage of all opportunities offered by globalization, especially those from the revolution in information technology and the democratization of transport. Indeed, thanks to globalized economic networks, it could develop its business relating to the international level, arms trafficking, drug, human and sometimes representing nearly 6% of the global economy. These criminal organizations are a strong source of instability especially in areas where the state is built on shaky foundations. Indeed, their primary purpose is not in the conquest of power for political purposes. But indirect control of territories gives them the upper hand on institutions and on companies. Weaken the state is a way for them to establish their business and maximize profits

Proliferating technologies: nuclear proliferation, always present in this post-Cold War world despite having changed. Indeed, it remains one of the major concerns of the international community. Today, the most feared risk is no longer a major nuclear confrontation that could jeopardize the survival of a part of humanity but a terrorist act perpetrated by means of an atomic weapon. At the Wall, equipment and fissile material disappeared from former Soviet facilities, and a number of scholars have put their experience to proliferating states. If currently producing a nuclear weapon remains at the stage of science fiction since the process requires resources and know-how that only states are able to mobilize, its flight is a dangerous assumption and very realistic. And an attack through a dirty bomb containing fissile material is also the realm of possibility. But other types of proliferating technologies such as biological, bacteriological and chemical methods are equally likely to be employed in an attack.

The new economic rivalries: the end of the bipolar world and the advent of globalization have shifted the competition between nations, from military to economic. Today, more than the power of his army, the economic influence of a country determines its position internationally. To integrate this profound change, the Western intelligence services have also shifted their activity from the 90s.

Competition for access to resources and energy policy: It relates particularly oil (but also gas) that can cause tension in some cases open conflicts between states not only to ensure its operations but also its transit. This will be probably even more in the future, as resources will diminish and will make this material an even more coveted than it is today. Many interns or regional conflicts in the world concern these issues. It can also be an indirect vector of rising tensions. China has significantly increased its military budget in recent years to ensure security of energy supply. Because overall competition between countries to access these materials means reinforcing safety and therefore to develop their military forces, which has the effect of creating fear among the states and creating tension .

4 US INTELLIGENCE VULNERABILITY BEFORE 9/11

Americans based their information gathering electronic espionage by considering the pursuit of traditional intelligence, as obsolete, expensive and dangerous, diplomatically. They neglected the infiltration of Islamist networks in favor of an electronic surveillance. The budgets of the intelligence services (especially human intelligence) have been seriously reduced. Today, they are looking for help from the public to glean intelligence since their budgets cannot fill their gaps. On top of that, although aware of the risk of terrorism, Americans were primarily focused on the risk of chemical or biological attacks, or new risks related to cybercrime. Air terrorism was not their concern. Some U.S. intelligence experts attribute the reasons for this failure on the bureaucratic hurdles and regulatory constraints associated with it the rivalries between intelligence agencies, the lack of resources and poor coordination for sharing information between the various intelligence agencies. Others cite the lack of qualified staff and a culture of intelligence. They also accuse intelligence officers and the officers responsible for enforcement who didn't take enough risks with numerous alerts, to prevent attacks of September 11.

4.1 LACK OF PERSONNEL TO ANALYZE INFORMATION

The U.S. intelligence agencies, like most intelligence services of the world are inundated with information and there are not enough actors qualified to process this information and make it useful. American intelligence falls down into the trap of the information paradox. This paradox is generated by the rise of information technology. On the one hand, we witness the increasing availability of information; the information technologies greatly facilitate the collection and storage of information, whether from the wiretap, sensors and satellites. But, on the other hand, these technologies generate perverse effects as a proliferation of data sources and too rapid growth of the importance of these technologies. The intelligence services should have foreseen that the glut of information would require an extremely laborious. too much data and information to be processed, but not enough qualified actors to analyze them. The authorities are overwhelmed and become unable to meet the challenges of technology. American services have almost all the necessary information on the terrorist threat, but they were unable to process it, analyze it and pass it into a product relevant to policy makers. A U.S. intelligence expert quoted by The New York Times, June 9-10, said "We did not know what we knew." In other words the U.S. intelligence services were unaware they have in their drawers a lot information about Al Qaeda and bin Laden. Not treated their pus masses of information, this information has served only to see the damage.

4.2 CONFLICTS AND LACK OF COOPERATION BETWEEN AGENCIES AND LACK OF RESOURCES

The information acquired by one agency may be kept secret and not necessarily transmitted between agencies. The FBI and the CIA had all the pieces of puzzle but they were unable to meet because of lack of cooperation between them. In addition to this lack of cooperation there are red tape (which complicate the searches and arrests of suspects) and the lack of resources. The U.S. intelligence agencies, including the CIA, do not currently have enough agents to infiltrate terrorist groups. The failure of American espionage is edifying. The CIA does not have a single Arab officer with real skill and a Middle Eastern culture that can pretend to be a fundamentalist Muslim and would volunteer to penetrate terror networks. September 11 has in fact proved, alas very tragically, the difficulty of intelligence and U.S. Securities send a common picture of the threat, mainly due to a lack of cooperation and communication. Better sharing of data would probably (but not with certainty) allow an increase of vigilance, and therefore a reduced risk. According to Tom Ridge, the first director of the Department of Homeland Security: It is the lack of communication between U.S. intelligence agencies before September 11 which can partly explain why the threat was not perceived at fair value and that Operation could not be countered. It is also indicative of the great difficulty of a large bureaucracy to adapt to a rapidly changing environment.

Faced with this failure, the explanation most frequently cited indicated that the United States intelligence dropped human intelligence and focused their energy on technological formations. But it's more likely that the excessive preponderance of tactical intelligence on/over the strategic intelligence is the determining factor. In the United States before 9/ 11, many intelligence agencies have tactical and very specialized competence. There are few analysts who have a strategic overview of the terrorist phenomenon and can see things that analysts can't determine. For example, the FBI before September 11 has ten tactical analysts for a strategic analyst. And this deficit has considerably limited analytical capabilities of the political world to understand the nature and intensity of the problem and make decisions. The lesson learned from 9/ 11 shows that the anticipation of the tactical action is often impossible, which gives a strategic anticipation role. Not the American intelligence only is concerned by this observation because 9/ 11 signaled the bankruptcy of an entire system.

4.3 THE ROLE OF WARNINGS IN THE PREVENTION OF TERRORIST ATTACKS

The world faced new threats, primarily the threat of terrorism, but also weapons of mass destruction, proliferation, illegal trafficking, etc. That is why the Intelligence Community must also evolve and adapt via a new strategy that emphasizes collaboration between relevant agencies but also by integrating the businesses that can contribute also to national security. The charge has been repeatedly made after September 11. The failure of the international security system is primarily the lack of collaboration, dialogue between the intelligence agencies. The terrorist threat has placed the information in the center of national security concerns. Its effectiveness has become essential in preventing attacks. The intelligence services obviously remain discreet about their activities; have seen their interest increased with the strengthening of credible terrorist threats after 2001. Major issues of security and the fight against terrorism are actually indeed the center of the action of American intelligence. Emphasis is first placed on the identification of threats, for example by monitoring electronic communications. Three key questions emerge: coordination of intelligence services, which fall within the Ministries of Defense, Interior and Finance, strengthening the means allocated to them and cooperation with foreign partners. The development of their action about anti-terrorism policies also raises more acutely the question of their control, particularly with the senate. The intelligence services are actively engaged in fighting terrorism. The document on National Strategy for

Homeland Security for example developed and updated after the attacks of 11 September by the Government about the internal and external US security recalls the importance of the continuous adaptation of the American system. In the prevention of risk, it places particular emphasis on capacity building of the intelligence services and security. The effectiveness of intelligence and police are the ability of these services to anticipate the violent action and to analyze all the mechanisms that contribute to the development of the phenomenon of terrorism and other criminal activities to better address them. This justifies the improvement of monitoring capabilities of electronic communications, facilitation of access by intelligence and security to certain administrative data and to better identify dangerous travelers. The notion of surprise attacks appears repeatedly in the debates. Its success proves that it expresses an intuition shared by many, although it suffers from a lack of conceptual strength. Indeed, the notion of uncertainty (surprise) that strategic perspective is: any strategic situation involves an element of uncertainty, not least because it brings into confrontation actors with different interests, varied means and so many initiatives. Basically, the strategy is always to produce strategic calculus facing uncertain situations, the decision makers to choose actions that improve their situation. There is much truth in the notion of strategic surprise, the truth should be revealed. The concept of surprise is actually quite old: from the Cold War in retrospect thought as a stable situation, everyone feared a surprise, with such a nuclear surprise attack that could upset the existing strategic balance. The concept has changed for example, in the 1990s, to fears of a major computer attack. In such catastrophic scenarios, considering this concept of decisive battle that remains, it must be remembered a very questionable concept and little discussed. However, the sharpness of strategic surprise peaked September 11, 2001. The specialists were already discussing asymmetric wars over symmetrical wars. However, no one had seen the emergence of a brutal hostile actor who suddenly succeeds in becoming the number one public enemy and polarize towards it hostility of the world in general and American in particular. This war against terrorism and organized crime has burdened the strategic debate for ten years, and we are just beginning to liberate ourselves. A mode of action based on the psychological effect, especially if it's obtained by surprise, no longer works: first we are neither surprised nor psychologically reached (even if we can be shocked, because it is not to deny the feelings of victims). Brice makes a major contribution in understanding the phenomenon of surprise attack. The mapping of this enigmatic problem by Brice allows us to identify all the nature and status attacks. He clearly identifies the types of actors: non-State and State and the kind of war: Conventional and unconventional, (Brice, 2003, 8) another factor that does not appear in the matrix and that Brice himself admits is playing important role in the determination of surprise, is the error calculations. He said the wildcard in Assessing << year's adversary intentions and the likelihood of miscalculation >> surprise is. The perception appears in this dialectical logic, as a critical variable that provides explanations to the problems of miscalculation. So Brice simply argues that to understand the problem of miscalculation must first understand the perception. The human cognitive competence is subject to two influences, conscious and unconscious. We'll just have to understand that not all information collected overstaffing that are obvious, complete and truthful. Some information is often false, unfounded. When we base our analysis on such information, we inevitably fall into errors of calculations. Perception is therefore a factor which can make and win a war. The father of the Observation-Orientation-Decision-Action (OODA loop), John Boyd strongly supports this idea and we will admit with him that only Humans fight wars and that other factors such Circumstances, land, and no weapons are not sources or priorities. The importance of information for intelligence is the second aspect on which Brice has directed his thoughts. This analysis is practically important and deserves to be included in this analysis that I present. The importance of intelligence in preventing criminal acts is accepted by all, but we have difficulties to formalize the basis of rational use of accurate intelligence. The major responsibility of intelligence is to collect data and provide information to decision makers. Brice, present in this paper the different levels of information. In this representation pyramidal submitted by Brice, we distinguish five levels hierarchy information: Truth, Wisdom, Knowledge, Information and Data.

In the Jack Davis analysis, we find a role devoted to intelligence. According Jack, the intelligence analysis must fulfill two main tasks. Both tasks are, to warn about the dangers US Officials to national security and to alert them to Perceived openings to advance US policy objective (Jack Davis 2003, 3). Also, we totally agree with Jack, when he asserts that << Regarding Threats of warning, the central analytic task is to peel back substantive Uncertainty about the Meaning Of Past Developments and the prospects for future US Developments that Could Endanger interest. Prescient, timely, convincing analysis imminent and potential dangers Regarding Can Be important year for US Officials multiply force by Reducing the likelihood, first, of incident surprise and, second, of inadequate defensive Preparedness for Effectively dealing with high-impact potential Threats >>. The notion of warning is responsible for interpretations, and that wave warning system plays its full role we have already mentioned above, it's important to make a semantic distinction between tactical warning and Strategic warning. The tactical covers everything or dangers that threaten the security of the United States (military attack, terrorism, WMD developments, illicit transactions, and political crises abroad). How to analyze and assess risks is the central question that the tactical warning should provide clear answers. This analytical perspective will provide the event, to confine and contain the damage. The second tactic is called strategic. The strategic tactical main objective, policy development, coordinated, reliable which can defend and manage potential emergencies. Finally, we will retain the collection, analysis and

transmission of information is absolutely vital intelligence. Yet the rules, mechanisms and practices are still too often marked by the period of the Cold War, and prevent or limit sharing. Must be redefined, and adjust it, finding the right balance between the need to produce the necessary information to decision makers and the risk that it could threaten the sources, methods, civil liberties or serve to the opponent . The plan proposes several initiatives: Create an information environment that is unique and common practice facilitate access and use of databases, developing an information technology with non-members of community, develop a single classification guide for intelligence.

5 CONCLUSION

9/11, was a huge shock to the world. The scale of destruction, the death toll, but also the huge psychological impact, gave this event a still unpublished which propelled terrorism, and especially the fight against terrorism at the forefront of international priorities. As we know, the responses to the attacks were organized around the American military interventions in the context of the war against terrorism in Afghanistan and Iraq but also in many other parts of the world. But beyond these important actions, reflecting overall development started to try to glimpse the reasons for the inability of U.S. authorities to anticipate and prevent these attacks. Intelligence and deficiencies regarding its transmission clearly emerged as the major elements of this bankruptcy. From on 9/ 11 emerged as the symbol of a world that had changed significantly since the fall of the Wall in the early 90s. These attacks marked the failure of intelligence and security could not understand a particular event (September 11), and beyond, have failed to properly fit the new situation of this post-Cold War world. In this new environment, characterized by threats emanating from now and transnational actors most often non-state, the information is of paramount significance for the entities entrusted with the defense and state security, including through the fight against terrorism. Changes were necessary and were undertaken around the world since 2001. The United States, has disputed the existence of major intelligence agencies (CIA, NSA, FBI, DIA) but they have already provided funding much higher than they were in the past in the field of terrorism against and intelligence. But mostly they have created the position of Director of National Intelligence (DNI) in order to establish a real exchange and share information internally but also externally with foreign services. 9/ 11 did not reveal the inadequacy of services to acquire information but their inability to pass them correctly and hence the overlap in order to anticipate and prevent attacks. But a general point of view, what conclusion, what conclusions can be drawn from developments that affected the information in the fight against terrorism since the events? In many cases, some progress has been made and the place overall intelligence is better today than it was several years ago. Not only its now probably the first pillar of the fight against terrorism, but beyond that, it has become a major element in the defense and state security. We understood that the information was probably the best defense against new threats that have developed from the end of the Cold War. But often the way interviews and plotted on a theoretical level could not be carried out in reality, or at least were not fully up to expectations, mainly due to the reluctance or slowness in within administrations or bureaucracies.

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Effect of Post Annealing Temperature on Structural Properties of ZnS thin films Grown by Spray Pyrolisis Technique

A.U. Moreh[1], B. Hamza[1], S. Abdullahi[1], A. Bala[1], Z. Abdullahi[2], and M. S. Shehu[1]

[1]Department of Physics, Usmanu Danfodiyo University, P.M.B. 2346, Sokoto, Nigeria

[2]Physics Advanced Lab, Shedda Science and Technology Complex, SHESTCO, Abuja, Nigeria

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ABSTRACT: ZnS thin films were grown on soda lime glass substrates using spray pyrolisis method at a substrate temperature of 573K. The films were then subjected to a rapid thermal annealing at different temperatures. X-ray diffraction carried out on the films revealed a single peak which increase in intensity with increase in annealing temperature. The patterns of the ZnS thin films showed that the full width at half-maximum (FWHM), micro-strain and dislocation density of the films decreased with increase in annealing temperature, indicative of an improvement of the crystal quality of ZnS films. Similarly the calculated grain size of the films exhibited an increase with increase in annealing temperature which is a clear indication of an improvement of the crystal quality of the ZnS films. The values of lattice constant '**a**' agree with the standard and reported values.

KEYWORDS: ZnS, Spray Pyrolisis, annealing, XRD, Structural property.

1 INTRODUCTION

II – VI semiconductors, such as Zinc Sulphide (ZnS) have attracted growing interest owing to their possible applications in Photovoltaics and optoelectronics [1]. It is important semiconductor material for the development of various modern technologies of solid – state devices (laser diodes, solar cells). Zinc Sulphide have wide direct band gap of about 3.50 eV in the UV region [2]; it is used as a key material for blue light emitting diodes and other optoelectronic applications such filters, photoelectric cells, display devices and materials for LEDs and lasers [2], [3]. ZnS exist in two forms, an α-phase (hexagonal Wurtzite structure) and β-phase (cubic Zinc blende structure); a cubic crystal structure is its most stable state. Many deposition techniques have been used to prepare ZnS thin films, such as spin coating [4], chemical vapor deposition [2], and chemical bath deposition [6], [6]. Among these methods, Spray Pyrolisis is the most common method in producing thin film because the advantages of spray pyrolisis are its convenience for the deposition of semiconductor thin films and has the several advantages in comparison with other deposition techniques such as low cost of the source materials, producing high quality films using comparatively simple deposition equipment, moderate substrate temperatures, deposition scaled for large area and uniform deposition with very thin layers with specific composition, morphology, good adhesion between the deposited film and controlling the shape and sizes. Usually, as-deposited films require a thermal treatment to improve stability and reduce the possible undesirable influence of the substrate. Thermal annealing is a widely used method to improve crystal quality and to study structural defects in materials. During an annealing process, dislocations and other structural defects will move in the material and adsorption/decomposition will occur on the surface, thus the structure and the stoichiometric ratio of the material will change. Such phenomena can have major effects on semiconductor device properties, light emitting devices being particularly affected. For ZnS films, many research groups have investigated the effects of annealing temperatures on the structure properties of ZnS films [7]. In this paper, we report deposition of ZnS thin film on soda lime glass substrates by spray pyrolisis technique at temperature of 573K. The thin films were subsequently annealed in two different batches at 573K and 673K. The samples were further investigated for their structural properties.

Corresponding Author: A.U. Moreh

2 EXPERIMENTAL

All the chemicals used for the deposition of ZnS thin films were 4N grade, soda lime glass was used as substrate, and film thickness was measured using Profilometer (Stylus Taylor Hobson model). Zinc sulfide thin films were prepared on soda lime glass substrates using KM 150 spray pyrolisis deposition machine. Before deposition the substrates were cleaned using trichloroethylene methanol and acetone sequentially. The dried substrate was rubbed gently with cotton. Solution containing Zinc Chloride ($ZnCl_2$) and Thiourea ($SC(NH_2)_2$) of molar concentration 0.1 M/L were used to prepare ZnS thin films. The precursor solution was sprayed for about 10 minutes. When zinc sulphide started depositing on the substrate, flow rate was maintained at 0.8ml/min. The substrate temperature was fixed at 300^{o}C. Similarly, the film thickness and nozzle to substrate distance were kept at 100nm and 11.0cm respectively. After deposition, samples were removed from the spray chamber and were subjected to a thermal annealing at different temperatures under nitrogen atmosphere. The ramp rate was 6□/s and the dwell time was 1 h. After annealing, the samples were taken out for characterization. Three samples were grown one sample was marked as as-deposited and did not undergo thermal annealing while the other two samples were annealed under nitrogen atmosphere at 573K and 673K respectively.

In order to investigate the crystallographic properties of ZnS thin films , X-ray diffraction analyses were carried out using PANALYTICA XPERT-PRO Diffractometer with Cu-Kα radiation (λ = 1.54056Å). The X-ray tube was typically operated at a voltage of 45 kV and a current of 40 mA. XRD patterns were recorded in the range of 20^0-80^0 with a scan speed of 2^o/min, step size of 0.2000^o and scan step time of 1.10 seconds for all deposited thin films.

2.1 FORMULATION OF STRUCTURAL PARAMETERS

The grain sizes **D** were calculated through the Scherer's formula [8]:

$$D = \frac{0.9\lambda}{\beta \cos\theta} \qquad (1)$$

Where β is full width at Full width half maximum (FWHM) of the preferential plane, θ is Bragg angle and λ is the wavelength of Cu-K_α radiation. The Dislocation density of thin films **δ** was calculated by employing Williamson and Smallman's relation [9]:

$$\delta = \frac{n}{D^2} \qquad (2)$$

Where n is a factor which equals unity giving minimum dislocation density and D is the grain size. The micro strain **ε** developed in thin films was calculated from the relation [10]:

$$\varepsilon = \frac{\beta \cos\theta}{4} \qquad (3)$$

Where β =FWHM (Full width at half maximum intensity and θ is the Bragg's angle. The lattice parameters '**a'** value for tetragonal crystallographic system was calculated from the following equation using *hkl* parameter and the inter planer spacing d [11]

$$\frac{1}{d^2} = \frac{h^2 + k^2}{a^2} + \frac{l^2}{c^2} \qquad (4)$$

3 RESULTS AND DISCUSSIONS

3.1 XRD RESULTS

Fig. 1, 2, and 3 represents the XRD pattern for as deposited ZnS thin film, ZnS annealed at 300°C under N_2 and ZnS annealed at 400°C under N_2 respectively. It can be observed that All films shows a diffraction peak centered at 26.5 corresponding to the (111) lattice plane of zinc-blende phase (International Centre for Diffraction Data ICDD, Card No. 01-089-4245). The XRD pattern for as-deposited ZnS films in figure 1 is characterized by a very small peak with orientation at 2θ=26.5°C. Figure 2 illustrate ZnS thin film annealed at 573K under Nitrogen atmosphere. It can be observed that the position

of peak is still at 2θ=26.5°C but its intensity stronger than that of as deposited films. Furthermore, as the annealing temperature is increased to 673K under N_2 atmosphere as displayed by figure 3 the peak intensity is observed to further increase and its position is still at 2θ=26.5°C. This implies that annealing enhances crystallinity of thin film. Improvement in crystal structure could be attributed to the increase in crystallite size as the small crystallites join each other in the planes by increasing heat treatments. Similar observation was reported by [12], [13], [14], [15] on ZnS thin films as well [16], [17], [18], [19] made related observation but for ZnO thin films.

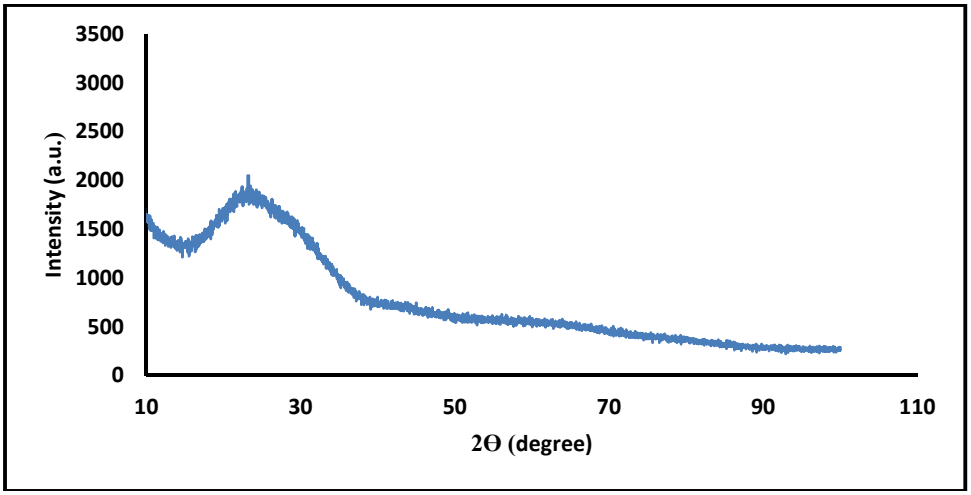


Fig. 1. XRD patterns for as deposited ZnS thin films

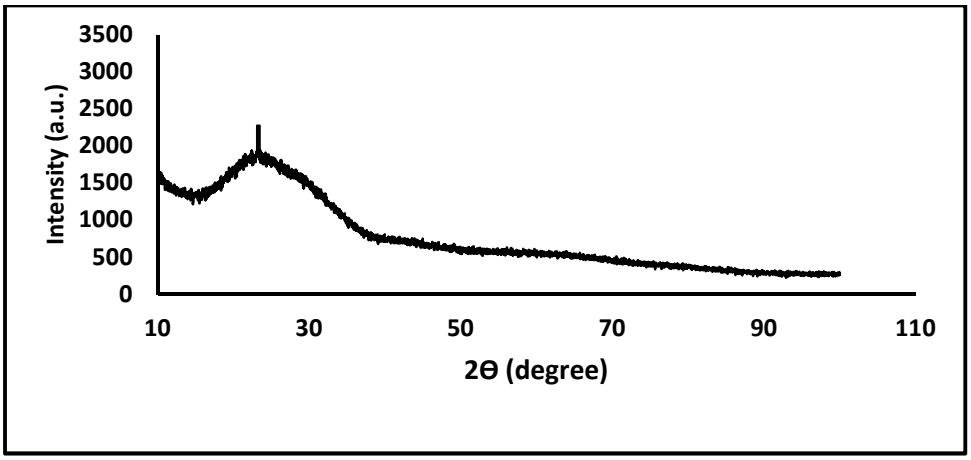


Fig. 2. XRD patterns for ZnS thin films annealed at 573K

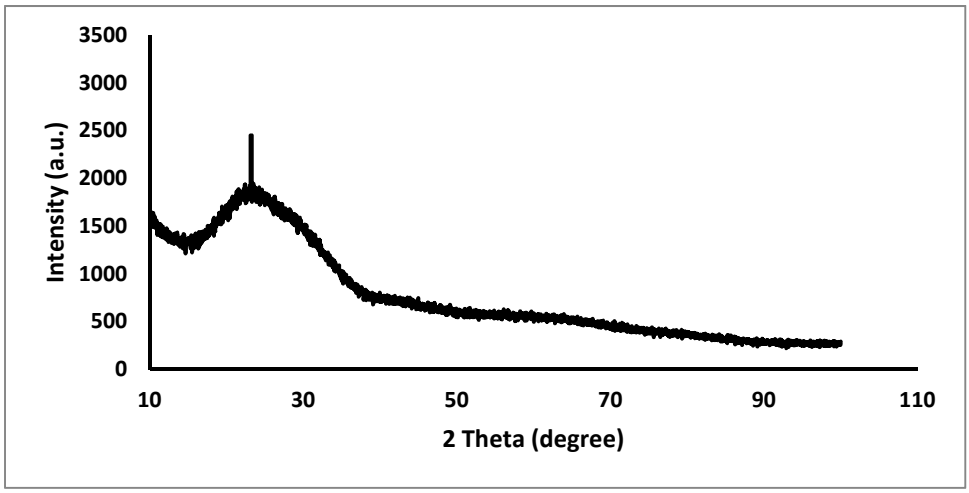


Fig. 3. XRD patterns for ZnS thin films annealed at 673K

3.2 STRUCTURAL PARAMETERS

Table 1.0 display the lattice parameters for three samples namely: - as deposited, annealed at 573K and annealed at 673K all grown at substrate temperature of 373K. It is observed from the table that for all the films the grain size D increases with increases in annealing temperature. In other words, sample annealed at 673K has the largest grain size, and hence should exhibit the most crystallinity. This is due to the small grains coalesced together to produce larger grains. It can also be seen in Table 1 that, the dislocation density **δ** and micro strain **ε** values decreases exponentially with increase in annealing temperature. This is because when films are annealed they become less strained. Our calculated values of dislocation density δ and micro strain **ε** are close to those reported by [3], [12] and [13]. In the same manner it should be observed from table 1.0 that FWHM decrease as annealing temperature increase; implying that as annealing temperature increase thin films becomes more crystalline. The value of the FWHM is inversely proportional to the grain size. That is, a narrower FWHM and a larger grain size imply better crystal quality. It is clear from the table that the lattice constant **a** decreases with the increase in annealing temperatures, this occurs because the strain decrement in the films treated at different annealing temperature as well as dislocation density values are found to decrease with increase in annealing temperatures. These values of lattice constant agree with those reported by [14].

Table 1. Calculated structural parameters of ZnS thin films deposited at 573K and annealed at different temperatures.

Sample thickness (nm)	Annealing temperature (K)	Grain size D (nm)	Micro strain Ɛ $x10^{-3}$	Dislocation density (δ) $x10^{14}$lines/m^2	Lattice Constant 'a' (nm)	FWHM B (degrees)
100	As deposited	35.68	94.80	7.85	5.40	0.412
100	Annealed at 573K	41.79	80.90	5.72	5.39	0.352
100	Annealed at 673K	44.30	76.40	5.09	5.38	0.332

4 CONCLUSION

Single crystalline ZnS films were deposited on Soda lime glass substrates by Spray Pyrolisis method. The structure of the films deposited at 573K substrate temperature and annealed at different temperatures under nitrogen environment was investigated by X-ray diffraction XRD. From the experimental results, it is clear that, the films grown at these temperatures exhibited polycrystalline structure. However the crystallinity is apparently improved as annealing temperatures increases. The grain sizes increase with increase in annealing temperatures while dislocation density, micro-strain, lattice constant and FWHM decrease with increase in annealing temperature.

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The influence of clients' perceived quality on health care utilization

Mavis Aggrey[1] and Seth Christopher Yaw Appiah[2]

[1]School of Medical Sciences, Department of Community Health,
Kwame Nkrumah University of Science and Technology
Kumasi, Ghana

[2]Department of Sociology and Social Work, Faculty of Art and Social Sciences,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

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ABSTRACT: *Introduction:* The patient's perception of quality of care is fundamental to utilization of health services. Health utilization would partly depend on clients' perception of the quality of care.
Methods: A cross-sectional study involving health clients (18 to 70 years) who accessed health services in the Bantama sub-metro in the Kumasi metropolis was conducted. A total of 400 clients were recruited from ten health facilities for the study. Data was collected through interviewing using semi-structured questionnaires using SPSS and analyzed into descriptive and inferential statistics with STATA 11.
Results: Majority of subscribers assessed healthcare with their National Health Insurance (NHI) cards. Eight percent (8%) had never accessed healthcare with their NHIS cards. Respondents' reasons included not falling sick and low quality of healthcare under the NHIS. Respondents 216 (54%) indicated delays in seeing a doctor, getting laboratories done, and accessing health care as a whole. Seventy-four percent (74%) of the entire population attributed both NHIS and cash and carry systems as the payment methods associated with delays in health facilities. Clients who viewed the overall the quality of health provision as good or very good were more likely to access healthcare with NHIS card as compared to those who rated the overall health provision as poor or very poor (OR=2.1; $p<0.01$).
Conclusion: Clients' perceptions and experiences with quality of health provision influence their utilization of healthcare under the NHIS scheme. Increased enrolment in the scheme should be supported with provision of quality services to enhance clients' satisfaction.

KEYWORDS: Ghana, Health Insurance, Perception, Satisfaction, Health, Utilization, Quality, Care.

INTRODUCTION

Access to health care remains limited in developing and least developed countries due to socio-cultural and financial barriers. It has been documented that[1,2] out-of-pocket expenditures (User fees) often deny people from seeking early health care. This phenomenon sometimes leads to a situation where tremendous financial burden comes upon the entire country through higher spending on complicated illnesses. Palmer et al.,(2004)[3] argue that user charges constitute a strong barrier to the utilization of health care services, as well as preventing adherence to long term treatment among poor and vulnerable groups.

As a response to replace the user fees approach to health care services and delivery , all member States of WHO adopted a resolution aimed at encouraging countries to develop health financing systems with the objective of providing universal coverage[4]. In 2004, an endorsement of this recommendation by the World Health Report by WHO endorsed the pursuit of universal coverage, defined as ensuring that population access to needed health services are without the risk of financial catastrophe or impoverishment associated with obtaining care.

Corresponding Author: Seth Christopher Yaw Appiah

In Ghana, the government adopted the National Health Insurance Scheme (NHIS) in 2003, which was fully implemented in 2005. The aim of the NHIS was to ensure equitable and universal access for all residents of Ghana to an acceptable quality package of essential health care services without out-of-pocket payment being required at the point of use[5]. Client's perception of the quality of health care under the national health insurance and their utilization of health services in the country are thus related[6]

METHODS

Data and Sample

The study adopted the cross sectional design as well as the mixed sampling technique. The study was conducted amongst health clients (400) who accessed health care services in ten health facilities in the Bantama sub-metro in the Kumasi metropolis of Ghana. A mixed sampling technique was used. The main tools or instruments used for data collection were questionnaire and interview guide.

Sample Characteristics

The sample considered in the study is made up of clients who are 18-70 years. Those below 18 and above 70 were excluded because they fall within the exemption category of the NHIS. The sample size considered was influenced by the average monthly number (10%) of patients seen at each selected facilities. At the facility, a systematic random sampling was used in selecting the clients from the list of clients. The Confidence Interval was taken as ±1.96 at 95% Confidence Level.

Measures

The dependent variable in the study is "the utilization of health care services" and the independent variables were "perceived quality (waiting time, satisfaction, staff attitudes and medication (drugs) given)".

Statistical Analysis

The study results were analyzed in both qualitative and quantitative terms. Data was collected from both primary and secondary sources. Tables, graphs and charts were used to ascribe quantitative value to qualitative data to make them amenable to statistical analysis. The responses and findings were converted to percentage scores to serve as units of measurement of results and findings of the study. The greater the percentage of responses and findings the more it was accepted as the opinion pool of the respondents (clients). The Statistical Package for the Social Sciences (SPSS) version 19 was used to analyze data gathered from respondents into descriptive and inferential statistics together with STATA 11. Percentages were used to analyze categorical data. For continuous data, the mean and the standard deviation were determined for normally distributed and median and the range for those that are not normally distributed determined. T-test was used to compare two continuous variables whiles Chi-test used to compare two categorical data.

RESULTS

The results of the study are indicated in tables and figures with their meanings elaborated below each of them.

Table 1.1: Time Spent in accessing Health Care under the NHIS

Averagely how long do you spend on a particular day at the hospital under NHIA? (n=393)	**Frequency**	**%**
– < 1hr	34	8.7
– 1hr – 2hrs	87	22.1
– 2hrs – 3 hrs	114	29.0
– >3hrs	158	40.2

Source: Field data, 2013

From table 1.1; one could picture that majority of the respondents (40.2%) are of the view that on the average, they spend more than three hours when they visit health facilities per day. Only 8.7% of the clients spent less than an hour at the health facility averagely. Those who spent between 1-2 hours and 2-3 hours on their visit to health facility for a particular day are 22.1% and 29.0% correspondingly. The in-depth-interview from the study also revealed that the delay (time wasted) in health facilities might be due to insufficient workers, increased workload, conversation among health staffs and long queues,

insufficient doctors, increased workload of doctors and long queues. Majority of the participants in the in-depth interview disclosed that they do not get their laboratory results easily done. One participant disclosed;

> ***'There is always a long queue here and you have to wait long before you are attended to'. There sometimes some people refuse to do the lab here. I think something must be done about it because it is frustrating'.***

Notwithstanding, the respondents opined that the non-insured spend much longer time at the facility because they have to go through a lot of procedures. Despite the time wasted, they expressed that they prefer NHIS to "cash and carry" with regards to time spent at the health facility. A participant explained;

> ***'I prefer the NHIS to the cash and carry because with the NHIS you only need your card and you will be attended to at the health facility and it doesn't involve many procedures so I spend less time'.***

Table 1.2: Level of Satisfaction with health provision

Overall satisfaction of health care (n=397)	Frequency	%
– Very poor	2	0.5
– poor	8	2.0
– Average	81	20.4
– Good	202	50.9
– excellent	104	26.2

Source: Field data, 2013

From table 1.2; it could be attested that majority of the respondents (50.9%) are of the judgment that their level of satisfaction of health care is good with 26.2% going the extra mile to express their satisfaction as excellent. However, 0.5%, 2.0% and 20.4% expressed their levels of satisfaction to health care as very poor, poor and average in orderly manner.

Table 1.3 Perception about medicines given under NHIS

Variable	Frequency	Percent (%)
Get easy access to drugs under the NHIA? (n=397)		
– Yes	335	84.4
– No	62	15.6
Get all the drugs prescribed by the doctor to be provided under the scheme? (n=395)		
– Yes	251	63.5
– No	144	36.5
How much money do you spend in obtaining drugs under NHIS? (n=334)		
– No money is spent	24	7.19
– <10GHS	19	5.69
– 10GHS-19.9GHS	76	22.75
– 20GHS-50GHS	139	41.62
– >50GHS	76	22.75
You prefer buying your own drugs outside of the scheme? (n=392)		
– Yes	181	46.2
– No	211	53.8
How you your rate of recovery with the drugs given under NHIS? (n=395)		
– Fast	240	60.8
– Slow	100	25.3
– Pro-long	43	10.9
– None	12	3.0
Suggested to by a health care provider to buy another brand of drug other than the one prescribed under NHIS? (n=395)		
– Yes	191	48.4
– No	204	51.4
Perception of the quality drugs given you under NHIS? (n=384)		
– Same	264	68.8
– Different	120	31.2

Source: Field data, 2013

Table 1.3 presents a summary of the respondent's perception about medicines given under NHIS. Almost 85% of the respondents gain easy access to drugs under NHIA while about 36.5% of the respondents fail to get all drugs prescribed physicians under the scheme. Most of the respondents indicated that, they spend between 20 and 50 GHC in obtaining drugs under the scheme while about 54% of the respondents claimed that they do not buy drugs outside the scheme. However, most of the respondents indicated that, the drugs prescribed to them are effective whereas about 15% of them reported that the drugs are very effective. Only, 8% of the respondents indicated that, the drugs prescribed to them are not effective.

Even though, about 10.9% of the respondents indicated that, their rate of recovery with drugs under NHIS is prolonged, majority (60.8%) of the respondents opined that their rate of recovery is rather faster with drugs under the scheme. Overall, Majority (68.8%) of the respondents indicated that, their perception about quality of drugs given under the scheme and those outside the scheme are same.

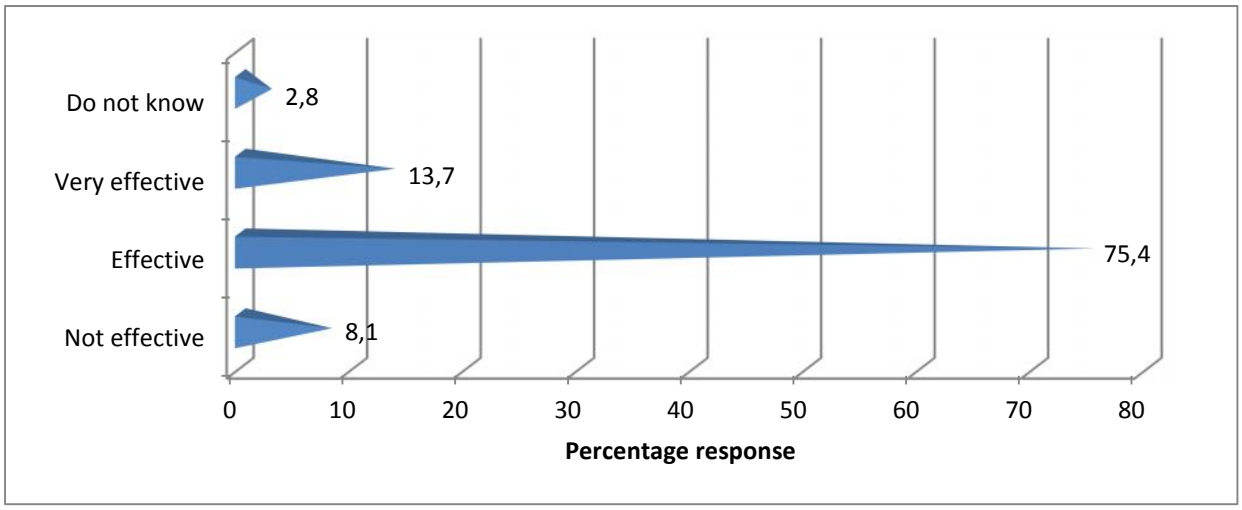


Figure 1.1: Rate of effectiveness of drugs administered under NHIS

Source: Field data, 2013

About 80% of the clients in the qualitative study further disclosed that they face problems when they have to collect their medicines from the pharmacy or dispensary. The participants indicated that they spend so much time as a result of unprofessionalism on some part of the dispensers. Others disclosed that there are drug shortages sometimes and this causes delay. Some participants further disclosed that they are not given all prescribed drugs at the dispensary and this they attributed to the fact that, the NHIS does not cover all drugs and some drugs are sometimes not available at the health facility so they have to buy from a private pharmacy. However, for the effectiveness of the drugs; majority (75.4%) accept that the drugs prescribed to them are effective with 13.7% of the clients going the extreme ends to express much more satisfaction that the drugs are very effective when used. Notwithstanding, 8.1% of the respondents are at the other side of the coin. Left to them alone, one could say, the drugs rendered to them are ineffective. Also, 2.8% of the clients expressed their views in a dilemma manner not knowing whether the drugs are very effective, effective or ineffective.

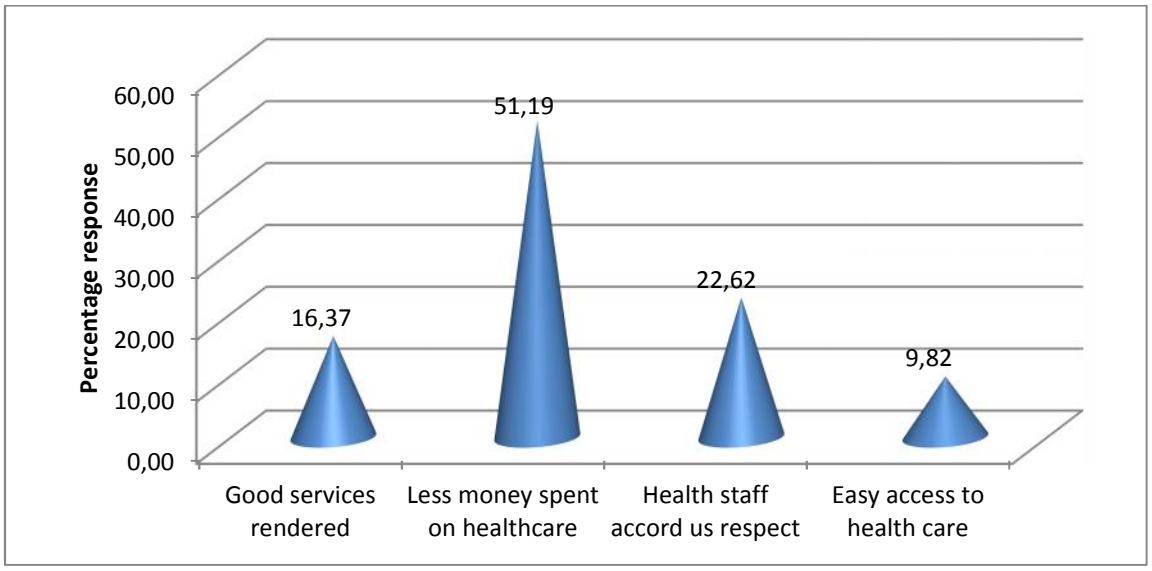


Figure 1.2: Reasons for commending NHIS to a friend

Source: Field data, 2013

Figure 1.2 indicates clearly the reason why a client would commend the scheme to a friend. It was identified that the over-arching reason (51.19%) for clients commending the scheme to a friend will be that, the NHIS is cost friendly (affordable). The next scale of order for commending the scheme to a friend is the respect accorded to them by health staff (22.62%); followed by the good services rendered to them (16.37%) and finally the ease of accessing health care under the scheme (9.82%).

DISCUSSION

Patient's perception of quality of care is fundamental to utilization of health services. Although the NHIS was meant to improve utilization of health services, health utilization would partly depend on clients' perception of the quality of care. According to Donabedian[6], patients' perception is significant as it impacts their health-seeking behaviour, including utilization of services and provides relevant information to the policy makers to improve the quality of health care services. Utilization of health services is influenced by many factors; but the study establishes a causal-relationship between utilization of health services (dependent variable) and clients' waiting time, satisfaction, staff attitudes and medication granted (independent variables). The researcher eliminated all competing explanatory factors that can affect utilization such as socio-economic conditions, education levels and other essential influences.

In this study, majority of the clients express long delay in accessing health services under the scheme. This goes contrary to Turkson[7] finding that majority of patients (83.4%) found the waiting time at health facilities in Komenda-Edina-Eguafo-Abrem (KEEA) District reasonable. Again, in this study, it was unveiled that those who are non-subscribers to the scheme spent much longer time than the insured due to the comparatively long procedures they have to go through to access health care services; thus, contradicting the studies brought forth by several studies [8,9,10] which reported that persons uninsured receive medical attention or treatment promptly at the health facilities as compared to the insured.

Taking the perception about the attitude of staff, most clients rated the general attitude of staffs as good and more than 80% would recommend NHIS to friends and colleagues citing "spent less on healthcare" as major reason. This is consistent with the study of Alatinga and Williams[8] who reported that there is no disparity among the insured and uninsured in terms of assessing health providers on their attitude. Their study also indicated that majority of respondents disclosed that the attitude put up by the health providers towards patient was commendable and appreciative.

For client satisfaction about health care services, this study expressed satisfaction with service provision with respect to the examination by a doctor or medical assistant, being informed about their illness, being told to return or not to the facility and having privacy during consultations. Again, majority of the respondents believed that speed of service, skill of service providers, respect for clients' views, handling of clients' complaints was good or excellent. Results from this study was similar to other studies which concluded that quality of health care given to clients was generally satisfactorily among both insured and non-insured[9,11].In a contrary finding[8,12,13] however insured clients had a significantly higher frequency of physical examination, laboratory investigations and diabetes education compared to their uninsured. Recognizing the importance of patients' satisfaction on health utilization, Almujali et al [14] opined that patient satisfaction represents a key marker for the quality of health care delivery and this internationally accepted factor needs to be studied repeatedly for smooth functioning of the health care systems. This will offer a better appreciation of the factors pertaining to client satisfaction.

Provision of essential drugs is part of the basic health care services as benefit package of the NHIS. Others include outpatient consultations, inpatient care and shared accommodation, maternity care (normal and caesarean delivery), eye care, dental care, and emergency care. This study looked at client's satisfaction and perceptions about drugs given to them at the health facility. More than 80% of the respondents gain easy access to drugs under NHIA and about 64% also disclosed that they get all drugs prescribed by the doctor to be provided under the scheme. Majority of clients rated their recovery with drugs given under NHIS as fast and clients believe that quality of drugs under NHIS was same as previous payment system. About a quarter of the total clients however believe recovery with drugs under NHIS was slow. This could be as a result of purchase of inferior drugs by some health providers. The scheme should therefore set up monitoring systems to ensure that providers offer to clients the best of services including drug provision.

CONCLUSION

The study has brought to the fore and adds to the surging studies about NHIS client satisfaction with health care accessed. The study presents that there are still delays in accessing health care which was attributed to multiple service factors. Client perception has been shown to positively relate to health service utilization. The study revealed that NHIS client with positive evaluation about the scheme and its service provision was twice likely to influence continual access to health care with the NHIS; a factor that predicts renewal of membership as against a negative perception about service quality. The

study therefore calls for stakeholders to work on how the media could be used in communicating the positive successes that the NHIS is chalking as against the constant negative media and political colourations that is attached to the scheme. A good public image through the media coupled with client experience of personal benefit with the scheme, will motivate renewal of membership to sustain the scheme

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Impact of Counseling in Pregnancy in Lower Socio-Economic Group at Tertiary Care Hospital

Zainab Manzoor Memon[1], Muneer Ahmed Sheikh[2], Binafsha Manzoor Syed[1], Rahil Sikandar[3], Bikha Ram Devrajani[1], and Ali Raza Memon[4]

[1]Medical Research Centre,
Liaquat University of Medical & Health Sciences,
Jamshoro, Sindh, Pakistan

[2]PMRC, Medical Research Centre,
Liaquat University of Medical & Health Sciences,
Jamshoro, Sindh, Pakistan

[3]Gynae Unit 4,
Liaquat University Hospital,
Jamshoro, Sindh, Pakistan

[4]Department of Biochemistry,
Liaquat University of Medical & Health Sciences,
Jamshoro, Sindh, Pakistan

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ABSTRACT: Pregnant women in developing countries face plenty of challenges with a very high morbidity and mortality due to lack of primary health care settings, health professional resource and basic infrastructure. Moreover, they are not adequately counseled for their nutritional requirements and appropriate weight gain. Situation gets even more complicated with huge illiteracy, lower socioeconomic status, lack of antenatal check by a trained or even skilled health professionals leading to high morbidity both for the mother and for their baby. In this study, we investigated 163 pregnant women of lower socioeconomic class in a tertiary care hospital from September 2013 to January, 2014. After taking informed consent, they were interviewed for basic socio-demographic features, their daily dietary intake and a plenty of medical history with body measurements, e.g. weight, height, pulse, blood pressure etc. The status of counseling was studied, whether or not provided with regards to ideal weight gain, dietary advice, balanced diet, iron supplementation, which foods to take more or what to avoid, particularly the time taken for antenatal examination and physical examination and we found that 39.3 % females were overweight . We conclude that counseling is a critical component of the management of women during pregnancy. In this study, we found that, it is not being carried adequately. The healthy and safe outcome of the pregnancy is highly dependent on the nutrition of the mother. The service of a dietitian or nutritionist may be made mandatory in the care of pregnant women.

KEYWORDS: Pregnancy, BMI, lower socioeconomic status, counseling, Pakistan.

1 INTRODUCTION

Being obese or overweight is the outcome of an improper energy balance, lead to store of more energy as fat and extra calorie intake can be fatal if not treated.Appropriate weight gain during pregnancy is critical. In pregnancy body mass index is

Corresponding Author: Zainab Manzoor Memon

a crucial healthy component for the health of the mother and her baby. Pregnancy with higher body mass index is a major public health worry leading to mortality and morbidity [1].

High prevalence of obesity affecting the women of child bearing potential is a fast growing public health concern. Pregnancy with additional weight gain is highly risky resulting in many obstacles and long term adverse consequences like infertility, recurrent miscarriage, gestational diabetes, hypertension, thromboembolism, pre-eclampsia, adverse neonatal complications, stillbirth, congenital anomalies, intrauterine fetal death, neonatal intensive care admission, higher incidence of caesarean deliveries, perinatal mortality and neonatal death [2], [3], [4].

Body Mass Index (BMI) between 25 and 30 kg/m^2 considered as overweight, greater than or equal to 30 kg/m^2 defined as obesity and greater or equal to 40 kg/m^2 known as extreme obesity [5]. Obesity has become a dominant challenge worldwide and fifth important hazard for universal deaths [6]. In Pakistan poor socio economic grade inhibits the females to participate in health development, leading to mortality and morbidity [7]. One in every 23 woman, die due to maternal complications in Pakistan while in industrialized nations the rate is 1 in 5,000 [8].

Overweight and obese mothers have more possibilities of cesarean deliveries, anesthetic complications, postoperative difficulties, puerperal infection and decreased rates of breastfeeding [9]. As vitamins and minerals play a vital part and fundamental for the development of fetus maternal malnourishment sustain adverse effects on the health of mothers and their children.

Anemia, lower rate of lactation, children developmental delay and impaired fetal growth are the opposing outcomes of perinatal malnutrition in pregnancy. Habit of tobacco, physical inactivity and poor nutrition diverse the normal mechanism of body [10]. Malnourish mothers are at increased risk of complications hence a healthy diet is necessary for successful pregnancy outcomes.

2 MATERIAL AND METHODS

This is a hospital based study, conducted at Tertiary Care Hospital Liaquat University of Medical and Health Sciences, Jamshoro from September 2013 to January 2014. Antenatal out patient department (OPD) were visited two days in a week with permission of head of department. Information was obtained from the pregnant women by pre-designed semi-structured questionnaire. Pregnant women attending the antenatal OPD were interviewed after taking informed consent.

Data was collected from pregnant females of all trimester. Socio-demographic facts were recorded through face to face interview. Body mass index of each subject wascalculated using the formula: BMI = Weight in (Kg)/ Height in (meters) ^{2}.

Weight of each pregnant women was measured in standing position using weight measuring machine (Model: TANITA JAPAN 1369R). Height was measured in standing position without shoes using steel tape (STEEL TAPE GW-F213). From heel to head-crown height was measured in feet/inches and was converted into meter square. Blood pressure was also taken of each subject in sitting position using blood pressure monitor (Model: Aneroid BP-005) by a single investigator.

The questionnaires covered socio-demographic characteristics of the pregnant women, age, residence, occupation, race, medical history, education, house type, family size, monthly income of spouse, maternal problems and complications, no. of antenatal visit, weight measured in each visit, counseling on target weight gain, counseling on balanced diet, history of addiction and history of vaccination.

Statistical Package for Social Sciences (SPSS version 16.0, Chicago, Illinois USA) was used for statistical analysis of the data.

3 RESULTS

Their mean age was 28.51±6.11 years. The systolic, diastolic blood pressure was 105.80±14.226/73.35±12.06 mmHg and the mean gestational age was 7.953±3.3908. Mean regular antennal visit was 3.93 ± 2.089. Of the overall pregnant women 6% was smoker, 18% females addict to chaliya, 6% naswar, 12% manipuri and 2% females addict to multanimitti while 56% females had no history of addiction. However 23% women were vaccinated to one time, 62% vaccinated to two times and 15% females had no vaccination to TT vaccine. The 63% females replayed that they were not counseled regarding gestational weight gain and balanced diet while 37% females were counseled during pregnancy. There was 25% still birth, 21% abortions and 10% had history of pre-eclampsia. The demographic variables are shown in table.

Table1: Socio-demographic characteristics of pregnant women

	Frequency	Percentage
Residence		
Hyderabad	28	17.2
Jamshoro	84	51.5
Kotri	38	23.3
Others	13	8.0
Total	163	100.0
Occupation		
House Wives	135	82.8
Working Women	28	17.2
Total	163	100.0
Education		
Illiterate	96	58.9
Primary	47	28.8
Secondary	13	8.0
Intermediate	7	4.3
Total	163	100.0
House Type		
Pakka House	91	55.8
Kaccha House	72	44.2
Total	163	100.0
Monthly Income		
1000-10,000	90	55.2
11,000-20,000	20	12.3
21,000-30,000	2	1.2
Don’t know	16	9.8
Job less	35	21.5
Total	163	100.0

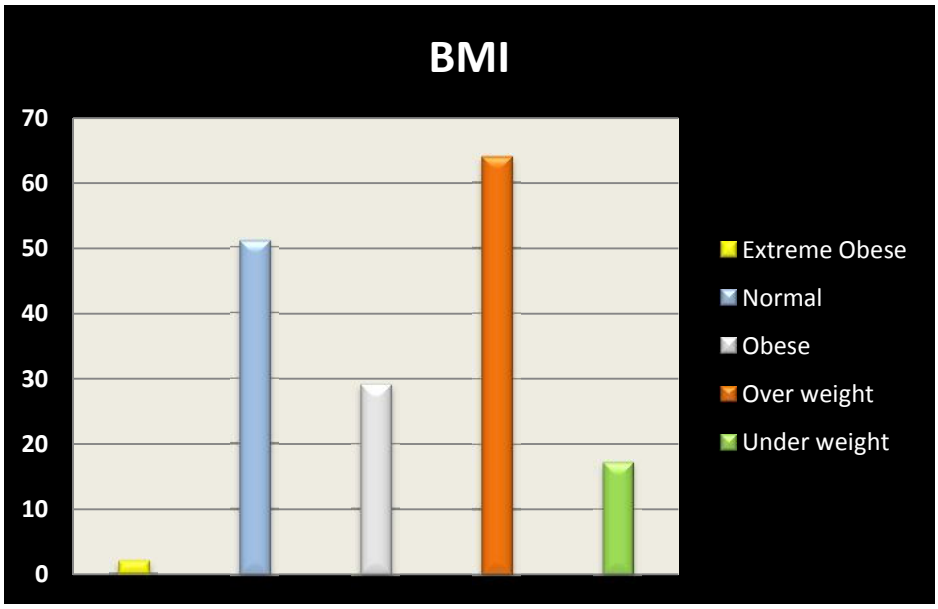


Fig.1. BMI of Pregnant Females

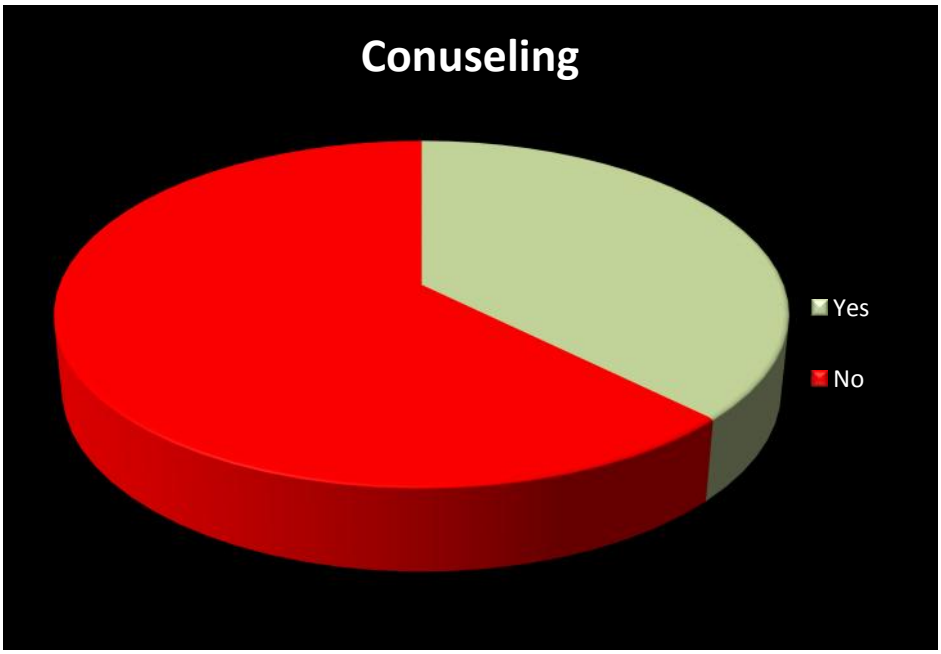


Fig. 2. Counseling on Target Weight Gain and Balanced Diet

4 DISCUSSIONS

Counseling during pregnancy is very much essential for the safe and successful outcome of pregnancy. Particularly in developing countries like Pakistan it is highly required, especially in public sector hospitals. In this study a great number of 62.6% women were not counseled about their diet and ideal weight gain in pregnancy.

We found positive and linear relationship between socioeconomic status and diet. Diet quality is affected by occupation, education, and income levels along with age and sex. Our assumptions prior to beginning the study was that since these women are from poor socioeconomic class, so would be rather underweight than being overweight. We found overweight pregnant females were 39% and obese were 29%. But this also has been reported in another study which is due to that being poor and uneducated they are least aware of the type of food important for them, hence taking only the cheapest

carbohydrates, refined grains, added sugars, lacking proteins, deficient vitamins, lower micronutrients and added fats to be energy rich but are nutrient poor which eventually expose them towards obesity [11], [12].

Vaccination in pregnancy is an important for both mother and neonatal. Antenatal TT vaccination is crucial to prevent from tetanus and provide immunization to pregnant mother and newborn against infectious diseases [13].

We found that 23% pregnant females were vaccinated to TT one times, 62% women vaccinated to two times while 15% females were not get vaccination during pregnancy.

Rubina et al. reported that lower socioeconomic groups have lack of education and nutritional knowledge than higher socioeconomic class which leads to poor health, obesity, diabetes and cardiovascular diseases [14].

In this study we found 82.8 % women were house wives and 17.2 % were working women and belong to lower socioeconomic class. Therefore they were dependent on their spouses, who were jobless or had low monthly income. Hence their eating behavior and antenatal checkup were fully dependent on their family members.

Diet cost is the barrier of consumption of healthy and energetic foods. One study conducted in America stated that food prices and income are correlated with selection and eating of healthy nutrition, dietary habits and diet quality [15]. Recommended daily dose for all pregnant women with a supplementation of 60 mg of iron and 400 g of folate is recommended to control iron deficiency anemia by World Health Organization.

One of the studies conducted in Iran was conclude that illiteracy is associated with higher BMI [16]. In this study we found 58.9% pregnant women was uneducated, 28.8% were primary passed, 8.0% were secondary and only 4.3% was intermediate. Fifty six (55.8%) women were lived in kaccha homes while 44.2% were lived in pakka homes with mean family size 10.45±6.6.

As antenatal checkup is the key for pregnant women to maintain the safe motherhood throughout pregnancy. The outcomes of obesity or overweight in pregnancy are macrosomia, cesarean deliveries and the incidence of preeclampsia. To overcome these complications it is necessary to restrict the excessive weight gain. The modern recommendation for the ideal weight gain in pregnancy is to note the patient's BMI before conception. One study highlighted that the recommended weight for overweight mothers should gain 0.9kg in the first trimester and no need of weight gain for obese pregnant women in first trimester [17]. Likewise overweight pregnant women should gain 0.3kg per week in second trimester while obese should gain their weight up to 0.2kg/week respectively. BMI must be checked at 1st antenatal checkup and should be monitored throughout pregnancy.

Maternal tobacco consumption during pregnancy is highly risky for the newborn. It increases the chances of morbidity and mortality in the neonatal period and associated with negative outcomes like mental and developmental health problems. One of the study highlighted that women of lower socio-economic class are more involved in smoking or smoke less habits [18]. In our study we also found 12% females were addicted to manpuri, 6% addicted to naswar, 6% were smoker, 18% were addicted to chaliya and 2% were addicted multanimitti, while 56% pregnant females had no habit of addiction.

5 CONCLUSIONS

Adequate counseling not carried out at tertiary care center. It must be an essential part of routine antenatal check for safe and healthy baby.

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STUDY ON DRYING OF FERMENTATED COCOA BEANS (Theobroma cacao)

A.S. Ajala and K.O. Ojewande

Department of Food Science and Engineering,
Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Nigeria

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ABSTRACT: In this study, cocoa beans were subjected to hot air drying in a tunnel dryer at 50, 55, 60, 65, 70, 75, 80 and 85^{o}C. The proximate, chemical and physical attributes of the samples were investigated. The results show that higher temperature of drying conferred higher drying rate on the samples; proximate, chemical and physical analyses were inversely related in most cases. The drying process employed would help in the preservation of the nutrients of the cocoa products.

KEYWORDS: cocoa beans, temperature, fermentation, quality and health benefits.

1 INTRODUCTION

Cocoa (*Theobroma cacao*) originated from Amazonian region of Brazil and is grown in tropical countries like Nigeria, Ghana, Ivory Coast, Brazil, Malaysia, Venezuela and Indonesia (Beckett, 1994). World production cocoa beans were about 3, 888, 000 tonnes in 2006/2007 crop year and nearly 40% of this quantity was produced in Cote d'ivoire (World Cocoa Foundation, 2008). Cocoa is one of the major cash crops through which agriculture contribution to Nigeria economy, the contributions of cocoa to the nation's economic development are vast (Folayan et al., 2006). Cocoa trees grow in a limited geographical zone, of approximately 20 degrees to the north and south of equator (Buijsse et al., 2006). It was introduced into Nigeria in 1874 through Equatorial Guinea by the Portuguese traders and has been grown extensively in the South-Western part of the country (Opeke, 1987). Cocoa beans is mainly consumed as chocolates and widely used in beverages, cosmetics, pharmaceuticals and toiletry products (Porter, 2006, Taubert *et al*., 2007).

The processing of cocoa beans consist of two major steps namely fermentation and drying (Hill et al, 2009). Different methods of fermentation and drying are followed in the cocoa growing countries (Wood and Lass, 1985). The beans and associated pulp are removed from the pod and subjected to microbial fermentation which is generally conducted as traditional, indigenous processes and constitute the first stage in preparation for chocolates production (Ardhana and Fleet, 2003). Fermented cocoa beans present generally moisture content between 55% and 60%. After fermentation, the beans are dried immediately to avoid over fermentation, which could lead to product deterioration.

In Nigeria, methods of drying the beans are usually by sun drying which is simple and cheap: not requiring the expensive mechanical devices used in the artificial dryers but it is also labour-intensive and there is much concern for hygienic condition of the product. Artificial, hot air drying of fermented cocoa beans has been reported in literatures, and mostly concentrated on the removal of moisture from the beans at the shortest possible time (Nganhau et al., 2003) but the effect of drying temperature on the overall nutritional contents has been given the little attention as far as literature is concerned. Therefore, the objective of this study is to investigate the effect of drying temperatures on the quality attributes of coco beans.

Corresponding Author: A.S. Ajala

2 MATERIALS AND METHOD

2.1 MATERIALS

The material used was cocoa beans, basket, wooden mallet, banana leaves and tray. These materials were obtained from a local market in Ifetedo, Osun state.

2.2 DRYING OF COCOA BEANS IN A TUNNEL DRYER AT DIFFERENT TEMPERATURES

Fresh cocoa beans pods were bought from cocoa farmers on the farm in Ifetedo, Osun State, Nigeria. These pods were opened with a stainless knife and the wet beans were removed from the pods. Basket method fermentation was used, the insides of the basket were covered with banana leaves but the bottom was remained uncovered to let the sweating drain away. The beans were turned on each day for four days to allow proper fermentation of the beans. The fermented beans were spread on a tray and dried inside the tunnel dryer at 50, 55, 60, 65, 70, 75, 80 and 85ºC.

2.3 STATISTICAL ANALYSIS

The (2009) SPSS 15.0 version, a software package was used for statistical analysis. Analysis of variance (ANOVA) was carried out on the data obtained from the physical and chemical analysis of the samples. Duncan test was used to separate the means.

2.4 ANALYSES DETERMINATION

2.4.1 PROXIMATE ANALYSIS DETERMINATION

Fibre, carbohydrate, fat, protein, ash and moisture content were determined using AOAC (2000) method.

2.4.2 CHEMICAL AND PHYSICAL DETERMINATION

Bulk density and pH were determined using AOAC (2000) method.

3 RESULTS AND DISCUSSION

3.1 DRYING RATE PATTERN OF THE COCOA BEANS

The drying rate of the samples is as shown in Figure 1. It is observed from the figure that the drying rate form a falling rate pattern in which the slope of each of the curves descended and flatten off at the end using different times. As reported by Ajala *et al.* (2013), that one of the key factors that affects the rate of drying rate is drying temperature. The greater the temperature difference between the drying air and the food, the greater the heat transfer to the food. It is observed that drying rate pattern takes shorter time at 85^{o}C than other temperatures because drying kinetics depends largely on temperature in food materials as reported by Ajala et al., (2012) and Hii *et al.,* (2009). Higher temperature of drying resulted in a higher driving force for moisture removal which shortened the overall drying time. According to Hii *et al.,* (2009), too high drying rate was not recommended for cocoa drying as this will retain most of the acids inside the beans and caused excessive acidity in the finished powder. Excessive acidity will cause improper flavour developments and the sour note cannot be removed especially when the samples are used for chocolate process. (McDonald etal., 1981; Jinap *et al*., 1994)

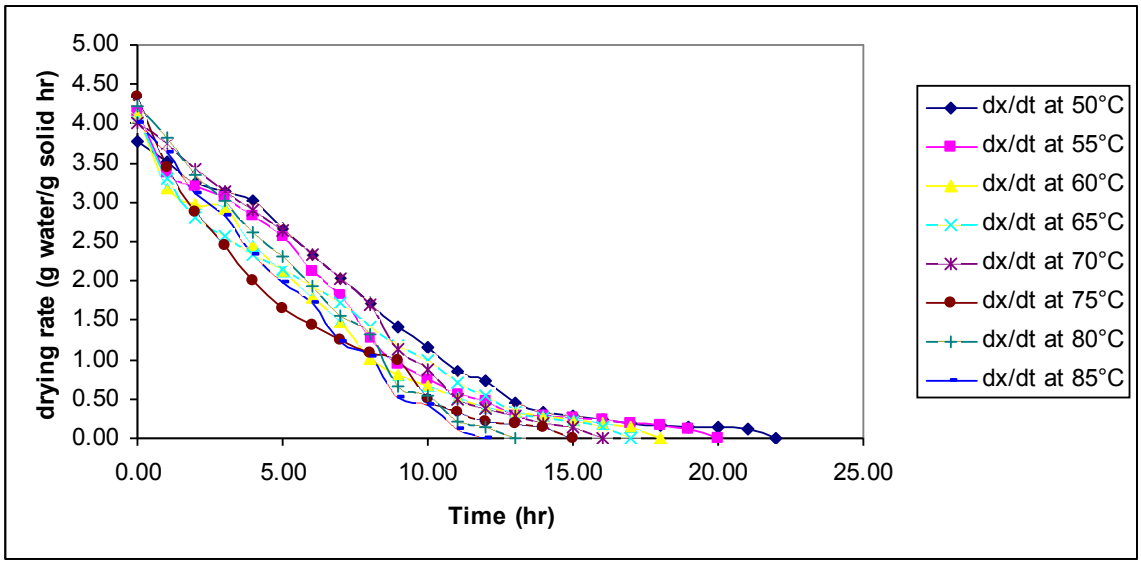


Figure 1 showing drying rate against time during the drying operation of cocoa beans

3.2 RESULTS OF THE PROXIMATE ANALYSES OF THE COCOA SAMPLES

Table 1 shows the values of protein content of the cocoa beans, the values range from 6.11 to 9.25 %. The values show a level of significant difference among the samples (p<0. 05). The protein values in this work are comparable with the values reported by Ndife *et al.* (2013). The protein content decreased as the drying temperature increased. This is similar to the observation of other researchers such as by Sefa – Dedeh and Kofi-Agyir, (2002). The protein content of cocoa is health improving as it helps in the functioning of liver and kidney, alanine aminotransferase, aspartate aminotransferase of cocoa helps to detect and monitor cardiac disease (Abrokwah *et al.,* 2009).

Fibre content results show that the values range from 1.075 to 2.19 % and the values are significantly different from one another. These values are close agreement with the value of 1. 80% reported by Ndife *et al.,* (2013). Furthermore, Ndife *et al.,* (2013) had earlier reported that fibre content decreased with increase in fermentation time, the values reported in this study has shown that as drying temperature increased, the values fibre content increased. Physicians and scholars alike have touted the health benefits of fiber, including a lowered risk of diabetes and heart disease. Example of one of such scholars is Finley (2014) who also noted that combining the fiber in cocoa with prebiotics is likely to improve a person's overall health and help convert polyphenolics in the stomach into anti-inflammatory compounds that are good for the heart.

Table 1: Proximate composition of cocoa beans

Sample	Protein (%)	Fibre(%)	Ash(%)	Moisture(%)	Fat(%)	CHO(%)
A	9.250±0.014h	1.075±0.007a	6.305±0.02h	7.005±0.007h	12.015±0.021h	67.24±0.000a
B	8.905±0.007g	1.265±0.007b	6.125±0.007g	6.685±0.007g	11.935±0.007g	67.330±0.014a
C	8.345±0.007f	1.325±0.007c	6.005±0.007f	6.275±0.007f	11.605±0.007f	67.58±0.007a
D	8.205±0.007e	1.395±0.007d	5.785±0.007e	5.925±0.007e	11.345±0.007e	67.84±0.04a
E	7.855±0.007d	1.755±0.007e	5.675±0.021d	5.685±0.007d	10.965±0.06d	67.98±0.02a
F	7.00±0.007c	2.032±0.007f	5.565±0.021c	5.350±0.014c	10.560±0.000c	67.98±0.02a
G	6.695±0.007b	2.105±0.007g	5.470±0.014b	5.165±0.021b	10.345±0.007b	67.92±0.042a
H	6.110±0.014a	2.190±0.024h	5.315±0.007a	4.965±0.066a	10.115±0.007a	73.00±7.07a

**values with the same subscript are not significantly different but values with different subscript are significantly different.*
**sample code: A=5OºC, B=55ºC, C=60ºC, D=65ºC, E=70ºC, F=75ºC, G=80ºC, H=85ºC*

The ash contents vary from 5.315 to 6. 305% and the samples are significantly from one another. The values reported in this work are greater than those reported by Ndifel *et al*. (2013) but closer with the values reported by Fanny *et al.,* (2000). The values show an inverse relationship with the drying temperatures because as the drying temperature increased, the ash content decrease. This observation was earlier reported by Blanco et al. (2004) on roots and tubers(cocoyam). Ash is an

indication of mineral contents of foods and has been shown by Leggli *et al*. (2011) to be high in cocoa products Cocoa contains iron for red blood cells, however, it boost the white blood cells which are responsible for the protection against infection (Abrokwah *et al.,* 2009). Adai (2009) has earlier reported that cocoa can strengthened the body immune system and prevents many viral diseases.

The moisture values of the cocoa powder are as presented in Table 1. The values ranged from 4.965 to 7.005% and are greater than the values reported by John *et al.* (2012) but are closer to those values reported by Ndife *et al.* (2013). The samples are significantly different from one another and the results show that higher temperature decreased the moisture content level of the samples. Temperature contribute to the loss of moisture content in the beans to a minimum value and the assurance of its microbiological purity (Redgwell et al., 2003). Abiola and Tewe (1991) reported that key factors for long shelf-life in cocoa powder are the control of the moisture content. Low moisture content confers higher shelf-life to the cocoa powder as microbial attack is minimal thereby keeping the nutritional ingenuity contact. Furthermore, effective control of moisture content of the powder reduces the water activity, oxidation and rancidity which inhibit good quality in cocoa beans.

The fat contents vary from 10.115 to 12.015 % and the values exhibited a level of significant difference among each other. These values are greater than the values reported by John *et al.* (2012) but are in close range with the values reported by Ndife *et al.* (2013) which are 10.05-12.65%. The fat profile helps to reduce the risk of coronary heart disease because the flavonoids in cocoa are capable to cause the modulation and prevent the oxidation and increase in cholesterol which could cause higher risk of heart disease as reported by Osakebe, *et al.,* (2000)

The carbohydrate values range from 67.24 to 73.00 % and are not significantly different from one another. The values of carbohydrate in this work are comparable with the values (61.0 - 62.48 %) reported by Ndife et al. (2013). The high percentage of carbohydrate in cocoa powder is health advantage especially for growing kids who need high calorie food to meet energy daily requirement and because low-energy foods tend to limit the optimal utilization of other nutrients through the protective effect of carbohydrate on protein and polyphenols (Belscak et al., 2009; Lettieri-Barbato et al, 2012).

3.3 RESULTS OF CHEMICAL AND PHYSICAL ANALYSES OF THE SAMPLES

Table 2 shows the pH of the cocoa powder, the pH contents show that all the samples are slightly acidic. The values range from 5.715 to 6.085 and sample H is significantly different from others. Sample A also is significantly different from others but samples B, C, D, E, F and G are not significantly different from one another. The values of pH in this work shows that it is less acidic and is in close range with the values reported Tagro *et al*. (2010) which range from 4.5 to 5.5. The pH of the sample decreased as the drying temperature increased. This is because at higher temperature, evaporation of moisture occurs rapidly as reported by Franke *et al*. (2008), this resulted in less evaporation of acetic acids in cocoa samples as reported Tagro *et al* (2010). The pH level of cocoa sample shows it is acidic which makes it possible to be preserved for appreciable amount of time before oxidation can set in.

The bulk densities of the samples vary from 4.277 to 5.481 g/cm^3 and are significantly different from each other. These values are less than the values (10.76) reported by Ndife *et al.,* (2013). The bulk density is an important consideration in transporting, storing and packaging particulate materials (Onwuka, 2006). The bulk density of cocoa powders is affected by their moisture contents (Ajala *et al.,* 2014). The bulk densities seem to increase as the percentage moisture loss in most of the cocoa powder samples decrease due to the increase in temperature.

Table 2: chemical and physical properties of cocoa beans

Samples	pH	bulk density (g/cm^3)
A	6.085±0.02e	5.481±0.03e
B	5.995±0.007d	5.431±0.03d
C	5.930±0.02c	5.404±0.02d
D	5.775±0.007b	4.456±0.006c
E	5.770±0.01b	4.420±0.03b
F	5.765±0.007b	4.393±0.002b
G	5.760±0.01b	4.289±0.002a
H	5.715±0.007a	4.277±0.05a

**values with the same subscript are not significantly different but values with different subscript are significantly different.*
**sample code: A=50ºC, B=55ºC, C=60ºC, D=65ºC, E=70ºC, F=75ºC, G=80ºC and H= 85ºC*

4 CONCLUSION

From the results obtained on the analysis, it can be concluded that the effective drying process affects the quality properties of cocoa as protein values was higher at lower temperatures while others increased with increase in temperatures. Value of pH was less acidic at lower temperature of drying which is a better quality in cocoa powder.

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Etude des troubles d'attention (négligence spatiale unilatérale) au sein d'un échantillon de collégiens à M'rirt (Moyen Atlas, Maroc)

[Screening for attention deficit disorder (unilatéral spatial neglect) in a sample of junior high school students of M'rirt (Middle Atlas – Morocco)]

Jamal El Azmy[1], Ahmed O.T. Ahami[1], Benissa Badda[3], Yossef Aboussaleh[1], Aboubaker El Hessni[2], and Stéphane Rusinek[4]

[1]Equipe de Neurosciences Cliniques, Cognitives et Santé Nutrionnelle,
Laboratoire de Biologie et Santé, Département de Biologie, Faculté des Sciences,
Université IBN TOFAÏL, BP. 133, Kenitra, Maroc

[2]Equipe de Physiologie Neuroendocrinienne,
Laboratoire de Génétique et de Physiologie Neuroendocrinienne, Département de Biologie,
Faculté des Sciences, Université IBN TOFAÏL, BP. 133, Kenitra, Maroc

[3]Centre de Formation des Instituteurs, Khémisset, Maroc

[4]Unité de recherche Psychologie : interactions, temps, émotions, cognition (PSITEC)-EA 4072,
Université Charles-de-Gaulle Lille 3, Domaine universitaire du « Pont de bois » Rue du Barreau,
BP 60 149 F-59653 VILLENEUVE D'ASCQ Cedex, France

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ABSTRACT: Screening and rehabilitation of attention disorders is a really encouraging field for clinical practice and research because of their effect on cognitive functions. Therefore, they can affect the language productions and cause significant educational, professional, social or familial difficulties. In this context, this study aims at screening for disorders of attention and unilateral spatial neglect in a sample of Moroccan junior high school students at El Moukaouama junior high school, M'rirt (Middle Atlas , Morocco). On a sample of 136 students aged between 11 and 19 years, a measure of attention was performed using the bells test. Scores obtained in the test in this study show that 21.32 % of students have attention problems and 5.88% have a profile of right or left unilateral spatial neglect. This study also shows a strong correlation between the students' school performance and their scores on the bells test. This study invites all interveners in the field of education, health and others to intervene to address the problems of attention in order to increase school achievement.

KEYWORDS: Disorder, Attention, Unilateral spatial neglect, Schoolboy, Bell test, School performance, Morocco.

RESUME: Le dépistage et la rééducation des troubles attentionnels constituent un champ réellement encourageant pour la pratique clinique et pour la recherche, vue leur effet sur les fonctions cognitives. Ils peuvent de ce fait avoir des conséquences sur les productions langagières. Ils peuvent engendrer des difficultés importantes dans le milieu scolaire, professionnel, social ou familial. Dans ce cadre, cette étude vise à dépister les troubles d'attention et la négligence spatiale unilatérale au sein d'un échantillon de collégiens marocains du collège El Moukaouama, M'rirt, (Moyen Atlas, Maroc). Sur un échantillon de 136 élèves d'âge compris entre 11 et 19 ans, une mesure de l'attention a été effectuée en utilisant le test de barrage des cloches. Les scores de ce test obtenus chez les sujets de cette étude, montrent que 21,32% des élèves présentent des problèmes d'attention et 5,88% présentent un profile de négligence spatiale unilatérale droite ou gauche. Cette étude a aussi met en évidence une forte corrélation entre les performances scolaires des élèves et leurs scores au test

Corresponding Author: Jamal El Azmy

de barrage des cloches. Cette étude invite tous les intervenants du domaine de l'éducation, de la santé et autres à intervenir pour remédier au problème d'attention afin d'augmenter la réussite scolaire.

MOTS-CLEFS: Trouble, Attention, négligence spatiale unilatérale, collégien, Test de barrages des cloches, Performance scolaire, Maroc.

1 INTRODUCTION

L'étude de l'attention s'est beaucoup développée depuis une cinquantaine d'années et a permis de mettre en évidence l'existence de différents processus, ou mécanismes, attentionnels. L'attention ne serait pas constituée d'un processus psychologique unique mais d'un ensemble de processus qui seraient en réseau les uns avec les autres. La référence [1] par exemple distingue quatre types de processus: la sélection de l'information, les ressources attentionnelles, le contrôle de la réponse et de l'activité, et l'attention soutenue. Les études effectuées dans le domaine de l'attention ont essentiellement cherché à préciser les caractéristiques de ces processus en spécifiant leur importance, leur rôle et leur influence sur les processus cognitifs en général (perception, langage, mémoire, etc.). Beaucoup d'études ont également porté sur les localisations cérébrales des zones sous-jacentes à ces processus. L'existence d'un processus attentionnel d'ordre spatial a été exploré dans de nombreuses études chez le sujet sain (par exemple [2] [3]). Un grand nombre d'indices confirment l'existence d'un tel processus attentionnel qui serait spécialisé dans la détection et la sélection de l'information (attention sélective) en fonction de la position spatiale des objets et des événements, il contrôlerait également le flux d'informations entre les systèmes perceptifs et les systèmes "cognitifs de plus haut niveau".

Il existe une diversité de modèles théoriques attentionnels qui peuvent être organisés en six parties distinctes, réparties de la façon suivante :

- Fonctions attentionnelles et réseaux cérébraux
- Modèle du filtre attentionnel
- Modèles des ressources attentionnelles
- Modèles relatifs au système de contrôle
- Modèle de Cowan- Modèle de Van Zommeren et Brouwer [4].

Le dépistage et la rééducation des troubles attentionnels constituent un champ réellement encourageant pour la pratique clinique et pour la recherche et d'autant plus que les déficits attentionnels, au même titre que les troubles mnésiques ou exécutifs, retentissent sur toutes les fonctions cognitives. Ils peuvent de ce fait aussi avoir des conséquences sur les productions langagières. Ils peuvent engendrer des difficultés importantes dans le milieu scolaire, professionnel, social ou familial.

Nous devons indiscutablement prendre ces troubles en considération en gardant toujours à l'esprit de proposer des soins optimaux, impliquant en particulier de bien cerner les difficultés et de se fixer des objectifs de généralisation dans la vie quotidienne ou dans les apprentissages, de progression, d'intégration ainsi que de bien-être des patients [5].

Parmi les troubles d'attention les plus importants, il y a La négligence spatiale unilatérale (NSU) qui qualifie le comportement pour le moins surprenant d'ignorance de l'hémi-espace controlaté-ral à une lésion pariétale, droite le plus souvent. À l'origine, ce trouble fut dénommé imperception, hémi-inattention, ou encore agnosie spatiale unilatérale. Il y a une trentaine d'année, la « négligence hémispatiale », ainsi dénommée par la référence [6], était définie par ces auteurs comme un trouble spatial caractérisé par « l'impossibilité de décrire verbalement, de répondre et de s'orienter aux stimulations controlatérales à la lésion hémisphérique, sans que ce trouble puisse être attribué à un déficit sensoriel ou moteur».

L'intérêt pour la Négligence spatiale unilatérale (NSU) provient des questions théoriques qu'elle pose sur des activités cognitives aussi complexes que la représentation mentale, l'attention et la conscience de l'espace et sur leurs localisations et fonctionnement dans le cerveau. Sur le plan de la santé publique, la NSU pose des problèmes importants, du fait qu'elle aggrave le handicap en gênant la rééducation motrice ([7], [8], [9]). La réhabilitation sociale de ces patients est également compromise, du fait de la réduction d'autonomie déterminée par la NSU (par exemple, ces patients ne peuvent plus conduire une voiture).

La compréhension des mécanismes de la NSU est importante pour fournir aux cliniciens des outils adaptés de diagnostic et de traitement (rééducation). La recherche sur la NSU peut en outre contribuer à une meilleure compréhension des mécanismes cérébraux du traitement de l'espace et des corrélats neuronaux de la conscience perceptive.

Notre but est de dépister les troubles d'attention, la négligence spatiale unilatérale et de savoir quelques données en relation avec ces derniers d'un échantillon d'élèves marocains.

2 MATÉRIEL ET MÉTHODES

Cette recherche est réalisée au sein du collège El Moukawama de la ville de M'rirt situé au moyen atlas, il se trouve au nord à 29 Km de la ville de Khénifra.

L'étude est réalisée auprès de 136 élèves âgés de 11 à 19 ans et qui sont répartis sur deux niveaux scolaires du collège.

Au total, 136 collégiens ont passé le test de Barrage des Cloches [10], qui utilise des stimuli cibles de type figures géométriques (plutôt que des lettres) qui semblent plus sensibles à la négligence spatiale unilatérale que ne le sont les tests les plus simples ([11], [12). Ce test est un instrument fiable et valide pour l'évaluation de l'héminégligence visuelle ([10], [13]). Le temps de passation est limité à 2 minutes.

L'analyse des données est faite par le logiciel SPSS et le logiciel Excel.

Vu le faible niveau scolaire chez les sujets de notre échantillon, on suppose la présence de problèmes d'attention (négligence spatiale unilatérale). Comme on suppose l'absence d'effet du sexe, âge et niveau scolaire sur les scores au test de barrage des cloches.

3 RÉSULTATS

3.1 DESCRIPTION DE LA POPULATION

3.1.1 REPARTITION SELON LE SEXE

La population étudiée est constituée de 63,2 % de garçons et 36,8% de filles (Figure 1). Cela montre que les garçons sont surreprésentés par rapport aux filles.

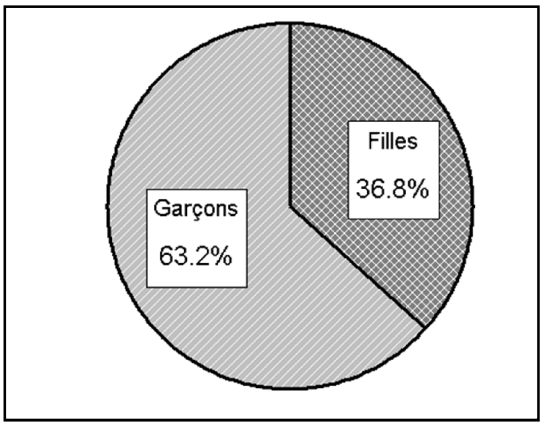


Fig. 1. Répartition de la population étudiée par sexe

3.1.2 REPARTITION SELON L'AGE

L'âge des élèves est compris entre 11 ans et 19 ans avec une moyenne de 13,82 ans et un écart type de 1,13 an (Tableau 1).

Tableau 1. Statistiques descriptives pour l'âge en années et en mois.

	Age en Année
N	136
Moyenne	13.82
Médiane	14
Mode	13
Ecart-type	1,45
Minimum	11
Maximum	19

3.1.3 REPARTITION SELON LE NIVEAU SCOLAIRE

La figure 2 représente la répartition des élèves de notre échantillon selon leur niveau scolaire:

- 80,15 % des élèves (soit 109 élève) appartiennent à la classe 1ère année du collège.
- 19,85 % des élèves (soit 27 élève) appartiennent à la classe 3ème année du collège.

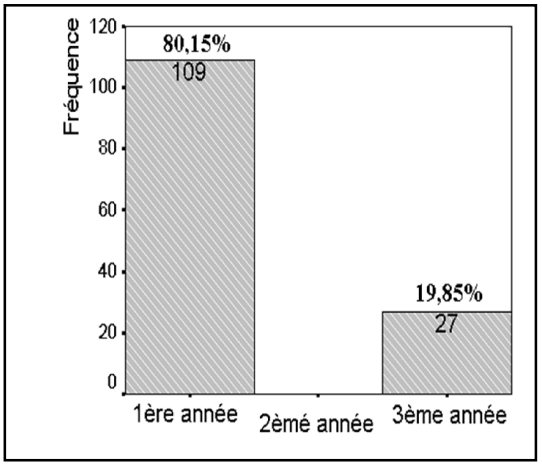


Fig. 2. Répartition des élèves par niveau scolaire

3.2 DÉPISTAGE DES TROUBLES D'ATTENTION (NÉGLIGENCE SPATIALE UNILATÉRALE)

3.2.1 RÉSULTATS AU TEST DE BARRAGE DES CLOCHES (TBC)

La lecture du Tableau 2 montre que le score moyen de l'échantillon au test de barrage des cloches est de 31,79 sur 35 avec un écart type de 3,50, la médiane est 33, le meilleur score est 35 et le score le plus bas est 17.

Tableau 2. Tableau descriptif des scores au test de barrage des cloches (TBC)

	Scores au TBC
N	136
Moyenne	31.79
Médiane	33.00
Mode	34
Ecart-type	3.50
Minimum	17
Maximum	35

3.2.2 REPARTITION DES SCORES AU TEST DE BARRAGE DES CLOCHES PAR CLASSE

Le tableau 3 montre que:

- Pour la classe 1ère année, le score moyen est de 31.47 avec un écart type de 3.73, le meilleur score est 35 et le score le plus bas est 17.
- Pour la classe 3ème année, le score moyen est de 33,11 avec un écart type de 1,91. Le meilleur score est 35 et le score le plus bas est 28.

On remarque que le score moyen croit légèrement avec le niveau scolaire en passant de 31,47. Au niveau 1ere année à 33.11 au niveau 3éme année collégiale.

Tableau 3. Tableau descriptif des scores au TCB par classes.

Classe	1ère année	3ème année
N	109	27
Moyenne	31.47	33.11
Ecart-type	3.73	1.91
Variance	13.94	3.64
Minimum	17	28
Maximum	35	35

L'analyse statistique par test de student ne fait apparaître aucune différence significative entre les deux classes (t = -2,425, dl = 26, p = 0,023). Ça vaut dire que le niveau scolaire n'a pas d'effet sur les scores des élèves.

3.2.3 RÉPARTITION DES SCORES AU TBC PAR SEXE

Le tableau 4 montre que les filles scorent en moyenne plus que les garçons avec

- Pour les filles, le score moyen est de 31,86 avec un écart type de 3,44. Le meilleur score est 35 et le score le plus bas est 22.
- Pour les garçons, le score moyen est de 31,75 avec un écart type de 3,56. Le meilleur score est 35 et le score le plus bas est 17.

Tableau 4. Tableau descriptif des scores au TBC par sexe.

Sexe	Filles	Garçons
N	50	86
Moyenne	31.86	31.75
Médiane	33	33
Mode	35	34
Ecart-type	3.44	3.56
Variance	11.83	12.68
Minimum	22	17
Maximum	35	35

L'analyse statistique par test de student ne fait apparaître aucune différence significative entre les scores des filles et ceux des garçons (t = -0,924; ddl = 49 ; p = 0,36). Ça vaut dire que le sexe n'a pas d'effet sur les scores des élèves.

3.2.4 RÉPARTITION DES OMISSIONS AU TBC

Le tableau 5 montre que le score moyen d'omission au TBC est de 3,21 avec un écart type de 3,5, un minimum d'omissions de 0 et un maximum de 18.

Tableau 5. Tableau descriptif des omissions au TCB

	Omissions
N	136
Moyenne	3.21
Médiane	2
Mode	0
Ecart-type	3.5
Minimum	0
Maximum	18

Le tableau 6 montre que:

- 29,32 % des sujets ont entouré toutes les cloches de la feuille.
- 51 ,47 % des sujets ont omis 1 à 4 cloches de la feuille.
- 8,82 % des sujets ont omis 5 cloches de la feuille.
- 18,38 % des sujets ont omis 6 cloches ou plus de la feuille.

Il est important de signaler que 12,2 % (17) des sujets ont omis 6 cloches ou plus de la feuille mais n'ont pas 6 omissions dans le coté droit ou gauche.

Tableau 6. Répartition des élèves selon le nombre d'omissions totale

	Nombre d'omissions (pourcentage)
0	29 (21,32 %)
1-4	70 (51,47 %)
5	12 (8,82 %)
≥ 6	25 (18,38 %)

3.2.5 RÉPARTITION DES ÉLÈVES SELON LE NOMBRE D'OMISSIONS DANS CHAQUE COTÉ DE LA FEUILLE DU TBC

Le tableau 7 montre que le score moyen des omissions (à gauches ; à droites) est de 1,23 ; 1,24 avec un écart type de 1,57 ; 2,04 , un minimum d'omissions de 0 ; 0 et un maximum de 6 ; 14.

Tableau 7. Tableau descriptif des omissions de chaque côté de la feuille du TBC

	Omissions gauches	**Omissions droites**
Moyenne	1.23	1.24
Ecart type	1.57	2.04
Minimum	0	0
Maximum	6	14

Le tableau 8 montre que:

- 47,79 % et 54 ,41 % des sujets ont entouré toutes les cloches de la partie gauche et droite de la feuille respectivement.
- 47,06 % et 37,50 % des sujets ont omis 1 à 4 cloches de la partie gauche et droite de la feuille respectivement.
- 2,94 % et 3,68 % des sujets ont omis 5 cloches de la partie gauche ou droite de la feuille respectivement.
- 2,21 % et 4,41 % des sujets ont omis 6 cloches ou plus de la partie gauche ou droite de la feuille respectivement.

Il est important de signaler qu'un seul élève présente 6 omissions à droite et 6 omissions à gauche.

Tableau 8. Répartition des élèves selon le nombre d'omissions dans chaque coté de la feuille du test

Nombre d'omissions	Omissions gauches	Omissions droites
	Nombre (pourcentage)	Nombre (pourcentage)
0	65 (47,79 %)	74 (54 ,41 %)
1-4	64 (47,06 %)	51 (37,50 %)
5	4 (2,94 %)	5 (3,68 %)
≥ 6	3 (2,21 %)	6 (4,41 %)

Ces résultats montrent que:

- 5,88 % (8) des sujets présentent un profil de négligence spatiale unilatérale.
- 2,21% (3) des sujets présentent un profile de négligence spatiale unilatérale gauche, contre 4,41% présentant un profile de négligence spatiale unilatérale droite.
- 21,32% (29) des sujets présentent des problèmes d'attention.

3.2.6 REPARTITION DES ELEVES SELON LA STRATEGIE DE BALAYAGE

La figure 3 montre que :

- 16,91 % des sujets utilisent la stratégie A pour chercher les cloches
- 11,03 % des sujets utilisent la stratégie B pour chercher les cloches
- 0,74 % des sujets utilisent la stratégie C pour chercher les cloches
- 2,2 % des sujets utilisent la stratégie D pour chercher les cloches
- 2,2 % des sujets utilisent la stratégie E pour chercher les cloches
- 0,74 % des sujets utilisent la stratégie F pour chercher les cloches
- 0 % des sujets utilisent la stratégie G pour chercher les cloches
- 2,2 % des sujets utilisent la stratégie H pour chercher les cloches
- 63,97 % des sujets utilisent la stratégie I pour chercher les cloches

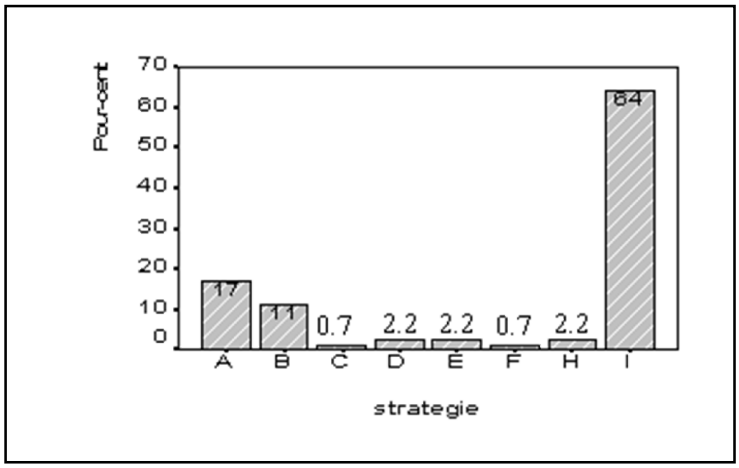


Fig. 3. Répartition des élèves selon la stratégie de balayage

Ces résultats montrent qu'un grand nombre d'élèves n'utilisent pas une stratégie de balayage organisée pour rechercher les cloches, ce qui influence négativement sur le score au TBC et ainsi le nombre d'omissions augmente.

Stratégie A : en haut de droite à gauche
Stratégie B : en haut de gauche à droite
Stratégie C : en bas de droite à gauche
Stratégie D : en bas de gauche à droite
Stratégie E : du haut au bas à droite
Stratégie F : du haut au bas à gauche
Stratégie G : du bas au haut à droite
Stratégie H : du bas au haut à gauche

Recherche organisée des cloches

Stratégie I : recherche désorganisé des cloches

3.3 RÉSULTATS SCOLAIRE

Le tableau 9 qui présente les statistiques descriptives de performances scolaires des élèves en arabe, français, mathématique et moyenne générale, montre que :

Les moyennes des élèves dans l'arabe, le français, les mathématiques et la moyenne générale sont successivement : 10.17, 8.34, 7.37 et 9.79 avec les écart-types suivants : 2.98, 3.76, 4 et 2.62. Ces résultats montrent que les performances scolaires des élèves sont globalement faibles.

Tableau 9. Tableau descriptif des performances scolaire

	Arab	Françai	Mathématique	Moyenn
N	136	136	136	136
Moyenne	10.17	8.34	7.37	9.79
Médiane	10	7.50	6.38	9.50
Mode	8	6.0	4	9.31
Ecart-type	2.98	3.76	4	2.62
Minimum	4	1.75	1	4.17
Maximum	18	18.5	20	17.54

3.4 INTERCORRÉLATIONS (R DE BRAVAIS-PEARSON) ENTRE PERFORMANCES SCOLAIRES ET TBC

L'analyse statistique par corrélations pour l'ensemble de la population regroupée qui apparaissent dans la figure 4, montre qu'il y a des corrélations significatives entre l'ensemble des performances scolaires et le score au TBC d'une part et les omissions au TBC d'autre part. C'est-à-dire que les élèves qui ont de bonnes performances scolaires scorent mieux au TBC et font moins d'omissions. Ces résultats montrent qu'il y a un lien entre les performances scolaires et les performances cognitives représentés ici par le traitement visuel.

	Arabe	Français	Mathé	Moyen	Score en 2 minutes	Omissions en 2 minutes
Arabe	1.000	.736**	.680**	.888**	.235**	-.235**
	.	.000	.000	.000	.006	.006
	136	136	136	136	136	136
Français	.736**	1.000	.701**	.864**	.200*	-.200*
	.000	.	.000	.000	.019	.019
	136	136	136	136	136	136
Mathématiques	.680**	.701**	1.000	.842**	.252**	-.252**
	.000	.000	.	.000	.003	.003
	136	136	136	136	136	136
Moyenne	.888**	.864**	.842**	1.000	.291**	-.291**
	.000	.000	.000	.	.001	.001
	136	136	136	136	136	136
Score en 2 minutes	.235**	.200*	.252**	.291**	1.000	-1.000**
	.006	.019	.003	.001	.	.000
	136	136	136	136	136	136
Omissions en 2 minutes	-.235**	-.200*	-.252**	-.291**	-1.000**	1.000
	.006	.019	.003	.001	.000	.
	136	136	136	136	136	136

**. La corrélation est significative au niveau 0.01 (bilatéral).

*. La corrélation est significative au niveau 0.05 (bilatéral).

Fig. 4. Corrélations (R de Bravais-Pearson) entre les scores au TBC et les performances scolaires

4 DISCUSSION

Dans cette étude on avait le but de dépister les troubles d'attention et de négligence spatiale unilatérale chez les élèves du collégial.

Les résultats ont montré que le score moyen au TBC est de 31,79 contre un score moyen de 33,3 trouvé dans l'étude [10] , un score moyen de 32,94 trouvé dans l'étude [14] , et un score moyen de 29,86 trouvé dans l'étude d'ODYDES [15]. Ce qui montre que le score moyen de notre échantillon est un peu faible par rapport à celui des deux autres études, chose qui peut être expliqué par la différence d'âge.

L'analyse statistique montre que l'effet du sexe sur le score au TBC est non significative ce qui rejoigne ce qu'ont rapporté les études [10] et [14].

L'effet de l'âge est apparu non significatif, chose qui concorde avec les résultats de l'étude [10]. Par contre dans [14] ils ont noté un petit effet de l'âge pour les tranches d'âge (65-79 ans).

L'analyse statistique n'a montré aucun effet significatif du niveau scolaire sur le score au TCB ce qui contredit ce qu'a rapporté l'étude [14] qui note un petit effet du niveau scolaire sur le score au TCB. Ceci peut être expliqué par le niveau rapproché entre les élèves de notre échantillon.

Les résultats ont montrés que 21,32 % des sujets présentent des problèmes d'attention et 5,88% présentent un profil de négligence spatiale unilatérale droite ou gauche. Ceci aura un effet négatif sur la scolarité des élèves ainsi le pourcentage de l'échec scolaire augmente.

Cette étude a montré que 64% des élèves de notre échantillon et particulièrement ceux qui présentent des problèmes d'attention n'utilisent pas une stratégie organisée de balayage pour rechercher les cloches. Ces résultats s'accorde avec ce qu'a rapporté [10] dans son étude qui a montré que la stratégie de balayage des hémiplégiques gauches est désorganisé en comparaison avec celle des normaux.

Cette étude a met en évidence des corrélations significatives entre les performances scolaires et les résultats au TBC. Ce résultat apparaît raisonnable car il rejoint ce qu'ont rapporté plusieurs études qui confirment qu'il y a un lien entre le traitement visuel et la réussite scolaire ([16], [17]).

Les résultats de cette étude confirment les hypothèses émises dans l'introduction. Le nombre de filles est inférieur à celui des garçons en raison de leur faible effectif au collège, site de l'étude.

5 CONCLUSIONS

Au terme de cette recherche qui a porté sur 136 élèves du collège EL Moukawama à M'rirt Maroc, nous avons pu dépister les trouble d'attention (Négligence spatiale unilatérale) grâce au test de barrage des cloches qui est un instrument fiable et valide pour évaluer l'héminégligence visuelle ([10], [13]). Ainsi, L'étude réalisée a pu mettre en évidence que 21,32% des élèves présentent des problèmes d'attention et 5,88% présentent un profil de négligence spatiale unilatérale droite ou gauche. Cette étude a aussi met en évidence une forte corrélation entre les performances scolaires des élèves et leurs scores au TBC, ce qui implique que les troubles d'attention influencent négativement le parcours scolaire des sujets, ainsi il augmente le pourcentage de l'échec scolaire.

Ces résultats interpellent tous les intervenants que ce soit au niveau du domaine de la santé, de l'éducation, de la recherche scientifique ou autres domaines à intervenir pour mettre la main sur les facteurs qui sous-tendent ce déficit neurocognitif et ainsi prendre les mesures appropriées pour remédier au problème. Comme il invite d'autres chercheurs à utiliser le même test pour dépister les troubles d'attention en travaillant dans d'autres régions du Maroc et de réaliser une standardisation marocaine du test de Barrage des Cloches.

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Optical Characterization of Fluorine doped Tin Oxide (FTO) thin films deposited by spray pyrolysis technique and annealed under Nitrogen atmosphere

Sanusi Abdullahi[1], A.U. Moreh[1], B. Hamza[1], U. Sadiya[1], Z. Abdullahi[2], M. A. Wara[1], H. Kamaluddeen[1], M. A. Kebbe[1], and U. F. Monsurat[1]

[1]Physics,
Usmanu Danfodiyo University,
Sokoto, Sokoto, Nigeria

[2]Advanced Physics Laboratory,
Sheda Science and Technology Complex,
Abuja, Abuja, Nigeria

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ABSTRACT: Spray pyrolysis technique has been used to deposit Fluorine doped Tin Oxide (FTO) thin films. Optical constants such as refractive index (n), extinction coefficient (K) and the absorption coefficient (α) of the FTO thin films were determined using spectrophotometric measurement of transmittance, absorbance and reflectance in the spectral range from 172 to 1100nm. The maximum value of transmittance was in the range of 77% to 86%. Furthermore, the effect of annealing temperature and the annealing condition on optical band gap (E_g) was studied. The optical band gap was found to be within the range of 3.50 to 4.0 eV.

KEYWORDS: Fluorine doped Tin oxide (FTO), Optical properties, Extinction coefficient, refractive index.

1 INTRODUCTION

Transparent conducting oxides (TCOs) are electrical conductive materials with a comparably low absorption of light. They are usually prepared with thin film technologies. Glass fibers are nearly lossless conductors of light, but electrical insulators such as silicon and compound semiconductors are wavelength dependent optical resistors (generating mobile electrons), as well as dopant dependent electrical conductors. Transparent conducting oxides are highly flexible intermediate states with both of these characteristics. Their conductivity can be tuned from insulating via semiconducting to conducting as well as their transparency adjusted. As they can be produced as n-type and p-type conductivities, they open a wide range of power saving opto-electrical circuitries and technological applications [1].

Transparent conductive oxides (TCO) have become increasingly important in a large variety of applications due to demands for optically-transparent, conductive materials. Applications of these devices include thin-film solar cells, display devices, optoelectronic devices, polymer-inorganic composite solar cells, gas sensors, and frost-resistant surfaces. [1, 2]. A common TCO used in research and industry is tin-doped indium oxide (ITO). ITO is an n-type semiconductor where indium oxide (In_2O_3) has been doped with tin oxide in order to improve many of the material's properties, including its electrical conductivity. However, ITO experiences a reduction of electrical conductivity when exposed to oxygen at elevated temperatures (> 300^0C) [3].

Fluorine doped Tin dioxide Thin Films belong to a special class of metal oxide thin films i.e. Transparent Conducing Oxide thin films which are a special part of nanostructured thin film solar cells. It offers the possibility of fabrication of low cost solar cells. As it permits the transmission of solar radiation directly to the active region with little or no attenuation, these solar cells have improved sensitivity in the high-photon-energy portion of the solar spectrum and make thin film solar cells

suitable for large scale application with high performance efficiency [4]. At higher temperatures, oxygen in the atmosphere combines with oxygen vacancies. When the number of oxygen vacancies decreases and the number of charge carriers reduces accordingly, the electrical conductivity decreases. Since many of the above-mentioned devices undergo thermal treatments, this reduction of conductivity becomes problematic. Therefore, FTO, which is much more thermally stable, is often used as an alternative to ITO. FTO is an ideal candidate for applications requiring TCO due to its ability to adhere strongly to glass, resistance to physical abrasion, chemical stability, high optical visible transparency, and electrical conductivity. In the case of FTO, fluorine (F) is doped into tin oxide where fluorine substitutes for O^{-2} and acts as an electron donor, resulting in an n-type degenerate semiconductor [3]. Many techniques have been employed to deposit FTO such as sputtering [5, 6], Inkjet printing technique [7], Aerosol assisted chemical vapor deposition (AACVD) [8], Sol gel [9], Atmospheric-pressure plasma deposition system [10], Spray pyrolysis [3, 11]. Spray pyrolysis has been chosen in this research because it is considered as a modification of vapour deposition using a fine spray of precursor solution (generated by a spray nozzle using compressed gas) that delivers the precursor metal organic molecules to the substrate surface for thermal reaction and film formation.

2 EXPIREMENTAL DETAILS

2.1 CLEANING OF THE MATERIALS

The soda lime glass, the beakers, and measuring cylinder were washed first with detergent and rinsed with distilled water, then washed with acetic acid and finally rinsed with ethanol.

2.2 PREPARATION OF FLUORINE DOPED TIN OXIDE (FTO)

10.0g of tin tetrachloride pentahydrate ($SnCl_2.5H_2O$) was measured using the digital weighing machine (balance) and dissolved in 100ml of ethanol in a closed container. The solution was stirred continuously until all the tin chloride pentahydrate was completely dissolved in the ethanol. The solution was labeled A

2.0g of ammonium chloride was measured and dissolved in 4.0ml of ethanol in another container; the solution was stirred continuously until all the salt dissolved. And then the solution labeled B.

After both solutions have been allowed to fully stir, the tin chloride penthydrate solution is placed in a water bath and heated to 60℃. Next, the ammonium fluoride solution is then admixed. The combined solution is allowed to stir overnight to ensure complete mixing, and the resulting solution is clear and stable.

The Tin tetrachloride pent hydrate ($SnCl_2.5H_2O$, Ammonium fluoride (NH_4F), Ethanol (C_2H_5OH) and Acetic acid were of analytical grade of 4N purity and obtained from Sonopharm chemical reagent company limited.

2.3 SYNTHESIS OF FLUORINE DOPED TIN OXIDE (FTO) THIN FILMS

The spray pyrolysis technique was employed to deposit the fluorine doped tin oxide thin films. Soda lime glass was used as substrate. The precursor solution was the mixture tin chloride pentahydrate solution and ammonium fluoride solution. The solution was sprayed on the heated glass substrate using KM – 150 spray pyrolysis deposition machine (SPD). The deposition temperature and solution flow rate were maintained at 723K and 1.5ml/min respectively. Other parameters were kept constant. Film thickness of 100nm was deposited on the glass substrate at a nozzle – substrate distance of 11.0cm. The growth rate was approximately 25nm/min. The film thickness was measured using a taly step profilometer (roughness detector with a stylus Taylor Hobson model).

Four samples were prepared and labeled as FTO 273: as deposited sample, FTO 423: sample annealed under nitrogen atmosphere at 423K, FTO 573: sample annealed under nitrogen atmosphere at 573K, and FTO 723: sample annealed under nitrogen atmosphere at 723K. Deposition rate is defined as the thickness divided by deposition time, and it is important in film thickness control, especially for precise multi-layer coating [6].

2.4 ANNEALING OF THE SAMPLES

Three samples designated as FTO 423, FTO 573, and FTO 723 were taken to an oven one after the other and heated at temperatures $423K$, 573K and723K respectively under nitrogen atmosphere for one hour. The Nitrogen gas flow rate is 1 standard cubic centimeter per minute (sccm). The sample marked FTO 273 was unannealed to serve as reference sample.

2.5 CHARACTERIZATION

The transmittance spectra of the films were measured in the range of 172 to 1000nm using Avantes Avaspec 2048 UV–VIS-NIR spectrophotometer at room temperature.

3 METHOD OF CALCULATION

The study of the fundamental absorption edge provides useful complementary information concerning energy band structure and the type of transition of the charge carriers. The absorption coefficient α of the films was determined using the formula [12, 13].

$$\alpha = \frac{1}{d} Ln[\frac{1}{T}] \quad (1)$$

Where T and d are the transmittance and thickness of the films respectively.

The optical energy band gap E_g was estimated from the optical measurements using the following expression [4, 14].

$$(\alpha h\nu)^2 = A(h\nu - E_g) \quad (2)$$

Where A is a constant, $h\upsilon$ is the photon energy, E_g is the energy band gap and α is the absorptivity. E_g values were obtained by extrapolating the linear portion of the plots of $(\alpha h\upsilon)^2$ versus $h\nu$ to α = 0.0.

The refractive index n was calculated from the following equation [12].

$$n = \frac{1+R\hat{}0.5}{1-R\hat{}0.5} \quad (3)$$

Where R is the reflectance.

The coefficient of absorption k was calculated from the following equation [15].

$$k = \frac{\alpha\gamma}{4\pi} \quad (4)$$

Where α is the absorption, γ is the incident wavelength.

The relation between the real dielectric constant ε and the wavelength, in the normal dispersion region is given by [12].

$$\varepsilon = n^2 - k^2 \quad (5)$$

4 RESULTS AND DISCUSSION

4.1 OPTICAL CHARACTERIZATION

The optical properties of fluorine doped tin oxide thin films prepared and deposited by spray pyrolysis technique on a soda lime glass substrate (at a substrate temperature of 723K) and annealed at different temperatures (423K, 573K and 723K) have been studied. Transmission and absorption spectra were measured in the range from (380nm to 750nm)

4.2 TRANSMITTANCE

Fig. 1 shows optical transmittance spectrum of the FTO films. All the films show high optical transmittance in the visible region of the electromagnetic spectrum. The annealed samples have high transmittance more than the as deposited samples. The optical transmittance of the as-deposited, sample annealed at 423K, 573K, and 723K are 72.85%, 80.66%, 84.14% and 79.05% respectively.

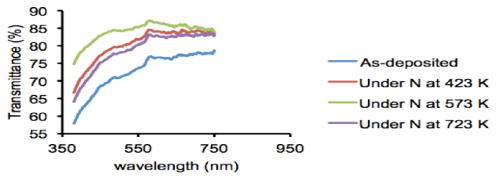


Fig. 1 A plot of optical transmittance versus wavelength for as-deposited and samples annealed under N_2 atmosphere.

Fig. 2 shows the plot of transmittance against temperature of the FTO films. It can be seen clearly that transmittance increases with an increase in annealing temperature. The transmittance keeps increasing when the films were heated from room temperature(273 K) to 723K, until it reaches a maximum value of 84.16% at 573K. Further increase in temperature leads to slight decrease in transmittance of about 5% at a temperature of 723K.

According to [12], the decrease of transmittance with increasing annealing temperature may be due to an improvement of the degree of crystallinity of the films and an increase of the grain size.

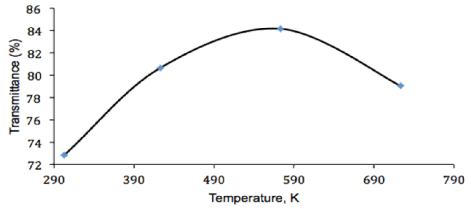


Fig. 2. Variation of transmittance with annealing temperature for as-deposited sample and samples annealed under N_2 atmosphere

Fig. 3 shows optical reflectance spectrum of the FTO films. All the films show low optical reflectance in the visible region of the electromagnetic spectrum. The annealed films have a low reflectance than the as-deposited sample. The optical reflectance of the films as-deposited sample and samples annealed at 423K, 573K, and 723K are 27.92%, 35.28%, 28.89% and 15.78% respectively.

The high transmittance and low reflectance properties of the films make them good materials for anti-reflection coatings and for solar thermal applications in flat plate collectors [13].

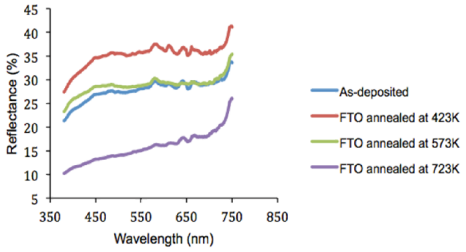


Fig. 3. Plot of optical reflectance versus wavelength for as-deposited and samples annealed under N_2 atmosphere.

4.3 ABSORPTION COEFFICIENT (α)

The ability of a material to absorb light is measured by its absorption coefficient. Fig. 4 shows variation of absorption coefficient of FTO films with various wavelength regions annealed at different temperatures. It can be seen that the as-deposited films have higher absorption coefficient than the annealed samples. This implies that the as-deposited sample have high ability to absorb light within the visible region than the other samples annealed at different temperatures. The absorption coefficient of the FTO films is shown in table 1.

According to [13], this higher value of absorption coefficient (α) for as- deposited FTO films with steeper optical absorption edge indicates better crystallinity of the films and lower defect density near the band edge.

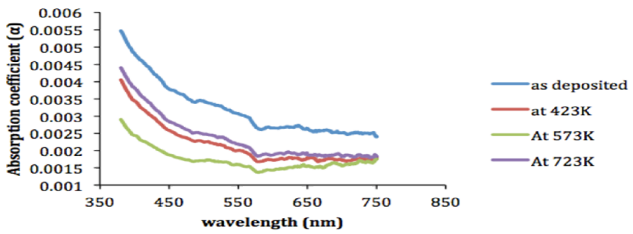


Fig.4. Plot of Absorption coefficient versus wavelength for as-sample and samples annealed under N_2 atmosphere

Table 1. Absorption coefficient for as-sample and samples annealed under N_2 atmosphere.

SAMPLE	*ABSORPTION COEFFICIENT, α (cm^{-1})*
As-deposited FTO films	*0.0032*
FTO films annealed at 423K	*0.0022*
FTO films annealed at 573K	*0.0017*
FTO films annealed at 723K	*0.0024*

4.4 OPTICAL BAND GAP (EG)

The plot of $(\alpha h\gamma)^2$ versus $h\gamma$ is shown in Figures 5a, b, c and d. By extrapolating the linear portion of the graph to $h\gamma$ axis, band gap have been obtained at the intercept. The obtained values of E_g are listed on table 2, where E_g increases with increase in annealing temperature.

This increase in E_g is due to quantum size effect. And that during the annealing process the films will have time for some atomic rearrangement to take place. Therefore, some defects will be removed which will result in reducing the density of dangling bonds, redistributing atomic distances and bond angles and optical gap then increases. Physically, the band gap growth effect in FTO system may originate from the change in nature and strength of the interaction potentials between the donors and host crystals. It is generally believed that this increase in the band gap is due to Burstein-Moss shift that is due to increase in carrier concentration, the absorption edge shifts to higher energy level [4, 12]. This increase is also connected to a reduction in the resistances of the films, implying enhancement of the carrier concentration [5].

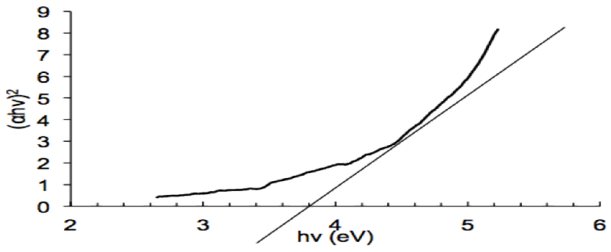


Fig. 5a. A plot of $(\alpha h\nu)^2$ versus hv for as-deposited sample.

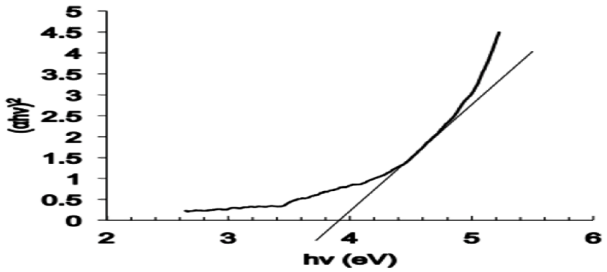


Fig. 5b. A plot of $(\alpha hv)^2$ versus hv for FTO annealed under N_2 at 423K.

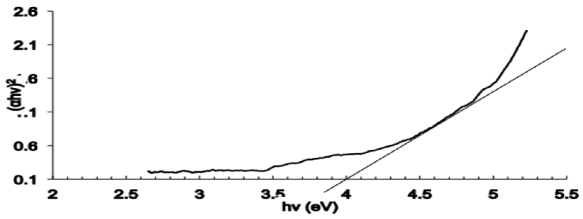


Fig. 5c. A plot of $(\alpha hv)^2$ versus hv for FTO annealed under N_2 at 573K

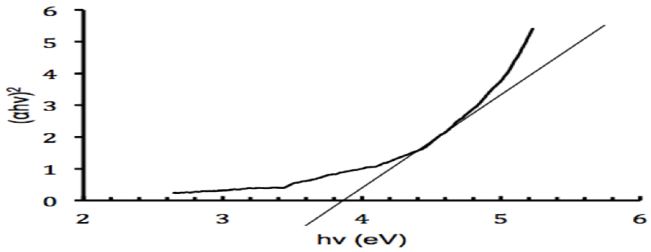


Fig. 5d. A plot of αhv^2 versus hv for FTO annealed under N_2 at 723K

Table 2. Energy band gap for as-sample and samples annealed under N_2 atmosphere.

S/NO.	SAMPLE	Energy Band Gap, E_g (Ev)
1	As deposited	3.80
2	Annealed at 423K	3.90
3	Annealed at 573K	4.00
4	Annealed at 723K	3.90

4.6 REFRACTIVE INDEX (N)

Fig. 6 shows variation of refractive index with wavelength of the FTO films. Refractive index decreases with increase in wavelength indicating that all the films exhibit anomalous dispersion. The refractive index of the FTO films for as-deposited, annealed at 423K, 573K, and 723K are 1.47, 1.41, 1.46, and 1.68 respectively. According to [12], the decrease in refractive index with increase in wavelength confirms the semi conductor behavior of the films.

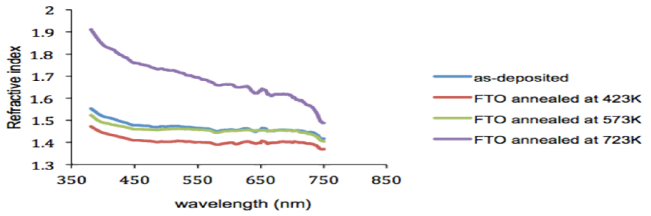


Fig. 6. A plot of optical reflective index versus wavelength for as-deposited and samples annealed under N_2 atmosphere.

Fig. 7 is a plot of refractive index versus annealing temperatures. The refractive index for FTO films annealed at 723K is higher than the rest of the films annealed at 423K, 573K, and as-deposited. According to [12], this could be due to increase in the packing density as the annealing temperature increases. Also according to [6], the increase in the refractive index could be due to the re-crystallization, oxidation, and diffusion of tin from the deposited films into glass matrix.

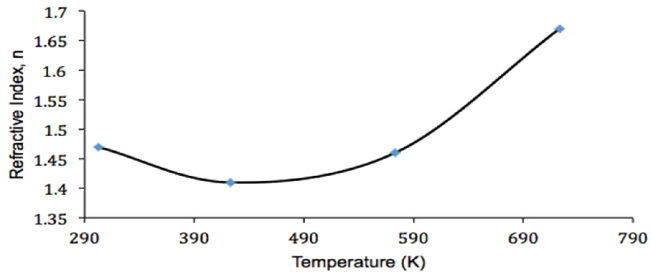


Fig. 7. Variation of refractive index with annealing temperature for as-deposited sample and samples annealed under N_2 atmosphere.

4.7 EXTINCTION COEFFICIENT (K)

This is a measure of the rate of attenuation of transmitted light through scattering and absorption for a medium. Fig. 8 shows a plot of extinction coefficient against wavelength for FTO films. The value k decreases as the wavelength of the incident light increases to 550nm, and then starts to increase, as the incident wavelength increases. The average values of extinction coefficient (k) of the FTO films for as-deposited sample and samples annealed at 423K, 573K and 723K are 0.138, 0.093, 0.076, and 0.102 respectively. The variation in the value of k spectra was quite different between ultraviolet (UV) region (above 3.0 eV and the near infrared (NIR) region (below 1.75eV).

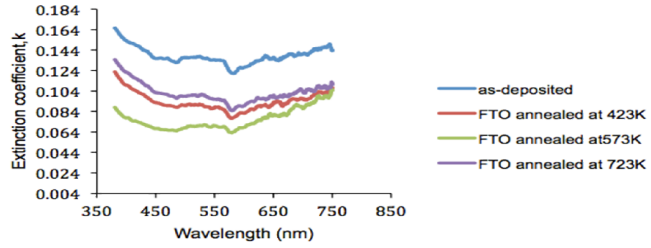


Fig. 8 A plot of extinction coefficient versus wavelength for as-deposited and samples annealed under N_2 atmosphere.

Fig. 9 shows a plot of extinction coefficient versus temperature. It is clear that the value of k decreases with increase in annealing temperature until when temperature is 423K, and with further increase in temperature it also increases. This according to [16] is due to crystallization of film structure by increasing the grain size, and slightly, the absorption edge shift to smaller wavelength (higher photon energy) with increasing annealing temperature. The decrease of k with increasing annealing temperatures are due to the increasing value of energy gap.

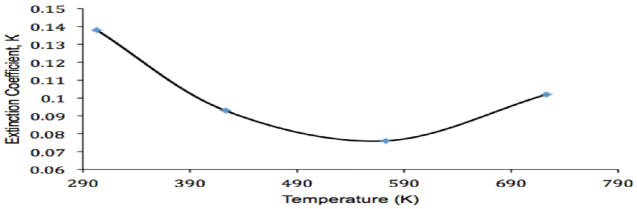


Fig. 9. Variation of extinction coefficient with temperature for as-deposited sample and samples annealed under N_2 atmosphere

4.8 DIELECTRIC CONSTANT (ε)

Fig. 10 is a plot of dielectric constant versus wavelength. The value of the dielectric constant decreases with increase in wavelength within the visible region of the spectrum. The dielectric constant of the FTO films for as –deposited sample and samples annealed at 423K, 573K, and 723K are 2.137, 1.967, 2.120, and 2.846 respectively.

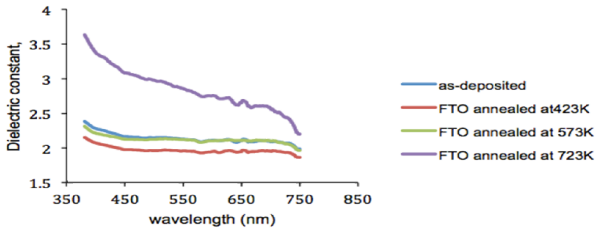


Fig. 10. A plot dielectric constant versus wavelength for as-deposited sample and samples annealed under N_2 atmosphere.

Fig. 11 shows the variation of dielectric constant of as-deposited FTO thin films and annealed at different annealing temperatures (423, 573,723K). It is interesting to see that dielectric constant increases with increasing annealing temperatures. This behavior according to [16] is due to increase in the reflection on which the refractive index depends on it.

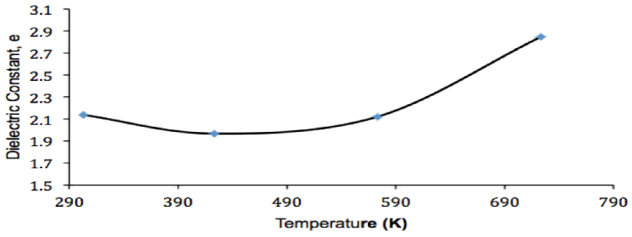


Fig. 11 Variation of dielectric constant with temperature for as-deposited sample and samples annealed under N_2 atmosphere.

Table 3. Values of transmittance,T, Reflectance,R, Absorption, A, absorption coefficient, extinction coefficient and Dielectric constant

S/No.	SAMPLE	T (%)	R (%)	A	α	K	ε
1.	As-deposited	72.85	27.92	0.138	0.003	0.138	2.137
2.	Annealed at 423K	80.66	35.28	0.093	0.002	0.093	1.967
3.	Annealed at 573K	84.16	23.89	0.075	0.001	0.076	2.12
4.	Annealed at 723K	79.05	15.78	0.102	0.002	0.102	2.846

5 CONCLUSION

This work reported the preparation growth and characterization of fluorine doped tin oxide thin films annealed under Nitrogen atmosphere at various temperatures. These films were deposited by spray pyrolysis technique. It is concluded that annealing under N_2 atmosphere influences some of the optical constants of the films.

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Drying and Dehydration Kinetics of Ginger

Md. Masud Alam[1], Muhammad Zakaria Hossain[1], Morgina Aktar[2], Md. Saiful Islam[3], and Zakiul Hasan[3]

[1]Spices Research Centre,
Bangladesh Agricultural Research Institute,
Shibganj, Bogra, Bangladesh

[2]Thakurgaon Polytechnic Institute,
Thakurgaon, Bangladesh

[3]HarvestPlus Bangladesh,
International Rice Research Institute,
Dhaka, Bangladesh

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ABSTRACT: The experiment was conducted to study the drying behavior of ginger using mechanical drier and osmotic dehydration and development of dehydrated ginger products. Three different thicknesses (3, 5 and 7mm slice) and three different temperatures (52^{o}C, 60^{o}C and 68^{o}C) were used in this study for ginger drying. The study revealed that 3mm thick slice required the least time to dry, followed by 5mm thick slice, while the highest drying time was for 7mm thick slice. It was also noticeable that for reaching to a specific moisture ratio, 68^{o}C temperature took least time to dry, followed by 60^{o}C, while highest was required at 52^{o}C. The influence of air temperature (db) on drying rate constant and diffusion coefficient showed Arrhenius type relationship between diffusion coefficient and absolute temperature. The activation energy for diffusion of water from ginger was found 15.868 Kcal/g-mole. The influence of sample thickness on drying time showed a power law relationship. The value of exponent of power law equation is 0.5315 which indicated the presence of significant amount of external mass transfer resistance. The rate of extent of weight loss , moisture content, solid gained and normalised solid content (NSC) were strongly influenced by strength of osmotic solution, immersion time and were rapid during the first 6 hrs of osmotic dehydration.

KEYWORDS: ginger, drying, osmotic dehydration, drying rate constant, diffusion coefficient, activation energy.

1 INTRODUCTION

Ginger (*Zingiber officinale Roscoe*) is important cash and one of the principal spice crops all over the Bangladesh and world. India is the largest producer, consumer and exporter in the world. Ginger of commerce is the dried rhizome prepared from the fresh rhizomes. It plays a significant role in earning valuable foreign exchange. It is marketed in different forms such as raw ginger, dry ginger, bleached dry ginger, ginger powder, ginger oil, ginger oleoresin, gingerale, ginger candy, ginger beer, brined ginger, ginger wine, ginger squash, ginger flakes, etc. Chinese ginger is usually not exported as a dried spice, but preserved in sugar syrup or converted into 'ginger candy'.

Ginger is seasonal in nature and available in large quantities during the peak season in the local market. But due to higher water activity (a_w), ginger cannot be kept for longer time after harvesting. Ginger is normally stored in pit but within few days sprout and roots are found. In this situation the farmers do not sell them without removing sprout and rooting part from ginger. That's why additional labour cost is required. Sometime decay or rotting is found due to higher moisture in pit. But if ginger is kept out of pit it become shrivel within few days. In this case the farmers do not get good price. If

spoilage/postharvest losses could be reduced to an acceptable level by proper processing/preservation; farmers would get proper price of their products and thus be encouraged to increase yield and production

Proper drying techniques as well as proper slice thickness of product are required for obtaining good quality dried products. Drying of ginger are carried out by open sun drying, solar or mechanical drying. Thus, it is important to know the drying characteristics of this crop. The drying rate of ginger is closely associated with the drying air temperatures, relative humidity and air velocity. One of the most important criteria of food is colour. Undesirable changes in the colour of food may lead to a decrease in consumer's acceptance as well as market value. Hence, it is necessary to dry ginger in a suitable environment to produce good quality stable dried products. The efficiency of drying system can be improved by the analysis of the drying process.

Hot air dehydration has been largely employed to preserve fruits and vegetables. In this case, simultaneous mass and heat transfer takes place. In order to obtain high quality dehydrated food, osmotic dehydration has been introduced as a pretreatment by immersion in liquids with lower water activity than that of the food. Through pretreatment before air drying moisture is reduced from 30% to 70% of the water content of the food [14]. Also, energy consumption is reduced [13]. However, osmotic dehydration will usually not lead to sufficiently low moisture content for the product to be considered shelf-stable [16]. The osmotic dehydration process carries out at the same time of removing of water and direct preparation of product [14].

Osmotic dehydration preceding air drying decreases colour changes and increases flavour retention in dried fruits and vegetables [6]. The resulting product has generally better quality than the dried one without pretreatment.

2 MATERIALS AND METHODS

The present study was undertaken to determine drying kinetics of ginger using mechanical and osmotic dehydration and to optimize process parameter to obtained high quality dried products. Fresh ginger (BARI Ada-1) was collected from the Bangladesh Agricultural Research Institute (BARI), Spices Research Center (SRC) farm. The other materials such as sugar, salt, chemicals etc purchased from market.

2.1 LABORATORY DRYER

The experiments of a single layer drying of ginger at different thickness and various air temperatures were conducted in laboratory type mechanical dryer (Fisher, Model 438 F). The dryer mainly consisted of a blower, heating unit, drying chamber and sample container. It was adjusted with the thermostat to control the temperature in the drying chamber.

2.2 SELECTION OF SLICE THICKNESS AND DRYING TEMPERATURE

Ginger was sliced to three different thicknesses (3, 5 and 7mm) by sterilized slicer. Three different slice thicknesses (3, 5 and 7mm) of ginger were selected for this study. Usually spices are being dried within the temperature range of 60 to 85^{o}C. At lower drying temperature products were dried for longer time and it caused a change in browning colour in the final dried products which is undesirable for consumer acceptance. Case hardening occurred at higher drying temperature generally above 70^{0}C drying in most of the spices. Outer surface was over dried hence caused disintegration of moisture diffusion from the interior part of the product during drying. The final dried material could not be regarded as good quality due to no-uniform drying. Therefore, 52, 60 and 68^{o}C temperature were selected for safe drying of ginger.

2.3 MECHANICAL DRYING

Sliced samples were placed on the tray in a thin layer in a mechanical drier. Samples were dried until the products were reached in equilibrium moisture content. Air flow and RH were maintained constant in the drier. Dehydrated ginger product was grinded in a grinding machine. This powder were packed in HDPE, Al-foil and stored at room and refrigeration temperature for shelf life study.

2.4 THEORETICAL DRYING EQUATIONS

Ficks second law is applied to describe mass transfer during drying since food dehydration is assumed to be a diffusion process. The expression is:

$$\frac{\delta M}{\delta t} = \Delta^2 D_e M \qquad \text{(i)}$$

Where,

M= Moisture content (dry basis), T= Time and D_e= Effective diffusion co-efficient.

To find a solution of the above unsteady state diffusion equation for one dimensional transport for the case of initial uniform moisture distribution in the sample and negligible external resistance, appropriate boundary conditions are assumed. The solution for an infinite slab (with thickness, L), when dried from one major face ([3], [10], [4])

$$MR = \frac{Mt - Me}{Mo - Me} = \frac{8}{\pi^2} \quad \sum_{n=0}^{\alpha} \frac{1}{(2n+1)^2} Exp \quad \frac{-(2n+1)^2 \pi^2 D_e t}{L^2} \qquad \text{(ii)}$$

Where, MR= Moisture ratio, M_t, M_o and M_e are the moisture content at the time t, initial moisture content and equilibrium moisture content respectively. MR can be calculated from equation ii. When MR versus drying time (hr) was plotted on a semi-log graph, drying rate graphs can be drawn. Consequently, a straight line should be obtained when plotting In MR versus time (t). The slope of the regression line is the drying rate constant, m from which the effective diffusion co-efficient, D_e is calculated.

2.5 SEMI THEORETICAL DRYING EQUATIONS

For low M_e values and for moisture ratio, MR<0.6 equation (i) reduces to:

$$\frac{M_t}{M_0} = \frac{8}{\pi^2} e - \pi^2 D_e t / L^2 \quad = \frac{8}{\pi^2} e^{-mt} \qquad \text{(iii)}$$

Where, $m = \frac{\pi^2 D_e}{L^2}$ = drying rate constant, sec^{-1}

Re-arranging equation (ii) gives:

$$In(\frac{M_t}{M_0}) = In(\frac{8}{\pi^2}) - mt \qquad \text{(iv)}$$

From the semi-theoretical equation as shown in equation (iii), it may be noted that the drying rate constant, m is a function of the square of thickness of the product dehydrated, as

$$m = \frac{\pi^2 D_e}{L^2} \qquad \text{(v)}$$

2.6 DIFFUSION COEFFICIENT AND ACTIVATION ENERGY

The effective moisture diffusivity can be expressed by simple Arrhenius equation as a function of temperature as follows

The relationship is as follows [8].

$$\frac{dInD_e}{dT_{abs}} = \frac{E_a}{RT_{abs}}$$

$$\text{or, In } D_e = \text{In } D_o - \frac{E_a}{RT_{abs}} \qquad \text{(vi)}$$

Where, D_o is constant equivalent to the diffusivity at infinitively high temperature (m^2/s), E_a is the activation energy of diffusion of water (cal/g-mole), R is the universal gas constant (8.314 x 10^{-3} kJ/mol K) and T_{abs} is the absolute temperature, ^oK.

From equation (vi), it is apparent that plotting diffusion co-efficient (D_e) versus the inverse absolute temperature on semi-logarithmic co-ordinates would lead to the evaluation of activation energy for diffusion of moisture during drying and activation energy was calculated by non-linear regression analysis.

2.7 OSMOTIC DEHYDRATION

Ginger were washed and sliced into 3, 5 and 7 mm thickness and initial moisture content was determined by oven drying method. Each slice were weighed and subsequently individually marked by using different coloured threads. Pieces were immersed into 40%, 50%, 60% sucrose and 45/15%, 50/10% and 55/5% sucrose-salt solutions at room temperature (25^{o}C) for different period of times, such as ½ hr, 1 hr, 2 hr, 4 hr , 6 hr. After the end of each definite time interval the slices were removed and quickly rinsed in water. Subsequently, surface water was removed by gently blotting with tissue-paper. The ratio of sugar to ginger slices was 5:1 w/w.

After weighing the slices at definite time interval, moisture content of each individual sample was determined by oven drying method. From the weight loss due to osmotic dehydration of each sample, percentage of water loss (%WL) solid gain (%SG), total solids (%TS) and Normalized solid content (NSC) were determined according to the standard formula reported by Hawkes and Flink (1978) [7].

The osmosed and nonosmosed ginger slices were placed in trays in single layer and drying was started in the cabinet dryer at 60^{o}C. Weight loss was gravimetrically determined to measure the extent of drying.

3 RESULTS AND DISCUSSION

In a mechanical dryer, 5 mm thick ginger slices were dried at three different air dry bulb temperatures at constant air flow and relative humidity to find the effect of temperature on drying time and another experiment was conducted to find the effects of thickness (such as 3, 5 and 7 mm thick) of ginger slices on drying time, when temperature and other conditions were kept constant.

3.1 EFFECT OF TEMPERATURE ON DRYING TIME OF GINGER SLICES

To determine the influence of temperature of drying time, 5 mm thick ginger slices were dried in a mechanical drier using three different air-dry bulb temperatures (52^{0}C, 60^{0}C and 68^{0}C). The experimental data were analyzed using equation (iv) and plots of moisture ratio versus drying time were made on semi-log co-ordinate and the regression lines were drawn. Accordingly, the following equations were developed:

$MR = 0.9943e^{-0.1467t}$ (for 52^{0}C; t=hr) (1)

$MR = 1.0538e^{-0.3357t}$ (for 60^{0}C; t=hr) (2)

$MR = 1.0155e^{-0.4493t}$ (for 68^{0}C; t=hr) (3)

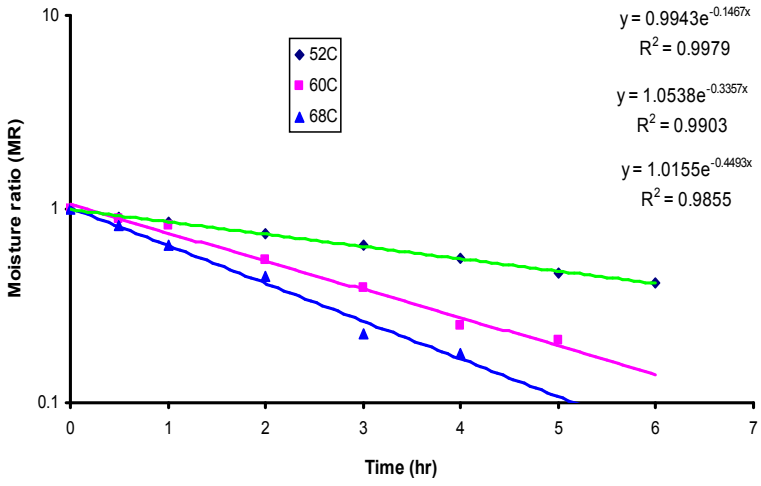


Fig.3.1 Effect of temperature on drying rate of ginger slices

From Fig (3.1) and the developed equation (1 to 3) it is clearly seen that when temperature is increased, drying rate constant is also increased. The drying time to a specific moisture ratio was decreased with the increase in drying temperature at constant sample thickness. As a result drying rate constant increased with increasing temperature. It was also noticeable that for a specific moisture ratio, the least drying time was achieved at 68^{o} C, followed by 60°C, while the highest drying time was required at 52°C to dry 5 mm onion slice. The results are in agreement with Islam (1980) [10].

From the drying rate constant, the diffusion co-effcients were calculated. By plotting diffusion co-efficient (D_e) versus inverse absolute temperature ($1/T_{abs}$) in a semi-log scale (as per equation vi) a regression line was drawn (Fig 3.2). The equation of the straight line can be represented as (Fig. 3.2).

From the slope of the resultant straight line, activation energy (E_a) for diffusion of water for ginger was calculated and found to be 15.868 Kcal/g-mole.

Islam (198O) [10] found 7.7 Kcal/g-mole of activation energy for diffusion of water from potato and Uddin and Islam (1985) [19] found 8.4 Kcal/g-mole for pineapple. Babu *et al.* (1997) [2], however, found higher activation energy (26.83 Kcal/g-mole) for diffusion of water from onion. These differences in activation energy value from product to product are attributed due to product characteristics and process parameters as noted by Villota and Hawkes (1992) [21]. The dependence of diffusion coefficient on absolute temperature can be represented as:

$$D_e=5E + 07\ e^{-7985.9\ 1/T_{abs}} \qquad (4)$$

Where, D_e=Diffusion coefficient (cm^2/s), T_{abs}= Absolute temperature

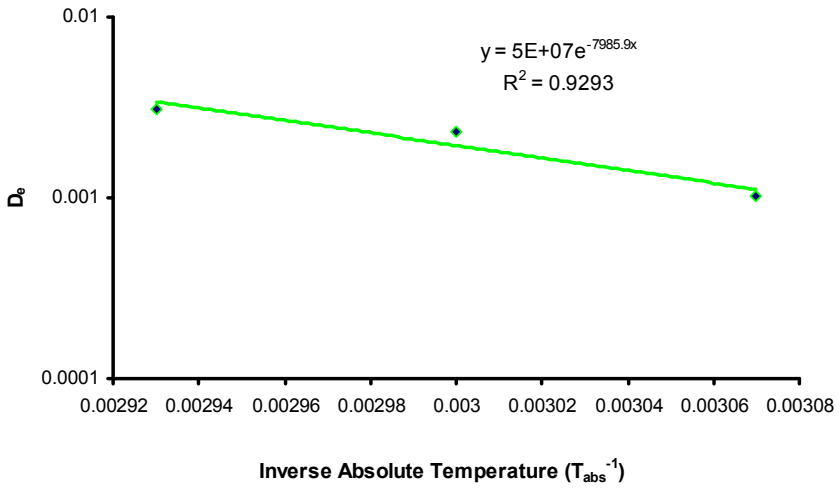


Fig.3.2 Effect of temperature on diffusion coefficient of ginger slices

3.2 EFFECT OF THICKNESS ON DRYING TIME

To investigate the influence of thickness on drying behavior 3, 5 and 7 mm slices were dried at a constant air dry bulb temperature (60^{0}C) and at constant air velocity in a cabinet dryer. The results were analyzed by using equation (iv) and moisture ratio (MR) versus drying time (hr) was plotted on a semi-log graph paper and regression lines were drawn (Fig 3.3). For the three different thicknesses of samples, the following regression equations were developed:

These are:

$MR=1.0124e^{-0.5512t}$ (for 3mm; t=hr) (5)

$MR=1.0538e^{-0.3357t}$ (for 5mm; t=hr) (6)

$MR=1.0425e^{-0.315t}$ (for 7mm; t=hr) (7)

The effect of different slice thicknesses on drying time is shown in Fig. 3.3 for ginger. The drying process took place in the falling rate period and no constant rate period was observed from the drying curves. From Fig 3.3 it was also observed that thickness had profound influence on drying time and as the thickness of the samples increased, the drying time to a specific

moisture ratio also increased with resultant decrease in drying rate constant. It is also noticed that for a specific moisture ratio 3 mm thick slice required the least time, followed by 5 mm thick slice, while the highest time is required to dry 7mm thick ginger slice.

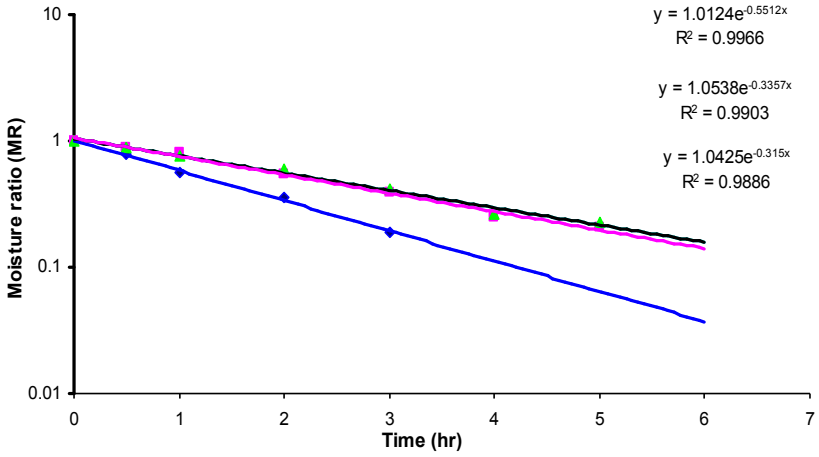


Fig.3.3 Effect of thickness on drying rate of ginger slices

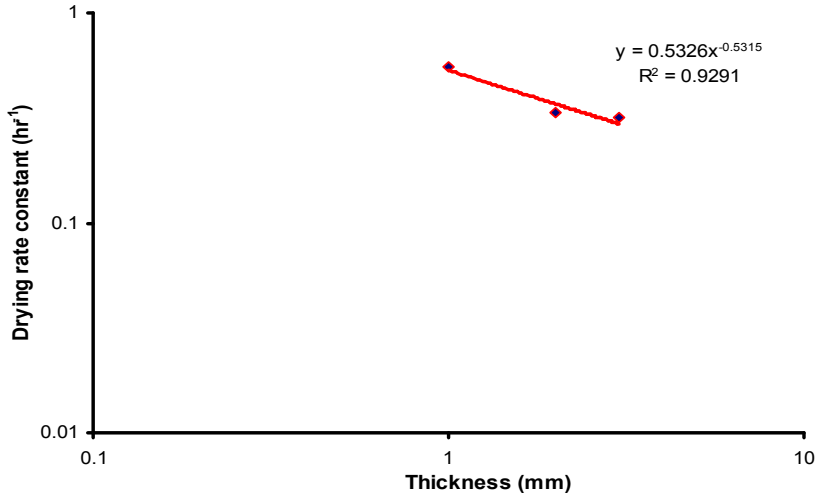


Fig.3.4 Effect of thickness on drying rate constant of ginger slices

The relationship between sample thickness and drying rate constant can be represented by power law equation as follows (Fig. 3.4).

$$m=0.5326L^{-0.5315} \quad (8)$$

Where,

m= Drying rate constant (hr^{-1})

L= Sample thickness (mm)

From equation 8, it is seen that the value of the index 'n' for ginger is 0.5315. This value is quite lower than 2 as predicted by Fick's unsteady state equation (iii) indicating that the external resistance to mass transfer was highly significant and internal resistance to mass transfer did not control the drying process under the given conditions. This conditions resulted primarily due to low airflow rate (<1 m/s), since similar samples did not indicate the presence of external mass transfer resistance under conditions of high air velocity (>2 m/s) as noted by Islam and Flink (1982 b). Islam (2003) found an n value of 1.57 for mechanical drying of indigenous varitey of onion and Hai (2002) found 0.49 for banana using similar air velocity (0.6m/s).

Table 1. Different drying parameter of mechanical drying system

Drying method	Sample thickness (mm)	Temperature (^{0}C)	Slope (hr)	Diffusion coefficient (D_e) cm^2/sec	Value of exponent (n value)	Activation energy (kcal/g-mole)
Mechanical	5	52	0.1467	$1.02x10^{-6}$		15.868
		60	0.3357	$2.33x10^{-6}$		
		68	0.4493	$3.12x10^{-6}$		
Mechanical	3	60	0.5512	$1.38x10^{-6}$	0.5315	
	5		0.3357	$2.33x10^{-6}$		
	7		0.315	$4.29x10^{-6}$		

3.3 OSMOTIC DEHYDRATION

The experiment is concerned with evaluation of osmotic concentration behavior of ginger measured by mass transfer parameters (influenced by type of solute (s), concentration of solute(s), immersion time). More specifically, the investigations include effect of solution concentration and time on percent water loss (WL), percent solid gain (SG) and normalized solid content (NSC) using different concentration of sucrose or salt alone or combined sucrose/salt solution on the basis of cost of solutes, their quality, availability at local market and organoleptic compatibility. Several authors ([9], [10], [15] [5]) indicated that 4 to 8 hrs osmotic time might be regarded as optimum time. It was, therefore, decided that minimum osmosis time would be 6 hours.

3.4 EFFECT OF SOLUTION (SUCROSE) CONCENTRATION AND TIME IN MOISTURE CONTENT OF GINGER SLICES

Effect of sucrose solution concentration (40, 50 and 60%) and sucrose-salt solution (45/15, 50/10 and 55/5%) on moisture content, percent water loss, solid gain and NSC at different time of 5 mm thick ginger slices is shown in Fig. 3.5 to 3.11. It was observed from Fig. 3.5 that 60% sucrose solution was the most effective among the solutions such as 40% and 50% sucrose solution when compared at the same immersion time interval. The result also showed that the higher the immersion time, the lower was the moisture content. As solution concentration increased osmotic pressure gradient also increased and thus resulted in more water loss as well as solute gain with resultant increase in solid concentration in the product. Higher solid concentration gave lower moisture content within osmosed sample as noted by Islam (1980) [10].

The result of another experiment for sucrose-salt solution (45/15, 50/10 and 55/5%) is shown in Fig. 3.6. It is seen from Fig. 3-6 that 55/5% sucrose/salt solution was the most accepted among the solutions tested when compared at the same immersion time interval. The result also showed that the higher the immersion time, the lower was the moisture content.

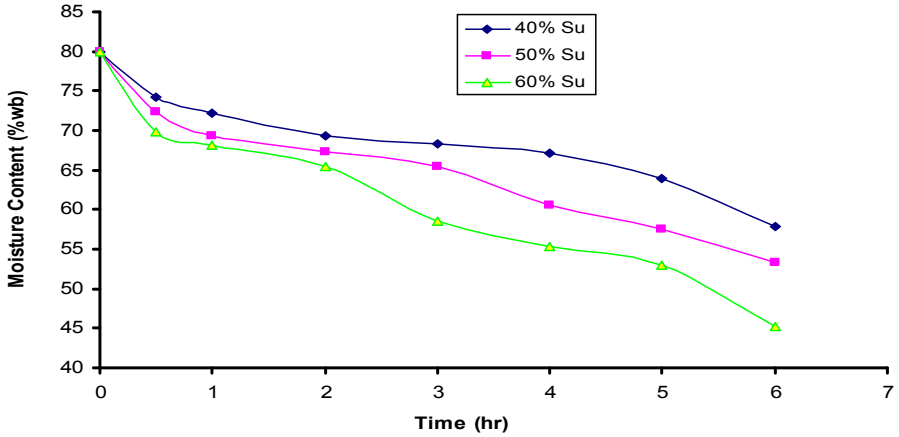


Fig.3.5 Change of moisture content of ginger slices with time in different sucrose solution

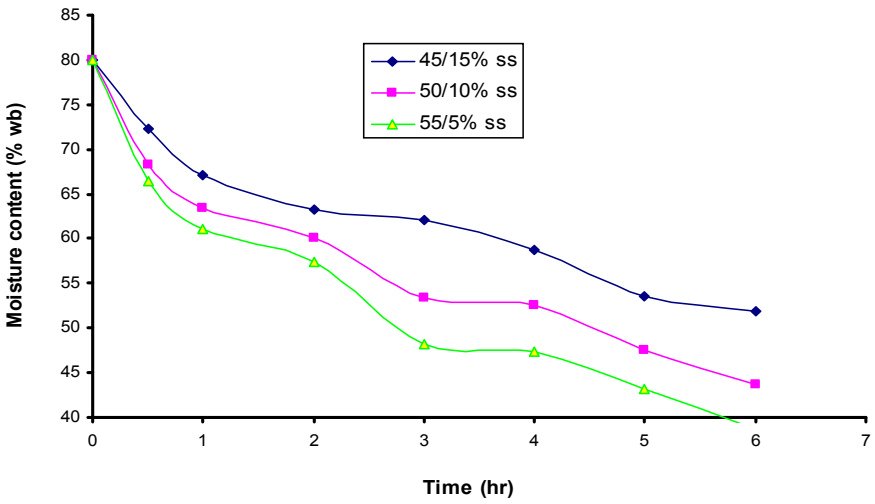


Fig.3.6 Change of moisture content of ginger slices with time in different sucrose/salt solution

3.5 Effect Of Sucrose Solution Concentration And Time On Percent Water Loss And Percent Solid Gain

Effect of sucrose solution concentration (40, 50 and 60%) on percent water loss and solid gain at different time of 5 mm thick ginger slices is shown in Fig.3.7. It is seen from the figure that as percent sucrose concentration increased, the percent water loss is (WL) also increased. Simultaneously, percent solid gain (SG) increased with increasing percent sucrose concentration but comparatively %WL is quite higher than % SG at the similar concentration of sucrose. It is also seen that the %WL and % SG also increased with increasing immersion time at similar concentration. This behavior is in agreement with Islam and Flink, (1982); Hawkes and Flink, (1978) ([11], [7]). Fig.3.8 showed similar behavior of solution concentration with water loss and solid gain for combined sucrose and/or salt solutions.

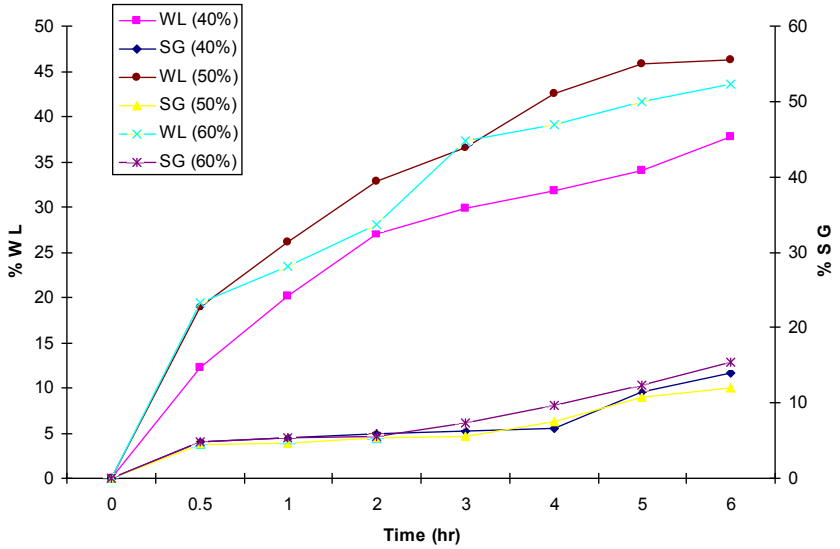


Fig.3.7 Water loss and solid gain of ginger slices with time in different concentration sucrose solution

In this study it is also observed that %WL and % SG and thus also NSC increased with increase in concentration of solute. This is supposed since the solute and water activity gradient increased with increasing solute concentration. Several other researchers ([11], [7], [9]) also showed that increase in concentration of sucrose gave increased amount of water loss and solid gain.

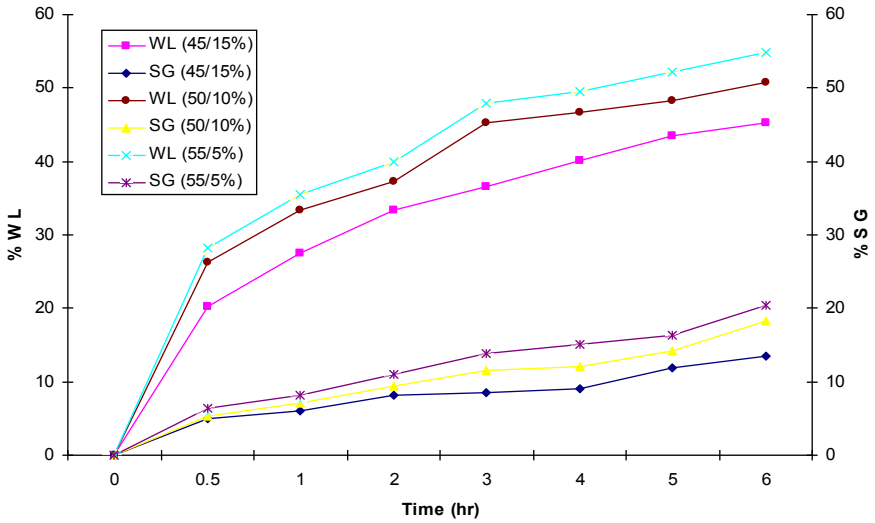


Fig.3.8 Water loss and solid gain of ginger slices with time in different concentration sucrose/salt solution

The results from Fig. 3.7, 3.8, 3.9, 3.10 and 3.11, showed that for total similar solution concentration, %WL was nearly the same for sucrose or sucrose and salt solution, while % SG was quite high for sucrose/salt solution, thus NSC also increased when compared with similar concentration of sucrose. As for example, 60% sucrose osmosed sample for 6 hrs gave 52.24% WL, 15.38% SG and 2.88 NSC and of 55/5% sucrose/salt sample osmosed for 6 hrs gave 54.86% WL, 20.35% SG and 3.11 NSC. A simple calculation showed that for 55/5% sucrose/salt osmosed ginger gave 1.06 times higher %WL, 1.31 times higher %SG and 1.12 times higher NSC than those of 60% sucrose osmosed product.

3.6 Effect Of Sucrose Solution Concentration On Normalized Solid Content (NSC)

To find out the effect of solution concentration on NSC, experiments were conducted with 40, 50 and 60% sucrose solution for periods of ½, 1, 2, 3, 4, 5 and 6 hrs and data were analyzed as per method of Hawkes and Flink (1978) [7]. NSC data versus concentrations were plotted and shown in Fig.3.7. It is observed that increase in sucrose concentration gave increased NSC and a linear relationship was obtained:

NSC = 0.034C+0.8267 (For 6 hrs, C = sucrose concentration) (9)

From the above equation it is indicated that higher concentration of sucrose in osmosis solution gave increased NSC at a given time. It is obviously understandable since the higher the concentration, the higher is solute and water activity gradient ([10], [12], [7]).

The45/15, 50/10 and 55/5% 45/15, 50/10 and 55/5% sucrose/salt osmosed ginger showed that increased sucrose concentration in the combined 60% sucrose/salt solution gave increased NSC (Fig.3.9). The highest NSC was given by 55/5% sucrose in the combined sucrose/salt solution was linear.

The relationship is NSC = 0.26 C +2.42 (For 6 hrs. C = sucrose/salt concentration) (10)

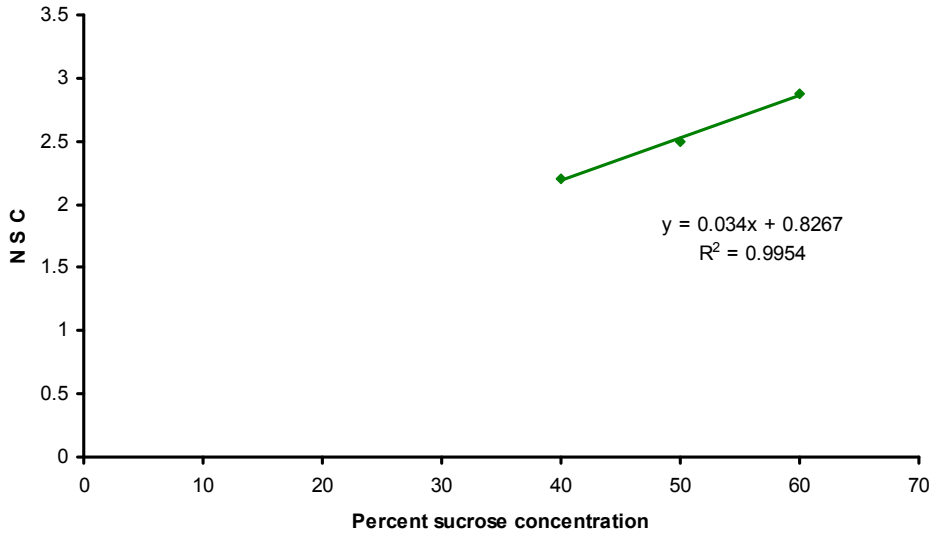


Fig.3.9 Effect of sucrose solution concentration on NSC of ginger slices

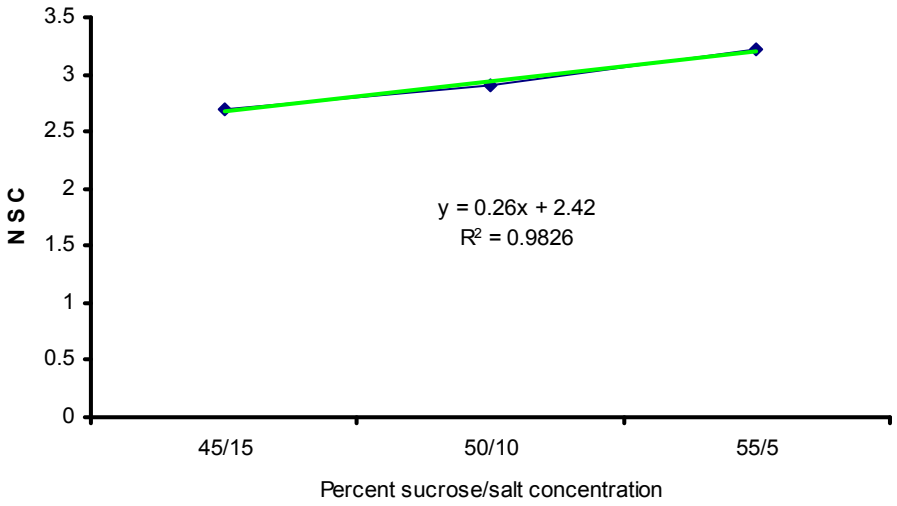


Fig. 3.10 Effect of sucrose/salt solution concentration on NSC of ginger slices

Uddin (2001) [20] also found that the highest NSC was given by 55/5% sucrose/salt solution compared to 45/15% sucrose/salt and 50/10% sucrose/salt osmosed papaya. But this behavour is inconsistent to earlier findings by Islam (1980) [10] who found that 45/15% sucrose/salt osmosed potato gave the highest NSC (3.94) as compared to 50/10% sucrose/salt osmosed potato who mentioned that increased salt in combined sucrose/salt solution of same total concentration results in increased molar concentration with resultant increased NSC. The differences of the NSC may be attributed to product's structure, texture and constituents as well as solute's characteristics ([10], [2]).

3.7 KINETICS OF OSMOTIC DEHYDRATION

From Fig.3.11, it is found that at constant solution concentration increase in immersion time gave increased normalized solid content. The relationship of NSC with square root of time for 60% sucrose and 55/5% sucrose/salt osmosed ginger are;

$NSC = 0.0999\sqrt{t} + 0.8886$, where t is in minute (11)

$$NSC = 0.1096 \sqrt{t} + 1.0875 \quad (12)$$

The relationship between NSC and time has been derived from theoretical consideration (Fick's diffusion equation) and is justified since osmotic dehydration is a two-way diffusion process and diffusional concentration is time dependent ([12], [7]).

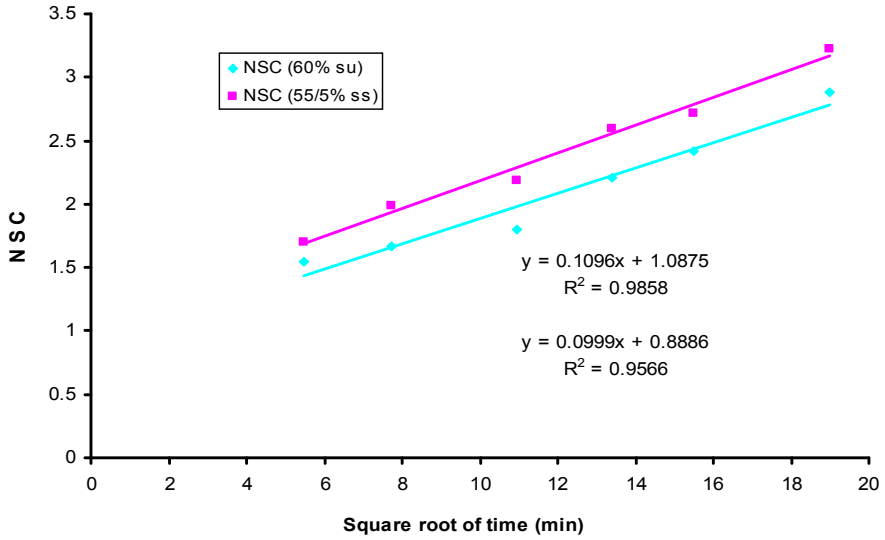


Fig.3.11 Effect of square root of time on normalized solid content for 60%sucrose & 55/5%sucrose/salt solution

From regression equation 11, it was seen that the mass transfer value (K-value) were 0.0999 and 0.1096 for 60% sucrose osmosed and 55/5% sucrose/salt osmosed respectively. It is remarkable that K-value is higher for 55/5% sucrose/salt solution is more effective than 60% sucrose/salt osmosed product due to higher molar concentration of 55/5% sucrose/salt osmosed product.

4 CONCLUSION

The rate of drying depends on air velocity, temperature, thickness etc. Drying time of ginger to a specific moisture ratio (eg. MR=0.1) increases with increase in sample thickness, while the rate constant has a power law relationship with thickness and the value of index of the equation is quite below 2 indicating presence of significant external resistance to mass transfer and increased airflow resulted in higher drying rate. Among 6 different solution concentration/types tested, the three top most solutions concentrations/types are 55/5 sugar-salt, 50/10 sugar-salt, and 60% sugar giving 3.22, 2.90 and 2.88 NSC for 6hr osmosis; though higher NSC is desirable for higher product throughput, the %WL and %SG could be crucial in the choice of solute type concentration with respect to stability related to depression of a_w taste and cost of solute(s). The developed equations based on Fick's law for different solution concentration/types, thickness of ginger slices and solution temperature and Arrhenius equations together with data on %SG and %WL could be advantagegeously used to develop cost-effective, good quality dehydrated ginger by using mechanical dryer as osmotic dehydration alone does not result in shelf stable product

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Savings Determinants of Moroccan banks: A cointegration modeling approach

El Mehdi Ferrouhi and Abderrassoul Lehadiri

Mohammed V Agdal University,
Faculty of law and economics, Rabat, Morocco

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ABSTRACT: The present paper examines the existence or not of long run relationship between bank-specific and macroeconomic variables and savings in Moroccan banks using cointegration approach and aims to identify the determinants of Moroccan banks' savings. We first use Augmented Dickey Fuller (DICKEY and FULLER, 1979) test and PHILLIPS-PERON (PP) unit root test to test the stationary. As all the variables are integrated of the order 1, we apply JOHANSEN JUSELIUS cointegration test to test the cointagration and to evaluate the existence of long-run relationship between the variables. The presence of cointegration between deposits and others variables provide evidence that these variables share a long-run relationship. Therefore, it concludes that there is a long run equilibrium governing the relationship among the variables.

KEYWORDS: Savings, Moroccan banks, cointegration modeling approach.

1 INTRODUCTION

Saving is defined as the excess of income over consumption, naturally follows (KEYNES, 2006). Thus, as the main activity of banks is to receive deposits from agents in excess of funds (and lend money to agents in need), deposits are the main and major source of funds for banks.

KEYNES defined three motives why people hold money: transactions, precautionary and investment motives. The author lists eight motives which lead individuals to refrain from spending out of their incomes and thus to save: to build up a reserve against unforeseen contingencies; to provide for an anticipated future relationship between the income and the needs of the individual; to enjoy interest and appreciation; to enjoy gradually increasing expenditure; to enjoy a sense of independence and the power to do things, though without a clear idea or definite intention of specific action; to secure a *masse de manœuvre* to carry out speculative or business projects; to bequeath a fortune and finally, to satisfy pure miserliness, i.e., unreasonable but insistent inhibitions against acts of expenditure as such. BROWNING and LUSARDI (1996) add to this list another motive which is the accumulation of deposits to buy houses, cars and other durables.

The aim of the present paper is to identify the determinants of Moroccan banks' savings and to examine the existence or not of long run relationship between bank-specific and macroeconomic variables and savings in Moroccan banks using cointegration approach.

The paper is organized as follows. In section 2, we review the existing literature on bank's determinants of savings. Methodology adopted and data used are presented in section 3 while results obtained are presented in section 4. Finally, section 5 offers conclusions.

2 LITERATURE REVIEW

The main studies on determinants of savings in banks were conducted by LAMBERT and HOSELITZ (1963), JUSTER and WACHTEL (1972), WILLIAMS and DEFRIS (1981), DOSHI (1994), MASSON et al. (1998), CARDEAS and ESCOBAR (1998), LOAYZA and SHAKAR (2000), LOAYZA et al. (2000), SARANTIS and STEWART (2001), AGRAWAL (2001), KIIZA and PEDERSON (2001), ROSENZWEIF (2001), ATHUKORALA and SEN (2003), DADZIE et al. (2003), OZCAN et al. (2003), ATHUKORALA and TSAI (2003),

COHN and KOLLURI (2003), HONDROYIANNIES (2004), HARALD and HEIKO (2009), ORJI (2012), KANJ and EL KHOURY (2013), BECKMANN et al. (2013), ROHMAH (2006), ZAINOL and KASIM (2010).

Thus, LAMBERT and HOSELITZ (1963) reviewed different works on savings behavior Ceylo (now Sri Lanka), Hong Kong, Malaya (now Malaysia), Pakistan, India, Philippines and Vietnam. JUSTER and WACHTEL (1972) analyzed US households savings. They found that unanticipated inflation tend to increase households saving while fully anticipated inflation is tend to decrease it. In Australia, WILLIAMS and DEFRIS (1981) found that households' consumption is significantly affected by inflation, unemployment, general consumer sentiment and perceived seriousness of inflation. DOSHI (1994) examined the effect of population growth and productivity growth on savings in 129 countries. The author found that savings are positively correlated with life expectancy in less developed countries and the inverse relationship was recorded for the high-income countries. MASSON et al. (1998) examined the determinants of private savings behavior of industrial and developing countries and found that demographic factors were important in determining the saving rates. They also found that GDP growth, real interest rate, and changes in the term of trades were positively correlated to saving. The level of foreign savings was found to have an inverse relationship with savings in the developing countries. CARDEAS and ESCOBAR (1998) studied the savings behavior in Colombia and found that higher government expenditure led to the decreasing national savings; that saving and investment were perfectly correlated and savings caused growth; and that higher taxation, urbanization and age dependency had negative effect on savings. LOAYZA and SHAKAR (2000) used cointegration approach to measure the relationship between savings in India. They found that real interest rate, per capita income and the share of agriculture in gross domestic product GDP had a positive relationship with savings while financial development, inflation and dependency ratio had a negative relationship with savings. LOAYZA et al. (2000) examined the effects of policy and non-policy variables on savings. They found that private saving rates are highly serially correlated; that positive saving rates with the level and growth rate of real per capita income and the influence of income are larger in developing than in developed countries and that inflation had a positive impact on savings. SARANTIS and STEWART (2001) studied the savings behavior in OECD. They found that government deficit does not increase savings. AGRAWAL (2001) studied the relationship between saving and growth in seven Asian countries (South Korea, Taiwan, Singapore, Malaysia, Thailand, Indonesia, and India) and found that both high rate of growth of income per capita, and the rapidly declining age dependency ratio contributed to the high rate of saving in the studied countries. Interest rate was found to be positively correlated with savings for Malaysia and Thailand and negative for Indonesia. KIIZA and PEDERSON (2001) studied determinants of savings in Uganda. They found that the availability of information, the accessibility of the saving facilities, level of education of the head of the household and the density of financial institution could influence customers to start savings while the availability of credit facilities, lower transaction costs, and higher permanent income were positively correlated to savings level. ROSENZWEIF (2001) studied the savings behavior of household in Thailand and found that the inefficient savings facility had influence the level of saving among farmers and the life-cycle model was not applicable to this group. ATHUKORALA and SEN (2003) found that rate of growth, real interest rate on bank deposits, spread of banking facilities and inflation were positively correlated with savings. DADZIE et al. (2003) studied determinants of savings in Ghana. They found that level of income, customer satisfaction, service quality and demographic factors such as number of dependents and location were positively correlated with the level of savings while age and formal education variables were found to be insignificant in explaining the level of personal savings. OZCAN et al. (2003) studied the determinant of private savings behavior in Turkey and found that income level, financial depth and measures, inflation were positively correlated to savings. ATHUKORALA and TSAI (2003) found that income growth, aging of the population; changes in social security contributions and the availability of credit were significant determinants of saving performance. While interest rate had a significant positive impact, inflation seems to have a negative impact on savings. COHN and KOLLURI (2003) examined the long run relationship between per capita households saving and the real rate of interest, government savings and social security contributions. They found that savings are positively correlated to interest rate, but negatively to government savings and social security contributions. HONDROYIANNIES (2004) used cointegration approach in estimating the behavior of Greece households. He found that, in the long run, savings function is sensitive to fertility changes, old dependency ratio, real interest rate, liquidity and public finance. HARALD and HEIKO (2009) examine the demand for commercial bank deposits in Lebanon using Impulse response functions and variance decomposition analyses. They found that Domestic factors such as economic activity, prices, and the interest differential between the Lebanese pound and the U.S. dollar are significant in explaining deposit demand, as are external factors such as advanced economy economic and financial conditions and variables proxying the availability of funds from the Gulf while bank-specific variables, such as the perceived riskiness of individual banks, their liquidity buffers, loan exposure, and interest margins, bear a significant influence on the demand for deposits. ORJI (2012) studied the determinants of bank savings in Nigeria and the impact of bank savings and bank credits on Nigeria's economic growth from 1970-2006 using Distributed Lag-Error Correction Model and Distributed Model. He found that values of GDP per capita, Financial Deepening and Interest Rate Spread had a positive impact o size of private domestic savings while Real Interest Rate and Inflation Rate had a negative impact KANJ and EL KHOURY (2013) investigates the main determinants of non-residents deposits in Lebanese

commercial banks using monthly time series data covering January 2002 to January 2013. They found that non-residents' deposits are shaped differently between domestic and foreign currency. For instance, bank assets, interest rates, and some adverse political situations affect non-resident deposits in all its measures. BECKMANN et *al.* (2013) uses data from the Euro Survey of the Oesterreichische Nationalbank for ten Central, Eastern and Southeastern European countries to analyze the saving behavior of CESEE households between 2010 and 2011. They found that age as well as education and income had a positive impact on savings.

The main studies on determinants of savings using long run cointegration in Islamic banks were conducted by ROHMAH (2006), ZAINOL and KASIM (2010). Thus, ROHMAH used autoregressive distributed lag approach in Indonesia. The author found long run cointegration between Islamic bank deposits with Islamic and conventional rate of return on deposit, level of income and number of Islamic banks' branches. ZAINOL and KASIM examined the determinants of rate of return and total deposits in Islamic banking. They found that Islamic banks' rate of return and conventional banks' interest rate are cointegrated and have a long-run equilibrium.

3 METHODOLOGY

As presented above, the present paper aims to identify the determinants of Moroccan banks' savings and to examine the existence or not of long run relationship between bank-specific and macroeconomic variables and savings in Moroccan banks.

To do this, we first begin by the definition of dependant and explanatory variables. Based on the literature above and on data available, we select banks savings as the dependant variable and bank-specific and macroeconomic variables as explanatory ones. Bank-specific variables are logarithm of the total assets of the bank LAGA to measure the size of banks; external funding to total liabilities EFL; equity to total assets ETA; while macroeconomic variables are: growth rate of gross domestic product GDP and foreign direct investment FDI.

Since various authors provide the use of cointegration to measure the relationship between savings and other independent variables (LOAYZA and SHAKER 2000, HONDROYIANNIES 2004, ROHMAH 2006, ZAINOL and KASIM 2010…), and as the aim of the present study is to examine the existence or not of long run relationship between bank-specific and macroeconomic variables and savings in Moroccan banks, we use cointegration approach.

The concept of cointegration was first introduced by Granger (1983, 1986) and then developed by Engle and Granger (1987). The existence of cointegration relationship, between two variables or more, means that these variables are do not drift too much apart and they are long run correlate… even though the series themselves may contain stochastic trends (non-stationary) (RIFKI, 2013). However, the linear combination of these variables (individually non stationary) may be stationary (DICKEY, 1991).

To conduct cointegration test, we first begin with unit root test. We use Augmented Dickey Fuller (DICKEY and FULLER, 1979) test and PHILLIPS-PERON (PP) unit root test to test the stationary. All the variables must be integrated at the same order. We apply then JOHANSEN JUSELIUS cointegration test to test the cointagration and to evaluate the existence of long-run relationship between the variables. JOHANSEN test was developed by JOHANSEN (1988) and JOHANSEN and JUSELIUS (1990). The JJ test is a multivariate cointegration test which can test the presence of multiple cointegrating vectors.

The data used in this paper are obtained from annual reports and annual financial statements of the commercial Moroccan banks for the period 2001-2012 and from databases of the World Bank, the International Monetary Fund and the Moroccan High Commission for Planning. Our study concerns Moroccan commercial banks, thus we have listed the various existing banks in Morocco in the last decade during a minimum of seven years to capture the effects of the financial crisis. We then selected banks that have existed throughout the study period and whose financial statements are available. We obtained eight banks which are the largest Moroccan banks.

4 RESULTS

As presented above, Augmented Dickey Fuller test and Phillips-Peron (PP) unit root test are conducted to test the stationary of time series. All the variables have unit root at level, they are not stationary at level but when convert them to first difference, they become stationary. All the variables must be integrated at the same order so we can run JOHANSEN JULISIUS test. Table 1 presents results of those tests. We remark that, using AUGMENTED DICKEY-FULLER and PHILLIPS-PERRON tests, all variables (deposits, logarithm of the total assets of the bank, external funding to total liabilities, equity to total assets, growth rate of gross domestic product and foreign direct investment) are non stationary at levels and stationary in the first difference (statistically representative at 5% level for deposits, logarithm of the total assets of the bank, external

funding to total liabilities, equity to total assets, growth rate of gross domestic product and at 10% for foreign direct investment). We conclude that these variables are integrated of the order 1 I(1).

Results obtained after the application of Augmented Dickey Fuller test and Phillips-Peron (PP) unit root test allow proceeding to JJ test. Thus, since the cointegration test is sensitive to the lag structure of VAR model, optimal lag length needs to be determined before conducting the test. Based on the Schwarz Criterion test, lag 1 is suggested as the optimal lag length (KASRI and KASSIM, 2009). In order to determine the vector autoregressive lag order, AIC and SC are used. The optimal lag length for deposits is 2.

Table 2 presents results obtained using JOHANSEN-JUSELIUS cointegration test. Two cointegrating vectors in Trace statistics are shown by the fact that 191,7717 and 100,3713 are respectively greater than 95,75366 and 69,81889 (5 percent critical value). Similarly two coitegrating vectors in Max-Eigenvalue are shown by the fact that 91,40041 and 56,11137 are respectively greater than 40,07757 and 33,87687 (5 percent critical value). These mean that deposits and its determinants namely logarithm of the total assets of the bank LAGA to measure the size of banks; external funding to total liabilities EFL; equity to total assets ETA; while macroeconomic variables are: growth rate of gross domestic product GDP and foreign direct investment FDI are found to be cointegrated. In short, the presence of cointegration between deposits and others variables provide evidence that these variables share a long-run relationship. Therefore, it concludes that there is a long run equilibrium governing the relationship among the variables.

Table 1: Unit root (ADF and PP) tests

Variable	ADF TEST		PP TEST	
	At level	1st difference	At level	1st difference
DEPOSITS	-1,32	-2,11*	-1,55	-2,26*
LAGA	-1,83	-3,20**	-1,83	-3,20**
EFL	-2,82	-2,79*	-2,24	-2,98*
ETA	-3,09	-4,19*	-3,09	-4,19*
GDP	-6,00	-4,67*	-6,00	-6,65*
FDI	-2,65	-4,77*	-2,65	-4,77*

*Variable statistically representative at the: * 5% level, **10% level*

Table 2: JOHANSEN-JUSELIUS cointegration test

Hypothesized No. of CE(s)	Trace statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
None*	191,7717	95,75366	91,40041	40,07757
At most 1*	100,3713	69,81889	56,11137	33,87687
At most 2	44,25994	47,85613	25,59350	27,58434
At most 3	18,66643	29,79707	13,29330	21,13162
At most 4	5,373137	15,49471	4,665772	14,26460
At most 5	0,707365	3,841466	0,707365	3,841466

5 CONCLUSION

The present paper aims to identify the determinants of Moroccan banks' savings and to examine the existence or not of long run relationship between bank-specific and macroeconomic variables and savings in Moroccan banks using cointegration approach.

Based on the literature review and on data available, we select banks savings as the dependant variable and bank-specific and macroeconomic variables as explanatory ones. Bank-specific variables are logarithm of the total assets of the bank LAGA to measure the size of banks; external funding to total liabilities EFL; equity to total assets ETA; while macroeconomic variables are: growth rate of gross domestic product GDP and foreign direct investment FDI.

To conduct cointegration test, we first begin with unit root test. We use Augmented Dickey Fuller test and PHILLIPS-PERON unit root test to test the stationary. As all the variables are integrated of the order 1, we apply JOHANSEN JUSELIUS cointegration test to test the cointagration and to evaluate the existence of long-run relationship between the variables. The presence of cointegration between deposits and others variables provide evidence that these variables share a long-run relationship. Therefore, it concludes that there is a long run equilibrium governing the relationship among the variables.

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Studies on the Development and Evaluation of Cereal Based Highly Nutritive Supplementary Food for Young Children

Rashida Parvin[1], Mohammed A. Satter[2], Syeda Absha Jabin[2], Nusrat Abedin[2], Faridul Islam[2], M. Kamruzzaman[3], and Dipak Kumar Paul[3]

[1]Department of Applied Food Science and Technology, Chittagong Veterinary and Animal Science University, Khulshi, Chittagong-4225, Bangladesh

[2]Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dr. Qudrat-E-Khuda Road, Dhanmondi, Dhaka -1205, Bangladesh

[3]Department of Applied Nutrition and Food Technology, Islamic University, Kushtia-7003, Bangladesh

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ABSTRACT: Early weaning practices are one of the most important causes of malnutrition of children which ultimately increase the chance of infant morbidity and mortality. The present study was carried out to develop cereal based supplementary food from indigenous raw materials for young children and to evaluate nutritional quality. The formulated baby food was produced from soy flour and wheat flour and was analyzed for their chemical, functional, microbiological and sensory qualities using standard methods. Moisture, Ash, Protein, Fat and Crude Fiber content was found 2.78%, 1.88%, 11.91%, 8.61% and 0.58% respectively, which was able to meet the young children's recommended daily allowances. The values of functional properties such as water absorption capacity 156.35%, bulk density 0.50%, solubility 47.913%, swelling power 12.16% and viscosity 34.4% were found. The microbial analysis was done to see the acceptability of the product and the result was good from the microbiological point of view. The main metal content of the formulated baby food such as sodium, potassium, iron, magnesium, zinc and calcium were 224.4, 280, 8.0, 5.1 and 453.4 (mg/100g) respectively and Vitamin A was found 200µg/100gm. The heavy metal content of the formulated weaning food was found below the detectable level. On the basis of results pertaining to chemical and functional properties of the formulated baby food, the nutrient content was sufficient to meet the infant's basic need. Therefore, the food may support us to maintain a healthier life at a cheap rate which is locally available and help to reduce malnutrition situation in Bangladesh.

KEYWORDS: Cereal; Supplementary food; Formulated baby food; Nutritional quality; Microbiological and sensory qualities

1 INTRODUCTION

Under nutrition is one of the major problems confronting infants and young children in the developing countries. However, at the age of six months and above when the child's birth weight is expected to have doubled, breast milk is no longer sufficient to meet the nutritional needs of the growing infant. Protein energy malnutrition and micronutrient under-nutrition occur together. Millions of children and women suffer from one or more forms of malnutrition including low birth weight, wasting, stunting, underweight, Vitamin A deficiencies, iodine deficiency disorders and anemia. Although recent progress has been made in reducing the incidence of poverty, malnutrition still remains one of the most serious problems in Bangladesh and responsible, directly or indirectly, for about one half of the 343,000 deaths that occur annually among children under five years in Bangladesh. About three-quarters of these deaths, which are often associated with inappropriate feeding practices, occur during the first year of life. Most children between the age 4 months and 2 to 3 years suffer from malnutrition. The reasons behind this fact are generally low incomes, poor sentimental conditions and lack of education (BDHS, 2007 and General Economic Division, Planning Commission, GOB, 2007).

Corresponding Author: Dipak Kumar Paul

Weaning of a child is a gradual process by which an infant is introduced to adult diet. Weaning food is a special formulation, which is a supplement to the breast milk. The composition will be as close as possible to breast milk except for higher calories and protein's values. Breast milk from a well-nourished mother is inadequate to meet nutritional needs of an infant for the first three months of life; therefore, there is need for supplement or weaning food (Unicef, 1998). In view of this nutritional problem, several strategies have been used to formulate baby food (Lalude & Fashakin, 2006; Ijarotimi & Bakare, 2006), through a combination of locally available foods that complement each other in such a way that provide the recommended daily allowance for infants. Guidelines state that an ideal formulated baby food must be nutrient dense, easily digestible, of suitable consistency and affordable to the target market (FAO/WHO, 1989). Therefore, development of supplementary foods based on locally available cereals and legumes has been suggested by the Integrated Child Development Scheme (ICDS) and Food and Agriculture Organization (FAO) to combat malnutrition among mothers and children of low socio-economic groups. Despite all these efforts, it is evident that the formulated supplementary foods currently available are not accessible to many low income mothers due to the high cost of production and non-availability of the food materials used in the formulation (Agbede & Aletor, 2003).

Infant feeding and rearing practices have a major effect on short term and long-term nutritional status of children, as most of under nutrition is associated with faltering practices that occur in weaning period. Faulty feeding practices as well as lack of suitable weaning foods are responsible for under nutrition. Only 42% of infants aged less than six months are exclusively breastfed and almost one-third (29%) of children aged 6-9 months do not receive any solid or semi-solid foods. Complementary foods given to infants and young children in Bangladesh are often nutritionally inadequate and unsafe, leading to malnutrition. Foods from animal sources such as fish, meat and egg are expensive and not commonly given to children. Nutritious complementary foods are therefore introduced - also known as weaning foods - which typically covers the period from six to twenty four months of age in most developing countries. Weaning foods currently manufactured and imported from abroad used to meet the needs of growing children are too costly to be afforded by the majority of the target population in our country. Simpler methods of making weaning foods using diverse and locally available raw materials which could be made available at low cost and able to meet infant's nutritional needs are necessary. The formulated food should have characteristics according to nutritional needs, appropriate textures and viscosity, and appropriate forms (liquid, semisolid, solid) to support mental and physical development.

At present, there are no formulated baby foods manufactured in Bangladesh from locally available food resources. Only a small sector of the community uses imported baby foods. Formulated baby food produced by sophisticated technologies is costly and is not within the reach of rural dwellers and low income earners in the urban cities. In recent years, consumers have become more health conscious in their food choices but have less time to prepare healthful meals. As a result the market demand for "minimally processed" or "lightly processed" foods has rapidly increased. The aim of this study was to develop a cereal based highly nutritive supplementary food for young children of Bangladesh by using available resources and cheap technology. And also to determine the acceptability and to identify microorganisms that were associated with the formulated baby food.

2 MATERIALS AND METHODS

2.1 PREPARATION OF HIGHLY CEREAL BASED INSTANT SUPPLEMENTARY BABY FOOD

A highly nutritive cereal based instant supplementary baby food has been prepared from wheat flour and soy flour at cereal technology section, IFST, BCSIR, Dhaka. Imported foreign commercial baby foods like: Wheat & Milk' (Cerelac 1), and mango, milk & rice' (Cerelac 2), were taken to compare with the formulated baby food. Wheat flour (Maida), Milk Powder, Processed Mango pulps and Processed Soybean flour were used for the preparation of formulated baby food in our laboratory and these ingredients (Maida, Milk powder, Soybean & Mango) were collected from New Market Kacha Bazar, Dhaka. Mango was processed within 1-2 hours of collection to inactivate the enzymatic reaction and various other physical factors effect. Soy bean was processed and prepared by using the laboratory techniques. Wheat flour was also processed before use. Wheat flour was sieving it with a siever to remove foreign particles if any and separate flour for making product. Now store it at cool place to avoid spoilage and used it to make product in future. All the materials were stored at low temperature for being good during the whole experiment time. The ripe mangoes were taken and wastes were removed. The fruit peels were removed and then pulps were blended. The blended fruit pulps were then weighed, heated and when boiled, 25% sugar of weighed juice were added to stop enzymatic reaction during storage. The paste were then cooled and packed in poly bags. These bags were then refrigerated at 4^0C temperature. The healthy and mature soybeans were selected and collected. Soybeans were soaked with 0.5% NaOH solution and after overnight soaking soybean were washed thoroughly to

remove hulls. Then the seed were boiled for 30 min to remove the anti-nutrient factors and then strained and dried in hot air oven at 80^0C. The dried seeds are then grinded into powder and sieved.

2.2 NUTRIENT ANALYSIS

Nutrient analysis was done for prepared sample and for all collected imported samples. Moisture content of collected samples was determined by drying the samples at 105^0 C in a drying oven till a constant weight was attained (AOAC, 1995). Ash content was determined in triplicate using a muffle furnace at 600±2.00°C for 8 h by AOAC method (AOAC, 2000). Total lipid content was also determined by the method of AOAC (2005). Protein content was determined by the AOAC (2005) Kjeldahl method by first determining the percent nitrogen content and then converted to % crude protein by multiplying with the factor 6.25. Crude fiber was determined by Acid-Alkali Hydrolysis as followed AOAC (2005). Total sugar of the prepared and imported sample was determined by Phenol Sulfuric acid method (Dubois *et al.*, 1956, Krishnaveni *et al.*, 1984).). Available carbohydrate content was determined by difference, i.e. by subtracting the sum of the values of moisture, ash, protein and fat from 100 (per 100gm) (AOAC, 2005). Lactose content of milk powder was determined by Gravimetric Method using Fehling's Solution (Official Methods of Analysis, 1998**).** Estimation of milk fat procedure is different from cereal fat estimation procedure. Milk fat content was determined using a Teichert type butyrometer (Molnar and Agh, 1970. Gluten content of the cereal flour was determined by the methods as described by the American Association of Cereal Chemists (AACC, 2000). The energy content of the baby food samples were determined by calculating the amount of protein, fat and carbohydrate of respective food items and by using the following equation (Edeoga, *et al.*).

$$\text{Energy} = (\text{Protein} \times 4.1) + (\text{Fat} \times 9.3) + (\text{Carbohydrate} \times 4.1).$$

2.3 FUNCTIONAL PROPERTIES ANALYSIS

Water binding capacity of baby food was analysed by adding 2 gm of sample along with 4 gm of distilled water in a centrifuge tube. The tube was shaken for I hour and then centrifuge for 15minutes at 2200 rpm. The supernatant was decanted and the percent of water gained was determined (Beuchat 1977). Water absorption capacity of samples was determined by the methods as described by Sathe and Salunkhe (1981). Bulk Density, Solubility and Swelling Power were determined by the methods as reported by Oladele and Ania, 2007). Viscosity of supplementary baby food was measured by a rapid Visco Analyzer, using slurries with 10% solids at 350^C and expressed in meter Meter×Pascal/ second (AACC, 2000).

2.4 VITAMIN AND MINERAL ANALYSIS

2.4.1 DETERMINATION OF VITAMIN-A

Vitamin A found in animals foods as retinol and in plant foods as all-trans-beta-carotene. Vitamin A (Retinol) was determined by high performance liquid chromatography with UV-detection after saponification and extraction (Horwitz W and GW Latimer, 2001). Standards and samples are saponified in basic ethanol-water solution, neutralized, and diluted. This process converts fats to fatty acids, and retinyl esters to retinol and the corresponding fatty acids. Retinol is quantified in an HPLC system, using UV detection at 326 nm. Vitamin A content was then calculated by comparison of peak heights or peak areas of retinol in test samples with those of standards.

2.5 DETERMINATION MINERAL AND HEAVY METAL CONTENT BY AAS

Mineral and heavy metal content of the tested baby foods were analyzed with the use of Flame emission atomic Absorption Spectrophotometer (Model no. Jencons, PEP7) at 589 nm and 769 nm of wavelength respectively (Jackson, 1967 and Gian Carlo *et al.* 2009). 10.0 gm of dry sample (dried at 200^0C) was taken in a porcelain dish and then placed into a muffle furnace and heated at 100^0C, 200^0C, 300^0C, 500^0C for 1 hour each and 600^0C for several hours. After burning, ashes were taken to 250 ml beaker and 50 ml of deionized distilled water and 15 ml concentrated nitric acid was added. Then the samples were returned to a hot plate with continued heating, additional acid (if necessary) was also added until digestion was completed. Then the sample was filtered into a 250 ml volumetric flask and each sample was made up to the mark with deionized water. Standard stock solution of 100 ppm was prepared for every tested mineral and metal. These solutions were prepared from their pure metal turning and pure compound using nitric acid. Working standard and blanks were acidified to the same extent as samples. Standard solution were preserved in clean polyethylene bottle and kept in refrigerator. These standard stock solutions were further used to prepare standard metal ion solution by suitably diluted with deionized water. The atomic absorption instrument was set up and flame condition and absorbance were optimized for analyte. Then blanks,

standards, and samples were aspirated into a flame in AAS. Mineral and heavy metals content were statistically analyzed by constructing a calibration curve (Gian Carlo *et al.* 2009).

2.6 SENSORY EVALUATION OF FORMULATED AND IMPORTED BABY FOOD

The sensory properties of products is usually evaluated and ranked on the basis of scores given by the panel of judges to the product. They like or dislike the various parameters. The food supplemented with wheat flour, soy flour, milk powder and mango were subjected to sensory evaluation for color, flavor, taste, texture and overall acceptability by a panel of trained judges for acceptance or rejection. Before analysis the supplementary food was mixed with warm water in a ratio of 1:3 and stirred slowly and served hot. Samples were presented in succession and panelists were asked to rate evaluation variables according to 9- point Hedonic scale as described by Larmond (1977). The 9-point Hedonic scale was used, where the lowest point 1 = extremely dislike and the highest point 9 = extremely like. The mean squares and the result of the analysis of variance revealed that sensory scores assigned by judges on color, flavor, taste, texture and overall acceptability were found statistically significant.

2.7 MICROBIOLOGICAL ANALYSIS

Microbial examinations of infant formulas were performed to assess Bacterial, Fungal and Yeast load under laboratory condition. Standard plate count, fungal count and enumeration of total Coliform, E. coli and *Staphylococcus aureus ssp* of those baby food samples were also examined. All media and equipment were sterilized by steam Sterilization at 15 psi for 20 minutes at 121^0C in an autoclave. For analysis 10 gm of each sample was aseptically weighted and diluted to 1:10 (10 gm in 90ml) with sterilized distilled water and mixed well. Serial dilutions were prepared and spread plate technique was used on appropriate selective media. Plate count method was employed for the examination of total number of viable microbes present in fish sample. In this method only plates having 30-300 colonies were counted. Standard Plate Count (SPC) was estimated by decimal dilution technique followed by Pour Plate Method and Spread Plate Method for Fungus. Streak Plate method was used to isolate the specific microorganism. In the Pour Plate Method, 0.1 ml and 1ml samples were pipette onto sterilized Petri plates. Sterilized agar medium was cooled to about 45^0C and was poured on the plates. The media was mixed well by a gentle swirling motion. The Petri plates were then allowed to solidify. The plates were incubated at the required temperature for 24-72 hours. In this study for each sample there were 2 Petri plates for 0.1 ml and other 2 for 1ml (Badau *et al*., 1999, Badau *et al*., 2001). For Spread Plate Method approximately 15 ml of previously autoclaved medium was poured in a sterilized Petri plate and was kept at room temperature until the agar was solidified. In Potato Dextrose Agar (PDA) plate 0.2 ml sample was dropped onto a solidified agar plate then the sample was spread on the agar plate with the help of sterilized bent glass rod (spreader). By this method Yeast and Mould counts were determined (Mosupye et al. 1999, Mudgil et al. 2004). In the Streak Plate Method, the media along with microbes were transferred with a narrow headed loop from lactose broth conical flask and from LST tube and dropped with this loop; the streak was done on to the agar plate. The plate was then incubated at the required temperature (37^0C) for 24 to 72 hours. All steps of this media were done under laminar airflow. Isolation and enumeration of total Coliform were performed by MPN method. The Most Probable Number (MPN) method using MacConkey broth (Harrigen and MacCance, 1976) is a statistical, multi-step assay consisting of presumptive, confirmed and completed phases. In the assay, serial dilutions of a sample are inoculated into broth media. From the gas positive (fermentation of lactose) tubes, the other 2 phases of the number of organisms can be estimated from statistical tables. Typically only the first 2 phases were performed in Coliform analysis for *E.coli* **(**Speck, M. L. 1976). Staphylococcus aureus of the food sample was examined according to APHA-1999.

3 RESULTS

3.1 CHEMICAL COMPOSITION OF RAW MATERIALS AND BABY FOODS

The data for chemical composition i.e. moisture, ash, crude protein, crude fat, crude fiber, crude carbohydrate and energy have been presented in the following manner. All the analysis was performed in triplicate and the values are used in average.

3.2 SHELF LIFE OF FORMULATED BABY FOOD

The shelf life of baby food was studied for three months at ambient conditions. No significant changes in ash, crude protein, crude fat, crude carbohydrate, sugar except moisture were observed. All the analysis was performed in triplicate and

the values were given in average (Table 2)**.** The moisture content of the formulated baby food was significantly increased from 2.78 to 3.69 g/100g and carbohydrate also increased from 74.39 to 76.55g/100g. The ash, fat, sugar, dietary fiber and energy value slowly decreased during storage period.

3.3 FUNCTIONAL PROPERTIES OF FORMULATED BABY FOOD

The functional properties of formulated baby food such as water absorption capacity (WAC), bulk density (BD), water binding capacity (WBC), solubility, swelling power and viscosity were analyzed and the results are given in Table 3.

The formulated baby food show the following functional properties such as water absorption capacity, bulk density, water binding capacity, solubility, swelling power and viscosity were 156.35(ml/g), 0.50(g/ml^{-1}), 480.13(g/100g), 47.913(%), 12.16(gg^{-1}) and 34.4 (mp/s) respectively.

3.4 MICRONUTRIENT ANALYSIS OF FORMULATED BABY FOOD

The micronutrient content of formulated baby food such as vitamin, mineral and trace metal e.g. vitamin A, beta carotene, sodium, potassium, iron, magnesium, chromium, cadmium, nickel were analyzed and the result are given in Table 4.

The results indicate that the vitamin A content of formulated baby food was 200µg and the sodium, potassium, iron, magnesium, chromium, cadmium, nickel, zinc, calcium content were 224.4, 280, 8, 5.1, 1.64, 0.1, 7.96, 10 and 453.4 (mg/100g) respectively. Cerelac-1 and Cerelac-2 contain the same amount of Vitamin A such as 270µg. The mineral content of Cerelac-1 such as sodium, potassium, iron, calcium and zinc was 100, 450, 7.5, 350 and 3 mg/100g respectively and Cerelac-2 contain 220, 510, 7.5, 540 and 3 mg/100g respectively.

3.5 MICROBIOLOGICAL ANALYSIS OF FORMULATED BABY FOOD

The distribution of micro-organisms and their amount of occurrence in the formulated baby food during storage period for three months (APHA-1999) were shown in Table 5. Comparative microbiological load of formulated baby foods has shown in table for three months. Microbial findings of Standard Plate count, total fungus count, total Coliform count and presence of *Staphylococcus aureus* per gram were absolutely nil/g or <10 cfu/gm in the baby foods analyzed, but the fungus count may be increase due to increasing moisture after few days which ranges from <10 to 200 cfu/gm .

3.6 SENSORY EVALUATION OF FORMULATED AND COMMERCIAL BABY FOOD

The results of the sensory evaluation performed on reconstituted weaning food paste made from warm water and baby food powder were shown in Figure-1. It was served to 10 members of testing panel who were asked to mark the paste on the basis of color, flavor, taste, texture and overall acceptability using a point hedonic scale where 1= dislike extremely and 9= like extremely as reported by Larmond .

The sensory parameter of the formulated baby food show that the average score of color, flavor, taste, texture and overall acceptability were 8.33, 7.56, 7.78, 7.89, 7.44 respectively. The sensory score for Cerelac-2 were 8, 7.2, 8.2, 7.5, and 7.45 for color, flavor, taste, texture and overall acceptability respectively.

4 DISCUSSION

The weaning period is the most critical phase of infant's life. During this period mother's milk is not generally adequate to cover the nutritional requirements and support body growth. Weaning foods are generally introduced between the ages of six months to three years old as breastfeeding is discontinued. While breastfed infants are often able to maintain adequate growth through their sixth month, additional nutrients are required to complement or, in some cases, replace breastfeeding completely. A weaning food should be accessible to the child and should be adequate in protein, fat, carbohydrates, vitamins and minerals to alleviate protein-energy malnutrition. It is an essential element in the care of young children especially in the developing countries where malnutrition is prevalent [World Bank, 2005 study was performed as a result of the high price of commercial baby foods which cannot be afforded by many of low income families. Commercial baby food was also unable to meet infant's nutritional requirement. To meet these requirements, we have tried to develop a highly nutritive supplementary baby food enriched with locally available indigenous raw materials such as mango, wheat flour, soy flour and milk powder in our laboratory and analyzed its nutritional composition and hygienic aspect.

In the nutritional point of view the supplementary baby food prepared in our laboratory was compared with the commercial baby foods available in Bangladesh. The carbohydrates content of the formulated baby food was 74.39g/100g, whereas Cerelac 1 contains 67.75 g/100g and cerelac 2 contain 71.7g/100g. The RDA of carbohydrate for infant is 95g/day (IOM, 2005). So the formulated food had higher carbohydrate content than cerelac and supply 71.32% recommended carbohydrate for infant. The protein content (g/100 g dry weight) in the formulated food was 11.91 g/100g. The high content of protein in the commercial foods Cerelac-1 was 15g/100g and cerelac-2 was 12.5g/100g, where the RDA of protein is 11g/day (IOM, 2005). According to the Indian Council of Medical Research (1981), the recommended optimal protein - calorie requirement for pre-schoolers is 7.1% in total mixed diet. The result indicated that the formulated baby food had lower protein content than Cerelac-1 but it was adequate in protein content for weaning purposes because it supply 108% protein of RDA for infant. The formulated baby food contained comparatively lower amount of fats than the commercial baby foods. Food sample with high fat content is more liable to spoilage than one with a lower fat content (Oduro *et al*., 2007). The ash content of the product gives an idea of the mineral content, although formulated baby food had low ash contents (1.88g/100g) than the commercial baby food (cerelac-1 contains 2.45g/100g and cerelac-2 contains 3.2 g/100g). Fiber containing food is better for maintaining good health but, infants do not get benefit from a high fiber intake and therefore fiber levels must be controlled in children's foods. In this study, the formulated baby food contained the lowest amount of fiber compared to the commercial baby food because soy flour was used as a major component of the food that contained low fiber and mango contain the soluble dietary fiber which was good for child health. The percent crude fiber of the formulated baby food was 0.58%. This value is comparable to the value of 1-2.3% which is found in Commercial baby food. Fiber is an important dietary component in preventing overweight, constipation, cardiovascular disease, and diabetes and colon cancer. However, high dietary fiber content has been reported to impair protein and mineral digestion and absorption in human subjects (Whitney EN, Hamilton EMN, Rolfes SR, 1990). The percent of protein derived calorie ranged from 11.96 to 14.25(%) in commercial baby food, whereas formulated baby food was 10.98(%). This implies that the products would supply the needed energy to meet infants' growth demands. The total energy content of the infant's diet must be maintained with controlled limits. An insufficient energy intake could lead to failure to thrive, whereas an energy intake in excess of requirements may lead to obesity. The "energy density" (amount of energy in a given quantity of food) is, therefore important. The energy content of the formulated weaning foods was 433.9 kcal/100 g. For the commercial baby food such as Cerelac-1 and Cerelac-2, the energy densities were 421 and 418 kcal/100g respectively. The RDA of energy for infant is 880kcal/day (IOM, 2005). The energy densities observed in this study for formulated baby food was slightly high than commercial baby foods and supply 58.27% calorie of RDA to meet the energy needs of the infant.

According to Singh (2001), water absorption capacity (WAC) is the ability of a product to associate with water under a condition where water is limiting, while water binding capacity (WBC) connotes water that is retained by the protein after processing. The water absorption capacity of the formulated baby food was 156.35 (g/100g) and the water binding capacity was 480 (g/100g). The significance of a lower WAC and WBC of the supplementary diets is that it will have lower water absorption and binding capacity which is desirable for making thinner gruels with high caloric density per unit volume (Elkahalifa *et al*., 2005). The bulk densities of the formulation was within range (0.49-0.63g/cm^3) reported for yam (Hsu *et al*., 2003). Bulk density is a measure of heaviness of flour (Adejuyitan *et al*., 2009) and an important parameter that determines the suitability of flours for the ease of packaging and transportation of particulate foods (Shittu *et al*., 2005) as well as for infant formulations. According to Nelson-Quartey *et al*. (2007), low bulk density flours are desirable in infant food preparation. The low bulk density of the formulated baby food therefore suggests they could be good for infant health. Solubility is an index of protein functionality such as denaturation and its potential applications. The solubility of formulated baby food was 47.91 % and swelling power was 12.16gg^{-1}. According to WHO (2003), appropriate complementary diet is one which produce a gruel or porridge that is neither too thick for the infant to consume nor so thin that energy and nutrient density are reduced. In this study the formulated baby food had moderate solubility and low swelling power, which make it good as a weaning food. The viscosity of the formulated baby food was 34.4mp/s. Low viscosity weaning diet with a high nutrient content is a desirable characteristic in weaning foods (Ariahu *et al*., 1999). Thus it can be inferred that the functional properties of the formulated diet will provide an appropriate complementary diet in terms of texture, dietary bulk and caloric density.

Sodium concentration was highest in the formulated baby food (224.4mg/100 g) and lowest in the commercial baby food (cerelac 1 contain 100 mg/100 g & cerelac 2 contain 220 mg/100 g). This was evident in the commercial weaning foods analyzed in this study; the Na concentrations in the cerelac were within the range (96.78–411.32 mg/100g) specified in the Codex Alimentarius standard for weaning foods (FAO/WHO, 1994). Potassium, just like Na, is an electrolyte essential in the homeostatic balance of body fluids. The concentration of K in Cerelac-1 was 450 and cerelac-2 was 550mg/100g, whereas 280mg/100g in the formulated baby Food. The RDA of K for infant is 700mg/day (IOM, 2005) which was higher than the formulated baby food. So the K content will be fortified in future by adding premix. Magnesium is a micronutrient used for

bone mineralization, teeth maintenance, building up of proteins, enzyme activities, normal muscular contractions and transmission of nerve impulses. Magnesium concentration was generally lower in the formulated baby food than the commercial weaning foods. Concentration of Mg in the formulated weaning foods was 5.1mg/100g. An iron concentration in the formulated baby food was 8.0 mg/100 g; while in the commercial foods (cerelac-1 & 2), the concentration was 7.5mg/100 g. The RDA of iron for infant is 10mg/100g (IOM, 2005). Thus the high iron content of formulated baby food compared to commercial baby food can meet the 80% RDA of iron for infant. Calcium is an essential micronutrient in infants and young children for building bones and teeth, functioning of muscles and nerves, blood clotting and for immune defense (Whitney *et al.* 1990). The concentration of Ca was highest (carelac-1 contain 350 and cerelac-2 contain 540mg/100 g) in the commercial weaning products and was moderate (453.4mg)/100 g) in the formulated weaning foods. According to the Codex Alimentary standards (FAO/WHO, 1994) Ca concentration in weaning foods should not be less than 435.51 mg/100 g of the dry food. So the formulated baby food fulfills 75% RDA of calcium for infants Zn content in the commercial products is 3.0 mg/100 g in Cerelac 1 & 2 and 10mg/100g in the formulated baby food. Results of this study indicate that the formulated baby foods were generally high sources of Zn compared to the commercial milk based products. The result revealed that the trace metal such as cadmium, cupper, chromium and lead content of the formulated baby food were 0.1mg/100g, 4.73mg/100g, 1.64mg/100g and bdl (below detectable level). This is very good results from the biological point of view.

Accelerated storage stability tests were used to estimate the shelf-life of the products developed. The shelf life of formulated baby foods was studied for three months at ambient conditions. No significant change in protein, fat, carbohydrate, ash, dietary fiber and energy values were observed except moisture (Table 2). Moisture content was slowly increased during storage period from 2.78 to 3.88 (g/100g). High moisture content in foods has been shown to encourage microbial growth (Temple VJ, 1996). The fungus count increased during storage period due to high moisture. The overall bacteriological status of the formulated baby food was observed to be satisfactory. It was found that the formulated baby food contained <10 cfu/gm microbial load in the sample which is in a normal range. The total Fungal Counts was <10 (cfu/gm) at 1st month, which was become 1×10^{2} (cfu/gm) at 2nd month and (2×10^{2} cfu/gm) at 3rd month due to moisture retention during storage period. A food product for consumption should have microbial count below 1× 10^{5} cfu/ml. The formulated food sample was found to contain no Coliform Count. However, yeasts and moulds, coliform group and *Staphylococcus aureus* were found to be totally absent in the formulated baby food. The low counts of the examined formulated baby food indicated adequate thermal process, good quality of raw materials and as a result of the good different processing conditions under which the production of formulas was carried out. The microbiological results suggested that the formulated baby foods are suitable to be submitted for sensory evaluation by babies and adult panelists.

The mango flavor of the formulated baby food made the product more acceptable than the commercial baby food (cerelac). Overall acceptability scores for the formulated food and the commercial food were almost similar. Members also commented on additional attributes of the foods such as the child's preference or after-taste discomforts, and suggested price and purchase intent. It has been shown that functional properties would produce a more physically balanced and acceptable products which will be cheaper and readily available. Further studies are necessary to determine the longevity of the product and economics of large scale production.

Table 1: Chemical Composition of Raw Materials and Baby Foods

Ingredients / Foods	Moisture (g/100g)	Ash (g/100g)	Protein (g/100g)	Fat (g/100g)	Crude fiber (g/100g)	Carbohy-drate (g/100g)	Total sugar (g/100g)	Energy (Kcal)	% Protein calories[&]
Wheat flour	9.10	0.276	11.56	1.83	0.33	77.234	NA*	381.0744	
Milk powder	2.20	4.59	23.73	26.87	NA	42.61	NA*	521.885	
Mango	57.71	0.427	0.74	2.475	1.54	38.648	NA*	184.5083	
Soy flour	5.85	3.56	47.81	25.48	2.3	17.3	NA*	503.915	
Formulated baby food	2.78	1.88	11.91	8.61	0.58	74.39	40.42*	433.9	10.98
Cerelac-1[†]	2.5	2.45	15	10	2.3	67.75	NA*	421	14.25
Cerelac-2[#]	2.5	3.2	12.5	9	1.0	71.7	NA*	418	11.96

**NA = Not available, †Cerelac-1 = Wheat and Milk, # Cerelac-2 = Mango, Milk & Rice,*
&% protein calories = protein % × 4 / total energy of formulations

Table-2: Storage Studies of Formulated Baby Food

Nutrients	Month-1	Month-2	Month-3	Average ± SD	% Change at Month 3	Declared Value
Moisture (%)	2.78	3.15	3.69	3.21±0.613	+32.73	-
Ash (%)	1.88	1.79	1.71	1.79±0.630	-9.04	-
Protein (%)	11.91	10.25	9.76	10.64±0.283	-18.05	-
Fat (%)	8.61	8.36	8.29	8.42±0.846	-3.72	-
Carbohydrate (%)	74.39	76.45	76.55	75.80±0.440	-2.90	-
Total Sugar (%)	40.42	32.078	30.88	34.46±0.661	-23.60	-
Dietary Fiber (%)	0.58	0.53	0.48	0.53±0.055	-17.24	-
Energy (kcal/100gm)	433.9	433.22	430.968	432.696±0.031	-0.66	-

Table-3: Functional Properties of Formulated Baby Food

Property	Formulated baby food
Water Absorption Capacity (ml//g)	156.35
Bulk Density (g/cm^3)	0.50
Water Binding Capacity (g/100g)	480.13
Solubility (%)	47.913
Swelling Power (gg^{-1})	12.16
Viscosity (mp/s)	34.4

Table 4: Micronutrient Analysis of Formulated Baby Food

Vitamin / Mineral	Formulated baby food	Cerelac 1 (Wheat & milk)	Cerelac 2 (Mango, Milk & Rice)
Vitamin A (µg)	200	270	270
Beta-carotene (µg)	400	540	540
Na (mg/100g)	224.4	100	220
K (mg/100g)	280	450	510
Fe (mg/100g)	8.0	7.5	7.5
Ca(mg/100g)	453.4	350	540
Mg (mg/100g)	5.1	Na	Na
Cr (mg/100g)	1.64	Na	Na
Cd (mg/100g)	0.1	Na	Na
Pb (mg/100g)	bdl	Na	Na
Ni (mg/100g)	7.96	Na	Na
Cu (mg/100g)	4.73	Na	Na
Zn (mg/100g)	10	3.0	3.0

Na= Not available

Table 5: Microbiological Analysis of Formulated Baby Food

Test Parameter	1 month	2 month	3 month
Standard Plate Count (cfu/gm)	<10	25	32
Total Coliform (MPN/gm)	Absent	Absent	Absent
E.coli (MPN/gm)	Absent	Absent	Absent
Total Fungus (cfu/gm)	<10	100	200
Staphylococcus aureus (cfu/gm)	Absent	Absent	Absent

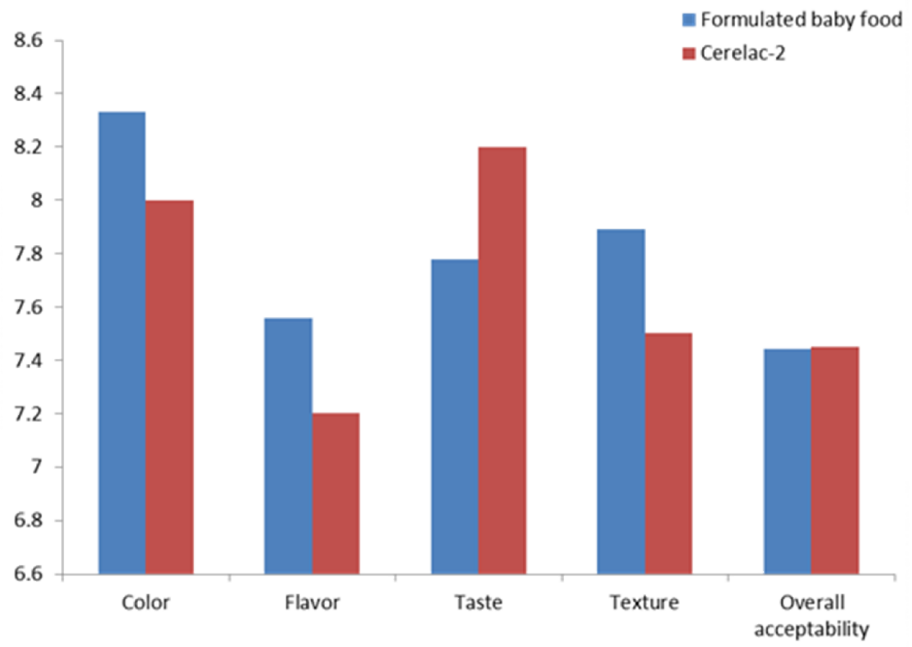


Figure-1: Sensory Evaluation of formulated and commercial baby food.

5 CONCLUSION

Infant malnutrition is an imperative health problem in Bangladesh. Proper nutrition is important to ensure growth and development of infant. Most of the supplementary baby foods are imported here in Bangladesh and these baby foods are usually beyond the affordable limit of people. Low cost local food ingredients were used to prepare a low cost baby food to meet the nutritional requirements of growing infant. The formulated baby food was found nutritionally rich and safe in microbial point of view comparable to imported baby foods. Mango flavored formulated baby food was also accepted by the test testing panel. This baby food could be an alternative of imported baby foods to meet the nutritional requirements of infants.

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Digital Dermatoglyphics Patterns of the Kanuri Ethnic Group of North Eastern Nigeria

B. Mohammed, S. H. Garba, and L. B. Adeyemi

Department of Human Anatomy,
College of Medical Sciences,
University of Maiduguri,
Borno State, Nigeria

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ABSTRACT: Lack of adequate anthropological data on indigenous Nigerians as compared to Caucasian and mongoloids has opened the need to obtain such data for a section of the Nigerian population. Dermatoglyphic study of whorls, loops and arches were made on three hundred (300) subjects, consisting of 150 males and 150 females that were randomly selected from the kanuri ethnic group in the North-eastern region of Nigeria. The result obtained showed that Arch frequency was 7.07%, Whorls was 33.80% and Loops was 59.10%. The Pattern Intensity Index showed a slightly higher value in males (12.85) than in females (12.49). Ridge counting was also done for each finger, males showed higher ridge count (122.64) than females (115.45) and the right digit was found to have a higher ridge count than the left digits except for digits II,III and V in males. Dankmeijer's indices for Kanuris were lower in males (19.99) than in females (21.92), while the Furuhata'sindices were higher in males (62.44) than in females (52.28). The results showed a similar pattern with other results obtained in the South-west and Eastern part of Nigeria.

KEYWORDS: Digital, Dermatoglyphics, Kanuri, Arches, Whorls.

1 INTRODUCTION

Dermatoglyphics is the scientific study of the patterns on the fingers and hands and it is believed to give an insight into someone's character. It comes from the Greek words *derma* and *glyphs* meaning skin and carve which refers to the friction ridge formations that appears on the palms of the hands and soles of the feet, it was first introduced by Cummins in 1926 [1]. Therefore digital dermatoglyphics deals with study of the ridge pattern of the fingers and thumb. The ridge pattern varies characteristically from one person to another and most at times in the fingers of the same person hand, these frictional ridges form pattern called finger prints. The ridging aids in prevention of slippage, serve well to enhance contact surface and also contained mechanoreceptors that plays a role in tactile perceptions [2], [3], [4]. The ridges begin to form during the 3rd and 4th months of intrauterine life and are permanent unless there is severe trauma to the hand [1], [5]. Dermatoglyphics has been found to be invaluable use in forensic science or medical jurisprudence which is commonly used to investigate crimes,positive identification of disease persons and disaster victims [6],[7],[8]. Some attribute interplay of genetic and environmental factors to development of digital ridges [9], [10], [11], [12].

Considering the number of ethnic groups in Nigeria, at present not much work has been carried out on the finger print patterns of the populations. Therefore this study aimed at obtaining a comprehensive indigenous digital database of dermatoglyphics pattern for the kanuris in the North-Eastern part of Nigeria and also to compare with findings of similar studies done in other parts of the country.

Corresponding Author: B. Mohammed

2 MATERIALS AND METHODS

2.1 SUBJECTS

This study was conducted on normal male and female pupils of two public schools located in Maiduguri Borno State, Nigeria. Prior informed consent was received from both the school authorities and pupils before the study was conducted. The study was conducted among pupils whose parents were both of the Kanuri ethnic group. A total of three hundred (300) pupils were randomly selected for the study consisting of 150 males and 150 females. Pupils showing any sign of hand or finger injury or deformity were excluded from the study. The research was conducted according to the local research ethics committee guide lines relating to the use of human subjects for research purposes.

2.2 PRINTS IMPRESSION

Bilateral fingerprints prints Impression were obtained using endorsing ink and plain duplicating paper while Screening was done on the white duplicating paper containing the prints with the aid of magnifying glass and the different patterns were identified and according to methods of Cummins and Charles [6],[11] as follows:

1. Whorls which is subdivided into Pocket Whorl, Central pocket loop, Double loop and Accidental whorls.
2. Loops subdivided into Ulna loop and Radial loop.
3. Arches subdivided into Tented Arch and Plane Arch.

2.3 DATA ANALYSIS

The Total Ridge count, Dankmeijer Index, Furuhata Index and Pattern Intensity Index were evaluated between the two sexes while other data obtained from each subject was recorded in a special form and data was transferred into a computer and analyzed using statistical package (SPSS version 11.0).

3 RESULTS

The most predominant fingerprint pattern configuration in the kanuris was Loop (59.14%), followed by Whorls (33.80%) and the Arch (7.07%). It was observed that the kanuri's males had 57.20% as Loops,35.67% as Whorls and 7.13% as Arches while the females kanuri's had Loops 61.07%,31.93% as Whorls and 7.00% as Arches. Males had more abundant Whorls and Arches than females, while the females had more abundant Loops than males (Table I).

Table I: Frequency of Pattern and Indices for Males and Females Kanuri's

Sex	Whorls	Loops	Arches	PI- Index	D- Index	F-Index	Mean TRC
Males (N=)	35.67	57.13	7.13	12.85	19.99	62.44	122.64
Females (N=)	31.93	61.07	7.00	12.49	21.92	52.28	115.45
M + F	33.80	59.10	7.07	12.67	20.92	57.19	119.05

***PI**=Pattern Intensity ;**D**= Dankmeijer's ;**F**= Furuhata's **TRC**= Total Ridge Count*

The percentage frequency of ulna Loops in males (56.13%) is less than females (59.87%), Radial Loop was also slightly higher in females (1.20%) than in males (1.07%).

The Pattern Intensity Index (PII) was seen to be slightly higher for males (12.85) than for females (12.49), the Furuhata's Index also followed same trend with values for males (62.44) higher than values for females (52.28),while the reverse trend was seen in Dankmeijer's Index , 21.92 for females and 19.99 for males.Other breakdown of the results obtained, see tables II-IV below.

Table II: Frequency of Fingerprint Pattern in Kanuri's

	Whorls				Loops		Arches	
	Accidental	Central Pocket	Double	Pocket	Radial	Ulnar	Plane	Tented
Males	0.20	5.27	4.20	26.00	1.07	56.13	6.13	1.00
Females	0.47	3.93	3.93	21.87	1.20	59.87	6.00	1.00

Table III: The Mean, Standard Deviation (SD) and Coefficient Variation (CV) of the ridge counts on individual digits in Kanuri males

	Right Hand		Left Hand		
Digits	Mean ± SD	CV	Mean± SD	CV	P-Value
I	14.71± 6.14	41.74	13.11±7.19	54.84	0.04*
II	10.35±5.39	52.08	10.40±5.93	57.02	0.94
III	10.64±5.06	47.56	11.19±5.97	58.35	0.39
IV	14.32±4.74	33.10	14.08±5.50	39.06	0.69
V	11.63±4.54	39.04	12.21±4.78	39.15	0.28

Table IV: The Mean, Standard Deviation (SD) and Coefficient of Variation (CV) of ridge counts on individual digits in Kanuri females

	Right Hand		Left Hand		
Digits	Mean ± SD	CV	Mean± SD	CV	P-Value
I	13.43±6.40	47.65	11.59±6.51	56.17	0.01*
II	09.97±5.08	50.60	09.96±5.52	55.42	0.99
III	10.58±5.27	51.26	10.26±5.81	56.63	0.98
IV	13.72±5.84	42.57	13.50±5.78	42.81	0.74
V	11.62±4.87	41.91	11.34±5.03	44.36	0.62

4 DISSCUSION

Digital dermatoglyphics has been found to be significant use in anthropogy as a means of personal identification of individual or groups for signing of legal documents as far back as 3000BC in China [11]. Racial differences in fingerprint pattern has been studied extensively in the developed world[12],these led to its use in forensic investigation and diagnosis of genetic diseases [6],[7],[9].The results thus obtained showed that the Kanuri's fingerprint patterns of 33.80% as whorls, 59.10% as loops and 7.07% which is similar to the findings by different workers[13],[14],[15],[16],[17],[18],[19],[20]. when compared with dermatoglyphic data in Tibetans [21] which had whorl frequency of 54.46%, loop frequency of 44.06% and an Arch frequency of 1.48%,while Bolognese in Italy [22] had a whorl frequency of 31.20%, loop frequency of 63.33% and arch frequency of 5.47%,also in Australian Aborigines whose fingerprint frequency of whorl of 64.79%, loop frequency of 32.25% and Arch frequency of 1.42%, while the Japanese had a whorl frequency of 45.95%, loop frequency of 52.38% and Arch frequency of 1.82% [23],[24] this disparity in dermatoglyphic data, could be attributed to racial variations. The Pattern Intensity Index (PII) was seen to be slightly of higher values in Kanuris than to the Igbos and Yorubas [18],[19],[25]. The mean total ridge count (MTRC) was highest on digits I and digits IV, with only digit I having a level of significance in individual digits in both sexes. Therefore it could be due to presence of more whorls and larger loop frequencies in males than their female counterparts.

5 CONCLUSION

The digital dermatoglyphic fingerprint pattern so obtained has showed a similarity with other studies conducted here in Nigeria and tallies with the much common expected distributions of higher pattern of loops followed by whorls and finally Arch patterns.

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Problématique de la non – intégration du planning familial et ses conséquences sur le développement des ménages dans les entités rurales de Kabare Nord

[Problematic of the no - integration of the domestic planning and its consequences on the development of households in the farming entities of Kabare North]

Théos Badose Musimwa[1], Willy Chishibanji Bisusa[1], and Félix Mugisho Maroyi[2]

[1]Secteur Scientifique,
Institut Supérieur de Techniques de Développement de Mulungu (ISTD – Mulungu),
Bukavu, Sud Kivu, RD Congo

[2]Department de Documentation et Education,
Centre de Recherche en Sciences Naturelles (CRSN) Lwiro, DS./Bukavu,
Bukavu, Sud Kivu, RD Congo

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ABSTRACT: An investigation on the adoption and the integration of domestic planning methods has been led of February to July 2014 to Miti, Bugorhe and Irhambi-Katana, three of 8 Groupings of the part Kabare North, in view to determine reasons and consequences bound to the resistance of the peasant of this entity to adopt methods of domestic planning. We resorted to the functional method pushed by techniques notably the interview and the questionnaire of investigation. 419 people have been investigated in these three Groupings. Of data gotten after investigation, he/it comes out again that the peasant's resistance to adopt the practice of the domestic planning is especially conditioned by various reasons the customary value respect and some beliefs dictations by churches to adepts. It dragged several consequences that justify himself a lot more by the state of farming household poverty driving to a malnutrition and the flight of parent responsibility towards their children often giving back them of the social deviants.

KEYWORDS: No-integration, domestic planning, consequence, development, farming entity.

RESUME: Une enquête sur l'adoption et l'intégration des méthodes de planning familial a été menée de Février à Juillet 2014 à Miti, Bugorhe et Irhambi-Katana, trois de 8 Groupements de la partie Kabare Nord, en vue de déterminer les causes et les conséquences liées à la résistance du paysan de cette entité à adopter les méthodes de planning familial. Nous avons recouru à la méthode fonctionnelle appuyée par des techniques notamment l'entretien et le questionnaire d'enquête. 419 personnes ont été enquêtées dans ces trois Groupements. Des données obtenues après enquête, il ressort que cette résistance du paysan à adopter la pratique du planning familial est conditionnée par diverses raisons surtout le respect de valeurs coutumières et certaines croyances dictées par des églises aux adeptes. Cela entraine plusieurs conséquences qui se justifient beaucoup plus par l'état de pauvreté des ménages ruraux conduisant à une malnutrition et la fuite de responsabilité de parents envers leurs enfants les rendant souvent des déviants sociaux.

MOTS-CLEFS: Non-intégration, planning familial, conséquence, développement, entité rurale.

Corresponding Author: Théos Badose Musimwa

1 INTRODUCTION

Le développement est un processus par lequel les efforts des nationaux s'unissent à ceux des autorités gouvernementales pour intégrer leurs collectivités dans la nation, leur permettre de contribuer pleinement au progrès du pays et améliorer les conditions économiques, sociales et culturelles de collectivités locales. [7]

La République Démocratique du Congo est un vaste pays doté d'énormes ressources naturelles mais qui a été confronté à de nombreuses crises multiformes ayant affecté tous les domaines du développement social, économique et politique au cours de deux dernières décennies.

Lors du recensement scientifique de 1984, la RDC abritait une population qui se chiffrait à 29 millions contre 13,5 millions en 1958. En 2013, la population de la RDC était estimée à 68 millions d'habitants par la Division de la Population des Nations unies et à 80 millions selon l'Institut National de la Statistique. On estimait par ailleurs en 2010, la fécondité à 6,3 enfants par femme, le taux de mortalité des enfants de moins de 5 ans à 158‰ naissances vivantes. [8]

La RDC fait ainsi face à de nombreux défis à relever dans la quasi-totalité des secteurs. Parmi ces nombreux défis à relever, notons l'importance qu'il convient d'attacher à l'augmentation de l'utilisation de la contraception moderne en RDC. Cette augmentation contribuera, en effet, non seulement à l'amélioration de la santé de la mère et de l'enfant dans le pays, mais aussi à la maîtrise de la croissance démographique et ainsi à une amélioration plus rapide des conditions de vie de la population. [8]

Les estimations actuelles disponibles indiquent que la population de la RDC devrait atteindre les 100 millions d'habitants avant ou autour de 2030.

Tableau n°1. Projection de la population de la RDC de 2010 à 2030

Années	*Projections SPECTRUM (août 2013)*			*Projections Nations unies (Juin 2013)*		
	Population total (en millions)	Femmes de 15-49 ans (millions)	% dans la population total	Population total (en millions)	Femmes de 15-49 ans (millions)	% dans la population total
2010	62,2	14,1	22,7	62,2	14,1	22,7
2013	67,9	15,5	22,8	67,5	15,5	22,9
2020	82,8	19,2	23,2	81,3	19,2	23,7
2025	94,4	22,3	23,6	92,1	22,3	24,2
2030	106,9	25,9	24,3	103,7	25,7	24,7

Source : [10]

Les résultats du prochain recensement de la population prévu en 2015 permettront d'affiner ces estimations.

En dépit de niveaux de mortalité toujours élevés, la forte fécondité, qui prévaut toujours dans le pays, conduit à une croissance de la population de 2,8% par an, ce qui correspond à une augmentation annuelle de près de 2 millions de personnes, et à un doublement de la population tous les 25 ans. [11]

Cette augmentation annuelle va s'accélérer et se poursuivre du fait de l'arrivée de générations plus nombreuses aux âges de procréation, phénomène inévitable, les mères de demain étant déjà nées (phénomène connu sous le nom de « *momentum démographique* ». En effet, la question climatique, la question agricole, la problématique de la surexploitation des ressources et de la dégradation de l'environnement débouchent bien souvent, sur la question de la surpopulation.

L'apport de Malthus (1766 – 1834) réside dans l'explication qu'il donne de la misère persistante du peuple. Selon lui, la croissance des ressources alimentaires serait structurellement plus faible que celle de la population (la première connaissant une progression arithmétique, tandis que celle de la seconde serait géométrique). L'équilibre ne pourrait donc être retrouvé que par la réduction de la population. [4].

Malthus est ainsi le premier à préconiser une politique de contrôle des naissances par l'éducation des familles pauvres à la continence. Il conseille, en outre, d'éviter toute mesure susceptible d'accroître la natalité, notamment la charité publique destinée aux hommes valides. L'aide sociale doit donc se limiter à l'éducation, seul moyen permettant aux masses de prendre conscience des fléaux engendrés par la surpopulation.

Selon les résultats de l'Enquête MICS réalisée en 2010, le taux de prévalence contraceptive moderne en RDC était de 5,4% ; ce qui reste faible comparativement à bon nombre d'autres pays africains. Pourtant, 24% de femmes congolaises expriment un besoin non satisfait en planification familiale, c'est-à-dire souhaitent soit espacer ou ne plus avoir d'enfants, mais n'utilisent aucune méthode contraceptive pour éviter une grossesse non désirée. Voilà ce qui fait que la RDC devrait s'engager sur le chemin de la « révolution contraceptive », grâce à une utilisation à large échelle des services de planification familiale. [6].

L'augmentation de l'utilisation de la contraception moderne devrait donc permettre un ralentissement progressif de la croissance démographique, qui entrainera une réduction des charges qui pèsent sur la population potentiellement active de 15 à 64 ans.

Dans d'autres pays, cette réduction des charges a permis une augmentation de l'épargne et des investissements qui a stimulé leur développement. La RDC pourrait s'inspirer de l'expérience de ces pays pour suivre une évolution similaire et bénéficier de ce qu'on appelle le *« dividende démographique »*. [8]

La partie Nord du Territoire de Kabare, notamment le Groupement de Miti, Bugorhe et Irhambi – Katana sont directement concernés par la problématique de la non intégration du planning familial conduisant à un accroissement de leurs populations. Les habitants de ces Groupements sont très retissant dans l'adoption des différentes méthodes de planification familiale, des méthodes une fois adoptées conduiraient au strict contrôle des effectifs voulus par ménage.

Il se dégage donc que les gens augmentent plus vite que l'augmentation des ressources alimentaires, ce qui constitue un grand problème car des gens nombreux qui sont limités dans les moyens pour faire face à leurs besoins constituent une terrible menace qui pèse sur leur entité, et donc une bombe démographique prête à exploser.

Pour ce faire, il a fallu rendre compte des causes du refus du planning familial dans les ménages de cette entité rurale et d'en dégager les différentes conséquences sur le plan socio-économique de cette population.

De ce qui précède, notre curiosité scientifique va chercher des réponses aux questions ci – après :

- En quoi la non intégration du planning familial entrave-t-il le développement des ménages de ces Groupements ;
- Quel comportement démographique faudrait – il que la population de cette entité adopte en vue de contribuer efficacement au développement de son entité ?

Pour éclairer ces deux questions de départ, nous sommes parti de l'hypothèse selon laquelle la non-intégration du planning familial entraverait le développement des ménages de ces Groupements par la présence des familles à grande taille conduisant à l'incapacité des parents de répondre aux besoins physiologiques (alimentaires, éducatifs et sanitaires) de leurs enfants ; ce qui justifierait une fuite de responsabilité de parents envers leurs enfants. Par ailleurs, la recherche de l'équilibre entre l'accroissement de la population et celui de produits nécessaires à la satisfaction de ses besoins serait un moyen efficace pouvant amener cette entité rurale à se développer.

Ce travail vise à :

- Déterminer les causes majeures ainsi que les conséquences y relatives concourant à la résistance du paysan de Kabare Nord à adopter le planning familial dans son ménage ;
- Inciter les hommes et les femmes de cette entité rurale à adopter le planning familial pour une bonne maîtrise de leur taille familiale.

2 CADRE METHODOLOGIQUE ET DETERMINATION DE L'ECHANTILLON

L'effort de vérification de cette hypothèse nous a imposé le recours à une méthodologie de recherche fondée sur la méthode fonctionnelle inspirée du fonctionnalisme de Robert King MERTON afin de répondre à la question de savoir quelles sont les fonctions du facteur démographique. Cette méthode a été utilisée dans ses concepts de fonction et dysfonction tout en dégageant le substitut fonctionnel. [3]

Un fait social peut jouer une fonction manifeste apparue comme conséquence logique du but visé et une fonction latente apparue comme n'ayant pas de rapport avec l'objet officiel. L'intégration du planning familial dans le comportement des habitants de Kabare Nord est un élément majeur pour y améliorer les conditions de vie. Par contre, la non-intégration de ce planning familial entraine un dysfonctionnement manifeste et pèse beaucoup plus sur ce milieu rural qui se plonge davantage dans le sous-développement en dépit de plusieurs potentialités qu'il regorge et qui, une fois mises en valeur rationnellement seraient bénéfiques pour cette entité.

Il est à noter que les 3 Groupements de l'axe Kabare – Nord dans lesquels nos enquêtes ont été réalisées sont formés d'une population plus rurale, donnant beaucoup plus de valeur à la sauvegarde des valeurs archaïques et rétrogrades. La population semi-rurale ne se trouve qu'au centre de négoce de chacun de ces Groupements notamment à Miti-centre, à Kavumu-centre et à Katana-centre ainsi qu'au deux centres de recherche de cette entité rurale tel l'INERA – Mulungu et le CRSN/Lwiro.

Tableau n°2. Effectifs de la population dans chacun de ces Groupements en 2013

N°	*Groupement*	*Population*	*Pourcentage*
1	Miti	25 271	12,1
2	Bugorhe	106 013	50,6
3	Irhambi – Katana	78 047	37,3
Total		*209 331*	*100*

Source : [1]

De toute cette population de notre univers d'enquête, nous avons pris un échantillon aléatoire de 0,2% soit :

$$\frac{209331X0,2}{100} = 418,662$$ soit 419 personnes

Pour une répartition proportionnelle de notre échantillon dans différents groupements, nous avons recouru à la recherche du coefficient selon la formule :

$$coefficient = \frac{échantillon}{PT} = \frac{419}{209331} = 0,002$$

D'où, la répartition de nos enquêtés par Groupement se présente de la manière suivante :

Tableau n°3. Répartition de l'échantillon par Groupement

N°	*Entité*	*Population*	*Nombre d'enquêtés*
1	Miti	25 271 X 0,002	51
2	Bugorhe	106 013 X 0,002	212
3	Irhambi-Katana	78 047 X 0,002	156
Total		//////////////////////	*419*

Le coefficient de 0,002 nous a permis de déterminer le nombre des personnes à enquêter par Groupement au prorata de ses effectifs. Ainsi, le plus grand nombre de nos enquêtés s'est retrouvé dans le Groupement de Bugorhe compte tenu de sa population.

Notons aussi que l'entretien nous a aussi permis de tirer des informations, des idées et des opinions ainsi que d'autres éléments de réflexion très riches et nuancés sur la non intégration du planning familial dans le vécu quotidien de cette population rurale de ces entités précitées.

Un questionnaire d'enquête constitué de sept questions a été distribué aux différents enquêtés dans chacun de ces trois Groupements. Ainsi, les différentes couches sociales étaient concernées par nos enquêtes et nous ont fourni des réponses selon leurs appréciations et la réalité qu'ils vivent dans leurs milieux respectifs.

Disons que dans les 3 groupements concernés par notre étude, la population est en grande majorité mono – ethnique, caractérisée par la tribu SHI, vivant dans leurs villages respectifs et étant beaucoup plus attachés par la langue, la culture et l'organisation sociale spécifique. Cette tribu bat le record avec plus de 95% de toute la population. D'autres personnes issues de différentes tribus sont très minoritaires tellement qu'elles viennent habiter certains coins (INERA-Mulungu, AEROPORT de Kavumu, CRNS-Lwiro) de ces Groupements précités pour des raisons professionnelles.

En 2012, seul le Groupement de Bugorhe ne comptait que 5111 personnes vivant hors du milieu coutumier sur un total de 103 379 habitants, soit 4,9%. Dans le Groupement de Miti, les étrangers sont estimés à 1370 personnes sur un total de 25 271 habitants, soit 5,4%. [1]

3 RESULTATS ET DISCUSSION

Tableau n° 4. Détermination du sexe de nos enquêtés

N°	*Sexe*	*Score*	*Pourcentage*
1	Masculin	209	49,9
2	Féminin	210	50,1
Total		419	100

Commentaire

Lors de nos enquêtes, nous avons préféré enquêter autant d'hommes que des femmes afin d'avoir une moyenne équilibrée d'opinions par rapport à la problématique du planning familial dans la compréhension des habitants des milieux ruraux. Cela car les hommes ont toujours tendance à culpabiliser les femmes en matière de conception d'une nouvelle grossesse.

Tableau n° 5. Détermination du niveau d'études de nos enquêtés

N°	*Niveau d'étude*	*Score*	*Pourcentage*
1	Analphabète	192	45,8
2	Primaire	121	28,9
3	Secondaire	82	19,6
4	Universitaire	24	5,7
Total		419	100

Discussion

La partie Nord du Territoire de Kabare est une entité avec une population adulte, mariée représentée par une grande proportion de personnes analphabètes et de niveau d'études primaires. Lors de nos enquêtes, sur 100 % de nos enquêtés, 45,8% sont des analphabètes et 28,9% ont un niveau d'étude primaire. Nous nous sommes rendu compte que ceux ayant un niveau secondaire ne sont représentés que par 19,6% et ceux du niveau universitaire à 5,7%. Cette forte proportion des analphabètes parmi les mariés et une raison valable pouvant justifier leur résistance dans la compréhension de la valeur du planning familial dans leurs ménages pour un développement durable de leur entité.

Tableau n° 6. Profession de nos enquêtés

N°	*Profession*	*Score*	*Pourcentage*
1	Fonctionnaires de l'Etat	108	25,8
2	Cultivateurs	201	48
3	Commerçants	32	7,6
4	Chômeurs	78	18,6
Total		419	100

Discussion

Les Groupements de Miti, Bugorhe et Irhambi-Katana constitue une entité à vocation agro-pastorale. De ce fait, cette entité est habitée par une population qui s'adonne plus à l'agriculture et l'élevage, tel que nos enquêtes le prouvent. Les agriculteurs et éleveurs que nous avons enquêtés sont représentés à 48% bien que les produits de leurs agricultures servent beaucoup plus pour leur subsistance ; cela car malgré les terres arables à leur disposition, les superficies exploitables se

minimisent au jour le jour suite à l'explosion démographique observable dans cette entité. Les fonctionnaires de l'Etat représentés à 25,8% de nos enquêtés sont en majorité des enseignants des écoles primaires et secondaires qui ont un salaire modique leur payé par le Gouvernement Congolais, et d'autres n'en ont même pas et ne se réjouissent que de la prime mensuelle que payent les parents aux enseignants avec beaucoup de mépris.

En outre, ceux-là qui font le petit commerce sont représentés à 7,6% de nos enquêtés avec d'autres qui n'ont presque pas d'activité représentés à 18,6% de nos enquêtés et donc sans aucun revenu ni journalier ni mensuel.

Tableau n° 7. Affirmez-vous que les habitants de Miti, Bugorhe et Irhambi-Katana affichent une résistance à l'adoption du planning familial ?

N°	*Réponse*	*Score*	*Pourcentage*
1	Oui	387	92,4
2	Non	27	6,4
3	Abstention	5	1,2
Total		419	100

Discussion

Sur un échantillon de 419 personnes enquêtées dans les 3 Groupements précités, 387 personnes soit 92,4% affirment que les habitants de ces Groupements affichent une résistance à l'adoption du planning familial. Seules 27 personnes soit 6,4% de nos enquêtés pensent que la notion du planning familial est la bienvenue dans le vécu quotidien des habitants de ces Groupements. En outre, 5 personnes soit 1,2% de nos enquêtés n'ont pas voulu nous faire leur point de vue par rapport à cette question et ont préféré s'abstenir.

Tableau n° 8. Quelles sont les causes majeures conduisant à la résistance de paysans à adopter le planning familial

N°	*Réponses*	*Score*	*Pourcentage*
1	Limiter les naissances c'est un péché contre la volonté de Dieu qui nous recommande de nous multiplier et remplir la terre	116	27,7
2	Les nègres n'ont pas raison de copier ce que font les blancs car nos ancêtres ne limitaient pas les naissances et nous devons les copier	26	6,2
3	La coutume nous apprend que l'enfant est une source de productivité, une richesse ; et par conséquent en avoir plusieurs c'est accroître la main d'œuvre familiale	130	31
4	La femme n'a plus de considération par son mari que quand elle est grosse et pendant la période d'allaitement du bébé	147	35,1
Total		419	100

Discussion

A l'issue de nos enquêtes effectuées dans ces Groupements, il ressort que plusieurs causes sont à la base du refus ou de la résistance du paysan à adopter les méthodes de planning familial, notamment :

Les causes religieuses

Les fausses croyances dictées par les responsables des églises à leurs adeptes selon lesquelles l'espacement ou la limitation des naissances qui ne sont possibles que par l'usage des méthodes appropriées est un péché mortel et une subversion à la volonté de Dieu qui veut que les hommes se multiplient et qu'ils remplissent la terre. Cela a été confirmé par 116 personnes lors de nos enquêtes soit 27,7%.

Les causes liées à la sauvegarde de la mentalité archaïque et rétrograde

Lors de nos enquêtes, il a été approuvé par 26 personnes soit 6,2% de notre échantillon que les ruraux agissent le plus souvent suivant ce que leur dicte la mentalité dominée par l'ignorance conduisant au renforcement des préjugés. De ce fait,

les hommes et les femmes en milieu rural estiment que les méthodes de planning familial proviennent de la race blanche qui voudrait réduire sensiblement et pourquoi pas exterminer la race noire afin de s'approprier librement les ressources naturelles du continent africain que la race blanche a toujours envier depuis plusieurs siècles.

Par ailleurs, d'après leurs déclarations, on remarque que la sauvegarde de cette mentalité les conduit parfois au refus de faire vacciner leurs enfants car ils pensent que ces vaccins administrés à leurs enfants n'empêchent en rien les différentes maladies mais plutôt affaiblissent le système immunitaire de leurs enfants, car disent – ils : « nous avons grandi avec une santé plus résistante à diverses maladies pourtant nous n'étions jamais vaccinés ».

Les causes coutumières

Le refus de l'adoption de méthodes de planning familial se justifierait, selon la déclaration de 130 enquêtés soit 31% de notre échantillon par la sauvegarde des us et des valeurs coutumières de certaines tribus à l'instar de la tribu Shi où l'enfant est considéré comme une source de productivité, de richesse, de la main d'œuvre. Et par conséquent en limiter le nombre serait une façon de contribuer personnellement à son appauvrissement.

Il se dégage donc que le paysan de Kabare Nord connait encore un grand retard par rapport à l'évolution des valeurs mondiales à sauvegarder au point qu'il se fie trop à la sauvegarde de valeurs coutumières, ancestrales et les observe à la loupe n'en déplaisent les conséquences qu'elles présentent sur le développement des générations présentent et celles futures. Il y a lieu de penser que les paysans de ces groupements cités ci – haut nécessitent une bonne formation en matière de notions du développement durable d'autant plus que ce développement n'est pas un état statique d'harmonie, mais un processus de transformation dans lequel l'exploitation des ressources naturelles, le choix des investissements, l'orientation des changements techniques et institutionnelles sont rendus cohérentes avec l'avenir comme avec les besoins du présent.

Ce développement sera parfaitement durable lorsqu'il vise à répondre aux besoins du présent sans compromettre la capacité des générations futures de répondre aux leurs ; cela car : « Nous n'héritons pas de la terre de nos ancêtres, nous l'empruntons à nos enfants. [5]

L'insouciance des maris envers leurs épouses

Il s'observe que dans les milieux ruraux, les maris se soucient moins de leurs épouses quant à l'habillement ainsi qu'à la ration alimentaire. La majorité de maris ne se soucie de leurs épouses quant à ce qu'à la période où elles sont enceintes et juste quelques temps après l'accouchement, tel que l'on affirmés 147 personnes de nos enquêtés soit 35,1%. C'est au cours de cette période qu'elles reçoivent des pagnes, des lotions et surtout la ration alimentaire quotidienne afin d'accroître le lait maternel en faveur de l'enfant. Cet état de fait devient une grande motivation pour la femme rurale de Kabare Nord à vouloir être enceinte tout le temps sans tenir compte des conséquences ultérieures quant à sa vie et celle des enfants multiples.

Tableau n° 9. Quelles sont les conséquences découlant de cette résistance à l'adoption du planning familial dans cette entité rurale ?

N°	*Réponses*	*Score*	*Pourcentage*
1	La mauvaise croissance des enfants au sein de ménage	18	4,3
2	La malnutrition des enfants	97	23,1
3	La mésentente et les disputes régulières entre les conjoints	49	11,7
4	La pauvreté de ménage	255	60,9
Total		419	100

Discussion

En dehors des causes énumérées ci – haut, les résultats que nous avons obtenus à l'issue de nos enquêtes dans les trois Groupements de Kabare Nord ont démontré que cette non-acceptation du planning familial débouche à diverses conséquences qui freinent considérablement le développement socio-économique de cette entité rurale.

La mauvaise croissance des enfants

Le non respect de l'espacement de naissances conduit à l'écartement de l'âge réel et l'âge chronologique de l'enfant mettant en péril et l'aspect physique et l'aspect mental de celui-ci, comme l'ont affirmé 18 personnes de nos enquêtés soit 4,3%.

La malnutrition

Les résultats de nos enquêtes sur terrain ont prouvé que le grand nombre d'enfants qui naissent à des intervalles de temps très rapprochées conduit les parents dans l'incapacité de procurer à leurs enfants les 3 régimes alimentaires notamment les aliments de construction, ceux de protection et enfin ceux énergétiques, comme l'ont soutenu 97 personnes soit 23,1% de nos enquêtés. Cela conduit le plus souvent à la malnutrition des enfants qui semble être combattu par l'installation dans ces milieux ruraux des unités nutritionnelles de supplémentassions en faveur des enfants mais sans éradiquer ce problème.

Les disputes fréquentes entre les conjoints

La découverte d'une grossesse non planifiée conduisant à une naissance acceptée mais non voulue indispose le mari qui culpabilise le plus souvent son épouse. Cela a été soutenu par 49 personnes soit 11,7% de nos enquêtés. Au lieu d'être un élément de réjouissance entre conjoints, la découverte d'une nouvelle grossesse devient un élément ennuyant au point d'entrainer des disputes régulières.

La pauvreté

La présence de plusieurs enfants conduit ipso facto à celui de plusieurs charges à régler par les parents en faveur des leurs enfants. Les parents étant dans une situation de disqualification sociale, une parfaite incapacité de répondre aux besoins de leurs enfants afin de préparer leur vie future, 255 personnes soit 60,9% de nos enquêtés ont affirmé que pareille situation accroît considérablement l'état de pauvreté dans les ménages rurales conduisant même à la déviance de ces enfants qui deviennent « enfants de la rue ».

Tableau n° 10. Que faudrait-il faire pour que cette intégration soit effective ?

N°	*Réponse*	*Score*	*Pourcentage*
1	Sensibiliser la population féminine adulte pour cette fin	11	2,6
2	Enseigner cette matière aux jeunes à partir de l'école secondaire	143	34,1
3	Intégrer la notion de planning familial dans les prédications dans différentes confessions religieuses	175	41,8
4	Faire de la question du planning familial un problème des hommes et des femmes à la fois	90	21,5
Total		419	100

Discussion

Au vu de résultats de ce tableau, il ressort que la grande stratégie à adopter pour une bonne intégration du planning familial dans le comportement de la population de ces trois Groupements de Kabare – Nord est la prise en mains de cette question par les responsables de différentes confessions religieuses, tel que l'ont soutenu 175 personnes enquêtées soit 41,8% de notre échantillon. A cela s'ajoute le rôle que doivent jouer les enseignants dans différentes écoles au profit de la population jeune qui devrait comprendre l'importance du planning familial dès le bas âge afin d'en faire leur préoccupation une fois intégrés dans la vie du couple, tel que l'ont soutenu 143 personnes soit 34,1% de notre échantillon.

Disons que nos résultats ont prouvé à suffisance que la question du planning familial n'est pas le seul apanage de la femme dans le ménage, mais c'est une question devant concerner à la fois l'homme et la femme pour l'atteinte de l'objectif, tel que l'ont soutenu 90 personnes de nos enquêtées soit 21,5%.

4 CONCLUSION

Ce travail avait pour objectif de déterminer les causes majeures de la résistance d'adoption du planning familial ainsi que les conséquences y relatives au sein de ménages de 3 Groupements de la région Kabare – Nord dont le Groupement de Miti, Bugorhe et celui d'Irhambi-Katana afin d'inciter cette population à adopter cette approche pour un développement harmonieux et durable de leur entité.

Une enquête par questionnaire a été menée de Février à Avril 2014 afin de recueillir des renseignements auprès d'un échantillon de 419 personnes, soit 0,2% de la population totale, de sexe et âge confondus, habitants de ces Groupements précités.

Il ressort des résultats obtenus que les ménages ruraux sont très retissant à l'adoption et à l'intégration dans leur vécu quotidien des méthodes de planning familial suite à plusieurs raisons d'ordre non seulement religieux mais aussi et surtout d'ordre coutumier, se justifiant par la tendance à la sauvegarde de leurs valeurs coutumières archaïques et rétrogrades. Cela présente plusieurs conséquences sur le plan social et économique, conséquences gangrenant le développement à plusieurs niveaux de ces entités rurales.

Voilà pourquoi une large sensibilisation dans les différentes communautés ecclésiastiques, et au besoin l'intégration de cette notion dans les thématiques à développer dans les différentes prédications afin que les gens n'en fassent plus une question taboue permettrait de résoudre de manière durable le problème de l'ignorance de la population quant aux avantages et aux inconvénients d'un accroissement démographique qui est exponentiel par rapport à celui des ressources naturelles.

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Nous tenons à présenter nos remerciements à l'Administrateur du Territoire de Kabare Monsieur Gérard KITUNGANO et tous ses collaborateurs, pour les différents éléments qu'ils ont mis à notre disposition pour la réalisation de ce travail d'une portée démographique.

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Les entreprises entre Système de Management Environnemental et Développement Durable : cas de la Société COSUMAR Sidi Bennour

[Companies between Environmental management system and Sustainable development: the case of Sidi Bennour COSUMAR Company]

O.E El Gueddar[1], F.A. Rahmouni[2], A. Sahib-Eddine[2], and A. Aajjane[1]

[1]Laboratoire de Géosciences Marines et Sciences du Sol,
(LGMSS : Unité Associée au CNRST –URAC 45),
Faculté des Sciences, Université Chouaib Doukkali, El Jadida, Maroc

[2]Laboratoire d'Eude et de Recherche en Science Economique et de Management,
Ecole Nationale de Commerce et de Gestion, Université Chouaib Doukkali, El Jadida, Maroc

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ABSTRACT: The System of Environmental Management is set up in the company according to the directives of the standard ISO 14001 for the control of the environmental impacts linked to its activity and also the respect for the regulations and laws in vigours. ISO 14001 is based on the environmental principle of continuous improvement of the performance of the company. So installed, the environmental politics of the company allows directly the respect for three pillars of durable development.
The present research with the Cosumar Sidi Bennour company demonstrates that the establishment of EMS according to ISO 14001 allows respect for the environment, the economic earning that allows a social emergence and thus an positive impact on the durable development of the region.

KEYWORDS: Environment, EMS, ISO14001, sustainable development, Cosumar Sidi Bennour.

RESUME: Le Système de Management Environnemental est mis en place dans l'entreprise selon les directives de la norme ISO 14001 pour la maîtrise des impacts environnementaux liés à son activité et ainsi le respect des règlements et des lois en vigueurs. ISO 14001 repose sur le principe d'amélioration continue de la performance environnemental de l'entreprise. Ainsi installé, la politique environnementale de l'entreprise permet directement le respect des trois piliers de développement durable.
La présente recherche auprès de la société Cosumar Sidi Bennour démontre que l'implantation de SME selon ISO 14001 permet le respect de l'environnement, le gain économique ce qui permet une émergence sociale et donc un impact positive sur le développement durable de la région.

MOTS-CLEFS: Environnement ; SME ; ISO 14001 ; Développement durable ; Cosumar Sidi Bennour.

1 INTRODUCTION

Le Management Environnemental désigne les méthodes de gestion et d'organisation de l'entreprise. C'est une démarche qui reste encore aujourd'hui innovante, car elle vise à prendre en compte de façon systématique l'impact des activités de

Corresponding Author: O.E El Gueddar

l'entreprise sur l'environnement, à évaluer cet impact et à le réduire. Elle consiste donc à intégrer l'environnement dans la gestion et la stratégie de l'entreprise. Le Management Environnemental s'inscrit donc dans une perspective de développement durable : il implique une interdépendance entre développement économique et qualité de l'environnement.

Dans le domaine de l'environnement, la gestion des entreprises est soumise à des pressions réglementaires et institutionnelles auxquelles les entreprises peuvent difficilement se soustraire sans remettre en cause leur légitimité (Hoffman, 1999 ; Bansal et Roth, 2000 ; Boiral, 2006b). Pour assurer cette légitimité, les entreprises vont réagir de façon plus ou moins réactive ou proactive, dépendamment de la sensibilité *verte* des dirigeants, de l'intensité des contraintes externes ou encore du développement de compétences distinctives dans ce domaine (Boiral, 2006b). Le système de management environnemental basé sur la norme ISO 14001 est une réponse à ces pressions.

2 CONCEPTS GENERAUX DE LA POLITIQUE ENVIRONNEMENTALE

Il s'agit des démarches établies par l'entreprise dans une vision du développement durable. C'est entre autres le Système de Management Environnementale (SME) selon les directives ISO 14001 qui est le plus adéquat.

Plusieurs définitions du SME existent dans la littérature (Nash et Ehrenfeld, 2001 ; Melnyk et al., 2002 ; Desmazes et Lafontaine, 2007 ; Boiral, 2008). Dans notre travail, on retient la définition de La norme internationale ISO 14001 (2004) qui définit le SME comme «une composante du système de management d'un organisme utilisée pour développer et mettre en œuvre sa politique environnementale et gérer ses aspects environnementaux. Un système de management est un ensemble d'éléments, liés entre eux, utilisé pour établir une politique et des objectifs afin d'atteindre ces derniers. Ce système comprend la structure organisationnelle, les activités de planification, les responsabilités, les pratiques, les procédures, les procédés et les ressources».

Le SME a fait objet de plusieurs recherches, Les études réalisées se sont essentiellement intéressées aux raisons qui poussent les entreprises à adopter ce système (Nash et Ehrenfeld, 2001 ; Morrow et Rondinelli, 2002 ; Boiral et Dostaler, 2004 ; Watson et Emery, 2004 ; Wagner et al. 2003); aux facteurs de contingence pouvant influencer son implantation dans les entreprises (A. Marquet-pondville,2003 ; Andrew et al.,2003) ; et aux impacts qu'il pourrait avoir sur la performance environnementale des entreprises (Berry et Rondinelli,2000 ; Florida et Davison,2001 ; Melnyk et al.,2002,2003 ; Janicot,2007).

Dans la pratique, le système de management environnemental (SME) élaboré à partir de la structure et des recommandations de la norme ISO 14001 s'est imposé comme la référence en la matière (Gendron, 2004). Cette dernière a fait l'objet de nombreux travaux de recherche qui, études de cas à l'appui, en ont décrit les principes et mis en avant les avantages et les limites (Boiral, 2003 ; Reverdy, 2005 ; Gondran et Fontaine 2006 ; Semal, 2006).

La norme ISO 14001 est une norme internationale qui précise la structure et les principes d'un SME, elle spécifie les exigences relatives à un système de management environnemental permettant à un organisme de développer et de mettre en œuvre une politique et des objectifs, qui prennent en compte les exigences légales et les autres exigences auxquelles l'organisme a souscrit et les informations relatives aux impacts environnementaux significatifs. Elle s'applique aux aspects environnementaux que l'organisme a identifiés comme étant ceux qu'il a les moyens de maîtriser et en avoir une influence. Elle n'instaure pas en elle-même de critères spécifiques de performance environnementale.

La norme ISO 14001 repose sur le principe d'amélioration continue de la performance environnementale par la maîtrise des impacts liés à l'activité de l'entreprise. Celle-ci prend un double engagement de progrès continu et de respect de la conformité réglementaire**.**

La norme ISO 14001 est riche en 17 exigences, organisées selon la méthodologie du PDCA, elle permet de structurer la démarche de mise en place d'un système de management environnemental.

La norme comporte, dans le chapitre 4 « Exigences du SME », des exigences réparties en cinq paragraphes comme le montre la figure 1:

- **Exigence 1 :** 4.2 Politique environnementale : Afficher ses intentions et principes de performance environnementale.
- **Exigence 2 :** 4.3 Planification (plan) : Connaître ses impacts environnementaux significatifs grâce à un état des lieux détaillé et se fixer des objectifs et des cibles à atteindre pour améliorer ses performances environnementales en cohérence avec sa politique, et programmer des actions pour atteindre ses objectifs et mettre en œuvre la politique environnementale.

- **Exigence 3 :** 4.4 Mise en œuvre et fonctionnement (do) : Se donner des moyens pour réaliser le programme d'actions élaboré en tenant compte, plus particulièrement, des situations normales et anormales de fonctionnement, du point de vue des parties intéressées, des capacités techniques, humaines et financières de l'entreprise.
- **Exigence 4 :** 4.5 Contrôle (check) : Vérifier et évaluer les résultats et progrès obtenus en matière de prévention de la pollution et contrôler en continu l'efficacité du système de management de l'environnement.
- **Exigence 5:** 4.6 Revue de direction (Act) : Réunir la direction et l'encadrement concernés pour suivre l'évolution du SME et décider des axes d'amélioration au vu notamment des résultats du contrôle. Et Être capable de s'adapter aux changements de circonstance.

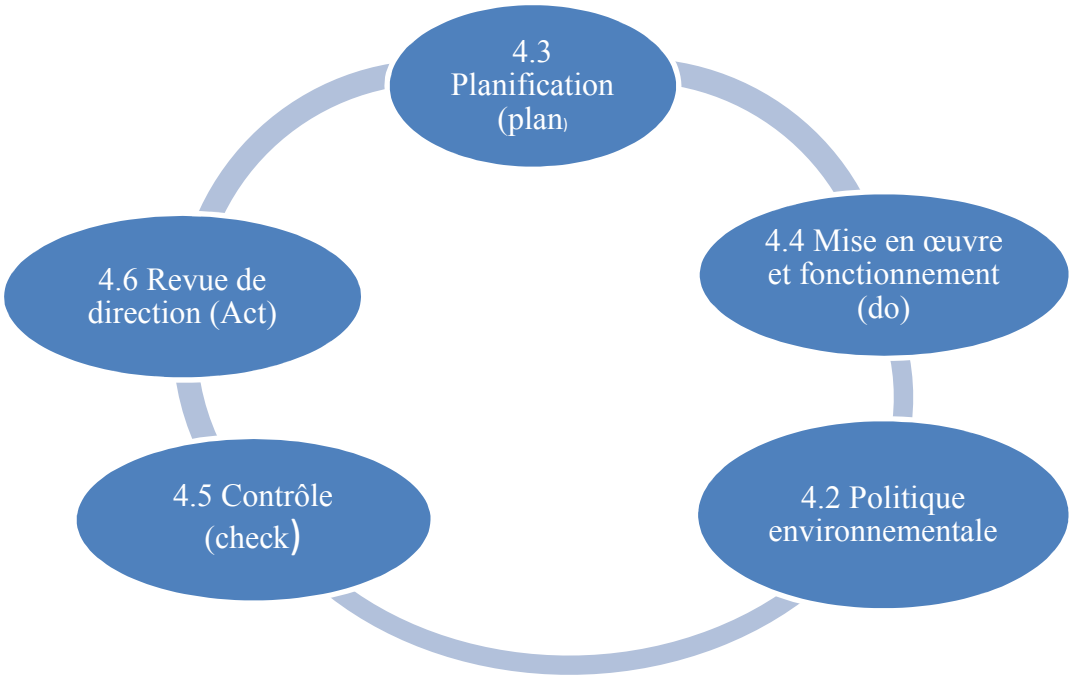


Figure 1 : la roue de Deming et la norme ISO 14001

Ce système qui a pour soubassement l'intégration des objectifs écologiques dans la gestion de l'entreprise peut être à juste titre considéré comme un outil du Développement Durable (Semal, 2006).

Le développement durable implique qu'aucune croissance n'est possible à long terme sans être économiquement efficace et socialement équitable, le tout dans un environnement vivable pour tous. Plus qu'une question d'accroissement économique qui préserve la nature et sauvegarde les ressources disponibles sur la planète, ce mode de développement nécessite une réflexion sur les inégalités socio-spatiales et le respect des populations.

La synthèse de l'étude de SME et de l'ISO 14001 a montré que l'implantation de SME selon les directives de la norme ISO 14001 dans les entreprises permet l'amélioration continue de la performance environnementale de celles-ci et que ce processus est un outil du développement durable.

Dans cet article, nous évaluons ces paramètres en se basant sur les résultats d'une etude exploratoire auprès de la Societé Cosumar Sidi Bennour puisque cette société s'est engagée dans la démarche de certification de son SME conformément à la norme ISO 14001 V 2004 dans un souci de démontrer son engagement environnemental et afin de garantir un entourage sain et salubre. C'est ce que nous essayerons de démontrer dans cette étude de cas, en se posant les questions suivantes:

- Comment l'implantation de SME dans la Cosumar Sidi Bennour permet-il le respect développement durable?
- Comment COSUMAR Sidi Bennour a pu améliorer sa performance environnementale en vue d'être une société durable dans la région des Doukkala ?

3 PRÉSENTATION DU DOMAINE D'ÉTUDE

De par sa position géographique privilégiée sur la côte atlantique, ses potentialités agricoles, piscicoles, halieutiques et touristiques, la région des Doukkala se doit d'être le deuxième pôle industriel national après la région du Grand Casablanca.

L'agriculture y constitue une activité importante. Les cultures pratiquées dans la région sont très diversifiées (céréales, légumineuses, cultures maraîchères, industrielles et fourragères).

Les Cultures industrielles sont pratiquées sur une superficie de 20 200 Ha et la production régionale de la betterave à sucre en 2009-2010 a atteint 12 300,5 milliers de quintaux (soit 50% de la production nationale), ce qui explique les raisons de l'implantation de la Société Cosumar Sidi Bennour ; celle-ci est en effet spécialisée dans l'extraction, le raffinage et le conditionnement du sucre sous différentes formes.

L'usine dispose actuellement d'une capacité de traitement de 15 000 tonnes par jour, ce qui en fait incontestablement la plus grande sucrerie du Maroc. Elle produit 36% de sucre en pains, en lingots ou en granulé de la production nationale.

Tableau 1 : Superficie et production de la culture de la betterave à sucre au titre de la compagne agricole 2009-2010

Niveau géographique	Production (en 1000 qx)	Superficie (en 1000 ha)
Région	10 901,8	18,2
Nation	24 359,1	43,3
Région / Nation	44,75	42 ,03

Source : Annuaire Statistique du Maroc 2011

La contribution industrielle et économique de la région au niveau national est démontrée dans le tableau suivant :

Tableau 2 : Contribution de la région de Doukkala dans l'économie nationale 2009

	Région	Nation	Région/nation
Investissements (10^3 DH)	2 571 455	24 184 433	**10,63**
Frais de personnel (10^3 DH)	1 557 848	31 388 770	**4,96**
Exportation (10^3 DH)	10 018 111	65 820 000	**15,22**
Production (10^3 DH)	17 929 035	265 660 909	**6,74**
Chiffre d'affaires (10^3 DH)	21 071 511	312 028 235	**6,56**
Effectifs employés permanents	10 941	459 652	**2,38**
Nombre d'établissements	169	7 922	**2,13**

Source : Annuaire Statistique du Maroc 2011

Tableau 3 : Typologie des Industries agro-alimentaires dans les Doukkala (en millions de dirhams) recensées en 2008

Industries agro-alimentaires	
Production industrielle de la région,	4 118 726
Exportations industrielles de la région,	483 380
Investissements industriels de la région,	290 746
Chiffre d'affaires industriel de la région,	4 313 205
Valeur ajoutée industrielle de la région,	944 780

Source : Délégations Provinciales du Commerce et de l'Industrie

Notre étude porte donc sur la société COSUMAR Sidi Bennour, entreprise exerçant dans le secteur agro-alimentaire. Le choix de ce secteur d'activité était imposé par la vocation de la région considérée comme étant le grenier agricole du royaume.

La société COSUMAR Sidi Bennour était Construite par des Français le 14 juillet 1968 sous la dénomination « Société Anonyme de la Sucrerie des Doukkala », elle a démarré le 11 mai 1970 avec une capacité de traitement de 2400 tonnes de betteraves/jour, la capacité actuelle étant de 15000 tonnes.

Tableau 4: Présentation de la Société Cosumar Sidi Bennour

Secteur d'activité	Agroalimentaire
Date de lancement du projet	1970
Production	- L'extraction du sucre à partir des plantes sucrières : betterave à sucre ; - Le raffinage du sucre brut importé ; - Le conditionnement sous différentes variétés
Etat juridique	Filial de la Société Anonyme (SA)
Capital social	5975,1 millions de dirhams
Effectif	234 permanents 210 saisonniers au cours de la campagne 22 000 Agriculteurs
Montant de la récolte	400 MDH (Année 2008)
Superficie	80 Ha (superficie de l'usine plus une exploitation de culture de betterave propre à l'usine et les bassins de décantation)
Adresse	COSUMAR, Sucrerie Sidi Bennour
Siège Social	8 rue El Mouatamid Ibnou Abbad BP 3098 20 000 Casablanca. Maroc
Certification	- ISO 14001- ISO 9000 - OSAHS - RSE-CGEM

4 DÉMARCHE MÉTHODOLOGIQUE

La COSUMAR Sidi Bennour est une entreprise dont la taille, les caractéristiques et la situation sont propice à l'innovation en matière de développement durable et à une démarche proactive en matière d'impact environnemental.

En effet, lorsqu'il s'agit de parler d'impact environnemental, les grands groupes sont en général montrés du doigt en premiers. Ils subissent donc des pressions plus importantes de la part de différentes parties prenantes (autorités légales, clients, investisseurs, grand public...) et doivent être très innovants en matière de stratégies environnementales pour pouvoir répondre de façon suffisante à ces pressions. C'est pourquoi il est relativement aisé de trouver une personne dont le poste exige une attention constante sur des points tels que les impacts environnementaux engendrés par l'entreprise : le responsable des services qualité/sécurité/environnement est l'interlocuteur par excellence.

Pour la collecte des données, nous avons effectué des visites de la Société et procédé à un ensemble d'entretiens auprès des responsables et des services concernés, en se basant sur un guide d'entretien adapté à la nature des informations recherchées. Nous avons utilisé également les rapports annuels de la Société et son manuel de Qualité. Les questions du guide permettent d'avancer graduellement pour arriver enfin à des questions concrètes et précises en rapport avec le fonctionnement de la Société et son degré d'implication dans l'esprit de Développement Durable.

5 LES PRATIQUES ENVIRONNEMENTALES DE LA COSUMAR SIDI BENNOUR

La question de l'environnement est au cœur des préoccupations de Cosumar Sidi Bennour, elle a ainsi introduit des mécanismes modernes de développement veillant au respect des normes écologique, la politique environnementale de la société a abouti à la certification ISO 14001.

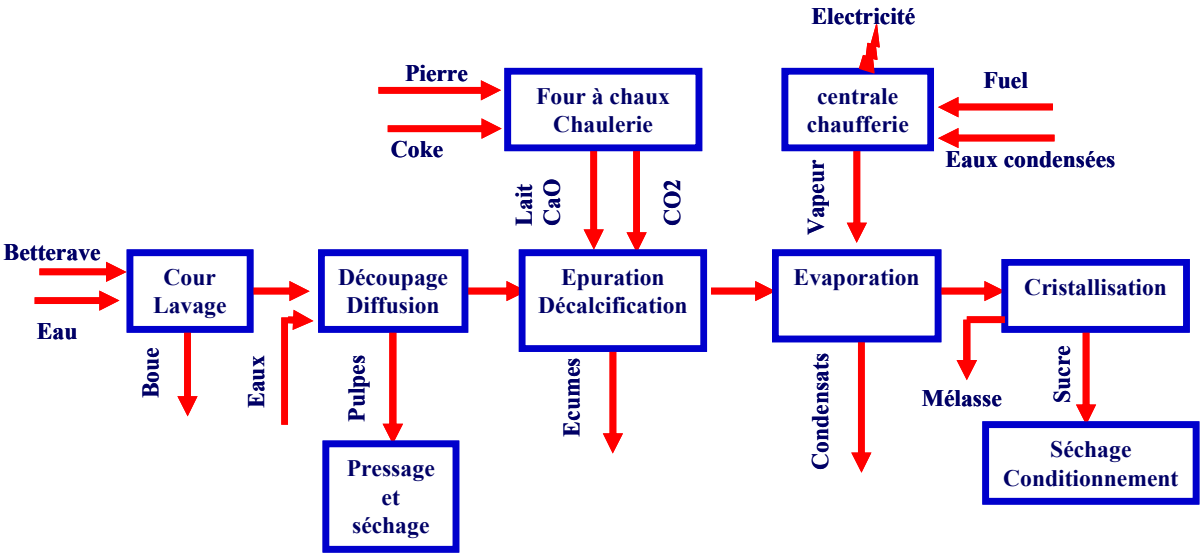


Figure 2 : flux entrant et sortant dans le processus de production

Dans la présente étude, nous avons étudié les quatre principaux aspects environnementaux selon le processus de productions suivant deux axes :

- La réduction de la consommation de la matière première : à savoir l'eau et l'énergie (Fuel)
- L'amélioration de traitement des rejets: liquides, solides et atmosphérique.

A- Réduction de la consommation de la matière première

- ***En matière d'énergie***

La consommation de fuel a baissé de 35.48 KWH par tonne en 2011 contre 32.53 en 2013 comme le montre le graphe suivant :

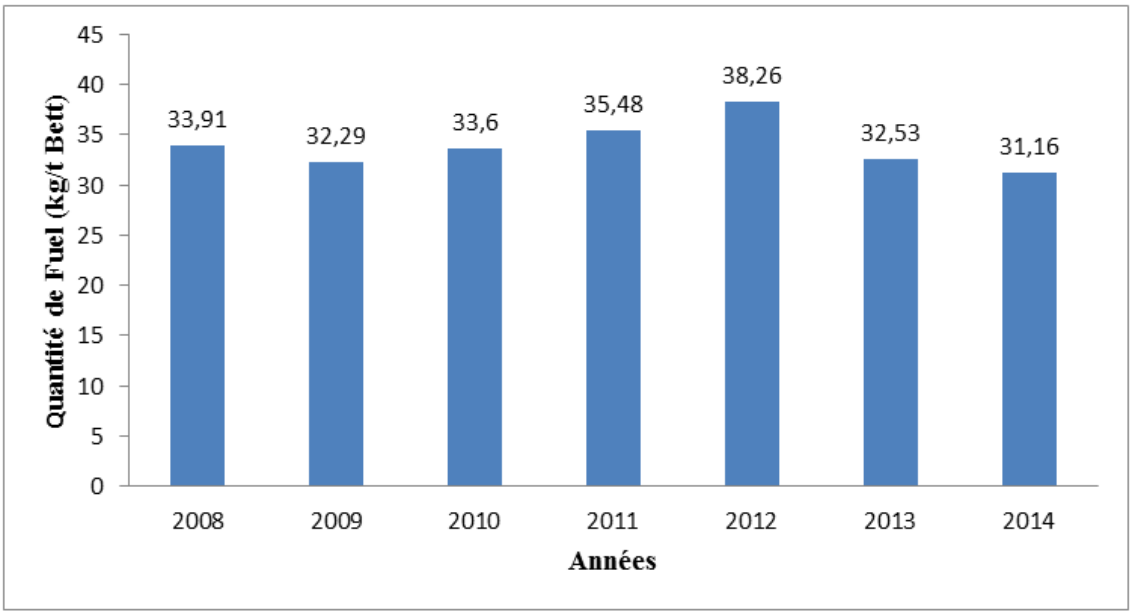


Figure 3 : Evolution de la consommation du Fuel par an

- ***Réduction Consommation Fuel par :***
    - Acquisition de Chaudière Performante
    - Acquisition d'appareils Technologiques Performants : Diffuseur, sécheur, Cuites Continues.
    - Adaptation d'un nouveau schéma thermique
- ***En matière de l'Eau :***

A Sidi Bennour, la consommation d'eau industrielle a baissé passant de 0.43 m^3/tonne en 2011 à 0.18 m^3/tonne en 2013, nettement en dessous du seuil réglementaire fixé à 0,16 m^3/tonne.

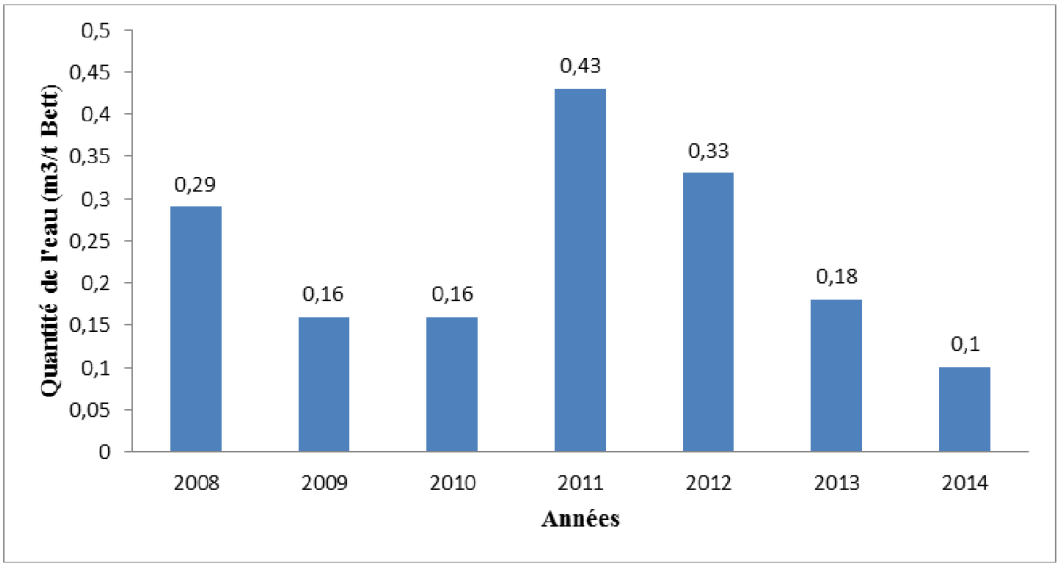


Figure 4 : Evolution de la consommation de l'eau par an

- ***Réduction Consommation de l'Eau***
    - Changement du processus de décalcification avec élimination totale des rejets des eaux saumâtres.
    - Modifications du circuit des eaux et optimisation des recyclages.
    - Augmentation du traitement Journalier de l'Usine.
    - Utilisation d'appareils Technologiques plus performants.

B- <u>Amélioration du traitement des rejets :</u>

Par respect de l'environnement, en particulier pour lutter contre les rejets des réalisations entretenues pour la préservation de l'environnement à travers la rationalisation de la consommation d'énergie et la maitrise des rejets liquides et gazeux. L'enveloppe globale du projet d'extension est estimée à 855 Mdh dont 40 Mdh dédiée à la mise à niveau environnementale:

- ***Rejets liquides :***

L'eau en sucrerie est utilisée pour :

- Le lavage des échantillons de betteraves au centre de réception
- Le lavage de la betterave.
- L'extraction du sucre à l'étape de la diffusion
- La chaufferie pour production de la vapeur
- Le refroidissement des machines
- Le lavage des filtres
- Les nettoyages divers

Ces eaux sont acheminées vers les bassins de lagunage y reposent plusieurs mois afin de réduire considérablement les paramètres de la pollution organique tels que MES, DBO, DCO… Ces eaux sont ensuite évacuées vers la colature et les boues sont récupérées au niveau du premier bassin par décantation; après évaporation des eaux puis réutilisée dans les champs.

- ***Réduction des rejets liquides :***
    - Les rejets de l'usine sont entièrement stockés dans des bassins
    - Utilisation d'un nouveau procédé pour la régénération de la résine de décalcification et qui consomme **zéro m^3 eau.**
    - Optimisation du circuit des eaux et automatisation des processus de transformation de la betterave.
    - Pressage des écumes et réutilisation des eaux de presse dans le process (Filtre presse PKF).
    - Installation d'une technologie propre (RNS : colonnes d'échange d'ion et filtres à boues PKF).
    - Augmentation de la superficie des bassins de lagunage naturel par l'aménagement d'un nouveau bassin supplémentaire de 190 000 m^3 de capacité pour la collecte des eaux usées. La capacité de rétention globale avoisine 496 000 m^3 pour épurer d'avantage les rejets liquides

Le système de lagunage a subi une amélioration en continue afin d'optimiser le respect de l'environnement :

- Une étude de profil géologique des bassins de stockage des rejets liquides a démontré que ces bassins sont imperméables.
- Ces lagunes suivent un plan annuel de désinsectisation et de dératisation.
- Suite aux nombreuses plaintes des riverains sur les mauvaises odeurs dégagées par le système de lagunage (ceci est généré par la stagnation de l'eau et le manque d'oxygène), le site a mis en place des aérateurs à très faible consommation énergétique permettant le brassage de l'eau et ainsi l'élimination des odeurs. Il est à noter que cela fait deux campagnes que la sucrerie a installé au niveau des bassins de lagunage des oloides (agitateurs - brasseurs) dont l'objectif est d'oxygéner les eaux stockées afin de dégrader la matière organique présente dans ces eaux. Il s'agit d'agitateur à faible consommation électrique (0,2kW/ agitateur) avec une forme spéciale du mobile qui permet un rendement d'incorporation de l'air meilleur que les agitateurs conventionnel et ainsi réduire les nuisances olfactifs.



Photo 1: Système de lagunage de Cosumar Sidi Bennour

- ***Emissions atmosphériques :***

Bien que l'entreprise n'ait pas fixé d'objectif chiffré à l'égard de cet aspect, Cosumar s'assure de la conformité légale des seuils à ne pas dépasser.

Cosumar effectue chaque année une étude sur la caractérisation des émissions atmosphériques de ses usines par LPEE « Laboratoire Public d'Essais et d'Etudes ». Les résultats des dernières années ont été conformes à la réglementation.

- ***Réduction des rejets atmosphériques :***
    - L'amélioration du rendement des chaudières et la réduction de la consommation du fuel à moins de 32 Kg/tonne betterave ce qui a contribué à la diminution des rejets atmosphériques.
    - Minimiser les démarrages qui dégagent des rejets gazeux en évitant les déclenchements
    - Elimination des poussières et fumées noirâtres au niveau des sécheurs à pulpes (chicanage, transport par élévateur à godet).



Photo 2: Cheminé pour évacuation des rejets atmosphériques

- ***Rejets solides :***

Un suivi des déchets est effectué au niveau de chaque entité: les déchets sont triés, répertoriés, puis classés selon le degré de leur danger:

Les déchets sont triés par leurs producteurs et stockés (stockage intermédiaire) sur place au niveau des emplacements définis tout en s'assurant du respect de l'environnement et des règles de sécurité.

Des poubelles par type de déchets sont prévues à cet effet dans les différentes zones du site et leur contenu est transféré, chaque fois que c'est nécessaire, dans des conteneurs de volume plus important installé dans la décharge. Ces conteneurs sont évacués par prestataire extérieur vers la décharge publique.

Les déchets générés par l'utilisation des produits chimiques sont rares compte tenu du fait que la commande en produit chimique est faite en fonction des besoins précis liés à la campagne. :

- ***Déchets industriels banals (DIB):*** Tous les déchets pouvant être évacués vers la décharge publique.

Tableau 5: Traitement des déchets industriels banals

Type	**Mode de collecte**	**Destination finale**
Les ordures ménagères	Entreposé dans les bennes de collecte	Décharge communale
Déchets de démolition exempts d'éléments toxiques	Déposé dans les aires prévues à cet effet	Réutilisé dans les travaux de génie civil
Boues et terres	Stocké dans les bassins des eaux de lavage	Evacué vers les carrières désaffectées
Ecumes		Evacué vers les carrières désaffectées

- ***Déchets industriels spéciaux (DIS) :*** Toutes formes de déchets qui, par leur nature dangereuse, toxique, réactive, explosive, inflammable, biologique ou bactérienne, constituent un danger pour la santé, la sécurité au travail et/ou pour l'environnement.

Tableau 6: Traitement des déchets industriels spéciaux

Type	Mode de collecte	Destination finale
Chiffons utilisés lors des activités de maintenance	Enfermés dans des fûts métalliques fermés déposés dans la décharge contrôlée	Prestataire externe délivrant un certificat
Huiles usagées	Récupérés dans des fûts déposés dans la décharge contrôlée	Prestataire externe délivrant un certificat
Produits absorbants contaminés		Prestataire externe délivrant un certificat
Produits chimiques : - Exploitation - Laboratoire	Périmés ils stockés au niveau du laboratoire	organisme spécialisé

- ***Déchets re-valorisables:*** Tous les déchets pouvant être vendus, Concernant les déchets de maintenance et les déchets de conditionnement, ils sont valorisés et vendus en l'état pour des acquéreurs.

Tableau 7: Traitement des déchets re-valorisables

Type	Mode de collecte	Destination finale
Déchets d'emballages : - Papiers et cartons - Films	Stockés dans la décharge contrôlée	Vendus à un prestataire
Ferrailles	Stockées dans la décharge contrôlée	Vendus à un prestataire
Incuits, surcuits et criblures	Stockés en vrac	Mis la disposition des autorités et des agriculteurs pour les utiliser dans le terrassement et le compactage des routes.
Bois (palettes, caissons ...)	Stockés dans la zone bois à la décharge contrôlée	Vendus à un prestataire
Fûts	Stockés dans la zone bois à la décharge contrôlée	Vendus à un prestataire
Radicelles et Pulpes		vendus aux agriculteurs
Câbles électriques	Stockés dans la zone câble	Vendus à un prestataire
Déchets de l'informatique et de la bureautique		Vendus à un prestataire

- ***réduction des rejets solides :***
    - Les écumes séchées sont actuellement évacués vers des carrières désaffectées avec possibilité d'utilisation en amendement calcaire pour les sols acides.
    - Contact en cours pour utilisation des écumes dans les cimenteries et les briqueteries.
    - Utilisation des criblures (déchet four à chaux) pour réaménagement des pistes.

6 INTERPRÉTATION ET DISCUSSION

La norme ISO 14001 comporte, dans le chapitre 4 « Exigences du SME », des exigences réparties en cinq paragraphes, en prenant on compte les données de la Cosumar Sidi Bennour on peut établir les exigences de la norme comme suit:

- **Exigence 1: 4.2 Politique environnementale :** La COSUMAR Sidi Bennour s'attache à mettre en œuvre une politique de gestion et d'amélioration constante de ses installations industrielles avec le souci de la préservation de l'environnement. Il met en œuvre les systèmes de contrôle nécessaires par des mesures permanentes et fiables.

  Dans son Code d'Ethique et de Conduite des Affaires, COSUMAR s'engage à respecter toutes les lois en vigueur en matière de protection de l'environnement et à « maintenir la biodiversité, les écosystèmes, l'épuisement des ressources naturelles, la gestion des déchets et des substances toxiques ».

- **Exigence 2: 4.3 Planification (plan) :** Se donner des moyens pour réaliser le programme d'actions élaboré en tenant compte, plus particulièrement, des situations normales et anormales de fonctionnement, du point de vue des parties intéressées, des capacités techniques, humaines et financières de l'entreprise.

- **Exigence 3: 4.4 Mise en œuvre et fonctionnement (do) :** Diminution de la consommation de la matière première « consommation de l'énergie et consommation de l'eau » et la réduction des rejets « liquide, solides et atmosphérique »

- **Exigence 4: 4.5 Contrôle (check)** Existence d'une cartographie des impacts environnementaux qui est revue tous les deux ans et à chaque événement majeur. Elle recense le nombre d'impacts, leur criticité et le nombre d'impacts significatifs ainsi que la conformité de COSUMAR Sidi Bennour à la réglementation environnementale. Elle est accompagnée d'un plan d'action pour la mise en œuvre des mesures visant à réduire ces impacts.

- **Exigence 5: 4.6 Revue de direction (Act)** Des actions de sensibilisation et de formation au profit des collaborateurs sur le volet environnemental sont régulièrement déployées. Des moyens humains, organisationnels et financiers sont alloués pour suivre la politique environnementale.

Des audits internes sont menés par le responsable QSE de la société, en plus, des audits externes de certification sont réalisés régulièrement.

L'analyse du tableau 8 montre que l'évolution des aspects environnementaux tendent vers une optimisation meilleure des ressources utilisées : diminution de la consommation d'eau qui annonce un écart de -0 ,06 et la consommation de fuel avec un écart de -0.84 par rapport à la valeur cible. Cela signifie que le taux de réalisation des objectifs a presque atteint les 100% pour ces aspects environnementaux. Il est à noter qu'en 2011 et en 2012, la société a souffert des intempéries climatiques et d'une réticence généralisée des agriculteurs à produire de la betterave, ayant eu pour conséquence une production basse comparée à celle des années précédentes.

Selon l'étude des exigences de SME et le tableau de bord environnementale, on peut conclure que la Cosumar Sidi Bennour a réalisé plusieurs **actions pour la préservation de l'environnement** à travers la rationalisation de la consommation d'énergie et la maîtrise des rejets liquides et gazeux grâce à un investissement de 40 Millions de DH dédié à la mise à niveau environnementale:

- L'optimisation du circuit des eaux et l'automatisation des processus de transformation de la betterave à l'issue desquels la consommation d'eau a été nettement réduite à moins de 0.16 m^3/tonne betterave.
- L'installation d'une technologie propre (colonnes d'échange d'ion et filtre presse à boues) qui neutralise les rejets issus de la décalcification et des écumes liquides.
- L'augmentation de la superficie des bassins de lagunage naturel par l'aménagement d'un nouveau bassin supplémentaire de 190 000 m^3 pour la collecte des eaux usées dont la capacité de rétention globale avoisine 496 000 m^3 pour épurer davantage les rejets liquides.
- L'amélioration du rendement des chaudières et la réduction de la consommation du fuel à moins de 32 Kg/tonne betterave ce qui a contribué à la diminution des rejets atmosphériques.
- L'installation d'une technologie innovante pour la campagne 2013 pour l'élimination des émissions d'odeurs.
- la plantation d'environ 2000 arbres aux alentours de l'usine.
- Renforcement du programme de rationalisation des consommables.
- Accompagnement du réseau d'agriculteurs pour se convertir à la goutte à goutte, ce qui contribue à réduire de 30% leur consommation en eau par an.
- Etude pour l'utilisation raisonnée des produits phytosanitaires et les engrais azotés.

Tableau 8: Tableau de bord environnemental de COSUMAR Sidi Bennour établi à partir des données de l'entreprise

Objectifs	*Indicateurs*	*Année*	*Valeur réelle*	*Valeur Cible*	*Ecart*
Minimiser la consommation d'eau	**Consommation d'eau (en m^3/tonne)**	2011 2012 2013 2014	0,43 0,33 0,18 0,10	**0,16**	0,27 0,17 0,02 -0.06
Minimiser les pertes et déchets	**Rebais (en tonnes)**	2011 2012 2013	896,74 1 995,36 3 049,80	-	-
Optimiser la consommation énergétique	**Fuel Total Consommé (en kg/Tbett)**	2011 2012 2013 2014	33,60 35,48 32,53 31,16	**<32**	1,6 3,48 0,53 -0.84
	Energie totale consommée (en KWH/ tonne)	2011 2012 2013	31,13 35,48 32,53	**<32**	-1,13 3,48 0,53

Tableau 9: Avantage potentiels de SME pour la société Cosumar Sidi Bennour

INTERNES	-Rationalisation de la production / réduction des coûts -Respect des lois environnementales/ sécurité juridique -Innovations technologiques/ Prévention des pollutions -Motivation des collaborateurs.
EXTERNES	-Compétitivité améliorée / Avantage concurrentiel -Meilleure image auprès des clients et du public -Meilleure relation avec les autorités/ Coopération active -Plus de transparence envers les actionnaires, banques, assureurs.

7 CONCLUSION

L'impact de l'implantation de la SME selon ISO 14001 à COSUMAR Sidi Bennour sur le développement durable de la région de Doukkala est **positif**, puisque en plus de **respect de l'environnement** par le respect des lois et des normes par la société, celle-ci assure **un gain économique** remarquable ce qui se répercute **socialement**.

La société contribue de manière substantielle à l'amélioration des revenus des producteurs betteraviers dont le nombre s'élève à 22 000, ainsi que le développement socio-économique de la région en générant des revenus et des emplois (2,2 millions de journées de travail, 240 emplois permanents).

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