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Contribution of Petty Trade on Household Income Poverty Reduction: A Case of Madukani Ward, Dodoma Region

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ABSTRACT: This paper is based on the study conducted in Dodoma Municipality at Madukani Ward to assess the contribution of petty trade to household income poverty reduction. Specifically, the study examined the nature of business done by petty traders, income and expenditure level of individuals from petty trading and assessed other income generating activities among petty traders. Data for this study were collected using interviews as the method of data collection whereby questionnaires were administered to 110 petty traders who were selected by using both random and purposive sampling techniques. The study involved collection of quantitative and qualitative data which was analyzed through SPSS to obtain frequencies in tables and figures. Qualitative data collected through interview and observation was analyzed by using content analysis. This was to give summary of each topic discussed and identify the content of discussion. The results from the study revealed that petty trade is the backbone of most of the traders as it has shown many changes in the lives of the respondents as they were more able to tackle most of the instances that they could not when they were not engaged in petty trading. The study provides the effective measures to be done in order to improve the status of petty trade.

KEYWORDS: Petty Trade, Income, and Poverty Reduction.

INTRODUCTION

In the course of globalization and liberalization, major cities in both North and South have evolved increasingly bimodal labor markets (Sassen, 1991; Marcuse and van Kempen, 2000). In the North, across the OECD, part-time or temporary jobs and self-employment have increased. Own-account work, particularly among women, has increased as a share of self-employment (ILO, 2002). In developing regions, the accelerated concentration of populations in dominant cities has contributed to a rapid growth in the informal economy (De Soto, 1989).

This phenomenon has been more rapid in sub-Saharan African cities, where growth in urban populations has been accompanied by limited job creation amongst the poor (Cohen, 2004; Carr and Chen, 2002). In Africa the informal sector as a whole is estimated to account for 60 percent of all urban jobs and over 90 percent of all new urban jobs. After home-working, street trading is estimated to account for the largest share of these jobs. Trends in street trading over time are integrally linked to urbanization, migration and economic development processes. A common sight in Africa's sprawling peri-urban areas is the widespread proliferation of petty traders, hawking everything from garden produce to imported consumer goods. These small-scale merchants represent perhaps the fastest growing segment of the labor market in Africa, attracting the unemployed, the displaced, and the impoverished. Recent economic stagnation and restructuring on the continent spurred new growth in this sector, as waged employment declined and inflation spiraled (Little, 1999).

THE AWARENESS OF POVERTY EXISTENCE

ILFS report 2006 reported that, the number of unemployed people out of Tanzania's workforce of more than 22m has fallen to 10.7 per cent in 2011, from the 11.7 per cent recorded in 2006, new projections by the National Bureau of Statistics show. Estimates are that the country is home to 2,368,672 unemployed persons this year, out of a 'labor force' estimated to

be 22,152,320-strong. In other words, 19,783,648 Tanzanians are currently employed, out of whom 2,502,327 persons are employed in the informal sector of the economy.

Business Times (May 2011) reported that, the issue of youth employment has remained a major challenge for the Government in Dar es Salaam. In any case, a majority of the country's youth are currently engaged in informal economic activities, including petty trading. Statistics from different sources show that the informal sector accounts about 60% of all employment opportunities in Tanzania. The agriculture sector and government both of which were major employers before economic liberalization took firm hold in the late 1980s and early 1990s, have taken the back seat.

STRATEGIES TO REDUCE POVERTY

MKUKUTA is a development framework which forms part of Tanzania's efforts to deliver on its National Vision-2025. The focus is outcome-orientated, and the programme? Whose first phase covered the years2005-2010? Aims at economic growth and reduction of income poverty; improved quality of life and social well-being; and good governance and accountability.

In respect of unemployment, the MKUKUTA operational target is to reduce unemployment from the 2000/01 rate of 12.9% to 6.9% by 2010. According to the survey, unemployment stood at 11.0% in 2006. When disaggregated, unemployment rates are 31.3%, 16.3%, and 7.1% for Dar es Salaam, other urban, and rural, respectively (ILFS 2006).

In terms of employment status, 84% of the persons are employed in the informal sector as their main activity and 92% employed in this sector as their secondary activity are self-employed without employees, (ILFS, 2006)

Where the informal sector activity is the main activity, the wholesale and retail trade employs 56% of the people, manufacturing 17% and hotels and restaurants 12%. In contrast, where the informal sector activity is the secondary activity, construction engages 48% of the people, mining and quarrying 23% and the wholesale and retail trade 14% (ILFS, 2006).

Two years later, with the passing of the Trading and Finance Act 2004, informal traders were further marginalized. No individual licenses could now be granted for businesses with underTsh20m turnover. This legislation has provided the overall framework for institutionalizing the informality – and illegality - of street trade.

A further year on, De Soto described the difficulties facing businesses which meet this criterion in attempting to formalize and register. As for smaller businesses, petty traders could now work legally in public space only if employed by corporate distributors, or as tenants of formally licensed markets. Although the SDP city consultation was re-run in 2005, street traders in Dar es Salaam were again on a knife edge. In March 2006 the prime minister issued an ultimatum requiring hawkers to leave the CBD, and several areas were cleared with bloodshed and casualties. Some of the traders went to a magistrate seeking a temporary injunction preventing eviction, and the Prime Minister suspended the process pending the allocation of suitable alternative sites, but on 30 September 2006 the final clear-up went ahead and traders were moved to new makeshift markets (Joseph, 2006).

FACTORS LEADING TO MUSHROOMING OF PETTY TRADERS

The number of people living and working in the cities in the world is rapidly increasing. Whereas only one in eight people lived in an urban area at the turn of the century, about half the world's population will live in urban settlements at the end of the century (Gugler, 1988). Two thirds of these 3 billion urban dwellers were in the Third World, where urban population grows at three times the rate of growth of the general population (Gugler. 1988; Mabogunje, 1991; United Nations, 1987). In 1975 the level of urbanization was 61% in Latin America and 25% in Africa and South Asia (Fridlay and Fridlay, 1987). But, according to Gugler (1988), there is evidence of a slowdown in Latin America. In Africa, where according to Fridlay and Fridlay (1987) the urbanization rate is fastest, 42% of the total population will live in urban areas by the year 2000. At that time seventeen of the twenty-three largest metropolitan areas, with populations over ten million was in the Third World (United Nations, 1987).

Indeed the rapid urbanization has been a result of the general population growth and of a process of urbanizing the rural areas, especially in the industrialized nations. But urbanization is mainly a result of massive redistribution of population from rural areas to urban centres. This is said to be the outcome of a general and universal development process as a result of which there is a rapid reduction of the number of people earning a living from agriculture and the increase in the proportion of people earning a living from industrial and service activities (Fridlay and Fridlay, 1987).

In colonial Tanganyika, areas where cash crops were not introduced such as Kigoma, Rukwa and Makete became sources of migratory labor. The cash crop plantation and small scale production areas such as Mwanza, Shinyanga, Mbeya, Kilimanjaro, Tanga, Kagera, and Coastal areas needed labour not only for the production of the cash crops but also for the

production and supply of foodstuffs. Other areas such as parts of Iringa and Mara regions served as sources of military labour. Consequently, considerable spatial inequity in both the growth of the population, the growth of the sectors of the economy and the benefits of such growth was created in favour of plantation and urban areas -md to the disadvantage of areas from where labour was recruited (Lwoga, 1985; Mbonile, 1993; Mlay, 1977).

At independence, the development pattern and the spatial structure of the economy inherited from the colonial administrators was continued resulting into intensified focus on small number of cities. In terms of population the attraction to the more "developed" urban centers from poorer and less developed areas was strengthened. Thus, increasingly migration was, and still is occurring not just from the rural areas to urban centers, but also from smaller towns to bigger cities.

As a result, according to Mosha (1993: 129), the Tanzania urban population grew from 183,862 (2.8% of total population) in 1948 to 685,547 in 1967 and to 1,664,079 (10.6% of total population) in 1978. Whereas the population growth rate for urban centers for the 1957-1967 intercensal periods was 6.5%, it was 8.4% for the 1978-1988 periods. Dar es Salaam accounts for the lion's share of both urban population and urban population growth rate, especially since 1948. Between 1900 and 1948 the population in Dar es Salaam increased from about 20,000 to about 70,000, an annual growth rate of 3% (Mosha, 1993: 131).

The biggest gap is between wholesalers and retailers. This is evident both in terms of ethnic identity and access to capital. No middleman has managed to become a wholesaler while many retailers have become middlemen. This gap between wholesalers and others corresponds to local perceptions of urban dwellers. While wholesalers are called Wauzaji wa Jumla, both middlemen and retailers are called Machinga by urban dwellers. Among the merchants, retailers refer to a middleman as Mtajiri (a rich person or employer) in the Swahili language, and middlemen refer to retailers as Machinga. However, middlemen recognize that they, like retailers, are called Machinga by urban dwellers. This builds a sense of fellowships among middlemen and retailers. As mentioned in the final chapter, the Mali Kauli transaction is underpinned by urban fellowships, (Sayaka, 2006).

DATA AAND METHODS

This study was conducted at Dodoma Municipality, in Madukani ward targeting petty traders. It involved a cross-sectional survey design whereby data were collected using various methods for the purpose of obtaining relevant information that helped to answer the research questions. The method was chosen because of its suitability for descriptive study as well as for determination of relationship between and among variables. Data were collected from both primary and secondary sources.

Primary data were collected by using interview, observation and Focused Group Discussion (FGD). Interview was guided by the use of questionnaires prepared by the researcher to petty traders. Checklists were used to collect the information from different officers and key informants including petty trader's association leader. Secondary data were obtained from both published and unpublished documents journals, reports and others documents available at the organizations offices as well as visiting internet and other materials related to the study. Apart from interviews physical observation method was used to examine the way petty traders are doing their activities physically and how the customers do respond to the traders.

SAMPLE SIZE AND SAMPLING PROCEDURES

As Gupta (2002) pointed out, a mere size alone does not ensure representativeness thus a sample, but well selected sample may be superior to a larger but badly selected sample. Hence, the sample size should neither be too small nor too large. It should be optimum. The optimum size is the one that fulfils the requirements of efficiency representative, reliability and flexibility. Therefore the study will involve 115 respondents. Whereby 110 respondents was traders running their activities in different streets and 5 was key informants involving trade officers, leaders and village officers. The study employed both judgmental and random sampling to obtain the sample. Judgmental sampling technique was used to obtain petty traders over other businessperson at Madukani ward.

Data analysis was done by using SPSS computer program. The program to be used in data analysis is Statistical Package for Social Science (SPSS) program. This study will use descriptive statistic on data analysis. Quantitative data collected was analyzed through SPSS including to obtain frequencies in tables and figures. Qualitative data collected through interview and observation was analyzed by using content analysis. This is to give summary of each topic discussed and identify the content of discussion. This will examine the capacity of the petty traders in raising economic situation and assessment of effectiveness of the trade in enhancing trader's wellbeing.

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents

The study examined the ages, marital status, levels of education and occupation of petty traders in Madukani ward. Not only that but also the study assessed the type of trades and other activities done by petty traders. This is due to the fact that those characteristics have direct link to petty trade and income poverty reduction. The results were as indicated in Table 1.

Table 1: Socio-demographic Characteristics of Respondents

Variables	Frequencies	Percentage
Age		
18-25	38	34.5
26-35	60	54.5
36-45	12	11.0
Marital Status:		
Single	70	63.6
Married	32	29.1
Separated	6	5.5
Widow	2	1.8
Level of Education		
No formal education	22	20.0
Primary Education	34	30.9
Secondary Education	54	49.1
Occupation		
Student	38	34.5
Employed	18	16.4
Jobless	36	32.7
Farming	18	16.4
Type of Residence		
Own House	14	12.7
Family House	18	16.4
Rented house	78	70.9
Type of Petty Trading Activity(ies)		
Selling Merchandise (New items)	22	20
Selling second hand clothes	34	30.9
Food vending	54	49.1
Others	**4**	**3.6**

Age of Respondents

Majority (89%) of the respondents in this study aged 18-35. This shows that, youths of this age are actively participating in petty trade as they are most productive age group. It means that a large number of traders in the field still have ability to do business in an advanced way and also they are people who are able to engage in other more productive activities which will enable more consumption of the available natural resources such as agriculture and industrial activities. If this group will be empowered in terms of resource capital and provided with entrepreneurial education it will ensure the supply of human resource hence it will ensure total income poverty reduction in many households.

Marital Status

The same table shows that more than half (63.6%) of the respondents single indicating that, the income generated from petty trading was insufficient for them to get married. This is due to the fact that, marriage unions adds the number of family members and hence the increase of costs of running families. Some of respondents who reported that they were separated explained the major reason for their separation to be low income which leads to the hardship in running the family.

Education Levels

As far as education is concerned, majority (49.1%) of respondents had secondary education level followed by those with primary education level (30.9%) and lastly those with no formal education (20%). This depicts the way many of literate people are either under employed or unemployed. Many petty traders at Madukani ward had enough basic knowledge that could be used to earn more but lack of exposure to credits to improve their businesses has forced them to enter into small businesses which generate incomes only at subsistence level.

Former Activities of Petty Traders

The respondents' occupation before engagement in petty trade was dominated by those who were from schools (34.5%) followed by those who were jobless (32.7%). Therefore, there is a need for the government and development stakeholders to take a look on the type of education provided at lower levels (primary and secondary) so as to make sure that the type of education provided at these levels creates a base for self employment among youths.

Type of Residence

Rented houses (70.9%) were the dominating type of residence among petty traders. This is due to the fact that, the income generated by petty traders was not sufficient to them to build their own houses. For those who reported that they own houses, they were not from the income generated from petty trades but by inheritance.

Type of Activities Done by Petty Traders

Moreover, food vending seems to be the trade which is free to enter as it needs only a small amount of capital to start the business. This is due to the fact that, majority (49.1%) of respondents was food vendors. This group was followed by selling second hand clothes (30.9%), general merchandise (new items) (20%) and lastly other trades (3.6%). This reflects the reality that the only driving force for many people to enter into petty trading as they are attracted more to food vending and selling second hand clothes which do not require them to have a huge status capital. This is due to the fact that in many cases it is not necessarily to have fixed premises for the businesses.

Income Generated From Business among Petty Traders per Day

The study examined the level of income generated by petty traders in the study area. It further examined the level of savings, capital growth, the ability to improve the well being including the ability to meet health services, ability to meet food requirements as well as the ability to meet housing expenses.

Growth of Capital

According to the response of petty traders, it shows growth of capital whereby most of the traders' initial capital was dominated by those who had a starting capital of between 100,000 and 500,000 Tshs but for the present capital is dominated by the range between500,000 and 1,000,000 Tshs and also there is a decrease of traders having the capital of less than 100,000 Tshs from 38.2% to 5.5% thus it shows the growth of the capital.

Table 9: Growth of Capital

Initial Capital invested in the business	Frequency	Percent
Less than 100,000	21	38.2
100,000-500,000	28	50.9
500,000-1,000,000	6	10.9
Total	**55**	**100.0**
Present capital in the business	**Frequency**	**Percent**
Less than 100,000	3	5.5
100,000 - 500,000	21	38.2
500,000 - 1,000,000	22	40.0
Above 1,000,000	9	16.4
Total	**55**	**100.0**

Ability to improve Wellbeing through Petty Trading

The results of the study in revealed that, petty trade has improved the wellbeing of people engaging with this trade.

Ability to Meet Health Services

Health is a key element in the development process, and hence a healthy population is required to meet development objectives. Good health is a major resource of social, economic and personal development and an important measure of quality of life (URT, 2005a; URT, 2005b) Figure 1 indicates that, the percentage of respondents who have ability to meet health services has increased from 36.5% to 76.4% before and after engaging themselves in petty trade respectively.
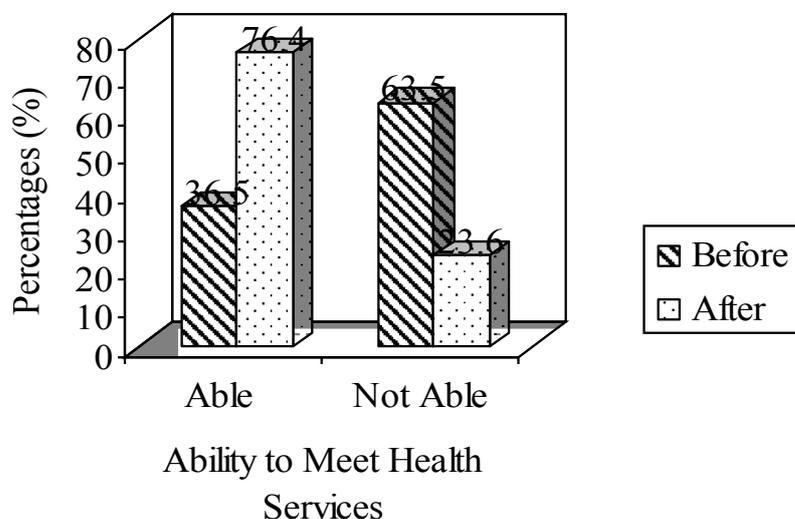

Figure 1: Petty Traders Ability to meet Health Services among

Ability to meet food Requirements

Not only that, but also the study indicates that, petty trade plays a great role in enabling petty traders to improve their ability to meet food requirements per day. This is due to the fact that, majority of respondents was getting two meals per day

before engaging in petty trade. The number of meals has increased significantly as they engaging to petty trade as shown in figure 2.
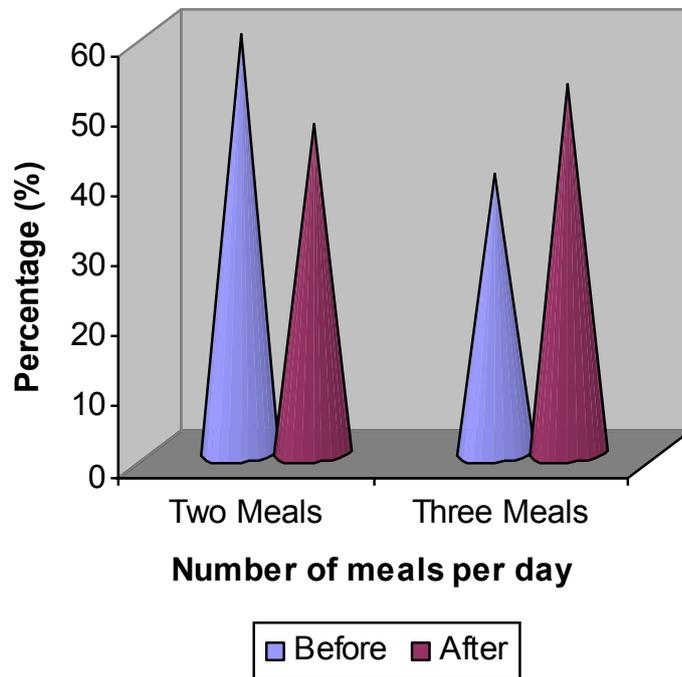
Figure 2: Petty Traders' Number of Meals per Day in the Study Area

Not only that but also, the results shows that there was an improvement in their wellbeing in terms of affording housing expenses which is rent, electricity and water bills.

Despite the success stories from petty traders, the study revealed that the income generated from these activities was not self sufficient to meet the needs of petty traders. This is because some respondents reported that they were engages in other activities rather than petty trade. This sector is also facing some challenges such as disturbances caused by municipal council police to those traders doing their activities in inappropriate areas while yet they have no any specified place. Also another challenge they face is stiff terms and conditions of loan provided by financial institutions such as banks. These challenges are much seen as the main constraint to some traders from improving from their business activities.

Results from Content Analysis

The analysis was done by looking on the content of the discussion done with selected people in relation to the answers of individual petty traders. This was to give summary of each topic discussed and identify the content of discussion. It examined the views of petty traders in what should be done in favour their trades in order to improve their wellbeing. The results of the analysis were as follows.
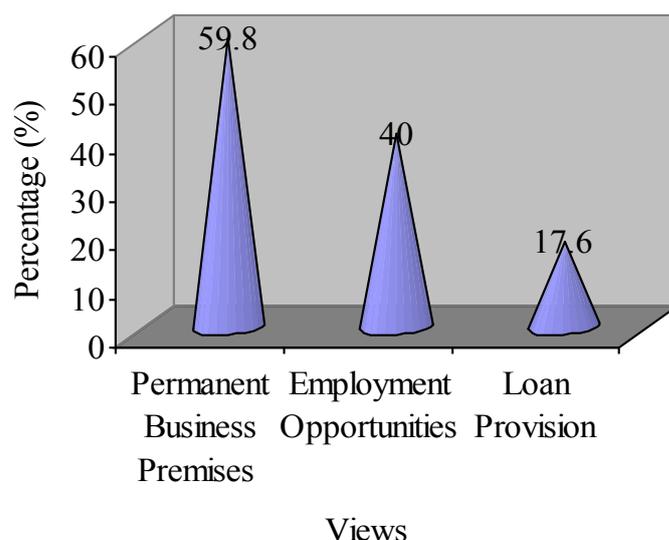
Figure 3: Views of Petty Traders from Content Analysis

The results from the study in figure 3 indicates that permanent business premises are in favour (59.8%) of many petty traders as they fill that, having a permanent place for displaying their products will improve their businesses to a large extent. Others argued that inadequate capital to start big business is the reason for the failure of petty traders to improve their living standards through trade. Therefore they suggested that, the government has to create more employment opportunities (40%) in which they can be employed and earn the reasonable capital to start big businesses. Not only that but also some (17.6%) petty traders viewed loan provision to be important to them as it will reduce the burden of capital for business start up and expansion.

CONCLUSION AND RECOMMENDATION

Petty traders are engaged in different types of petty trading activities whereby most of them are food venders, others are selling second hand clothes and few of them are selling merchandise items. The study has revealed that if well managed petty trade can play a great role in households' income poverty reduction. Majority of respondents have reported improvements in their abilities to get health services, to meet house expenses and also to get the reasonable number of meals per day. This reflects the fact that, creation of good businesses environment for petty traders could play a great role in income poverty reduction and hence improve their wellbeing.

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Inventory Model for Dynamic Demand and Product Cost with Limited Storage Space Using L.P.P/I.P.P. Technique

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ABSTRACT: In global market, where demand as well as the cost fluctuates rapidly, whereas the inventory holding capacity and capital to be invested doesn't change at the same pace; long term planning seems reasonable to avoid any loss either due to overstocking the inventory or due to stock-outs. This paper presents proposes a deterministic mathematical model to effectively control the inventory holdings. Proposed model considers the periodic fluctuations in demand and cost that affect the cost and quantity of inventory holding under the constraint that available storage space is limited. It minimizes the total cost of inventory in a given period of time and without any shortages.

KEYWORDS: EOQ model, Inventory Control, Shortages, Stock holding, Carrying Cost.

1   INTRODUCTION

Inventory is the stock to be held by an organization (may be a retailer/manufacturer/charity organization etc.) to meet the future demand. As any denial in fulfilling the demand is not a healthy sign for the growth of business outlet, because each denial results in loss of goodwill and a potential consumer. To meet all the demands that may occur at any period of time a very careful and effective strategy should be adopted so that while maintaining and managing the items in store. This strategic management of the inventory is called inventory control.

Many businesses have limited resource. In such a case if a large part of the capital is tied up in wrong kind of inventory then it may be catastrophic for the organization. Also inventory may be old, worn out, shop worn, obsolete, or of the wrong sizes or colours, or there may be an imbalance among different product lines that reduces the customer's appeal of the total operation. Therefore it is essential to ensure that the organization has the right amount of goods on hand to avoid stock-outs, to prevent shrinkage (spoilage/theft), and to provide proper accounting.

In today's open market the demand and/or cost does not remain constant but keeps changing with time. It actually varies when the selling price of any item is changed [1]. So the problem arises that how much should be kept in stock prior to the arrival of next demand?

Also, if there are some items are left from the previous period then how to decide for the next level of inventory. So it is necessary to pre-decide the inventory level and manage it effectively at any instant of time. Since if supplier/ manufacturer doesn't check the inventory level on time than they may be at loss either due to over-stocking it or by underestimating it.

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2 INVENTORY MODEL FOR DYNAMIC DEMAND AND PRODUCT COST WITH LIMITED STORAGE SPACE USING L.P.P/I.P.P. TECHNIQUE [SINGLE ITEM]

In the basic Barabas EOQ Model [2], [3] demand of the item as well as the cost of product is assumed to be constant. But in today's open market, the cost and demand is not static rather fluctuate rapidly. It actually varies when the selling price of any item is changed [1]. It may also vary if the paying capacity of the consumer changes.

Again in Barabas EOQ Model, the inventory left (if any) during the previous period has not been accounted for, as it has been assumed that next order is placed when inventory level reaches zero with zero lead time. Thinking of it that cost doesn't change and inventory is replenished as soon as it is ordered, than why does a firm need extra expenses on holding the inventory? It would be better that organization orders for the item, only when a demand arises and thus saving the capital, which can be used for other productive work. Practically it is not possible. In fact, the Cost and demand both changes rapidly due to various reasons. Also, there may be inventory left from the previous period which should be utilized in the next time period. Organization just cannot throw the leftover inventory except for the case where it is expired or spoiled for one or the other reasons.

One more point of concern is the storage capacity. Holding an inventory needs space and acquiring more space is not that easy due to various constraints. Definitely, any organization cannot have unlimited storage space. Thus, one has to keep this constraint in mind, while developing a model. Thus, a long term inventory plan may be more beneficial for any organization. Therefore, it is more desirable for a supplier/ manufacturer to have prior knowledge of the state of inventory holdings, so that he can manage his inventory level effectively, at any instant of time. Since if supplier/ manufacturer doesn't check the inventory level on time than they may be at loss either due to over-stocking it or by running short of it.

Many models have been proposed for time dependent demand rate over the years such as Baker & Urban, (1988)[4] presented the EOQ model in which the demand is a multivariate function of price, time, and level of inventory;

Mandal & Maiti's (1999)[5] model with stock dependent demand. This study proposes a new inventory control model which addresses all the above cited problems and takes into account the fluctuation in demand rate and product cost that affects the inventory and still minimizes the total cost of inventory in a given period of time.

The model that has been formulated in this study considers all the above factors and is based on the following assumptions

- Multiple items are being stocked.
- Demand is deterministic and changes with time.
- Cost of a product also fluctuates.
- One period is divided into 'n' time zones. 'n' refers to the number of times demand or price or both changes during the period under study.
- Storage capacity is limited.
- Shortages are not allowed.
- There may be stock holdings from the previous time zone and it is carried to the next and utilized.

Now consider the following variables:

n: Number of time zones in a given time period (may be a financial year).
t: Time period which takes the values 1,2,3……n in one financial year.
I: Maximum number of units that can be stocked at a time.
I_0: Initial stock holding.
I_t: Number of units in stock at the end of the period t. (t = 0, 1, 2…..n)
h: Inventory carrying cost.
d_t: Demand of the product in the period t: (t = 1, 2…..n)
C_t: Cost of unit item in the period t: (t = 1, 2…..n)
X_t: Number of units to be ordered in a time period t. (t = 0, 1, 2…..n)

Since inventory is being carried from one period to the next, it is necessary to define the stock.

Closing stock of period t = opening stock of period t + Quantity ordered in period t – demand

Symbolically, $I_t = I_{t-1} + X_t - d_t$

Obviously, *Opening stock in any period = Closing stock of previous period.*

Also $I_t \geq 0$ 　　　　　　　　　　　　　　　　　　　　　　　　　2.1

Thus we get the constraint $I_{t-1} + X_t \geq d_t$ 　　　　　　　　　　　2.2

Since storage space is limited therefore $I_t \leq I$ 　　　　　　　　　　2.3

Since number of units cannot be negative, therefore, $X_t \geq 0$ 　　　2.4

The inventory problem is to minimize the cost of inventory and obtain the optimal order quantity. Thus it can be formulated as:

$$Min\, T_c = h\sum_{t=0}^{n} I_t + \sum_{t=1}^{n} C_t X_t$$

This is the linear objective function. Combining it with constraints equations 2.1, 2.2, 2.3 and 2.4; inventory problem can be modeled as follows

$$Min\ T_c = h\sum_{t=0}^{n} I_t + \sum_{t=1}^{n} C_t X_t$$

Subject to the constraints:

$$I_t \leq I$$
$$I_{t-1} + X_t \geq d_t$$
$$I_t \geq 0,\ X_t \geq 0$$

This is a linear programming problem and can be solved by Simplex method proposed by George Dantzig[6] in 1947. Numerical examples presented in this study are solved with the help of "lp_solve 5.5.2.0"[7] (http://lpsolve.sourceforge.net/5.5/). lp_solve is a software to solve optimization problem using simplex method. It was originally developed by Michel Berkelaar at Eindhoven University of Technology. Henri Gourvest, developed easy to use graphical interface called LPSolve IDE for this program. This is very simple and user friendly.

NUMERICAL EXAMPLE [2.1]: If 15 units of a beverage are already in store and it is possible to hold up to 90 units of a beverage in store from one period to the next at a carrying cost of Rs. 2 per unit. Demand and cost for four consecutive periods of the beverage is estimated as below:

Table 1. Table of Demand and Cost of beverage

Period	Demand (unit)	Cost per unit
1	100	Rs. 15
2	80	Rs 14
3	120	Rs 17
4	110	Rs 18

It is required to determine the storage schedule which will meet the stated demands over the four time periods at minimum cost.

SOLUTION: This problem can be modeled as

$$Min\ T_c = 2\left(I_0 + I_1 + I_2 + I_3 + I_4\right) + 15X_1 + 14X_2 + 17X_3 + 18X_4$$

Subject to the constraints:

$I_0 = 20$, $I_1 \leq 90$, $I_2 \leq 90$, $I_3 \leq 90$, $I_4 \leq 90$

$I_0 + X_1 \geq 100$, $I_1 + X_2 \geq 80$ $I_2 + X_3 \geq 120$, $I_3 + X_4 \geq 100$
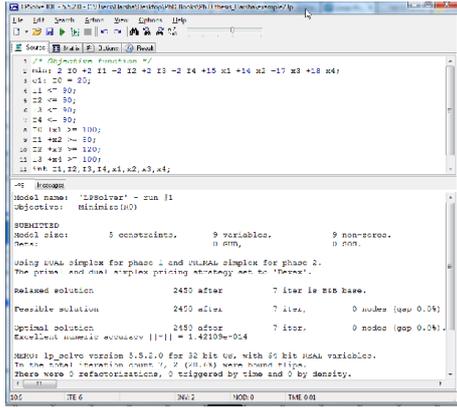
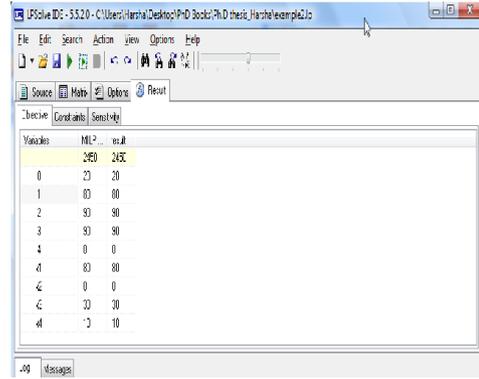*Fig 2.1: Window image showing objective function*

Fig 2.2: Window image showing result

$I_t \geq 0$, $X_t \geq 0$

This is solved using lp_solve 5.5.2.0 [7] [Refer Window images 2.1 and 2.2 for solution]

$I_1 = 80$, $I_2 = 90$, $I_3 = 90$, $I_4 = 0$, $X_1 = 80$, $X_2 = 80$, $X_3 = 30$, $X_4 = 10$

$Min\ T_c = $ Rs. 2450

NUMERICAL EXAMPLE [2.2]: Demand and product cost for an item for 2 periods are given below:

Table 2. Table of Demand and Cost for an item

Period	Demand (unit)	Cost per unit
1	75	Rs 6
2	124	Rs 8

Carrying cost is Rs 2.5 per period and initially there are 25 items in the store. If a store can hold a maximum of 100 units, from one period to another, than find the inventory that minimizes the total cost for the given time.

SOLUTION: The problem takes the following l.p.p. form.

$$Min\ T_c = 2.2 \left(I_0 + I_1 + I_2 \right) + 6X_1 + 8X_2$$

Subject to the constraints:

$I_0 = 25$, , $I_1 \leq 100$, $I_2 \leq 100$,

$I_0 + X_1 \geq 75$, $I_1 + X_2 \geq 124$, $I_t \geq 0$, $X_t \geq 0$

Solving by '*lp_solve 5.5.2.0*' [7] We get

$I_1 = 100$, $I_2 = 0$, $X_1 = 50$, $X_2 = 24$ and. Min T$_c$ = Rs 804.50.

3   INVENTORY MODEL FOR DYNAMIC DEMAND AND PRODUCT COST WITH LIMITED STORAGE SPACE USING L.P.P/I.P.P. TECHNIQUE [MULTIPLE ITEMS]

The model presented in the last section deals with single item inventory holdings. It can be reformulated for the multiple item inventory holding, which will be more applicable as most of the time an organisation deals with many items inventory holding.

Assumptions: All the assumptions remain the same as the previous one except for the first one that is now 'multiple items are being stocked.

Now consider the following variables:

n: Number of time zones in a given time period.

t: Time period which takes the values 1,2,3......n in one financial year.

p: Product number; which takes the values 1,2,3......k, if there are k different types of product to be stored.

I_p: Maximum number of t units of the pth product that can be stocked at a time.

I_{0p}:   Initial stock holding for p^{th} product.

I_{tp}:   Number of units of the pth product in stock at the end of the period t. (t = 0, 1, 2.....n)

h_p: Inventory carrying cost of the pth product.

d_{tp}:   Demand of the pth product in the period t: (t = 1, 2.....n)

C_{tp}:   Cost of unit item in the period t: (t = 1, 2.....n)

X_{tp}:   Number of units to be ordered in a time period t. (t = 0, 1, 2.....n)

Since inventory is being carried from one period to the next, it is necessary to define the stock.

Closing stock of period t = opening stock of period t + Quantity ordered in period t − demand

Symbolically,

$$I_{tp} = I_{(t-1)p} + X_{tp} - d_{tp}$$

Obviously,

Opening stock in any period = Closing stock of previous period.

Also $I_{tp} \geq 0$ 3.1

Thus we get the constraint $I_{(t-1)p} + X_{tp} \geq d_{tp}$ 3.2

Since storage space is limited therefore $I_{tp} \leq I_p$ 3.3

Since number of units cannot be negative, therefore, $X_{tp} \geq 0$ 3.4

The inventory problem is to minimize the cost of inventory and obtain the optimal order quantity. Thus it can be formulated as:

$$Min\, T_c = \sum_{p=1}^{k} \left[h_p \sum_{t=0}^{n} I_{tp} \right] + \sum_{p=1}^{k} \sum_{t=1}^{n} C_{tp} X_{tp}$$

This is the linear objective function. Combining it with constraints equations 3.1, 3.2, 3.3 and 3.4; inventory problem can be modeled as follows

$$Min\, T_c = \sum_{p=1}^{k} \left[h_p \sum_{t=0}^{n} I_{tp} \right] + \sum_{p=1}^{k} \sum_{t=1}^{n} C_{tp} X_{tp}$$

Subject to the constraints:

$I_{tp} \leq I_p$, $I_{(t-1)p} + X_{tp} \geq d_{tp}$, $I_{tp} \geq 0$, $X_{tp} \geq 0$

This is a linear programming problem and can be solved by Simplex method proposed by George Dantzig in 1947.

NUMERICAL EXAMPLE [3.1]: A retailer selling grocery item stores five items for future use. Variation in demand and cost of items are given below:

Table 3. Table showing retailer's grocery demand and storage capacity

Product No.	Time period	Demand units	Cost / unit	Initial Inventory I_{0p}	Holding capacity (units)	Carrying cost
1	1	100	Rs 32	30	80	Rs.1
	2	110	Rs 34			
	3	90	Rs 31			
2	1	65	Rs 5	35	95	Rs. 1.5
	2	130	Rs 6			
	3	100	Rs 7			
3	1	68	Rs 15	28	72	Rs. 0.5
	2	83	Rs 13			
	3	70	Rs 14			

Retailer wants to have inventory policy so that he can fulfil the demands without investing much money on it. Plan the inventory policy.

SOLUTION: Following l.p.p. problem will be formulated:

$$Min \ T_c = \left(I_{01} + I_{11} + I_{21} + I_{31}\right) + 1.5\left(I_{02} + I_{12} + I_{22} + I_{32}\right) + 0.5\left(I_{03} + I_{13} + I_{23} + I_{33}\right)$$

$$+32X_{11} + 34X_{21} + 31 X_{31} + 5 X_{12} + 6 X_{22} + 7 X_{32} + 15X_{13} + 13X_{23} + 14X_{33};$$

Subject to the constraints:

$I_{01} = 30$; $I_{02} = 35$; $I_{03} = 28$; $\quad I_{11} \leq 80$; $I_{21} \leq 80$; $I_{31} \leq 80$; $\quad I_{12} \leq 95$; $I_{22} \leq 95$; $I_{32} \leq 95$;

$I_{13} \leq 72$; $I_{23} \leq 72$; $I_{33} \leq 72$; $\quad I_{01} + X_{11} \geq 100$; $\quad I_{11} + X_{21} \geq 110$; $\quad I_{21} + X_{31} \geq 90$;

$I_{02} + X_{12} \geq 65$; $\quad I_{12} + X_{22} \geq 130$; $\quad I_{22} + X_{32} \geq 90$; $\quad I_{03} + X_{13} \geq 68$;

$I_{13} + X_{23} \geq 83$; $\quad I_{23} + X_{33} \geq 70$;

And $I_{11} \geq 0$, $I_{21} \geq 0$, $I_{31} \geq 0$, $\quad I_{12} \geq 0$, $I_{22} \geq 0$, $I_{32} \geq 0$, $\quad I_{13} \geq 0$, $I_{23} \geq 0$, $I_{33} \geq 0$,

$X_{11} \geq 0$ $X_{21} \geq 0$, $X_{31} \geq 0$, $\quad X_{12} \geq 0$, $X_{22} \geq 0$, $X_{32} \geq 0$, $\quad X_{13} \geq 0$, $X_{23} \geq 0$, $X_{33} \geq 0$;

Solving by '*lp_solve 5.5.2.0*' [7]

$I_{11} = 80$, $I_{21} = 80$, $I_{31} = 0$, $\quad I_{12} = 95$, $I_{22} = 90$, $I_{32} = 0$, $\quad I_{13} = 72$, $I_{23} = 70$, $I_{33} = 0$,

$X_{11} = 70$ $X_{21} = 30$, $X_{31} = 10$, $\quad X_{12} = 30$, $X_{22} = 35$, $X_{32} = 0$, $\quad X_{13} = 40$, $X_{23} = 11$, $X_{33} = 0$

and Min T_c = Rs 5278

Thus inventory plan for the retailer is as follows:

Table 4.   Table showing inventory plan for the retailer

Product No.	Time period	Units to be ordered	Inventory units	Minimum Inventory Cost
1	1	$X_{11} = 70$	$I_{11} = 80$	
	2	$X_{21} = 30$	$I_{21} = 80$	
	3	$X_{31} = 10$	$I_{31} = 0$	
2	1	$X_{12} = 30$	$I_{12} = 95$	Min T_c = Rs 5278
	2	$X_{22} = 35$	$I_{22} = 90$	
	3	$X_{32} = 0$	$I_{32} = 0$	
3	1	$X_{13} = 40$	$I_{13} = 72$	
	2	$X_{23} = 11$	$I_{23} = 70$	
	3	$X_{33} = 0$	$I_{33} = 0$	

4   RESULTS AND DISCUSSION

Inventory planning and control is an essential evil of any organization. In this study it has been thoroughly studied and two models are proposed to help anyone keeping efficient merchandise. Proposed models use simple mathematics that even a person with little subject knowledge can understand easily. The models are deterministic and simplicity of the model is its strength.

The models can predict the economic order quantity for more than one period at a time; therefore, it is fit for long range inventory planning and control.

The models have a limitation that it requires demand to be estimated well before time. But if demand is predicted correctly than model seems to be a good enough to keep inventory control.

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Mushrooming Village Community Banks in Tanzania: Is it really making a difference?

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ABSTRACT: Village Community banks have been reported to benefit the poorer men and women in developing countries since their establishment. In Tanzania, VICOBA and other informal financial institutions have reached 27.9% of rural communities who were initially unserved. Much as the grassroots communities have been served by VICOBA few studies have been conducted in Arumeru Distict to evaluate how VICOBA have benefited the poor. It was from this concern that this study was conducted in June 2012 to assess the services, achievements and challenges pertaining to VICOBA in Arumeru District. A sample of 96 respondents was selected for the study. From the study it was found that Village Community Bank members of Muhorere, Mchele mchele and Mwangaza groups have benefited as members and sole owners of the banks. Members have been empowered in different skills and received different services such as soft loans, savings, shares, trainings and social or emergency loans. The banks on the other hand have achieved a lot since their commencement. There has been an expansion of their member base, their stakeholder base and even their capital base. Nevertheless there have been some hurdles encountered such as illiteracy for some members, inadequate capital and lack of bank offices among others.

KEYWORDS: Credit, Poor, Loan, Saving, Shares, Village Community Banks, Women.

1 INTRODUCTION

1.1 BACKGROUND INFORMATION

Since its inception, Village Community Banks (VICOBA) has benefited the poorer group of people in developing countries who were initially termed as the "unbankables" by the formal microfinance setting. Through VICOBA, poor rural women and men have been able to save or obtain loans to help them set up or improve business, invest in long term life needs such as health, education or deal with emergencies (ILO, 2008). Also, VICOBA have empowered its members who are the sole owners in different skills such as governance, accountability, business management and have enhanced women's confidence and improved their status in the community.

In Tanzania, Village Community Banks were originally adopted from Niger, in West Africa, where they were popularly known as "Mata Maso Dubara" (MMD). The model was initiated in Tanzania in 2000 with the aim of empowering less privileged people in both urban and rural settings. VICOBA in Tanzania has reached the grassroots communities as from the FINScope survey done in 2011; it was revealed that 27.9% of the rural communities who were initially un-served are now served by informal financial institutions such as VICOBA, Rotating Savings and Credit Association (ROSCAs), and Village Savings and Loan Associations (VSLAs).

Though VICOBA has been very valuable to its members, different studies have revealed various problems they encounter the same way as members of other financial institutions. In a study done by Kihulya (2007) it was reported that the members of formal and semi formal financial institutions in Tanzania encounter multiple challenges including lack of collateral, high interest rate ranging from 20% to 40%, short term repayment and rudimentary repayment schedule. On another hand those who are members of informal financial institutions such as ROSCAs, VICOBA and VSLAs complained of small amount of credit, lack of shares, and sometimes lack of business management trainings.

While members of VICOBA face some hardships, the bank as a local unregistered institution also faces a lot of adversity in its different operations. In a study done in South Africa in 2002 by Cotzee and Cross, it was revealed that village banks encounter problems from the initial stages to maturity due to weak group structures; high proportion of illiterate group members; weak or ineffective leadership leading to unresolved grievances and disputes; absence of mechanism for equitable division of interest revenue and lack of transparency and access to records. In Tanzania, few studies have been conducted to assess the performance of different VICOBA operating in different parts of the country. In a study done by Kihongo (2005) in Ukonga Dar es Salaam, it was revealed that the institution was faced by inadequate capital for credit, and members were unsatisfied with the interest rate, unavailability of credit and procedures for credit acquisition. In another study by Lema (2011) in Njombe district it was learnt that Inadequate entrepreneurship skills was mentioned by many respondents being the main problem they faced followed by inadequate capital, Local Authority Taxes and lack of permanent office.

In Arusha and especially in Arumeru district, with more than 30 VICOBA groups, it was discovered that few researches have been done on how different VICOBA groups operate and analysis on individual group is inadequate. It is from this juncture that this study intended to assess Mwangaza, Mchele mchele and Muhorere VICOBA groups operating in Arumeru District.

1.2 OBJECTIVES OF THE RESEARCH

The main objective of the study was to assess the operations, achievements and challenges of the three VICOBA groups in providing services to the members. Specifically the research intended to study services, achievements and identify different challenges facing Mwangaza, Mchele mchele and Muhorere VICOBA groups in their daily routine as savings and credit groups.

2 REVIEW OF LITERATURE

2.1 THEORETICAL BACKGROUND

According to the World Bank, poverty is said to exist when people lack the means to satisfy their basic needs (World Bank 1998). Income poverty is a state where one lacks a usual or socially acceptable amount of money or material possessions. Income poverty is a major cause of other types of poverty like food poverty, basic needs poverty, ill health and handicap poverty. Because of lack or low income people fail to utilize other forces of production that is land, entrepreneurial, and labour. Although the Human Development Index for Tanzania rose from 0.458 in 2000 to 0.530 in 2007, poverty in the country is still widespread and acute (UNDP, 2009). Poverty is a predominantly rural phenomenon; more than 80% of Tanzania's poor live in rural areas (NBS, 2009). As a response towards poverty reduction, the Government of the United Republic of Tanzania has been battling against poverty since the early days of independence, and such efforts have been reinforced in many times through various policies.

2.2 POLICY REVIEW

In order to get out of poverty trap, the country developed the Tanzanian Development Vision 2025. The Development Vision was later translated by Poverty Reduction Strategy of 2000-2003 which was succeeded by the current, National Strategy for Growth and Reduction of Poverty (NSGRP) or commonly known in Kiswahili as 'MKUKUTA' of 2005-2010. The NSGRP is country policy towards reduction of poverty thus all development agents (State organizations and non-state organizations) are tied to implement poverty reduction initiatives under the guidance of NSGRP (URT, 2005).

Among the strategies, all the policies sought to enable the poor people come out of poverty by providing them with means and capacity so that they can invest into income generating activities and get income. One of the means is capital, but, given the fact that they don't meet conditions (mostly collateral), which have been put by financial institutions, the poor people fail to access capital. Thus establishment of microfinance institutions was important as they can provide loans to the active poor people with soft conditions that take into consideration the need and capacity of the poor. As part of the solution, different organization has assisted the people in formation of informal/formal groups and associations like SACCOS and Village Community Banks (VICOBA) program.

2.3 STRUCTURE OF VICOBA

Village Community Banks program was established in order to overcome capital shortcomings and empower the poor to have their own MFIs, which meet their needs and can, reduce income poverty. Village Community Banks are informal, village

based savings and credit groups being promoted in various parts of Tanzania (Duursma, 2007). VICOBA is structured in such a way that poor people, especially those in the rural areas, are organized in groups and trained in various skills so as to build up their capacity to fight against poverty. VICOBA holds a strong belief that even poor people have skills, capabilities and abilities which when unleashed and utilized effectively can help them to attain and improve their economic development and social welfare. By 2009 VICOBA has spread in 19 out of 25 regions in Tanzania with approximately 56,280 members (MoFEA/PED, 2009).

2.4 EMPIRICAL REVIEW

The study by Mike FitzGibbon (1999) in microfinance services offered through SACCOS found that half of the institutions, do not offer credits and those offering credits, condition require that the loan seeker has some form of fixed assets as collateral. Corruption, and especially embezzlement, was a common problem. There are huge gaps still to be filled at institute on level. The Tanzanian economy in general and the financial sector in particular, still lack sufficient base capacity in terms of human resources and effective and efficient organisations. This lack of'absorption' capacity at institutional level is considered the major bottleneck in developing the microfinance market in Tanzania (Duursma, 2007). This justifies VICOBA to be far beneficial to the poor Tanzanians as compared to SACCOS.

VICOBA lending scheme has already proved to be one of the better tools for community emancipation socially and economically in Tanzania. This is evident in the people benefiting from the scheme. There are a lot of testimonies and recorded facts from the VICOBA practitioners as derived from the Documentation Report by the Ministry of Finance and Economic Affairs/Poverty eradication Department (2009). Jerome Adamu Lupila of Ujenzi group in Masasi says VICOBA is a place where members become courageous and are built in mutual support habit. 'Mama wa Joji' from Nanyore group in Minjingu village Nkaiti ward Babati District Manyara call it a place where a poor is transformed from "Hali choka" - Doldrums to "vifijo" – jovial life. For Mr. Abdi Magoda of zingatia group in Kabuku Handeni, VICOBA is a place where individual livelihood and interpersonal relationship are bettered. According to Mr. Yusuph of Somanga Village in Kilwa District Says VICOBA is a place in which those used to one meal a day are lifted to two, three and even more meals per day. He adds that those who couldn't afford education cost become education tycoons.

In the mid-1990s, the International Food Policy Research Institute (IFPRI) made a strong case for the connections between rural finance and food security. The study found that financial services that respond to the food security needs of rural households can lead to more successful outreach and have a greater impact on the poor (Sharma, 2000). Agricultural loans are often used to purchase seed inputs (both improved and local) and tools as well as to hire labor. It is expected that the net effect of these loans is an increase in the production of crops (including key household staple crops.) An increase in food production can lead to an increase in food availability and also to an increase in access to income if more crops are being sold for profit. An increase in food production can also contribute to year-long household food stability.

The study conducted by Kihongo (2005) revealed that there was effectiveness in the capacity building through various skills by provision of training ranging from simple accounting procedure, business management and some entrepreneur skills as part of VICOBA project operation. The trainings have been not only useful in successful operation of VICOBA but also growth of their economic activities.

On the other hand, though there is progress in microfinance sector in Tanzania in terms of number and products they offer, still there are some limitations, which are a hindrance to income poverty reduction. Further, sustainability of VICOBA members' projects is not assured as with the small size of capital in business, it is difficult for them to compete with new entrants in the same business with large capital (Kihongo, 2005).

3 RESEARCH METHODOLOGY

3.1 AREA OF THE STUDY

The study was conducted in Meru District Council in Arusha Region, most focused at Usa River ward. Meru district council is among the two councils that form Arumeru district. Administratively, the District is divided into 3 divisions, 17 wards, 69 villages, 275 hamlets and 48,768 households. The district has a total population of 268,144 people according to 2012 population census, among which 131,264 (49%) are males and 136,880 (51%) are females. Meru district council covers an area of 1268.2 Km2. The District Council lies on the slopes of Mount Meru which is the second highest mountain in Tanzania after Kilimanjaro.

3.2 RESEARCH DESIGN

The study used a descriptive cross-sectional survey designed to facilitate collection of information about VICOBA in a uniform and reliable manner. The findings will thus apply to the sampled VICOBA at that particular time it was undertaken.

3.3 SAMPLE SIZE AND SAMPLING PROCEDURE

The sample size under this study was 96 respondents. This included members of the bank selected equally from all members of VICOBA. Similarly the sample included bank trainers, DCDO, DCO and non bank members.

Table 1: Sample Size

Categories	Population Sample
District Community Development Officer	2
District Cooperative Officer	2
VICOBA Members	80
VICOBA Non Members	7
Trainers and VICOBA Leaders	5
Total	96

Source: Field findings, 2012

3.4 SAMPLING PROCEDURES

The research team employed different sampling techniques to capture enough information whereby both probability and non probability sampling was employed in selecting respondents. Under probability sampling the researchers used simple random sampling techniques to ensure that all VICOBA members and non members as well as trainers and leaders had the same chance of being included in the study. On another hand in non probability sampling the purposive sampling technique was employed to select the staff from Community Development and Cooperative Offices.

3.5 METHODS OF DATA COLLECTION

Due to complexity of the study in question, the research used various methods including focus group discussions, interviews, observations and documentation. The researchers considered different characteristics of the respondents before determining the proper method for data collection.

3.6 DATA ANALYSIS PROCEDURES

The data gathered from the respondents were coded, tabulated and analyzed by using the Statistical Package for Social Science (SPSS). Descriptive statistics helped to answer research questions by establishing percentages, frequencies, means and standard deviations of different categories of responses obtained through the questionnaires. For qualitative data, content analysis was used in which interpretations was made based on patterns and trends of information gathered.

4 FINDINGS

4.1 OCCUPATION OF VICOBA MEMBERS

Each VICOBA visited (Mwangaza, Mchele mchele and Muhorere) had a total of thirty (30) members who were all women. Table 2 indicates that more than half of the members (51.1%) were entrepreneurs. The remaining 12.5% were teachers, 12.5% farmers, 10% housewives, 12.5% food vendors and 1.2% nurses.

Table 2 Occupation of VICOBA members

Stakeholders of VICOBA	Frequency	Percentage
Teachers	10	12.5
Entrepreneurs	41	51.1
Farmers	10	12.5
Housewives	8	10.0
Food vendors	10	12.5
Nurse	1	1.2
Total	80	100.0

Source: Meru District research findings 2012

4.2   SERVICES PROVIDED BY VICOBA

The Village Community Banks visited provided several services just like other banks or financial institutions using a distinctive unique procedure which is very useful to low income earners. Respondents from all three VICOBA groups visited mentioned that since they joined the savings and credit groups they have been benefited from soft loans, savings, trainings and social or emergency funds as discussed below:

4.2.1   SOFT LOANS

VICOBA provides soft loans to almost all its members. This was reported by 96% of the respondents. The first loan to members is provided three months after the member deposits savings. That loan has to be repaid after three months for the first loan and six months for the second loan. During first cycle, the bank offers a loan amounting three times of what a member has saved. This situation was the same to all banks visited. For example a member with savings of one hundred thousand shillings (100,000) is provided a loan worth three hundred thousand (300,000) in the first cycle and from there the bank can offer any amount requested by a member which is to be repaid within six months. Nevertheless the amount disbursed during the weekly meetings depends on different factors such as the shares collected on that particular meeting, and the repayment trend of the member applying for the loan.

Though termed as soft loans which intended to mean that the conditions for acquiring the loan are also soft, it was also noticed that the members complained of the 5% interest rate charged on the loans. In all groups visited it was revealed that the interest rate was the same and the members are the ones who decided upon this rate. This becomes strange as some members were complaining while they were involved in decision making.

4.2.2   SHARES AND SAVINGS

Capital for running of the group is mobilized through loans from other financial institutions and shares from its members. Also interests from loans given to members tend to contribute to increasing capital of the particular group. It was learnt that VICOBA members meet once per week to deposit their money by buying shares. It is a prerequisite to buy shares whenever they meet, the maximum shares to be bought per day is five (5) shares while the minimum is one (1) share. Each share has the value of two thousand (2000) Shillings. If each member managed to buy five shares then they collect three hundred thousand (300,000) Shillings per week. This is the same for all three groups. If a member fails to buy the shares other members are obliged to make contributions so as to enable the failed member to purchase the lowest amount of share which is one.

4.2.3   SOCIAL OR EMERGENCY LOAN

Muhorere and Mchele mchele VICOBA groups termed this type of loan as social loan while Mwangaza group preferred to call it emergence loan. About 59% of VICOBA members reported to have benefited from this type of loan. It is a loan which

helps in solving social problems arising among members. It covers things such as funeral services and health expenses. A member passing through these difficulties at a certain point during his/her membership can take a loan and pay within three months. If it happens that a member needs this loan and the bank is not in position to offer the loan due to financial hardships, then it is the duty of the bank to borrow the money elsewhere on behalf of the member.

Funds for the social or emergency loan are mainly not from the shares and savings but rather they are from fines which are collected whenever a member misbehaves or fails to attend the weekly meetings on time. According to the members of the three groups, it became clear that they always agree synonymously on the time they meet. Muhorere meets on Friday at 4.00 p.m., Mchele mchele meets every Thursday at 4.00 p.m. while Mwangaza meet on Sunday at 2.00 p.m. The members are only allowed to be late by five minutes, beyond that they are fined an amount of 500 Tanzanian Shillings. Also fine of the same amount is charged to members who fail to attend the meeting without informing the group leaders. For cases where a member fails to show up in three consecutive meetings without a genuine reason she/he is obliged to pay 5000 Tanzanian Shillings.

4.2.4 TRAININGS

During the interviews it was revealed that 82% of the respondents have benefited a lot with different trainings provided. The trainings varied from record keeping skills, good governance, entrepreneurship and business establishment skills.

Business establishment training:

The findings show that through VICOBA, members are provided with free training on how to establish a business, in this type of training they are taught how to select prime business place, type of business and customer care. The management of business skills provided help members manage their business. This kind of training is provided to members even before having loan, and hence when they are provided with loans majority of them will run their firms in a sustainable manner.

Good Governance

VICOBA is the only bank which has the system of making its members learn and practice good governance. The bank provides training to members concerning good governance and also let the members practice it. Through good governance training the bank provides its members with skills on how to participate actively in decision making on different matters in their group. An example of good governance practice is when the group is selecting its management, when they are deciding on the interest rates and fines. Further each member participates on deciding the amount of shares they should buy on a weekly basis. These are all documented in the constitution put forward by the group. All the 3 groups visited revealed that they are guided by regulations, procedures and by laws which explains and takes them through their daily operations.

Entrepreneurship

The bank has succeeded to provide trainings concerning entrepreneurship. The bank provides training on how to save, to start a business and how to manage a business. The trainings are also provided on how and when to use the loan in a useful manner, but also taught on where to invest and at what time. The research found that Mchele mchele work together as a group in the business of cleaning the market place and selling rice. This is the great achievement because the members work communally. In Muhorere, the researcher found out that bank members were trained on how to engage on entrepreneurship. Through focus group discussions it was learnt that they have build a habit of keeping savings and also are running their businesses without loss. In Mwangaza, the bank members had the same opinion as the other two bank groups, that is, some of members were not good in business but due to training provided by the bank are now good entrepreneurs

4.3 ACHIEVEMENTS REACHED BY VICOBA

All the three VICOBA groups visited reported to be successful in different aspects as it is discussed here under:

4.3.1 MEMBERS EXPANSION

All the groups visited alleged to have increased their members' base since they started their operations. Muhorere which was established in September 2010, with only seventeen (17) members had now reached a saturation point of thirty (30) members as stipulated by the VICOBA constitution. The same situation above was observed in Mchele mchele which started with twenty three (23) members in May 2009. Mwangaza which was established on February, 2012 started with only nineteen (19) members but now has reached thirty members. The groups can only add another member if a current members drops out due to different reason such as death, prolonged illness, loan defaulting or voluntary exit.

4.3.2   CAPITAL EXPANSION

The capital base was very low when the three VICOBA groups started their operations but now it has increased. From the research it was found out that the capital base of any VICOBA group is built through shares bought by members on a weekly basis. With few members at the start that meant a meager amount of capital but with the increased member base that implies an increase in capital. Apart from the member base the value of the shares also contributed much to the capital expansion. At the start Muhorere sold its share at a value of only one thousand 1000 Tanzanian shillings, but now the value of one share has increased to 2000 Tanzanian shillings and they are now planning to increase the value of one share up to 3000 Tanzanian shillings. Muhorere has increased the capital up to 8,000,000 million Tanzanian shillings while it started with a capital of 600,000 Tanzanian shillings only.

With Mchele mchele, the situation is the same as Muhorere, as it started selling one share at a value of only 500 Tanzanian shillings but now the value of one share is 1,000 Tanzanian shillings. They started with the capital base of 300,000 Tanzanian shillings only but now the capital has increased to 4,000,000 Tanzanian Shillings. The same applied to Mwangaza which started with only 500,000 Tanzanian Shillings but now the capital has increased up to 8,000,000 Tanzanian Shillings.

Another reason which led to the increase of capital of the bank is the fact that the interest accrued by the bank is added to the capital. The bank is operated without any costs such as salaries because there is no employee from outside the bank, members alone work for the bank. Further the bank has no expenses such as rent because operations are conducted at one of the members building. At the end of the year (one cycle), they share the dividends and start another cycle. An exception is the Mchele mchele group which has the bank account in Meru Community Bank.

4.3.3   STAKEHOLDERS EXPANSION

During their establishment, all banks had only farmers as members but currently the three VICOBA have opened way to people of different occupations including public servants, private sector workers and entrepreneurs. The only condition the banks give to this new type of stakeholders is that they should adhere to the bank's constitution. With varied members in the banks it was appreciated by Mwangaza group since in the start majority of them had poor educational background but now they have teachers, nurses and even accountants who can help them in record keeping and other activities requiring educated people.

4.4   CHALLENGES FACING VICOBA IN PROVIDING SERVICES TO THE COMMUNITY

VICOBA groups face different challenges in their daily procedures in serving their members. This was deduced during interviews and focus groups discussions with the members, non members, trainers as well as the DCDO and DCO.

4.4.1   ILLITERACY

Majority of VICOBA members are not well educated and therefore it becomes difficult to understand when given trainings and even when running their businesses. From the research conducted it was learnt that 20% of the respondents have no formal education, 55.6% have attained primary education, while the remaining 24.4% have attained secondary education. With this intellectual capacity it becomes clear that, when trained it takes long for them to understand different matters and even sometimes they fail to even grasp simple concepts.

4.4.2   INADEQUATE CAPITAL

During focus group discussions with the VICOBA groups, it was found out that Village Community Banks group members mobilize resources through buying of shares, monthly fees and fines. The shares which contribute to 90% of the bank capital are pegged at Tshs. 2,000/= per week, amounting to approximately Tshs 60,000/= per meeting if each member buys only one share. Another source of money includes Monthly fees and fines. The fines are paid for breach of group rules and regulations e.g. delay in meetings or delay in payment of shares.

With this small amount collected during a meeting, it becomes clear that it will not be enough if a member even wants a 100,000 TShs loan, with that, it means the bank have to look for other sources to fulfill their customers' requirements. When asked what they do during situations like this the banks responded that it is during this time that they have to take loans from other commercial banks likes Cooperative and Rural Development Bank, Meru Community Bank and even National Microfinance Bank.

4.4.3 LACK OF VICOBA OFFICE

All VICOBA visited operated at the place which is not conducive as they do not have their own building to meet so they have to meet at the house of one of the members. Sometimes the area is small to accommodate all of them, but also it is risky for the owner of the house to accommodate all of the members since people may think that the money collected are kept there and so the house owner being in the fear of being attacked by people who want to steal the money. Apart from that it is very inconvenient to the house owner since she has to sacrifice all other activities to accommodate her peers.

On the other side the banks lack land for constructing their own buildings. The situation necessitates the bank to use safe metal box for money keeping collected every week they met. Other money is kept in circulation by being borrowed to members. That box which is locked with three locks has to stay with accountant of the group. Different three members stay with the keys and it is not supposed to be opened unless it is in the meeting. This challenge makes an accountant to stay with the money but having fear of being attacked by thieves.

4.4.4 INADEQUATE KNOWLEDGE ON RECORD KEEPING

The research observed that VICOBA are operated with the people who have little knowledge concerning how to keep records. The situation might be caused by the fact that most members have low education level hence becomes difficult to adhere with this. It has also been observed that members of VICOBA are the ones who serve the bank. That is to say there is no other employee outside the members unless they recruit one on temporary basis who can help them with the repayment records and even calculation of dividends and interest.

4.4.5 LOAN DEFAULT AND FAILURE TO REPAY

During the interviews and focus group discussions, it was mentioned that the repayment rate was above 90% in all the banks visited. When probed on the excellent repayment rate they simply mentioned that is because women are more responsible than men. However in Mwangaza group it was mentioned that few group members have failed to repay the loan. This situation forced other group members (guarantors) to repay the loan on behalf of the defaulted member.

5   CONCLUSION

In general the study found out that Village Community Bank members of Muhorere, Mchele mchele and Mwangaza groups have benefited much as members and sole owners of the banks. It was clearly deduced that the sole owners of the bank visited are women. To this the study concludes that the banks in rural areas as Arumeru have helped in empowering women who are members and owners of the banks. Further from the findings it was revealed that the women have benefited from different services provided such as soft loans, savings, shares, trainings and social or emergency loans provided.

The banks as other financial institutions on another hand have achieved a lot since they started their operations. They reported to have expanded their member base, their stakeholder base and even their capital base. Much as the banks reported great achievements attained, they also complained of some hurdles faced in their growth. They mentioned illiteracy, inadequate capital and lack of bank offices as among the major hurdles slowing their growth.

6   RECOMMENDATIONS

In view of the research findings of the study and the above conclusion, the following are the recommendations drawn to the government and members of Village Community Banks.

To the Government

- The Government through Social and Economic Development Initiatives of Tanzania (SEDIT) and Meru District Council should make sure that they provide the banks with required infrastructure and trainings so that they operate smoothly and sustainably.
- The Government also, should enact different policies which favor the informal financial settings such as VICOBA, as the banks visited felt that the current microfinance policy in use favours the formal and semi formal financial institutions which are legally registered by the Bank of Tanzania.

To the members

- Since the groups are formed based on mutual trust, it is advised that members of the banks recruited should be familiar with the risk involved in case their peer member defaults. Adding to this, the banks should introduce new conditions such as presentation of business plan for new loans applied and visit of the group to the member applying for new loan to check on the viability of the business.

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The Effects of Financial Liberalization in Singida region: Experience from Utemini ward, Tanzania

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ABSTRACT: The study examined the effects of financial liberalization in Singida region. Data collected through questionnaire while survey and focus group discussion techniques applied. Data were analysed through Statistical Package for Social Science (SPSS) version 11.5. Results indicated that four types of loans offered by financial institutions includes; personal loans offered to employees of different organizations; Mortgage loans given to business persons with existing business; Corporate loans targeted agricultural groups; and loans is offered to SACCOs from banks. However no loans found favored directly youth as first target as a result Persistence of Youth unemployed is increasingly in Singida region. It is concluded that contribution of financial liberalization to youth employment in Singida municipality is only 22.5%. The researchers recommended that government should supported financial sectors to play a significant role in economy by establishment of appropriate policies which consolidate the gains of first generation reforms.

KEYWORDS: financial liberalization, employment, unemployment, investment.

INTRODUCTION

Financial liberalization (FL) refers to the measures directed at diluting or dismantling regulatory control over the institutional structures, instruments, and activities of agents in different segments of financial sector Chandrasekhar (2004), cited by Ghosh (2005). The term financial liberalization is also used to refer to the deregulation of domestic financial market and liberalization of capital account (Arestis and Caner, 2009).

Starting in the 1980s, and mainly in the 1990s, two facts became decisively in international relations: one is a significant rise in private capital flows and the capital account liberalization. This process began in developed nations and found fertile ground in developing countries and Tanzania in particular. As argued by Edwards (2000), it flourished in the 1990s when market-oriented reforms were implemented. At the same time capital flows increased, channeled mainly through foreign direct investment (FDI). According to Froot (1993), worldwide flows of FDI increased almost threefold between 1980 and1990.

Following the financial liberalization in developed countries it contributed to the general savings which were in access of investment ex ante, increased the flexibility of banking and financial institutions where creating credit and investment, permitting the proliferation of financial institutions, encouraged competition and whetted the appetite of banks to earn higher returns hence boom to customer credit (Arestis and Caner, 2009).

Ranciere *at al*. (2005), cited by (Arestis and Caner, 2009) found that countries adopted financial liberalization have passed through boom and busts and has an average of economy which grow faster than those without financial liberalization. In 2008, the ILO noted that recently there had been a declining trend in youth unemployment around the world. The world unemployment rate of youth aged 15-24 rose from 10.9% in 1999 to a peak in 2004 of 12.6% and declined to 11.9 per cent by 2007. The ILO noted that the world youth unemployment rate was nearly three times the adult rate but 2.4 times in the developed world. It is apparent that, in contrast to the rest of the world, the trend in youth unemployment has been rising in the UK, as has the ratio of youth-to-adult rates.

In developing countries, financial liberalization took place in the 1980s and 1990s as part of general move toward giving market a greater role in development. Before the financial liberalization in developing countries had financial repression between 1970s and 1980s, this characterized by a mix of state led development, nationalism, populism, politics and corruption. Financial system was treated as an instrument of treasury; government allocated credit at below market interest rate, used monetary policy instruments and state guaranteed external borrowing to ensure supplies of credit for themselves and public sectors firms (Arestis and Caner, 2009).

Financial liberalization in developing countries went together with significant parts of the economic policy package promoted by the so-called 'Washington consensus', associated by freeing interest rate, allowing financial innovations, reduce directed and subsidized credit as well as greater freedom in terms of external flows of capital in various forms such as private capital flows and FDI (Ghosh, 2005).

African countries adopted financial liberalization in 1990s often in the context of stabilization and reform programs supported by International Monetary Fund and World Bank. As the cost of repression become clear, many countries have made an attempt to liberalize their financial sector by deregulating interest rate, eliminating or reducing credit control, allowing free entry into financial sector, giving the autonomy to commercial banks, permitting private ownership of banks and liberalizing international capital flows (Arestis, 2005).

In Tanzania Financial Liberalization aimed at sustaining growth in real sector by boosting resources mobilization, motivating competition in financial market and enhancing quality and efficiency in credit allocation, financial liberalization is also major factor for Structural Adjustment Policies (SAPs) which aimed at rationalization of fiscal and monetary policies and creation of micro-economic environment favorable for economic growth (Shechonge, 2009). Financial liberalization has been to the large extent based on the view that it mobilizes savings and allocate capital to a more productive uses, both of which help to increase the amount of physical capital and its productivity, the trickledown effects of economic growth caused by financial liberalization increase income, reduce poverty and improve income distribution (Maliyamkono, 2006).

In order to liberalize the financial sector in Tanzania, government undertook number of measures such as; 'introduction of banking and financial institutions Act' (BFIA) to legalize the establishment of private financial institutions, foreign exchange Act 1992, the capital market and securities market Act 1994.

Also government has encouraged the development of savings and credit cooperative societies (SACCOs) or microfinance type of institutions. Most of the SACCOs are rural and community based (Muganda, 2004). Together with these initiatives, government passed into law a legal and regulatory framework to guide microfinance institutions with the objective of enhancing access to credit particularly to the rural sector and facilitating deepening of the sustainable financial intermediation.

These have resulted into proliferation of new merchant banks, commercial banks, bureau de change, insurance companies, stock exchange and related financial units. Also community based banks have been established through the grassroots initiatives such as Kilimanjaro cooperative bank, Kagera cooperative bank, Mwanga community bank, Mufindi community bank and Mbinga community bank. The entry of new banks and non bank financial institution has enhanced the competition and improved the quality and type of financial products and services provided. Currently in Tanzania there are 27 registered banks and nonbanks financial institutions, each of these institutions play an important role in financial recourses mobilization (Ghosh, et al, 2003).

Regardless the adoption of financial liberalization program in African countries, Youth unemployment is much higher than the world average of 14.4 per cent and second to the Middle East and North Africa where youth unemployment is 25.6 per cent. The youth population in Sub-Saharan Africa was estimated at 138 million people in 2002- 2003, with 28.9 million which is 21 per cent of unemployed. The high share of young people ages 15–24 in Africa's population contributes to the severity of the problem.

There are notable differences in youth unemployment with regard to gender and geographical dimension where unemployment rate for young women is 18.4 per cent–lower than the unemployment rate for young men which are 23.1 per cent and it is generally higher in urban areas than in rural areas, (ILO 2004b). Although in Tanzania, liberalization of financial sector has substantially transformed the economy into the more diversified, competitive and vibrant in economy of the country, there is an increasing number of youth unemployment. Therefore researcher is interested to examine the effects of financial liberalization with focus on employment creation to youth.

STATEMENT OF THE PROBLEM

Tanzania youth unemployment is becoming big problem. According to Integrated Labour Force Survey (ILFS), (2006) there is an average increase of 760,000 persons interring labour market in yearly basis, while government capacity to employment is 40,000 people which is only 5 percent of the whole population. The remains depend on informal employment and private sectors while majority stay jobless. According to Semboja, (2007), youth unemployment rate is about four times the adult unemployment rate and is growing at double the rate of adult counterpart.

Several factors account for the high youth unemployment rate in Tanzania, most notably is low economic growth, which is manifested in low economic activity and low investment. Also lack of skills/training and credit facilities. Low economic

Activity entails low overall job creation. Given the sustained population growth rates, labour markets are not able to absorb all the newcomers, resulting into high youth unemployment rate.

Government undertook various measures to overcome the problem, among which is financial liberalization which aimed at ensuring a better mobilization of capital, allocate capital to a more productive uses, stimulation of investments, and ultimately encourage economic growth. All of which would help to increase the amount of physical capital and its productivity, the trickledown effects of economic growth accompanied by financial liberalization could increase income, reduce poverty and unemployment rate, (Maliyamkono, 2006).

Despite the effort of government to liberalize financial sector, problem of youth unemployment continues, and there is little official information on the impact of financial liberalization on employment. Therefore researcher is interested to examine the effects of financial liberalization with focus on employment creation to youth.

OBJECTIVE OF THE STUDY

The general objective of this study is to examine the effects of financial liberalization in order to establish new understanding on how youth unemployment can be reduced.

DATA AND METHODS

Primary data collected from youths engaging in small business and financial institutions in study area. In secondary data conducted through documentary review in financial institutions, National Bureau of Statistic, marketing offices, Tanzania Investment Center (TIC) and beneficiaries' offices' annual reports, records, published and unpublished information. Non experimental research design were applied in the Study whereby cross-sectional technique while Sample size of 89 respondents include in the study.

The study used probability and non probability sampling techniques. The method of simple random sampling in probability technique was used mostly because each respondent had equal chance to be selected. Purposive non-probability technique was used to select target respondents such as financial institutions' loan officers, marketing officer and key informants where deep information related to study were obtained.

Both primary and secondary data were collected, whereby; Primary data were collected through unstructured interview using checklist, structured interview using structured questionnaire. Secondary data; were collected through documentary review in financial institutions and beneficiaries' offices, such as annual reports, records and published and unpublished available information's of financial institutions.

After collection, data was edited depending on the situation that encountered in the field. Then editing, classification, tabulation and coding of data were undertaken to enable analysis and categorization of the data into meaningful components.

The computer program used in data analysis was Statistical Package of social Science (SPSS) version 11.5.

Qualitative data collected through discussion with key informative were analyzed using content analysis .This was to give summary of each topic discussed and identify the content of discussion.

Already analyzed data produced outputs which were presented through tables, graphs, charts and figures. Also text was used to present information for different studied variable.

RESULTS

**New investments created after financial liberalization**

The trend of project supported by financial institutions is dramatically increasing as shown in table 3 below, they are individual owned projects ranging from small scale to medium scale projects. Most of this project is owned by individual persons who engage in business such as selling cooking oil, honey transit, second hand clothes just to name the few. These businessmen/women primarily must meet loans qualification as mentioned above; unfortunately youths in Tanzania are not among the qualified candidate of loans in most banks.

Table 3: Trend of financial service provision

Year	Project supported	Size	Type	Ownership
2009	198	500,000-15m	business	individual
2010	280	500,000-40 m	business	individual
2011	360	500,000-30 m	business	individual
Total	838	1,500,000-85m		

From the findings researcher found that majority of youth are engaging in small business such as selling second hand clothes, shoes, food vender, solon works just to mention, all of these makes them hardly to afford a minimum life expenses such as food, water costs and rent houses.

Most of this is either by self-employment or employed by individual person. Figure 3 shows the situation of youth job distribution in informal sector.
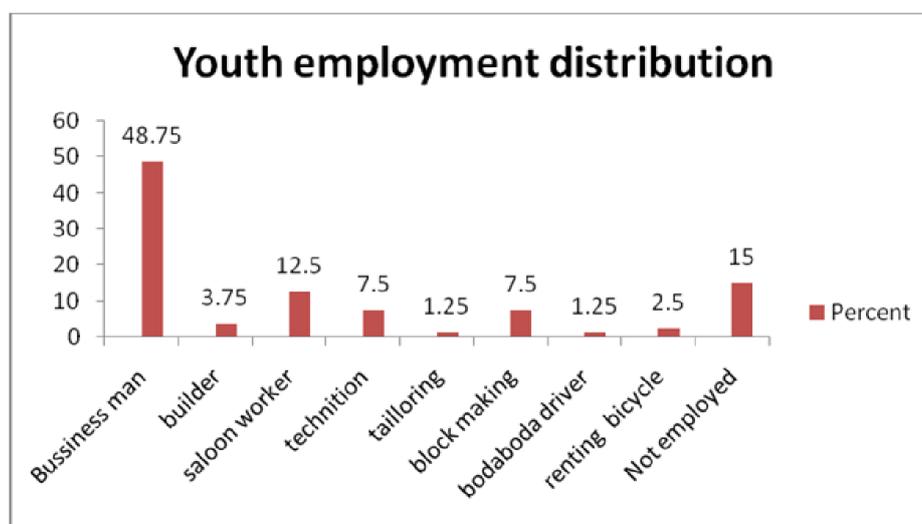
Figure3: Youth job distribution in Singida

Beneficiaries' Views

Views of youth at Singida municipality on the contribution of financial institutions on youth employment and development demonstrated grievances among them. Youth saw financial sectors as one of the accelerating factor to their increasing poverty, due the fact that, they do attracts people to access loans and letter on it leads to confiscation of their little owned properties, it is because, the interest rate is high which is hardly reached by youth. Loan beneficiaries at Mandewa ward in focus group discussion on contributions of financial sectors' had the following views ''Yaani hazina faida kwavijana, ukiangalia riba kubwa inapelekea wengikufilisiwa hata kidogo ulichomiliki. Ni Kama kujiweka kitanzi mwenyewe. Wengi wamekuwa vibarua wakujenga, ambavyo leo vipo kesho hakuna'' (Mandewa ward loan beneficiaries, 2012).

This is how mere people view financial institutions and their operation, such kind of notions has greater impact on youth decision to ask for financial services. As situation show many lacks prior requirement for loans acquisition, alternatively they rely on other sources such as relative contributions and or remain permanent jobless individual till good day occurs to them.

CONCLUSIONS

The contribution of financial institutions to youth employment in Singida municipality by this finding suggests that, only 22.5% of youth employment in study area is a result of financial institutions by either extending loans or get employed in the organization which primarily secured loan from financial institutions. This is very small contribution to overall employment creation in Tanzania and it imply that, financial liberalization is not effective towards increasing youth employment in Tanzania.

Factors which hinder youth employment in study area and Tanzania in general, includes; lack of education to meet employment qualification, lack of enough investments, high cost of capital/interest rate, low understanding of loans accessibility, absence of enough training and business education, lack of loan information, lack of commitment to loans seekers and poor money management and discipline to meet loan requirement as well as their development. It is recommended that, The government should put in place good financial policies which incorporate youth's needs and requirements, this will create an environment to reach require group of beneficiaries at the grass root level and hence creation of employment to youth groups. The government should support Tanzania financial sectors to play a more significant role in economy by establishment of appropriate policies which consolidate the gains of first generation reforms. Also training colleges and VETA should be offered to train standard seven leavers to be part of development initiative in our community.

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Typologie de la résistance des consommateurs à l'adoption de l'e banking

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ABSTRACT: Online banking is facing too many types of resistance which hinders its adoption by Tunisian customers. The objective behind this present research is to identify the barriers underlying the non adoption of online banking in Tunisia. It is based on a survey of nearly 150 Tunisian customers who are non adopters of internet banking services. This study identifies three groups of non- adopters of online banking technology: the postponers, the opponents and the rejectors. On the one hand, the results indicate that the three groups of non- adopters differ significantly with respect to psychological barriers (tradition and image). On the other hand they revele that the functional barriers (use, value and risk) have no impact on the resistance to the adoption of e- banking in Tunisia.

KEYWORDS: innovation, online banking, resistance to adoption, non- adopters.

RESUME: La banque en ligne est confrontée à différents types de résistances qui peuvent entraver son adoption par les clients. L'objectif de la présente recherche est de déterminer les obstacles à l'origine de la non adoption de la banque en ligne. Elle est basée sur une enquête au près de 150 clients tunisiens non adoptants des services bancaires en ligne. Cette étude identifie trois groupes de non adoptants de la technologie bancaire en ligne : les postponers, les opposants et les détracteurs. Les résultats obtenus indiquent, d'une part que les trois groupes diffèrent de manière significative par rapport aux obstacles psychologiques (tradition et image) et d'autre part, que les barrières fonctionnelles (utilisation, valeur et risque) n'ont pas d'impact sur la résistance à l'adoption des services bancaires en ligne.

MOTS-CLEFS: innovation, banque en ligne, résistance à l'adoption, non adoptants, analyse typologique.

1 INTRODUCTION

L'e banking constitue désormais un canal de distribution et de communication à partir duquel les clients peuvent effectuer diverses opérations à distance,(El Idrissi, 2005). Toutefois et en dépit de ses nombreux avantages, l'e banking est encore confronté à l'existence de barrières qui ralentissent son utilisation (Gouia et al, 2013). Cependant tous les clients ne réagissent pas de la même manière face à ces barrières et différents groupes de non adoptants semblent exister. Cette recherche, se justifie entre autres, par le fait que la résistance à l'adoption de l'innovation n'a pas suscité un grand intérêt de la part des chercheurs contrairement aux facteurs incitants à son adoption. Ce manque d'intérêt concerne aussi bien les pays développés que les pays en voie de développement, (Hanafizadeh et al, 2014). Les objectifs assignés à la présente étude visent à identifier les différents groupes de non adoptants tunisiens des services bancaires en ligne et à analyser comment les différences entre les groupes peuvent être expliquées et interprétées. Elle est basée sur les résultats d'une enquête auprès de 150 particuliers clients des banques tunisiennes non utilisateurs des services de l'e banking afin de valider les hypothèses de recherche. Nous considérons comme Lee et al, (2005) que les différences de comportement sont indentifiables entre les non utilisateurs et non entre les utilisateurs et les non utilisateurs.

Les banques tunisiennes au nombre de 22 bénéficient d'un taux de bancarisation de l'ordre de 50%. Le réseau bancaire n'a cessé de s'étendre, et il est même prévu, qu'il atteint le taux d'une agence pour 7000 habitants (contre 8400 en 2009), (Amen Invest, 2011). D'autre part, le nombre de cartes bancaires est passé de 2 082 905 millions à la fin de décembre 2009, à 2 346 165 cartes au début de 2010, (Rapport Annuel de l'APTBEF, 2010). Par ailleurs, 55% des actifs tunisiens sont détenteurs d'une carte bancaire, (Amen Invest, 2011). Le rythme d'automatisation des opérations bancaires s'est accéléré avec la multiplication des GAB dont le nombre s'élève à 1608 au cours des dix premiers mois de 2010, contre 1409 en décembre 2009. En outre, le nombre de TPE installés dans les magasins est passé de 10450 en 2009 à 11843 unités en 2010. Sur un autre plan, plus de 80% des banques commerciales tunisiennes offrent des SBL (Nasri, 2011). Aussi, sur une population de près de 10 millions 732900 habitants, le nombre d'utilisateurs d'internet a atteint 4,2 millions au 30 Juin 2012, soit un taux de pénétration de 39,1 %, contre 2 millions 68 milles utilisateurs en juin 2008. Ce taux de pénétration est élevé comparé au taux moyen en Afrique qui est de 15,6 % (Nasri et Charfeddine, 2012; Internet World Stats, 2012). Cependant, bien que l'offre des banques tunisiennes en matière d'e banking est bien développée, le nombre d'utilisateurs de ces services, demeure limité (Nasri et Charfeddine, 2012). Ainsi, il y a un besoin de comprendre le phénomène de non adoption de l'e banking et d'identifier les facteurs de résistance à leur adoption de la part des consommateurs tunisiens.

2 CADRE CONCEPTUEL

La résistance apparaît lorsque les caractéristiques d'une innovation entrent en conflit avec les représentations du consommateur. Nous passerons en revue dans ce qui suit les principales barrières à l'adoption de l'innovation et les principales typologies de non adoptants.

2.1 LES BARRIÈRES À L'ADOPTION DE L'E BANKING

Différents chercheurs se sont intéressés à la compréhension de la résistance de l'innovation et ont analysé les barrières à son adoption. Parmi les plus célèbres, Ram et Sheth (1989), ont identifié deux types d'obstacles : les barrières fonctionnelles et les barrières psychologiques.

2.1.1 LES BARRIÈRES FONCTIONNELLES

Les barrières fonctionnelles risquent de se poser si les consommateurs perçoivent des changements considérables lors de l'adoption d'une innovation. Ram et Sheth (1989) ont divisé les barrières fonctionnelles en utilisation, valeur et risque. La barrière utilisation est liée à l'incompatibilité de l'innovation avec les habitudes et les expériences passées du consommateur et par conséquent, le consommateur a besoin de beaucoup de temps pour l'accepter. Cette barrière est liée à la facilité d'utilisation y compris la complexité ou la similarité au concept et la facilité d'utilisation associée à l'innovation du modèle d'acceptation de la technologie, qui sont deux notions étroitement liées. Elle corresponde à la raison la plus courante pour la résistance de client à une innovation, (Ram et Sheth, 1989). Laukkanen et al, (2007) ont trouvé que l'incompatibilité de l'innovation avec les pratiques, les habitudes et les expériences passées est un frein à l'adoption du mobile banking. Tandis que la barrière valeur est basée sur la valeur monétaire d'une innovation en se référant à l'idée que si l'innovation n'offre pas une forte performance-prix il n'y a aucune motivation pour les consommateurs pour qu'ils l'adoptent, (Ram et Sheth, 1989). Lian et Yen, (2013) ont affirmé que la barrière valeur est l'obstacle majeur de la résistance des consommateurs de l'acceptation de l'innovation. Gerrard et al, (2006) ont trouvé que le risque est le principal facteur qui explique pourquoi le consommateur n'adopte pas la banque électronique. Par ailleurs, Ram et Sheth, (1989) ont identifié quatre types de risque, le premier est un risque physique : Des soucis corporels ou matériels peuvent être inhérents à l'innovation. Le deuxième est un risque économique : Plus le coût d'une innovation est élevé plus le risque perçu est élevé. Le troisième est un risque fonctionnel : Si l'innovation ne fonctionne pas d'une manière fiable ou correctement ou elle est défectueuse. Enfin le dernier type de risque est un risque social concernant le statut social du consommateur qui utilise la technologie bancaire en ligne qui peut être touché si la technologie est perçue négativement par les autres .

Les barrières psychologiques

Les barrières psychologiques sont souvent causées par le conflit avec les croyances antérieures des consommateurs. Elles incluent la tradition et l'image, (Ram et Sheth, 1989).

La barrière tradition implique les changements qui peuvent générer une innovation dans les routines quotidiennes des consommateurs et si ces routines sont importantes pour le consommateur la barrière tradition sera probablement élevée. Laukkanen et al, (2008) ont jugé que le changement des routines implique une résistance à l'adoption de l'e banking. Alors que la barrière image est associée à l'identité des innovations comme la catégorie de produit, la marque et le pays d'origine.

Si le consommateur a une impression défavorable du pays d'origine ou de la marque ou de produit il rejette l'innovation. Laukkanen et al, (2008) ont trouvé que l'impression défavorable implique une résistance à l'adoption des SBL.

2.2 LES TYPOLOGIE DE LA RÉSISTANCE À L'ADOPTION DE L'INNOVATION

Différentes typologies de non adoptants de la banque sur internet ont été élaborées. Lee, Kwon et Schuman, (2005), identifient deux groupes de non utilisateurs : les non adoptants persistants et les non adoptants qui prospectent d'utiliser l'innovation. La résistance à la consommation des SBL conduit les consommateurs à répondre sous l'une des trois formes : le rejet direct (détracteurs), le report (postponers) et l'opposition (opposants), (Szmigin et Foxall, 1998). Cette catégorisation est basée sur l'intention d'adoption, (Laukkanen et al, 2008). Cette typologie a été étudiée, en Tunisie, par différents chercheurs dont, Gouia et al. (2013), El Badraoui et Abdel Aziz (2011) et Mzoughi et Msallem (2013).

2.2.1 LES CARACTÉRISTIQUES DES DÉTRACTEURS

Les détracteurs correspondent aux personnes qui rejettent directement l'innovation. Le rejet est définie par Rogers (2003), comme la décision de ne pas adopter une innovation. Le rejet direct est la forme extrême de résistance à l'innovation (Kleijman, et al, 2009). Quand il y a un rejet direct d'une innovation par les consommateurs, la responsabilité de l'entreprise est de la modifier puis de la soumettre de nouveau au marché. Le rejet peut se produire soit lorsque l'innovation n'offre pas un avantage, soit lorsque son usage est vu comme complexe, difficile ou risqué, (Szmigin et Foxall, 1998). Pousttchi et Schurig, (2004) ont identifié deux types de rejet : le rejet actif et le rejet passif. Le premier se produit si l'innovation a été envisagée puis elle a été rejetée. Quant au second, il se réalise si l'innovation n'est jamais adoptée ou mise en œuvre.

2.2.2 LES CARACTÉRISTIQUES DES POSTPONERS

Les postponers correspondent aux personnes qui retardent l'adoption d'une innovation (Kuisma et al, 2007). Le plus souvent ceci semble être causé par des facteurs situationnels comme l'attente du bon moment pour devenir capable d'adopter l'innovation ou pour s'assurer que le produit fonctionne efficacement, (Cornescu et Adam, 2013). Szmigin et Foxall, (1998) notent que le report peut se transformer en acceptation ou en rejet après un certain temps.

2.2.3 LES CARACTÉRISTIQUES DES OPPOSANTS

L'opposition fait référence à une sorte de rejet mais, dans ce cas le consommateur est prêt à tester, à essayer et à vérifier l'innovation avant de la rejeter définitivement (Mirella et al, 2009). Toutefois, les raisons de l'opposition à l'innovation peuvent se rapporter aux habitudes, aux facteurs situationnels ou au style cognitif qui peut amener le consommateur à rejeter le nouveau produit ou service. L'opposition se produit lorsque les consommateurs perçoivent un désavantage par rapport à l'innovation, (Szmigin et Foxall, 1998). Compte tenu de ce qui précède nous émettons l'hypothèse qui stipule que les barrières à l'adoption changent d' un type de non adoptant à un autre et qu'il y a des différences entre les différents types de non utilisateurs de l'e banking par rapport aux barrières suivantes :

H_1 : Les groupes de non utilisateurs de l'e banking diffèrent selon la barrière utilisation.

H_2 : Les groupes de non utilisateurs de l'e banking diffèrent par rapport à la barrière valeur.

H_3 : Les groupes de non utilisateurs de l'e banking diffèrent par rapport à la barrière risque.

H_4 : Les groupes de non utilisateurs de l'e banking diffèrent selon la barrière tradition.

H_5 : Les groupes de non utilisateurs de l'e banking diffèrent par rapport à la barrière image.

3 MÉTHODOLOGIE DE RECHERCHE

Nous préciserons dans ce qui suit la méthode de collecte des données, les échelles de mesure et les techniques de traitement des données à savoir l'AFE et la méthode d'analyse typologique.

3.1 LA COLLECTE DES DONNÉES

La collecte des données a été effectuée au moyen d'une enquête auprès d'un échantillon de 150 tunisiens qui n'utilisent pas les services bancaires en ligne. L'entretien en face à face avec un questionnaire constitue le mode de recueil le plus

adapté pour ce type d'enquête. Un pré-test fut réalisé au près de quinze participants afin de s'assurer de la clarté et de la compréhension des questions. Les répondants ont été invités à indiquer leur degré d'accord ou de désaccord avec les énoncés proposés sur une échelle de 1 pour tout à fait en désaccord à 5 pour tout à fait d'accord.

3.2   LES ÉCHELLES DE MESURE DES VARIABLES

D'après la littérature, nous avons recensé 23 items qui résument les barrières de la résistance à l'adoption des services bancaires en ligne (utilisation, valeur, risque, tradition et image).

3.3   L'ANALYSE FACTORIELLE EXPLORATOIRE

Sur la base de l'analyse factorielle exploratoire (AFE) et en utilisant la méthode des composantes principale (ACP) avec la rotation varimax, nous avons éliminé les items qui ont un coefficient factoriel inferieur à 0,5. Suite à cette purification des échelles de mesure, on a éliminé 3 items et retenu ainsi 20 items comme l'indique le de l'annexe. Les alphas de Crombach des variables étudiées varient entre 0,577 et 0,894 ce qui indique des niveaux de fiabilité acceptables pour une étude exploratoire (Nunnaly, 1967). La mesure de précision de l'échantillonnage de Kaiser-Meyer-Olkin est adéquate (KMO = 0,816) et le test de sphéricité de Bartlett ($p < 0,001$) confirment que l'analyse factorielle est adéquate. Les résultats de l'AFE sont consignés dans l'annexe.

3.4   L'ANALYSE TYPOLOGIQUE

L'analyse typologique est une technique qui permet d'identifier des regroupements d'individus ou d'objets qui partagent des attributs communs, (Baillargeon, 2003). La classification des non adoptants de l'e banking a été effectuée en utilisant la méthode des nuées dynamiques et le logiciel SPSS version 18. Cette méthode permet de générer une partition à partir de données sur lesquels on n'émet pas d'hypothèses a priori.

4   PRÉSENTATION DES RÉSULTATS

Le but de cette classification est de comprendre la résistance à l'adoption des services bancaires en ligne en divisant les non adoptants en trois groupes en fonction de l'intention d'adoption de l'e banking puis, d'identifier comment la résistance diffère entre ces groupes. Cette typologie a été effectuée en s'inspirant des travaux de Laukkanen et al, (2008), El badraoui et Abdel aziz (2011) et Gouia et al (2013). Les résultats obtenus sont présentés dans le tableau 1 ci-dessous.

Tableau 1: Typologie selon l'intention d'adoption de l'e banking

	Effectifs	Pourcentage
Groupe 1 : Opposants	71	47,33
Groupe 2 : Postponers	44	29,33
Groupe 3 : Détracteurs	37	24,66
Total	150	100,0

La répartition des 150 répondants qui refusent l'adoption de la banque en ligne indique que 47 % appartiennent au premier groupe : ce sont les personnes qui ont l'intention d'adopter l'e banking dans plus d'un an (les opposants), 29 % font partie du deuxième groupe : ce sont les individus qui ont l'intention d'adopter l' e banking dans une année (les postponers) et 24 % constituent le troisième groupe (les détracteurs) comme l'indique les tableaux 1& 2. Les résultats du test des différences entre les trois groupes par l'analyse de la variance (ANOVA), est consigné dans le tableau 2 ci-dessous. Ces résultats montrent que les trois groupes de non adoptants identifiés diffèrent significativement par rapport aux barrières tradition ($F= 16,47$ et $p=0.00$) et image ($F= 13,27$ et $p=0.00$). Quant aux barrières risque ($F= 7,59$), utilisation ($F= 3,29$) et valeur ($F= 8,56$), elles n'ont pas montré de différences significatives entre les trois groupes. Ces résultats indiquent donc que les hypothèses H1, H2 et H3 sont rejetées et que les hypothèses H4 et H5 sont vérifiées.

Tableau 2 : Caractéristiques des trois groupes selon l'intention d'adoption de l'e banking

Items	G1: Opposants		G2 : Postponers		G3 : Détracteurs		Total		F	Sig
	Moyenne	Ecart type	Moyenne	Ecart type	Moyenne	Ecart type	Moyenne	Ecart type		
Barrière utilisation	2,26	1,35	2,76	1,50	2,38	1,35	2,43	1,42	3,29	0,04
Barrière valeur	1,97	1,35	2,85	1,67	1,88	0,89	2,21	1,43	8,56	0,00
Barrière risque	3,80	1,26	3,15	1,52	3,65	1,17	3,58	1,37	7,59	0,05
Barrière tradition	3,77	1,45	2,53	1,56	3,67	1,27	3,38	1,55	16,47	0,00
Barrière image	3,99	1,22	2,77	1,59	3,75	1,16	3,61	1,42	13,27	0,00

4.1 LES CARACTÉRISTIQUES DES OPPOSANTS TUNISIENS

Les résultats montrent qu'en Tunisie la barrière image (3,99) est l'obstacle majeur à l'adoption des services bancaires en ligne pour les opposants suivie par les barrières risque (3,80) et tradition (3,77). Ainsi, les risques et les obstacles psychologiques tels que perçus par les répondants sont les déterminants les plus importantes pour les opposants à l'adoption des services bancaires en ligne offerts par les banques tunisiennes. Par contre, les barrière utilisation (2,26) et valeur (1,97) ont les moyennes les plus faibles et elles ne constituent pas des obstacles à l'adoption des services bancaires en ligne pour les opposants.

4.2 LES CARACTÉRISTIQUES DES POSTPONERS TUNISIENS

Les résultats indiquent que la barrière risque (3,15) est le seul déterminant de la résistance à l'adoption des SBL pour les postponers. Les barrières valeur (2,85), image (2,77), utilisation (2,76) et tradition (2,53) ont les moyennes les plus faibles. Ainsi, les postponers ne considèrent pas les barrières valeur, image, utilisation et tradition comme des obstacles importants à l'adoption des SBL.

4.3 LES CARACTÉRISTIQUES DES DÉTRACTEURS TUNISIENS

Les résultats suggèrent que la barrière image (3,75) est l'obstacle le plus intense à l'adoption des services bancaires en ligne pour les détracteurs suivie respectivement par les barrières tradition (3,67) et risque (3,65). Les obstacles risques et psychologiques sont les déterminants de la résistance à l'adoption des services bancaires en ligne pour les détracteurs. Les barrières utilisation (2,38) et valeur (1,88) ont les moyennes les plus faibles et elles ne déterminent pas la résistance à l'adoption des services bancaires en ligne pour les détracteurs tunisiens.

5 SYNTHÈSE DES RÉSULTATS ET DISCUSSION

Les services bancaires en ligne sont confrontés à différents types de résistances qui peuvent entraver leur adoption par les clients tunisiens. La présente recherche, réalisée auprès d'un échantillon de 150 clients, nous a permis de vérifier la pertinence de certaines variables issues de la littérature pour l'étude de la résistance à l'adoption de la banque en ligne dans le contexte tunisien. Suite à la typologie des non adoptants tunisiens selon l'intention d'adoption des services bancaires en ligne, nous avons constaté que les trois groupes des non adoptants différent significativement en ce qui concerne les barrières psychologiques (tradition et image). Les barrières fonctionnelles (risque, utilisation et valeur) n'ont pas montré les mêmes types de significations pour les trois groupes de non adoptants tunisiens. Les résultats de Laukkanen et al. (2008), indiquent que les trois groupes de non adoptants Finlandais des services bancaires en ligne à savoir les postponers, les opposants et les détracteurs différent d'une manière significative par rapport aux barrières utilisation, valeur, tradition et image. Par contre, la barrière risque ne constitue pas une source de différences entre les trois groupes de non adoptants. En comparant les résultats que nous avons obtenus aux résultats des recherches antérieures, qui sont reproduits dans le tableau 3 suivant, on relève ce qui suit.

Tableau 3 : Comparaison des résultats des travaux empiriques

Barrières	Ben Brahim (2014)	Gouia et al. (2013)	El Badraoui et Abdel Aziz (2011)	Laukkanen et al. (2008)
Utilisation		*	*	*
Valeur		*	*	*
Risque				
Tradition	*			*
Image	*	*	*	*

El badraoui et Abdel aziz (2011) et Gouia et al (2013), ont trouvé que les trois groupes des non adoptants égyptiens et tunisiens (les postponers, les opposants et les détracteurs) différent d'une manière significative par rapport aux barrières utilisation, valeur et image. Les barrières risque et tradition n'entrainent pas de différences significatives entre les trois groupes de non adoptants ni en Egypte, ni en Tunisie.

Recommandations et implications managériales :

Les banques sont invitées à adopter des stratégies de marketing capables de réduire les réticences des consommateurs tunisiens à l'adoption des services bancaires en ligne. Les messages publicitaires diffusés par les banques sont à focaliser sur le fait que les services bancaires en ligne sont sécurisés, en mentionnant explicitement les techniques de sécurité utilisées. Par ailleurs, les dirigeants des banques peuvent encourager les démonstrations gratuites des services bancaires en ligne pour simuler leur adoption. Ils peuvent inciter les clients à essayer d'utiliser le système sur internet en recourant à des comptes fictifs. Aussi, les avantages de l'e banking sont à mettre en valeur lors des compagnes publicitaires et de communication pour réduire l'image négative perçue des services bancaires en ligne.

Limites et voies futures de recherche :

Les limites de cette étude concernent la classification des non adoptants des services bancaires en ligne en utilisant l'analyse typologique puisque cette méthode est sensible aux problèmes de multi colinéarité, qu'il n'existe pas de tests statistiques formels permettant de dire si la solution de regroupement proposée est la meilleure et que l'interprétation des groupes est subjective. En outre, il serait intéressant d'enrichir cette recherche quantitative en augmentant la taille de l'échantillon, en intégrant d'autres variables comme le genre, le niveau d'éducation et le revenu et d'effectuer une étude qualitative au prés d'une vingtaine de clients qui ont auparavant adhéré à l'e banking puis qu'ils l'ont abandonné pour identifier les raisons de l'abondon et de la sortie de ce système.

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ANNEXE : RÉSULTATS DE L'ANALYSE FACTORIELLE EXPLORATOIRE (AFE)

Items	Coefficient factoriel	Alpha de Crombach	KMO	Khi deux	Sig
Barrière utilisation		**0,800**	**0,816**	**221,812**	**0,000**
Les SBL sont faciles à utiliser.	0,796				
L'utilisation des SBL est convenable.	0,782				
Les SBL sont rapides à utiliser.	0,786				
Le progrès des services bancaires en ligne est clair.	0,602				
Possibilité pratique de changer les données personnelles.	0,768				
Barrière valeur		**0,738**	**0,500**	**63,444**	**0,000**
L'utilisation des SBL est économique.	0,892				
L'utilisation des SBL m'aident à mieux contrôler mon compte.	0,892				
L' e banking n'offre aucun avantage pour le suivi de la position de mon compte.	0,455) A éliminer				
Barrière risque		**0,836**	**0,791**	**485,581**	**0,000**
Je crains que la connexion à internet s'interrompe.	0,652				
Je crains de commettre des erreurs.	0,600				
Je risque de perdre mon identifiant et mon mot de passe.	0,863				
Les SBL peuvent ne pas bien fonctionner ce qui peut entrainer des problèmes pour la gestion de mon compte.	0,762				
L'utilisation de l'e banking peut conduire à une perte financière.	0,554 0,675				
Il faut du temps pour apprendre à utiliser les SBL.	0,827				
Les SBL ne vont pas avec mon image et ma vision.	0,688				
Je crains de perdre des informations personnelles	0,682				
J'ai peur du piratage par des personnes mal intentionnées.					
Barrière tradition		**0,577**	**0,500**	**27,316**	**0,000**
Les banques exercent des pressions pour l'adoption des SBL	0,840				
Les visites à l'agence et les discussions avec le personnel de contact sont une source de plaisir et de joie.	0,840				
Le SBL sont plus agréables que les services obtenus à l'agence.	0,429 A éliminer				
Barrière image		**0,894**	**0,500**	**156,745**	**0,000**
Je pense que l'e banking est très compliqué à utiliser.	0,951				
J'ai l'impression que les SBL sont difficiles à utiliser.	0,951				
J'ai une image très positive des services bancaires en ligne.	0,350 A éliminer				

Malaria Prevalence and Insecticide Treated Nets Usage in Argungu (North Western Nigeria)

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ABSTRACT: Insecticide treated net (ITNs) is known to have a major impact on malaria control if properly used. The study was carried out to ascertain the impact of insecticide treated nets (ITNs) on malaria prevalence in Argungu, Northwestern Nigeria a decade after free distribution of ITNs. Questionnaires were administered to obtain relevant information such as: age, occupation, and ownership and use or otherwise of ITNs. Capillary blood samples obtained using sterile lancet were used in making thick blood films which were stained using Giemsa staining technique. The stained thick films were all examined microscopically for malaria parasites. Of the 300 household studied 226(75%) possessed at least one ITNs. Possession of ITNs is significantly associated with occupation (P<0.05). Eighty nine percent of the civil servants had at least one ITNs, and only 40% of the unemployed household had at least one ITNs. Not all these ITNs are being put into use. Only 113(57%) out of the 199 pregnant women used ITNs the night before the survey. Malaria prevalence is more among non ITNs users with proportionate decrease with increase in age among pregnant women. Impact of insecticide treated nets on preventing malaria may be minimized if they are not used properly most especially by the vulnerable populations.

KEYWORDS: Malaria, Insecticide treated nets, prevalence, Argungu.

1 INTRODUCTION

Malaria is a vector-borne disease caused by a pathogen that is transmitted by female mosquitoes of several species from the genus *Anopheles.* It is one of the oldest diseases of mankind, with human adapted species appearing to have evolved along with us [1]. Malarial disease in humans is caused by 4 different species of Plasmodium parasites, namely *P. falciparum, P. vivax, P. ovale* and *P. malariae.* By far the most pathogenic of these, *P. falciparum* is mainly prevalent in sub-Saharan Africa, Papua New Guinea and Haiti. *P. vivax* accounts for most other cases of malaria in humans and is most common in Central and South America, North Africa, the Middle East and the Indian subcontinent, *P. ovale* is mainly found in West Africa and *P. malariae* is widely distributed but mainly found in Africa [2].

Malaria has remained a huge public health problem in this part of the world with very devastating impacts on the vulnerable groups in the population. World Health Organization [3] reported that over forty percent of the world population lives in areas where malaria transmission occurs. It is estimated that 216 million episodes of malaria occur each year worldwide resulting in 655,000 deaths. It occurs mostly in poor tropical and subtropical regions of the world. This is due to the combination of factors such as the presence of mosquito vectors, predominant parasite species and socio-economic

instability [4]. Eighty one percent of globally estimated cases of malaria occurs in Africa, with children under-five years of age and pregnant women being most severely affected [3].

In Nigeria, malaria is highly endemic and remains one of the most leading causes of morbidity and mortality which poses a major challenge to socio-economic development. It currently accounts for nearly 110million clinically diagnosed cases per year, 60% of outpatient visits and 30% hospitalizations, an estimated 300,000 children die of malaria each year and up to 11% of maternal mortality. In addition to the direct health impact of malaria, there is also a severe social and economic burden on country with about N132billion lost to malaria annually in form of treatment costs, prevention, lost of man's hour [5].

Despite the fact that strong attempts to eradicate malaria have been made, the disease burden is still on the rise and some estimate that the number of cases could double in the next twenty years without the development of new methods for control [6]. This situation calls for a global concerted efforts towards management and control of the disease.

At the historic Role Back Malaria (RBM) summit hosted by Nigeria in 2000, African Heads of States made a declaration to halve the burden of malaria by the year 2010, by way of primary prevention through vector control or use of personal preventive methods such as bed-nets, mosquito repellants, chemo-prophylaxis and finally, through effective case management and medication [7].

In Nigeria the use of ITNs is currently considered one of the most cost effective methods of malaria control. Regular use of ITNs by all those at risk of malaria infection is a key component of the national control programme. Over a decade since the introduction of RBM initiative in Africa, there is therefore the need to assess the impact of the programme. The aim of this study was to assess the impact of Insecticide Treated Nets on malaria prevalence in Argungu local government area, Kebbi state, Nigeria

2   MATERIALS AND METHODS

2.1   STUDY AREA

Kebbi State is located in the north western part of Nigeria and lies between latitude 10^0 8` and $13^0$ 15` North and longitude 3^0 30` and $6^0$ 02` East of the Meridian. It occupies a landmass of about 36,800km^2, which is about 4.0% of the country's landmass. The State is transverse by two major rivers namely; River Niger and River Rima. Agriculture is the main occupation of the people especially in rural areas. Crops produce are mainly grains, which include millet, guinea corn, rice and maize. Other crops produce include; cassava, beans, onions among others. Animal rearing and fishing are also common among the people living close to the river banks [8].

The State lies within the tropical region, with mean annual rainfall of 800mm in the North and 1000mm in the South. The wettest months are August and September. Temperature is generally high with mean annual of about 26^{0}C in all location.

2.2   ETHICAL CONSIDERATION

A detailed explanation of the purpose, nature and all the processes involved in the research was made to the heads of the participating households. They were informed that their participation along with their wives was voluntary and that they were free to decline from participating or to withdraw from partaking at any stage of the research, and their identities would remain anonymous. They were also informed that all those infected with malaria parasites would be treated in accordance to the National Malaria Control Treatment Guidelines free of charge. Only households that gave informed verbal consent were recruited for the research.

2.3   RESEARCH DESIGN

The study was a cross sectional and three hundred households were randomly selected in the study area and structured questionnaires were then administered to the head of the selected households. The questionnaire was designed to collect information on population characteristics, net ownership, use of nets, and present of pregnant women in the households. To diagnosed malaria, one member and one pregnant woman in each household were randomly selected. Where there was more than one pregnant woman in a household, they were numbered and only one was selected by balloting. This was then followed by house to house visits to diagnose malaria among the selected members of the household under close supervision of the head of the households. At the point of blood collection, information on age, and use of ITNs last night was recorded for each pregnant woman.

2.4 MALARIA DIAGNOSIS

Thick blood film was prepared and stained with Giemsa stains for each subject as described by [9]. Stained slides were all examined under a microscope using x100 objective. The number of malaria parasites asexual parasitic forms on each slide were counted per 200 leucocytes and recorded in the record book. A slide was considered negative if no parasites were found after 100 microscopic fields were scanned.

2.5 STATISTICAL ANALYSIS

The data obtained in this research was analyzed and expressed in term of percentage. Differences in socio-demographic characteristics were assessed between households with ITNs and those without ITNs, pregnant women using ITNs and those not using it, and between under-five children with malaria and those without malaria using Chi-square tests.

3 RESULTS

Of the 300 households enrolled in this study, 226(75%) possessed at least one ITNs, 74(25%) are without ITNs. Possession of ITNs by Occupation is shown in Table 1. Civil servants had the higher number 128(89%). This was followed by other businesses households 16(76%), Farming households 80(61%), and unemployed households 2(40%) respectively. Possession by occupation is highly significant (P<0.05).

Figure 1 depicts usage of ITNs among household and pregnant women in the households. Of the 300 households, only 173(58%) used ITNs the night before the survey, and out of the 199 pregnant women only 113(57%) used ITNs.

Table 2 shows the prevalence of malaria infection by age among subjects in the households. The overall prevalence was 37.3%. Prevalence according to age shows that those within the age bracket 18-29 years had the highest prevalence (40.5%). This was followed by those within the age group of 41-51 years (38.3%), 30-40 years (35.8%) and 52-56 years (34.1%) respectively. The difference was however not statistically significant (P>0.05).

The prevalence of malaria infection among pregnant women by age is as shown in Table 3. Of the 199 samples examined 86(43.2%) had malaria parasite in their blood. Prevalence generally decreases with increase in age. Those within the age group 14-20 years had the highest prevalence (45.8%). This was followed by those within the age group 21-27years 44.9%), 28-34 years (41.7%), and 35-41 years (36.4%) respectively. The difference was however not statistically significant (P>0.05).

Figure 2 depicts the prevalence of malaria infection by ITNs usage. The prevalence was significantly higher among households not using ITNs (54.3%) and low among those using ITNs (24.9%). Prevalence by ITNs usage among pregnant women also shows the same pattern as for the households. Pregnant women not using ITNs had a prevalence of 61.6%, and those using ITNs shows a prevalence of 29.2%.

Table 1. Possession of ITNs by occupation of head of the households in Argungu, North western, Nigeria

Occupation	ITNs No (%)	NO ITNs No. (%)	Total
Civil servants	128(89.0)	16(11.0)	144
Farmers	80(61.5)	50(38.5)	130
Unemployed	2(40.0)	3(60.0)	5
Others	16(76.0)	5(24.0)	21
Total	226(75.0)	74(25.0)	300

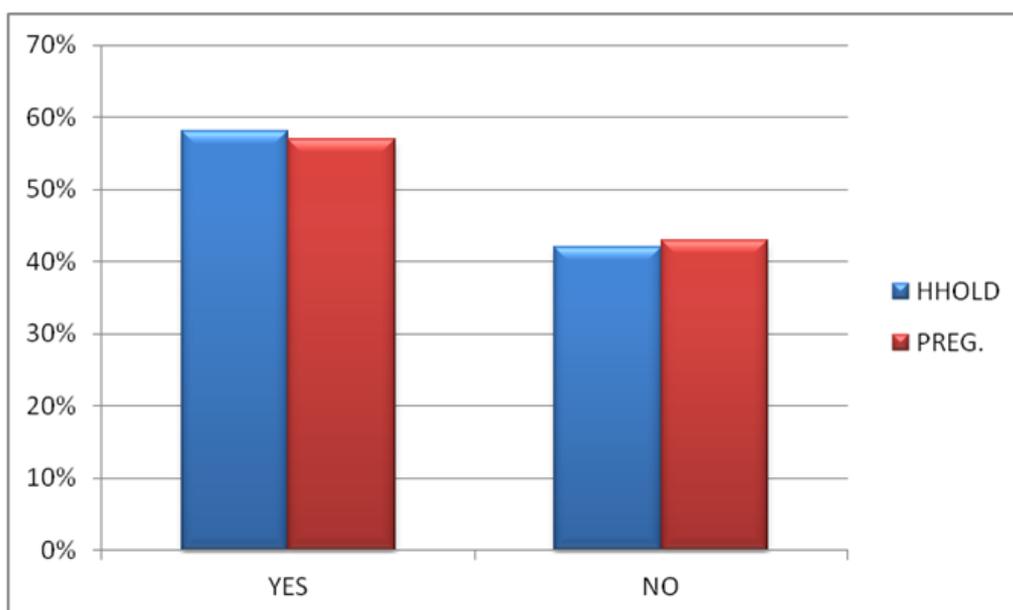**Key**: ITNs = Household with ITNs, NO ITNs = Household without ITNs

Figure 1. Insecticide Treated Nets usage among households and pregnant women in Argungu North western Nigeria
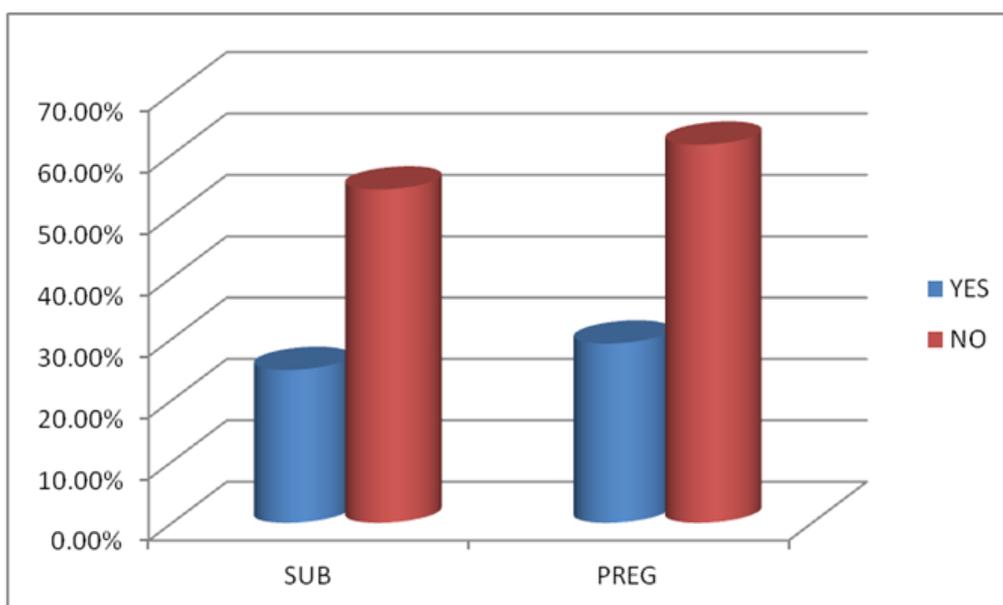
Key: HHOLD = Household, PREG = Pregnant women, YES = ITNs Usage, NO = Non ITNs Usage.

Table 2. Prevalence of malaria infection by age among subjects in the households in Argungu North western Nigeria.

Age(years)	No. Examined	No. Infected	Prevalence
18-29	79	32	40.5
30-40	120	43	35.3
41-51	60	23	38.3
52-62	41	14	34.1
Total	300	112	37.3

Table 3. Prevalence of malaria infection among pregnant women by age in Argungu,North western Nigeria.

Age (years)	No. Examined	No. Infected	Prevalence
14-20	48	22	45.8
21-27	69	31	44.9
28-34	60	25	41.7
35-41	22	8	36.4
Total	199	86	43.2

Figure 2. Prevalence of malaria infection by ITNs usage in Argungu North western Nigeria

Key: SUB = Subject, PREG = Pregnant women, YES = ITNs users, NO = Non ITNs users.

4   DISCUSSION

In this study, an equitable distribution of Insecticide treated nets was observed among the study population. Two-third of the sampled households had ITNs (75%). This finding is consistent with other findings carried out by researchers like[10], who reported nets ownership in Kano to be 70%.

Possession and appropriate utilization of ITNs do not automatically go hand in hand. In this study, only 58% ITNs were utilized, 42% of the distributed ITNs have not been put into use. Variable like occupation of the household appeared to be directly associated with ITNs utilization.

Impact of insecticide treated nets on preventing malaria may be minimized if they are not used by vulnerable population. Proportion of pregnant women who slept under ITNs the preceding night is one of the key RBM indicator used to investigate the strengths and weaknesses of monitoring malaria control. In this study, usage among pregnant women was investigated. Only 57% of the pregnant women used ITNs. This result corroborated evidence from other research conducted in Ethiopia by [11], who reported that 57% of pregnant women utilized ITNs. The report however, was higher compared to report of [12] who documented 22.7% usage among pregnant women in Otukpo.

Overall prevalence was generally low among those households using ITNs, but higher in those not using ITNs. This is attributable to the protective effect of the ITNs when used properly. Prevalence was highest among age group of 18-29 years (40.5%) and lowest among those within the age bracket 52-62 years.

Data obtained in this study have also, shown low prevalence among pregnant women who uses ITNs, compared to their counterpart that do not utilized. Both prevalence decreases with increase in age. Infection rates have been consistently demonstrated to be higher in women in their first and second pregnancies, with lower rates in later pregnancies[13]. This is understandable as pregnancy is naturally accompanied by general immune suppression which may cause loss of acquired immunity to malaria most especially among primigravidae.

5   CONCLUSION

The coverage of ITNs in the study area was higher than the 60% target of the Roll Back malaria initiative. However, not all ITNs owned by the households in the area were being used by under-five children and pregnant women. An appreciable number of the vulnerable groups are not protected from malaria using ITNs. This is linked to the lack of strong educational component on the distribution programmes that explain and promote the benefit of ITNs use. Awareness and knowledge of

benefits and proper use of ITNs will lead to the most consistent and correct use, consequently increasing coverage and community wide benefits. While mass distribution campaign is able to rapidly achieve high and equitable ITNs ownership, it is unable to provide continuous coverage for a population at risk for malaria as it only occurs every few years.

Having ITNs doesn't confirm protection from malaria unless there is proper use and strong adherence. Malaria prevalence of 43.2% is still a major public health problem among people in the study area. It is critical that ITN ownership and use be sustained to keep the disease burden low and potentially move towards eradication and elimination. Well designed ITNs distribution programme will not only prevent and control malaria transmission, but also enhance the overall condition of the country and subsequently the quality of life.

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Mitigation of Voltage Deviation in Transmission Line Using Distributed Power Flow Controller

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ABSTRACT: According to growth of electricity demand and the increased number of non-linear loads in power grids, providing a high quality electrical power should be considered. In this paper, voltage sag and swell of the power quality issues are studied and distributed power flow controller (DPFC) is used to mitigate the voltage deviation and improve power quality. The DPFC is a new FACTS device, which its structure is similar to unified power flow controller (UPFC). In spite of UPFC, in DPFC the common dc-link between the shunt and series converters is eliminated and three-phase series converter is divided to several single-phase series distributed converters through the line. The case study contains a DPFC sited in a single-machine infinite bus power system including two parallel transmission lines, which simulated in MATLAB/Simulink environment. The presented simulation results validate the DPFC ability to improve the power quality.

KEYWORDS: FACTS, Power Quality, Sag and Swell Mitigation, Distributed Power Flow Controller.

1 INTRODUCTION

In the last decade, the electrical power quality issue has been the main concern of the power companies [1]. Power quality is defined as the index which both the delivery and consumption of electric power effect on the performance of electrical apparatus [2]. From a customer point of view, a power quality problem can be defined as any problem is manifested on voltage, current, or frequency deviation that results in power failure [3]. The power electronics progressive, especially in flexible alternating-current transmission system (FACTS) and custom power devices, affects power quality improvement [4], [5]. Generally, custom power devices, e.g., dynamic voltage restorer (DVR), are used in medium-to-low voltage levels to improve customer power quality [6]. Most serious threats for sensitive equipment in electrical grids are voltage sags (voltage dip) and swells (over voltage) [1]. These disturbances occur due to some events, *e.g.,* short circuit in the grid, inrush currents involved with the starting of large machines, or switching operations in the grid. The FACTS devices, such as unified power flow controller (UPFC) and synchronous static compensator (STAT-COM), are used to alleviate the disturbance and improve the power system quality and reliability [7], [8].

In this paper, a distributed power flow controller, introduced in [9] as a new FACTS device, is used to mitigate voltage and current waveform deviation and improve power quality in a matter of seconds. The DPFC structure is derived from the UPFC structure that is included one shunt converter and several small independent series converters, as shown in Fig. 1 [9]. The DPFC has same capability as UPFC to balance the line parameters, i.e., line impedance, transmission angle, and bus voltage magnitude [10].

The paper is organized as follows: in section II, the DPFC principle is discussed. The DPFC control is described in section III. Section IV is dedicated to power quality improvement by DPFC. Simulation results are presented in section V.
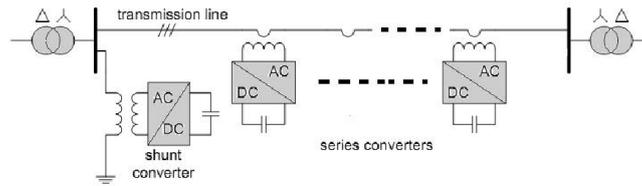
Fig. 1.The DPFC Structure

2 DPFC PRINCIPLE

In comparison with UPFC, the main advantage offered by DPFC is eliminating the huge DC-link and instate using 3rd-harmonic current to active power exchange [9]. In the following subsections, the DPFC basic concepts are explained.

A. Eliminate DC Link and Power Exchange

Within the DPFC, the transmission line is used as a connection between the DC terminal of shunt converter and the AC terminal of series converters, instead of direct connection using DC-link for power exchange between converters. The method of power exchange in DPFC is based on power theory of non-sinusoidal components [9]. Based on Fourier series, a non-sinusoidal voltage or current can be presented as the sum of sinusoidal components at different frequencies. The product of voltage and current components provides the active power. Since the integral of some terms with different frequencies are zero, so the active power equation is as follow:

$$p = \sum_{i=1}^{\infty} V_i I_i \cos \phi_i \qquad (1)$$

Where V_i and I_i are the voltage and current at the ith harmonic, respectively, and φ_i is the angle between the voltage and current at the same frequency. Equation (1) expresses the active power at different frequency components are independent. Based on this fact, a shunt converter in DPFC can absorb the active power in one frequency and generates output power in another frequency. Assume a DPFC is placed in a transmission line of a two-bus system, as shown in Fig.1. While the power supply generates the active power, the shunt converter has the capability to absorb power in fundamental frequency of current. Meanwhile, the third harmonic component is trapped in Y-Δ transformer. Output terminal of the shunt converter injects the third harmonic current into the neutral of Δ-Y transformer (Fig. 3). Consequently, the harmonic current flows through the transmission line. This harmonic current controls the DC voltage of series capacitors. Fig. 2 illustrates how the active power is exchanged between the shunt and series converters in the DPFC. The third-harmonic is selected to exchange the active power in the DPFC and a high-pass filter is required to make a closed loop for the harmonic current. The third-harmonic current is trapped in Δ-winding of transformer. Hence, no need to use the high-pass filter at the receiving-end of the system. In other words, by using the third-harmonic, the high-pass filter can be replaced with a cable connected between Δ-winding of transformer and ground. This cable routes the harmonic current to ground.
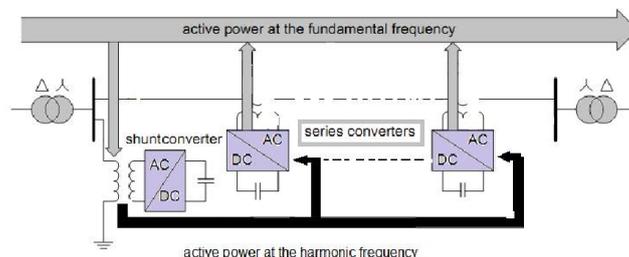

Fig. 2.Active power exchange between DPFC converters

B. The DPFC Advantages

The DPFC in comparison with UPFC has some advantages, as follows:

- *High Control Capability*

The DPFC similar to UPFC, can control all parameters of transmission network, such as line impedance, transmission angle, and bus voltage magnitude.

- *High Reliability*

The series converters redundancy increases the DPFC reliability during converters operation [10]. It means, if one of series converters fails, the others can continue to work.

- *Low Cost*

The single-phase series converters rating are lower than one three-phase converter. Furthermore, the series converters do not need any high voltage isolation in transmission line connecting; single-turn transformers can be used to hang the series converters.

Reference [9] reported a case study to explore the feasibility of the DPFC, where a UPFS is replaced with a DPFC in the Korea electric power corporation (KEPCO). To achieve the same UPFC control capability, the DPFC construction requires less material [9].

3 DPFC CONTROL

The DPFC has three control strategies: central controller, series control, and shunt control, as shown in Fig. 3.

A. Central Control

This controller manages all the series and shunt controllers and sends reference signals to both of them.

B. Series Control

Each single-phase converter has its own series control through the line. The controller inputs are series capacitor voltages, line current, and series voltage reference in the dq-frame. The block diagram of the series converters in Matlab/Simulink environment is demonstrated in Fig. 4.
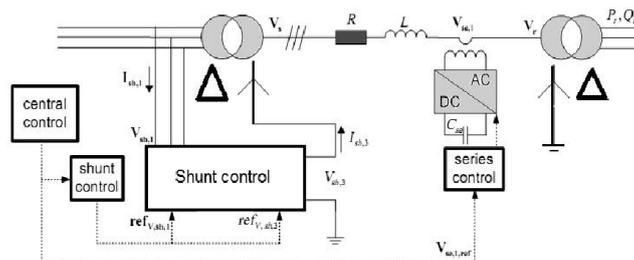
Fig. 3. DPFC control structure
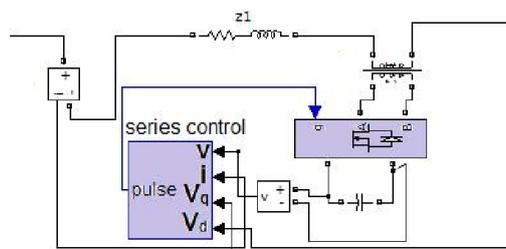
Fig. 4. Block diagram of the series converters in Matlab/Simulink

Any series controller has a low-pass and a 3rd-pass filter to create fundamental and third harmonic current, respectively. Two single-phase phase lock loop (PLL) are used to take frequency and phase information from network [11]. The block diagram of series controller in Matlab/Simulink is shown in Fig. 5. The PWM-Generator block manages switching processes.

C. Shunt Control

The shunt converter includes a three-phase converter connected back-to-back to a single-phase converter. The three-phase converter absorbs active power from grid at fundamental frequency and controls the dc voltage of capacitor between this converter and single-phase one. Other task of the shunt converter is to inject constant third-harmonic current into lines through the neutral cable of Δ-Y transformer.
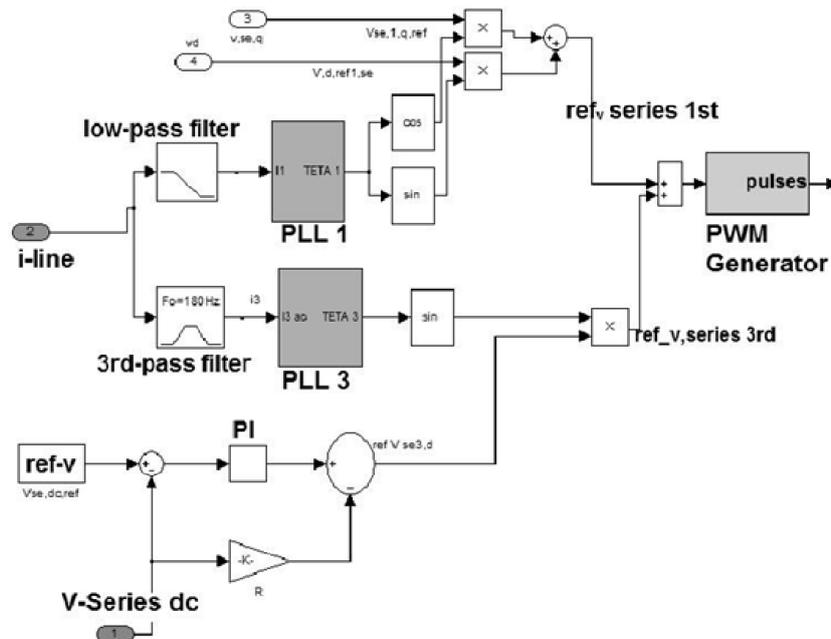
Fig. 5. Block diagram of series control structure in Matlab/Simulink

Each converter has its own controller at different frequency operation (fundamental and third-harmonic frequency). The shunt control structure block diagram is shown in Fig. 6.
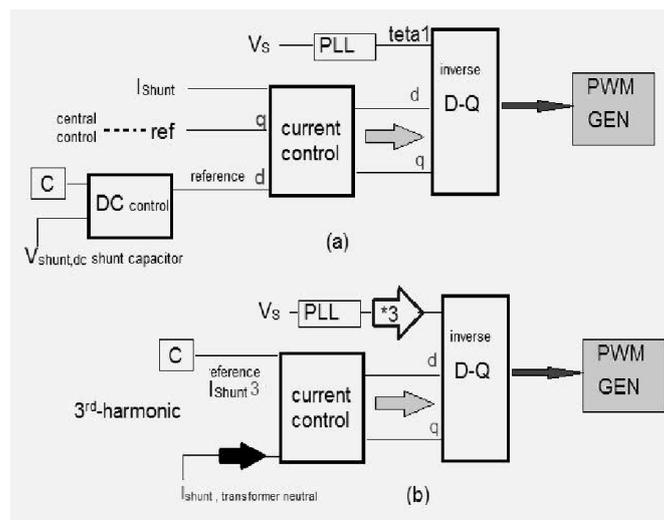

Fig. 6. The shunt control configuration: (a) for fundamental frequency (b) for third-harmonic frequency

4   POWER QUALITY IMPROVEMENT

The whole model of system under study is shown in Fig. 7. The system contains a three-phase source connected to a non-linear RLC load through parallel transmission lines (Line 1 and Line 2) with the same lengths. The DPFC is placed in transmission line, which the shunt converter is connected to the transmission line 2 in parallel through a Y-Δ three-phase transformer, and series converters is distributed through this line. The system parameters are listed in appendix TABLE I.

To simulate the dynamic performance, a three-phase fault is considered near the load. The time duration of the fault is 0.5 seconds (500-1000 millisecond). As shown in Fig. 8, a significant voltage sag is observable during the fault, without any compensation. The voltage sag value is about 0.5 per-unit. After adding a DPFC, load voltage sag can be mitigated effectively, as shown in Fig. 9.
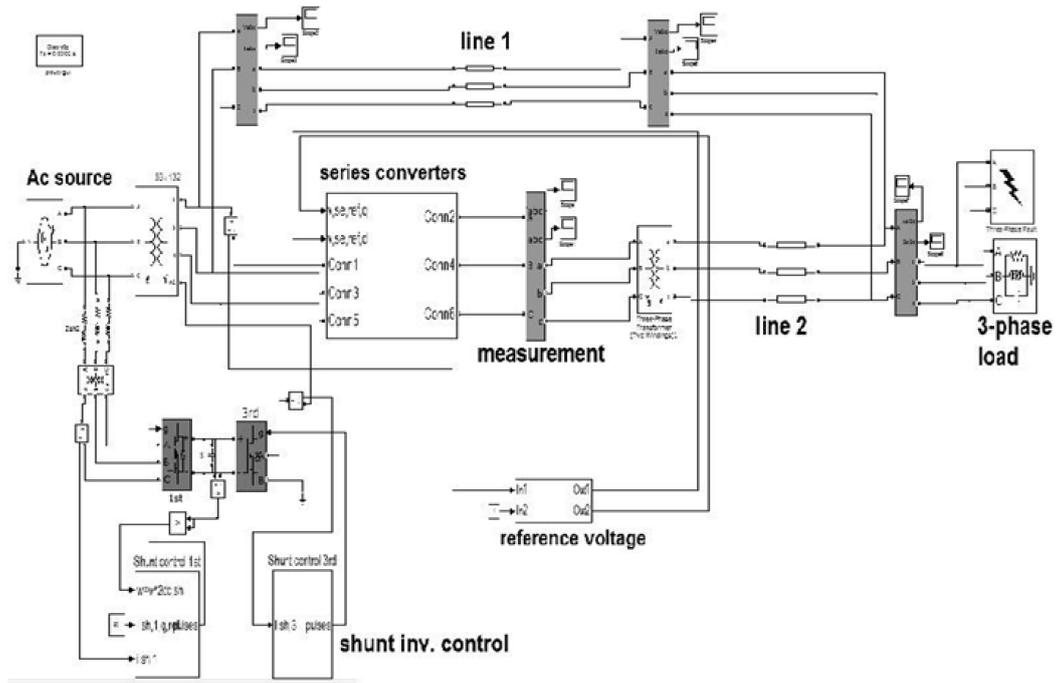

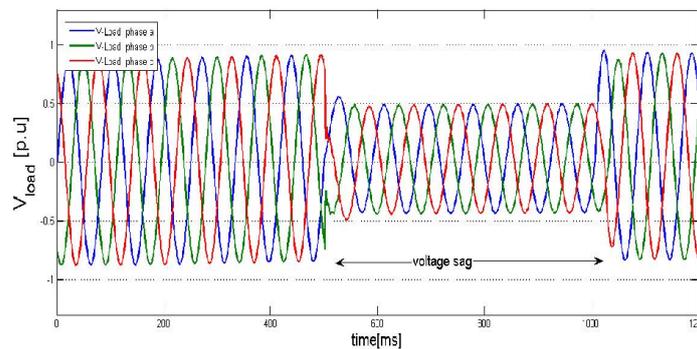*Fig. 7. Simulation model of the DPFC*
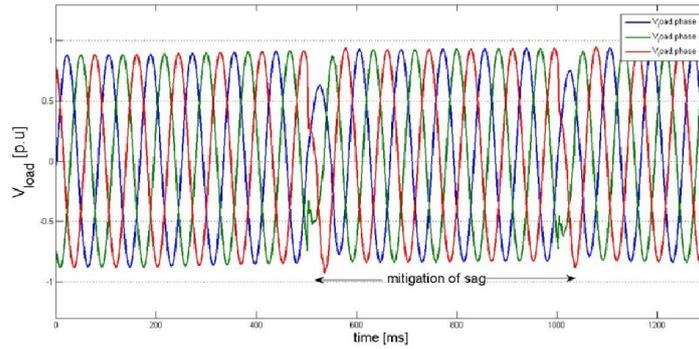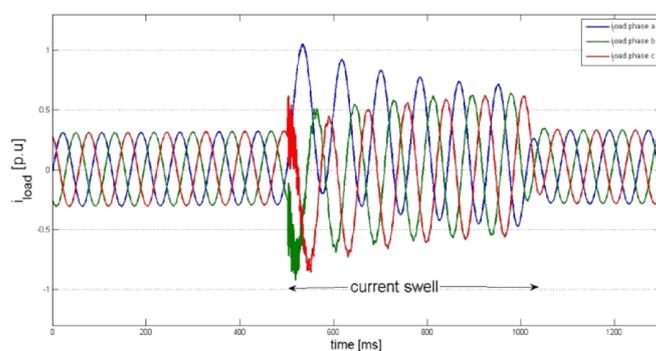
5   EXAMINING SIMULATION RESULTS


Fig. 8. Three-phase load voltage sag waveform

Fig. 9. Mitigation of three-phase load voltage sag with DPFC

Fig. 10 depicts the load current swell about 1.1 per- unit, during the fault. After implementation of the DPFC, the load current swell is removed effectively. The current swell mitigation for this case can be observed from Fig. 11.

Fig. 10. Three-phase load current swell waveform without DPFC
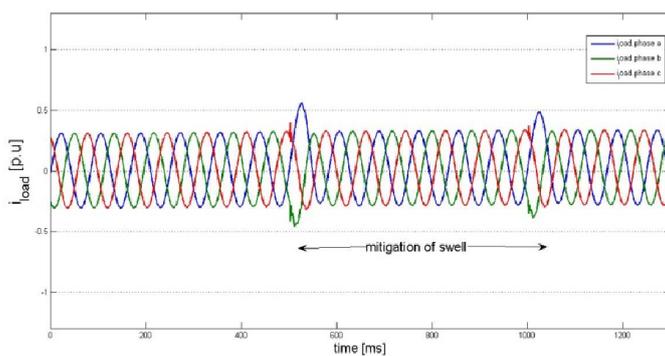
Fig. 11. Mitigation of three-phase load current swell with DPFC

The load voltage harmonic analysis without presence of DPFC is illustrated in Fig. 12. It can be seen, after DPFC implementation in system, the even harmonics is eliminated , the odd harmonics are reduced within acceptable limits, and total harmonic distortion (THD) of load voltage is minimized from 45.67 to 0.65 percentage (Fig. 13), i.e., the standard THD is less than 5 percent in IEEE standards.
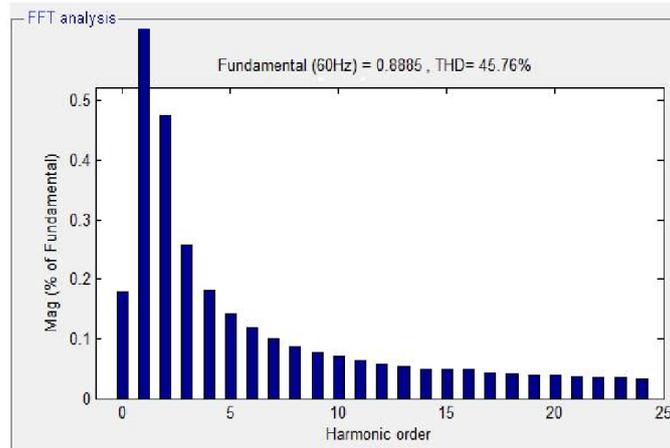
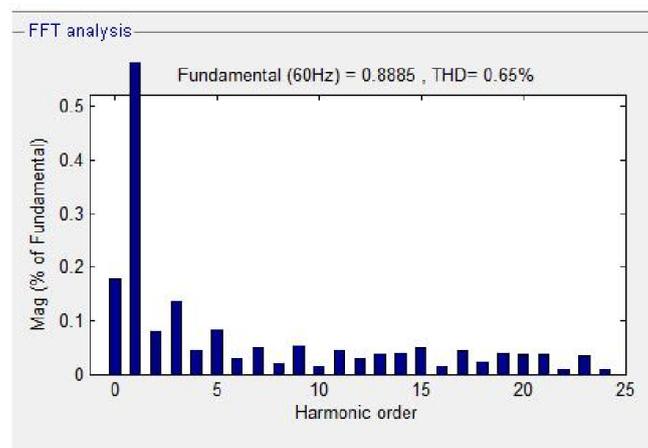*Fig. 12. Total harmonic distortion of load voltage without DPFC*

Fig. 13. Total harmonic distortion of load voltage with DPFC

6   CONCLUSION

To improve power quality in the power transmission system, there are some effective methods. In this paper, the voltage sag and swell mitigation, using a new FACTS device called distributed power flow controller (DPFC) is presented. The DPFC structure is similar to unified power flow controller (UPFC) and has a same control capability to balance the line parameters, i.e., line impedance, transmission angle, and bus voltage magnitude. However, the DPFC offers some advantages, in comparison with UPFC, such as high control capability, high reliability, and low cost. The DPFC is modeled and three control loops, i.e., central controller, series control, and shunt control are design. The system under study is a single machine infinite-bus system, with and without DPFC. To simulate the dynamic performance, a three-phase fault is considered near the load. It is shown that the DPFC gives an acceptable performance in power quality mitigation and power flow control.

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APPENDIX

TABLE I. Simulation System Parameters

Parameters	values
Three phase source	
Rated voltage	220 kV
Rated power/Frequency	100MW/50HZ
X/R	3
Short circuit capacity	11000MW
Transmission line	
Resistance	0.012 pu/km
Inductance/ Capacitance reactance	0.12/0.12pu/km
Length of transmission line	100 km
Shunt Converter 3-phase	
Nominal power	60 MVAR
DC link capacitor	600 µF

Continue of Table I :	
Coupling transformer (shunt)	
Nominal power	100 MVA
Rated voltage	220/15 kV
Series Converters	
Rated voltage	6 kV
Nominal power	6 MVAR
Three-phase fault	
Type	ABC-G
Ground resistance	0.01ohm

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Bluetooth technology for industrial application (Party slave)

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ABSTRACT: The cable transmission of the information between computer devices or / and electronic devices is increasingly replaced by wireless transmission. Bluetooth modules are currently among the best performing wireless communication devices. They are characterized by their small size, excellent radio range and low power consumption.

The Bluetooth technology is commonly used for creating wireless networks in the IT field (keyboard, mouse, printer…). However, this technology can be used in many more application.

In this paper we describe a way to apply the Bluetooth technology in various industrial fields.

The project objective is to establish a Bluetooth communication between industrial supervision system (SS) and a peripheral such as a motor. The peripheral is configured as a slave, while the supervision system is configured as a master.

In this article we describe the party of the Bluetooth peripheral.

KEYWORDS: Bluetooth, Industrial chain, Bluetooth Profiles, Serial port profile, Slave.

1 INTRODUCTION

Among the first applications where wireless was used in industrial applications was in wireless control of Automated Guided Vehicles (AGV) and cranes in warehouses where proprietary radios where used to achieve flexible control of the moving devices.

During the last 14 years, standardized radio technologies like Wireless LAN / WLAN (IEEE 802.11), IEEE 802.15.4 and Bluetooth technology (IEEE802.15.1) have become the dominating technologies for wireless data transmission. [1]

The Bluetooth technology is specified for transmission over short and medium distances. It's highly favored for industrial applications due to the cost-efficiency and to the following advantages: [1] [2].

- Eliminate expensive transmission media such as flexible cables, swivels, etc.
- Eliminate expensive and heavy maintenance
- Bypassing long distances and areas where cables cannot physically fit
- Fast and easy installation and commissioning
- High flexibility if there is a need to modify an installation

- Easy integration of devices into the network
- low power consumption, and automatic power control
- Robust and reliable radio link thanks to Adaptive Frequency Hopping (AFH), Forward Error Correction (FEC), narrow frequency channels, and low sensitivity to reflections /multi-path.
- Security features with 128-bit encryption and authentication

2   INDUSTRIAL CHAIN

An Industrial chain as shown in Figure 1 consists mainly of two blocks, the first is the supervision system and monitoring, the second is the production chain.

The supervision system and monitoring is composed of a control and processing station and an industrial controller (PCL). His role is to ensure its quality production and the best functioning of the equipments of the production chain.

The production chain is composed of actuators such as motors and jacks and sensors. [3]

The two blocks are connected by cables or optical fiber. The connection cables are of two types: one type (Control lines) for controlling the actuators by the system of supervision, the other (Status lines) is to transmit the state of the equipment of the production chain.
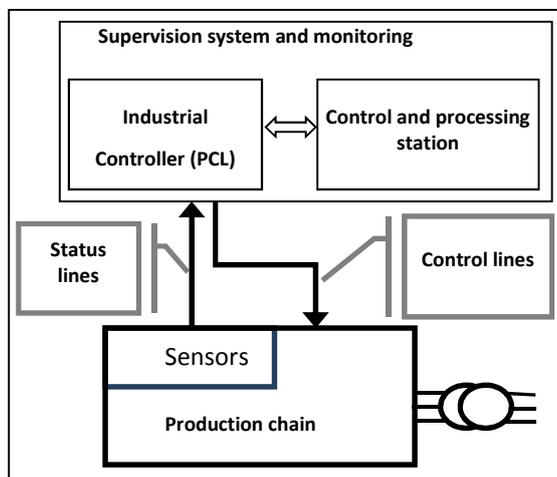
Fig. 1.   Synoptic of an industrial chain

The signals associated to an element in a production line (for example a motor) are approximately seven (See figure 2). Five signals associated to sensors of state of the motor and two for control (start and stop motor). A machine consisting average of five motors, each uses 7 x50m of cable, in total about 2 km of cable per machine. [4]
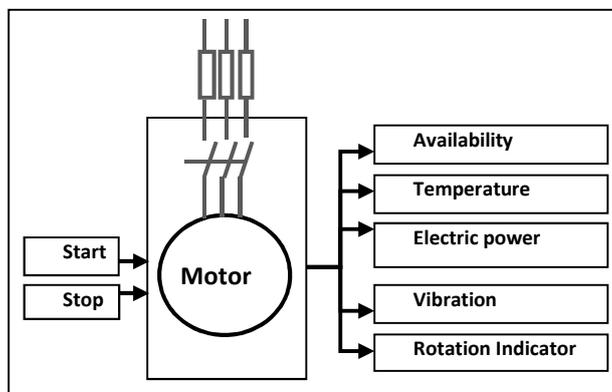
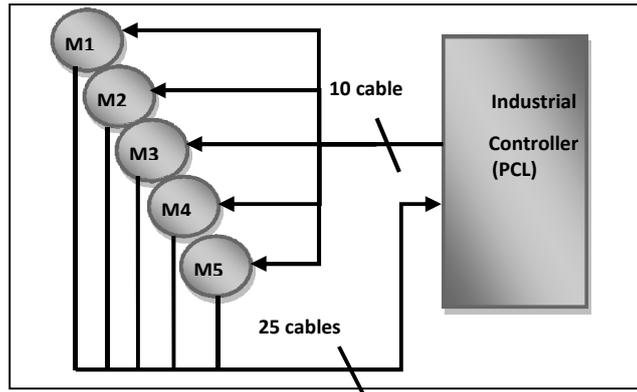*Fig. 2.   Signals associated to a motor*

Fig. 3.   Cabling of an industrial machine (5 motors)

3   BLUETOOTH NETWORK

Bluetooth devices all operate in the 2.4 GHz frequency band. This means that it uses the same radio frequencies as microwaves, 802.11. What makes Bluetooth different from the other technologies is that it divides the 2.4 GHz band into 79 channels and employs channel hopping techniques so that Bluetooth devices are always changing which frequencies they're transmitting and receiving on.

Bluetooth devices can operate in two modes: master or slave. The master is the first device that provides synchronization, all others are considered slaves. When the slave connects to the master it receives an address and clock, it uses this information to calculate the frequency hopping sequence

A master can control up to seven slaves in his zone. These form a small network called Piconet. Also, one apparatus can participate in several piconets, being the slave in one and master in another. The interlacing of several piconets forms what is called a Scatternet (See figure 4). Thanks to the frequency jumping, 10 independent piconets can transmit at maximum output (or up to 80 apparatus). [5]
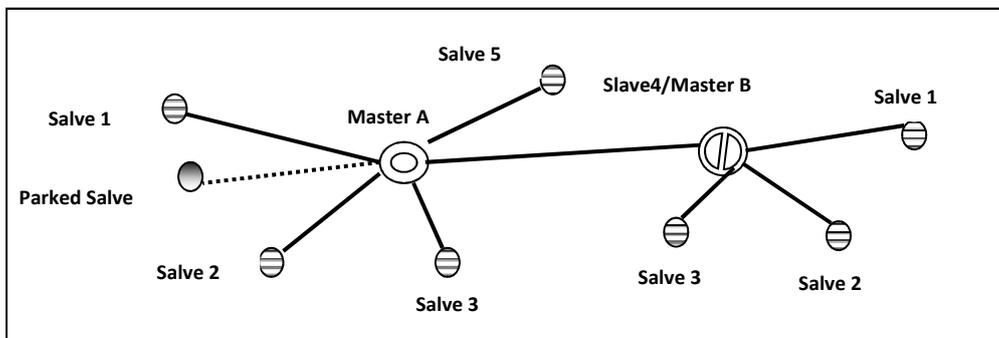
Fig. 4.   Bluetooth network (piconet and scatternet)

4   SERIAL PORT PROFILE (S.P.P.)

A Bluetooth profile is a specification regarding an aspect of Bluetooth-based wireless communication between devices. In order to use Bluetooth technology, a device must be compatible with the subset of Bluetooth profiles necessary to use the desired services.

The Serial Port Profile defines the requirements for Bluetooth devices necessary for setting up emulated serial cable connections using RFCOMM between two peer devices

Essentially, the Serial Port Profile defines the protocols and procedures that shall be used by devices using Bluetooth for RS232 serial cable emulation. The scenario covered by this profile deals with legacy applications using Bluetooth as a cable replacement, through a virtual serial port abstraction (See figure 5). [5]
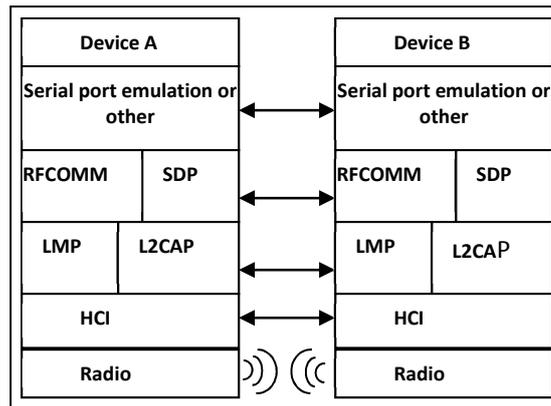
Fig. 5.   Serial Port Profile model

5   THE PROJECT OBJECTIVE

The objective of the project is to replace in an industrial chain all cabled transmissions low and medium distance by a wireless Bluetooth Type (Figure6). This transformation requires the use of hardware and software resources.
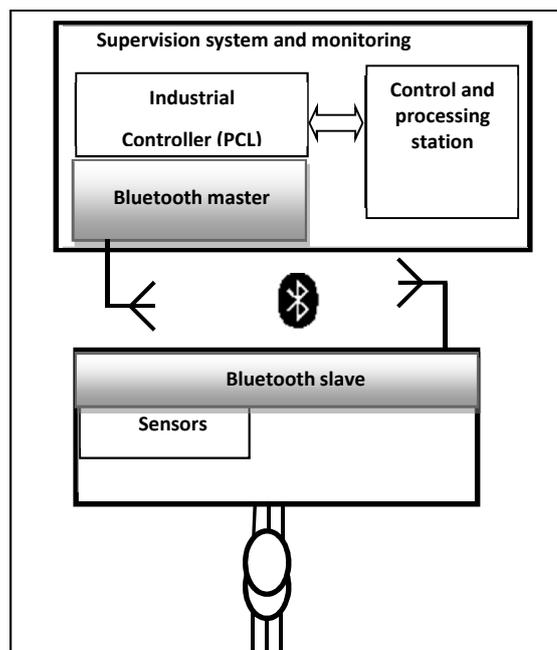
Fig. 6.   Synoptic of an industrial chain with Bluetooth transmission

6   THE HARDWARE PART OF THE PERIPHERAL

Materially the Bluetooth communication between the peripheral system and the supervision system is provided by a special Bluetooth module.

The first interest of this module is the fact of belonging to the class using the Bluetooth SPP protocol (RFCOMM). This feature reduces the real Bluetooth communication to a virtual serial communication between the Bluetooth module and the system of supervision (SS).

The second advantage is that this module can be programmed to always remain a slave.

6.1 BLUETOOTH MODULE

Ezurio's Embedded Intelligent Bluetooth Serial Module BISMS02BI-01 is a fully Bluetooth solution designed for lowest cost of integration Bluetooth functionality into products. The module is qualified to Bluetooth Version 2.0.

Fig. 7.   Bluetooth Serial Module BISMS02BI-01

The Embedded Intelligent Bluetooth Serial Module is designed to give a rugged solution that is ideal for industrial automation and ruggedized handheld devices.

The Embedded Intelligent Serial Module is based on Cambridge Silicon Radio's BlueCore4 chipset. The Module has an integrated, high performance antenna which is matched with the Bluetooth RF and baseband circuitry.
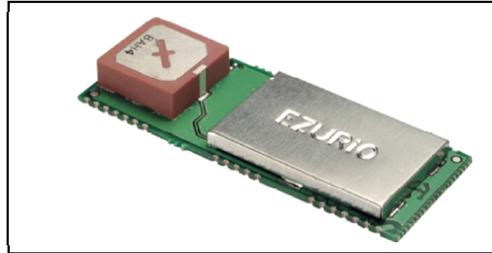
The firmware integrated into the module implements the higher layer Bluetooth protocol stack, up to and including the Generic Access Profile (GAP), Service Discovery Profile (SDAP), Serial Port Profile (SPP) and Audio Gateway.

 A virtual processor is used within the BC04 to implement an AT command processor. This interfaces to the host system over a straight forward serial port using an extensive range of AT commands.

In addition to the Bluetooth functionality, The Embedded Intelligent Serial Module provides access to 6 General I/O lines and one ADC input. These can be configured to extend the UART control or to provide connection to devices without requiring any external processing. The GPIO lines can be accessed either via the wired host UART connection, or remotely over the Bluetooth link.

A low cost development system and integrated RS232 products with the same firmware are available for fast product evaluation and development. [6]

The new structure allows the industrial machine to communicate via Bluetooth with the monitoring system is shown in Figure 8.
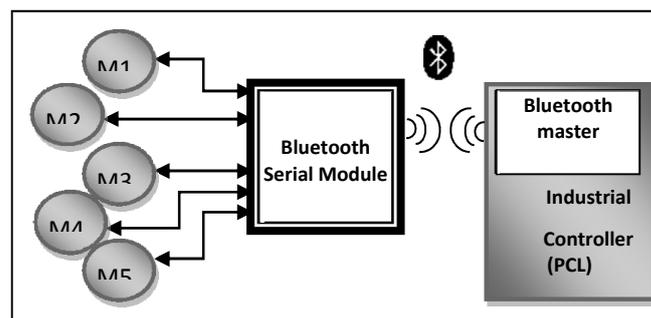
Fig. 8.   Bluetooth communication between a device and a system of supervision

6.2 THE ELECTRONIC CARD

The electronic card presented to the figure 9 is capable of driving at least 5 motors with 7 signals for each one. It operates one Bluetooth module BISMS02BI-01, multiplexers and registers (CD4051 BM: Analog multiplexer, CD4094B: register).
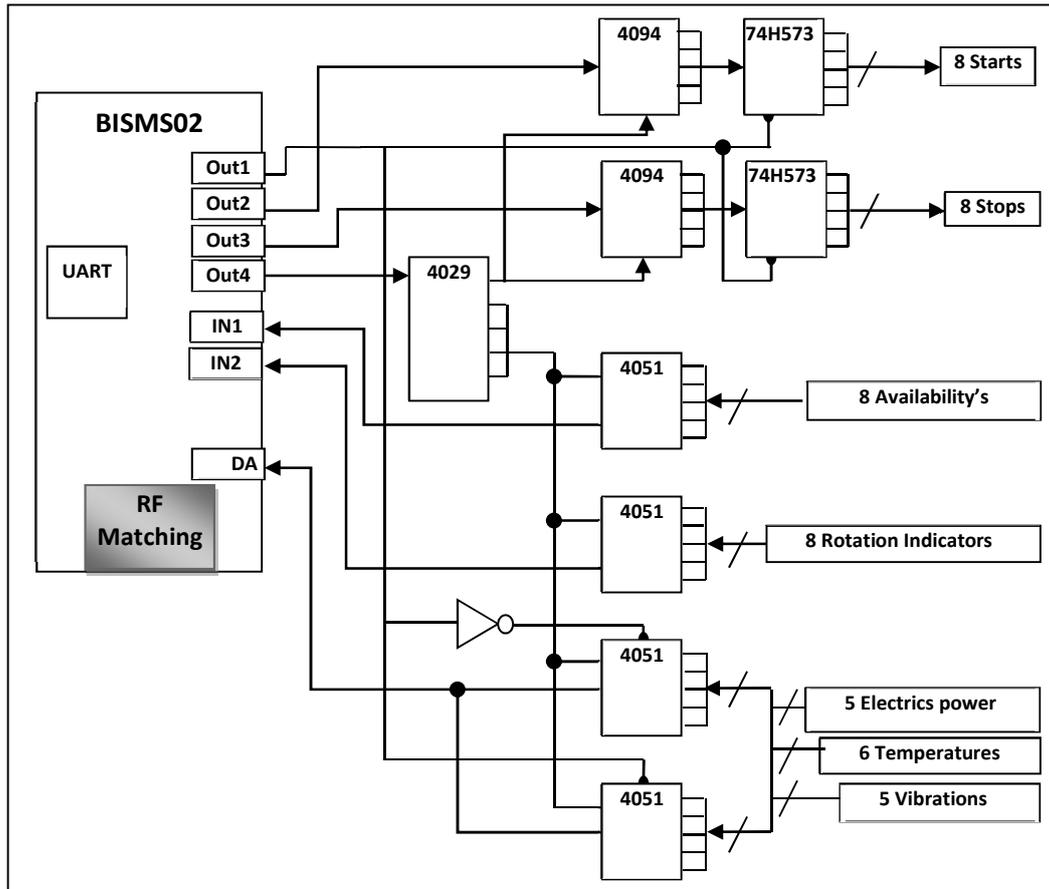
Fig. 9.   Schema of the electronic card

7   THE SOFTWARE PART OF THE PERIPHERAL SLAVE

The establishment of a connection between two Bluetooth devices is relatively a complicated procedure, which ensures a level of safety. The steps of this sequence are as follows: The steps of this sequence are as follows:

- Passive mode (In normal use a device operates in "passive mode", it is listening to the network)
- Phase inquisition providing research and discovery of the connection.
- Synchronization (paging).
- Service Discovery.
- Creating a communication channel.
- Pairing with a PIN (security).
- Using the network.

The software part of the slave system is based on the module configuration. This configuration consists of several procedures (See figure 10) to apply to the registers of the module, we cite a few:

- Configuration for be a slave
- Configuration for enabling serial port profile
- Configuration for be discoverable
- Configuration for be connectable
- Configuration for have an automatic response
- For the security of communication we use encrypted mode with a PIN code

The programming uses the industry standard Hayes AT protocol used in telephony modems which is appropriate for cable replacement scenarios. The telephony commands have been extended to make the EZURiO device perform the two core

actions of a Bluetooth device, which is make/break a connection and Inquiry. Many others AT commands are also provided to perform ancillary functions, such as, pairing, trusted device database management and S Register maintenance. [7]

```
        ┌─────────────────────────────┐
        │      ( Configuration )       │
        │              │               │
        │        [ To be slave ]       │
        │              │               │
        │  [ Serial port profile (ATS0=1) ] │
        │              │               │
        │   [ Discoverable (ATS0=1) ]  │
        │              │               │
        │ [ Connectable (AT+BTP) (ATS512=4) ] │
        │              │               │
        │ [ Automatic response (ATS536=1) ] │
        │              │               │
        │  [ Encrypted mode (ATS502=1) ] │
        │              │               │
        │          ( End )             │
        └─────────────────────────────┘
```
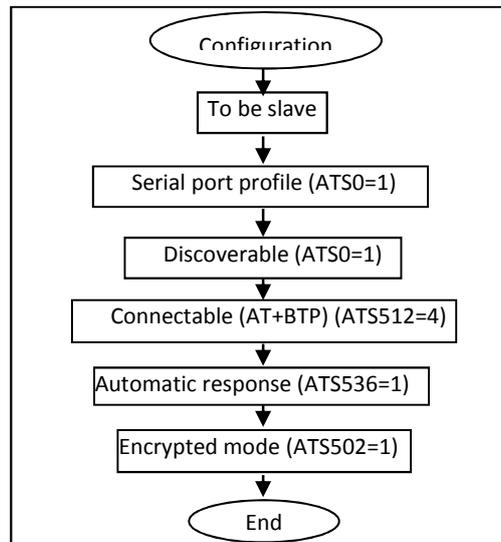
Fig. 10.   Organization chart for the configuration of Bluetooth module.

8   CONCLUSION

In this paper we showed the hardware and software levels to develop for exploiting the Bluetooth system as a means of communication between a device of a production chain and an industrial supervision system.

The proposed solution presents a very low cost compared to cable transmission. In addition it promotes energy optimization and minimizes electrical accidents and nature pollution.

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Modélisation multicouche du système aquifère du bassin de Tadla et le plateau des phosphates

[Modeling multi-aquifer system of Tadla basin and plateau of phosphates]

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ABSTRACT: The area of the plateau of phosphates, and the plain of Tadla which extends over an area of 12300 km^2 in Morocco central, is very well known for its interests industrial, economic and social very important. The groundwater resources in waters that is more vulnerable to overexploitation and/or to the alteration. The aquifer system is present in the coverage meso-Cenozoic and quaternary which has deposited on the Paleozoic formations. The modeling of the hydrodynamic functioning of this multilayered system allows the understanding and monitoring of the hydrogeological balance sheets, it is in the heart of the management of resources and their preservation. This work aims at the finite difference modeling the multi-layered complex of the plateau of phosphates and the plain of Tadla, the application adopted for the realization of the modeling is the GMS (Groundwater Modeling System of Aquaveo) with the Modflow code (U.S. Geological Survey) which have proved flexible enough for the design and the manipulation of the modeling. The conceptual model is composed of 4 bunk aquifers. The rivers of Oum Errabia, Derna, Laabid and Tassawout rivers form the main drains in the model, as-the climate inputs combined with the surplus water after irrigation of the perimeters of Tadla, without evaluated by the model of the hydrological balance "Wetspass" and form the main resource of the recharging. From the results of the timing of the model of the aquifer system "in whole" it may be pointed out its flexibility to reproduce the water operation of a complex system and multi-layered. The Oum Errabia, Derna, Laabid and Tassawout rivers form the main drains in the model, inputs are represented by climate apport combined with the surplus water after irrigation of the perimeters of Tadla without evaluated by the hydrological balance model "Wetspass". From the results of the calibration of the "entirely" aquifer system model we can see flexibility to reproduce the hydrological functioning of a complex and multi-layered system.

KEYWORDS: Hydrogeology, Aquifer, Modflow, Turonian, hydrogeological balance.

RESUME: Le domaine du plateau des phosphates et la plaine de Tadla qui s'étend sur une superficie de 12300 Km^2 au Maroc central, est très connu pour ses intérêts industriel, économique et social très importants. Les ressources souterraines qui s'y trouvent sont de plus en plus vulnérables à la surexploitation et/ou à l'altération. Le système aquifère est présent dans la couverture méso-cénozoïque et quaternaire qui s'est déposée sur les formations paléozoïques.
La modélisation du fonctionnement hydrodynamique de ce système multicouche permet la compréhension et le suivi des bilans hydrogéologiques, elle est dans le cœur de la gestion des ressources et de leur préservation.
Ce travail vise la modélisation en différences finis du complexe multicouche du plateau des phosphates et la plaine de Tadla, l'application adoptée pour la réalisation de la modélisation est le GMS (Groundwater Modeling System d'Aquaveo) avec le code Modflow (de l'U.S. Geological Survey) qui se sont avérés assez souple pour la conception et la manipulation de la modélisation. Le modèle conceptuel est composé de 4 aquifères superposés. Les rivières d'Oum Errabia, Derna, Laabid et Tassawout forment les principaux drains dans le modèle, quant-aux apports climatiques conjugués aux surplus d'eau issue de l'irrigation des périmètres de Tadla, sans évalué par le modèle du bilan hydrologique « Wetspass » et forment la principale

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ressource de la recharge. A partir des résultats du calage du modèle du système aquifères «en entier » on peut remarquer sa flexibilité pour reproduire le fonctionnement hydrique d'un système complexe et multicouche.

MOTS-CLEFS: Hydrogéologie, Aquifère, Modflow, Turonien, Bilan hydrogéologique.

1 ZONE D'ÉTUDE, OBJECTIFS DE L'ÉTUDE

1.1 ZONE D'ÉTUDE

La zone d'étude fait partie du domaine du Meseta occidentale marocaine, plus précisément des deux domaines géomorphologiques du plateau des phosphates et de la plaine de Tadla. Le domaine est limité au nord par la formation primaire du Zeïr, à l'est et au sud-est par la chaine Atlasique (Moyen Atlas), Au Sud et au sud-ouest par le haut Atlas et le bourgeonnement de la plaine de Bahira, et à l'ouest par le domaine primaire du Rehammna (fig.1). Hydrologiquement le domaine étudié fait (majoritairement) partie du bassin versant d'Oum Errabia. La partie nord du domaine appartient au bassin versant de Bouregreg. La ligne de partage des eaux entre ces deux bassins passe de l'est vers l'ouest près de la ville de Khouribga. La situation géologique est encore plus complexe, le domaine est composé d'une série du crétacé supérieure qui se repose sur des terrains paléozoïques, avec parfois des intercalations de faciès d'âge triasique, la série crétacé est marquée par la présence des étages de l'Infra-cénomanien, du Turonien ou Cénomano-turonien et du Sénonien [14]. Une formation d'éocène riche en phosphate se repose sur les terrains identifiés du Crétacé et forment le plateau des phosphates. Au sud, une plaine mio-plio-quaternaire s'est déposé dans un synclinal pour former la plaine de Tadla. Les précipitations mensuelles atteignent leur maximum pendant les mois de janvier et février; après une diminution au mois de mars, un deuxième pic se manifeste au mois d'avril [16] et [19].
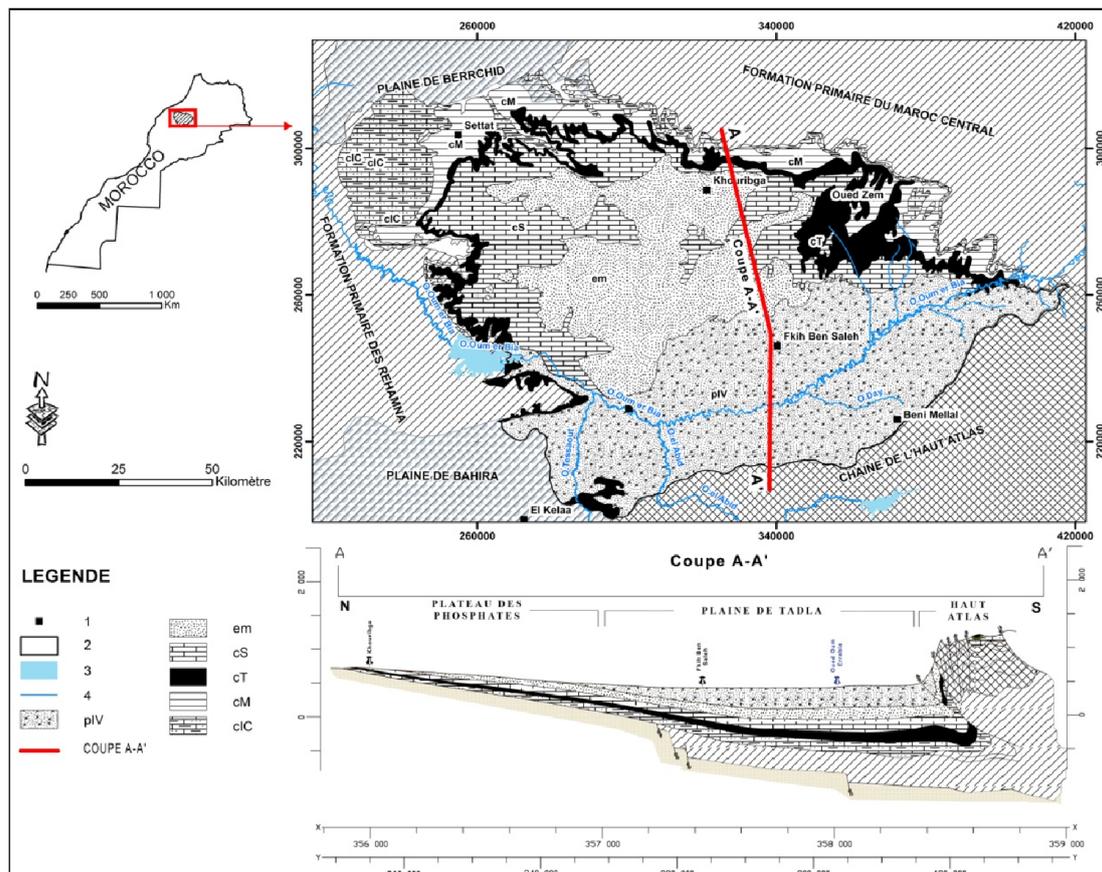
Fig. 1. *Esquisse de la carte géologique au 1/500000 [21] et coupe sur de la zone du plateau des phosphates et la plaine de Tadla. 1 : ville principale ; 2 : Limite de la zone d'étude ; 3 : Barrage ; 4 : Rivière ; pIV : Mio-Plio-Quaternaire ; em : Eocène moyen ; cS : Sénonien ; cT : Turonien ; cM : Cénomanien ; cIC : Infra-Cénomanien.*

De point de vue lithologique, les terrains du Crétacé sont d'une prédominance calcaire et marneuse, la formation Maastrichtienne riche en sable phosphatés et en phosphates sableux [4], tandis que les terrains quaternaires de Tadla sont composés de matériaux de nature argilo-sableux et conglomératique [2], [20], [22]. L'hydrogéologie est marquée par les nappes du Cénomano-turonien, du Sénonien, de l'Eocène, des Beni Amir et Beni Moussa dans le plio-quaternaire de Tadla. La recharge est partagée entre apports latéraux [11], [12], recharge superficielle et drainance des autres unités hydrogéologiques.

Les domaines irrigués de Tadla, d'une superficie de 107000 ha, sont constitués par les périmètres des Beni Amir, Beni Moussa et Dir. Ils sont gérés majoritairement par l'Office Régionale de Mise en Valeur Agricole de Tadla (ORMVAT). Cet organisme est responsable de la gestion de l'irrigation et le suivi des cultures [15]. L'irrigation dans la plaine du Tadla est assurée par les grands barrages d'El Hansali (capacité de 800 millions de m3) sur l'oued Oum er-Rbia et Bin el Ouidane (1,5 milliard de m3) sur l'oued El Abid. La construction des équipements hydrauliques du périmètre des Beni Amir a commencé en 1932 et la mise en culture progressivement à partir de fin 1936, alors que le périmètre des Beni Moussa a été mis en service à partir de 1952 [24]. Ce domaine est complété par des zones diffuses de pompage sur environ 18 600 ha et par des périmètres traditionnels (9 100 ha) au piedmont de l'Atlas à l'Est des Béni Moussa (domaine du Dir) [26]. La gestion de la totalité des ressources en eau dans le bassin versant est assurée par l'agence du bassin versant hydraulique d'Oum Errabia (ABHOER).

1.2   OBJECTIFS DE L'ÉTUDE

La superposition verticale des différents aquifères confère au domaine le nom de « complexe aquifère ». Du faite de l'anthropisation d'une bonne partie du domaine étudié, notamment l'installation des domaines irrigués de la plaine de Tadla à partir des années 30, le fonctionnement hydrique naturel du complexe aquifère a été extrêmement affecté, impliquant des remontées spectaculaires des nappes (notamment les nappes phréatiques libres du domaine de Tadla). Ainsi, il a été toujours difficile de quantifier et de justifier le fonctionnement de chaque nappe dans ce système, voir le fonctionnement global dû aux échanges entre les différentes nappes.

La problématique exposée ci-dessus nous a orientés vers les objectifs suivants:

- Identifier et délimiter les origines des ressources en eau et la nature de leurs interactions,
- Etablir une géométrie générale du fonctionnement hydrique,
- Quantifier la recharge efficace du système étudié,
- Réaliser un modèle mathématique qui reproduit ce fonctionnement,
- Quantifier les ressources et les réserves.

2   IDENTIFICATION DES RESSOURCES EN EAU

Les systèmes aquifères sont composés de plusieurs unités gardant (le plus longtemps possible) leur intégrité et leur équilibre. Ces unités peuvent être classées en : unités de ressources représentées par nappes proprement dite, les unités d'apport qui permettent la recharge du système et unités de décharge. Ces unités peuvent avoir un fonctionnement individualisé, comme elles peuvent interagir en fonctionnement complexe, c'est cette dernière situation qui est prédominant dans le cas du complexe aquifère de la plaine de Tadla et le plateau des phosphates.

Les unités et composantes du système aquifère étudié peuvent être présentées sommairement comme suit :

- Les formations aquifères sont composées des nappes de Cénomano-turonien, de la nappe du sénonien, la nappe de l'éocène, la nappe des Beni-Amir et la nappe des Beni Moussa, ces formations superposées désignent les unités de ressources,
- Le réseau hydrographique qui inclut Oued Oum Errabia, Oued Laabid, Oued Darna, Oued Tassaout, et le reste du réseau hydrographique représente, dans ce cas d'étude une unité de recharge et de discharge compte tenus des l'inter-échanges entre les formations hydrogéologiques et le réseau hydrographique,
- Les précipitations forment l'unité de recharge dans cette modélisation, combinées au surplus infiltré des eaux d'irrigation, une quantification par « Wetspass » permet de déterminer la lame d'eau réelle qui sera infiltrée vers la nappe et pouvoir de percolation [17],
- L'irrigation des domaines de Tadla, notamment les domaines des Beni moussa, des Beni Amir et de Dir sera évalué en tant qu'unité de recharge,
- Les apports des domaines juxtaposés (Haut Atlas, Bahira, Plaine de Berrchid,…), ainsi que les drainances verticales des ressources en eau [13].

3   CARACTÉRISTIQUES ET GÉOMÉTRIE DES AQUIFÈRES

La modélisation du complexe aquifère du plateau des phosphates et de la plaine de Tadla inclue l'établissement d'un modèle conceptuel représentant les quatre formations aquifères, la géométrie de ce modèle a été figée à partir de 71 sondages géologiques et pétroliers réalisés dans la région, les conditions aux limites du modèle sont de type à potentiel imposé aux contacts avec les cours d'eau, à flux imposé aux zones de drainance latérale et à flux nul dans les limites stérile du modèle. Les paramètres géométriques des « layers » du modèle sont issus à partir des données de sondage, géophysiques et des cartes topographiques. Les paramètres hydrodynamiques (perméabilité, transmissivité, anisotropie, …) sont issus des essais de pompages (Fig.2).
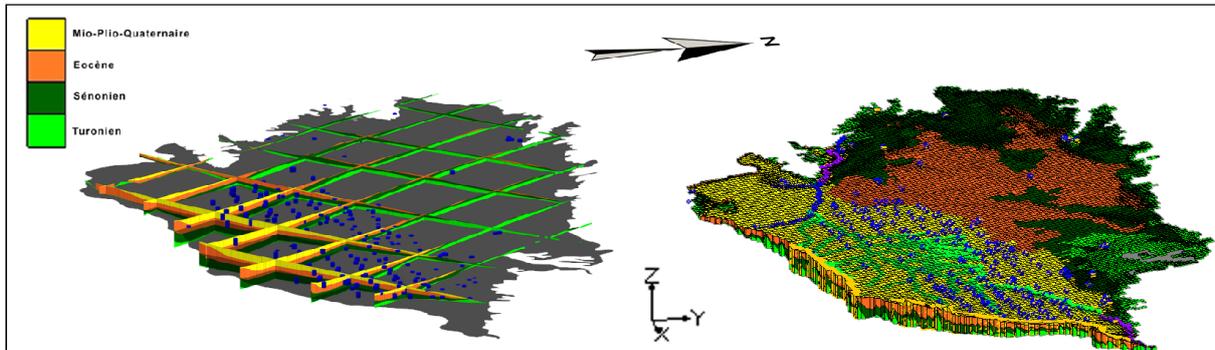

Fig. 2.   Géométrie du modèle mathématique du complexe aquifère du plateau des phosphates et de la plaine de Tadla

L'architecture adopté est en différence finie, implanté sur le modèle « Modflow » de l'U.S. Geological Survey sous l'interface GMS, l'équation de la diffusivité est résolue dans chaque cellule du modèle [25], elle est de la forme suivante (Eq. 1) :

$$\frac{\partial}{\partial x}\left(K_{xx}\frac{\partial H}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_{yy}\frac{\partial H}{\partial y}\right)+\frac{\partial}{\partial z}\left(K_{zz}\frac{\partial H}{\partial z}\right)+W=S_s\frac{\partial H}{\partial t} \qquad \text{(Eq. 1)}$$

Où :

- K_{xx}, K_{yy} et K_{zz} sont les conductivités hydrauliques au long des axes, x, y, et z (les directions principales d'anisotropie sont les mêmes que les axes du référentiel Oxyz [m/s],
- H est la charge hydraulique [m],
- W est le terme source ou perte par unité de volume [1/s],
- SS est le coefficient d'emmagasinement spécifique [1/m]. En nappe libre, en intégrant cette équation sur la verticale, le coefficient d'emmagasinement S est remplacé par la porosité de drainage (w_d),
- t est le temps [s].

Les caractéristiques hydrodynamiques (Tableau. 1) sont introduits au modèle sous forme de grille de données « raster », Le tableau suivant représente le sommaire de ces paramètres calés pour le modèle hydrodynamique de la plaine de Tadla et le plateau des phosphates :

Table 1.   Présentation des paramètres hydrodynamiques exploités dans la modélisation

	Perméabilité (m/jour)				Anisotropie				Coef. d'emmagasin. (%)			
	Tur.	Séno.	Eoc.	PIV	Tur.	Séno.	Eoc.	PIV	Tur.	Séno.	Eoc.	PIV
Max	190	83	154	390	1	1	1	1	5	3	6	11
Min	2.1	0.8	6.3	2.5	1	0.8	1	0.5	5	2	2	1.4

4   QUANTIFICATION DE LA RECHARGE

La réalisation d'un modèle mathématique d'une telle fluidité vis-à-vis de la variation de la recharge implique un traitement préalable du bilan hydrologique, ceci est réalisé grâce d'un autre modèle hydrologique appelé « Wetspass » acronyme de Transfère d'Eau et de l'Energie entre le Sol, les Plantes et l'Atmosphère [7], le modèle est complètement intégré dans le SIG et permet l'estimation à long terme (régime quasi-permanant) des paramètres influençant la recharge

efficace des ressources souterraines, des ruissèlements et de l'évapotranspiration [3]. Les entrées de ce modèle incluent des grilles de données de l'occupation du sol, de la profondeur initiale de la nappe, de la précipitation, de l'évapotranspiration potentielle, de la vitesse du vent et des types de sols, ces grilles sont interconnectées dans le modèle par leurs tables d'attribue respectives. Un traitement spécifique est réalisé à fin d'ajouter les quantités d'eau issues de l'irrigation des périmètres irrigués à la grille des données de précipitation. La résolution des termes du bilan hydrologique s'effectue dans l'ordre selon les formules suivantes (Eq. 1, 2 et 3):

$$ET_{raster} = a_v ET_v + a_s ET_s + a_o ET_o + a_i ET_i$$

(Eq. 2)

$$S_{raster} = a_v S_v + a_s S_s + a_o S_o + a_i S_i$$

(Eq. 3)

$$R_{raster} = a_v R_v + a_s R_s + a_o R_o + a_i R_i$$

(Eq. 4)

Où : ET_{raster}, S_{raster} et R_{raster} sont respectivement l'évapotranspiration totale, le ruissellement et la recharge des nappes souterraines pour une cellule donnée du domaine modélisé. Chacun de ces paramètres dépend des ratios a_v, a_s, a_o et a_i, relatifs respectivement au ratio de la végétation, du sol nu, d'étendue d'eau et des zones imperméables.

Les résultats de Wetspass (recharge efficace & évapotranspiration) peuvent être introduits directement dans le modèle hydrogéologique [8]. L'exploitions du modèle Wetspass a permet de suivre le cycle hydrologique de la plaine de Tadla et du plateau des phosphates. Les flux d'irrigation sont également incluent dans le calcul de la lame d'eau infiltrée à travers l'analyse des données concernant 2358 forages et puits installés sur les nappes libres ainsi que les données sur 178 forages installés sur les nappes profondes [18]. Les résultats atteints permettent l'estimation avec plus de précision des valeurs de la recharge efficace, de l'interception, du ruissèlement et de l'évapotranspiration. Les deux domaines étudiés : plaine de Tadla et plateau des phosphates, géo-morphologiquement très diversifiés ont été partagés en quatre sous-zones et fonction de l'origine et le devenue des eaux du cycle hydrique.
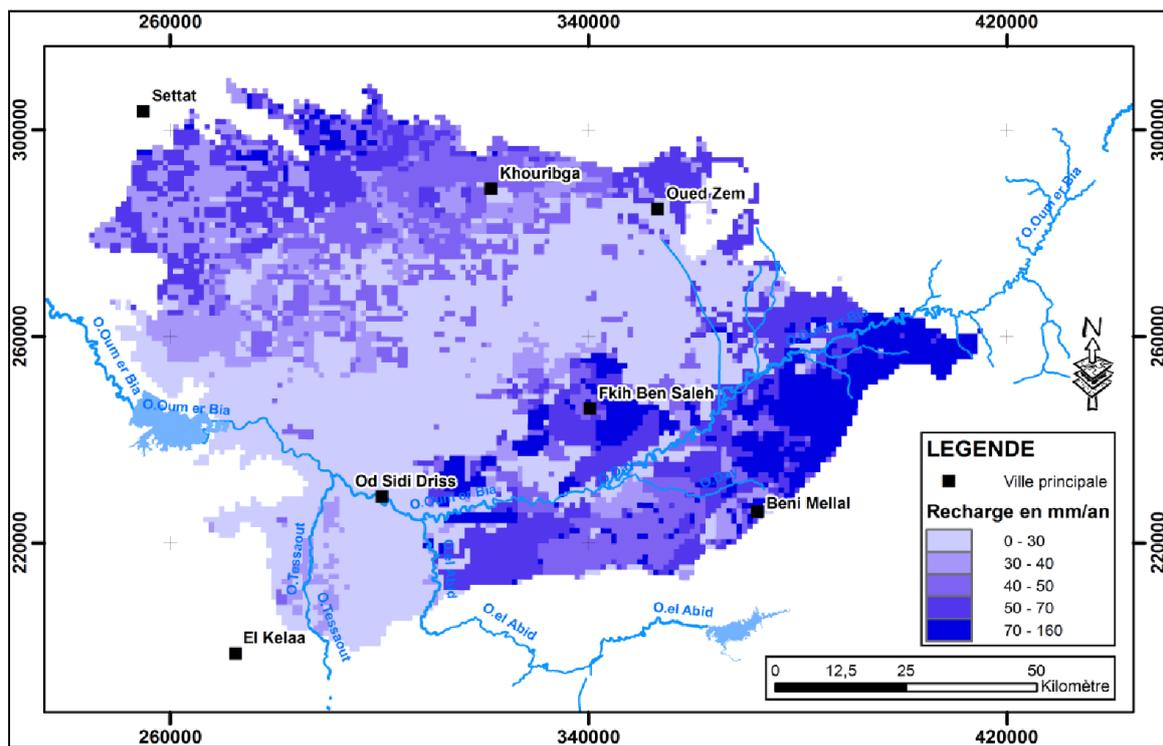
Fig. 3. *Carte simulée par Wetspass de la recharge annuelle (en mm) des nappes souterraines*

Ainsi, sur la basse de 4200Mm^3 d'apport d'eau mise en jeu annuellement dans la zone d'étude, seulement 10% (417Mm^3) de cette quantité atteint les niveaux saturés du sous sol, et sera utilisé comme recharge efficace des nappes, dont 40% (166Mm^3) dans le domaine du plateau et 60% (250Mm^3) dans la plaine de Tadla. Sur la base de ces données, la comparaison avec les estimations établies par l'ABHOER [1] montre une différence négligeable de 1% (équivalent à 3 Mm^3) du volume global. La simulation avec Wetspass a montré également la nécessité de rectifier les estimations établies dans la zone du plateau de 30% pour que ces estimations soient limitées à 166Mm^3.

5 MODÉLISATION MATHÉMATIQUE

La réalisation et le calage d'un modèle mathématique des eaux souterraines du complexe aquifère de la plaine de Tadla et le plateau des phosphates, n'est qu'un premier objectif indispensable à la validation du modèle, l'étape la plus contraignante et de simuler des périodes critiques dans le passé et voir la réaction du modèle vis-à-vis des projections futures de la recharge climatiques et la variation des besoins en irrigation.

Le calage du modèle a été effectué en trois étapes successives, correspondant à trois configurations hydrodynamiques distinctes :

- Un régime hydrodynamique permanent de basses eaux, correspondant à « l'état naturel » initial du système aquifère, avant la mise en place et l'exploitation des périmètres irrigués «modernes» à la fin des années 70.
- Un régime hydrodynamique transitoire, associé à la mise en eau des périmètres irrigués dans le secteur Plio-Quatérnaire (Beni Amir et les Beni Moussa).

Les travaux hydrogéologiques réalisés dans la zone d'étude, ont été menés principalement par [5] et [6] et les travaux de [9] et [10]. Ces travaux ont permet de dresser plusieurs cartes hydrogéologiques qui constituent la base des esquisses de comparaison.

6 RÉSULTATS ET DISCUTIONS

Les résultats (Entrées-sorties) des deux phases de calage du modèle introduites précédemment en état permanant et transitoire sont illustrés dans la fig.4 ci après :
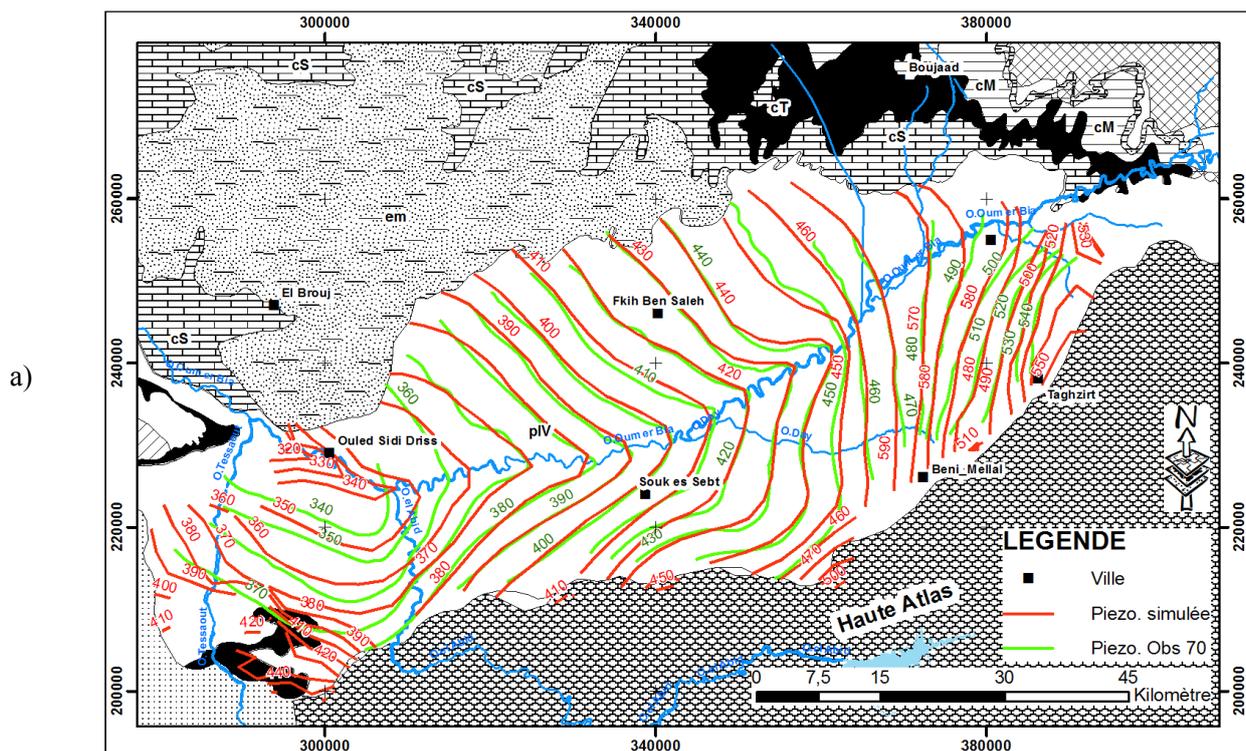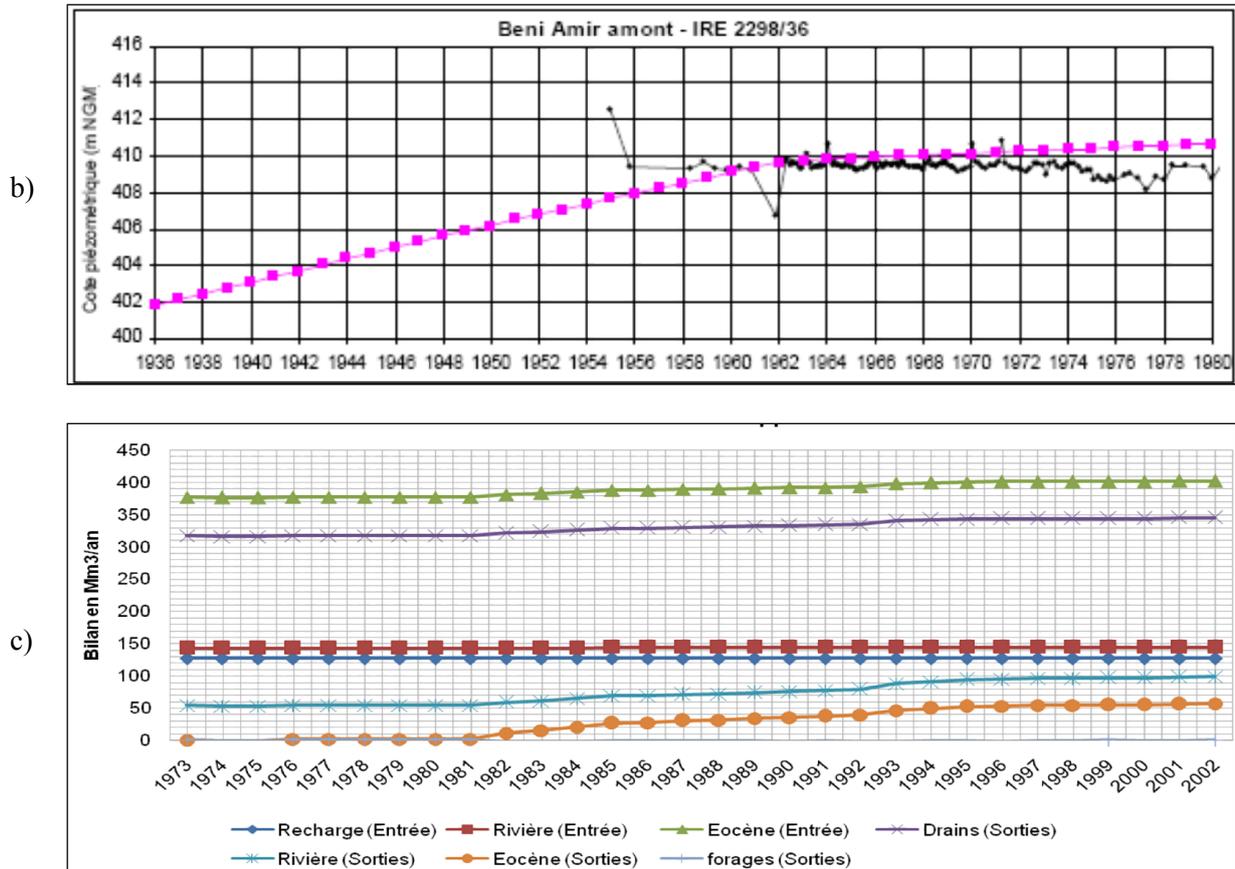
Fig. 4. **Résultats du calage permanant et transitoire du modèle mathématique du complexe aquifère du plateau des phosphates et de la plaine de Tadla : a)comparaison des courbes isopièzes mesurées et simulées dans le Tadla ; b) comparaison du suivi piézométrique (piézomètre n° IRE2289/36) ; c) suivi du bilan de la nappe turonienne au cours de la période 73-03.**

D'après des résultats du calage du modèle pour « l'état naturel », nous avons remarqué que pour les nappes phréatiques et dans les secteurs où l'on dispose de références piézométriques avant la mise en irrigation des périmètres, à savoir dans les Beni Moussa et le Dir, une excellente adéquation a pu être obtenue entre piézométrie mesurée et piézométrie simulée (Fig.3-a), et ceci avec un champ de perméabilités parfaitement vraisemblable. Reste une forte incertitude qui pèse, en particulier, sur toute la zone située au Nord de l'Oum Errbia, puisque le modèle n'y a pas été calé lors de cette première étape, faute de mesure piézométrique antérieure à la mise en service du périmètre irrigué des Beni Amir. Pour l'Eocène et le Turonien : des incohérences géométriques [23] ponctuels ont engendrés des problèmes de dénoyage pour plusieurs mailles ; la solution consiste à considérer les aquifères profonds comme entièrement captifs, c'est-à-dire saturés sur l'ensemble de leur épaisseur y compris en zone libre. Cette hypothèse n'a aucune influence sur les bilans hydrologiques de l'ensemble du modèle. Ailleurs, le tracé des courbes isopièzes est très cohérent avec les esquisses de 1975, que ce soit pour le Turonien ou pour l'Eocène.

En deuxième étape de calage transitoire, comme pour les Beni Moussa, le processus de calage a amené à introduire une bande peu à très peu perméable le long de l'Oum-er-Rbia, et à affecter des perméabilités importantes à la partie centrale du périmètre pour reproduire la piézométrie très plate relevée en hautes eaux. L'observation de la superposition des chroniques piézométriques mesurées et simulées dans chacun des 14 piézomètres de suivi qui sont implantés dans les Beni Amir amont (Fig.3-b) et dans les Beni Amir aval montre qu'après une longue période de montée, correspondant à la mise en eau progressive du périmètre (simulée de 1939 à 1954), les niveaux atteignent des paliers très proches de ceux qui ont été effectivement mesurés entre 1970 et 1975. En ce qui concerne les nappes profondes de l'Eocène, du Sénonien et du Turonien, le bilan global (Fig.3-c) des échanges entre ces unités et les autres ressources disponibles est sensiblement affecté plutôt par le changement de la recharge climatique que par la mise en place et l'installation des domaines irrigués notamment dans la partie nord du modèle avec une allure générale en déclin sur toute la période modélisée.

7   CONCLUSION

Le modèle hydrodynamique élaboré pour le système aquifère du bassin de Tadla et plateau des phosphates a permis de limiter favorablement les incertitudes liée au bilan climatique ; recharge pluviométrique et évapotranspiration. Par ailleurs, ce modèle simule très convenablement des situations piézométriques diverses et contrastées, telles que le régime piézométrique naturel, les fortes remontées de nappe induites par la mise en eau des périmètres irrigués, et les baisses piézométriques significatives mais temporaires résultant de séquences pluviométriques déficitaires. Toutefois, vue le contexte hydrogéologique très particulier de ce système certaines incertitudes subsistent quant au modèle conceptuel. En effet, une très grande partie du domaine concerné correspond à des périmètres irrigués où, par nature, les flux hydrauliques échappent à la mesure et sont difficiles à quantifier : infiltrations agricoles hypothétiques, pompages privés très nombreux et incontrôlables, évapotranspiration importante et immatérielle, débits drainés jaugés épisodiquement, biaisés par les pompages et les rejets directement effectués dans les fossés de drainage. Il sera indispensable de continuer à utiliser le modèle avec tendance de l'améliorer au fur et à mesure de simuler des impacts diversifiés liés aux nouveaux aménagements et à des scénarios climatologiques exceptionnels, isolés ou répétitifs.

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Les effets des émotions négatives engendrées par un message publicitaire à caractère sexuel provocateur sur l'embarras et les attitudes des récepteurs envers la marque et le message

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ABSTRACT: The particular interest to sexual advertising or shockvertinsing returns to his considerable effect on advertising efficiency in spite of critics about the social's and ethical's implications. However, these ads can engender negative affective reaction as well as feeling of embarrassment which can influence and modify the behaviour and especially attitudes toward the ads and brand. This paper try to study the impact of negative emotions on embarrassment and attitudes toward the ad and the brand and so contributes to comprehension of advertising process.

KEYWORDS: embarrassment, negative emotions, attitude toward the brand, attitude toward the ad.

RESUME: L'intérêt particulier à la publicité à caractère sexuel provocateur revient à l'effet considérable qu'elle peut engendrer sur l'efficacité publicitaire malgré les critiques concernant les implications sociales et éthiques qu'elles peuvent aussi engendrer. Cependant, ces publicités peuvent entraîner des réactions affectives négatives ainsi qu'un sentiment d'embarras qui peuvent influencer et modifier les comportements et surtout les attitudes des récepteurs. Ce papier étudie l'impact des émotions négatives sur l'embarras et les attitudes à l'égard du message et de la marque et contribue ainsi à appréhender le processus de persuasion publicitaire.

MOTS-CLEFS: embarras, émotions négatives, attitude envers la marque, attitude envers le message.

1 INTRODUCTION

Les recherches s'intéressant aux réactions affectives se multiplient de plus en plus dans le domaine publicitaire vue l'efficacité des émotions ressenties envers un message publicitaire sur les processus ultérieurs comme le changement des attitudes et les comportements des consommateurs : l'attitude envers la marque et le message, la mémorisation, l'achat du produit….

Ainsi, plusieurs études ont étudié le rôle des émotions positives comme l'amour, la joie, le plaisir, l'éveil… En revanche, d'autres études se sont beaucoup plus concentrées sur l'étude des émotions négatives comme la peur, le choc, la culpabilité… engendrées par un stimulus publicitaire.

Une pratique courante en publicité ne cesse d'accroître dans ce sens, celle de l'utilisation des messages visuels à caractère sexuel provocateur (Lambiase et al., 1999 ; LaTour, 1990 ; Severn, Belch et Belch, 1990 in De barnier, Merunka et valette Florence, 2005 p1) qui peuvent provoquer différentes réactions affectives. En effet, Alexander et Judd (1986) ont mis en évidence les réactions positives et négatives qu'engendre ce type de visuel publicitaire sur le récepteur.

L'intérêt particulier à cette technique revient donc à l'effet considérable qu'elle peut engendrer sur l'efficacité publicitaire malgré les critiques concernant les implications sociales et éthiques qu'elles peuvent aussi engendrer (Gould, 1994 ; LaTour et Henthorne, 1995 ; Tinkham et Weaver-Lariscy, 1994 ; Tissier-Desbordes et Manceau, 2003 in De barnier, Merunka et valette Florence, 2005 p1).

Pour comprendre cette pratique et les mécanismes mis en œuvre lors de l'exposition à un message publicitaire à caractère sexuel provocateur, Goffman (1956, 1967) s'est concentré sur l'étude de l'embarras qui se présente comme un malaise qui génère chez l'individu une perte de contrôle de ses émoûtants et une impossibilité de les maîtriser.

Nous désirons alors dans cette recherche examiner l'efficacité des publicités à caractère sexuel ressenti et donc nous avons choisi de mesurer l'impact de l'embarras que peut engendrer une telle technique sur les attitudes envers la marque et le message. Il est à noter que les études s'intéressant à cette relation n'ont pas pris en considération l'effet des émotions ressenties sur l'embarras.

Par ailleurs, la détermination du rôle des émotions ressenties par le récepteur et de leur influence sur l'embarras pourrait permettre de mieux appréhender le processus de persuasion publicitaire des publicités à caractère sexuel provocateur.

Les objectifs de cette recherche cherchent à apporter une réponse à la question centrale :

« Quels sont les effets des émotions négatives engendrées par un message publicitaire à caractère sexuel provocateur sur l'embarras et les attitudes des récepteurs ? »

La première partie de ce papier traite l'étude des émotions négatives en publicité. Ensuite, une deuxième partie s'attellera à l'approfondissement des fondements théoriques sur l'embarras dans la publicité à caractère sexuel provocateur. Une troisième partie sera consacrée à la méthodologie de recherche et le test des hypothèses développées dans le cadre théorique. Une présentation des résultats et leurs discussions sera à la fin avancée ainsi que les contributions théoriques et managériales sans oublier les limites de cette recherche.

2   L'IMPACT PERSUASIF DES EMOTIONS NEGATIVES EN PUBLICITE

La définition de l'émotion constitue une difficulté assez importante rencontrée par les chercheurs qui se sont intéressé à ce domaine. C'est ce qui explique la multitude de définitions parfois contradictoires autour du même concept d'émotion. Ces divergences sont inhérentes aux théories privilégiées par certains auteurs dans ce domaine.

Ainsi, la définition proposée et considérée comme étant la plus générale et qui tient en compte du fait que l'émotion est un sous ensemble particulièrement important des états affectifs, est celle de Gouteron (1995) in Jean François Lemoine (2001, p51) qui considère l'émotion comme « une réaction affective, momentanée, multiforme et plus ou moins intense qui est faite à un facteur perturbateur et externe à l'individu ».

Cette définition affirme que l'émotion est considérée être parvenue dans un contexte de situation précise et particulièrement découverte ayant une certaine intensité associée à un stimulus d'objet ou d'événement exogène à l'individu et qui désorganise un état durable.

Dans ce cas, la relation entre l'individu et la situation émotionnelle ou le stimulus émotionnel peut être caractérisée par une indication positive ou négative à un niveau quelconque d'intensité. Ainsi, une émotion positive est associée à un comportement complémentaire dirigé à un certain objectif et une émotion négative est associée à un désistement ou comportement défensif dirigé envers des stimuli menaçants ou dégoûtants (Schneirla, 1959 in Richard L.Hazlett and Sasha Yassky Hazlett, (1999, p9)).

L'intérêt et l'importance de l'affectif et plus précisément des émotions qui ont été soulignés par les différentes définitions de ce concept, ont été également marqués par l'évolution des différents modèles de persuasion publicitaire que nous proposons de présenter dans ce qui suit.

2.1   LES MODÈLES DE LA HIÉRARCHIE DES EFFETS

La notion d'hiérarchie des effets se fond sur l'idée qu'une série d'étapes doivent se succéder pour qu'une exposition à une publicité parvienne à déclencher un comportement d'achat. Les différents modèles ne se distinguent que par l'ordre d'intervention des étapes. Celles-ci forment une base de structure cognitive de traitement de l'information, sur la quelle une publicité s'appuie pour convaincre la cible.

Les différents modèles d'effet publicitaire sont présentés dans le tableau suivant :

Tableau 1: Les différents modèles d'effet publicitaire

	AIDA	LAVIDGE STEINER	DAGMAR	ADOPTION
COGNITIF	attention	Notoriété Connaissance	Attention compréhension	Prise de conscience
AFFECTIF	Intérêt Désir	Appréciation Préférence Conviction	conviction	Intérêt évaluation
CONATIF	action	Achat	action	Essai adoption

Source : Moser, K (1998) : « Les modèles d'effet publicitaire », *Recherche et Application Marketing*, vol 13, N°1, p30

La critique qui a été adressé à ces modèles, c'est que le consommateur est obligé de suivre le traitement séquentiel de l'information dans le quel le cognitif précède toujours l'affectif. Or, nous savons que les émotions ne sont pas toujours subordonnées à la raison/cognition. Elles peuvent parvenir avant ou même sans l'existence de cognition.

Et c'est pour cette raison d'ailleurs que plusieurs autres modèles ont été développés confirmant l'existence d'un double processus tels que le modèle de probabilité de traitement et le modèle de chemins alternatifs de l'effet.

2.2 LE MODÈLE DE PROBABILITÉ DE TRAITEMENT DE PETTY ET CACCIOPPO

Ce modèle représente deux routes de persuasion selon Joan Meyers-Levy et prashant Malaviya(1999, p47) :

- une route centrale qui correspond à la stratégie systématique qui exige que le traitement doit être basé sur une élaboration extensive et critique des revendications du message. Le consommateur est amené à intégrer des informations nouvelles à celles qu'il possède déjà en mémoire afin de formuler ses jugements sur l'objet en question dans le message.

Ces jugements dans le traitement de l'information persuasive dépendent de la force de la tonalité de l'argumentation utilisée dans le message. Ainsi, les individus, selon la stratégie systématique, modifient leurs attitudes davantage lorsque les arguments sont forts et rationnels (Schwartz David, p6). En effet, selon Petty et Caccioppo (1986), les messages comportant des arguments rationnels sont persuasifs parce qu'ils influencent les cognitions évaluatives à propos d'objet.

Cette route exige une forte implication des individus

- une route périphérique qui correspond à la stratégie heuristique qui résulte de jugements éphémères qui sont connue à des inférences simples et intuitives émergeant à travers l'exposition à des signaux.

Dès lors, le traitent exige peu de capacités cognitives et l'individu préfère une évaluation rapide et superficielle plutôt qu'un examen attentif de l'information. Selon Chaiken, les décisions de l'individu proviennent des expériences et observations passées. En d'autres termes, l'effet de la publicité ne dépend pas de la force d'argument mais de stimuli d'indice périphériques tel que l'attractivité des modèles présentés ou le statut d'expert de la source.

2.3 LE MODÈLE DES CHEMINS ALTERNATIFS DE L'EFFET (ELM : BATRA ET RAY, 1985)

Le modèle tient compte de nouveaux médiateurs des effets de la publicité. Il suppose l'existence de différents chemins d'action de la publicité qui sont importants selon le niveau d'implication du destinataire. Ainsi deux principaux chemins se présentent.

Dans le cas de forte implication, le chemin de persuasion poursuivi est de nature cognitive. Dans le cas contraire, le chemin est affectif. En effet, « si l'implication est forte, l'effet de la publicité dépend surtout de la qualité des arguments….si l'implication est faible, la qualité des arguments joue un rôle moins important. Ce qui jouera plutôt, sera la « sympathie » pour la présentation ainsi que la fréquence de diffusion » (Moser, K, 1998, p29).

L'étude des modèles d'effet publicitaire marque l'intérêt porté aux réactions affectives et émotionnelles. Ainsi, la compréhension des mécanismes d'action des émotions est d'une extrême importance puisqu'elle permet d'influencer les comportements face à des stimuli publicitaires émotionnels.

Nous nous intéressons dans ce qui suit à l'effet persuasif des messages publicitaires faisant appel aux émotions négatives.

La plupart des recherches traitant les émotions négatives se sont concentrées sur l'étude de l'effet persuasif de la peur en publicité.

Le message phobique ou apeurant (*fear Appeal*) est un message persuasif destiné à faire peur aux gens à travers la description d'événements choquants susceptibles de survenir si l'audience ne suit pas les recommandations données dans ce message (Witte, 1992 in Becheur I., 2008, p7).

Pour être persuasif, le message apeurant doit exprimer d'abord une menace qui provoque une sensation d'anxiété ou de tension. Il s'agit du risque « qui consiste en la perception d'une incertitude relative aux conséquences négatives potentiellement associées à une alternative de choix » (Volle, 1995). Ensuite, le message apeurant doit décrire la manière dont la solution recommandée prévient efficacement ou minimise la menace (efficacité de la réponse) et met en avant des étapes faciles à suivre pour prévenir cette menace dans l'objectif d'augmenter l'efficacité personnelle perçue (Becheur, I. 2008, p8).

Ainsi, le message phobique ou apeurant sera plus efficace si la perception de la menace est élevée et par conséquent le récepteur sera plus motivé à traiter le message et avoir des réponses à ce message et donc évaluera l'efficacité. Le tableau qui suit montre les résultats de Witte (1992) en ce qui concerne le mode d'action du modèle de processus parallèles étendues (EPPM) traitant la menace et l'efficacité.

Tableau 2 : Les modes d'actions de l'EPPM

	Efficacité élevée *Croyances d'être capable d'éviter efficacement la menace*	**Efficacité faible** *Croyances de ne pas être capable d'éviter la menace*
Menace forte *Croyances d'être sous le risque d'une menace dangereuse*	**Contrôle du Danger** Mesures préventives	**Contrôle de la Peur** Nier la menace et réagir contre elle
Menace faible *Croyances que la menace est insignifiante et/ou triviale*	**Contrôle Plus Faible du Danger** Actions préventives mais pas de motivation de faire plus	**Aucune Réponse** Ne pas considérer la menace ou être inconscient d'elle

Source: Witte K. (1992), Putting the Fear Back into Fear Appeals: the Extended Parallel Process Model, *Communication Monographs*, 59, December, 329-349.

A côté de la peur, des recherches se sont intéressées à l'étude de l'efficacité d'autres émotions négatives comme la culpabilité mais qui restent limitées (Bennet, 1998) et témoignent de divergences de résultats, ce qui ne permet pas de trancher sur l'efficacité des messages culpabilisants. A cet égard, selon Becheur (2008, p11), Bozinoff et Ghingold (1983) disent que, bien que, dans certains cas, l'émotion de culpabilité soit facilement activée après l'exposition à des messages culpabilisants, ces messages s'avèrent inefficaces pour changer les attitudes et les comportements.

3 L'ETUDE DE L'EMBARRAS DANS LA PUBLICITE A CARACTERE SEXUEL PROVOCATEUR

Ce que les hommes de marketing appellent en général le « shockvertising » est une technique de provocation qui est censée imprimer efficacement le message dans la tête du récepteur. Il suffit pour les publicitaires d'exploiter des éléments forts, percutants et de préférence rejetés et refusés par l'opinion publique tels que : le sexe, le racisme, la violence, la mort, la politique, la maladie, la drogue etc. (Garcia Raphael, 2010, p 16).

La tendance du « porno chic » est l'une technique de plus en plus utilisée dans les campagnes publicitaires du « shockvertising » surtout dans le domaine des parfums et du luxe. Pour les publicitaires, c'est une technique qui permet

d'inciter les consommateurs à répondre au message ou le mémoriser. En effet, « En impliquant fortement le consommateur, le shockvertising garantit la remarquabilité de l'annonce et augmente son taux de mémorisation de manière substantielle » (Lugrin, 2001). Ces résultats rejoignent les travaux de Baker (1961) qui prouvent que les illustrations sexuelles augmentent l'attention et l'intérêt, tant des hommes que des femmes. Dahl et al (2003) rajoutent à cet égard que le caractère provocateur favorise la mémorisation des bénéfices du produit et influence positivement le comportement.

Goffman (1956, 1967) a intégré l'étude de l'embarras dans ses recherches sur les publicités à caractère provocant qui a permis d'apporter une clarification des mécanismes mis en œuvre par ce type de message. Ainsi, l'embarras se présentant comme une réaction émotionnelle de courte durée qui apparaît lorsqu'une situation difficile ou une transgression viennent perturber l'image de soi d'une personne dans un contexte social (Edelman, 1981; Goffman, 1956 ; Higuchi et Fukada, 2002), peut appréhender la tolérance d'un individu exposé à un message sexuel provocant. Nous pouvons alors comprendre les effets des publicités a caractère sexuel provocant par l'étude de l'embarras ressenti envers ces stimuli publicitaire.

La littérature se rattachant à l'embarras et spécifiquement à ses causes a permis de distinguer deux situations (Higuchi et Fukada (2002)):

- une situation d'embarras « public » qui est lié au regard des autres et pour laquelle les facteurs déterminants suivent l'ordre suivant :

Disruption lors d'une interaction sociale - Appréhension concernant une évaluation sociale -Rupture avec l'image de soi- Perte de l'estime de soi.

- une situation d'embarras « privé » lié au regard que l'individu porte de lui-même et pour la quelle les facteurs prépondérants apparaissent dans un ordre inversé :

Perte de l'estime de soi - Rupture avec l'image de soi - Appréhension concernant une évaluation sociale -Disruption lors d'une interaction sociale.

4   LES EFFETS DE LA PUBLICITE A CARACTERE SEXUEL PROVOCATEUR SUR LES EMOTIONS ET LES ATTITUDES DES RECEPTEURS

Selon La Tour (1990), les publicités à caractère sexuel engendrent des réactions affectives chez les individus qui auraient un impact sur leurs opinions à l'égard de la publicité elle même. Pour lui, l'individu serait excité en fonction du caractère explicite des images sexuelles figurant en publicité. Ainsi, « les individus ressentiront un sentiment d'excitation positive en réponse à une image à caractère sexuel, et auront une opinion positive à l'égard de la publicité (et vice versa). Ces conclusions rejoignent celles de Belch et al (1981) et Siglimpaglia et al. (1979) ».

Nous nous intéressons dans cette recherche aux émotions négatives seulement. Dans ce sens, les publicités faisant recours au sexe et pouvant susciter des éléments troublants, des tensions chez les récepteurs, vu le caractère choquant et provocateur, auront tendance à engendrer une opinion négative envers le message publicitaire. De même pour l'évaluation de la marque mise en avant par la publicité.

Nous pouvons alors poser nos deux premières hypothèses comme suit:

H1 : Les émotions négatives ont une influence négative sur l'Aad

H2 : Les émotions négatives ont une influence négative sur L'Ab

D'autre part, si nous revenons sur la définition de l'embarras, nous allons remarquer qu'il s'agit d'une réaction émotionnelle qui apparaît lors d'interactions sociales quand les événements imprévus interviennent et quand ils génèrent chez l'individu une impossibilité de maîtrise la situation (Goffman, 1956, 1967). Les émotions négatives engendrent des troubles et des perturbations amenant à une situation d'embarras. Dans ce sens, il peut être pertinent que les émotions négatives renforcent l'évaluation négative de la part des autres et donc influencent positivement l'embarras public. D'autre part, les émotions négatives renforcent la perte de l'estime de soi et donc influencent positivement l'embarras privé

Nous pouvons suggérer donc les hypothèses suivantes :

H3 : Les émotions négatives ont une influence positive sur l'embarras public

H4 : Les émotions négatives ont une influence positive sur l'embarras privé

Plusieurs chercheurs ont aussi étudié l'effet des publicités à caractère sexuel provocateur sur les attitudes envers la marque et le message. De Pelsmacker et Van Den Bergh (1996) postulent que ces publicités entraînent une réaction négative à l'égard de la publicité, rendant floue leur perception globale. Selon eux, l'utilisation de la provocation en publicité est

certes perçue de façon négative par les consommateurs par rapport à une publicité « neutre » mais elle n'influence pas leur regard sur le produit et sur son image de marque. (Agathe Nova, 2006, p 22). Ces résultats sont consensuels avec ceux de Peterson et Kerin, 1977, Alexander et Judd, 1978, Sciglimpaglia et al., 1978 in De barnier, Merunka et Valette Florence (2005), qui affirment que les annonces à contenu sexuel manifeste génèrent des attitudes moins favorables à l'égard de l'annonce, du produit et de l'annonceur. En plus, elles peuvent même conduire au rejet de la publicité et de fait, nuire à l'image de marque (Aaker et Bruzzone, 1995 ; LA Tour et Henthorne, 1995, Vezina et Paul, 1997).

Cependant, si nous faisons recours à l'étude de l'embarras engendré par les publicités à caractère sexuel, nous remarquons que dans le même contexte publicitaire, l'influence diffère selon la situation d'embarras. Ainsi, selon De barnier, Merunka et Valette Florence (2005, p 6), l'embarras public renforce l'attitude envers la marque et le message tandis que l'embarras privé aurait une influence négative puisqu'un visuel embarrassant sur le plan privé peut amener à rejeter le message et la marque.

Nous suggérons ainsi les hypothèses de recherche suivantes :

H5 : l'embarras public a une influence positive sur l'Aad

H6 : l'embarras privé a une influence négative sur l'Aad

**H7 : L'embarras public a une influence positive sur l'Ab**

H8 : L'embarras privé a une influence négative sur l'Ab

Nous rajoutons une hypothèse classique concernant la relation entre l'attitude envers la marque et l'attitude envers le message :

H9 : L'attitude envers le message a une influence positive sur l'attitude envers la marque

5 METHODOLOGIE DE RECHERCHE

L'examen de la revue de la littérature nous a permis d'identifier différentes relations justifiant l'impact des publicités à caractère sexuel provocateur en soulignant l'influence des émotions négatives sur l'embarras engendré par ce contexte publicitaire ainsi que sur les attitudes envers la marque et le message. A l'issu de ce développement théorique, nous avons pu construire le modèle de notre recherche qui se présente comme suit :
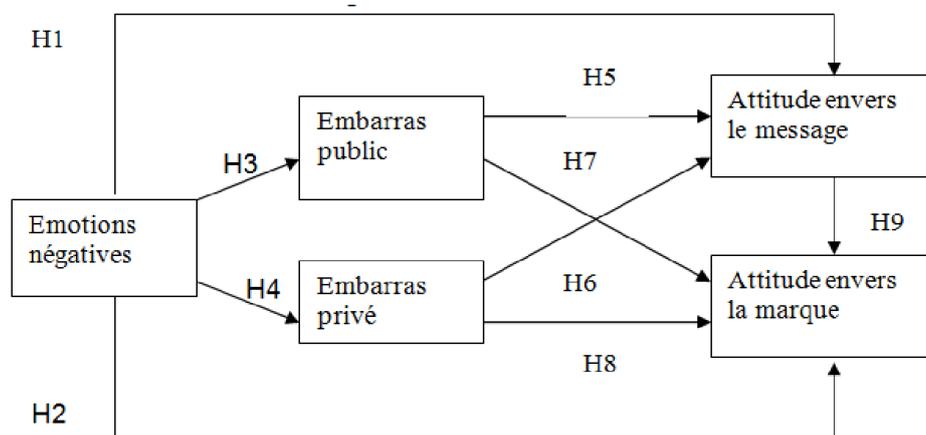
Figure 1 : Modèle de la recherche

Le test des différentes hypothèses découlant du modèle de recherche passe par une expérimentation qui consiste à exposer des individus à une publicité à caractère sexuel explicite. Puis mesurer les émotions qu'ils ressentent envers ce message, les niveaux d'embarras public et privé et enfin leurs attitudes envers la marque et le message.

Dans ce qui suit, nous allons présenter le design expérimental de la recherche.

5.1 CHOIX DU STIMULUS PUBLICITAIRE

nous avons choisi dans cette recherche d'exposer les individus à un message publicitaire portant sur un produit de luxe. Ce choix est justifié par le fait que dans ce domaine, la tendance du porno chic a un impact assez important. Nous avons choisi quatre affiches réelles de marque de parfums connues : Gucci, Yves Saint Laurent et Tom Ford. Les compagnes publicitaires présentant toutes des visuels provocateurs sont destinées aussi bien aux hommes qu'aux femmes. (voir annexe)

5.2 CHOIX DE L'ÉCHANTILLON

nous avons veillé à ce que l'échantillonnage soit au maximum représentatif, c'est pourquoi l'expérimentation a permis la participation d'individus Hommes et Femmes de différentes catégories d'âge : adolescents, jeunes et adultes. Nous avons réussi à interroger 276 individus pour l'étude exploratoire et 320 individus pour l'étude confirmatoire et ce par la méthode de convenance.

5.3 CONDITION D'EXPÉRIMENTATION

les individus participants à l'enquête ont été exposé à une seule compagne publicitaire selon leur propre choix de la marque qu'ils connaissent et préfèrent le plus (évidement sans voir les images publicitaires provocantes). Une seule exposition a été faite et dont la durée n'a pas dépassé les 30 secondes, suivie d'une évaluation des émotions, de l'embarras et des attitudes envers l'annonce et la marque.

5.4 PRÉSENTATION DES VARIABLES ET LEURS ÉCHELLE DE MESURE

- les variables dépendantes : l'Aad et l'Ab :

Pour mesurer l'efficacité des messages visuels à caractère sexuel, nous avons choisi comme indicateurs les réponses affectives à la publicité, à savoir l'attitude envers la marque et l'attitude envers le message. Nous avons fais recours aux échelles développées par De barnier (2002).

Pour l'attitude envers le message, l'échelle utilisée est inspirée de Machleit et Wilson (1988) qui présente une échelle de Likert à cinq point sur laquelle les répondants sont amenés à donner leur degré d'accord sur les affirmations suivantes :

- J'aime beaucoup cette publicité
- Cette publicité est très bonne
- Je suis très favorable à ce type de publicité
- Cette publicité est plaisante
- J'adore cette publicité
- Cette publicité est bien faite

Pour l'attitude envers la marque inspirée de Goodstein, Edell et Moore (1990), les répondants sont aussi amenés à exprimer leur accord sur les affirmations suivantes sur une échelle de Likert à cinq points :

- Je suis favorable à la marque
- Cette marque est une bonne marque
- J'aime beaucoup cette marque

- les variables indépendantes : Les émotions négatives

Afin de mesurer les émotions négatives engendrées par le message sexuel, nous avons choisi d'utiliser l'échelle de Edell et Burke (1987). Cette échelle conçue à la base pour mesurer les émotions envers un message publicitaire, permet d'évaluer des émotions positives et négatives qui représentent trois dimensions : chaleur, éveil et les émotions négatives. Nous avons alors gardé la dernière dimension qui contient vingt émotions. Les items sont évalués sur une échelle de Likert à cinq points après traduction à la langue française. Ces items se présentent comme suit :

Tableau 3 : échelle originale des émotions et sa traduction à la langue française

Emotions originales	traduction	Emotions originales	traduction
Angry	Faché	**Dull**	Morne
Annoyed	Mécontent	**Fedup**	En a marre
Bad	Mal	**Insulted**	Insulté
Bored	Ennuyé	**Irritated***	Irrité
Critical	Critique	**Lonely**	Solitaire
Defiant	Provoquant	**Offended***	Offensé
Depressed	Déprimé	**Regretful**	Plein de regret
Disgust	Dégoûté	**Sad**	Triste
Disinterested	Désintéressé	**Skeptical**	Sceptique
Dubious	Douteux	**Suspicious**	soupçonneux

* des émotions qui ont été supprimées de l'échelle vue leur imprécision lors du pré-test

- variable médiatrice : l'embarras

Pour la mesure de l'embarras, nous avons fait recours à l'échelle développée par Verbeke et Bagozzi (2002) utilisée dans un contexte de vente embarrassant. Il est à noter que les items relatifs à la vente ont été éliminés et seuls les items liés à l'embarras.

Tableau 4 : Echelle de l'embarras

En regardant cette publicité je me suis senti :	Lorsque j'ai regardé cette publicité j'ai :	- Lorsque je vois ce type de publicité je reste :
- Embarrassé - Mal à l'aise - Gêné - Ridicule - Stupide - Honteux	- Rougi - Détourné le regard - Eu l'impression de paraître risible - Evité le regard des autres	- Sans voix - Interloqué.

6 LES RESULTATS DE LA RECHERCHE ET DISCUSSIONS

Nous avons commencé notre analyse des données par la méthode d'analyses en composantes principales afin de réaliser l'analyse factorielle exploratoire ayant pour but la purification des échelles de mesure. Cette analyse nous a permis de vérifier les structures des échelles ainsi que la mesure de leur cohérence interne par l'indice Alpha de chronback (5-1). Puis, nous avons réalisé l'analyse factorielle confirmatoire qui nous a permis de valider les échelles et de tester la fiabilité et la validité convergente (5-2). Enfin, nous avons testé le modèle global et les différentes hypothèses de la recherche (5-3).

6.1 L'ANALYSE FACTORIELLE EXPLORATOIRE

L'analyse factorielle exploratoire que nous avons mené, nous a permis d'identifier les structures uni ou multidimensionnelles des différentes échelles de mesure. Nous avons d'abord effectué la mesure de précision de l'échantillonnage de Kaiser-Meyer-Olkin (KMO). La valeur retenue étant entre 0.8 et 0.7 pour aboutir à une analyse factorielle pertinente. Ensuite, nous avons fait recours à l'ACP sur un échantillon de 276 personnes. Nous avons retenu dans chaque échelle les items dont les poids factoriels et les communautés sont > 0.5 et pour l'alpha de chronback des valeurs > 0.7 ont été vérifiées pour l'ensemble des dimensions retenues. Le tableau suivant résume les différents résultats :

Tableau 5 : Résultats des analyses factorielles exploratoires et mesure de fiabilité des échelles

Echelles	Dimensions	Items	Alpha de chronback
Attitude envers le message	1- Aad	Aimer/bonne/favorable/bien faite	0.935
Attitude envers la marque	1- Ab	Favorable/aimer la marque	0.469
Embarras	1- embarras public	Ridicule, stupide, honteux, rougi, risible, éviter regard, sans voix, interloqué	0.880
	2- embarras privé	Embarrassé, mal à l'aise, gêné, détourné	0.714
Emotions négatives	1- Insatisfaction	Fâché, mécontent, mal, ennuyé, critique, déprimé, dégoûté, désintéressé, en a marre, morne	0.933
	2- Méfiance	Douteux, sceptique, soupçonneux	0.766

6.2   L'ANALYSE FACTORIELLE CONFIRMATOIRE

Afin de valider les structures retrouvées par l'analyse factorielle exploratoire, nous avons réalisé une analyse factorielle confirmatoire sur un échantillon de 320 individus. Cette analyse a montré une structure unidimensionnelle des échelles d'attitude envers la marque et attitude envers le message et une structure bidimensionnelle pour les échelles d'embarras et celle des émotions négatives telles qu'elles sont retrouvées par l'analyse en composantes principales. Nous avons testé la fiabilité par le calcul de fiabilité par le Rho de Joreskog qui a révélé des valeurs significatives (> 0.7) ainsi que la validité convergente attestée par un test t >1.95 et un indice de Rho de validité convergente > 0.5. Nous avons également testé la validité discriminante des échelles en vérifiant que la racine carrée du Rho de validité convergente de chaque construit est bien supérieure aux corrélations partagées avec les autres construits. Le tableau suivant montre la validation des structures des différentes échelles :

Tableau 6 : Résultats des analyses factorielles confirmatoires et les mesures de validité et fiabilité des échelles

Dimensions	Items	Coefficient factoriel standardisé	cr	Rho de Jôreskog	Rho de V.C
Aad	Aimer	0,743	14,914	0.840	0.570
	Bonne	0,622	13,459		
	Favorable	0,852	18,711		
	Bien faite	0,784	15,163		
Ab	Favorable à la marque	0,860	19,106	0.727	0.576
	Aimer la marque	0,642	13,287		
Embarras public	Ridicule	0,814	16,556	0.923	0.605
	stupide	0,659	13,007		
	honteux	0,760	15,300		
	rougi	0,856	16,350		
	risible	0,515	16,216		
	éviter regard	0,849	9,957		
	sans voix	0,841	15,035		
	interloqué	0,858	15,287		
Embarras privé	Embarrassé	0,952	24,416	0.899	0.695
	mal à l'aise	0,684	14,671		
	gêné	0,734	16,510		
	détourné	0,932	23,498		
Insatisfaction	Fâché	0,874	22.239	0.954	0.680
	mécontent	0,773	21.394		
	mal	0,987	26.985		
	ennuyé	0,868	20.969		
	critique	0,733	16.267		
	déprimé	0,697	22.110		
	dégoûté	0,924	23.215		
	désintéressé	0,694	22.239		
	En a marre	0,733	16.492		
	morne	0,903	22.387		
Méfiance	Douteux	0,705	15,771	0.798	0.574
	Sceptique	0,646	13,846		
	Soupçonneux	0,898	21,501		

6.3 TEST DES HYPOTHÈSES DE LA RECHERCHE

Le modèle structurel révèle une bonne qualité d'ajustement. Ainsi, les indices absolus, incrémentaux, de parcimonie témoignent de valeurs significatives. Ce test a permis aussi de conclure la confirmation de certaines hypothèses de notre recherche. Le tableau suivant résume le test des différentes relations préconisées par notre modèle de recherche :

Tableau 7 : Résultats des tests des hypothèses et du modèle structurel

Estimations structurelles	Liens structurels	CR	P
Insatisfaction ⟷ Aad	- 0.523	- 8.242	0.000
méfiance ⟷ Aad	- 0.298	- 2. 437	0.008
Insatisfaction ⟷ Ab	- 0.494	- 7.922	0.000
méfiance ⟷ Ab	- 0.206	- 2.539	0.003
Insatisfaction ⟷ embarras public	+ 0.199	3.001	0.010
méfiance ⟷ embarras public	+0.054	0.736	0.541 NS
Insatisfaction ⟷ embarras privé	+ 0.434	2.987	0.000
méfiance ⟷ embarras privé	+ 0.027	0.896	0.398 NS
Embarras public ⟷ Aad	- 0.561	- 4.202	0.000
Embarras privé ⟷ Aad	- 0.495	- 6.548	0.005
Embarras public ⟷ Ab	- 0.279	- 2.229	0.032
Embarras privé ⟷ Ab	- 0.119	- 2.087	0.037
Aad ⟷ Ab	+ 0.587	7.764	0.000
Chi-deux	893.435		
Degré de liberté	167		
P associée	0.000		
Chi-deux/degré de liberté	3.994		
GFI	0.944		
AGFI	0.843		
RMSEA	0.053		
RMR	0.040		
TLI	0.889		
CFI	0.897		
BIC/ saturated model	1432.563/1989.366		

Les résultats exposés au tableau précédant montrent que les émotions négatives influencent négativement l'attitude envers la marque et l'attitude envers le message. En effet les liens structurels sont significatifs et négatifs. Nous pouvons alors dire que les hypothèses H1 et H2 sont validées. Mais nous remarquons que cette influence est plus importante pour la dimension d'émotion Insatisfaction que pour la dimension Méfiance. L'effet des émotions négatives sur les attitudes dépend donc des dimensions d'émotions.

En ce qui concerne la relation émotions négatives - embarras nous remarquons que seule la dimension Insatisfaction influence positivement aussi bien l'embarras public que l'embarras privé. En revanche, l'effet des émotions négatives relatives à l'insatisfaction sur l'embarras privé est plus important que son effet sur l'embarras public. Donc H3 et H4 sont partiellement validées puisqu'une seule dimension d'émotion a une influence directe positive et significative.

Pour la relation d'embarras avec l'attitude envers le message, nous remarquons que la dimension « privée » ainsi que la dimension « publique » ont toutes les deux une influence négative sur l'évaluation de l'annonce. Ce résultat valide H6 mais ne permet pas de valider H5.

De même pour la relation embarras - attitude envers la marque, l'embarras public et l'embarras privé exercent tous les deux une influence négative. Donc H7 est infirmée et H8 est validée.

Et enfin l'attitude envers le message influence positivement l'attitude envers la marque. En effet, le lien structurel entre les deux variables s'avère être significatif et de ce fait, H9 est validée.

6.4 DISCUSSION DES RÉSULTATS ET CONTRIBUTIONS DE LA RECHERCHE

L'objectif de notre recherche est d'étudier l'effet des émotions négatives ressenties envers une publicité à caractère sexuel provocant sur l'embarras ressenti et sur les attitudes envers la marque et le message. La détermination du rôle des émotions ressenties par le récepteur et de leur influence sur l'embarras nous a permis de mieux appréhender le processus de persuasion publicitaire.

Nos résultats nous ont permis de conclure que les dimensions d'émotion n'ont pas le même effet sur les autres variables. En effet, la dimension Insatisfaction a un effet plus important que la dimension méfiance, aussi bien sur l'embarras que sur les attitudes. Ce résultat confirme que lorsque l'individu est ennuyé, désintéressé ou dégoûté de ce qu'il regarde dans l'annonce, ceci entraîne d'une part un sentiment d'embarras c'est-à-dire qu'il se sent de plus en plus gêné et embarrassé, et par conséquent ceci aurait une influence sur son jugement de l'annonce et de la marque.

D'autant plus, les effets de l'embarras sur les attitudes ne varie pas en fonction du type d'embarras ressenti face au visuel publicitaire provocant comme nous l'avons supposé. Ainsi, l'embarras privé et l'embarras public influencent négativement les attitudes envers la marque et le message. Ce qui s'explique par le fait que se sentir mal à l'aise ou gêné ou encore embarrassé engendre un rejet de la marque et du message car il met en jeu la rupture de l'image de soi et la perte de l'estime de soi (embarras privé). D'autre part, se sentir stupide, honteux ou ridicule peut aussi entraîner un jugement défavorable de la marque et du message publicitaire.

Il semble d'après nos résultats que l'embarras génère des effets négatifs sur les indicateurs d'efficacité publicitaire. Les publicités à caractère sexuel sont embarrassantes parce qu'elles sont contraires aux valeurs et règles sociales. Ce qui a engendré un rejet de l'annonce et de la marque. Ces résultats se trouvent justifiés par différents travaux qui stipulent que les annonces à caractère sexuel manifeste génèrent des attitudes moins favorables à l'égard de l'annonce et du produit (Petersonet Kerin, 1977 ; Alexander et Judd, 1978 ; Sciglimpaglia et al., 1978 in De Barnier, Merunka et Valette Florence, 2005, p7). Les études de La Tour (1990), selon Nova A. (2006, p31), montrent aussi que les publicités mettant en scène des images sexuelles entraînent une réponse négative des consommateurs en terme d'éthique et de moral. Cet auteur rajoute que ce même type de publicité entraîne une réponse négative des consommateurs vis-à-vis de la publicité elle-même et de la marque.

Ces résultats peuvent se justifier par notre contexte d'étude et les caractéristiques de la culture tunisienne qui est préservatrice et très sensible à l'interdit, au tabou, et d'autres formes de transgression des normes sociales. En effet, la sexualité dans les pays musulmans demeure un tabou à fort pouvoir normatif (Bouhdiba, 2001 cité par Sabri-Zaaraoui W. 2006 p9).

Nous pouvons conclure à cet égard que la publicité à caractère sexuel provocateur n'est pas efficace dans ce type de culture et ce contexte bien déterminé.

Ainsi, sur le plan managérial, cette recherche peut aider les publicitaires tunisiens dans le sens où il serait important de prendre en considération l'embarras ressenti lorsqu'ils veulent tester l'efficacité de leurs publicités. Ils pourront aussi penser à étudier l'effet de l'embarras sur d'autres types de provocation utilisés en publicité et qui peuvent engendrer des émotions négatives (les tabou, les chocs,…). Ainsi, les effets peuvent être positifs sur les attitudes et les comportements dans d'autres cas comme les publicités à caractère social.

De telles tentatives permettront d'améliorer la compréhension de l'intervention des émotions négatives et de l'embarras sur les attitudes envers la marque et le message publicitaire.

7   LES LIMITES DE LA RECHERCHE

Malgré les contributions que peut apporter notre recherche, celle-ci ne peut pas échapper à certaines limites. En effet, nous avons interrogé un échantillon par convenance alors que nous aurions dû mettre des quotas bien déterminés pour pouvoir généraliser les résultats. Nous aurions dû par exemple interroger soit les consommateurs des marques, soit les non consommateurs. Et nous aurions pu par là examiner l'effet des émotions et de l'embarras sur les consommateurs fidèles et réguliers de l'industrie de luxe qui peuvent accepter de telles publicités provocatrices et sur les non consommateurs qui ne connaissent pas les bénéfices du produit et les sensations qu'il peut engendrer.

Ces effets auraient pu également être comparés entre les hommes et les femmes. Généralement les femmes sont plus sensibles et émotionnelles que les hommes et la susceptibilité à l'embarras peut différer selon le genre également. D'autant plus que l'attitude envers les publicités sexuelles dépend du sexe. Ainsi, les hommes sont plus sensibles aux annonces présentant des femmes nues (Peterson et Kerin, 1997 ; La Tour et al., 1990 ; La Tour et Henthorne, 1995 ; Geuens et DePelsmaker, 1998 cité par De Barnier, Merunka et Valette-Florence, 2005, p8).

Nous aurions pu également comparer ces effets selon l'âge car l'acceptation des messages à caractère sexuel décroît avec l'âge (Alwitt et Prabaker, 1994 ; La Tour et Henthorne, 1995 ; De Pelsmaker et Van Den Bergh, 1996 ; Vezina et Paul 1997 ; Manceau et Tissier-Desbordes, 1999 cité par De Barnier, Merunka et Valette-Florence, 2005, p9). Une comparaison interculturelle serait aussi pertinente afin de comprendre l'effet culturel des émotions et de l'embarras.

Nous ne doutons pas que des études sur des marques non connues peuvent donner d'autres résultats. En plus, le recours aux médias interactifs serait intéressant dans la mesure où il peuventt évoquer plus de sensations que les visuels.

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