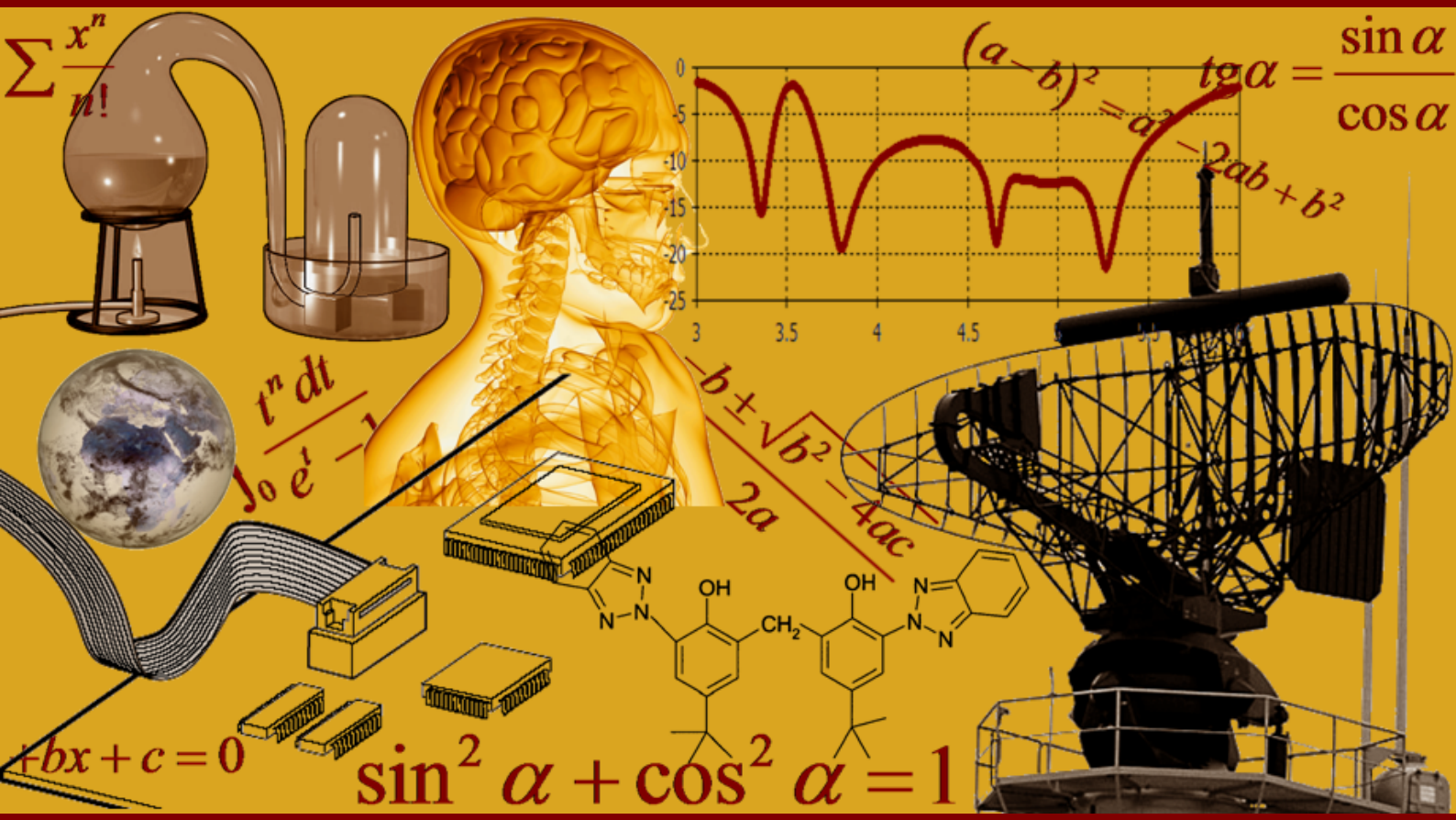
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Real Time Palm Recognition: Review and comparisons of Various Techniques

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ABSTRACT: In this 21st era, the palm print is a new and emerging biometric feature for personal recognition as it provides various advantages over other biometric system. An individual can be identified effectively with the help of palm print. This paper discuss various research activities introduced which rectifies the difficulties faced in various palm print recognition stages like palm image acquisition, image processing, palm feature extraction and palm recognition. This paper also discusses various algorithms used for palm feature detection with openCV.

KEYWORDS: Biometric, Acquisition, Recognition, Palm print, PCA

1 INTRODUCTION

In the applications like online banking, airport security, time and attendance control, access to restricted areas, personal identification number or identity cards are used. However these types of identity recognition methods have serious disadvantages, as they become less and less secure in a world of identify theft and terrorism. Therefore biometric identification systems which ensures reliability and is highly resistant to the mentioned risks should be implemented.

1.1 DEFINITION AND CONCEPT OF BIOMETRICS

Biometrics is automated method of recognizing a person based on a behavioral or physiological characteristic. The behavioral category includes the movement of the human, such as hand gesture, speaking style, signature etc. The physiological category includes the human traits such as hand shape, palm print, eyes, veins, etc. The uniqueness of an individual ensures reliability and is highly resistant to brute force attacks. Biometric systems are superior because they provide a nontransferable means of identifying people. Nontransferable means it cannot be given to another individual so nobody can get around the system and they personally have to go through the control point. This is much better than conventional security methods such as password, personal identification numbers (PIN). The measurement of these traits helps in authentication using the biometric systems.

1.2 DEFINITION AND CONCEPT OF PALM RECOGNITION SYSTEM

One of the most successful biometric systems is the palm print recognition system which recognizes a person on the basis of the palm print of that person. It is reliable due to the fact that the print patterns of each and every person are always unique. The ridge structure is permanent which is formed at about the thirteenth week of the embryonic development. This formation gets completed by the eighteenth week therefore even the monozygotic twins have unique palm prints.

Palm print is preferred compared to other biometric methods, because it is distinctive, easily captured by devices as well as contains additional features such as principal lines, wrinkles (secondary lines) a fingerprint in that it also contains other information such as texture, indents and marks which can be used when comparing one palm to another. Palm print contains fixed line structure, low intrusiveness and requires low cost capturing device, low resolution imaging. Thus palm print recognition is a very interesting research area. Therefore it has become an important and rapidly developing biometric

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technology in last decade. A lot of work has already been done in this field, but there is still a lot of scope to make the systems more efficient and reliable.

In a practical biometric system, there are a number of other issues that should be considered, including: Performance, which refers to the achievable recognition accuracy and speed, the resources required to achieve the desired recognition accuracy and speed, as well as the operational and environmental factors that affect the accuracy and speed; acceptability, which indicates the extent to which people are willing to accept the use of a particular biometric identifier (characteristic) in their daily lives, circumvention, which reflects how easily the system can be fooled using fraudulent methods.

The major steps in palm print recognition are Image acquisition, pre-processing, Feature extraction, Database and Matcher shown in following figure.

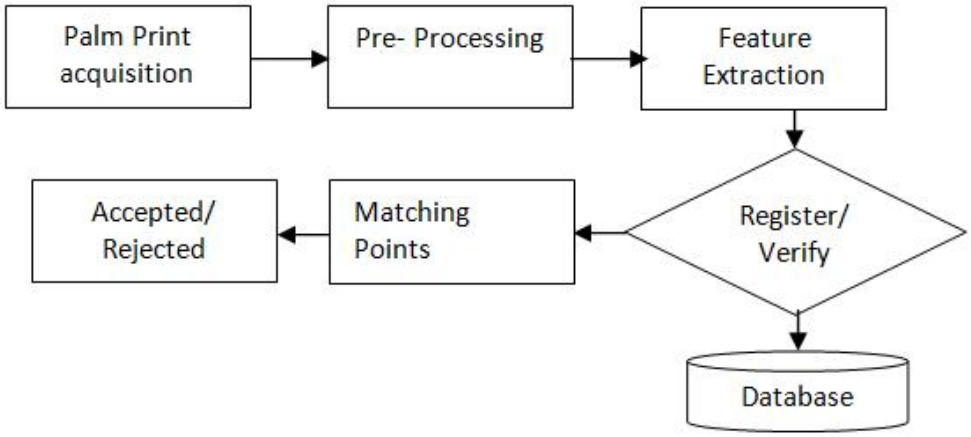


Fig. 1. Block Diagram of Palm Print Recognition

Following section explains each block in fig.1 in brief.

a) Palm Print acquisition:

In this step, image of palm print is first capture with the help of different types of capturing devices discussed in following section. The captured image may contain noise, which can decrease the quality of the image and can affect the rate of performance of palm print recognition system directly [1].

b) Pre-Processing

In this step, noise if present in the captured palm print image can be removed with the help of low pass filter.

c) Feature Extraction

After pre-processing on the captured image, its features are extracted like minutia, principal lines eigen vectors etc.

d) Register/Verify and Matching Points

Register creates the new database for the image and verify verifies the matching of the image features with already existing database. Verify determines the degree of similarity of recognition template with master template [1]. Various approaches are used for matching and discussed in following section.

e) Accepted/ Rejected

Finally, the degree of similarity of recognition decides whether the palm print image is recognized or not.

This paper analyzes the already existing systems and thereby proposes a new approach.

2 LITERATURE SURVEY

In this section review of various traits for biometric technologies are discussed.

2.1 SURVEY BASED ON VARIOUS BIOMETRIC TECHNOLOGIES

Based on seven biometric identifiers, a comparison of various biometric techniques is done by [3]. The following table 1 shows the comparison of various biometric techniques based on universality, distinctiveness, permanence, collectability, performance, acceptability, and circumvention as low(L), medium(M) and high(H).

The following comparison shows that the palm print recognition system gives more reliable, distinctive and high performance results.

Table 1. Comparisons of various Biometric technologies based on perceptions of the authors [3]

Biometric Identifier	Universality	Distinctiveness	Permanence	Collectability	Performance	Acceptability	Circumvention
DNA	H	H	H	L	H	L	L
Ear	M	M	H	M	M	H	M
Face	H	L	M	H	L	H	H
Facial Thermogram	H	H	L	H	M	H	L
Fingerprint	M	H	H	M	H	M	M
Gait	M	L	L	H	L	H	M
Hand geometry	M	M	M	H	M	M	M
Hand vein	M	M	M	M	M	M	L
Iris	H	H	H	M	H	L	L
Keystroke	L	L	L	M	L	M	M
Odor	H	H	H	L	L	M	L
Palmprint	M	H	H	M	H	M	M
Retina	H	H	M	L	H	L	L
Signature	L	L	L	H	L	H	H
Voice	M	L	L	M	L	H	H

2.2 SURVEY BASED ON PALM PRINT ACQUISITION DEVICES

There are various palm print acquisition devices used by various researchers like CCD based palm print scanners, digital cameras, video cameras, digital scanners etc. CCD based palm print scanners have pegs for guiding the placement of hands. Fig.2 shows CCD based palm print scanner. CCD camera contains of a set of optical components which work together to obtain the data from the palm. Digital scanner takes more time to scan the palm image and hence cannot be used in real time applications. Images captured with digital and video cameras may contain distortions and might cause recognition problem as they collect images in uncontrolled environment. Fig.3 shows the palm images taken from CCD based palm print scanner and digital camera.



Fig. 2. CCD based palm print scanner

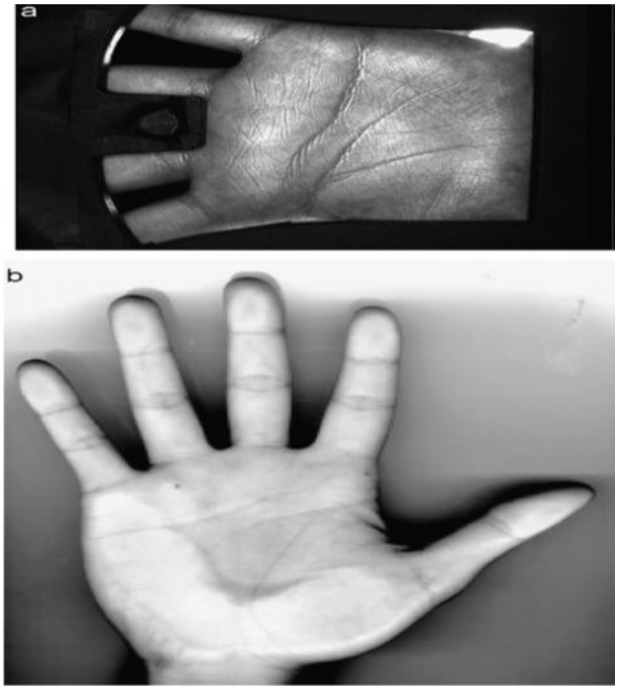


Fig. 3. Palm images a) By using CCD based scanner
b) By using digital camera

2.3 SURVEY BASED ON FEATURE EXTRACTION ALGORITHMS

In last few years various algorithms are developed by researchers to obtain reliable palm print recognition. G. Lu, D. Zhang and K. Wang [2] has proposed palm print recognition by means of Eigen palms features, where original image of palm print is altered into the feature space i.e. Eigen palm with the aid of K-L transform. Euclidean distances classifier is used for harmonizing of recognition template and master template.

Cappelli, Ferrara, and Maio [3] proposed high resolution palmprint recognition scheme which is based on minutiae extraction. Pre-processing is done by segmentation of an image from its background. To improve the quality of image, local frequencies and local orientations are evaluated. Local orientation is estimated via fingerprint orientation extraction approach and local frequencies are anticipated by counting the number of pixels amid two consecutive peaks of Gray level along the direction normal to local ridge orientation. Minutiae feature is taken out in feature extraction phase. Contextual filtering with Gabor filters approach is applied to extract the minutiae attributes.

The captured image can be deformed due to large number of creases on palm print Dai, Feng, Zhou [8] introduced a segment-based palmprint matching and fusion algorithm, where whole palmprint image is separated into different regions and then every region is separately matched to deal with the distortion. The similarity of two palm prints is computed by fusing the similarity scores of dissimilar segments using a Bayesian framework. Dai, Feng, Zhou [4] also introduced an orientation field-based registration algorithm which is used to reduce the computational complexity.

2.4 SURVEY BASED ON PALM PRINT APPEARANCE

Appearance based method is also called Sub-spacing based approach in which the entire palm image is considered as a vector with pixel intensities as its components, This vector is usually subjected to different transformations in order to select a small feature set suitable for recognition. Earlier approaches usually used fixed transforms, such as Fourier transform [5], while the newer approaches tend to use transformations which maximize some criterion function on the training data in order to select the best features. These transformations include principal component analysis (PCA) [6], [7] linear discriminant analysis (LDA) [9] and independent component analysis (ICA) [10]. Lu et al. [11] are among the first to propose the use of PCA in the palmprint recognition. It finds a set of orthogonal basis vectors. It describes the major variations among the training images. The bases have the same dimension as the original images and are like palmprint in appearance, they are also called eigenpalms. PCA can only separate pair-wise linear dependencies between pixels. It reduces the dimensionality.

3 CONCLUSION

By comparing various existing algorithms and techniques, we concluded that a palm recognition system which consists of image capturing with digital camera is the best suited biometric application in which fearture extraction algorithm is based on extracting features for palm region as image and creating xml file for eigen vectors of palm. For the same PCA algorithm can be used. It should be noted that variation of illumination of different palm-print images of the same person may affect their similarity. Therefore, prior to feature extraction, an illumination adjustment step is included in the proposed algorithm. After feature extraction, a harr classifier compares two palm-print features and a database can be used to store registered templates and also for verification purposes.

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REFERENCES

[1] J. Dai and J. Zhou, “Multi feature-Based High-Resolution Palmprint Recognition,” *IEEE Transaction on Pattern Analysis and Machine Intelligence*, Vol.33, No. 5, pp. 0162-8828, May 2011.

[2] G. Lu, D. Zhang and K. Wang, “Palmprint recognition using eigenpalms features,” *Pattern Recognition, Science Direct*, pp. 1987–1998, 2003.

[3] R. Cappelli, M. Ferrara, and D. Maio, “A Fast and Accurate Palmprint Recognition System Based on Minutiae,” *IEEE Transaction on System, Man and Cybernetics- Part B: Cybernetics*, Vol. 42, No. 3, pp. 1083-4419, and June 2012.

[4] Konga, D. Zhang, M. Kamel, “Palmprint identification using feature-level fusion,” *Pattern Recognition, Science Direct,* pp. 478 – 487, 2006.

[5] W. Li, D. Zhang and Z. Xu, "Palmprint Identification by Fourier Transform", *Int'l Journal of Pattern Recognition and Artificial Intelligence*, Vol. 16, pp. 417-432, 2002.

[6] M. Turk and A. Pentland, "Eigenfaces for Recognition", *Journal of Cognitive Neurosicence*, Vol. 3, No. 1, pp. 71-86, 1991.

[7] G. Lu, D. Zhang and K. Wang, "Palmprint Recognition Using Eigenpalms Features", *Pattern Recognition Letters*, Vol. 24, pp. 1463- 1467, 2003.

[8] J. Dai, J. Feng, J. Zhou, “Robust and Efficient Ridge- Based Palmprint Matching,” *IEEE Transaction on Pattern Analysis and Machine Intelligence*, Vol.34, No. 8, pp. 0162-8828, August 2012.

[9] X. Wu, D. Zhang and K. Wang, "Fisherpalms Based Palmprint Recognition", *Pattern Recognition Letters*, Vol. 24, pp. 2829-2838, 2003.

[10] T. Connie, A. Teoh, M. Goh and D. Ngo, "Palmprint recognition with PCA and ICA", *Proc. Image and Vision Computing, New Zealand*, 2003.

[11] D. Zhang, W.K. Kong, J. You and M. Wong, —On-line palmprint identification , IEEE Transactions on Pattern analysis and Machine Intelligence, vol. 25, no. 9, pp. 1041-1050, 2003.

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A Critical Overview of the Kenyan Prisons System: Understanding the Challenges of Correctional Practice

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ABSTRACT: Kenya has been widely criticized for its on-going abuse of human rights and corruption in government administration more specifically the prison system. Moreover, the prison system in Kenya has been termed to be dilapidated since they were adopted from the colonial administration in 1963 after gaining independence. The paper looks at the utilitarian rationale of punishment that supports the prisons as rehabilitation institutions that aim to reform prisoners therefore reforming them towards proper societal norms. This paper critically reviews various studies carried out by other researchers and authors that disparagingly look at and have elaborated the understanding of the prison system in Kenya. Additionally, the paper identified the challenges of the prison system that includes the punitive and dire conditions in prisons since independence, inadequate legal representation, usage of drugs by inmates. Moreover, there is mistreatment of prisoners and lack of the privileges and rights, and eventually, lack of independence oversight of the prison system with regard to prisoners. At the same time, the challenges facing the prison officers or staff as identified in this paper include; inadequacy of skills, poor working conditions/environment and unfavourable scheme of service, inadequate in supply of food and clothing and varied perception by the civil society and corruption within the prison walls. The paper concludes that the correctional services are in dire need of reforms because of the earlier mentioned challenges facing both the prisoners and the prison staff. The paper recommends that reflective policies need to advocate for prison welfare and also securing their rights of prisoners. Furthermore, there is need for stakeholder participation, improved training especially those involved directly in the reforming the prison system.

KEYWORDS: Reforms, Prison Officer, Prisoners, Rights and Privileges, Challenges, Correctional Practice.

1 INTRODUCTION

Accordingly, the pre-penal system in Africa in the traditional form of criminal justice originated from the council of elders who determined the form of punishment for the criminal offenses committed. Furthermore, there was no prisons system at the time, thus the punishment offers was final. The introduction of the penal systems in Africa was largely adopted as a result of colonization, which drew up the legislative framework addressing the form of criminal justice system, the infrastructure that remains unchanged (Dissel, 2001).

Several countries have attempted to improve the prison conditions; by introducing reforms that target the rehabilitation of offenders but in most cases they are still inadequate. In most cases the prisons in Africa are characterized by severe overcrowding. In most cases the prison capacity is very limited and has not been expanded over time. Although the inmate to population ratios may be small, the impact of overcrowding on inmates is nevertheless severe. Coupled with this, many of the facilities are rudimentary in nature, and there are shortages of food, bedding, medical supplies and treatment, and an absence of recreation facilities. Moreover, ill treatment or torture of inmates was also reported for many of the countries (Dissel, 2001).

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Accordingly, Kenya inherited the penal system from the British Colonial government on its independence in 1963. At the time of independence, there were 86 prisons accommodating 13,000 prisoners (Amnesty International, 2000, KHRC, 2001). The Penal Code and Kenya's constitution contain fairly liberal laws concerning prisoners. In addition, the country has ratified a number of international instruments protecting the rights of prisoners and detainees, including the African Charter on Human and People's Rights (KHRC, 2001). However, there is a large gap between the legal provisions and the actual conditions in prison.

Moreover, various reports and studies have looked at the prevailing conditions existing in the prison systems in the world and Kenya (KHRC, 2002; Dissel, 2001; Gaes, 1985; Omboto, 2010). Therefore this paper provides a critical review of the prison system in Kenya with a view of understanding the challenges that affect the prison system in Kenya. Furthermore, this paper provides an understanding of the Kenya's prison with regard to the types of prisons that are in Kenya, the organization and finally the prison structure. Furthermore, the paper looks at the challenges faced by both the prisoners and the prison staff with regard to the environmental conditions that exist in the prison system in Kenya.

2 METHODOLOGY

This paper used a desk review to examine the various reviews based on the studies of the correctional practice in Kenya. The paper also analyses the challenges facing the prison system. These challenges impede the promotion of the rights and of the prisoners. At the same time, the prison system in Kenya needs a total revamp since there are challenges facing the prisoners and the prison warders in general.

3 THEORETICAL UNDERSTANDING OF THE CORRECTIONAL PRACTICE

3.1 UTILITARIAN RATIONALE UNDERSTANDING OF CORRECTIONAL PRACTICE

Accordingly, prisons were and are still used for long-term and convicted offenders who are to be simultaneously punished (experience retribution), deterred, and reformed (rehabilitated) while being isolated (incapacitated) from the community and, for most, reintegrated back into that community (Stephan, 2008). A majority agree that subjecting someone to pain is wrong. Nevertheless, punishment, by characterization, involves the inflicting pain on someone (Murphy, 1995). Moreover, logicians especially the philosophers are divided on this issue. One group believes that inflicting pain as punishment is fundamentally different from inflicting pain on innocents, and therefore is not inherently wrong. Another group believes that punishment is a wrong that can be justified only if it results in a "greater good" (Murphy, 1995; Durham, 1994).

This paper used the utilitarian rationale that explains the fact that if there are prisons facilities their aims are to deter, incapacitate, and or rehabilitate prisoners. In addition, the rationale defines punishment as essentially evil, and seeks to justify it by the greater benefits that result. Moreover, the concept of utilitarianism advocates that what is good is that which benefits the majority (Pollock, 2005).

This rationale for punishment originated from the Greek philosophers such as Plato who argued that punishment is a benefit to the person because it improves their souls or characters (Murphy, 1995). Furthermore, thinkers such as Jeremy Bentham (1748–1832), believed that punishment can be used to deter crime. His introduction of the *hedonistic calculus* provided that mankind was essentially rational and hedonistic (pleasure-seeking), and would seek to maximize pleasure and reduce pain in all behaviour decisions. He further indicated that a legal system could accurately determine exactly what measure of punishment was necessary with regard to crime. Thus, if done correctly, the possible pain of punishment would be sufficient to outweigh the potential pleasure or profit from crime, and all people would rationally choose to be law-abiding (Pollock, 2005).

Furthermore, the utilitarian rationale for punishment is supported by the term social contract. The concept of social contract gives society the right to punish, not because of the offender's violation, but rather, to protect all members of society against future harms. The right of society to punish comes from the responsibility of society to protect. Therefore, the utilitarian approach of punishment sees it as a means to an end the end being deterrence (general or specific), incapacitation, or rehabilitation (reform).

This paper specifically looks at rehabilitation as a sub-concept of utilitarianism that aims to reform the performer of crime (prisoner). Accordingly, Pollock (2005) defines the term rehabilitation as internal change that results in a cessation of the targeted negative behaviour. It may be achieved by inflicting pain as a learning tool (behaviour modification) or by other interventions that are not painful at all (for example, self-esteem groups, education, or religion). Therefore, the reform of a prisoner starts from the reforms of the prison system.

4 UNDERSTANDING THE KENYAN PRISONS AND THE FORMATION

The United States of American correctional facilities have greatly transformed. However, that is not the case of Kenyan prisons as this paper will clearly reveal the challenges faced. Accordingly, as the number of prisons expanded, their diversities have increased (Stephan, 2008; Dissel, 2001). The all-purpose maximum and medium security prisons were first built in the United States of America. However, there are state and federal prisons with innumerable security levels, including super maximum, maximum, medium, and minimum. In addition to that, there are prisons for men, for women, for men and women, for children, and for military personnel. Prisons come in the form of regular confinement facilities, but also prison farms, prison hospitals, boot camps, reception centers, community corrections facilities (sometime known as work release or day reporting facilities), and others (Stephan, 2008). In Kenya per se prisons total to 89 and are established by the Kenya Prisons Act (CAP 90) and the Kenya Prisons Standing Orders Chapter 69, which classifies the prisons in Kenya on the basis of the level of the security needs, the age of the inmates and the length of the sentence of offenders and thus classified into the following categories:

1) Closed (Maximum security prison for long term offenders for subversion of more serious or violent offences in nature) for example Kamiti Maximum Security and Naivasha maximum prison for men and the Lang'ata Women's prison among other prisons not mentioned in this paper.
2) Semi-closed (Prisoners serving minimum term for less serious offences of subversion or violent offences in nature). These prisons are regional based institutions such as the Kodiaga Prison in Nyanza region, the Ngeria farm prison in Uasin-Gishu region.
3) Borstal institutions or youth corrective training centers (below 18 years; 15 years and above). They include those in the Western region (Shikutsa- Kakamega district), Coastal region (Shimo la Tewa) and finally the Kamiti Youth Corrective Training Centre.

Prisons are institutions in Kenya established for the purpose of taking custody and care of people who have been convicted of offences by courts of law. There are two categories of prisoners: those who are on remand pending hearing of their cases and those who have been convicted. However, prisoners too have rights and it is possible for organizations to monitor how these rights are respected, especially in view of the manner in which prisons have opened themselves up to public scrutiny in recent times. Prisons in Kenya have three basic functions which include; securing and controlling offenders; to punish offenders and to rehabilitate or reform offenders. The below figure (**fig 1**) shows the structure showing the various directorates in the Kenya's prison system.

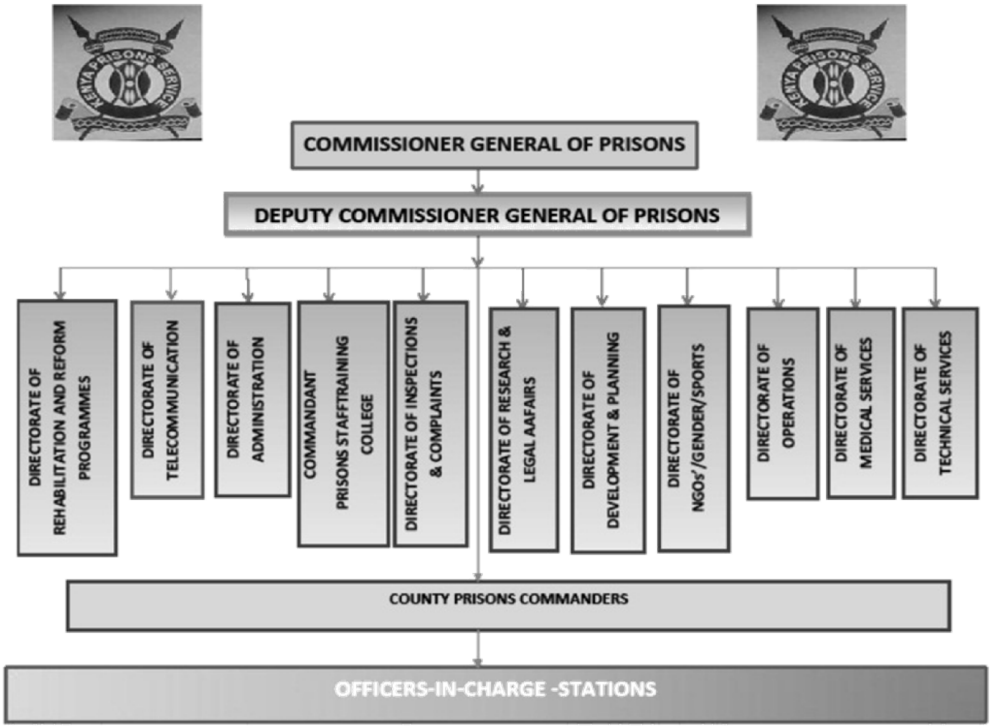


Fig 1: Indicating the structure of the prison command in Kenya (Adopted from & G.O.K (2013) as cited in Olivia L.A, 2014)

5 CHARACTERISTICS OF THE PRISON SYSTEM IN KENYA: CHALLENGES FACING THE PRISONERS IN THE PRISON SYSTEM IN KENYA

Accordingly, one of the identified characteristic of the prison system in Kenya entails the fact that the conditions have been dire and punitive since independence. Omboto (2010) points out that harsh prison conditions in Kenya are mostly characterized by overcrowding and congestion, poor diet, degrading clothing and beddings, lack of clean water, poor sanitation, infectious diseases, and homosexuality among other vices, can be attributed to several factors (Nation, 2001). Studies by other authors have attributed the poor state and maintainace of prisons to the fact that the colonial government in Africa targeted such facilities to the Africans, particularly those who rebelled against their rule and more specifically those who were resistant to the white rule (Dissel, 2001; Dankwa, 2000; Dankwa, 1997). Furthermore, in Kenya, such resistance imposed the declaration of state of emergency in 1952 which led to arrest and incarceration of about 24,000 natives who were confined in crowded camps which served as prison institutions then (KHRC, 2002). This is still the case up to date, since the prisons are still congested. Moreover, a study by Dissel (2001) points out that inmates/prisoners sleep on dirty and damp cement floors. The communal cells are often poorly ventilated and badly lit, and lack adequate washing facilities. Overflowing buckets in one corner of the cell usually serve as the only toilets. Acute water shortages in some prisons have exacerbated the unsanitary conditions. These conditions have been dealt with by the introduction of the prison reforms (Moody Awori reforms) but sill the reforms are yet to be realized. Furthermore, there is the depressing factor of overcrowding among inmates/prisoners in the Kenya's prison system. Studies in correctional practice have shown that poor accommodation of the in the prisons presents a case of high assault rates among inmates (Gaes, 1985; Fagan, 2002; Morgan *et al.,* 2002; Dankwa, 1997; Dankwa, 2000). Moreover, studies have shown that overcrowding can itself induce stress for inmates. Overcrowding may act as an intensifier of stressful prison conditions that have been precipitated by other causes with consequences that can at worst be life threatening (Penal Reform International, 2012; Gaes, 1985). This is in the case of the Kenyan prison system due to lack of expansion of the prison system.

Accordingly, inadequate legal representation can be seen as another challenge facing most of the prisoners are not able to seek legal representation because they cannot afford the costs. In most cases, prisoners are not aware of their rights because they are '*wrong*' before the law. Some of the criminal offenders who have no adequate knowledge may be forced to abide by the outcome of the court proceedings. Criminal offenders lack the vast knowledge in advocating for their rights, thus there are no mechanisms to address the rights of the prisoners. However, with the government commitment in introducing the reforms, the reforms are yet to capture the rights and freedoms of the prisoners. The challenge of legal representation and understanding the court process and procedures among the inmates is still seen to be prevailing.

Evidently, drug usage by inmates has been established as a major challenge facing the prison system in Kenya. A study by Omboto (2010) found that inmates still access drugs which are prohibited in the prison. The main of these prisons is to rehabilitate the prisoners or criminal offenders as suggested by the utilitarian rationale. Furthermore, he established that psychotropic substances resulted in a majority of the prisoners rioting and engaging in a more violent behaviour. The help of the dishonest prison officials enable the smuggling of drugs in the prison facilities. This clearly shows the addictive nature of the criminal who seem not to reform. Studies by Omboto (2013) clearly show that the prison system is in dire need to eradicate such depravities that derail the aim of the correctional or prison facilities to rehabilitate and reform offenders.

Accordingly, there is still the prevailing feature of mistreatment of prisoners and lack of the observed freedoms, privileges and rights. A report by Amnesty international (2000) indicated that torture and ill treatment are widespread and are used to discipline prisoners as well as taking place through indiscriminate attacks. Prisoners are beaten for failing to obey orders. One ex-prisoner expressed the fear that warders are spreading HIV/AIDS by using hippo hide whips consecutively to punish prisoners. Corporal punishment is allowed, up to twelve strokes for adult prisoners, and prisoners may also be punished by restricted (penal) diet and confinement of up to 30 days in a separate cell. This form of retributive punishment goes against the utilitarian rationale for punishing offenders. The Kenyan prison system is obliged to observe the prisoners' rights as stipulated by the United Nations Congress on the Prevention of Crime and the Treatment of Offenders, held at Geneva in 1955, and approved by the Economic and Social Council by its resolutions 663 C (XXIV) of 31 July 1957 and 2076 (LXII) of 13 May 1977.

Inadequacy in terms of food and clothing can be termed as a key characteristic and a challenge facing the prison system in Kenya. Accordingly, food and clothing is also inadequate in most prisons. The fiscal difficulties and inadequacy of resources which the Kenyan government is experiencing are having serious impact on prisons for instance, in Nyeri, where it is reported that prisoners were starving as the treasury had failed to provide money for supplies (Dissel, 2001). Furthermore, Dissel (2001) points out that the problem was worsened by their inability to get food from outside of prison. Prisoners reported last year that rations at Kodiaga prison were reduced by 50 percent, and special meals that were ordered on medical grounds had been scrapped completely. They alleged that many inmates were starving as they could not afford to bribe the warders for

their meagre rations. This in most cases resulted to riots as a consequence of the rationing meals. However, the prison farms have established prison farms such as the Ngeria prison in Rift-Valley province (now refered to as Uasin-Gishu County), but this still remains a challenge. A report by Amnesty International (2000) further indicates that these conditions are responsible for the deaths of hundreds of prisoners in Kenyan prisons each year. Statistics are inaccurate, but six hundred and fifty are reported to have died in 1997. Infectious diseases such as diarrhoea, typhoid, tuberculosis and HIV/Aids spread easily, and are inadequately treated. This may in many cases result to epidemics.

There is still the lacking independence of an oversight authority with regard to the prison system in Kenya. Accordingly, Dissel (2001) cites in her work that independent oversight of Kenya's prisons is completely lacking. Prisons are closed institutions that do not allow visits from non-governmental organizations, and international organizations have also been prohibited access. She further stated that the UN Special Rapporteur on Torture was refused access to one prison in September 1999. Furthermore, members of parliament were prohibited from visiting their constituents in prison without permission from the authorities. Although Parliament appointed a Standing Committee on Human Rights, this was been characterized by weak responses to human rights violations. For, example, the Committee did not respond publicly to the King'ong'o deaths. However, with the introduction of the prison reforms (Moody Awori Reforms) and the constitution 2010 passed gives a glimmer of hope that the prison system will be transparent and more specifically, open to scrutiny by the public so as to transform the county's prison system. At the same time, the media has been given a chance to explore the happenings inside the prison, for instance, KTN's Case files an investigative series by Dennis Onsarigo among other media reports have partially addressed the challenges faced by the prisoners in the prison.

6 CHALLENGES FACED BY THE PRISON OFFICERS AND THE PRISON FACILITIES SYSTEMS IN KENYA

Accordingly, one of the chief challenges facing the prison officials/warders entails the fact that they lack inadequate skills and expertise. Moreover, the prison system lacks various skills with regard to penology and corrections. Training in most cases is the core function of reformation and rehabilitation that require prison officers to accept that prisoners are incarcerated as a punishment and not for punishment, and they must have the ability to facilitate behaviour and attitude change (Omboto, 2013).The lacking skills are varied from sociologists, psychiatrists, psychologists, professional counsellors, social workers, penologists especially those from security studies. These skills are crucial in the rehabilitation effort of offenders and reintegration back to the society. Lacking such skills may result to inadequacy in the reformation process of the offenders.

Accordingly, there has been established poor working conditions/environment, more specifically the unfavourable scheme of service. The state of prisons in Kenya is in dire need of refurbishment. The poor working conditions of the prisons staff especially those of the lower cadre lowers morale of the lower and thus are unable to fully dedicate themselves to working in such unbearable conditions. It is ironical that the same prison officers, who are supposed to rehabilitate the prisoners, suffer the same consequences as the prisoners. However, the introduction of the reforms have slightly improved their remuneration and improved transportation facilities (formally refered to as *mariamu*). Nonetheless, studies by Omboto (2010) point out that housing still remains problem, thus the prison officers who cannot rent houses outside are forced to stay with their families in the dilapidated structures that are not comfortable in the varied seasons. He further indicates that in rural prisons; there are grass thatched mud walled houses; these very structures are in most cases shared by at least two families. Moreover, other problems that face several prison institutions, include poor drainage and sanitation, and water shortage also hamper the work of prison officers. Added to the unfavourable scheme of service, that do not give clear career progression path; such as the automatic movement from one job group to another, and the requirements for such movements that is not dependent on the whims of the senior officers; claims that some prisoners e.g. the trustees (the special stage prisoners) are happy and comfortable in prisons than the prison warders cannot be dismissed (Omboto, 2013). In most cases, if there is no job evaluation and satisfaction then the prison officers have no motivation to perform. Furthermore, the stressing conditions make it more difficult for the prison warders to perform their duty of reforming the prisoners. Studies by Muntingh (2009) as cited in Moyo *et al.,* (2014) argues that prison understaffing and overcrowding have a depressing impacts on prison staff manifested by high staff turnover, excessive leave, high rates of sick leave and absenteeism. These factors have potential to prevent prisons from implementing and fulfilling their operational functions. Cheek and Miller (1983) further point out that stress among correctional officers is partly caused by overcrowding. The inside of the prison system in Kenya is associated with physical 'dangers' associated with potential harm by inmates that may cause stress among prison officers. This is partly due to the correctional facility environment which is considered a 'tough', 'dangerous' place of employment dominated by machismo attitudes among offenders (Morgan *et al.,* 2002).

There has always been the negative perception by the civil society about Kenya's prison system. The perception of the civil society towards the prisons in Kenya is seen to be critical. Kenya's prisons, labelled as 'death chambers', are overcrowded and unhygienic. For instance, in Nakuru prison, 450 convicted inmates and 780 remand prisoners were held in 14 cells. Prisoners sleep on dirty and damp cement floors. The communal cells are often poorly ventilated and badly lit, and lack adequate washing facilities. Overflowing buckets in one corner of the cell usually serve as the only toilets. Acute water shortages in some prisons have exacerbated the unsanitary conditions. King'ong'o prison had its water supply disconnected for failing to pay its water account in September 2000, and a water shortage in Nakuru prison led to an outbreak of cholera (Nation, 2001; Nation, 2000 a ; Nation, 2000 b; Dissel, 2001). Omboto (2013) points out that the problems that face several prison institutions include poor drainage and sanitation, and water shortage also impede the work of prison officers.

Corruption still remains the main challenge facing the prison system in Kenya. Consequently, in the public knowledge corruption exists in the outside world, especially in the institution of police. This is not the case as Omboto (2010) indicates that there is some dishonesty among officers who are bribed so as to favour inmates in the obtaining drugs which are prohibited. These prohibited substance tend deter the main aim of the facilities in punishing the prisoners and at the same time rehabilitating the prisoners towards reforming them. At the same time, (Omboto, 2013) the use of mobile phones by the prisoners seems to be the new crime refered to as the '*mobi-crime*' whereby the offenders solicit money from the public and at the same time threatening the public. They have been reported to have defrauded the public of millions. In most cases, the corruption by the officers may be as a result of the government not paying the prison officers better remuneration. This includes house allowances and risk allowances. According to Omboto (2013) this may have resulted in the prison officers engaging in corrupt practices in order to sustain themselves and improving their impoverished conditions.

7 CONCLUSION

Accordingly from the reviewed literature and other studies, the paper has identified that the prison system is in dire need of reforms and as such there persistent challenges that have made the prison facilities be in the same state since the post-colonial era. Moreover, the prisoner's rights seem to be neglected by the prison officials yet the United Nations Congress on the Prevention of Crime and the Treatment of Offenders of 1955 establishes the rules and regulations of safeguarding prisoners' rights. The Government of Kenya critically needs to evaluate its stance with regard to correctional practice, thus the government needs to put pen into paper by safeguarding prisoner rights and ensuring that prison officers have proper facilities that enable them reform the convicted offenders. Other non-governmental agencies should come in towards the promoting education and training of offenders as seen by the K.I.M (Kenya Institute of Management). A reformed prison system is a gain to the prisoner who in turn when reformed is a gain for the society at large.

8 RECOMMENDATIONS FOR THE REFORMS IN THE KENYA'S PRISON SYSTEM

The recommendations put forward include the following;

Firstly, there should be total reforms targeting the prison system. As Omboto (2010, 2013) puts it, there is need for improved prison staff welfare since they are participants in the criminal justice system. This can be done by improving housing, better remuneration, and increase in allowances. This will lead to them reforming prisoners without fear or favour.

Secondly, it is recommended that there is need in providing opportunity for prison officers/staff with a platform to share and at the same time explore new skills and ideas towards correctional practice in Kenya. This can be done by offering sponsorships and scholarships to the prison officers by undertaking education and training. This can be done through collaborating with institutions for higher learning, for instance, Moi University among other institutions of higher learning have started offering courses on penology and correctional practice courses. This will gear the prison staff in the right direction towards understanding more about correctional practice. This may also expand their horizon in dealing with the prevailing challenges facing the prison system/institution. Exchange programmes should also be encouraged, for instance visits to other developed countries so as to learn and thereby counter the current challenges they face.

Thirdly, it is recommended in this paper that the government should improve the prison infrastructure through expansion of the existing prison facilities. At the same time the government needs to provide a blue print for new prison establishment or in some cases the government can partially privatize these institutions so as to provide more expansive and inclusive prison system in Kenya.

Fourthly, prisoner rights need be observed because the aim of the prison facilities and system is transforming the lives of the prisoners by reforming them into better persons. It is therefore recommended that there should be stringent security measures to counter the use of illegal paraphernalia by providing proper technology to the prison staff members. This should be in line with the prison reforms.

Lastly, a report by Kenya Human Rights Commission (1997) has indicated the need for urgent address for the dire conditions in the prison system. Therefore, it is recommended that funding the prison facilities should be the most considered factor in improving these facilities and thus this will improve the prevailing conditions being faced in these prisons. Funding should also cater for the proper sanitation and improved hygiene to avoid manifestation of infectious diseases such as typhoid and diarrhoea.

REFERENCES

[1] Amnesty International (2000). *Kenya. Prisons: Deaths due to torture and cruel, inhuman and degrading conditions*. Retrieved from http://web.Amnesty .org.

[2] Cheek, F., & Miller, M. (1983). The experience of stress for correctional officers: A double-bind theory of correctional stress. *Journal of Criminal Justice*, 11, 105-130.

[3] Dankwa, E.V.O. (1997). Prisons *in the Mozambique: Report of the Special Rapporteur on Prisons and Conditions of Detention in Africa*. African Commission on Human and People's Rights: Series IV no. 3.

[4] Dankwa, E.V.O. (2000). *Prisons in the Central African Republic: Report of the Special Rapporteur on Prisons and Conditions of Detention in Africa*. African Commission on Human and People's Rights: Series IV no. 7.

[5] Durham, A. (1994). *Crisis and Reform: Current Issues in American Punishment*. Boston: Little, Brown.

[6] Fagan, H. (2002). Prison overcrowding: One of our biggest challenges to transformation. *Prison Transformation in South Africa*, 11(2), 16-19.

[7] Gaes, G. (1985). The effects of overcrowding in prisons. *Crime and Justice*, 6, 95-147.

[8] Kenya Human Rights Commission (1997). *Prisoners' Rights in Kenya*. Nairobi: Kenya.

[9] Kenya Human Rights Commission (2001). *Draft report of the Study of Prison. Conditions in Kenya*. Nairobi: Kenya.

[10] Kenya Human Rights Commission (KHRC) (2002).*Improving Prison in Kenya*. Foundation Press, Nairobi.

[11] Morgan, D. R., Van Haveren, A. R., & Pearson, A. C. (2002). Correctional officer burnout: Criminal Justice and Behaviour. *American Association for Correctional Psychology*, 29(2), 144-160.

[12] Moyo, P., Magungxu, V., & Abuya, W. (2014). Prisoner-warder ratio parity in a South African Correctional Centre: Repercussions on prison work environment and correctional security personnel. *Journal of Economics and Behavioral Studies*: Vol. 6, No. 5, pp. 411-417.

[13] Muntingh, L. M. (2009). Surveying the prisons landscape: What the numbers tell us. Law, *Democracy and Development*, 9(1), 21-44.

[14] Murphy, J. (1995). *Punishment and Rehabilitation*, 3rd ed. Belmont, CA: Wadsworth.

[15] Olivia, L.A. (2014). *Overview of the Kenyan Criminal Justice* System (Corrections). SHA-KEN S-RIP Vol 1 - D03.

[16] Omboto, J.O. (2010). *Challenges Facing the Control of Drugs and Substances Use and Abuse in Prisons in Kenya*: The case of Kamiti Prison. " Unpublished MA Project, University of Nairobi.

[17] Omboto, J.O. (2013). The challenges facing rehabilitation of prisoners in Kenya and the mitigation strategies. *International Journal of Research in Social Sciences*: June. Vol. 2, No.2(2013). ISSN 2307-227X.

[18] Penal Reform International. (2012). *Ten-point plan to reduce prison overcrowding*. Retrieved from: http: //www. penal reform.org [Accessed on 14 July 2014].

[19] Penal Reform Media Network. (1999) *Prison and Penal Reform Fact Sheet*. Vol 1, Number 1, October.

[20] Pollock, J. M. (2005). *The Rationale for Imprisonment*; Texas State University–San Marcos.

[21] Stephan, J.J. (2008).*National Prisoner Statistics Program Census of State and Federal Correctional Facilities, 2005*: Bureau of Justice Statistics, U.S. Department of Justice.

[22] The Nation Newspaper (2000 a, 15 January)."*Prisoners killed in Cholera*": Nation Media Group, Kenya.

[23] The Nation Newspaper (2000 b, 23 September)."*Prison's Water Supply Cut Over Bill* ": Nation Media Group, Kenya.

[24] The Nation Newspaper (2001, 24 March). ''*Ex-convict Recount Ordeals''*: Nation Media Group, Kenya.

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The Benefits and Challenges Emanating from Community Policing in Kenya: A Criminological Perspective

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ABSTRACT: Community policing is an integral component in ensuring that there is no insecurity incidence in the community. Accordingly, the Kenyan government introduced the concept of community policing which became effective in the Kibaki regime. It was seen as the interaction of the police and the community members, thus with the view of ensuring that they are safe from criminal activities especially from the vigilante groups. Community policing has been seen as an effort to prevent crime and at the same time ensure communal participation towards stamping out crime at communal level. This paper is a critical review of the various attempts to identify the concept of community policing, more specifically, identifying the benefits and challenges of Kenyan community policing system. This paper recommends that concerned stakeholders should devise ways of ensuring that policies on community policing reflect the needs and aspirations of all the citizens in all regions in the country. This can be done by ensuring that the Kenya government or successive regimes; and all sectors are committed towards community policing efforts. Critically, this will emphasize on the ability to address community policing strategies through public participation forums.

KEYWORDS: Kenya Police, Community Participation, Security, Collaborative efforts.

1 INTRODUCTION

According to Kenya Police (2009) as cited in Masese and Mwenzwa (2012), community policing is the perceived effort to enhance security thus recognizing the interdependence and shared responsibility of the police and the community in ensuring a safe and secure environment. Furthermore, it is an active partnership between the police and the public to combat crime and enhance community safety which is the core theme of Kenya's community policing. Community policing responds to the decline in public buoyancy in the police and the need for partnership between different stakeholders to fight crime (Coquilhat, 2008). Through this approach, the community gets to know and understand that it has a role to play in ensuring its own safety and that of their property (Masese and Mwenzwa, 2012). Community policing, recognizing that police rarely can solve public safety problems alone, therefore, encourages interactive partnerships with relevant stakeholders. The range of potential partners is large and these partnerships can be used to accomplish the two interrelated goals of developing solutions to problems through collaborative problem solving and improving public trust (BJA, 1994). Community policing is therefore a tacit acknowledgement that official security apparatus including the police cannot solve all security problems single-handedly thus requiring collective and inclusive involvement of all excluding none (BJA, 1994; Kenya Police Service, 2014). Therefore, the public plays a role in prioritizing public safety problems that affects all.

Accordingly, the police are finding that crime-control tactics need to be augmented with strategies that prevent crime, reduce the fear of crime, and improve the quality of life in neighbourhoods. Fear of crime has become a substantial component in enhancing the theme of community policing. Thus, highly visible police presence helps reduce fear within the community (Fridell, 2004; Coquilhat, 2008; BJA, 1994).

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To begin with, community policing can be traced back to the introduction of community constables, known as 'bobbies', in the London's Metropolitan Police District during the early 19th century (Patterson, 2007 ; Brogden and Nijhar, 2005). Sir Robert Peel who introduced the concept articulated the fact that "the police are the public and the public are the police" (Fridell, 2004). Accordingly, Fridell (2004) notes that the key principle of community policing is that the police should not be detached from community policing, thus emphasizing that community policing is aimed at creating partnership between them and the public at large.

In the United Stated, community policing as a concept was first introduced in the 1960's to intensify the police-community contact and reduce the fear of crime among the citizenry (Cordner, 1999; Innes, 2003). Accordingly, other authors have noted that the concept became a dominant policing strategy in the United States during the 1990's with the introduction of 100,000 new community police officers (Cordner, 2007a). The introduced concept of community policing presented the transformation that encouraged problem solving thus community engagement and involvement with police activities as opposed to reactive policing (Innes, 2003).

Accordingly, it is believed that community policing emerged as a result of a number of social trends relating to the quest for human rights thus human movements. Furthermore, it advocated for the police to be more accountable to the public by being more responsive and connected to the community (Weisheit *et al.,* 1994). Accordingly, authors have argued that community policing emerged in response to the evolving technology, such as the police radio and patrol vehicles that have changed the relationships between the police and the community. Heretofore, officers developed personal relationships with the community and needed the community to be willing to share information. In addition, the police used pragmatic scientific principles to policing, which created the perception that the police were responsible for keeping the community safe. Previously, the community understood that ultimately the communities were responsible for reaffirming the social norms that promoted public safety (Bucqueroux, 2006; Bucqueroux, 2004). With the above view, this paper critically reviews the various attempts to identify the concept of community policing and more specifically identifying the benefits and challenges of Kenyan community policing system.

2 METHODOLOGY

This paper used a desk review design to critically review the community policing concept in Kenya. The paper also analyses the benefits and challenges of community policing in Kenya as perceived in the grassroots level. Furthermore, the concept of community policing in Kenya is significant in providing the much needed security in grassroots level thus there is need to focus on the benefits and perceived challenges with a view of providing empirical recommendation.

3 LITERATURE REVIEWED

3.1 UNDERSTANDING THE CONCEPT OF COMMUNITY POLICING

Community policing is considered as a modern-day policing approach in response to the decline in public confidence in police and the increasing indications that police cannot fight crime by themselves (Skogan, 2006; Virta, 2006; Innes, 2003; Tilley, 2003; Fridell, 2004). Accordingly, Fleming (2005) believes that policing requires communal involvement both at individual and organisational level outside of law enforcement and beyond the public sector. Community involvement in community policing is crucial in identifying community issues, addressing public fear of crime and increasing police visibility thus encouraging increased trust in police (Smartt, 2006; Joyce, 2006; Virta, 2006).

Furthermore, law abiding citizens deserve to participate and contribute towards community policing thus they are involved and support the idea of community policing and the police process comes as a result of stakeholder participation (Trojanowicz and Bucqueroux, 1990; Skogan, 2006). Community policing not only involves the community members but more specifically incorporates the police responsiveness to community concerns towards ensuring full benefits of policing (Skogan, 2006). Community policing involves communal identification of their security needs, which in turn the police take up the matter seriously even if the problems they define differ from police priorities (Wycoff, 1988).

Moreover, community policing determines community needs thus participation is required to identify problems, assist police to drive the solutions, and maintain community ownership of the issues (The Office of Community Oriented Policing Services, 2007). Community policing not only assists the stakeholders in identifying problems, but also in prioritising and finding solutions (Cordner, 1999; Carroll Buracker Associates, 2007; Skogan, 2006).

Accordingly other authors have indicated that there are a number of mechanisms for achieving community engagement, that include systematic and periodic community surveys, fora, community meetings, and meeting with advisory groups and businesses (Cordner, 1999). Skogan and Hartnett (1998) suggest that the public have a great deal informing the police, and that they are grateful for the opportunity to have their voice heard. However, Reno *et al.,* (1998) warns that the type of neighbourhood determines whether the community is good at dealing with their own problems. For example, if the community has more social capacity then they were more likely to deal with their own problems and attend arranged meetings than those without such investment. Crime prevention is central to the concept and ultimate goal of community policing (Skolnick and Bayley, 1988) and will have long term benefits (Segrave and Ratcliffe, 2004). Skogan (2006) suggests community capacity to prevent crime will be strengthened by encouraging communities to enhance community safety.

3.2 UNDERSTANDING KENYA'S COMMUNITY POLICING

Accordingly, the Kenya police (2014), creates the understanding that community policing works by creating an understanding between the police and the community about their role in crime prevention; Supplementing police patrols through private guards and neighbourhood watch groups; Providing educational, capacity building, enhancing Kenya Police personnel and members of the community to enable constructive participation in addressing the problems of crime; Forming community policing victim support centres and training response teams (units); Improving street lighting (security lights) to reduce crime (the use of adopt-a-light programme for the slum population). Moreover, community policing aims at evaluating community policing programmes; Giving special attention to vulnerable groups whom include the women and children that are crime prone; Share responsibility and decision-making as well as sustained commitment from both the police and community, with regard to safety and security needs; Encouraged enhancement of accountability of the police to the community they serve; Conflict resolution between and within community groupings in a manner which enhances peace and stability; further basing problem solving activities on a consultative approach that constantly seeks to approve responsiveness to identified community needs. Furthermore, participation of all members of the Kenya Police in community policing and problem solving initiatives and ensuring that community policing informs, guide and sustain all policing activities is part and parcel of community policing in Kenya thus it is an all-inclusive activity between community members and the police.

3.2.1 ROLE OF THE POLICE AND COMMUNITY MEMBERS TOWARDS COMMUNITY POLICING

The role of community members towards community policing entail the fact that they need to volunteer information on suspicious characters or activities, working closely with the police through Community Policing Forums, helping the police to help you by offering any kind of support, encourage greater contacts between neighbours. More specifically, the community members support the victims of crime through counselling, safeguarding your own neighbourhoods and eventually, security begins with one-self; hence you should be alert always (Kenya Police, 2014).

The police are the most perceptible institution of the security sector and their functions impacts on the entire citizenry. Community policing is a new style of policing that is reactive to the needs of local communities; a force multiplier that contributes to conflict management. The role of the police in community policing as stipulated by the Kenya Police (2014), entail the fact that they communicate with the community and provide give feedback regarding crime and security information; providing a listen ear and understand public needs; being part and parcel of problem solving towards community satisfaction; being transparent, accountable and effective; carrying out their day today activities and other police duties; providing a platform for the formation of Community Policing Forums. Moreover, the police are encouraged to maintenance law and order in crime prevention strategies, enforcement of law and order and conducting patrols in their beat areas to ensure that there is enhanced security.

3.2.2 COMMUNITY POLICING FORUM (CPF)

Accordingly, Community Policing Forum (CPF) is a group of people from the Police and different committees (local leaders, residents, and community based organizations) who meet to identify and solve problems in their areas. The Community Policing Forums are established in residential places, business areas and estates near local Police Stations for easy communications and complementary support. The community policing forums play a crucial role in identify the problems that affect your community, providing Contact Community Policing Unit (C.P.U), Organizing joint sensitization workshops together with C.P.U, Planning and implementing community policing programmes and eventually monitoring and evaluate through the committees formed (Kenya Police, 2014). The joint efforts established in the Community policing forums (CPF) foster strength and unity between the police and the community members.

3.3 BENEFITS OF COMMUNITY POLICING AMONG VARIOUS COMMUNITIES IN KENYA

3.3.1 PREVENTION EMPHASIS

Accordingly, various scholars have indicated that the central theme of community policing is crime prevention (Skolnick and Bayley, 1988) thus this will have long term benefits to the society at large (Segrave and Ratcliffe, 2004). Skogan (2006) suggests community capacity to prevent crime will be strengthened by encouraging communities to enhance community safety. The prevention emphasis of community policing is more proactive than traditional policing models (Cordner, 1999). However, the community do appreciate and value traditional policing, such as rapid response and reactive investigation but would prefer that victimization be prevented in the first instance. Prevention emphasis entails the fact that community members need to enjoy securing oneself and more specifically securing their property; therefore, the interests of the community members are well safeguarded.

3.3.2 ENHANCED PARTNERSHIP BETWEEN THE POLICE SERVICE AND THE COMMUNITY

The essential component of community policing is enhanced partnership. Therefore, the Police need to engage the community in dealing with crime and related problems that may include working collaboratively with other public and private agencies (Cordner, 1999). Police and community should work in partnership not only to solve problems, but to reduce the fear of crime, physical and social disorder, and neighbourhood decay (Trojanowicz and Bucqueroux, 1990; Wycoff, 1988). Moreover, the police should not take sole responsibility for crime prevention. They need to play a crucial role in developing strategies in partnership with local communities. Measuring the impact of crime prevention should move away from relying on crime statistics and clearance rates and complement the qualitative practice of community policing (Young and Tinsley, 1998). Furthermore, increasing community capacity to deal with issues has enabled them building capacity by mobilizing and empowering them to identify and respond to concerns (Segrave and Ratcliffe, 2004). The benefit of an empowered community is a stronger community who want to participate in addressing issues (Mastrofski, 2006).

3.3.3 LOCALITY FOCUS WITH REFERENCE TO SECURING THE COMMUNAL NEEDS

Consequently, authors have indicated that organizing and deploying officers to maximize identification between specific officers and their specific community should result in stronger police-community relationships. This in turn will increase mutual recognition, responsibility and accountability (Cordner, 1999, 2007a; Cordner, 2007 b; Mastrofski, 2006). Furthermore, this will enable communication and partnerships to develop, and sustain relationships between the officer and community members thus securing their communal needs. Cordner (1999) believes that officers develop knowledge about the community, which enables early intervention and problem identification and avoids conflict based on misperceptions or misunderstandings. Furthermore, the incorporation of the police reservist who understands the terrain and community members should be encouraged for this will bring about enhanced community policing. The permanency of officers is a crucial component as it builds familiarity, which in turn will develop trust, confidence and cooperation from both police and the community (Cordner, 1999). Equally, if a specific officer has permanent responsibility for a fixed area, then they will become more responsible for identifying and dealing with the crime problems and encourage in communication with the community (Farrell, 1988; Skogan, 2006).

However, there are a few challenges that confront communally based officer's officers in securing communal needs. First, the mobility of the urban population, where both victims and offenders cross geographical boundaries, presents a major challenge for geographically based officers (Young and Tinsley, 1998). Secondly, crime related problems do not always develop in identifiable communities but in pockets of several communities. Thirdly, problematic communities are often fractured and difficult to engage with. To address these challenges, models of community policing need to be flexible enough to accommodate the particular character of the area. Accordingly, this paper acknowledges the fact that in most cases the police reservists do not have able resources, be it financial and material towards enhancing community policing. For instance, they have inferior weapons and surveillance skills/techniques. As a beneficial gain to the society, community policing strategies should be developed in order to equip the reservists, creating strong policies that will reign in insecurity and also creating communication channels that benefit community members and the police. This will foster positive relationship between different stakeholders

3.3.4 PROBLEM SOLVING

The theme of community policing is the fact that problem solving techniques form an interactive process, involving police and communities in identifying crime problems and developing appropriate solutions (Young and Tinsley, 1998). Problem solving is essential to community policing and as such, problems should not be limited to crimes, therefore solutions should not have to involve arrests (Weisheit *et al.,* 1994). Police and the community should be empowered to adopt problem solving techniques and take every opportunity to address the conditions that cause incidents (Cordner, 1999, Cordner, 2007a; Cordner, 2007b; Carroll Buracker and Associates Ltd, 2007). The problem solving aspect of community policing relies more on preventing crime than traditional methods, through deterring offenders, protecting likely victims and making crime locations less conducive to identified problems (Office of Community Oriented Policing Services, 2007). Problem solving establishes the fact that community policing encourages the involvement of people in realizing their potential to solve crime incidences. Community policing offers the public a larger the window into police activity (Skolnick and Bayley, 1988) and provides opportunities for 'grass roots' support for police (Palmiotto, 2000). Moreover, communities with existing capacity are more likely to participate in community policing, but are less likely to benefit from it because, in general, they are already proactively addressing issues to increase community safety thus problem solving (Mayhill, 2007).

3.3.5 COMMUNICATION AND INFORMATION SYSTEM

Police information systems are central in providing information to assist the community members respond to criminal activities effectively (Trojanowicz and Bucqueroux, 1990). The utilization of problem solving practices has emphasized the requirement for information systems to aid the identification and analysis of problems faced by the community, including the use of Geographical Information Systems (GIS). This information traditionally has not been available (Cordner, 2007b). Further, Cordner (1999) suggests that information can be collected from: community police officers performance appraisals that reflect community activities; evaluating programmes for effectiveness as well as efficiency; and assessing the police's overall performance on a wider range of key indicators. Cordner emphasizes the need for qualitative information to measure success rather than traditional '*bean counting*' techniques; for example, collecting information on wider functions than enforcement and calls for service. However, in the Kenyan case the police still do not have adequate facilities that enhance the collection of information and sharing systems. This is seen due to the fact that the government has not done enough to ensure the needs of the police have been meet in terms of information and communication technology.

3.3.6 IMPROVED POLICE-COMMUNITY RELATIONSHIPS AND COMMUNITY PERCEPTIONS OF POLICE

Community policing enables police to develop improved police-community relationships (Segrave and Ratcliffe, 2004). This provides the police with the opportunity to meet the community's needs (Ferreira, 1996), while increasing public accountability over police through participation (Skolnick and Bayley, 1988; Palmiotto, 2000). Furthermore, established initiatives have shown a positive improvement in police-community relationships and community perceptions of police (Skogan and Steiner, 2004; Sadd and Grinc, 1996). The introduction police reforms in Kenya have seen the encouraged participation of the community members and the fear traditionally perceived has reduced greatly. However, the reforms have not been fully implemented to the realization of the society as a whole.

3.3.7 CHANGING POLICE OFFICERS' ATTITUDES AND BEHAVIOURS

Accordingly, authors have indicated that there is strong evidence suggesting that community policing has positive effects on police through increased job satisfaction and improved interaction with, and confidence in, the community (Mayhill, 2006; Patterson, 2007). Mayhill (2006) argues that community policing 'embeds' officers within the community where they become more understanding of the local situations and promote a positive image of police. This provides the officers with the opportunity to make positive community-police experiences and contacts, which is said to increase morale amongst police through the encouragement of a supportive and welcoming community (Palmiotto, 2000). However, the implementation of the police reforms is yet to be fully realized therefore the key theme should be the government's commitment towards enhanced police participation towards the securing the needs of the citizenry, more specifically, ensuring that there is people participation. The full implementation of the Kenya's police reforms should be realized to enhance police participation.

3.3.8 REDUCED PERCEPTIONS OF SAFETY/DECREASING FEAR OF CRIME

It is widely accepted that community policing increases the perceptions of safety and decreases the fear of crime. Skogan (2006) argues that there is evidence to suggest that increasing community-police interactions are associated with lower levels in fear of crime. However, police and the community have differing levels of perceptions of safety and it has been suggested that police are more likely to perceive a reduction in the fear of crime than the community (Sadd and Grinc, 1994). The community members in order to realize the full benefits emanating from community policing should ensure cooperation and willingness to share and interact with the police in order to reduce crime.

3.3.9 REDUCING CRIME, DISORDER AND ANTI-SOCIAL BEHAVIOUR

Community policing is beneficial as a policing approach to address a range of different crime, disorder and anti-social behaviour. For example, community policing approaches have been used to address graffiti and property damage to gang violence and organized crime (Skogan and Hartnett, 1998). More recently it has been an approach adopted to deal with anti-terrorist activities in some communities (Pickering *et al.,* 2007). Sherman and Eck (2002) argue that community policing needs clear objectives that focus on crime risk factors. This is through developing closer liaison between Police and the public thereby improving their relationship and removing fear of Police, enhancing public confidence and trust in the Police ability to control crime, encouraged public participation thereby reducing the demand upon Police Service and eventual improved crime reporting of the community members.

3.4 CHALLENGES TOWARDS PROMOTING COMMUNITY POLICING IN KENYA

3.4.1 CHALLENGES IN MANPOWER MANAGEMENT

The ratio of the police force has been seen to be greatly affecting community policing efforts. This gap has been filled by the private security industry that has experienced a dramatic increase in growth, and simultaneously greater demand to be involved in crime prevention (Minnaar, 2005; Minnaar and Ngoveni, 2004). Owing to limited financial and human resources, they cannot meet the diverse safety and security needs of the market. Therefore, the private security industry fulfils the security needs the police are unable to satisfy to the population at large (Schönteich, 1999 as cited in Nyaura and Ngugi, 2014). In addition, the private security sector has the ability to employ security officers on permanent or part-time contracts, which is impossible in public policing because of strict public service regulations (Schönteich, 1999). Accordingly, the police and the private security industry need not be left alone, therefore, the paper also advocates for the involvement of community members into developing the neighbourhood watches in all estates in the country. Although some have done this especially in Nairobi County (some of the estates such as South B & C), this needs to cut across all counties including residential neighborhood watches just like those formed in the United States of America among other developed nations.

3.4.2 CORRUPTION AMONG THE POLICE OFFICERS

Nyaura and Ngugi (2014) point out the fact that community policing is an effort between the different security agencies that identifies and solves community problems such as insecurity issues. Their work discussed the challenges facing the local private security guards toward enhancing community policing. Their study findings indicated that poor working conditions, poor pay, lack of recognition from the public, inadequate working facilities, and poor communication channels were among the major challenges facing private guards. These challenges are similar to that of the police, who live in a deplorable conditions yet they are supposed to protect the general population. Moreover, the police who are faced with these challenges may result to corruption in order to sustain their families. This in turn affects the core theme of community policing which is to prevent crime. The police may also be lured to collude with the criminals in engaging in crime who are the enemies of community policing.

3.4.3 EXISTENCE OF MISTRUST

The relationship between police and the community has long been negative and impacted to a large extent by the police service's role as the visible agent of government, tasked with executing past policies of control and suppression, fuelling distrust and resentment. For police, operating in a sometimes hostile community troubled by violence, alcohol misuse and the increasing presence of illicit drugs has been challenging. Efforts by police and community leaders to improve relations

have at times been broken down following violent disturbances. This has been seen where one area has been perceived to be favoured by the police more than the other side. The persisting mistrust is a clear manifestation that community policing has not been fully realized up to the grass-roots. Furthermore, a study by Nyaura (2014) found that there was mistrust between the police and the private security guards. This was seen where there was lack of information sharing between the two agencies. This in turn affects the community members, thus they are prone to insecurity incidences.

3.4.4 INADEQUATE SENSITIZATION OF THE COMMUNITY POLICING POLICIES TO COMMUNITY MEMBERS

Accordingly, community engagement in community policing is vital. Contemporary community policing is based on the notion that all residents should be empowered to enhance their quality of life and prevent or eliminate crime and the problems that lead to crime (Patterson, 2007; Palmiotto, 2000). Community members must be recognized for the vital role they play in accomplishing these goals. Everyone benefits when community members understand the role and function of their police and become active proponents of law enforcement. However, the community members sometimes are not aware of the role played by the police towards enhancing community policing policies. Therefore, the key component of ensuring that community members are aware of community policing is through educating community members about community policing and their role in its implementation policies. Although the Kenya Police have not been seen to fast track this, there is need to sustain and build initiatives that encourage community participation.

3.4.5 ESTABLISHED FACILITIES AND INFRASTRUCTURE

The police participation in crime prevention activities is often constrained by limited resources. For long, the police have lacked facilities in ensuring the enhancement of community policing. Dilapidated structures including lack of improved police stations are the order of the day in the police stations. Therefore, the public may lack confidence in the police due to the lack of facilities. Moreover, the Kenyan government has not done enough to improve facilities that include the police cells and station facilities in the country. Renovations and funding should be done to improve such facilities. An improved facility entails improved service delivery to the community members thus improved security. Accordingly, there have been attempts to improve the current ailing situation facing the police in Kenya. This is through the implementation of the police reforms. Nonetheless, the government is implementing the police reforms in piece-meal, for example, creation of housing and improved transportation facilities. Therefore, overall provision of much needed facilities will improve confidence among the community members thus this will in turn propagate the participation all stakeholders towards community policing.

3.4.6 EFFECTIVE AND EFFICIENT TRAINING OF THE POLICE TOWARDS COMMUNITY POLICING

Inadequate training among the police has been seen to be lacking towards community policing efforts (BJA, 1994; Office of Community Oriented Policing Services, 2007; Sadd and Grinc, 1996). Effective community policing requires training for both police personnel and community members. Effective training aids the development of new police attitudes, knowledge, and skills and facilitates reorientation of perceptions and refinement of existing skills. Training must similarly target such misconceptions. Tactics that can help overcome misperceptions about community policing including conducting accurate community needs assessments, including all the stakeholder in collecting data to develop community policing strategies; assuring appropriate resources are available for community programs; and finally, evaluating and modifying programs as needed. This will be a pull factors towards community members engaging in community policing.

3.4.7 LACK OF TRANSPARENCY AND OPENNESS

Accordingly, the police culture that cultivates an aura of secrecy also impedes the implementation of a community policing strategy in Kenya. Openness in the Police service can generate trust and improved relations between the police and the community. Some feel policing cannot be truly effective without such trust (Cordner, 2007 b; Bucqueroux, 2007). Therefore enhanced transparency and openness should be core theme for community policing. Accordingly there are exceptions among community members, although the one obstacle to creating effective partnerships may be a lack of trust between law enforcement and private security (Nyaura and Ngugi, 2014; Nyaura, 2014). Despite considerable discussion about partnerships between the two groups, overlapping missions and the need to work together and the level of trust is reported to be quite low. Another major cause of lack of trust is misinformation and misunderstanding. Often, neither law enforcement nor private security has an accurate understanding of what the other does or can do (Nyaura, 2014). This can be problematic with regard to crime and disorder.

4 CONCLUSION

This paper concludes that community policing should be encouraged towards promoting enhanced security needs of the local inhabitants in Kenya. Community policing, recognizing that police rarely can solve public safety problems alone, encourages interactive partnerships with relevant stakeholders. There need be collaborative efforts between the police and the community members towards enhancing community policing policies. The introduction of the Nyumba- Kumi initiative can be seen to complement the established community policing polices in the Kenya police. Therefore, community policing calls for a long-term commitment that entails efficient and effective planning and more specifically, full participation of all stakeholders to eradicate the insecurity challenges among community members in various communities in Kenya. Accordingly, police reforms should be geared to targeting community policing efforts in Kenya.

REFERENCES

[1] Brogden, M., & Nijhar, P. (2005). *Community-oriented policing: The Anglo-American model*, in Brogden M & Nijhar P (eds). Community policing: National and international models and approaches. Devon, UK: Willan Publishing: 23–45

[2] Bucqueroux, B. (2004). 'Community Policing in the Years Ahead: And Now for the Really Hard Part' *in Community Policing: The Past, Present, and Future*, eds. Fridell, L., & Wycoff, M. Police Executive Research Forum: Washington, pp 73-82.

[3] Bucqueroux, B. (2007). *What Community policing teaches us about Community Criminal Justice*: Retrieved from http://www.policing.com/articles/pdf/ccj.pdf (accessed on 08/05/2014).

[4] Bureau of Justice Assistance (BJA) (1994). *Understanding Community Policing: A Framework for Action*. Washington DC: Bureau of Justice Assistance, US Department of Justice.

[5] Carroll Buracker and Associates Ltd (2007). *Elements of Community Policing*, Carroll Buracker and Associates Ltd Retrieved from http://www.buracker.com/sanfran.html (accessed on 13/04/2014).

[6] Coquilhat, J. (2008). *Community Policing*: An International Literature Review. Wellington. Australian Police.

[7] Cordner, G. (1999). '*Elements of Community Policing in Policing Perspectives: an Anthology*, eds. L. Gaines and G. Cordner, Roxbury Publishing Company: Los Angeles, pp 137-149.

[8] Cordner, G. (2007 a). *The Key Elements of Oriented Community Policing, Regional Community Policing Institute*: Colorado Retrieved from http://www.dcj.state.co.us/crcpi/KeyElements.html (accessed on 13/04/2014).

[9] Cordner, G. (2007 b). *Community Policing: Principles and Elements, Regional Community Policing Institute*: Eastern Kentucky University. Retrieved from http://www.kycops.org/wcp.htm (accessed on 13/04/2014).

[10] Farrell, M.J. (1988). '*The Development of the Community Patrol Program: Community-oriented policing in the New York City Police Department'* in Community Policing: *Rhetoric or Reality* ed. Green, J., and Mastrofski, S. Praeger Publishers: New York, pp73-88.

[11] Fridell, L. (2004). '*The Defining Characteristics of Community Policing' in Community Policing: the Past, Present, and Future*, eds L Fridell and M Wycoff, Police Executive Research Forum: Washington, pp 3-12.

[12] Innes, M. (2003). Understanding Social Control: Deviance, Crime and Social Order, McGraw-Hill International: New York.

[13] Joyce, P. (2006). *Criminal Justice: An Introduction to Crime and Criminal Justice System*, Willan Press: London.

[14] Kenya Police (2014). "*Community Policing*". Retrieved from the Kenya Police official website www.kenyapolice.go.ke.

[15] Masese, R. E., & Mwenzwa, E. (2012). The genesis and Evolution of Sungusungu Vigilante Group among the Abagusii Ethnic Group of Kenya. *Elixir Soc. Sc.* 42 (2012): 6485-6492.

[16] Mastrofski, S. (2006). '*Critic - Community Policing: A Skeptical View' in Police Innovation: Contemporary Perspectives*, ed. D. Weisburd and A. Braga, Cambridge University Press: Cambridge, pp 44-73.

[17] Mayhill, A. (2007). *Community engagement in Policing: Lessons from the literature*. Retrieved from http:// police.homeoffice.govt.uk/news and publications /community policing/ community_engagement_lit_review.pdf (accessed on 12/04/2014).

[18] Minnaar, A., & Ngoveni, P. (2004). The relationship between the South African Police Service and the private security industry: Any role for outsourcing in the prevention of crime. *Acta Criminologica*, 17(1), 42-65.

[19] Minnaar, A. (2005). Private-public partnership: private security, crime prevention and policing in South Africa. *Acta Criminologica*, 18(1), 85-114.

[20] Nyaura, J.E., & Ngugi, M. N. (2014). Challenges Faced by the Local Private Security Guards ("Watchmen") in Eldoret Municipality, Kenya, towards Community Policing: A Criminological Perspective. *Elixir Social Studies.* 71 (2014) 24803-24806.

[21] Nyaura, J.E. (2014). The link between the police and the private security guards toward enhancing community policing in Uasin-Gishu County, Kenya: A Criminological Perspective *Elixir Social Studies.* 75 (2014) 28006-28010.

[22] Office of Community Oriented Policing Services (2007). *Organizational Elements*. Retrieved from: http: // www. Cops. usdg.gov/print.asp (accessed on 20/05/2014).
[23] Palmiotto, M. (2000). *Community Policing: A Policing Strategy for the 21st Century*. Jones and Bartlett Publishers: Boston.
[24] Patterson, J. (2007). *Community Policing: Learning the Lessons of History*, Lectric Law Library. Retrieved from http://www.lectlaw.com/files/cjs07.htm (accessed on 09/04/2014).
[25] Pickering, S., Wright-Neville, D., McCulloch, J., & Lentini, P. (2007). *Counter-Terrorism Policing and Culturally Diverse Communities*: Final Report 2007, Monash University.
[26] Reno, J., Marcus, D., Leary, M.L., & Travis, J. (1998). *Problem Solving in Practice: Implementing Community Policing in Chicago, US Department of Justice: National Institute of Justice*. Retrieved from http: // www. ncjrs.gov /pdffiles1 /nij/179556.pdf (accessed on 09/04/2014).
[27] Sadd, S., & Grinc, R. (1996). *Implementation Challenges in Community Policing Innovative Neighbourhood Oriented Policing in Eight Cities*. Retrieved from http://www.ncjrs.gov/txtfiles/implcp.txt (accessed on 09/04/2014).
[28] Schönteich, M. (1999). Fighting crime with private muscle: The private sector and crime prevention. *African Security Review*, 8(3), 65-75.
[29] Segrave, M., & Ratcliffe, J. (2004). *Community Policing: A Descriptive Overview*, Australian Institute of Criminology.
[30] Sherman, L.W., & Eck, J.E. (2002). '*Policing for crime prevention*', in Sherman, L.W., Farrington, D.P., Welsh, B.C., and MacKenzie, D.L, Evidence-Based Crime Prevention, Routledge: New York, pp 295-329.
[31] Skogan, W. (2006). '*Advocate - The Promise of Community Policing' in Police Innovations: Contrasting Perspectives*, ed. Weisburd, D., & Braga, A. Cambridge University Press: Cambridge, pp 27-43. Retrieved from http: //www. ncjrs.gov /policing/use139.htm (accessed on 19/04/2014).
[32] Skogan, W. G., & Hartnett, S. (1998). *Community Policing: Chicago Style*, Oxford University Press: New York.
[33] Skogan, W. G., & Steiner, L. (2004). *Community policing in Chicago, Year ten*. Chicago: Illinois Criminal Justice Information Authority.
[34] Skolnick, J.H., & Bayley, D. (1988). *Community Policing: Issues and Practices around the World, National Institute of Justice*: Office of Communication and Research Utilization.
[35] Smartt, U. (2006). *Criminal Justice*, Sage: London.
[36] Tilley, N. (2003). '*Community Policing, Problem-oriented Policing and Intelligence-led Policing' in Handbook of Policing*, ed. T Newburn, Willan Publishing: Cullompton.
[37] Trojanowicz, R., & Bucqueroux, B. (1990). *Community Policing: A contemporary perspective*. Anderson Publishing Co: Ohio.
[38] Virta, S. (2006). '*Community Policing':* The Sage Dictionary of Criminology, eds. McLaughlin, E., and Muncie, J. Sage: London.
[39] Weisheit, R. A., Wells, L. E., & Falcone, D. N. (1994). 'Community Policing in Small Town and Rural America'. *Crime and Delinquency*, v40, n4, pp 549-567.
[40] Wycoff, M.A. (1988). '*The Benefits of Community Policing: Evidence and Conjecture' in Community Policing: Rhetoric or Reality* ed. Green, J., & Mastrofski, S. Praeger Publishers: New York, pp 103-134.
[41] Young, W., & Tinsley, Y. (1998). *Options for the development of COP/problem solving policing in New Zealand*, Victoria University of Wellington: Wellington.

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Applied the Technology Acceptance Model to Survey the mobile-learning adoption behavior in Science Museum

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ABSTRACT: The concept of mobile learning was proposed by Revans from England in 1982 which has been more than 25 years (Revans, 1982). Revans offers an iterative model, successively alternating experience and preparation/reflection, which is a useful paradigm for mobile learning (McDermott et al., 2000). However, scholars perceive mobile learning in different ways. The following section contributes to various explanations of mobile learning by international scholars: m-learning is e-learning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone (Quin, 2001). Mobile learning is a context-based learning by using mobile technology medium and is learner-centered. The flexibility of mobile learning in a proper location allow learners to interact with other learners and instructors and conduct technology-learning, content learning or context-based learning that is proactive, instant, distant /approximate, individual or group-centered. Moreover, learner will experience meaningful knowledge construction through this process (Young et al., 2005). Mobile learning is defined as any educational provision where the sole or dominant technologies are handheld or palmtop devices (Traxler, 2005).

KEYWORDS: Technology Acceptance Model, mobile-learning, Science Museum.

1 INTRODUCTION

The concept of mobile learning was proposed by Revans from England in 1982 which has been more than 25 years (Revans, 1982). Revans offers an iterative model, successively alternating experience and preparation/reflection, which is a useful paradigm for mobile learning (McDermott et al., 2000). However, scholars perceive mobile learning in different ways. The following section contributes to various explanations of mobile learning by international scholars: m-learning is e-learning through mobile computational devices: Palms, Windows CE machines, even your digital cell phone (Quin, 2001). Mobile learning is a context-based learning by using mobile technology medium and is learner-centered. The flexibility of mobile learning in a proper location allow learners to interact with other learners and instructors and conduct technology-learning, content learning or context-based learning that is proactive, instant, distant /approximate, individual or group-centered. Moreover, learner will experience meaningful knowledge construction through this process (Young et al., 2005). Mobile learning is defined as any educational provision where the sole or dominant technologies are handheld or palmtop devices (Traxler, 2005).

The following definition of m-learning are proposed based on the aforesaid theories regarding the application of mobile device in museums. In this project we came up with the following definition of m-learning：The so called mobile learning refers to mobile instant learning which must be a portable, light-weighted mobile device with wireless internet feature. The content of the device must contain multimedia systems to provide sufficient messages and allow visitors to search for information of exhibit items when necessary, transmit related information and experience real-time interaction with museum staff.

About the m-learning study area at present which can divide into two directions: one is focusing on the education level. The scholars are applying the tradition education theory with the m-learning environment, and try to discovery the learning effectiveness. Another is focusing on the learning technology system and emphasis system platform function as consideration

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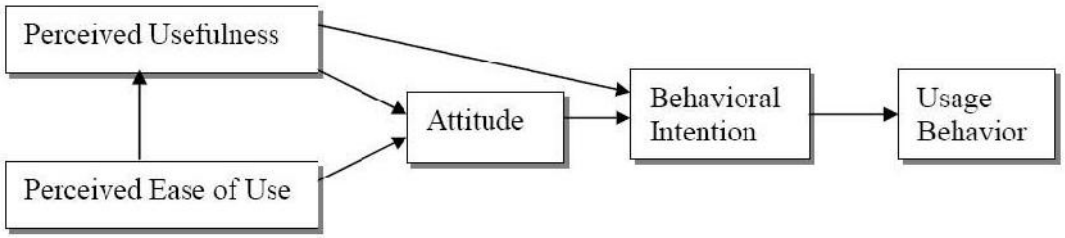
foundation. So when planning to develop m-learning system, you should consider the different goal for education learning theory and learning technology and satisfy the need of mobile learner. After all, facing the m-learning environment, the learner is the most important and direct one who can feel. So understanding the learner's factors for learning technology which includes accepting level, cognition factor, learning motivation, learning attitude and learning satisfaction will be the successful key point in the future. According to the above, this study bases on the Technology Acceptance Model and tries to modify the external variables according to the m-learning. We try to establish the evaluation model structure for the degree of m-learning satisfaction and can supply the need of m-learning industry and academy for planning and construction learning system.

The primary goal of this work was to enhance our understanding of user acceptance of m-learning in museum. This study addressed the ability to predict museum visitors' acceptance of m-learning in terms of individual difference as stipulated by the extended technology acceptance model（TAM2）. The TAM2 is to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. Because m-learning technology is still in its development stage in museum, the crucial motivational variables that affect its adoption by museum visitors need to be explored.

2 RELATED LITERATURE

2.1 TECHNOLOGY ACCEPTANCE MODEL

The Technology Acceptance Model (TAM) is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new software package, a number of factors influence their decision about how and when they will use it, notably: Perceived usefulness (PU) - This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived ease-of-use (PEOU) - Davis defined this as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).



Technology Acceptance Model（Davis, 1989）

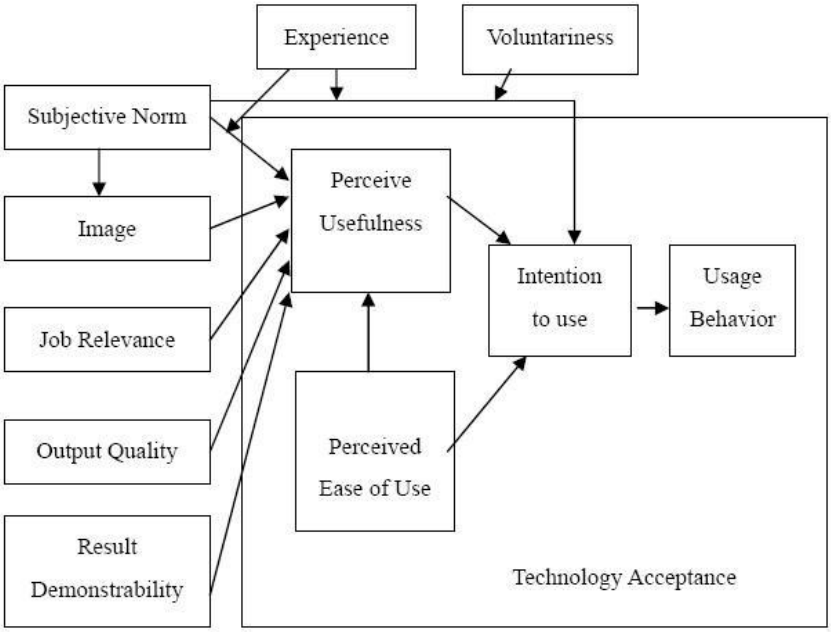
TAM is one of the most influential extensions of Ajzen and Fishbein's theory of reasoned action (TRA) in the literature. It was developed by Fred Davis and Richard Bagozzi (Bagozzi et al., 1992; Davis et al., 1989). The theory of reasoned action says that a persons intentions are the best guide to behavior. If a person intends to do a behavior then it is likely that the person will do it. Moreover a person's intentions are themselves guided by two things: the person's attitude towards the behavior and the subjective norm. To put the definition into simple terms: a person's voluntary behavior is predicted by his/her attitude toward that behavior and how he/she thinks other people would view them if they did the behavior. A person's attitude, combined with subjective norms, forms his/her behavioral intention. TAM replaces many of TRA's attitude measures with the two technology acceptance measures— ease of use, and usefulness. TAM has discovered strong relationships between individual differences and IT acceptance (Agarwal and Prasad, 1999; Venkatesh, 1999). The Technology Acceptance Model (TAM) has served as basis for past researches on IS dealing with behavioral intentions and usage of IT (Adams et al., 1992; Davis et al., 1989; Gefen and Straub, 1997; Amoako-Gyampah and Salam, 2004).

As a well-recognized theoretical basis for studying user acceptance, TAM (e.g., Davis, 1989) proposes that user's perceptions of a system's ease of use and usefulness can influence how quickly and efficiently users will adopt the new technologies. Thus, according to TAM, the easier a technology is to use, and the more useful it is perceived to be, the more positive the user's attitude and intention towards using the technology. Consequently, the usage of the technology increases. Recently, researchers have explored personal and situational factors that influence users' perceptions. One such factor is the user's perception of his/her computer self-efficacy, i.e., proficiency at using technology (Igbaria and Iivari, 1995; Compeau and Higgins, 1995; Venkatesh and Davis, 1996; Venkatesh, 2000).

2.2 THE EXTENDED TECHNOLOGY ACCEPTANCE MODEL （TAM2）

While users' perceptions of computer self-efficacy have been shown to be important in their system perceptions, knowledge workers need both computer and task proficiency to apply a workplace system efficiently and effectively in performing their jobs. Thus, their perceptions of self-efficacy related to both computer technology and the underlying task are likely to affect their perceptions about the system and their intentions to use it as intended by the system developers. Earlier research on the diffusion of innovations also suggested a prominent role for perceived ease of use. Tornatzky and Klein (1982) analyzed the adoption, finding that compatibility, relative advantage, and complexity had the most significant relationships with adoption across a broad range of innovation types. Several researchers have replicated Davis's original study (Davis, 1989) to provide empirical evidence on the relationships that exist between usefulness, ease of use and system use (Adams, Nelson & Todd, 1992; Davis et al., 1989; Hendrickson, Massey & Cronan, 1993; Segars & Grover, 1993; Subramanian, 1994; Szajna, 1994). Much attention has focused on testing the robustness and validity of the questionnaire instrument used by Davis. Adams et al (1992) replicated the work of Davis (1989) to demonstrate the validity and reliability of his instrument and his measurement scales. They also extended it to different settings and, using two different samples, they demonstrated the internal consistency and replication reliability of the two scales. Hendrickson et al (1993) found high reliability and good test-retest reliability. Szajna (1994) found that the instrument had predictive validity for intent to use, self-reported usage and attitude toward use. The sum of this research has confirmed the validity of the Davis instrument, and to support its use with different populations of users and different software choices. Segars and Grover (1993) re-examined Adams et al's (1992) replication of the Davis work. They were critical of the measurement model used, and postulated a different model based on three constructs: usefulness, effectiveness, and ease-of-use. These findings do not yet seem to have been replicated.

Venkatesh and Davis extended the original TAM model to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The extended model, referred to as TAM2, was tested in both voluntary and mandatory settings. The results strongly supported TAM2 (Venkatesh and Davis, 2000).



TAM2(Venkatesh and Davis, 2000)

2.3 EXTERNAL VARIABLES

Although TAM is a model applicable to a variety of technologies (Adams et al., 1992; Chin and Todd, 1995; Doll et al., 1998), it has been criticized for not providing adequate information on individuals' opinions of novel systems (Mathieson, 1991; Moon and Kim, 2001; Perea y Monsuwe et al., 2004). Davis (1989, p. 985) observed that external variables enhance the ability of TAM to predict acceptance of future technology. In other words, the constructs of TAM need to be extended by

incorporating additional factors. Choosing additional factors depends on the target technology, main users and context (Moon and Kim, 2001). Job relevance and result demonstrability seemed to play important role, but there were also cases where these were not perceived. Result demonstrability seemed to be extremely important when judging whether or not to continue using system. Subjective norm did not present itself in the form it was introduced in TAM2, but when superior did suggest experimenting using web based course tools it did take place at least in one case. Image and output quality were noticeable, but seemed not to be critical factors. All factors introduced in TAM2 were noticeable at least in some degree, but in none of the cases were all factors clearly present at the same time. These findings suggest that there seems to be personal differences in approaches towards technology. Wang et al. (2003) noted that variables relating to individual differences play a vital role in the implementation of technology. To understand user perception of M-learning, this study integrated four individual difference variables and try to set up the first level constructs, namely "learning motivation, job relevance, learning efficiency and user characteristics" into the proposed TAM2 model. Those four constructs are captioned behind.

Learning Motivation：Mobile Learning is not only a technology that has to be introduced but a whole concept which also requires changes in the museum exhibition to work fast and efficiently. Especially in combination with assured information delivery and just in time learning there is no clear dividing line between intranet-knowledge management systems and mobile learning environment. There are many theories of learning, some apparently more applicable to informal learning in general and to museums in particular, some seemingly more relevant to the use of digital technologies. Many of the best-known models provide useful insights, at least into identifying issues worthy of consideration. According to Falk and Dierking (1998) individual interest is one of the major factors that influence a visit to a museum. "Personal history and values play a major role in museum-going as well". The individual interest is seen as an example of intrinsic learning motivation, and it has been found to influence user acceptance importantly.

Job relevance: Effects of this new technology and a way of work and learning have not earned as much attention as they might deserve. Computing technology has been a major force for change in organizations for over 30 years and throughout that time there has been little evidence that developers of user applications are able to predict or plan organizational outcomes (Eason 2001). One can not deny that when implementing a new system into organization, it quite likely produces consequences which could not be predicted. About the m-learning system in museum, we try to understand whether the factor have the important effect to accept the novel technology.

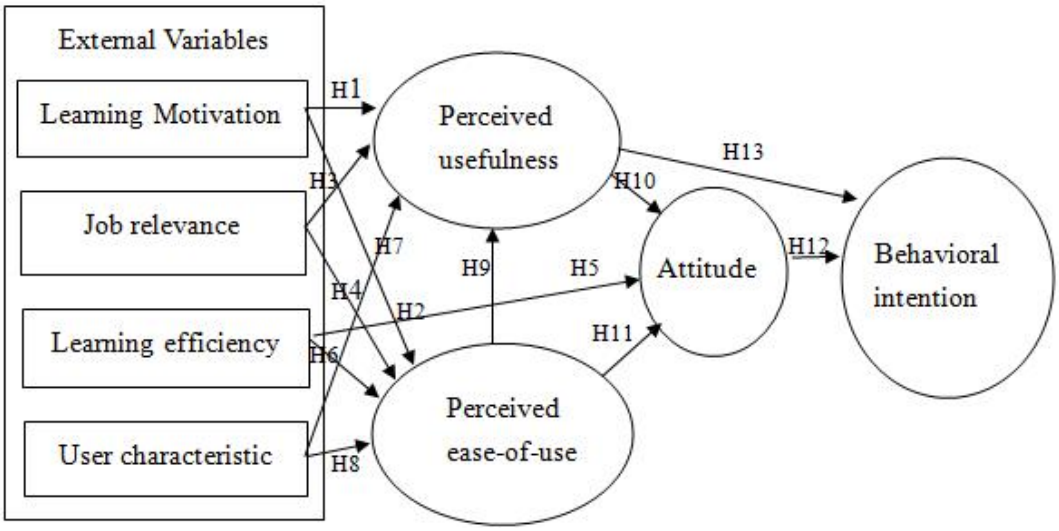
Learning efficiency: The most valuable function of mobile device is to provide the description content of the exhibit items. Mobile device also allows the visitor to record the content they previously viewed and provide the apparatus of self-reflection and recall memories. It is evident that internet search engine and interactive Q&A will allow the visitors to self-examine the learning efficiency in museums. Hiebert, Gallimore and Stigler's(2002) assert that 'teachers rarely draw from a shared knowledge base to improve their practice' nor do they routinely use research-based knowledge to inform their work, and concurrently draw attention to the assumption that researcher's knowledge could be of value to teachers in its generalized and trustworthy character whilst the knowledge teachers use is often considered craft knowledge, characterized more by its concreteness and contextual richness than its generalization ability and context independence. One viewpoint from the cognitive learning theorist is that new knowledge is learned by the merging of previous knowledge with new information (Hannafin & Peck, 1988). In a similar view, Brandt (1997) agrees that learners construct knowledge by making sense of experiences in terms of what is already known. So this study treats learning efficiency as a new variable in the TAM2.

User characteristic: When looking the results using theoretical framework from TAM, it can be quite unarguably said that perceived usefulness does play more important role than perceived ease of use. Venkatesh and Morris (2000) did suggest that this is a male dominant way of thinking, but this study does not make that clear difference between genders and personal priority knowledge of mobile device. This is quite obvious when listening stories about difficulties encountered when taking m-learning systems into use for the first time. This study treats genders and personal priority knowledge as a new variable

3 RESEARCH METHOD AND HYPOTHESES

This study is to discover the m-learning system user's attitude and behavior in museum. The issue includes the application of information technology and education theory. Therefore, except for integrating the TAM2 into the base of study, we also synthesis related education theory to study and evaluate the learning attitude and satisfaction level for m-learning users. Meanwhile, the mediate variables will accord to the factors of Perceived usefulness (PU) and Perceived ease-of-use (PEOU) which mentioned in TAM2. However, the both of factors of information technology and education theory are inclined to the learning cognition and ignore the subject factors. So this research will include the learning motivation, job relevance, learning efficiency and user characteristics to build the relationship between the Perceived usefulness and Perceived ease-of-use. As shown in figure 3, the proposed TAM2 includes four external variables. These four constructs may significantly affect existing

TAM variables. In addition, other relationships between the constructs by the TAM2 are also presented (Venkatesh and Davis, 2000). The next section describes in detail all hypotheses concerning the relationships among the variables in the model.



The Extended TAM model

3.1 LEARNING MOTIVATION

Learning Motivation has not been tested previously, but it relates to users' personal awareness of mobility value. Mobility enables users to receive and transmit information anytime and anywhere (Anckar and D'Incau, 2002; Coursaris et al., 2003; Hill and Roldan, 2005; Ting, 2005). The mobility associated with time-related needs will encourage users to adopt mobile technology since enhanced accessibility in the museum is expected to affect hands-on interaction exhibition and high levels of engagement. Hence, visitors who perceive the value of mobility also understand the uniqueness of M-learning in museum and have a strong perception of its usefulness. In other words, perceived mobility value has a positive effect on the perceived usefulness of M-learning. Therefore, this work treats Learning Motivation as a direct antecedence of perceived usefulness and perceived easy-of use.

H1. Learning Motivation has a positive effect on perceived usefulness.

H2. Learning Motivation has a positive effect on perceived easy of use.

3.2 JOB RELEVANCE

The concept of Job relevance adapted from Davis et al. (2000) means that users feel helpful for their work from the instrumental value of using M-learning. Prior studies on technology acceptance behavior examined the effects of Job relevance on perceived ease of use (Venkatesh, 2000; Venkatesh et al., 2002; Yi and Hwang, 2003).

H3. Job relevance has a positive effect on perceived usefulness.

H4. Job relevance has a positive effect on perceived ease of use.

3.3 LEARNING EFFICIENCY

There is a causal relationship between Learning efficiency and attitude. When users feel that M-learning is easy of use, it will in turn enhance their perception of M-learning. Some research showed that attitudinal outcomes, such as happiness, pleasure, and satisfaction, result from the enjoyable experience (Childers et al., 2001; Moon and Kim, 2001; van der Heijden, 2003; Yu et al., 2005). These findings indicate that Learning efficiency highly correlates with the users' positive attitudes.

H5. Learning efficiency has a positive effect on attitude.

H6. Learning efficiency has a positive effect on perceived ease of use.

3.4 USER CHARACTERISTIC

User Characteristic of gendor and priority knowledge has not been tested previously, but it relates to user difference and ability to new technology.

H7. User Characteristic has a positive effect on perceived usefulness.

H8. User Characteristic has a positive effect on perceived ease of use.

3.5 PERCEIVED EASE OF USE, PERCEIVED USEFULNESS, ATTITUDE, AND BEHAVIORAL INTENTION

TAM delineates the causal relationships between perceived usefulness, perceived ease of use, attitude and behavioral intention to explain users' acceptance of technologies. Perceived easy of use is hypothesized to be a predictor of perceived usefulness. Additionally, attitude is determined by two salient beliefs, namely perceived usefulness and perceived ease of use (Davis, 1989). Finally, behavioral intention is determined by perceived usefulness and attitude.

The influence of perceived ease of use on perceived usefulness, TAM posits a strong direct link between perceived ease of use and perceived usefulness. If all other factors are equal, users are likely to consider a technology to be more useful if they perceive that it is easier to use (Brown and Licker, 2003; Bruner and Kumar, 2005; Hu et al., 1999; Igbaria and Iivari, 1995). Therefore, perceived ease of use is likely to have a direct effect on the perceived usefulness of the construct.

H9. Perceived ease of use has a positive effect on perceived usefulness.

3.6 THE INFLUENCE OF PERCEIVED EASE OF USE AND PERCEIVED USEFULNESS ON ATTITUDE.

The attitude toward using a given technology is the overall evaluation that predicts a user's likelihood of adopting that emerging technology. Past research indicates that attitude is influenced by both Perceived easy of use and Perceived usefulness components (Childers et al., 2001; Dabholkar and Bagozzi, 2002; Mathieson, 1991; O'Cass and Fenech, 2003). Thus, that attitude is positively influenced byPerceived usefulness and Perceived easy of use is proposed here.

H10. Perceived usefulness has a positive effect on attitude.

H11. Perceived ease of use has a positive effect on attitude.

3.7 THE INFLUENCE OF PERCEIVED USEFULNESS AND ATTITUDE ON BEHAVIORAL INTENTION.

In TAM, behavioral intention. is influenced by both Perceived usefulness and Attitude. This relationship has been examined and supported by many prior studies (Adams et al., 1992; Davis et al., 1989; Hu et al., 1999; Venkatesh and Davis, 1996, 2000). Therefore, this study presents the following hypotheses.

H12. Attitude has a positive effect on behavioral intention.

H13. Perceived usefulness has a positive effect on behavioral intention.

4 RESULT AND ANALYSIS

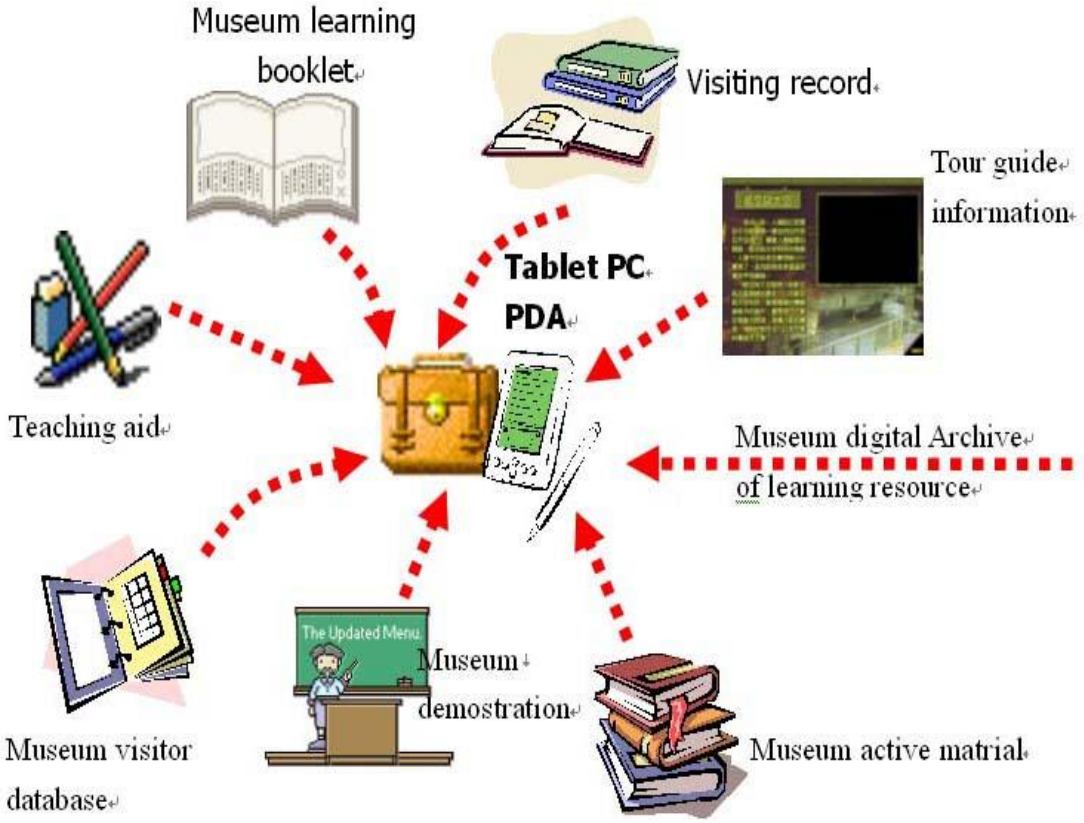
Interviews showed that people adapt and use technology in different ways. Original reasons for taking unfamiliar new technology into use did also vary. The heterogeneity of users was quite evident, although there were no real borders between different disciplines in adapting new technology. There might have been some special requirements for the actual ways of technology use in teaching though (Jyri, 2004). The pilot study is trying to construct the new extended technology acceptance model for m-learning in museum. Until now, we have the study model and will design the questionnaire for investigate the items used to construct each variable which were mainly adopted from the study.

Museums now use digital technology that contain not only sound and picture, but also the interactive device of multi-media, allowing the visitors to have more flexibility and more freely select their desired route and pace while visiting (Hawkey, 2005). In the future, mobile learning shall take the following elements into consideration:

- things to know when using mobile learning device
- Quick search and efficient learning efficiency
- the use of operation interface and accessibility
- value-added of the learning context

As the learning device provides service through wireless technology in creating a learning environment that will not be restricted by space, time and any form of mediums, it is essential that a light, easy-to-carry and reader-friendly mobile tool to optimize mobile learning（Chao, 2005）.

When people think about education and learning, they often think about information. They ask questions like: What is the most important information for people to know? What are the best ways to transmit that information from one person (a teacher) to another (a learner)? What are the best ways to represent and display information so that it is both understandable and learnable? There are so many kinds of information and activities in the museum. For examples, there are visitor records, museum tour guide, museum visitor information, museum education activity information, museum exhibition information, museum learning list, museum demonstration information, museum digital collection, and so on. So we try to integrate those informations into the structure of the mobile learning system for the museum. The chart of the system structure can be shown as follows:



Mobile Learning System model for museums

5 CONCLUSION

In the past, the learning method in museums is to present a real object or a model to the audience. However, the learning stops after visitors leave the museum. The advanced internet technology gives birth to online virtual museums which present the exhibit items digitally, distinguishing it from traditional museums which feature exhibitions, education, research and archive. Online museums thus allow learners to browse and learn through computers at home with no time limit but are restrained by the immobility of the bulky computers. Nevertheless, the development of small size mobile device, along with wireless internet technology, the assistance provide by mobile device further extends the functions of museums regardless of the location and significantly enhances learning efficiency.

The pilot study is trying to establish the relationship between the external variables and user's attitude and behavior in the museum. The study is still under constructure and later we will do the investigation in our museum for the m-learning system exhibition which will be opened in Febuary, 2008. After that, we will finish the final in our paper to show the detal relationship between the external variables and user's attitude and behavior.

REFERENCES

[1] Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. MIS Quarterly, 16, 227-247.

[2] Agarwal, R. and Prasad, J. (1999), "Are individual differences germane to the acceptance of new information technologies?", Decision Sciences, Vol. 30 No. 2, pp. 361-91.

[3] Bagozzi, R. P., Davis, F. D., & Warshaw, P. R. (1992). Development and test of a theory of technological learning and usage. Human Relations, 45(7), 660-686.

[4] Chao, Z. Y.（2005）, The Development and Application of Mobile Learning in National Museum of History, *Elementary Education*, Vol. 45, No.6, pp.62-68.(In Chinese)

[5] Compeau, D.R. and Higgins, C.A. (1995), "Computer self-efficacy: development of a measure and initial test", MIS Quarterly, Vol. 19 No. 2, pp. 189-211.

[6] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

[7] Falk, J. H., and L. D. Dierking., School Field Trips: Assessing Their Long-Term Impact, *Curator* ,40.3, 1997, pp. 211-218.

[8] Hawkey, R.(2005), Learning with Digital Technologies in Museums, *Science Centres and Galleries*, Bristol: Nesta Futurlab Report 9.

[9] Hendrickson, A. R., Massey, P. D., & Cronan, T. P. (1993). On the test-retest reliability of perceived usefulness and perceived ease of use scales. MIS Quarterly, 17, 227-230.

[10] Igbaria, M. and Iivari, J. (1995), "The effects of self-efficacy on computer usage", Omega, International Journal of Management Science, Vol. 23 No. 6, pp. 587-605.

[11] Igbaria, M., Parasuraman, S. and Baroudi, J.J. (1996), "A motivational model of microcomputer usage", Journal of Management Information Systems, Vol. 13 No. 1, pp. 127-43.

[12] Jyri, N.(2004), "Reflections on technology acceptance in higher education" access 5 December 2006, Available at http://is2.lse.ac.uk/asp/aspecis/20040115.pdf

[13] McDermott, K.J.; Nafalski, A.; Gol, O., Active learning in the University of South Australia, *Frontiers in Education Conference*, Vol.1, 18-21 ,2000, pp.18-21.

[14] Quin, C., Mlearning: Mobile, Wireless, in –Your-Pocket Learning, *LiNE Zine*, 2001.

[15] Revans, R., The Origins and Growth of Action Learning, *Chartwell Bratt*, 1982.

[16] Segars, A. H., & Grover, V. (1993). Re-examining perceived ease of use and usefulness: A confirmatory factor analysis. MIS Quarterly, 17, 517-525.

[17] Subramanian, G. H. (1994). A replication of perceived usefulness and perceived ease of use measurement. Decision Sciences, 25(5/6), 863-873.

[18] Szajna, B. (1994). Software evaluation and choice: predictive evaluation of the Technology Acceptance Instrument. MIS Quarterly, 18(3), 319-324.

[19] Tornatzky, L. G., & Klein, R. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. IEEE Transactions on Engineering Management, EM-29, 28-45.

[20] Traxler, J., Mobile Learning : It's Here but Where Is It? Access 5 December 2006, Available at http://www2.warwick.ac.uk/services/cap/resources/ineractions/archive/issue25/traxler/, 2005.

[21] Venkatesh, V. (2000), "Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model", Information Systems Research, Vol. 11 No. 4, pp. 342-65.

[22] Venkatesh, V. and Davis, F.D. (1996), "A model of the antecedents of perceived ease of use: development and test", Decision Sciences, Vol. 27 No. 3, pp. 451-81.

[23] Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, (46:2), 186-204.

[24] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, (27:3), 425-478.

[25] Venkatesh, V. (2000), "Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model", Information Systems Research, Vol. 11 No. 4, pp. 342-65.

[26] Young, S. C., Chung, C. H. and Liu, I. F. （2005）, An Overview of Integration of Mobile Technologies into Teaching and Learning Settings, *Instructional Technology & Media*, 73, pp.62-76. (In Chinese)

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A novel design to allow recording multiple facial measurements without changing subject's position

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ABSTRACT: *Statement of the problem:* Research on the human face has seen a surge, especially with rapidly developing new concepts of dynaesthetics. Besides dentistry, medical specialties like surgery, forensics and ophthalmology have found renewed interest in studies on human face. In dentistry, specialists from the field of orthodontics, prosthodontics, orthognathic surgeons and aesthetic dentists have done considerable research on various landmarks of human face especially measurements between different landmarks. While researchers have focussed on different methods of measuring, none seemingly has focussed on the significance of stabilizing the subject on which measurements are made or the device with which measurements are made.
Purpose: To review the literature related to the methods used to measure facial parameters.
To design a new device that firmly stabilizes subject as well as measuring device.
Materials and methods: An innovative device was first designed from data obtained from measurements of average head sizes of various races. Thirty dentulous and thirty edentulous subjects were then selected on whom the reliability of the instrument was verified. For dentulous subjects three different observers measured predetermined facial parameter whereas for edentulous subjects, vertical dimensions were measured on the newly designed device called Subject stabilizing device. Vertical dimensions incorporated in the denture were approved in a two stage procedure.
Results: Distances between various different landmarks of the human face were measured without the subject having to move his/her head and without ever removing the measuring calliper from the device.
Conclusion: The device is reliable in measuring different clinical landmarks and can be particularly useful in research where measurements need to be standardized when large populations are studied.

KEYWORDS: facial parameters, vertical dimensions of face, facial midline, interpupillary line, vernier calliper.

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1 INTRODUCTION

Evidence of measuring faces in humans can be seen even in a sketch in Windsor Castle by Leonard da Vinci [1] showing the use of various facial measurements as an aid when drawing face. Human face has been a subject of study since ages and many disciplines of medical sciences like general anatomy, ophthalmology, ENT (ear, nose and throat), forensic medicine and dentistry, pediatrics, psychology (science of human expression), genetic engineering, cosmetic and plastic surgery has contributed enormously to its existing knowledge. In dentistry, specialties like orthodontics, oral surgery, Pedodontics, Prosthodontics and cosmetic dentistry have done research, which involves measuring various parameters of the face in order to understand the dynamic relation between structures and at the same time develop new methods or techniques. The dynamic parameters of the face and its relations with surrounding structures have also led to the development of new equipment's, machines, devices and appliances. Landmarks like midline of face, interpupillary line, base of the nose, angle of the mouth, tragus of the ear and so on, are not new to any field of dentistry since researchers have used these landmarks or parameters to expand solutions. One problem that has acquired more attention from researchers, especially in the field of Prosthodontics and orthodontics, is establishing correct vertical dimensions of occlusion (VDO) when it is lost, altered, distorted or even misused. In dentistry, facial measurements have been more extensively used especially since 1887, when Ivy [2] mentioned the role in determining the lost vertical dimensions.

Since then, this critical step has prompted many prosthodontist's to find a constant anthropometric measurement within the face. [3] To make matters more difficult, face shows infinite variety of dynamic patterns. [4], [5] the problem with measurements on face magnify once the subject is rendered edentulous as the 'sinking-in' of the lips, loss of tissue support, [6] along with facial wrinkles complicate measurements. Amongst many procedures, determination of the VDO is an important procedure in the treatment of the edentulous patient. [7], [8], [9]

Methods described in literature to restore lost vertical dimensions that utilizes facial measurements [10-21] directly on the subject are to be recorded multiple times and mostly average of multiple readings is taken into consideration. Various devices like jaw relator, [13] Willis gauge, [14] Dakometer [19] and simple dividers, [22] have been used to record facial measurements. The accuracy of such instruments has been established. [19], [23], [24], [25] Other mechanical methods that have been advocated include use of a Bimeter that measures biting force, [26], [27] strain gnathodynamometer that measures increase in closing forces, [28] a central bearing device through which patient's tactile sense verifies the correct VDO [29] and a jig to determine interocclusal distance. [30]

To eliminate the errors introduced by measuring soft tissues, the significant role of cephalometric radiographs, [31] introduced first as a Broadbent Boltan cephalometer [32] and since then has been extensively used for studying vertical dimensions of occlusion. Radiographs have been used to verify the reliability of various facial measurements [33], [34], [35], [36] Pre extraction methods for VDO determination include mounted diagnostic casts, [37] making of transparent vacuum formed template [38] and use of existing dentures [39], [40]

When multiple measurements are done on subjects face, it is important that the subject and the measuring device remain in constant relation to each other. This article in the form of innovation has designed a new instrument that has the basic feature of a cephalostat which has been modified to hold the measuring digital calliper at its end. For descriptive purpose the device has been named as Subject stabilizing device (SSD)

2 SUBJECT STABILIZING DEVICE (SSD)

A device that would allow the observer/ operator to measure distances between various landmarks was based on the principle that the device should be heavy, allow the circumference of the head to fit within the device, should carry a measuring device to any part of the face, including the lateral surfaces and be inexpensive, resist wear and minimize incorporation of errors due to the subject, observer or because of its own function and be universally applicable and acceptable. With the above principles in mind, the first step of such designing was to collect data of different human races. This data comprised of various measurements of human head like length, width of face, circumference of head at different points, distances of anterior part of the face from the shoulder and neck, width of the human shoulders, the angle of the chin with the neck in various facial relations and the distance of the bridge of the nose from the surface of the face in various races. After analysis of the data, a blue print of the device was designed that could accommodate the size of any human subject. (**Fig 1)**

Structure:

The Subject stabilizing device comprises of following parts:-

1- Horizontal Platform or base with four plastic adjustable pins.
2- Chin rest (adjustable)
3- "U" shaped frame connected to the base.
4- Head positioner.
5- Horizontal arm, which is attached to one side of the "U"-shaped frame. It has 3 components:-

a) A swivelling arm, which has 4 detachable, movable and adjustable short horizontal components (**Fig. 2**)
b) Attachment for vernier or any other measuring device connected to the rest through a ball and socket joint.
c) Magnetic disc.

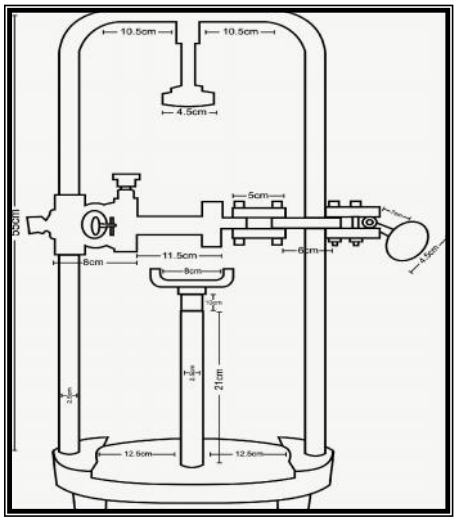


Figure 1: Schematic diagram of the device with various dimensions

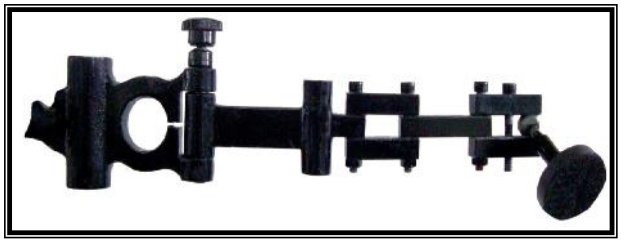


Figure 2: Design and components of swivelling arm

Horizontal Platform: - The horizontal platform or base of the device is made of heavy metal so as to self-resist destabilizing forces as a result of subject's movement of the head or while the observer is moving the horizontal arm. The platform consists of four plastic adjustable cylinders that are connected through a screwed pin. Rotation of the plastic cylinders clockwise or anticlockwise allows the base to be adjusted parallel to the floor on which the device is placed. Aligning the base in such a manner prevents the binding of the subject's head within the device and allows the head positioner to adapt properly to the contour of the subject's head. Extension of the screw to permanently clamp the whole device to any working table if and when the device is to be used for the permanent research area is also incorporated. Such a feature is advantageous in institutes where large population has to be studied. The horizontal platform carries two components on its superior surface. The position of these two components is designed according to the most comfortable position of the subject and the observer. The platform is oval shaped with a maximum width of 40 centimetres on one side and 30 centimetre's maximum on the other side. The rest of the borders are tapered towards each other.

Chin Rest: - Measurement of individual parameter does not consume much time for the person who is recording, but in a study where many such measurements are taken for many parameters it is important that the subject is comfortable. One such feature of comfort is the chin rest. The chin rest is a simple plastic holder which can be further customized e.g. a leather

or foam casing, according to the individual need. The chin rest is designed to be vertically adjustable with a simple double hollow cylinder design, wherein the diameter of one cylinder is slightly less than the other. The subject superior aspect of the head has to contact the head positioner and the chin rest has to be adjusted accordingly. Once the vertical height is adjusted the vertical rest is locked, thereby stabilizing the head. Between the head positioner and the chin rest the subject's head is comfortably stabilized and not allowed to move.

"U" Shaped Frame: - is a hollow cylindrical rod of 1" diameter that has a uniform bend, the two sides of which are fastened within the horizontal platform and is permanently fixed to the base. The length of each leg of this frame is about 22 inches. One leg of the frame carries the horizontal arm, which can be adjusted in a vertical direction according to the convenience of the observer and the subject. A vertical extension towards the horizontal platform at the mid portion is the head positioner. The horizontal arm attachment can be loosened or tightened with a screw.

Head Positioner: - This is a vertical extension which carries a plastic disc about 4 cms in diameter, at its end that is concave from down inside. This allows the surface contour of the parietal portion of the subjects head to fit snugly into the subject and device stabilizing device (SSA) without causing any discomfort to the subject. This component is permanently fixed to the u shaped frame.

Horizontal Swivelling Arm (Fig.2): - The "U" shaped frame also carries the horizontal swivelling arm on its one side which can be detached from the main device. The horizontal arm is broken into four flexible joints that allow the arm to be freely adjusted in horizontal direction. This feature also extends the length of the arm so that the device that is attached at the end can be aligned on the left side of the subject's face to measure any parameter. In order to bring the device on the right side of the subject's face, the first joint is short and can be moved away from the face, which brings the device holder towards the right side of the subject's face. The second and the third joint is just a split extension of the arm so that it can be adjusted in any part of the face. At the end of this horizontal arm is attached an attachment for measuring device i.e. a digital vernier or any other measuring device. At this junction is attached a magnetic disc, which is connected with ball and socket arrangement. This feature allows the free positioning of the vernier in not only vertical and horizontal direction, but it can also move inward and outward with this arrangement (**Fig.3**). The entire feature allows the observer to place the vernier on any part of the subject's face. The subject and device stabilizing device (SSA) is designed to allow the observer to measure distance between any two points on the face without changing his position or the subject's position, a feature unique to this device. The horizontal arm can swivel around 360 degrees as well as move vertically along the entire length of the subject's face. This feature again allows the horizontal arm to be brought to the right and the left of the subject. Observers, who are left handed and would like to manipulate the digital vernier with their left hand, just have to use the horizontal arm on the other side.



Figure 3: Subject stabilizing device

3 MATERIALS AND METHODS

Following the fabrication of the device, its reliability was checked clinically by measuring the chin, nose distance that is used to measure the vertical dimension of occlusion in completely edentulous patients. Sixty complete dentures were fabricated using the above mentioned device by various post graduate students under the supervision of experienced staff in the field of removable prosthodontics. The supervisors were not told that the vertical dimensions incorporated in the prosthesis were recorded using the device. Out of sixty patients, only two post graduates were told to alter the recorded vertical dimensions of occlusion. For the same subjects interpupillary distance was measured on the device following which the same distance was verified with the optometrist. Among all subjects, three subjects had different values which were within a fraction of a millimetre.

4 DISCUSSION

There is enough literature that shows the use of mechanical devices like simple gauge, simple to digital callipers and in some instances different types of scales that have been used to measure two distant points on the face. Though the reliability of such instruments cannot be questioned, but the manner in which they have measured raised doubts about the reliability of the results. The holding of the instrument in hand and placing the instrument on the face cannot be relied as both the subject, one who is measuring and the other on whom the measures are taken are not stable and fixed and as a result error is incorporated.

Subject Stabilizing Device (SSA) eliminates the drawbacks and errors in measurements between two points as a result of handheld devices for measuring along with unstable head position of the subject as given in the past literature. The stabilization of subjects had at one place along with the fixation of the measuring device to the same instrument eliminates all the errors arising through movements of subjects head and neck, variable pressure applied by the observer on the device, transfer of device to a measuring scale and frequent shifting of subject as well as observer while recording different points

within the same face. The horizontal arm of the device is dynamic in nature as well as entire horizontal arm can be adjusted vertically as well as could be kept fixed in one place. The joints within horizontal arms allows the measuring device to record all five measurements (three times each) without the subject moving his/her head even once. This makes any measurement on face accurate, less time consuming and convenient for the observer and the patient. The ball and socket joint allows free movement of the entire digital vernier calliper which gives the observer the freedom of placing either the external or internal jaws without changing the subject between various measurements.

5 CONCLUSION

Correct determination of vertical dimensions is important when using facial measurements for research and clinical purpose. A detailed review of literature regarding the methods used to determine vertical dimensions of occlusion has been described along with a new instrument that has been designed to overcome the flaws with previous methods of measuring with callipers. The instrument is extremely beneficial where a large data is to be collected in a short time. The feature of the instrument is its flexibility to measure any point on face without moving the subject or the operator.

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REFERENCES

[1] Da Vinci L. Her Majesty's collection at Windsor Castle (Clark, Kenneth A. *Catalogue,* 1935.
[2] R.S. Ivy. Dental and facial types. The American system of dentistry. *Operative and prosthetic dentistry*, 1887. Vol 2; Edinburg, Pentland: p. 1030.
[3] W.L. Wylie. The Naso-Meatal line as a guide for the determination of the occlusal plane. *Dent Res.* 1944; 23: 309-312.
[4] A. Goldstein. Potentials in pattern of mandible. *Angle Orthodontics.* 1959; 29: 206-217.
[5] W.L. Wylie. The relationship between ramus height, dental height and overbite. *Am J Orthodontics* 1946; 32:56-67.
[6] J.R. Thompson. The rest position of the mandible and its significance to dental science. *J.A.D.A* 1946; 33:151.
[7] J.D. Rugh, C.J. Drago. Vertical dimension: A study of clinical rest position and jaw muscle activity. *J Prosthet Dent* 1981; 45: 670-5.
[8] L.B. Toolson, D.E. Smith. Clinical measurement and evaluation of vertical dimension. *J Prosthet Dent* 1982; 47:236-41.
[9] F. Fayz, A. Eslami. Determination of occlusal vertical dimension: A literature review. *J Prosthet Dent* 1988; 59:321-3.
[10] J.F. McCord, A.A. Grant. Registration: Stage II - Intermaxillary relations. *Br Dent J*. 2000; 188:601-6.
[11] G. Villain. Principle generaux appliqué aux different. *Prostheses*, p. 15 Libraire J. B. Baillere Fils, Paris.
[12] A.J. Brodie. Some recent observations on the growth of the jaws and eruption of the teeth. *Angle Orthodontist* 1940; 10: 63-77.
[13] D.J. Goodfriend. Symptomatology and treatment of abnormalities of the mandibular articulation. *Dent Cosmos* 1933; 75: 844, 947.
[14] E. Niswonger. The rest position of the mandible and the centric relation. *JADA*. 1934; 21:1572-82
[15] F.M. Willis. Features of the face involved in full denture prosthesis. *Dent Cosmos* 1935; 77:851.
[16] G.F. McGee. Use of facial measurements in determining the vertical dimension. *J Am Dent Assoc* 1951; 43:160-3.
[17] W. Harvey. Investigation and Survey of malocclusion and ear symptoms with particular reference to Otic Baro trauma. *Br Dent J* 1948; 85: 221-5.
[18] E. Pound. Recapturing esthetic tooth position in the edentulous patient. *Am Dent Assoc* 1957; 55:181- 91
[19] M.A. Pleasure. Correct vertical dimension and freeway space. *J Am Dent Assoc* 1951; 43: 160-3.
[20] H.R.B. Fenn, K.P. Liddelow. *Clinical prosthesis*, Ed (1). 1953; Staples Press, London: 191.
[21] C. Chawla, H. Prakash, R. Duggal. Facial measurements as a means of determination of vertical dimension. *J Ind Prosthet Dent* 2000; 11: 33-41
[22] A.J. Bowmann, A.O. Chick. A note on facial proportions. *Br Dent J* 1962 112: 288-9
[23] M.M. Silverman. Determination of vertical dimension. *J Prosthet Dent* 1962; 14: 560-67
[24] A.J.W. Turrell. The pre-extraction recording of the vertical dimension by an intra-oral method. *Dent Pract Dent Res*. 1955; 6: 68-72.

[25] S. Imber, D.R. McMillan. The accuracy of facial measurements using the Willis bite gauge. *Dent Pract Dent Res* 1968; 18: 213-7.
[26] R. Moyers. An electromyographic analysis of certain muscles involved in the temporomandibular joint movement. *Am J Orthod* 1950; 36:481-86.
[27] R.H. Boos. Intermaxillary relation established by biting power. *J Am Dent Assoc* 1940; 27:1192-97.
[28] E. Smith. Method of securing centric relation and other positional records in complete denture prosthesis. *JADA* 1941; 28: 37-43.
[29] L.K. Ann. Determination of vertical dimension by biting force. *Malaysian Dent J* 1967; 7:23-38
[30] R. Lytle. Vertical relationship of occlusion by the patient's neuromuscular preceptor. *J Prosthet Dent* 1964; 14: 12-18
[31] R.G. Willie. Trends in clinical methods of establishing an ideal interarch relationship. *J Prosthet Dent* 1958; 8: 243-51
[32] H.T. Perry. The rest position of the mandible and its significance to dental science. *JADA* 1974; 89: 45-50.
[33] A.G. Brodie: Growth pattern of human head from third month to eighth year of life. *Am J Orthodontics* 1941; 68:209-262.
[34] J.E. Pyott, A. Schaeffer. Simultaneous recording of centric occlusion and vertical dimension. *JADA* 1952; 44: 430-436.
[35] P.J. Coccaro. Factors in the position of the mandible. *JADA* 1965; 12:70-9.
[36] D. Brzoza. Comparison of the most comfortable mandibular position with the intercuspal position using cephalometric analysis. *J Oral Rehabil* 2005; 9:12-8
[37] V.S. Bhat, M. Gopinathan. Reliability of determining vertical dimension of occlusion in complete dentures: A clinical study. *J Ind Prosthet Dent* 2006; 6:38-42.
[38] C.H. Hickey, G.A Zarb, C.L. Bolender. Boucher's prosthodontist treatment for edentulous patients. 9th Ed. St Louis: CV Mosby; p. 174-203, 1985.
[39] M. Bissasu. Pre-extraction records for complete denture fabrication: A Literature review. *J Prosthet Dent* 2001; 91: 55-8.
[40] M. Bissasu M. Copying maxillary anterior natural tooth position in complete dentures. *J Prosthet Dent* 2004; 67: 668-9.

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Phytochemical profile of *Baliospermum montanum (Wild.) Muell. Arg.*

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ABSTRACT: The present study reveals the qualitative and quantitative analysis of the major bioactive constituents of different parts such as root, stem, leaf, flower and latex of medicinally important plant *Baliospermum montanum* using seven different solvents. Qualitative study of Alkaloids, Carbohydrates, Glycosides, Steroids, Flavonoids, Coumarins, Saponins, Fatty acids, Tannins, Protein and Amino Acids, Gum and Mucilage, Terpenoids, anthroquinones and Phenols showed variable of results in different solvents. Quantitative estimation revealed that phytochemicals are in between the following range alkaloids (6.2 - 9.5%), flavonoids (35.63-43.33%), Saponins (9.9 to 13.2%), phenolics (38.43 to 43.44%), tannins (13.26 to 18.3%), terpenoids (25.36 to 33.4%).

KEYWORDS: *Baliospermum montanum*, Euphorbiaceae, Phytochemicals screening.

1 INTRODUCTION

Baliospermum montanum (Wild.) Muell. Arg., (Hindi: danti, Kannada: kaadu haralu, Malayalam: katalavanakku, Marathi: buktumbo Sanskrit: kakubha, Tamil: appaiccevakam, Telugu: ettadundiga) belongs to Euphorbiaceae family. *Baliospermum montanum* is a stout undershrub with numerous branches. Plant is 10 cm to 8 m in height with herbaceous branches from the roots. Leaves are simple, toothed with undulations. Upper leaves are small, lower ones large, sometimes, 3-30 cm long, 1.5-15 cm broad. Male and female flowers are separated, seen in the same flowering branch, about 3 mm across, greenish yellow, arranged in axillary and terminal racemes, spikes or fascicles. Capsules are distinctly 3-lobed, obovoid, stony, 8-13 mm diameter, minutely densely pubescent. Seeds are egg-shaped.

B. montanum is distributed throughout the sub-Himalayan region from Khasi Hills to Kashmir. It is common in Bihar, West Bengal, and Peninsular and Central India. In Ayurveda, roots are used to cure jaundice, leucoderma, skin diseases, wounds, and as an anthelmintic [1]. Leaves are found to be useful in asthma, bronchitis [2] and in treating abdominal tumor [3]. Seeds are used as purgative and in gastric complaints [4]. Decoction of stem is used to get relief from toothache [5].

Phytochemicals are, literally, “The plant chemicals”. They provide protection, color, odor and taste to the plants. Many evidences have come up showing the effects of phytochemicals on chemical process in human body, when they are ingested. The majority of these bioactive compounds are alkaloids, carbohydrates, glycosides, steroids, flavonoids, coumarins, saponins, fatty acids, tannins, protein and amino acids, gum and mucilage, terpenoids, anthroquinones and phenols. For developing new drugs, the ethnobotanical research and phytochemical test are imperative.

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2 MATERIALS AND METHODS

2.1 COLLECTION OF PLANT MATERIAL

Baliospermum montanum (Wild.) Muell-Arg was collected from Sirsi, Western Ghats of Karnataka and now the plant is being maintained in the Department of Molecular Biology, Bangalore University, Bangalore.

2.2 PREPARATION OF PLANT EXTRACT

Leaf, stem, root and flowers were collected from *B. montanum*. They were dried for one week at room temperature (in shade). Dried plant parts were grinded in a blender to fine particles. Crude plant extract was prepared by Soxhlet extraction method. Seven different solvents were used namely methanol, ethanol, water, chloroform, petroleum ether, hexane and acetone. 20 gm of dried fine grinded powder was uniformly packed into thimble and phytochemicals were extracted with 250 mL of seven mentioned solvents separately. The extraction was carried out for 24 hours. Later extract was concentrated by keeping it on hot plate at 30 to 40°C and stored at 4°C for further analysis.

2.3 COLLECTION OF LATEX

Latex sample was collected early in the morning from plant by twinging the leaves near the stem and branches of the plant and latex was allowed to drain in clean glass tube, and it was stored at 4°C, chilled latex was homogenized and filtered through muslin cloth for further phytochemical study.

2.4 PHYTOCHEMICAL PROFILING

QUALITATIVE AND QUANTITATIVE STUDY

The extracts were subjected to both qualitative and quantitative phytochemical tests of secondary metabolites viz. alkaloids, anthroquinone, cardiac glycosides, flavonoid, phenols, phylobatannins, saponin, steroids, tannins and terpenoids using standard procedures [6], [7], [8].

3 RESULTS

Table 1- Qualitative analysis of different parts like root, stem, leaf, flower and latex of Baliospermum montanum using different Solvents-

Plant name	W	Ac	Et	Mt	Ch	Hx	Eth	Tests	Phytochemicals
BM (leaf)	-	-	+	+	+	-	+	Dragendorff's	Alkaloids
BM (stem)	-	-	+	+	-	+	+		
BM(flower)	-	-	+	+	-	-	+		
BM (roots)	-	-	+	+	-	-	+		
BM (leaf)	-	-	+	+	-	-	+	Mayer's test	
BM (stem)	-	-	+	+	-	-	+		
BM(flower)	-	-	+	+	-	-	+		
BM (roots)	-	-	+	+	-	-	+		
BM (leaf)	-	-	+	+	-	+	+	Wagner's test	
BM (stem)	-	-	+	+	-	+	+		
BM(flower)	-	-	+	+	-	-	+		
BM (roots)	-	-	+	+	-	-	+		
BM (leaf)	-	-	-	-	-	-	-	Borntreger's test	Anthroquinones
BM (stem)	-	+	-	-	-	-	-		
BM(flower)	-	+	-	-	-	-	-		
BM (roots)	-	+	-	-	-	-	-		
BM (leaf)	+	+	+	+	-	-	-	Molisch's test	Carbohydrates
BM (stem)	+	+	+	+	-	-	-		
BM(flower)	+	+	+	-	-	-	-		
BM (roots)	-	-	+	+	-	-	-		

BM (leaf)	+	+	+	+	-	-	-	Barford's test	
BM (stem)	+	+	+	+	-	-	-		
BM(flower)	+	+	+	-	-	-	-		
BM (roots)	-	-	+	+	-	-	-		
BM (leaf)	+	+	+	+	-	-	-	Benedicts test	
BM (stem)	+	+	+	+	-	-	-		
BM(flower)	+	+	+	-	-	-	-		
BM (roots)	-	-	+	+	-	-	-		
BM (leaf)	+	+	+	+	-	-	-	Keller- Killiani test	Cardiac Glycosides
BM (stem)	+	+	+	+	-	-	-		
BM(flower)	-	-	-	+	-	-	+		
BM (roots)	-	-	-	+	-	-	-		
BM (leaf)	-	-	-	-	-	-	-	Using NaOH	Coumarins
BM (stem)	-	-	-	-	-	-	-		
BM(flower)	-	-	-	-	-	-	-		
BM (roots)	-	-	-	-	+	-	-		
BM (leaf)	-	-	-	-	-	-	-	Paper test	Fatty acids test
BM (stem)	-	-	-	-	-	-	-		
BM(flower)	-	-	-	-	-	-	-		
BM (roots)	-	-	-	-	-	-	-		
BM (leaf)	-	+	+	+	+	-	-	Shinoda test	Flavonoids
BM (stem)	-	+	+	+	+	-	-		
BM(flower)	-	+	+	+	+	-	-		
BM (roots)	-	+	+	+	+	-	-		
BM (leaf)	-	+	+	+	+	-	-	Alkaline reagent test	
BM (stem)	-	+	+	+	+	-	-		
BM(flower)	-	+	+	+	+	-	-		
BM (roots)	-	+	+	+	+	-	-		
BM (leaf)	-	+	+	+	+	-	-	Lead acetate test	
BM (stem)	-	+	+	+	+	-	-		
BM(flower)	-	+	+	+	+	-	-		
BM (roots)		+	+	+	+	-	-		
BM (leaf)	-	-	-	-	-	-	-		Gum and Mucilage
BM (stem)	-	-	-	-	-	-	-		
BM(flower)	-	-	-	-	-	-	-		
BM (roots)	-	-	-	-	-	-	-		
BM (leaf)	+	-	-	-	-	-	-	Ninhydrin test	Protein and Amino Acids
BM (stem)	+	-	-	+	-	-	-		
BM(flower)	+	-	-	-	-	-	-		
BM (roots)	+	-	+	-	-	-	-		
BM (leaf)	-	+	+	+	-	-	-	Ferric chloride test	Phenols
BM (stem)	-	+	+	+	-	-	-		
BM(flower)	-	+	+	+	-	-	-		
BM (roots)	-	+	+	+	-	-	-		
BM (leaf)	+	-	-	+	-	-	+	Frothing test	Saponins
BM (stem)	-	-	-	-	-	-	-		
BM(flower)	+	-	-	-	-	-	+		
BM (roots)	+	-	-	-	-	-	-		
BM (leaf)	-	-	-	+	-	-	-	Liebermann Burchard reaction	Steroids
BM (stem)	-	-	-	-	-	-	-		
BM(flower)	-	-	-	-	-	-	-		
BM (roots)	-	-	-	-	+	+			
BM (leaf)	-	-	+	-	-	-	-	Using FeCl3	Tannins test

BM (stem)	+	-	+	+	-	-	-		
BM(flower)	+	-	+	+	-	-	-		
BM (roots)	+	-	+	+	-	-	-		
BM (leaf)	+	-	+	+	+	+	+	Salkowski test	Terpenoids
BM (stem)	+	-	+	+	+	+	+		
BM(flower)	+	-	+	-	+	+	+		
BM (roots)	+	-	+	+	+	+	+		

BM= Baliospermum montanum, W=water, Ac=Acetone, Et= Ethanol, Mt= Methanol, Ch= Chloroform, Hx=Hexane, Eth= ether, + = present, - = absent

Table 2- Qualitative analysis of latex of Baliospermum montanum

Test	Observations
Alkaloids i)Mayers test ii)Wagners test iii) Dragendorffs test	 + + +
Cardiac glycosides	+
Phenolic compounds	-
Flavonoids	+
Terpenoids	+
Tannins	+
Saponins	+
Anthroquinone	-
Phlobatannins	-

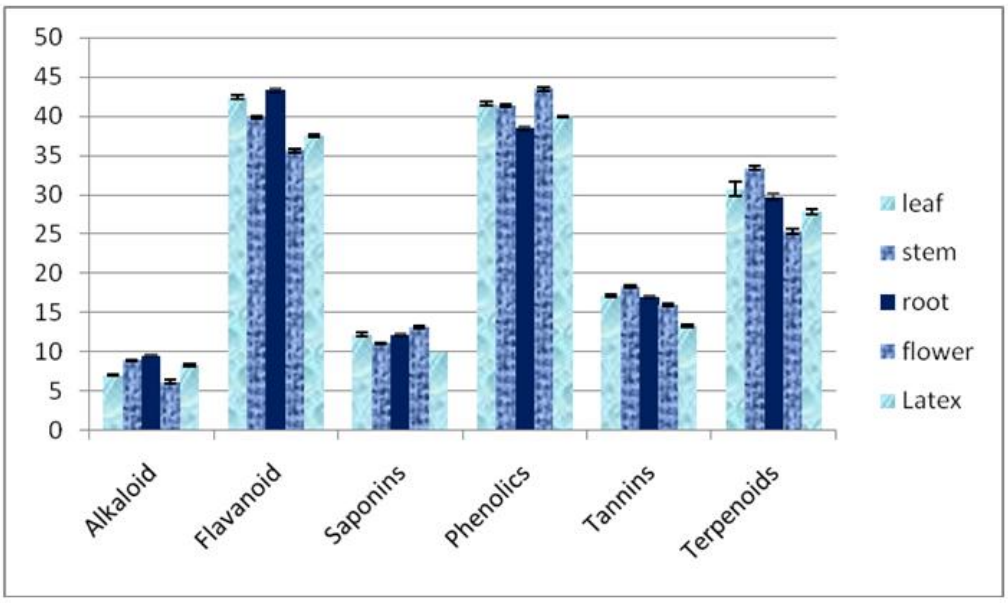


Fig:1- Quantitative estimation (%) Secondary metabolites of different parts of Baliospermum montanum, n=3, Data is presented as Mean± SD.

4 DISCUSSION

Medicinal plants are of great importance to the health of individuals and communities. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body [9]. These chemicals are called as phytochemicals. Secondary metabolites are non nutritive phytochemicals which are produced at different developmental stages, under stress conditions and plays important role in giving protection against pathogen attack. When

these phytochemicals are ingested by humans, it enhances their resistance power [10]. The medicinal properties of phytochemicals such as diterpenes, triterpenes, flavonoids, Saponins, tannins, alkaloids, phenol, ricin and esters are reviewed by Julius T. Mwine and Patrick Van Damme, 2011 [11]. They have cited medicinal properties such as anti-tumor, anti-fungal, anti- plasmodial, anti inflammatory, anti-oxidant, anti-viral, anti-mutagenic, vaso-depressor and etc. Due to the versatile nature of phytochemicals, researchers and industries are looking forward the phytochemicals as a rich resource of succeeding drugs. Not only medicinal field but also nutraceuticals and food industry are getting engage in phytochemical research.

Considering the importance and applications of phytochemical study, qualitative and quantitative study of phytochemicals is being carried out worldwide. Jeruto Pascaline [12] evident the presence of phytochemicals in leaf and root of *Clutia abbysinica* using chloroform, methanol and water. Pandith [13] witnessed their presence in *Achyranthus aspera, Acalypha indica* (whole plant) in ethanol and acetone. R.R. venkat raju [14] estimated leaf, shoot and root of 15 species belonging to genus *Phyllanthus* in petroleum ether, methanol and water. S.D. Shruthi [15] conducted preliminary phytochemical test on leaf of *Kirganelia reticulate* in aqueous, ethanol, methanol, chloroform, acetone and hexane solvent

The present study revealed the presence of medicinal active constituents of *Baliospermum montanum*. The phytochemical compounds of *Baliospermum montanum* are qualitatively analyzed for root, stem, leaf, flower and latex separately using seven different solvents and results are presented in Table 1. Qualitative study of alkaloids, carbohydrates, glycosides, steroids, flavonoids, Coumarins, Saponins, Fatty acids, Tannins, Protein and Amino Acids, Gum and Mucilage, Terpenoids, anthroquinones and Phenols variation in the content in different organic solvents as depicted in Table 2.

Quantitative estimation unveil that phytochemicals of different plant parts are in between the following range alkaloid ranges (6.2 -9.5%), flavonoids (35.63-43.33%), Saponins (9.9 to 13.2%), phenolics (38.43 to 43.44%), tannins (13.26 to 18.3%), Terpenoids (25.36 to 33.4%).The estimated quantitative data is presented in Fig 1. Coumarins, fatty acids, gum and mucilage was found to be absent.

5 CONCLUSION

The *Baliospermum montanum* sieved for phytochemical constituents seemed to be good source of medicinally active constituents and turn out to be potential source of modern drugs. This work justifies the need to isolate and characterize the medicinally active compounds.

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REFERENCES

[1] G. M. Ravindra and R.W. Raju, "*Baliospermum montanum* (Danti): Ethnobotany, Phytochemistry and Pharmacology - A review", *International Journal of Green Pharmacy,* Vol. 2 no.4, pp.194-199, 2008.
[2] K. M. Nadkarni, *The Indian Materia Medica*, 3rd ed. Vol. 1 Bombay: Popular Prakashan, 1988.
[3] R.N. Chopra, I.C. Chopra, K.L. Handi and L.D. Kopor, *Indigenous drugs of India* Vol II Academic Publishers Calcutta 1994.
[4] A. K. Goel, A.K. Sahoo and V. A. Mudgal, "*Contribution to the Ethnobotany of Santal Pargana Bihar*," Bulletin of the Botanical Survey of India, pp. 22-26, 1984.
[5] A.V. Bhatt, K. V. Nair, C.A.A. Nair and H.S. Puri, "Ethno-botanical studies in the Silent valley and adjoining areas," *Bulletin* of Medico-*Ethnobotanical* Research, vol.3, pp. 153-161, 1982
[6] G.E. Trease and W.C. Evans, *Pharmacognosy* 11th Edn. Brailliar Tiridel and Macmillian Publishers, London 1989.
[7] J.B. Herborne *Phytochemical Methods* 3rd Edn. Chapman and Hall Ltd., London, pp: 135-203, 1973.
[8] A. Sofowora, *Medicinal Plants and Traditional Medicine in Afric*., John Wiley and son Ltd., pp. 150-153, 1993.
[9] H.O. Edeoga, Okwu D.E. and B.O. Mbaebie, "Phytochemical constituents of some Nigerian medicinal plants," *African Journal of Biotechnology* vol.4 no.7, pp 685-688, 2005.
[10] Sangha R. Bijekar and M.C. Gayatri, "In vitro techniques to accelerate flavonoid synthesis in some Euphorbiaceae members," *International Journal of Innovation and Scientific Research*, vol. 9, no. 1, pp. 54–60, 2014.
[11] Julius T. Mwine and Patrick Van Damme, "Why do Euphorbiaceae tick as medicinal plants? A review of Euphorbiaceae family and its medicinal features," *Journal of Medicinal Plants Research,* Vol. 5, no.5, pp. 652-662, 2011.

[12] Jeruto Pascaline, Mutai Charles, Catherine Lukhoba and Ouma George, *"*Phytochemical constituents of some medicina plants used by the Nandis of South Nandi district, Kenya,*"* *Journal of Animal & Plant Sciences,* vol. 9, no. 3, pp. 1201-1210, 2011.

[13] Pandith Javid Iqbal, *"*Phytochemical screening of certain plant species of Agra city,*"* *Journal of Drug Delivery & Therapeutics*, Vol.2, no. 4, 135-138, 2012.

[14] R.R. venkat raju and C. Lakshmi narasimhudu, "Phytochemical constituents of phyllanthus species (Euphorbiaceae) from eastern ghats of Andhra Pradesh, india," *International research journal of pharmacy*, vol.3 no.5 pp. 184-200, 2012

[15] S.D. Shruthi, A. Rajeshwari, K. Govardhana Raju, A.B. Pavani Avedamaurthy and Y.L. Ramachandran, Phytochemical and antioxidant analysis of leaf extracts from *Kirgenelia reticulate* Baill.," *International Journal of Pharmacy and Pharmaceutical Sciences*, Vol 4, no. 3, 2012.

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Performance Evaluation of Vehicular Data Transfer Protocol Using Metaheuristic Techniques

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ABSTRACT: Vehicular ad hoc networks (VANETs) are the emerging field, which deals with a set of communicating vehicles that are able to deploy Intelligent Transportation Systems (ITS). In this kind of networks, it is difficult to make an ideal configuration of the communication protocols. In this work, we consider a problem which lies in configuring the File Transfer Protocol configuration with the aim of optimizing the amount of data transferred, the transmission time and the number of lost packets in realistic VANET scenarios. In order to do this we have used metaheuristic algorithms, which lie in searching efficient parameters setting of VDTP protocol. The VDTP protocol has been tested by employing five different parameter settings: PSO, DE, GA, ES, and SA. For our tests, two different environment instances of VANETs for Urban and Highway scenarios have been taken. The experiments using ns-2 prove that PSO outperforms all the compared algorithms.

KEYWORDS: VANETs, VDTP, Metaheuristics, optimized configurations, performance analysis.

1 INTRODUCTION

Vehicular Ad hoc Networks (VANETs) [1] [2] are fluctuating networks composed of a set of communicating vehicles (nodes) equipped with contrivances which are able to spontaneously interconnect each other without any pre-subsisting infrastructure. This designates that no accommodation provider is present in such kind of networks as it is conventional in traditional or in mobile cellular communication networks. The most popular wireless networking technology available now days for establishing VANETs is the IEEE 802.11b WLAN, also known as WiFi (wireless fidelity). Incipient standards such as the IEEE802.11p and WiFi direct are promising but still not available to perform authentic tests with them. This imperatively insinuates that vehicles communicate with in a constrained range while moving, thus showing a topology that may change expeditiously and in capricious ways. In such kind of networks, antecedent to its deployment, it is critical to provide the user with an ideal configuration of the communication protocols in order to increment the efficacious data packet exchange, as well as to minimize the transmission time and the network use (with their implicative insinuations on higher bandwidth and lower energy consumption). This is especially true in certain VANET scenarios (as shown in Fig. 1) in which buildings and distances discontinue communication channels usually, and where the available time for connecting to vehicles could be just 1s. The efficient protocol configuration for VANETs without utilizing automatic perspicacious design implements is virtually infeasible because of the large number of possibilities. It is especially arduous (e.g. for a network designer) when considering multiple design issues, such as highly dynamic topologies and decreased coverage. In integration, the utilization of exact techniques is also impracticable due to the time spent during the great number of simulations required. All this motivates the utilization of metaheuristic techniques [3] which arise as well-suited implements to solve this kind of quandaries.

In this paper, we face the File Transfer protocol Configuration in VANETs by betokens of five different optimization techniques. This problem lies in the core of any VANET application, and thus ideal configuration is main concern. Also, we utilize many optimization algorithms because this is an incipient field, and their relative advantages are still obscure. Indeed, we cannot find results for comparisons in the literature since only manual (human expert) VDTP configurations were made so

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far. These algorithms are two swarm astuteness techniques: Particle Swarm Optimization (PSO) [4] and Differential Evolution (DE) [5], two evolutionary algorithms: Genetic Algorithm (GA) [3] and Evolutionary Strategy (ES) [6] and a trajectory search technique, Simulated Annealing (SA) [7]. We have chosen these algorithms because they constitute a representative subset of well-kenned metaheuristics (population and trajectory predicated algorithms), with opportune operators for authentic parameter optimization, and with heterogeneous schemes of population and evolution. This way, we offer a set of initial results sanctioning future comparisons with other modern techniques.

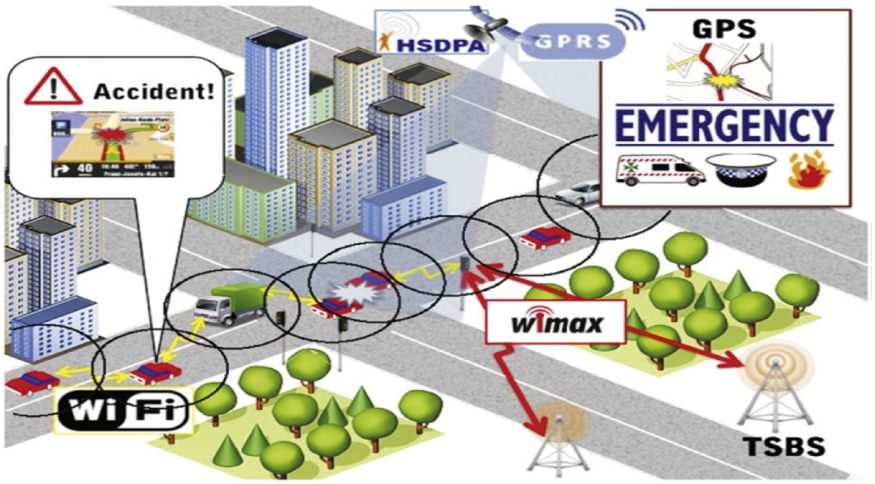


Fig. 1. Typical urban VANET scenario. Circles represent the WiFi coverage of vehicles.

For our experiment, two typical car-to-car environment instances have been taken: Urban and Highway VANETs. We rely both on a flexible simulation structure utilizing ns-2 (The Network Simulator Project—Ns-2) [8] [9], and authentic tests for optimizing the transmission time, the number of lost packets, and the volume of data transferred. One addition contribution of this work is to provide the specialist with an utilizable platform, embedded within ns-2, to configure network protocols and hence obtaining a fair QoS control in VANETs.

2 RELATED WORK

Few cognate works can be found in the specialized literature concerning the utilization of metaheuristics for the optimization of Mobile Ad hoc Networks (MANETs). Vanhatupa [10] proposed a flexible Genetic Algorithm for optimizing channel assignment in mesh wireless networks. In that work, the network capacity was increased by 20% while keeping the coverage above 80%. In Alba [11], a specialized Cellular Multi-Objective Genetic Algorithm (cMOGA) was utilized for finding an optimal broadcasting strategy in Urban MANETs, obtaining in this case three objectives fronts with coverage, bandwidth, and duration as performance metrics. The application of multi-objective techniques in this kind of works provides the specialists with a range of non-dominated solutions which can help them in the decision making process. Nevertheless, the use of (mono-objective) aggregated functions allows us the possibility of weighting the objectives and assigns more (or less) importance to them for better guiding the search. This way, in Dorronsoro [12], six versions of Gas (panmictic and decentralized) were evaluated and prosperously utilized in the design of ad hoc injection networks. From a different point of view, and due to its particular design, ant colony optimization (ACO) has been successfully adapted for implementing new routing protocols for MANETs [13], as well as for resource management [14]. Nevertheless, in these two last cases, the routing load incited by the internal operations of ACOs makes these approaches infeasible for astronomically immense networks. More recently, Huang [15] proposed an incipient routing protocol predicated on a PSO to make scheduling decisions for reducing the packet loss rate in a theoretical VANET scenario.

In our work, besides of utilizing the optimization technique itself as a protocol algorithm, our main contribution consists of ameliorating the performance of a subsisting protocol by optimally tuning its parameters. This way, we will optimistically obtain ideal configurations in the network design phase without incorporating extra management load to the authentic network operation.

3 PROBLEM OVERVIEW

The ideal File Transfer Configuration consists in optimizing the main parameters required by an application communication protocol. This protocol, called VDTP (vehicular data transfer protocol) [16], operates on the transport layer protocols of VANETs, sanctioning the end-to-end file transfer. This implies that considerations about the multi-hop interconnection mode and routing issues can be avoided, since they are carried out by the previous down layer protocols (e.g., UDP, DSR, IP, etc.). Hence, the different vehicles that constitute the nodes in a given VANET can exchange consummate files of information to each other by utilizing VDTP. In this section, we briefly describe the VDTP, detailing the main parameters to be optimized.

3.1 A BRIEF OVERVIEW OF VEHICULAR DATA TRANSFER PROTOCOL

VDTP is an application layer protocol that allows the end-to-end file transfer to be used in VANETs. It operates on Dynamic Source Routing protocol [17]. In VDTP, the communication process is carried out by both a file petitioner, which endeavors to download a file, and a file owner, which stores the file. This communication protocol works by utilizing these packets: FIRQ (File Information Request), FIRP (File Information Reply), DRQ (Data Request), and DRP (data reply). As presented in Fig. 2(a), once the file petitioner kens the designation and the location of a given file, it commences the communication by utilizing the FIRQ packet in order to obtain the file size. Then, the petitioner waits for this information which is sent by the owner by denotes of a FIRP packet. After receiving the information about the file size, the petitioner computes the number of segments in which the file will be split, dividing the file size by the chunk_size. The petitioner commences the transfer by sending a DRQ (1) packet asking for the first segment of the file; then it waits for the first data chunk sent by the owner which utilizes the DRP (1) packet. This operation is reiterated by both, petitioner and owner, until transferring the last chunk DRP (n), and hence making up the consummate file. In VANETs, it is customary to work in a truculent medium which can incite a high number of lost packets during the communication process. In such situation, Vehicular Data Transfer Protocol uses various procedures on the basis of timers and counters to solve such issues.

The timeout mechanism controls the waiting time until a concrete DRQ or FIRQ packet has to be resent (retransmission time). Fig. 2(b) shows an example of how the DRQ and the DRP packets are disoriented (and retransmitted) after an established timeout. The counters are used to control the number of times a packet has been retransmitted. As shown in Fig. 2(c), after an antecedently designated number of retransmissions (total_attempts) of the same DRQ/FIRQ packets, the transmission between the vehicles is refused.

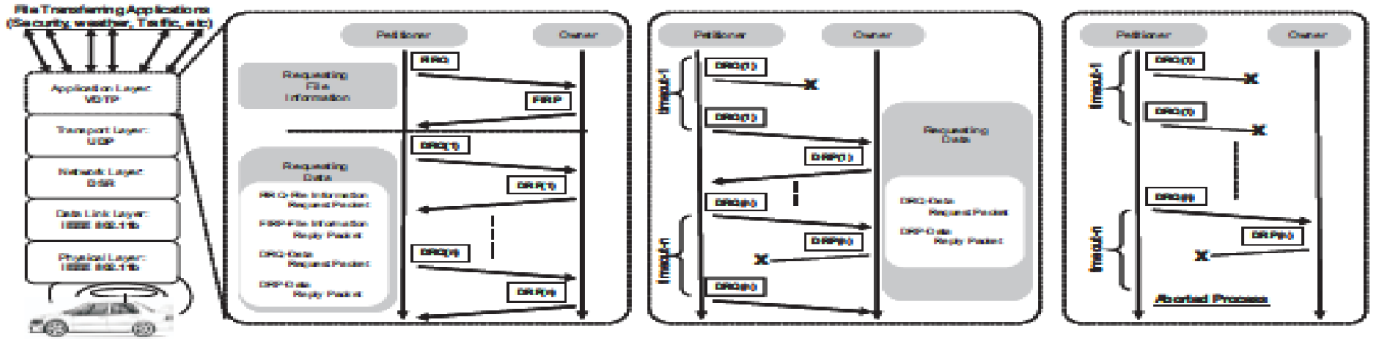


Fig. 2. VDTP operation modes: (a) a complete file exchange is done; (b) timeout expiration and retransmission; (c) communication refused. urban VANET scenario.

3.2 PROBLEM DESIGN VARIABLES

Since we are fascinated with finding the best possible configuration of VDTP, we have fixated on the three aforementioned parameters: chunk_size, retransmission_time and number of total_attempts. Therefore, a given configuration (representing a solution of the problem) is a vector of three authentic values (chunk_size, total_attempts and retransmission_time). The scope of each parameter is:

- chunk_size: R+ ϵ [128…524,288] bytes (524,288 bytes = 512 kBytes),
- total_attempts: R+ ϵ [1….250] attempts,
- retransmission_time: R+ ϵ [1…. 10] s.

4 THE ALGORITHMS

Major In this section we describe a brief overview of the five metaheuristic algorithms used in our study. Concretely, they are Particle Swarm Optimization, Evolutionary Strategy, Differential Evolution, Genetic Algorithm, and Simulated Annealing. These techniques were selected with the aim of experimenting with different population structures, as well as different reproduction mechanisms. We have verbally expressed the same stop condition (reaching a certain number of generations) in all algorithms in order to simplify the following descriptions.

4.1 PARTICLE SWARM OPTIMIZATION (PSO)

Particle Swarm Optimization [4] is a population based metaheuristic inspired in the social behavior of birds with in a flock, and initially designed for continuous optimization problems. In PSO, each potential solution to the problem is called particle and the population of particles is called swarm. SO, each potential solution to the quandary is called particle and the population of particles is known as swarm. Each particle position x^i updated each generation g by betokens of the following equation:

$$x_{g+1}^{i} \leftarrow x_{g}^{i} + v \quad (1)$$

Where factor x_{g+1}^{i} is the velocity of the particle and is given by

$$v_{g+1}^{i} \leftarrow \omega \cdot v_{g}^{i}\ \varphi_1 \cdot (p_{g}^{i} - x_{g}^{i}) + \varphi_2 \cdot (b_g - x_{g}^{i}) \quad (2)$$

In this formula, p_g^i is the best solution that the particle i has stored so far, b_g is the best particle (also known as the leader) that the entire swarm has created, and ω is the inertia weight of the particle (it controls the trade-off between global and local experience). Finally, φ_1(cognitive component) and φ_2(social component) are specific parameters which control the relative effect of the personal and global best particles ($\varphi_1 = \varphi_2 = 2 \cdot$ UN(0, 1)).

Algorithm1 describes the pseudo-code of PSO. The algorithm commences by initializing the swarm (Line1), which includes both the positions and velocities of the particles. The corresponding pi of each particle is randomly initialized, as well as the leader g (Line 2).Then, during a maximum number of iterations, each particle moves through the search space updating its velocity and position (Lines5and 6), it is then evaluated (Line7), and its pi is also calculated (Lines8). At the end of iteration, the leader b is updated.

Algorithm1. Pseudo code of PSO.

1: initializeSwarm ()
2: locateLeader (b)
3: **while** g < maxGenerations **do**
4: **for** each particle x_g^i **do**
5: updateVelocity (v_g^i) **//**Equation 2
6: update Position (x_g^i) **//**Equation1
7: evaluate (x_g^i)
8: update (p_g^i)
9: **end for**
10: updateLeader (b_g)
11: **end while**

4.2 DIFFERENTIAL EVOLUTION (DE)

Differential Evolution [5] is a stochastic population based algorithm designed to solve optimization problems in continuous domains. The population resides of a set of individuals which evolve simultaneously through the search space of the problem. The task of producing new individuals is performed by differential operators such as the differential mutation and crossover. A mutant individual w_{g+1}^i is generated by the following equation:

$$w_{g+1}^{i} \leftarrow v_g^{r1} + \mu \cdot (v_g^{r2} - v_g^{r3}) \quad (3)$$

Where r1, r2, r3 ϵ {1, 2, . . . , i − 1, i + 1, . . . ,N} are random integers mutually dissimilar, and also different from the index i, the mutation constant μ > 0 stands for the amplification of the difference between the individuals v_g^{r2} and v_g^{r3}, and it avoids the stagnation of the search process.

In order to increase even more the diversity in the population, each mutated individual bears a crossover operation with the target individual v_g^i, by means of which a trial individual u_{g+1}^i is produced. A randomly chosen position is taken from the mutant individual to prevent that the trial individual replicates the target individual.

$$u_{g+1}^i(j) \leftarrow \begin{cases} w_{g+1}^i(j) & if\ r(j) \le Cr\ or\ j = j_r, \\ v_g^i(j) & otherwise. \end{cases} \quad (4)$$

As shown in Eq. (4), the crossover operator randomly chooses a uniformly distributed integer value j_r and a random real number r ϵ (0, 1), also evenly distributed for each component j of the trial individual u_{g+1}^i. Then, the crossover probability Cr and r are compared just like j and j_r. If r is less than or equal than Cr (or j is equal to j_r) then we select the jth element of the mutant individual to be allocated in the jth element of the trial individual u_{g+1}^i. Otherwise, the jth element of the target individual v_g^i becomes the jth element of the trial individual. Finally, a selection operator chooses the acceptance of the trial individual for the next generation if and only if it yields a reduction in the value of the evaluation function (also called fitness function f()), as shown by the next Equation:

$$v_{g+1}^i \leftarrow \begin{cases} u_{g+1}^i & if\ f(u_{g+1}^i) \le f(v_g^i), \\ v_g^i(j) & otherwise. \end{cases} \quad (5)$$

Algorithm 2 shows the pseudocode of DE. After initializing the population (Line1), the individuals evolve during a number of generations (maxGenerations). Each individual is then mutated (Line 5) and recombined (Line6).The new individual is selected (or not) following the operation of Eq. (5) (Lines 7and 8).

Algorithm2. Pseudo code of DE.

1: initializePopulation()
2: **while** g < maxGenerations **do**
3: **for** each individual v_g^i **do**
4: choose mutually different (r1, r2, r3)
5: $w_{g+1}^i \leftarrow$ mutation (v_g^{r1}, v_g^{r2}, v_g^{r3}, μ)
6: $u_{g+1}^i \leftarrow$ crossover (v_g^i ,w_{g+1}^i, cp)
7: evaluate (u_{g+1}^i)
8: $v_{g+1}^i \leftarrow$ selection (v_g^i, u_{g+1}^i)
9: **end for**
10: **end while**

4.3 GENETIC ALGORITHM (GA)

Genetic Algorithms [3] are the most popular metaheuristic algorithms. A GA iterates a process in which two parents are selected from the whole population with a given Selection criterion, they are then recombined, the obtained offsprings are mutated, and finally they are evaluated and inserted back into the population following a given criterion. The mutation process is carried out by randomly (uniformly) selecting one of the elements in the solution, and assigning (randomly) a new value in the range as stated in Section 3.1.1. As recombination operator we use here a polynomial crossover defined for continuous variables [3]. Algorithm 3 summarizes the operations of a canonical GA.

Algorithm3. Pseudo code of GA.

1: $P_0 \leftarrow$ initializePopulation()
2: **while** g < maxGenerations **do**
3: P'_g recombine(P_g)
4: P''_g mutate(P'_g)
5: evaluate(P''_g)
6: P_{g+1} select($P''_g \cup P'_g$)
7: **end while**

There are two main versions of GA: steady state GA (ssGA) and generational GA (genGA). The difference between the ssGA and the genGA is the way in which the population is being up dated with the new individuals generated during the evolution. In the case of the ssGA, new individuals are directly inserted into the current population while in the case of the genGA, a new auxiliary population is built with the obtained offsprings and then, once this auxiliary population is full, it entirely replaces the current population. Thus, in ssGAs the population is a synchronously being updated with the newly generated individuals, while in the case of genGAs all the new individuals are updated simultaneously, in a synchronous way.

4.4 EVOLUTIONARY STRATEGY (ES)

Evolutionary Strategy [6] is a metaheuristic algorithm, designed by Rechenberg and Schwefel, also based on the ideas of adaptation and evolution. As common with evolutionary algorithms, the mutation and selection operators are applied to the individuals through a given number of generations. The selection in evolutionary strategies is deterministic and only based on the fitness rankings, not on actual fitness values. We used here a mutation operator as explained in GA.

Algorithm4. Pseudo code of ES.

1: $c_0 \leftarrow$ initializeParent()
2: **while** g < maxGenerations **do**
3: $o_g \leftarrow$ mutate(c_g)
4: evaluate (o_g)
5: **if** f(o_g) is better than f(c_g) **then**
6: $c_g \leftarrow o_g$
7: **end if**
8: **end while**

The canonical ES (Algorithm 4) operates on a population of size two: the current individual (parent c) and the result of its mutation (offspring o). After the parent initialization (Line1), ES starts the evolution process by generating a mutated offspring (Line 3) which is evaluated (Line 4). Only if the offspring has a better fitness than the parent, it takes place the parent of the next generation (Lines 5 and 6). Otherwise the offspring is ignored. This is version of ES is called (1+1)-ES. More generally, in (1+λ) - ES, a population with more than one offsprings (λ) can be generated for being compared with the same parent. In a(1, λ)-ES the best offspring becomes the parent of the next generation while the current parent is always ignored. The most generalized version, (μ +/, λ) - ES, often uses a population of parents (μ) and also recombination as an additional operator.

4.5 SIMULATED ANNEALING (SA)

SA was first presented as a trajectory based optimization technique in [18]. It is inspired in the metallurgy processes of annealing, and basically lies in a local search method with a mechanism that eventually promote solutions of worse quality than the current ones (uphill moves), in order to escape from local minima. The probability of performing such a movement decreases during the search process. The pseudo code of the canonical SA is showed in Algorithm 5.

Algorithm5. Pseudo code of SA.

```
1:  initialize(T, S)
2:  evaluate(S)
3:  while g < maxGenerations do
4:  while not coolingCondition(g) do
5:  S' ← chooseNeighbor(S)
6:  evaluate(S')
7:  if accept(S, S', T) then
8:  S ← S'
9:  end if
10: end while
11: coolDown(T)
12: end while
```

The algorithm works iteratively keeping a single tentative solution S at any time. In every iteration, a new solution S' is generated from the previous one, S (Line 5), and either replaces it or not depending on an acceptance criterion (Lines7–8).The acceptance criterion works as follows: both the old(S) and the new (S') solutions have an associated quality value, determined by a fitness function (f()). If it is worse, it replaces it with probability prob (Eq. (6)). This probability depends on the difference between their quality values and control parameter T named temperature. This acceptance criterion provides the way of escaping from local optima.

$$prob(T, s, s') = \frac{2}{1 + e^{\frac{f(s') - f(s)}{T}}} \qquad (6)$$

As iterations go on, the value of the temperature(T) is reduced following a cooling schedule(Line11), thus biasing SA towards accepting only better solutions. In this work, we employ the geometric rule T(n+1) = α, where 0 < α < 1, and the cooling is performed every k iterations (k is the Markov chain length).

For then neighbor selection, we use a mutation operator (as in GA and ES). The initial value of temperature T is automatically generated in such a way that any movement from the initial (random) solution will be accepted with a certain probability.

5 OPTIMIZATION STRATEGY

Our optimization strategy for this problem is composed of rudiment ally two main components: an optimization algorithm and a simulation process. The optimization part is carried out by (independently) one of the algorithms described in Section 4. All of them are specially adapted to find ideal (or cuasi- optimal) solutions in continuous search spaces (which is the case in this work). The simulation activity is a way of allocating a quantifiable quality value to the factors regulating VDTP, thus leading to ideal configurations of this protocol customize to a given scenario. This procedure is carried out by betokens of the ns-2 simulator in which we have implemented the VDTP protocol for sending files in VANETs.

In each optimization algorithm, the evaluation of each solution is carried out by denoting of the simulation component. As Fig. 3 illustrates, when a given algorithm engenders an incipient solution it is immediately utilized for configuring the VDTP. This configuration evaluates the quality of the solution by utilizing the received retransmission time, chunk size, and total number of endeavors, as expounded in Section3.1. Then, ns-2 is commenced and maps a given VANET scenario instance, taking its time in evaluating the scenario with buildings, signal loss, obstacles, vehicles, velocity, covered area, etc., under the circumstances defined by the three control parameters optimized by the algorithm. After the simulation, ns-2 returns the global information about the transmission time required for sending the file, the number of lost packets engendered during the simulation, and the amount of data transferred between vehicles. This information is utilized to compute the fitness function.

5.1 FITNESS FUNCTION

Since ns-2 operates by simulating (and averaging) many potential variations scenario all fitting the genuine vehicle system, there is a possibility of obtaining different fitness values even utilizing the same VDTP configuration (solution).

Hence, in order to provide each solution with a fitness value as sure as possible, a single estimation of one solution requires N=10 internal simulations, computing the universal fitness (F) as the mean of all ns-2 results:

$$F = \frac{1}{N}\sum_{i=1}^{N}\frac{transmission_time_i + lost_packets_i}{\log(data_transferred_i + C)} \quad (7)$$

In this equation, I ϵ [1…. 10] is the number of simulations per solution evaluation. The factor C=2 avoids division zero if there is no data transference, preventing a possible error in the fitness calculation. The data transferred is presented in logarithmic scale in order to make up for the difference in the range of values. This way, the algorithm looks for minimizing the global fitness.

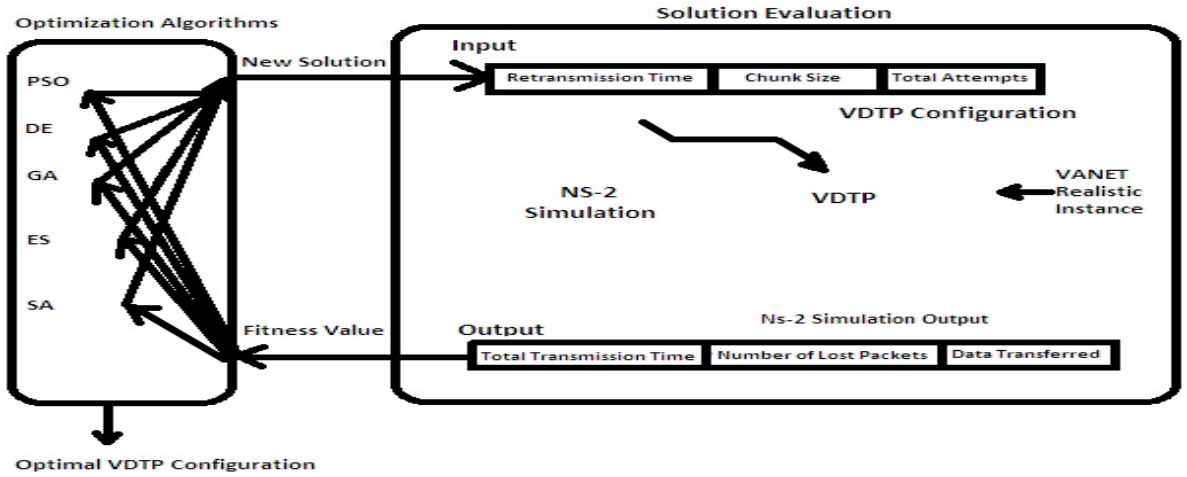


Fig. 3. Optimization strategy for VDTP configuration in VANETs. The algorithms invoke the ns-2 simulator each solution Evaluation

6 EXPERIMENTS

We have utilized the implementation of the five algorithms provided by MALLBA [19], a C++ predicated framework of metaheuristics for solving optimization problems. The simulation phase is carried out by running ns-2 simulator v-2.31.For the experiments; we made 30 independent runs of each algorithm on machines with intel core i3 2.2GHz core, 4 GB of RAM and O.S Linux Ubuntu 12.04.

6.1 INSTANCES: VANET SCENARIOS

We have engendered two simulations VANET scenarios (instances) from authentic Urban and Highway areas of Jaipur, India (selected areas in Fig. 4). These instances have been engendered following the authentic tests carried out by experts with the aim of obtaining as different as possible conditions of speed, quantity of vehicles, obstacles, signal noise, network use, etc. Hence, we can analyze in both scenarios the comportment and performance of the compared algorithms, as well as the differences in the resulting VDTP configurations in terms of communication efficiency. Furthermore, we can compare these automatically engendered configurations against the ones utilized in the authentic experiments by human experts in [20] [21].

6.1.1 URBAN

The Urban scenario covers an area: Approximately 120,000 m^2. It includes no buildings and semaphores. We have utilized VanetMobiSim [22] for engendering an authentic simulation mobility model where vehicles move desultorily according to authentic traffic rules. Around 30 vehicles move with a speed between 30 and 50 km/h, and 20 of them endeavoring to send and receive a file of 1024kBytes.

6.1.2 HIGHWAY

The Highway scenario covers a distance of 1km with two directions. In this case, the absence of obstacles is compensated for the handicap of the high speed of vehicles, which additionally interferes the communication among vehicles. Engendering an authentic simulation mobility model where vehicles move desultorily according to authentic traffic rules. In the Highway VANET, an amount of 30 vehicles move with a speed between 80 and 110 km/h, and 20 of them endeavoring to send and receive a file of 1024kBytes size. The resulted communication environments of Urban and Highway instances, including directions and mobile nodes (vehicles), were mapped in the ns-2 simulator following the VANET designations of contrivances and protocols summarized in Table 1.

Table 1. VANET instance specification.

Parameter	Value
Propagation model	Two ray ground
Carrier frequency	2.472 GHz
Channel bandwidth	5.5 Mbps
Wifi channel	13
Link layer: transceiver	PROXIM ORiNOCO PCMCIA (IEEE 802.11b)
Link layer : antenna gain	7 dBi (Omnidirectional)
Mac protocol	802.11-b
Routing protocol	DSR
Transport protocol	UDP
Application protocol	VDTP
File transfers	20 sessions

6.2 PARAMETER SETTINGS

In our experiments, all studied algorithms were configured in order to perform 1000 solution evaluations per run. At each one of these solution evaluations, ns-2 performs 10 independent simulations of the target scenario with the same protocol configuration as stated in Section5.1.Therefore, the population based algorithms (PSO, DE, GA, and (μ, λ) - ES) were configured with 20 individuals, accomplishing 50 generational steps.

Table 2 summarizes the remaining parameters categorical to each algorithm. These parameters were culled as the most precise after a set of initial tuning experiments. In these, a number of five coalescences of parameters per algorithm and VANET instance were tested performing 10 independent runs per amalgamation, hence results a number of 500 supplemental executions.

Table 2. Parameterization of the optimization algorithms.

Algorithm	Parameter	Symbol	Value
PSO	Local coefficient	φ_1	2.rand(0.1)
	Social coefficient	φ_2	2.rand(0.1)
	Inertia weigh	w	0.5
DE	Crossover probability	Cr	0.9
	Mutation factor	μ	0.1
GA	Crossover probability	Pcros	0.8
	Mutation probability	Pmut	0.2
ES	Crossover probability	Pcros	0.9
	Mutation probability	Pmut	0.1
SA	Temperature decay	T	0.8

Table 3. Final fitness values regarding the Urban and Highway VANET scenarios.

Instance	Algorithm	Mean ± Std. dev.	Minimum	Median	Maximum
Urban	PSO	**1.6346 ± 0.2899**	0.9077	**1.7809**	**1.8918**
	DE	1.7423 ± 0.3717	**0.7389**	1.8658	2.0228
	GA	1.9086 ± 0.2260	0.8799	1.9731	2.1614
	ES	2.1517 ± 0.1266	1.8862	2.1222	2.4246
	SA	2.7850 ± 0.8718	0.8730	2.1663	3.8025
Highway	PSO	**4.1761± 0.2556**	3.3301	4.2513	**4.4554**
	DE	4.6631 ± 0.9328	2.7145	4.2272	7.0531
	GA	4.3805 ± 0.8695	**2.5345**	4.1918	5.8608
	ES	5.7833 ± 0.9705	3.8836	6.1347	6.9421
	SA	4.4246 ± 0.7401	3.1498	**4.0855**	5.7922

6.3 RESULT AND COMPARISONS

In this section we compare the five studied algorithms when solving the ideal File Transfer Configuration quandary on VDTP. The results of fitness values regarding the Urban and Highway VANET scenarios in terms of the mean, the standard deviation, the minimum (best fitness), the median, and the maximum (worst fitness) found in 30 independent runs of every algorithm can be seen in Table3.

For the Urban scenario, we can detect (in Table 3) that PSO getting the best result with regard to the mean fitness. This most diminutive mean value leads us to believe that utilizing the PSO the resulting VDTP ends in an efficient communication which is expeditious and precise between vehicles. In advisement, the best median and maximum values were additionally obtained by PSO, albeit the best minimum (e.g., the best VDTP configuration found for Urban) was reached by DE. This is an expected value, since DE generally shows a pronounced exploitative comportment (utilizing a parameterization proximate to the standard one) [5], while PSO inclines to have an explorative performance utilizing a high inertia (as in this study w=0.5) [23]. Homogeneous results can be observed for the Highway scenario, in which PSO obtained the best mean fitness value again. For this instance, PSO additionally showed the lowest value of standard deviation. This implicatively insinuates a considerable advantage, since it provides our model with a high robustness, which is a crucial issue when designing VANETs. From the results, we found that GA and DE obtained the best VDTP organizations for the Highway instance. The worst organization was obtained by ES.

Table 4. PSO versus other algorithms Signed Rank test with confidence level 95% (p-value=0.05).

	Urban		Highway	
Algorithm	Test	p-value	Test	p-value
DE	▲	0.047	▲	0.001
GA	▲	0.001	Δ	0.453
ES	▲	0.001	▲	0.001
SA	▲	0.001	Δ	0.371

Table 5. Friedman rank test with confidence level 95%.

Urban			Highway	
Algorithm	Rank		Algorithm	Rank
PSO	**1.27**		SA	**1.83**
DE	1.83		GA	1.97
GA	3.07		PSO	2.17
ES	4.33		DE	3.67
SA	4.50		ES	4.97

In order to provide such comparison with statistical meaning, we have applied a Signed Rank [24] statistical test to the distributions of the aforementioned results. We have used this non-parametric test with confidence level of 95% (p-value=0.05), which leads us to ensure that these results are statistically different if they result in p-value < 0:05. Table 4 contains the resulted p-value of applying the Signed Rank test to PSO (the one with the best mean fitness) in comparison with the remaining of algorithms, hence substantiating the differences in results. In this table, the symbol ▲ denotes that PSO is statistically more preponderant than the compared algorithm, whereas the symbol Δ betokens that PSO has a more preponderant rank than the compared algorithm, but without statistical difference.

As we can observe in Table 4, PSO is statistically more preponderant than all compared algorithms for the urban instance. Only DE shows a p-value (0.047) proximate to 0.05, being lower in any case. Concerning the Highway instance, PSO presents the best rank, not far from GA and SA. A general comparison can be made utilizing the Friedman [25] statistical test by betokens of which the algorithms are sorted in a ranked list. Table 5 exhibits the Friedman ranking of the compared algorithms in Urban and Highway scenarios (the best ranked algorithm is in the top). For Urban scenarios, PSO and DE are the best ranked algorithms, but exhibiting SA the last position. However, for Highway scenario, SA obtains the best rank, whereas PSO is situated in the third position.

These statistical results lead us to cerebrate that, in spite of the global best deportment of PSO, the different requisites implicit to both instances implicatively insinuates that each algorithm can show quite different results depending on the VANET scenario on which it operates. For example, DE exhibits a moderate performance in urban scenario while it is the second worst in Highway. The antithesis example can be observed in GA and SA which show impotent results in Urban but highly competitive ones in Highway. Therefore, the VANET designer can cull the optimization model more suited to his/her requisites, and opt ate the best option for each studied VANET scenario.

6.4 PERFORMANCE ANALYSIS

We present now a performance study which fundamentally lies in analyzing the best fitness value, resulted from each function evaluation, during the whole evolution process of a given algorithm Figs. 5 and 6 demonstrate the graphs of the best fitness values (communicate on cost) acquired through the median execution in Urban and Highway instances, properly. We can observe in both graphics that PSO and DE tend to converge in the same range of solution evaluations, although they could improve their fitness even in the final steps of the evolution process. GA shows a kindred trend as the former ones but it is subjected to an early slowness.

Conclusively, the different deportments observed in ES, and categorically in SA, for Urban and Highway instances substantiate us the high dependency of such algorithms to each different VANET instance (they are not robust in this application). Regarding the mean run time that each algorithm spent in the experimentation, Table 6 shows both the mean time in which the best solution was found Tbest, and the global mean run time Trun for Urban and Highway scenarios. In general, SA shows the shortest times to find the best solution for the two VANET instances. We suspect that despite its temperature mechanism, SA expeditiously falls in local optima hence obtaining impotent results in urban scenario. Nevertheless, this demeanor can be an advantage for Highway scenario where SA obtained precise solutions with an expeditious performance as expected in PSO and DE; they spent closed executions times for the two VANET instances since they have homogeneous internal operations this likeness in time consumption was withal registered in GA and ES.

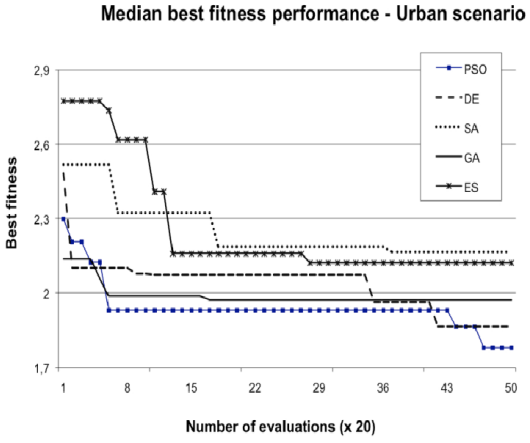


Fig. 4. Median fitness performance in urban scenario.

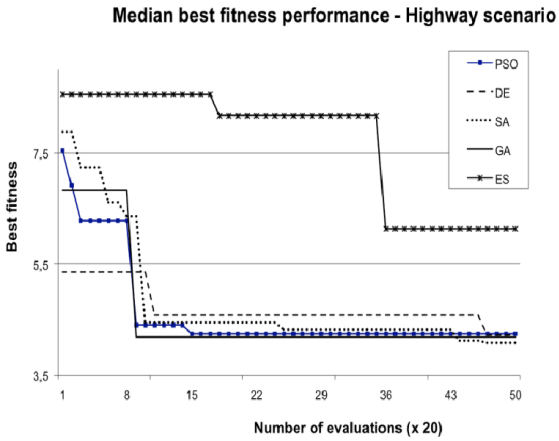


Fig.5. Median fitness performance in highway scenario.

As a summary, the algorithms use between 9.00E+03 and 4.76E+03s for the Urban scenario (150 and 80 minutes, respectively), and between 2.19E+03 and 8.45E+02s for Highway scenario (60 and 23 minutes, respectively). This relative low effort in the protocol design is thoroughly justified by the subsequent benefits obtained in the global data transmission time and loss of packets once the VANET is physically deployed as observed in the following analysis.

6.5 SCALABILITY ANALYSIS

Once we have analyzed the performance of the five algorithms in two different VANET scenarios, we study in performance of these optimization techniques. For this purpose, we have generated two new VANET instances from the initial urban scenario (of Jaipur) by enlarging the metropolitan area considered. Hence, as Fig. 7 shows, the initial urban area (A1) has been augmented to A2 and A3 VANET areas. We have set the traffic flow as described in Section 6.1, also increasing the number of vehicles as follows:

Table 6. Mean execution time (seconds) per independent run of each algorithm for both, urban and highway, scenarios.

Instance	Algorithm	T_{best}	T_{run}
Urban	PSO	4.68E + 03	7.95E + 03
	DE	4.37E + 03	7.12E + 03
	GA	3.48E + 03	6.68E + 03
	ES	5.46E + 03	9.00E + 03
	SA	**2.18E + 03**	**4.76E + 03**
Highway	PSO	1.39E + 03	2.19E + 03
	DE	9.82E + 02	2.10E + 03
	GA	8.83E + 02	1.56E + 03
	ES	9.84E + 02	1.47E + 03
	SA	**5.85E + 02**	**8.45E + 02**

Table 7. Performance comparison in terms of mean fitness and mean optimization time (Tbest) of the three scaled Urban VANETs.

Algorithm	Mean fitness			T_{best}		
	$Urban_{A1}$	$Urban_{A2}$	$Urban_{A3}$	$Urban_{A1}$	$Urban_{A2}$	$Urban_{A2}$
PSO	**1.6346±0.2899**	**1.3920±0.2831**	**3.6763±0.4435**	7.95E+03	5.93E+03	1.20E+04
DE	1.7423±0.3717	1.4504±0.1885	3.9186±0.7419	7.12E+03	1.10E+03	1.43E+04
GA	1.9086±0.2260	1.4100±0.1235	3.6829±0.5063	6.68E+03	9.81E+03	1.41E+04
ES	2.1517±0.1266	1.5462±0.6023	3.7799±0.6227	9.00E+03	8.99E+03	1.50E+04
SA	2.7850±0.8718	2.3880±1.0207	3.8143±0.1260	**4.76E+03**	**3.40E+03**	**5.36E+03**

Table 8. VDTP configurations and simulation output values for the ideal fitness achieved (in the median execution) by all studied algorithms.

Instance	Algorithm	VDTP configuration			Simulation results		
		Chunk size (Bytes)	Retransmission Time (s)	Attempts	Transmission Time (s)	Lost Packets	Data Transferred (kBytes)
Urban	PSO	41.358	10.00	3	**3.41**	**0.27**	1.024
	DE	28.278	6.00	9	3.59	0.63	1.024
	GA	31.196	3.83	9	3.61	**0.27**	1.024
	ES	23.433	10.00	8	3.50	**0.27**	1.024
	SA	19.756	6.43	3	4.22	0.36	1.024
	Human Experts	25.600	8.00	8	4.24	1.60	1.024
Highway	PSO	29.257	6.42	9	**24.67**	3.18	1.024
	DE	19.810	6.91	8	27.66	3.45	1.024
	GA	34.542	9.54	10	26.96	2.72	1.024
	ES	38.490	8.15	12	33.99	3.36	1.024
	SA	32.002	8.21	4	25.43	**2.54**	1.024
	Human Experts	25.600	10.00	10	33.08	3.27	1.024

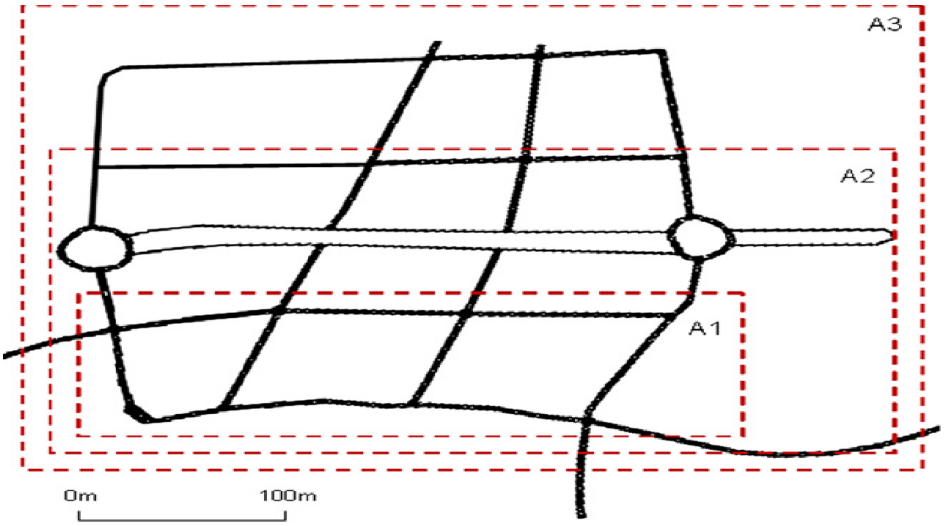


Fig. 5. Three urban areas from jaipur.

- $Urban_{A1}$ with 30vehicles in 120,000m2,
- $Urban_{A2}$ with 40vehicles in 240,000m2,
- $Urban_{A3}$ with 50vehicles in 360,000m2

Component From the point of view of the mean fitness acquired by each algorithm (out of 30 independent runs), we can observe in Table 7 that PSO keeps the best performance for $Urban_{A2}$ and $Urban_{A3}$.

Supplement ally, one of the most fascinating results can be observed in GA, which appears as the second best algorithm in amending its comportment with the VANET size ES obtains reasonable mean fitness values for all network instances, keeping a low standard deviation. The worst results are enlisted by SA in $Urban_{A2}$, and DE in $Urban_{A3}$. Concerning DE, the initial choice of its parameters (Cr=0.9 and μ= 0.1) could lead the algorithm to perform an exploitative search, hence obtaining good results in minuscule instances (the second best for UrbanA1) but damaging its demeanor in more immensely colossal VANETs (the worst for $Urban_{A3}$). In summary, excepting for GA and DE, we can attest that for the scaled VANET instances the performance of the algorithms are kindred to their performances in $Urban_{A1}$ (the initial Urban VANET instance) being PSO always the best procedure.

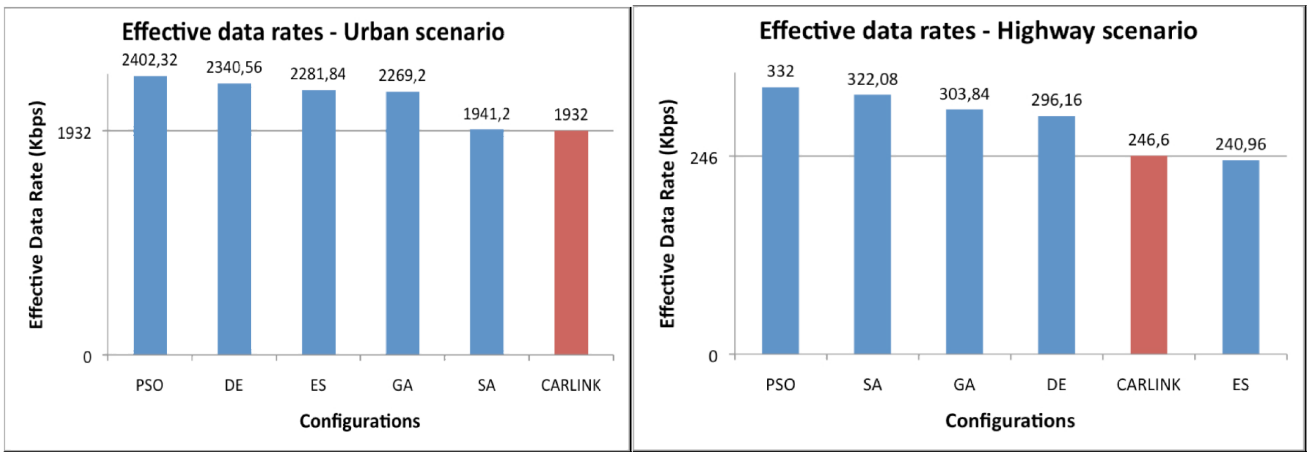
A trivial but withal intriguing observation lies in the mean fitness values, which are in UrbanA2 smaller than in UrbanA1. We suspect that, in spite of the more astronomically immense dimension of UrbanA2, the proportion of communicating vehicles (perm2) in this VANET avails the protocol operation especially for intermediate nodes, hence ameliorating the efficacious ratio of distribution packets and the overall retransmission time. This proportion could not be enough for UrbanA3 where the cost of transmissions is the more astronomically immense one.

Regarding the execution time, Table 7 shows in the three last columns the time required to gain the best solution (Tbest) for each VANET instance. Especially, for PSO, ES, and SA the time required to unify in UrbanA2 is lower than in UrbanA1. This demeanor can be explicated by the fact of obtaining good solutions more expeditious in UrbanA2 than in UrbanA1, where the lower number of vehicles could ruin the communications conditions. On the contrary, the global runtime (Trun) always increases with the network size. This is of course a wonted result.

6.6 QUALITY OF SERVICE (QOS) ANALYSIS

Determinately, from the perspective of the worked VDTP configurations (solutions), we analyze the results in terms of the QoS be speakers considered here: the transmission time, the number of lost packets, and the quantity of data transferred induced in the designed VANET. In this sense, Table 8 exhibits the results after simulating the best solutions found by the studied algorithms. In advisement, the last row of this table contains the results of simulating the configuration of VDTP that has been utilized in the scope of the CARLINK project.

For the Urban VANET, the VDTP configuration obtained by PSO (Chunk_Size=41,358Bytes, Retransmission_Time =10s, and number of Attempts=3) achieves the best performance in terms of transmission time and mean number of lost packets. Concretely, in comparison with the human experts configuration of CARLINK, PSO obtains a reduction in the transmission time of 0.83s (19.5%) registering withal a lower number of lost packets.



a) Urban scenario **b) Highway scenario**

Fig. 6. Effective transmission data rates (throughput) in Kbps achieved during the simulations of the final VDTPconfigurations in comparison with values given by human expert configurations of CARLINK consortium.

However, it is in the Highway scenario was PSO gets the higher time decline of 8.41s (25%) regarding the human experts configuration (from 33.08 to 24.67s).We must notice that, in spite of achieving the PSO a higher reduction in the transmission time than SA and GA, the fact of losing more packets (3.18 in PSO, 2.71 in GA and 2.54 in SA) in the global transference leads SA and GA to calculate a more preponderant fitness value (as shown in Table3). A final analysis can be done concerning one main QoS designator: the efficacious transmission data rate (throughput) achieved. As we can observe in Fig. 8, the VDTP configuration obtained by virtually all algorithms in the two VANET scenarios obtained higher efficacious data rates than the human configured VDTP. Concretely, PSO achieves the highest efficacious data rate (300.29kBytes/s in Urban and 41.54kBytes/s in Highway).This clearly claims for the utilization of these automatic algorithms to help human designers. We again remind that the genuine rectification of efficacious data rates between cars are in the order of tens of kBytes/s, so our savings (58.79kBytes/s iUrban and 10.5kBytes/s in Highway) are genuinely consequential in current authentic applications such as safety, traffic control, and weather presages.

7 CONCLUSIONS

In this paper, we tackle the ideal File Transfer protocol Configuration in VANETs by designates of five popular metaheuristic algorithms. For this, we require an intricate system accounting for a flexible simulation structure targeted for optimizing the transmission time, the number of lost packets, and the quantity of data transferred in simulated and additionally authentic VANET scenarios. The experiments, utilizing ns-2 (well-kenned VANET simulator), disclose that all algorithms are capable of efficiently solve the Ideal File Transfer problem. In the comparisons, PSO performs statistically more preponderant than all algorithms in Urban and statistically more preponderant than DE and ES in Highway. In addition, GA and SA show a competitive performance in Highway. The scalability analysis shows that GA ameliorates with the network size, whereas DE decreases its performance with astronomically immense VANET instances. PSO keeps the best result even for more sizably voluminous instances. From the perspective of its authentic world utilization, PSO can reduce 19% of the transmission time in Urban and 25.43% in Highway with regards to human experts configuration of CARLINK, while transmitting the same amount of data (1024kBytes). The highest efficacious data rates obtained by PSO (of 300.39kBytes/s in comparison with 241.5kBytes/s of human experts) and DE (292.57kBytes/s) in Urban lead us to advise the final utilization of our design algorithms.

As a matter of further work we are presently elongating our benchmark with incipient VANET authentic instances (e.g. consummate cities and highway knots). In integration, we are orchestrating to define incipient optimized configuration schemes for other communication protocols such as: UDP, DSR, etc. which should effectively support authentic VANET design.

REFERENCES

[1] Liming Zheng, Wanlei Li, Bo Xie, "Research on Communications over VANET under Different Scenes and Implementation of Vehicle Terminal", Wireless Communications, Networking and Mobile Computing (WiCOM), 2012 8th International Conference, pp. 1-7, sep. 2012.

[2] Harri, J., Filali, F., Bonnet, C., "Mobility models for vehicular ad hoc networks: a survey and taxonomy", Communications Surveys & Tutorials, IEEE (Volume:11 , Issue: 4) pp. 19-41, Dec. 2009.

[3] Blum, C., Roli, A., "Metaheuristics in combinatorial optimization: overview and conceptual comparison", ACM Computing Surveys (CSUR) 35(3), pp. 268–308, 2003.

[4] Kennedy, J., Eberhart, R., "Particle swarm optimization", IEEE International Conference on Neural Networks 4, 1942–1948, 1995.

[5] Price, K. V., Storn, R., Lampinen, J., "Differential Evolution: a practical Approach to Global Optimization", Springer, London, UK, 2005.

[6] Beyer, H., Schwefel, H., "Evolution strategies: a comprehensive introduction", Journal Natural Computing 1(1), 3–52, 2002.

[7] Rodriguez, F.J., Garcia-Martinez, C., Lozano, M.,"Hybrid Metaheuristics Based on Evolutionary Algorithms and Simulated Annealing: Taxonomy, Comparison, and Synergy Test", Evolutionary Computation, IEEE Transactions, Dec. 2012.

[8] Alba, E., Luna, S., Toutouh, J., "Accuracy and efficiency in simulating vanets". In Modelling, Computation and Optimization in Information Systems and Management Sciences (MCO), Metz, France, pp.568–578, 2008.

[9] The Network Simulator Project—Ns-2. [online] Available in URL (http://www.isi. edu/nsnam/ns/).

[10] Vanhatupa, T., Hannikainen, M., Hamalainen, T., "Optimization of mesh WLAN channel assignment with a configurable genetic algorithm", In 1st International Workshop on Wireless Mesh (WiMeshNets'06), Waterloo, Ontario, Canada, 2006.

[11] Alba, E., "A cellular multi-objective genetic algorithm for optimal broadcasting strategy in metropolitan MANETs", Computer Communications 30(4), pp. 685–697, 2007.

[12] Dorronsoro, B., Danoy, G., Bouvry, P., Alba, E., "Evaluation of different optimization techniques in the design of ad hoc injection networks", In: Workshop on Optimization Issues in Grid and Parallel Computing Environments, part of the HPCS, Nicossia, Cyprus, pp.290–296, 2008.

[13] Di Caro, G. A., Ducatelle, F., Gambardella, L. M., AntHocNet: an adaptive nature-inspired algorithm for routing in mobile ad hoc networks. European Transactions on Telecommunications 16 (5), pp. 443–455, 2005.

[14] Chiang, F., Chaczko, Z., Agbinya, J., Braun, R., Ant-based topology convergence algorithms for resource management in vanets. In Lecture Notes in Computer Science of EUROCAST, vol.4739, pp.992–1000, 2007.

[15] Huang, C., Chuang, Y., Hu, K., "Using particles warm optimization for QoS in ad-hoc multicast", Engineering Applications of Artificial Intelligence 22 (8), 1188–1193, 2009.

[16] Alba, E., Toutouh, J., Luna, S., VDTP: a file transfer protocol for vehicular ad-hoc networks. Technical Report D2006/10, University of Malaga, Spain, 2006.

[17] Johnson, D. B., Maltz, D. A., Broch, J., DSR: The dynamic source routing protocol for multi-hop wireless ad hoc networks. In: Perkins, C.E. (Ed.), Ad Hoc Networking, Chapter5, Addison-Wesley, pp.139–172, 2001.

[18] Kirkpatrick, S., Gelatt, C. D., Vecchi, M. P., "Optimization by simulated annealing", Science 220 (4598), pp. 671–680, 1983.

[19] Alba, E., Luque, G., Garcıa-Nieto, J., Mallba: a software library to design efficient optimization algorithms. International Journal of Innovative Computing and Applications 1 (1), pp. 74–85. 2007.

[20] Alba, E., Toutouh, J., and Luna, S., MEUs ad-hoc communications performance evaluation in highway scenarios (DYNAMIC tests in the CARLINK-UMA scenario) Technical Report D.2.2.5,University of Malaga, Spain, 2008.

[21] Alba, E., Toutouh, J., and Luna, S., MEUs ad-hoc communications performance evaluation in urban scenarios (DYNAMIC tests in the CARLINK-UMA scenario). Technical Report D.2.2.4., University of Malaga, Spain, 2008.

[22] Alba, E., Toutouh, J., and Luna, S., VanetMobiSim: the vehicular mobility model generator tool for CARLINK. Technical Report D1.3.1, University of Malaga, 2007.

[23] Eberhart, R., Shi, Y., "Comparing inertia weights and constriction factors in particle swarm optimization", In Proceedings of the IEEE CEC, vol.1, La Jolla, CA, USA, 2000, pp. 84–88, 2000.

[24] Wilcox, R., "New Statistical Procedures for the Social sciences", Hillsdale, 1987.

[25] Iman, R. L., Davenport, J. M., "Approximations of the critical region of the Friedman statistic", Communications in Statistics 18, pp. 571–595, 1980.

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Implementation of Hermite Normal Form in NTRU Matrix Formulation Algorithm

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ABSTRACT: In this paper, we have shown that applying Hermite Normal Form (HNF) for the matrix formulation algorithm in NTRU public key cryptosystem substantially Increases it efficiency as compare to other PKC, such as Nayak et al.

KEYWORDS: NTRU, Hermite Normal Form, Private Key, Public Key, Encryption, Decryption.

1 INTRODUCTION

Lattices were first studied by mathematician Joseph Louis Lagrange and Carl Friedrich Gauss. Later lattices have been used in public key cryptosystems by Ajtai Dwork (Ajtai and Dwork 1997), Goldreich Goldwasser Halevi (Goldreich et al. 1997) and NTRU (Hoffstein et al.1998)cryptosystem. Lattices have been used recently in computer algorithms and in cryptanalysis. In 1996, Mikls Ajtai showed in a seminal result the use of lattices as a cryptography primitive. NTRU the best among the other lattice based cryptosystems. The NTRU PKC Nayak et al. [7] was designed with invertible matrix. In this paper we use and introduce NTRU cryptosystem for Hermite Normal Form. We also find Key generation, Encryption and Decryption by upper triangular matrix. This cryptosystem is a new design of Matrix formulation algorithm.

NTRU allegedly stands for “Nth Degree Truncated Polynomial Ring Units".NTRU is a public key cryptosystem presented by J. Hoff stein, J. pipher and J. Silverman [4]. The first version of the NTRU encryption system was presented at the crypto 96 conference [4]. The computational basis of the NTRU lies in polynomial algebra and it is a relatively new cryptosystem. NTRU is based on lattice-based cryptography it has different cryptographic properties from RSA and ECC [3]. The strength of cryptographic NTRU performs valuable private key operations much faster in comparison to RSA. Polynomial algebra is the basic building block of the NTRU Encryption system. The truncated polynomials given in J. Silverman [6], P.Prapoorna [5] in the ring $R = Z[X]/(X^N - 1)$ are basic objects and the reduction of polynomials with respect to relatively prime modulo i.e., p and q are the basic tools. NTRU polynomials a(x) are frequently reduced to modulo p and q, the small and large modulo. The large modulus q is an integer, so reduction of $a(x) = a_0 + a_1 x + a_2 x^2 + \cdots\cdots\cdots a_{N-1} x^{N-1}$ (mod q) means just reduction of each a_i modulo q. The small modulo p can also be an integer. It is required that p and q are relatively prime i.e. gcd (p, q) = 1. The main objects in such systems are use of small polynomials; i.e. polynomials with small coefficients. The public key h is defined by an equation f*h = p*g (mod q), where f and g are small polynomials. The polynomial f should always have inverses modulo p and q [1], f*fp = I (mod p) and f*fq = I (mod q). Moreover, the parameters N, p and q are also public, and can be used as common domain parameters for all users. Polynomials f and g are private to the key owner. The polynomial g is needed only in key generation. Firstly Bob chooses two small polynomials f and g in the ring of truncated polynomials and keeps f and g private. He then computes inverse of f (mod p) [fp] and inverse of f (mod q) [fq], where p and q are relatively prime to each other. He then computes h = p*fq*g (mod q), which becomes the public key for Alice and the pair of polynomials f and fp forms his private key pair. The message is also represented in the form of a truncated polynomial. Let it be m. The sender Alice encrypts using the public key i.e. h as e = h*r + m (mod q), where r is a random polynomial basically

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used to obscure the message. This encrypted message may be sent in a public channel. Alice decrypts the encrypted message using his private key pair by performing the following operations:

a = f * e (mod q)
b = a (mod p)
c = fp* b (mod p) where c is the original message:
c = m mod p.

Recently, Nayak et al. [7] have proposed taking invertible or non singular matrix in NTRU cryptosystem [4]. They have given a PKC by method, which is suitable to send in the key generation phase of large message in the form of matrices. Now in this paper, we consider Hermite Normal Form during key generation replacing the invertible matrix of Nayak et al. [7] design. In our opinion Hermite Normal Form makes the PKC more efficient as compare to invertible matrix because HNF is always upper triangular matrix hence easily reducible. This makes the PKC more efficient and more secure as well as time HNF always provides non commutative matrix where as invertible matrix can be commutative also.

2 PRELIMINARIES

In this section, we briefly describe the basic definitions of Hermite Normal Form.

Hermite Normal Form

For any n × m integer matrix A the Hermite normal form (HNF) of A is the unique matrix $H = (h_{i,j})$ such that there is a unimodular n×n matrix U with UA = H, and such that H satisfies the following two conditions:

a) there exist a sequence of integers $j_1 \prec .... \prec j_n$ such that for all 0 ≤ i ≤ n we have $h_{i,j} = 0$ for all $j \prec j_i$ (row echelon structure),
b) for $0 \leq k. < i \leq n$ we have $0 \leq h_{k,j_i} \prec h_{i,j_i}$ (the pivot element is the greatest along its column and the coe_cients are nonnegative).

Thus the Hermite normal form is a generalization over Z of the reduced row echelon form of a matrix over Q. Just as computation of echelon forms is a building block for many algorithms for computing with vector spaces, Hermite normal form is a building block for algorithms for computing with modules over Z (see, e.g.,[Coh93, Chapter 2]). Hermite Normal Form (HNF) matrices are a standard form of integer matrices used in application such as lattice based cryptography and integer programming.

3 BRIEF REVIEW OF NAYAK ET AL. [7] MATRIX FORMULATION FOR NTRU CRYPTOSYSTEM

3.1 KEY GENERATION

Key is Bob creates a public/private key pair. He first randomly chooses two matrices X and Y , where matrix X should be an invertible matrix (modulo p). Bob keeps the matrices X and Y private, since any one who knows either one of them will be able to decrypt messages sent to Bob. Bob's next step is to compute the inverse of X modulo q and the inverse of X modulo p. Thus he computes matrix Xq and Xp which satisfies X *Xq = I (modulo q) and X *Xp = I (modulo p).

(Bob can ensure the existence of inverse of matrix X by checking X is non-singular and X is invertible mod p (i.e.[det[X]](mod p ≠0).Otherwise he needs to go back and choose another matrix X). Now Bob`s computes the product H = p* Xq*Y (modulo q). Bob's private key is the pair of matrices X and Xp and his public the matrix H.

3.2 ENCRYPTION

Alice wants to send a message to Bob using Bob's public key H. She first puts her message in the form of a binary matrix M, (which is a matrix of same order as X and Y) whose elements are chosen modulo p. Next, she randomly chooses another matrix R of the same order as X. This is the "blinding value", which is used to obscure the message (similar to the way that the ElGamal algorithm uses a onetime random value when encrypting).

To send message M, Alice chooses a random matrix R (which is of same order as matrix X), and Bob's public key H to compute the matrix.

E = R*H + M (modulo q).

The matrix E is the encrypted message which Alice sends to

3.3 DECRYPTION

Now Bob has received Alice's encrypted message E and he decrypt it. He begins by using his private matrix X to compute the matrix. A = X*E (modulo q).

Bob next computes the matrix B = A (modulo p).

That is, he reduces each of the coefficients of A (modulo p). Finally Bob uses his other private matrix *Xp* to compute C = *Xp**B (modulo p). The matrix C will be Alice's original message M.

4 PROPOSED ALGORITHM

Bob creates a public/private key pair. He first randomly chooses two matrices f and g, where matrix f must have the following property.

1. f is upper triangular matrix.
2. f is unique matrix.
3. f is non singular matrix.
4. f is upper triangular matrix mod p.
5. f is upper triangular matrix mod q.

Now in this section, we define that f is an upper triangular matrix mod p and mod q Because, during the key generation process, we throw f away if the inverse does not exist. In commercial application, we use an alternative way of choosing f. We take

f= XU,

Where X is non singular matrix or invertible matrix and U is unimodular matrix. unimodular matrix is a square integer matrix with determinant equal to ±1, so that U^{-1} is also an integer matrix.

The proposed cryptosystem is divided into three parts: Key generation, Encryption, and Decryption.

4.1 KEY GENERATION

Step1: Bob`s randomly chooses two matrices f and g, where matrix f should be an upper triangular matrix (mod p) that is determinant of f should be 1.Here the matrices f and g is private.

Step2: Bob's next step is to compute the inverse of f mod q and the inverse of f mod p. Thus he computes matrix fq and fp which satisfies,

f * fq = I (mod q)

and

f * fp = I (mod p), where I is an identity matrix.

by checking, the existence of inverse of matrix f is non-singular and f mod p is upper triangular, because f = XU is always upper triangular matrix**.**

Step3: Now Bob`s computes the product H = p*(XU)q*g (mod q). Bob's private key is the pair of matrices f and fp and his public key is the matrix H.

4.2 ENCRYPTION

Step 1: Alice wants to send a message to Bob using Bob's public key H. She first put her message in the form of binary matrix M and its size is same as private key f and g.

Step 2: Create an encrypted message she chooses a Random matrix R of size f and g, this matrix is based on blinding value.

Step 3: Alice computes encrypted message using R and Bob's public key as follows.

$$E = R^* H + M \pmod q$$

The matrix E is the encrypted message which Alice sends to Bob.

4.3 DECRYPTION

Step 2: Bob next computes the matrix $B = A \pmod p$.

Step 3: Finally Bob uses his other private matrix fp to compute

$$C = fp^* B \pmod p.$$

The matrix C will be Alice's original message M.

4.4 CORRECTNESS OF ALGORITHM:

Theorem 1. The equation $C = M \pmod p$ is correct.

$C = fp * B$
$C = fp * A \pmod p$
$C = fp * f * E \pmod p$
$C = fp * f * (R * H + M) \pmod p$
$C = [fp^* f * R * H + fp^* f * M] \pmod p$
$C = fp * f * R * p * fq * g \pmod p + fp * f * M \pmod p$ [Since $fp * f \pmod p = I$
$C = R^* p^* fq * g \pmod p + M \pmod p$ [Since $p \pmod p = 0$]
$C = M \pmod p$

5 EFFICIENCY

Table 1 defines parameter value for encryption and decryption procedure in our paper.

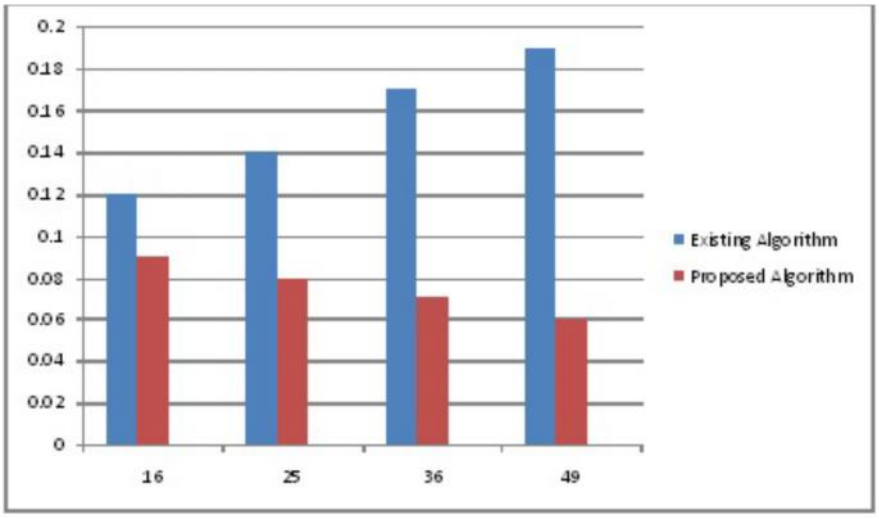
Table 2 shows the efficiency comparison of our proposed algorithm with the algorithm of Nayak et al.[5]. We have successfully performed the encryption and decryption operations for message. The codes of the algorithm given by Nayak et al. [7] and proposed by us have been computed and run out on Mathematica 7.0 [8]. Also we have estimated time for different size of degree of polynomials for p =3, q = 256.

Table 1. parameter values for encryption and decryption

Degree of Polynomial	q	p
36	256	3

Table 2. Comparison of Time

Degree of Polynomial	Existing Algorithm	Proposed Algorithm
16	0.12 Sec	0.09 Sec
25	0.14 Sec	0.08 Sec
36	0.17 Sec	0.07 Sec
49	0.19 Sec	0.06 Sec



6 EXAMPLE

6.1 KEY GENERATION EXAMPLE

Let F = 6×6 matrix, g = 6×6 matrix. Let parameters p = 3, q = 256 and N = 36

Let: $X = \begin{bmatrix} 1 & -1 & 0 & -1 & 1 & 1 \\ -1 & 0 & 1 & 1 & -1 & -1 \\ 0 & 0 & 1 & -1 & -1 & 1 \\ -1 & -1 & 0 & 0 & 1 & 1 \\ 0 & -1 & 1 & 1 & 0 & -1 \\ 0 & 1 & -1 & -1 & 1 & -1 \end{bmatrix}$ And $U = \begin{bmatrix} -2 & -3 & 1 & 0 & 2 & 0 \\ -10 & -12 & 5 & 2 & 8 & 1 \\ -9 & -11 & 5 & 2 & 8 & 1 \\ -5 & -6 & 2 & 1 & 4 & 0 \\ -8 & -10 & 4 & 2 & 7 & 1 \\ -4 & -5 & 2 & 1 & 3 & 0 \end{bmatrix}$

Then: $f = XU = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

Suppose: $g = \begin{bmatrix} 1 & 0 & -1 & 0 & -1 & 0 \\ -1 & 1 & 0 & 0 & 1 & 1 \\ 2 & -2 & 1 & 0 & -1 & 1 \\ 0 & 0 & -1 & 1 & -1 & 2 \\ 1 & 0 & 0 & -3 & 2 & 0 \\ -1 & 0 & 0 & 0 & 1 & 2 \end{bmatrix}$

Next Bob find inverse of f (mod q) [fq]. Thus we get: $f_q = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

Now Bob generates a public key H as H = p*fq*g (mod q).

$$H = \begin{bmatrix} 3 & 0 & 0 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3 \end{bmatrix}$$

6.2 ENCRYPTION EXAMPLE

Now, suppose Alice want to send the message M to bob by using bob's public key.

$$M = \begin{bmatrix} 1 & 0 & -1 & 0 & -1 & 0 \\ -1 & 1 & 0 & 1 & 1 & 1 \\ 0 & -2 & 1 & 0 & -1 & -1 \\ 2 & 0 & 1 & 0 & -1 & 2 \\ 0 & 1 & -1 & 0 & 1 & 1 \\ 1 & 0 & -1 & 0 & 2 & -1 \end{bmatrix}$$

He first choose a random matrix

$$R = \begin{bmatrix} 1 & 1 & -1 & 1 & -1 & 1 \\ -1 & 1 & 1 & -1 & 1 & 0 \\ 0 & 1 & 1 & 2 & -1 & 1 \\ -1 & 0 & 1 & -1 & -1 & 2 \\ 1 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & -1 & 1 & 2 & 1 \end{bmatrix}$$

Therefore encrypted message E = (R* H +M) (mod q) is computed as

$$E = \begin{bmatrix} 254 & 0 & 255 & 0 & 255 & 0 \\ 255 & 4 & 0 & 1 & 1 & 0 \\ 0 & 254 & 4 & 0 & 255 & 255 \\ 2 & 0 & 1 & 253 & 255 & 2 \\ 0 & 1 & 255 & 0 & 7 & 1 \\ 1 & 0 & 255 & 0 & 2 & 5 \end{bmatrix}$$

Alice sends this encrypted message E to Bob.

6.3 ENCRYPTION EXAMPLE

Bob has received the encrypted message from Alice. He uses his private key f to compute

A = f *E (mod q)

$$A = \begin{bmatrix} 254 & 0 & 0 & 0 & 0 & 0 \\ 0 & 4 & 0 & 0 & 0 & 0 \\ 0 & 0 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & -253 & 0 & 0 \\ 0 & 0 & 0 & 0 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 & 5 \end{bmatrix}$$

Since Bob is computing A (mod q). Next Bob reduce the coefficients of A (mod p), we get:

$$\mathrm{B} = \mathrm{A} \ (\mathrm{mod}\ \mathrm{p}) = \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 \end{bmatrix}$$

The matrix will be Alice's original message M, So Bob has successfully decrypted Alice message.

7 CONCLUSION

In this paper we have proposed a method for choosing the different form of f = UX for encryption and decryption using by matrices of taking f as proposed in the original matrix formulation for NTRU cryptosystem. The advantage of using Hermite Normal Form matrices is that these improve the efficiency of lattice based cryptosystem in terms of key length and computation time without compromising their security. This method is more efficient and more secure as compare to the Nayak et al. [7]. There is always a matrix in NTRU Cryptosystem in the form of upper triangular matrix and invertible matrix which speeds up the key generation. Because a matrix is invertible only when it's determinant is 1.

REFERENCES

[1] Wells A. L., “A polynomial form for logarithms modulo a prime", IEEE Transactions on Information Theory, pp. 845-846, 1984.

[2] Cohen H., “A Course in Computational Algebraic Number Theory", Springer-Verlag, Berlin, 1993.

[3] Coppersmith and A. Shamir, “Lattice attacks on NTRU", in Proc. of EURO-CRYPT 97, Lecture Notes in Computer Science, Springer-Verlag, 1997.

[4] Hoffstein J., Pipher J. and Silverman J.H., \NTRU": A Ring Based Public Key Cryptosystem, In Proc. Of ANTS III, volume 1423 of LNCS. Springer-Verlag, Available at http://www.ntru.com, pp. 267-288, 1998.

[5] Ho_stein J., Lieman D., Silverman J. “Polynomial Rings and Efficient Public Key Authentication", Proceeding of the International Workshop on Cryptographic Techniques and E-Commerce (CrypTEC 99), M.Blum and C.H.Lee, eds., City University of Hong Kong Press, 1999.

[6] Roja P.Prapoorna, Avadhani P.S. and Prasand E.V. “An Efficient Method of Shared Key Generation Based on Truncated Polynomials", IJCSNS International Journal of Computer Science and Network Security, VOL. 6 No. 8B, pp. 156-161, 2006.

[7] Nayak Rakesh, Sastry C.V., and Pradhan Jayaram “A Matrix Formula-tion for NTRU Cryptosystems", Proc. 16th IEEE International conference on Network(ICON-2008), New Delhi, India, pp. 12-14, 2008.

[8] User Manual of, “Mathematica 7.0".

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Design and Construction of a World-Wide-Mobile-Call-Back Burglar Alarm System

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ABSTRACT: This paper presents the design, construction and testing of a world-wide-mobile-call-back burglar alarm system. The principle of operation of this burglar alarm is based on that of a Passive Infrared Sensor as motion detector to sense movement of people, as well as, versatility of an Arduino board and a Global System for Mobile Communications Shield. When the motion of a person is detected by the PIR sensor, the alarm is triggered and a signal is sent to the Arduino board which in turn activates the shield. The shield interfaces with mobile network whose Subscriber Identity Module is used to make call to a pre-programmed mobile line of a property owner. The received call from the particular line thus alert the property owner and/or security personnel of the presence of an intruder on the monitored property.

KEYWORDS: Motion, Sensor, Arduino, Programmed, Shield, Module, Global, Alarm.

1 INTRODUCTION

Security of live and properties is an aspect of existence that cannot be handled with flippancy. Individuals, Corporate bodies and Governments desire to know the conditions of their properties every second daily despite the disperseness of these properties across the globe.

Alarms as the name implies are used to alert in the event of any situation that is a threat. There are several kinds of alarms [1]. A security alarm is a system designed to detect intrusion – unauthorized entry – into a building or area. Security alarms are used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, as well as personal protection against intruders. Car alarms likewise protect vehicles and their contents. Prisons also use security systems for control of inmates. [2]

Burglar alarms systems are increasingly being used in private homes, offices, stores and other businesses. They have become standard equipments especially in stores, warehouses etc. The system is also suitable for use in jewelry stores, artifacts in museums and for safe guarding drawings, paintings and sculpture in art galleries and also to detect unauthorized access. [3].

2 MATERIAL AND METHOD

My design uses; among others; Passive Infrared (PIR) Sensor, 555 Timer, Arduino board (Arduino Uno) and Global System for Mobile Communications (GSM) Shield, Subscriber Identity Module (SIM) cards, mobile phone. In this work the modular approach - where the overall design was first broken into functional block diagrams- was employed and each block represents a functional section of the circuit that performs a specific function, as shown in Fig. 1. below and depicts the interconnection between these blocks. Each section of the block is analyzed below.

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Fig. 1. Block diagram of the burglar alarm system

2.1 SENSOR

A PIR sensor, that is, an electronic sensor that measures infrared (IR) light radiating from objects in its field of view was used as a motion detector.

The PIR-based motion detector was used to sense movement of people; when an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature. [4]

2.2 ALERTING CIRCUITRY

The alerting circuitry consists of LM555 Integrated Circuit (IC) wired in monostable mode; shown in figure 2; to create a minimum time delay of three seconds (≥ 3s). In this mode an external trigger from the PIR sensor causes the 555 timer to output a pulse of this duration into the transmitting circuitry to enable establishment of complete and successful connection.

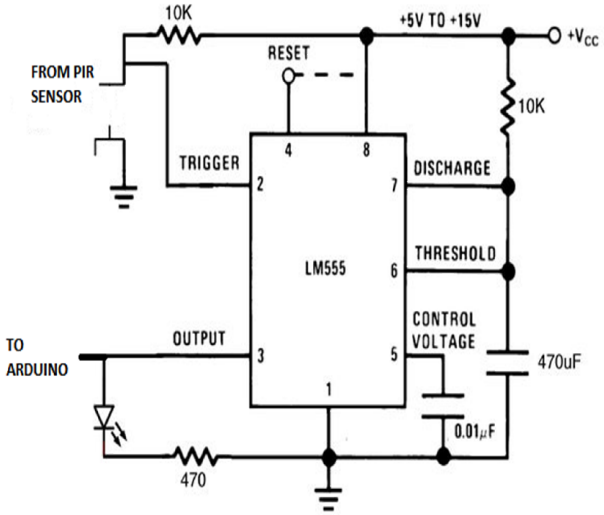


Fig. 2. Circuit Design for an LM555monostable mode

2.3 TRANSMITING CIRCUITRY

The transmitting circuitry was built around an Arduino Uno which was programmed to and capable of communicating or interacting with a GSM Shield connected to it. The GSM Shield in turn; works as a modem; and has the capability of initializing a call to a pre-programmed mobile phone of a property owner; through a SIM card of a preferred communication network provider inserted into it.

2.4 INTERFACE

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. Macro cell is regarded as a cell where the base station antenna is installed on a mast or a building above average rooftop level which are very common within our environment. [5] These masts, Fig. 3a, serve as antenna holder and an interface

through which the GSM shield communicates with base stations, Fig. 3b, and through which the base station communicates with the property owner's mobile phone.



Fig. 3a. Communication Mast

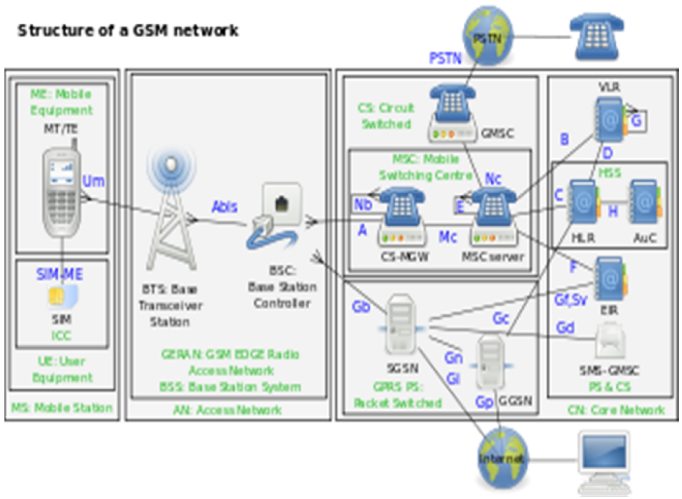


Fig. 3b. GSM network structure

Sources: [5]

2.5 MOBILE ALERT

Mobile Alerts is the last section of this system. Readily availabilities of mobile phones of different types and specifications makes this system realizable and complete, though any phone that can received calls can be used here. Once the alarm is triggered a call is initiated by the alarm system and this call is received on the owner's phone, having pre-stored the incoming mobile SIM number on her/his phone, he/she is able to identify where the call is emanating from.

Discussion on power supply to the circuit is omitted.

3 CONSTRUCTION AND TESTING

The world-wide-mobile-call-back burglar alarm system was constructed in accordance with the circuit and block diagram illustrated by Fig. 1. The design was simulated on electronics work bench [6]. The testing followed the modular pattern used in the design with each functional block being tested as described below.

The sensor stage was tested for the output voltage level, using the multimeter. It was wired to an LED via a 220Ω resistor and worked perfectly.

The monostable circuit was, tested and gave a time delay of about 5.1s, then connected to the transmitting circuitry which was built around an Arduino Uno programmed to communicate with a GSM Shield connected to it. Into the GSM shield was slotted a SIM card – of a preferred network provider – that had already being programmed with a property owner's number to be dialed or called on detection of an intruder.

The entire circuit was checked for short circuit and open circuit faults that could result into problems and later tested by allowing a person to move in front of the PIR sensor, shortly after this, a call was received on the phone whose line was programmed to be called indicating accomplishment of the aims of this paper.

4 RESULTS

The system has been implemented as described above. The following results were obtained for the processing time, Table 1. and Fig. 4; for which the Alarm System was triggered, as human distances (u) from the sensor and the time (t) it takes for a call to be received on the property owner's mobile phone were considered.

Table 1. Alarm test for different distance

HUMAN DISTANCE, u (m)	TIME, t (s)
10.00	-
9.00	22
8.00	20
7.00	19
6.00	18
5.00	15
4.00	15
3.00	14
2.00	13
1.00	13

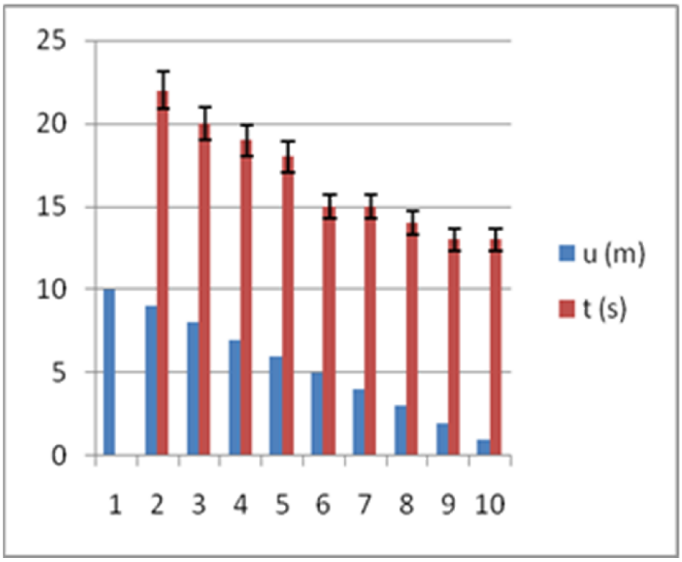


Fig. 4. Processing time

Fig. 4. above, shows that at a distance of about ten meters (10m) away from the PIR sensor nothing happened which might be due to combination of several factors like variation in component makeup, GSM network problem and so on, though at distance slightly shorter than 10m, the response was perfect. It is also clear that distance from the PIR sensor affects the processing time of the system, that is, the closer a person is to the sensor, shorter time it takes to be alerted of trespass of an intruder. Hence, Initial tests suggest that this method of burglar detection is effective. The Arduino Uno is small and light weight and the whole system is portable.

5 CONCLUSION

Conclusively, the basic goal of this project was met; a world-wide-mobile-call-back burglar alarm system that calls property owner's mobile phone anywhere he may be in the world has been designed, constructed and tested. It is suitable for residential or official property, supermarket, artifacts in museums, jewelry stores and art galleries security. This burglar alarm is thus very good for safe guarding valuable properties, so the owner can call a neighbor to check happenings on her/his property or inform police directly.

5.1 RECOMENDATIONS

This work is not without its limitations as its accuracy and sensitivity is dependent on the service performances of GSM network provider, it is therefore, recommended that communication networks keep improving on their service provision level.

This alarm system could be programmed to call Police distress line directly as well and relay a pre-programmed message with the address of the burglary scene for better efficiency, that is, save time and police can terminate burglary at its earliest stage.

For wider coverage in more practical situations, it is recommended that a multichannel and multi-sensor programming is possible with this system to monitor different locations of an apartment together. It could also be adapted to monitor other alarm conditions like, fire, heat and smoke, flood and so on.

Above all, there is no gainsaying in recommending that provision for a security alarm system should be included in the electrical services design of every house, industry, office and shops/store.

ACKNOWLEDGMENT

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REFERENCES

[1] How Burglar Alarms work., Available at: http://www.howstuffworks.com, 2005.
[2] K.A. Oyelakin, “Design and implementation of infrared burglar alarm system.” unpublished
[3] M.S. Ahmed, A.S. Mohammed and G.A. Agbo, “Development of a simple sound activated burglar alarm system,” Leonardo Journal of Sciences, Issue 9, pp. 97-102, July-December 2006, ISSN 1583-0233
[4] Passive Infrared Sensor, Available at: http://en.wikipedia.org/wiki/Passive_infrared_sensor
[5] GSM., Available at: http://en.wikipedia.org/wiki/GSM
[6] Electronics Workbench Software, Version 5.12, 2005.

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Factors Influencing Access to Debt Finance by Micro and Small Enterprises: A Case of Chwele Township, Bungoma County

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ABSTRACT: This study sought to investigate the factors that influence access to debt finance by Micro and Small Enterprises (MSEs) in Chwele Town, Bungoma County. The categories of firms under study were all registered MSEs in operation at the time. The study examined the following objectives: to determine the effect of Collateral security on access to debt finance, to establish effect of financial information on access to debt finance and to determine the effect of managerial competence on access to debt finance. The study employed a descriptive research design. The target population was 256 MSEs from which a sample size of 120 MSEs was selected using Nassiuma (2000) formula. Data was collected using self-administered questionnaires. The raw data was analyzed using descriptive statistics and regression. The first study objective sought to establish the relationship between the Collateral security and access to debt finance by MSEs in Chwele Township. It was established that most of the respondents had not pledged Collateral security for finance while. Most of the indicated that the nature of the Collateral security offered was private property which included their land. The study further established that respondents who could not provide Collateral security had their finance requests declined. From the regression analysis it was established that Collateral security and access to debt finance are positively related. The second objective aimed at establishing the relationship between financial information maintained by the firm and access to debt finance by MSEs in Chwele Township. It was established that most of the MSEs owners did not maintained their financial records and that the records maintained were mostly business plan, income statements and balance sheet. On access to debt finance, the study found out that most firms which kept financial information had their applications for debt finance approved while those that never maintained financial information had of the application declined. Thus the denial rate for debt finance was high for the firms that did not keep financial information. The analysis of regression revealed that financial information and access to debt finance had a positive relationship. Thus, a firm that maintains financial information was likely to obtain debt finance compared to one that does not. The last objective sought to establish the link between managerial competence of firm's owner and access to debt finance by MSEs in Chwele Township. In the study, it was found that most firm owners had an education level up to KCSE while a few had bachelor's degree. In terms of experience, most respondents had operated their firms for a period less than 4 years while a view had and experience above 20 years. On access to debt finance, respondents who had been in operation for a period less than 4 years had their financial request declined while for those in operation for over 20 years was accepted. The study established that; Collateral security, financial information and managerial competence influenced a firm's access to debt finance.

KEYWORDS: Access to Debt Finance, Micro and Small Enterprises, Chwele Township, Bungoma County.

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1 INTRODUCTION

1.1 BACKGROUND

According to Lucey et al.,(2006) financing decisions are some of the most critical decisions for MSES owners since they have direct impact on capital structure and financial performance of the MSEs. He further indicated that Small and Medium Enterprises prefer internal funds over debt, while growth oriented firms use more debt to fund their growth and higher educated firm owners use less debt.

Previous studies on general small firm capital structure have presupposed small and medium sized enterprises to (predominantly) act in such a way as to maximize their financial wealth. A consequence of this presupposition is that, these studies have assumed that MSEs, in general, desire substantial growth and consequently have a desire for external finance (Beck et al., 2008).Academic research has documented that there are differences in financing patterns between MSEs and large firms and analyzed possible causes of these differences (Elaine et al, 2005; Kaplan and Turluccio, 2007; Howorth, 2001; Mac et al, 2010).

The importance of micro and small enterprise (MSE) sector to the Kenyan economy has been widely recognized. According to KIPPRA (2007), the MSE sector is crucial to the government's effort in reducing poverty as it employs nearly 6.8 million Kenyans and of the new jobs created, 89% were in the small sector firms. Obert and Olawale (2010) acknowledge that the sector has contributed immensely to the employment creation, poverty alleviation, savings and economic growth in both developed and developing countries. Olomi (2005) suggests that the sector was a training ground for entrepreneurship, managerial development and motivates individuals to find avenues for investment and expanding operations. Olufunso et al (2010) argues that the sector was expected to be an important vehicle in addressing the challenges of job creation, sustainable economic growth, and equitable distribution of income and overall stimulation of economic development. Ntsika posits that the MSE sector's contribution to the private sector employment and gross domestic product (GDP) indicates a very high labour absorption capacity and its significance to the reduction of unemployment. Kayanula and Quertey (2006) opines that MSEs employs 22 percent of the labour force in the developing countries are recognized world-wide to be the key source of dynamism, innovation and flexibility (OECD, 2006).

Kenya suffers from high unemployment rate with an official estimate of 75 percent of the economically active population unemployed (IFAD, 2009). One of the best ways of addressing an employment problem is to leverage the employment creation of MSEs and promote small scale business development. According to GOK,(1996) the sector offers unmatched potential as source of new jobs for the expanding labour force while the self-employed and small scale enterprises represent part of the business activity in major market towns. Kiira, (2013) noted that a strong developed productive industrial sector can only be attained where MSEs and large scale enterprises not only exists but also function in a symbolic relationship. Accordingly, the health of an economy as a whole has strong relationship with the health and value of micro and small enterprises, when the state in micro economy is less favorable, the opportunities for profitable employment expansion in MSEs are limited(Mead, 1998). The Kenya government is aware of the crucial role private sector plays in her economic development. This has made it to initiate finance schemes such as youth and women enterprises (YWE) and UWEZO fund with a view of finance MSEs as lack of access to finance is a major constraint to their growth in Kenya (Atieno, 2009).

Finance is required by MSE's to establish and expand business operations, develop new products , invest in new staff or production facilities and acquire latest equipment and technology; which is largely funded internally and inadequate for their development and profitability(ibid).

Finance is the lifeblood for any business enterprise including MSE's, lack of it therefore have led to the sector not providing enough support to the economic development process (Sacerdoti, 2005).Kiira(2013) established that MSEs required finance for speedy innovations so that they can improve their productivity and maintain competitiveness. Atieno (2009) argues that lack of access to finance is a major constraint facing MSE's and one of the reasons for its slow growth in Kenya. According to The International centre for economic growth (1999) only 1.5% MSEs had received loans from Commercial Banks in Kenya and 50% of rural individuals had never used any credit (Financial Survey, 2009). It therefore follows that Financial Institutions seem not to be providing enough credit to new economic activities and in particular the expansion of MSE's.

In spite of the potential the sector has, its growth has been constraint by challenges a raising from lack of financial services among other factors (Livingstone, 2001). Pretorius and Shaw (2004) posit that access to external finance was essential to solving shortage of the firm's cash flows.

Given the constraints on the supply side of debt finance, an option for MSEs would be to resort to external financing (Mac et al., 2010). Owners of MSEs, particularly from those which have high growth possibilities, might be willing to concede some control in a firm and attract venture capital funding. Nevertheless, formal venture capital by institutional investors has been so far a viable option only for a very small minority of MSEs, the ones with high growth and feasible exit possibilities for outside investors (European Commission, 2010). Moreover, the supply of venture capital is insufficient, and the costs of this form of finance for MSEs at the start-up stage are high. In the context of MSEs, Ramalho and Vidigal da Silva (2009) document that the proportion of zero-leverage firms in their sample of Portuguese MSEs is even higher than a proportion of zero-leverage large public firms (Strebulaev and Yang, 2006).

According to the World Bank (2010), access to finance is a significant business environment and an issue for MSEs. Agnew (2003) argues that finance is the life blood of any firm and no matter how well managed , it cannot survive without enough funds for working capital fixed assets, investment and employment of skilled labour force. Beaver (2002) there is an enduring finance gap which results in MSEs being discriminated against in their efforts to raise debt finance. Musamali and Tarus (2013) noted that there is a disconnect between MSEs and lenders which results in the latter failing to secure the required debt finance for development. Bowen et al (2009) argues that given the importance of MSEs and their failure rate, it becomes necessary that a study be done to establish the factors that influence the MSEs growth and survival. This study therefore sought to establish the factors that influence accesses to debt finance by MSEs in Chwele Township, Bungoma County.

1.2 STATEMENT OF THE PROBLEM

The importance of MSEs in economic development has been recognized and documented in many studies and government policy documents. According to Fatoki and Asah (2011), MSE's contributes positively to economic growth, employment and poverty alleviation. Kiira (2013), financing viable MSEs projects have an implication on their sustainable growth and potential to create jobs and alleviate poverty.Due to fixed costs of external finance, smaller firms choose to refinance less frequently than larger firms because they are more affected by these fixed costs in relative terms. Hence, small firms choose to operate at a higher leverage level at a refinance moment to compensate for less frequent rebalancing. This argument explains why smaller firms, if they have some debt, are more levered than larger firms. In addition, as the time period between restructurings is longer for small firms, on average, they have lower leverage ratios (Hirth, 2011). According to the Kenya Bureaus of Statistics(2007), three out of five businesses fail within the first few months of operations due to non-availability of debt finance(Beck,2007). Bigsten et al (2000), argues that the sluggishness growth of MS's sector in Africa is associate with scarcity of capital. This lack of access to external finance due to lack of collateral security, lack of financial information and poor managerial competence inhibits the performance of MSEs thereby impacting adversely on their ability to achieve poverty alleviation, employment creation, income redistribution and economic growth (Machirori and Fatoki,2013). Statistics from Bungoma County Council Department of trade (2013) shows that MSEs have not fully accessed financial assistance from lenders. Thepercent is very low especially in Chwele township as compared to other areas in the entire County. It is against this background that this study sought to establish factors that influences access to debt finance by MSEs in Chwele township, Bungoma County and in turn their contributions to the economic development of the area..

1.3 OBJECTIVES OF THE STUDY

1.3.1 GENERAL OBJECTIVE

The main objective of the study was to assess the factors that influence access to debt finance by MSEs in Chwele Town, Bungoma County.

1.3.2 SPECIFIC OBJECTIVES

The study was guided by the following objectives

a) To determine the effect of Collateral security on access to debt finance by MSE's in Chwele township.

b) To verify the effect of financial information on access to debt finance by MSE's in Chwele Township.

c) To establish the effect of managerial competence on access to debt finance by MSE's in Chwele Township.

1.4 RESEARCH QUESTIONS

The study was guided by the following research questions;

a) What is the effect of Collateral security on access to debt finance by MSE's in Chwele Township?

b) What is the effect of financial information on access to debt finance by MSE's in Chwele Township?

c) What is the effect of managerial competence on access to debt finance by MSE's in Chwele Township?

1.5 JUSTIFICATION OF THE STUDY

One of the factors that influence the growth, survival and performance of MSEs is access to debt finance. Firms that have access to debt finance are expected to perform better than those without access (Machirori, 2012). The study therefore was to determine the extent to which financial access by firms could enhance their growth and survival so that they can continue to effectively contribute to the development challenges facing Kenya, like unemployment, poverty, reduced economic growth and widespread income inequality as documented in Vision 2030.

It is also hoped that the findings will yield empirical results that can be useful to the financial analysts, Consultants and Accountants who utilize these firms' financial statistics to evaluate their performance.

Government officers, law makers and other small business policy makers will also find the results useful in understanding the problems facing MSEs in raising finance and how to overcome them. Further, the study findings may provide a framework on which future research on capital structure and profitability of MSE's in Kenya can be based as most of the studies have been linked on large liability companies quoted in the stock exchange in the developed countries

Scholars and researcher's knowledge and information realized through this research undertaking will benefit other future scholars who wish to study the same area as it provides an insight of what has not been examined.

MSES capital structure is rapidly growing as a field of practice. Many business leaders believe that there is need to make effective financial decisions. The findings will inform appropriate policy making and implementation that could spur the growth of MSEs into medium-sized companies. In addition, the study provided information to the MSE' owners on the problems that generally face and how best they can be able to solve the challenges. Prospective entrepreneurs might find the conclusions on the challenges that face the MSES sector useful on how best they can surmount them upon entry into business. The research helped to elucidate on how well capital structure could explain the growth of MSEs within Chwele Township

In addition this study is useful to financial reforms that favour MSEs so that MSEs can contribute significantly to meeting millennium development goals and Kenyan's vision 2030.

1.6 SCOPE OF THE STUDY

The study covered Chwele Township in Bungoma County. Chwele Township encompasses the following areas; Kilimani, Musese, Makhonge, and Chebukaka. The accessible population of MSEs was 256. The researcher employed stratified random sampling in selecting respondents. The population was segregated into four sectors, namely; general traders, metal work and carpentry, agriculture and other different sectors such as mobile accessories, electronics and computer. The number of employees was used as the criterion to measure the size of an MSEs.

1.7 LIMITATION OF THE STUDY

The researcher encountered the following limitations .The respondents were reluctant in giving information thinking it was for commercial purposes but they were assured of confidentiality. It was not easy to get some respondents to respond to the questions but the researcher was patient and made several trips to collect from them. The data was captured from MSEs who do not maintain complete financial records as they relied on single entry system of book keeping. Considering the exponential growth of Chwele Township, the number of MSEs is growing on a daily basis hence accurately capturing these Enterprises was a challenge. The findings from this study may not be generalized beyond the MSEs participating in the study

2 LITERATURE REVIEW

2.1 INTRODUCTION

This Chapter deals with the review of Literature related to the study of the topic. The theoretical and conceptual framework on which the study was based was discussed, factors influencing access to debt finance were explored and lastly the research gap discussed.

2.2 THEORETICAL FRAMEWORK

The relevant theoretical framework on which the study was based is capital structure.

2.2.1 THEORY OF CAPITAL STRUCTURE

Scholars have defined capital structure in terms of equity-debt relationship**.** According to Pandey (1995), capital structure represents the proportionate relationship between debt and equity used by the firm in financing the projects. Gitman (2003) describes capital structure as a mix of debt and equity that a firm uses to finance its operations. Horne van and Wachowicz (2007) noted that capital structure is a mix of a firm's permanent, long term financing represented by debt, preferred stock and common equity.

2.2.1.1 PECKING ORDER THEORY

According to the Pecking Order Theory of business finance advanced by Myers and Majluf (1984), the presence of asymmetric information between outsiders and insiders of the firm is used to predict a negative relationship between indebtedness and profitability. In the Pecking Order Theory, the outsiders are presumed to have less information than managers and owners of the business and any issues of shares to raise funds for expansion or to finance a project will be valued by the potential investors on the value they think is the market value. If the stock is undervalued, according to the owners and managers, they may decline to issue the stock and forego the investment opportunities.

On the other hand, if a firm issues shares to outsiders it will be believed to be overvalued, and the share price will fall. This will discourage firms from issuing shares. Myers uses this theory to argue that firms will prefer to use internally generated funds and if eternal funds are required, debt will be preferred to issuing shares. Firms will use debt only when they have exhausted the internal funds (Nivorozhkhin, 2000). Quan (2002) suggests that the Pecking Order Hypothesis in general, advocates the existence of an optimal capital structure (or an optimal capital structure range) of the firm, this optimal capital structure range being dependent on the firm's trade-off of the various factors influencing its decision of the source of finance. This is against the propositions of the non-optimal capital structure perception.

2.3 CONCEPTUAL FRAMEWORK

A conceptual framework is a brief explanation of the relationship between variables identified for the study in the light of the problem, objectives and the research questions. This study was guided by the following perceived conceptual framework.

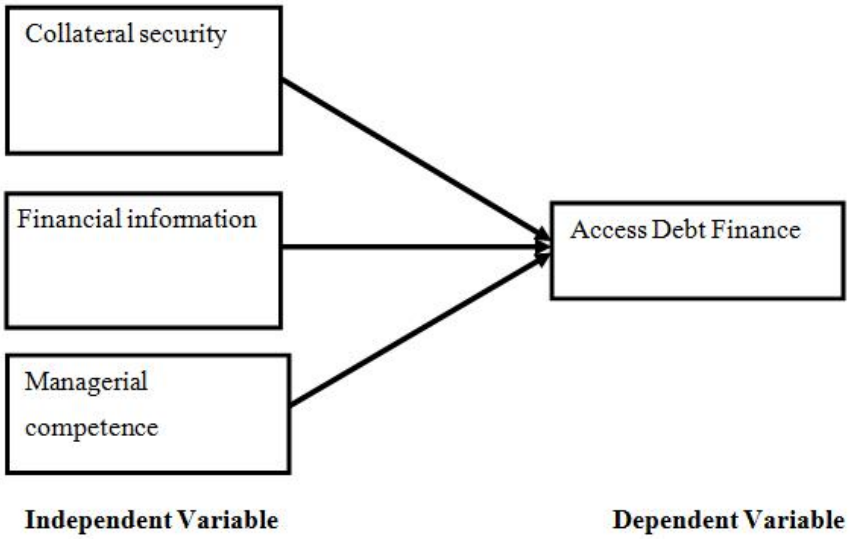


Figure 2 .1 Conceptual framework

In this study the independent variable was factors influencing access to debt finance while the dependent variable was access to debt finance.

2.4 REVIEW OF FACTORS INFLUENCING ACCESS TO DEBT FINANCE

Access to debt finance entails the firm's ability to get and use financial services that are affordable, usable and meets its needs (Claessen, 2006).According to Musamali and Tarus (2013), access to finance is measured in terms of access to certain institutions such as banks, micro-finance or services that these institutions provides. Financial access has four key dimensions- physical access, affordability, appropriateness to the user needs and terms that do not effectively exclude any category of potential user.(Ibid)Musamali and Tarus (2013) asserted that access to debt finance was more adverse to MSE's due to high fixed cost associated with loan appraisals, supervision and collection. This made lenders prefer lending larger amounts of credit to large enterprises than small amounts to many smaller enterprises.

There is some evidence to suggest that some SMEs in rural environments may face additional difficulties. This has been reported for Kenya by the OECD when collecting evidence for their review of rural policy (OECD, 2008). Recent unpublished research for Scottish Enterprise suggested that fast growth firms find it easier to raise finance in the Central Belt (Glancey and Greig, 2008). It is suggested that these difficulties can arise with high growth or manufacturing SMEs in rural areas (OECD, 2008), since bankers are not familiar with high growth proposals.

Although there are wealthy individuals in rural areas, the evidence in Scotland suggests that they prefer to invest in the main metropolitan areas, especially Edinburgh and Glasgow (Glancey and Greig, 2008)

The perception of a finance gap may reduce the willingness of SMEs to approach the banking network to secure appropriate financing. A report for the Small Business Service (SBS) (Allinson, 2005) commented: "if people do not present themselves to a financial institution in the first place, because of self-selection and possibly underpinned by belief in a myth, then it may appear that the institutions' rates of granting loans are quite high that they are meeting demand." This can lead to businesses seeking to 'bootstrap' rather than securing more appropriate financial packages. Typically these businesses become dependent on financial support from their own resources and family and friends.

2.4.1 COLLATERAL SECURITY AND FIRM'S ACCESS TO DEBT FINANCE

According to Coco (2000), Collateral security is the lenders second line of defense which can be used the firm to solve the problem of asymmetry in valuation of project's risks and the cost of supervising the borrowers behavior. Coleman(2000) pointed out that many MSEs are in service industry and lacked assets that could be used as a Collateral security .Thus, firms that invested heavily in tangible assets tended to have a higher financial leverage as they could borrow at lower interest rates given that the debt is fully secured with such assets (Barbosa and Moraes, 2004). Bongheas et al (2005), noted that Collateral security was an important factor for MSEs in order to access debt finance as it reduced the riskiness of the loan by giving lenders claims on tangible assets. According to Zeller (1994) ,there is a link between individual resources and access to

bank credit. Thus, with more wealth inform of assets, land and livestock access to bank credit is increased (Bhuiya et al 2001).Berger and Udell (1995), established that firms that have a good a affiliation with creditors may require lower amount of Collateral security as they convey information necessary to reduce asymmetry information risky.Ebadi et al, (2011) argue that tangible assets reduce moral hazard risks as they convey a positive signal to creditors in case of default. Thus, Collateral security reduces bankruptcy cost which in turn increases credibility and access debt market.

Collateral security is used to address moral hazard and adverse selection problems (Bester, 1985; Boot, 2000). The more serious these informational problems are, the more likely it is that banks will use Collateral security to exclude low quality borrowers from bank credit. Where the quality of information is poor, banks will depend more on Collateral security to signal the quality of borrowers and to reduce the incentive to deviate loan funds into activities other than the project for which they are intended. It is also possible that banks may demand very high Collateral security requirements as a way of rationing credit.

A better understanding of how Collateral security substitutes affect access to bank finance is important in finding strategies that improves the ability of firm to secure bank loans. According to Balkenhol and Schütte (2001), if banks were better informed about the benefits of Collateral security substitutes, they would be more willing to offer loan contracts using these substitutes. Banks may be reluctant to extend credit to firms because of adverse selection and moral hazard problems. Collateral security substitutes provide unique information about borrowers, thus alleviating adverse selection. They also improve incentives for repayment (McKee, 2004), and thus reducing moral hazard.

2.4.2 FINANCIAL INFORMATION AND ACCESS TO DEBT FINANCE

Studies by Stigliz and Weiss (1981) revealed that information asymmetries and imperfect information made lenders provide insufficient credit to all sound or bankable propositions. Sarapaivanich and Kotey (2006), acknowledges that lack of adequate information led to information asymmetry and credit rationing .According to Kitindi et al (2007) creditors, banks and lenders used financial information provided by firms to analyze their performance and predict future performance. For technology based firms, entrepreneurs were reluctant to provide full information about the opportunities as their disclosure could make it easy for others to exploit (Shane and Cable, 2002). Kinyanjui (2006) pointed out that, it was difficult to obtain loans as MSEs had to show credit records and some did not fully understand the requirements of getting and paying for loans. Cochran, (1981) established that MSEs were relatively new and lacked a track record on profitability to prove their ability to repay loans.

Financial literacy provides knowledge and understanding of financial concepts and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts and to improve the financial well-being of MSEs (Hogarth, 2002). The programme has been implemented since 2009 providing basic financial information with a view to enabling them address the financial challenges, provide a platform for enterprise performance, growth, and sustainability.

Financial literacy remains an interesting issue and has elicited much interest in the recent past with the rapid change in the finance landscape. Atkinson and Messy (2005) define financial literacy as the combination of consumers'/investors' understanding of financial products and concepts and their ability and confidence to appreciate financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being (Miller et al., 2009). Financial literacy helps in empowering and educating investors so that they are knowledgeable about finance in a way that is relevant to their business and enables them to use this knowledge to evaluate products and make informed decisions. It is widely expected that greater financial knowledge would help overcome recent difficulties in advanced credit markets. Financial literacy prepares investors for tough financial times, through strategies that mitigate risk such as accumulating savings, diversifying assets, and purchasing insurance.

Financial literacy facilitates the decision making processes such as payment of bills on time, proper debt management which improves the credit worthiness of potential borrowers to support livelihoods, economic growth, sound financial systems, and poverty reduction. It also provides greater control of one's financial future, more effective use of financial products and services, and reduced vulnerability to overzealous retailers or fraudulent schemes. Facing an educated lot, financial regulators are forced to improve the efficiency and quality of financial services. This is because financially literate investors create competitive pressures on financial institutions to offer more appropriately priced and transparent services, by comparing options, asking the right questions, and negotiating more effectively. Investors on their part are able to evaluate and compare financial products, such as bank accounts, saving products, credit and loan options, payment instruments, investments, insurance coverage, so as to make optimal decisions (Miller et al., 2009).

Greenspan (2002) argues that financial literacy helps to inculcate individuals with the financial knowledge necessary to create household budgets, initiate savings plans, and make strategic investment decisions. Proper application of that knowledge helps investors to meet their financial obligations through wise planning, and resource allocation so as to derive maximum utility. Hilgert et al., (2003) asserts that financial knowledge appears to be directly correlated with self-beneficial financial behavior.

2.4.3 MANAGERIAL COMPETENCY AND ACCESS TO DEBT FINANCE

Education is one of the factors that impact positively on the growth of firms (Kings and McGrath, 2002). Entrepreneurs with large stock of human capital in terms of education and training are better placed to adapt their enterprises to changing business environment. According to Hisrich and Drnovsek(2002) managerial competence as measured by education, managerial experience and knowledge of business positively affects MSEs' performance. Martin and Staines (2008) established that lack of managerial experience, skills and personal qualities led to MSEs' failure in South Africa. According to Women entrepreneurs (2008), education for women is low thereby creating a barrier to accessing training other business development services. According to Abor (2008) women owned businesses are less likely to use debt due to discrimination and greater risk aversion. Women owned firms in the USA had a higher loan denial rates and lower application rates than their male counter parts, Mijid (2009).

Namusonge(1998) argued that entrepreneurial education and training played a key role in stimulating entrepreneurship and self-employment while Herrington and Wood (2003) pointed out that lack of education and training reduced management capability of MSEs.

According to Nguyen and Ramachandran(2006) , the small size of MSEs leads to severe information asymmetries with lenders as they do not have adequate and reliable financial statements. According to Cotheren (1997), information asymmetry negatively affected MSEs access to debt finance as banks did not have the necessary information on their future profitable investment opportunities thereby turning down the request for credit facilities (Olufunso et al, 2010).

Managerial competencies are a cluster of similar knowledge, skills and attributes that are essential to effective job performance (Karns, 1998). For this study, managerial competencies did cover employee training and development, leadership skills, knowledge and professional experience (Stoner et al., 1995). These competencies are the result of behavioural research to identify superior performance and are applied horizontally across the organization (Nyhan, 1995).

On the other hand Boyatzis (2000) describes managerial competencies as underlying characteristics of a person that he or she uses to solve problems that arise at a work place. Some of the underlying characteristics of the Executive Directors include the ability to speak and perform in public, express the desire to persuade others of their point of view, motivate others to action, make decisions and amend those decisions to fit in with the organizational vision or current realities (Hagberg Consulting Group 2005). Boyatzis (2000) as well as Munene (1998), have identified different types of competences, which they have referred to as operant competences and emotional competences respectively.

Managerial competencies are further reflected through Leadership Skills which are an occurrence when one group member modifies the motivation or competencies of others in a given group (Boam, 1992). In order for managers to be both effective and efficient in their managerial functions, they must possess exemplary leadership skills (Cangemi et al., 1998)

For leaders to allow employees to take risks, they must also trust them a great deal. Trust is an important element of good leadership. It is something that is very hard to earn and very easy to loose. Such skills are ways in which trust is built between employees and the leaders, (Bartlett, 2007).

Hence given the size of their firms, managers of MSEs are expected to be a window to the outside world. They need to be innovative, figurehead; that is having a greater degree of power and influence. The manager is the nerve centre and turbulent handler for they either make or break their organizations. In a survey carried out on the high mortality rate of MSEs that were failing in the USA; of the 1200 respondents, 41 percent said the major culprit was lack of reliable managerial competencies that in turn influenced business success (Penrose, E.T.; 1995).

Education and training of managers through educational policies and curricular content emphasize practical business skills such as; technical skills, engineering, accounting and finance, marketing and human resource management do contribute to providing potential entrepreneurs with the needed managerial skills, (Stoner et al, 1995).

Education and training policies and programmes are most supportive of MSEs when they lead to the development of skills and attitudes that are consistent with and relevant to the opportunities present in the environment. Innovation provides the firm with the capability to generate new products and services faster than the competitors. For example; several studies

suggest that the increase in the level of education and business skills in the United States increased entrepreneurship and new firms, (Calderon & Nickel, 1998).

Managers with autonomy are motivated to act and make decisions independently (Frese et al, 2002). Autonomy leads to the desire to express ones individuality in the work place and also disliking superior orders. There are many tasks for which business managers don't receive explicit training in developing a business plan, book-keeping and marketing. Therefore they depend on learning from experience and must develop their knowledge base independently in order to succeed (Minniti & Bygrave, 2001). Despite the lack of financing being cited as a constraint in other publications, there are a variety of funding programmes and financing schemes through the use of guarantees that are available, in addition to other support programmes. Awareness and the uptake of these schemes, however, have been very low. A number of publications, most of which can be accessed on the provide information on the various Government SME support programmes available.

2.5 RESEARCH GAP

Empirical studied on MSEs in Kenya are limited to large towns. Bowen et al (2009) examined management challenges facing small and micro enterprises in Nairobi, Musamali and Tarus (2013) explored firm specific factors that influences financial access among small and medium enterprises in Eldoret town, while Namusonge (1998) investigated the determinants of growth oriented small and medium enterprises in Nairobi. However evidence in Chwele Township shows that firms encounter difficulties in accessing debt finance despite the availability of financial institutions. The study therefore sought to establish factors that hinder access to debt finance among the MSEs in Chwele Township.

2.6 SUMMARY

Empirical studies in this research have focused on factors that determine access to debt finance by MSEs. It is evident that MSEs face difficulties in accessing credit finances from lenders and the latter seem not to be providing enough finances to new economic activities and the expansion of MSEs. Collateral security, financial information and managerial competence have been identified as factors that influence access to debt finance by MSEs.

3 RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter examines the Introduction, Research Design, Target Population, Sample size and sample selection. Further described are the data collection procedures Research instruments, validity of the research instruments and data analysis techniques.

3.2 RESEARCH DESIGN

Polit and Hungler (1999) described research design as a blue print or outline for conducting a study in such a way that maximum control was exercised over factors that could interfere with the validity of the research results. This study adopted an explanatory design because the research was a cause-effect relationship. This design was best for analyzing the MSEs capital structure patterns and its effects on the MSEs financial performance. Explanatory research focuses on why questions and causal relationships design. Answering the 'why' questions involves developing causal explanations. Causal explanations argue that phenomenon Y (MSEs access to debt finance) is affected by factor X (for example Collateral, security, financial information and managerial competence). Some causal explanations were simple while others were more complex. For example, we argue that there is a direct effect of Collateral, security on MSEs access to debt finance (De Vaus, 2001)

3.3 TARGET POPULATION

Cooper and Schindler (2006); Kothari (2004); Mugenda & Mugenda (2003) defines population as the total collection of elements that is the main focus of a scientific query. The population of study comprised MSEs registered and in operations within Chwele town which is located in Chwele Town. According to Bungoma County Council- Trade and Licensing Department records, there were 256 MSEs registered. The study targeted 256 in the four sectors, namely; general traders, metal work and carpentry, agriculture and other different sectors such as mobile accessories, electronics and computer. This is because the targeted MSEs kept proper books of accounts as required by law and the four sectors dominated Chwele town.

3.4 SAMPLE SIZE

Sampling means selecting a given number of subjects from a defined population as representative of that population. Any statements made about the sample should also be true of the population (Orodho 2005).To sample theMSEs managers/owners the researcher used Nassiuma (2000) formula. Nassiuma, (2000) asserts that in most surveys, a coefficient of variation in the range of 21%≤ C≤ 30% and a standard error in the range 2%≤ e ≤ 5% is usually acceptable. The study therefore used a coefficient variation of 30% and a standard error of 2%.The higher limit for coefficient of variation and standard error was selected so as to ensure low variability in the sample and minimize error

Nassiuma (2000) gives the formula as follows:-

$n=Nc^2/c^2+(N-1)^2$

Where:
n=Sample size,
N=Population,
c=coefficient variation,
e= standard error

Substituting these with the selected values we get:

n=256*0.3*0.3/0.03*0.03+(256-1)*0.02*0.02
n=120 MSEs

3.5 SAMPLING TECHNIQUE AND PROCEDURE

To select the individual MSEs owners, the researcher used simple random sampling method using lottery method where from 256 MSEs owners 120 were selected. This was done by writing all the names of the 256 MSEs obtained from the records of the selected MSEs folding them into same shape and picking 120 names while blind folded.

The study also used stratified random sampling to stratify the sample MSEs into four sectors, namely; general traders, metal work and carpentry, agriculture and other different sectors such as mobile accessories, electronics and computer where the sample size was allocated under stratified proportional allocation. The purpose of the method was to maximize survey precision, given a fixed sample size. With stratified proportional allocation, the best sample size for stratum h was:

$n_h=(N_h/N)n$

Where,

n_h - The sample size for stratum h,
n - Total sample size,
N_h -The population size for stratum h,
N - The total population

Hence, distributions were as follows;

Table 3.1 Sampling Technique and Procedure

Sectors	**Target**	**Sampling procedure $n_h=(N_h/N)n$**	**Sample size**
General Traders	108	(108/256)*120	50
Metal Work and Carpentry	78	(78/256)*120	37
Agriculture and other different sectors such as mobile accessories	34	(34/256)*120	16
Electronics and Computer	36	(36/256)*120	17
Total	**256**		**120**

INSTRUMENTS

The study utilized questionnaires and unstructured interview schedule for data collection. According to Orodho (2008) each item on the questionnaire should be developed to address a specific objective, research question or hypothesis of study. A fully structured questionnaire was chosen for this study as it ensures a standardized data collection procedure so that the data obtained are internally consistent and can be analyzed in a uniform and coherent manner (Boyce, 2002). The questionnaire comprised two sections, namely: Section A: which has biographical information such as gender, age, business operated and level of education and section B:-which has specific study objectives which includes, effect of Collateral securitysecurity on access to debt finance by MSE's, effect of financial information on access to debt finance by MSE's, and the effect of managerial competence on access to debt finance by MSE's in Chwele town.

3.6 DATA COLLECTION PROCEDURE

The researcher obtained research permit from the National Council for Science and Technology (NACSOTI) and clearance from department of Trade and Licensing Bungoma County. An introduction letter was presented to all manages/owners of the selected MSEs in Chwele. Administration of the questionnaires was done in the town. A cover letter which explained the purpose of the study was attached to the research instruments. This introduced the study to the respondents. This also assured the respondents that their responses were held confidential and used only for the intended study. The researcher visited the MSEs twice, when taking the questionnaires and on collection of the questionnaires

3.7 PILOT STUDY

Piloting is trying out of research instruments on the respondents who will not be used in the main study. Therefore it was necessary to pretest the instruments of the research on a small sample of respondents as preparatory exercise to find out if there was any weakness so that it could be corrected. In this study, a pilot study was done to enhance the questionnaire's validity. A pilot study was conducted on 20 MSEs in Sirisia Town. The result of the pilot test was used to identify areas where the questionnaire required adjustments like changing the order of questions and use of simple words to obtain more information on the study objectives .The questionnaire was then administered the second time to establish if the adjustments had been done correctly.

3.7.1 VALIDITY OF THE RESEARCH INSTRUMENTS

Validity of research instrument refers to the extent to which the instrument measures what it is supposed to measure (Amin, 2005). To ensure validity of the research instrument, the researcher used expert raters. The rated findings were used to calculate content validity index (CVI) using the formula

CVI = K/N

Where K = Total number of items in the questionnaire declared valid by both

Raters/judges.

N = Total number of items in the questionnaire

The computed CVI of the instrument computed 0.78 which was greater than the recommended 0.7 value therefore the questionnaires were termed valid (Amin, 2005: 288).

3.7.2 RELIABILITY OF THE INSTRUMENTS

Reliability refers to the consistency of data arising from the use of a particular research instrument. Mugenda (2003), states that reliability is the measure of the degree to which a research instrument yields consistent results after repeated trials over a period of time. This view is shared by Gay and Airasian (2000), who describe reliability as the degree to which a test consistently measures what it is measuring. Following the design type for this study, only internal reliability was measured using Cronbach's alpha.

Nunnally (1978, p. 245) recommends that instruments used in basic research have reliability of about .70 or better. He adds that increasing reliabilities much beyond .80 is a waste of time with instruments used for basic research. On the other hand, with instruments used in applied settings, a reliability of .80 may not be high enough. Where important decisions

about the fate of individuals are made on the basis of test scores, reliability should be at least .90, preferably .95 or better. The instruments Cronbach was 0.87 therefore the instruments were deemed to be reliable.

3.8 DATA ANALYSIS AND PRESENTATION

The data collected were analyzed using descriptive statistics. Descriptive analysis involves collection, summarizing, and presentation of a set of data to make it easy for the researcher to conduct and users to understand (Kolb, 2008). The method therefore enabled the researcher to see pattern in the research data. In this study, frequency tables and percent were used to analyze the quantitative data. Statistical package for social sciences (SPSS) was the main tool of analysis. Logit regression was conducted to establish if the relationship between the study variables and access to debt financing by MSEs in Chwele Town.

In this study, the dependent variable was firm's access to debt finance while the independent variables (Collateral security, financial information and managerial competence) constituted factors that influence access to debt finance by MSEs.

MODEL SPECIFICATION

The study used logistic regression .Logistic regression gives each predictor (independent variable) a coefficient 'b' which measures its independent contribution to variations in the dependent variable, the dependent variable can only take on one of the two values: 0 or 1. What this model predicts from a knowledge of the relevant independent variables and coefficients is therefore not a numerical value of a dependent variable as in linear regression, but rather the probability (p) that it is 1 rather than 0 (belonging to one group rather than the other).The *logit* regression model was used because it allows properties of a linear regression model to be exploited it is shown:

$$logit(p) = a + b_1x_1 + b_2 x_2 + b_3x_3$$

Which in our case was used to establish the relationship between the variables under study and access to debt finance is as shown below;

Access to debt finance = a +b_1 (Collateral security) +b_2 (financial information) +b_3 (managerial competence)

Where; b_1, b_2, and b_3 represented coefficient values estimated and were found to be positively related to access to debt finance. These coefficient values measured the rate of change of a dependent per change in independent variables.

a- The level of debt finance in the absence of independent variable under the study.

4 RESULTS AND DISCUSSION

4.1 INTRODUCTION

The chapter examines the study sample demographic characteristics in terms of gender, age, level of education, training and managerial experience of firm's owner. This is followed by basic information on finance of MSEs. For the purposes of this preliminary analysis descriptive statistics were frequently used to describe the general characteristics of the data collected. The chapter ends with the discussion of the research findings.

4.2 RESPONSE RETURN RATE

Data from Bungoma County Council (2013) shows that Chwele Town has 400 registered Micro and Small Enterprises but the study utilized 256 MSEs. The researcher distributed a total of 150 questionnaires and 120 were returned making response rate of 80%.According to Nachimias and Nachimais (1996) 80% to 90% return rate is enough for a descriptive survey study and therefore the return rate of 80% boosted the reliability of the study.

4.3 DEMOGRAPHIC CHARACTERISTICS

The study sought to determine the demographic characteristics of respondents based on gender, age, level of education industrial type, number of workers, and management courses undertaken.

4.3.1 GENDER

The gender of the respondents was sought since its findings would assist the study to categorize respondents based on gender

Table 4.1 Gender

Gender	Frequency	Percent
Male	74	62
Female	46	38
Total	**120**	**100**

As portrayed in table 4.1 above 62% of the respondents were male and 32% were female. The result shows that men were more involved in entrepreneurial activities than women in Chwele Town.

4.3.2 AGE OF THE FIRM OWNERS

The age of the respondents was sought since its findings would assist the study categorize respondents based on age.

Table 4.2 Age

Age(years)	Frequency	Percent
Below 20	12	10
21-30	33	27
31-40	46	38
41-50	15	13
51-60	08	07
Above 60	06	05
Total	**120**	**100**

As portrayed in table 4.2, above, 10% of the sampled respondents were aged below 20 years, 21-30 were 27%, 31-40 (38%), 41-50(13%), 51-60(07%) and above 60 years (05%) .The result shows that firm owners in the study were predominantly in the age bracket 31-40 years due to the fear that they may have failed to secure salaried employment and opted for entrepreneurship to earn a living. We also have few business owners in the category above 60 years as they are old and have bequeathed the running of the firms to young people.

4.3.3 LEVEL OF EDUCATION

The level of education respondents was sought since its findings would assist the study categorize respondents based on level of education.

Table 4.3 Level of education

Level of education	Frequency	Percent
Below KCPE	13	11
KCPE	46	38
KCSE	35	29
Diploma	19	16
Bachelors	07	06
TOTAL	**120**	**100**

As portrayed in the table above the number of respondents had an education level up to KCSE were 78% in Chwele Town. 16%, had a diploma and 06% had a bachelor's degree. This agrees with Bowen, Morara and Mureithi (2009) assertion that

MSEs are dominated with people with relatively low education level. Moreover highly educated people may have other jobs rather than be involved in business.

4.3.4 INDUSTRIAL TYPE

The level of industrial type of respondents was sought since its findings would assist the study categorize respondents based on industrial type.

Table 4.4 Industrial type in Chwele town

Sectors	Frequency	Percent (%)
General Traders	50	60
Metal Work and Carpentry	37	44.4
Agriculture and other different sectors such as mobile accessories	16	19.2
Electronics and Computer	17	20.4
Total	**120**	**100**

As depicted in the table above, 60% of the MSEs in Chwele town are involved in general traders, 44.4% in metal work and carpentry, 19.2% in agriculture and other different sectors such as mobile accessories and 20.4% in electronics and computer. The result indicates that most MSEs are involved in metal work and carpentry due to perhaps easy legal requirements and small capital needs of the enterprises.

4.3.5 WORKERS EMPLOYED

The number of workers employed of respondents was sought since its findings would assist the study categorize respondents based on number of workers employed.

Table 4.5 Workers employed

No. of Workers	Frequency	Percent
1-10	80	67
11-20	21	18
21-30	10	08
31-40	05	04
41-50	04	03
Total	**120**	**100**

As evident in the table 4.5 above most MSEs in Chwele township employs between 1-10 workers 67%. This could be due to the limited business activities they are involved in a raising from inadequate finance.

4.3.6 MANAGEMENT COURSES UNDERTAKEN

The management a course undertaken by the respondents was sought since its findings would assist the study categorizes respondents based on management courses undertaken by the respondents.

Table 4.6 Management courses undertaken

Response Rate	Frequency	Percent
Yes	24	20
No	96	80
Total	**120**	**100**

From the table 4.6 above, majority of MSEs had not undertaken managerial courses (80%). This explains why most MSEs in the area face managerial difficulties in running their businesses there by hindering them from raising debt finance.

4.4 FACTORS INFLUENCING ACCESS TO DEBT FINANCE

4.4.1 COLLATERAL SECURITY PLEDGED

This objective sought to determine the number of respondents who pledged collateral security for debt financing.

Table 4.7 Respondents who pledged Collateral security

Response rate	Frequency	Percent
Yes	47	39
No	73	61
Total	**120**	**100**

The findings revealed that 47 (39%) of respondents had pledged by the Collateral security, while 73 (61%) had not pledged with the Collateral security and the findings.

The findings show that most of the MSEs owners had not pledged for Collateral security. These could be women who are not accessed to Collateral security such as land because most of the land is owned by their husbands and fathers

4.4.1.1 NATURE OF COLLATERAL SECURITY PLEDGED

The study sought to determine the nature of collateral security pledged for finance and the findings.

Table 4.8 Nature of Collateral security pledged

Nature	Frequency	Percent
Private property	37	78.7
Business property	10	21.3
Total	**47**	**100**

From table 4.8 above, out of the 47 respondents, 37 (78.7%) of respondents had pledged by the private property, while 10 (21.3%) had pledged by business property This therefore explains why most respondents could not raise finance due to lack of business property to act as Collateral security. This agreed with Zeller (1994) who opined that there is a link between firms resources and access to bank credit.

4.4.1.2 COLLATERAL SECURITY AND ACCESS TO DEBT FINANCE

Investigation to determine whether Collateral security pledged managed to secure access to debt finance and the findings.

Table 4.9 Collateral security and access to debt finance

Response rate	Application Approval	Percent	Application Rejected	Percent	Total
Yes	43	87.8	04	5.6	47
No	06	12.2	67	94.4	73
Total	**49**	**100**	**71**	**100**	**120**

The findings revealed that 43 (87.8%) of respondents had pledged and managed to secure debt finance, while only 4 (12.2%) who had not pledged with the Collateral security managed to secure debt finance. This could be due to the lender depending on other factors such as firms' reputations other than Collateral security. This agrees with Bhuiya et al (2001) who argued that with more wealth inform of assets land and livestock, access to bank credit is increased. A Collateral security reduces the riskiness of the loan by giving the lender claims on tangible assets (Bongheas et al, 2005).

4.4.2 FINANCIAL INFORMATION AND ACCESS TO DEBT FINANCE

4.4.2.1 RESPONSE ON MAINTENANCE OF FINANCIAL INFORMATION

The study sought to determine whether respondents maintained their financial information and the findings.

Table 4.10 Respondents who maintained financial information

Response rate	Frequency	Percent
Yes	43	35.8
No	77	64.2
Total	**120**	**100**

The findings revealed that 43 (35.8%) of respondents had maintained financial information, while only 77 (64.2%) who cited that they didn't maintain their financial information. Those who did not maintain financial information cited challenges such as lack of resources to employ experts who could assist in preparing and maintaining the financial information leading to information asymmetry and credit rationing (Sarapaivanich and Kotey 2006)

4.4.2.2 TYPES OF FINANCIAL INFORMATION MAINTAINED

The study also sought to find out types of financial information maintained by the respondents.

Table 4.11 Types of financial information maintained

Type of Financial Information	Frequency	Percent
Business Plan	**22**	18.6
Income Statement	**81**	67.4
Balance Sheet	17	14
Total	**120**	**100**

The findings revealed that 29 (67.4%) of respondents had maintained income statements, 06 (14%) cited balance sheets, while only 8 (18.6%) indicated business plans and. The result shows that most respondents prepared income statements to evaluate the performance of their enterprises.

4.4.2.3 FINANCIAL INFORMATION AND ACCESS TO DEBT FINANCE

The study also sought to investigate whether financial information maintained by the firm helped it to secure access to debt finance.

Table 4.12 Financial information and access to debt finance

Response Rate	Application Approval	Percent	Application Rejected	Percent	Total
YES	37	72.5	06	8.7	43
NO	14	27.5	63	91.3	77
Total	**51**	**100**	**69**	**100**	**120**

The findings revealed that 37(72.5%) of the respondents who kept financial information had their applications approved, while 14 (27.5%) of respondents who never kept financial information had their applications approved. The findings are shown in table 4.13**.** This agreed with the studies by Sarapaivanich and Kotey (2006) who argued that lack of adequate information by MSEs led to information asymmetry and credit rationing.

4.4.3 MANAGERIAL COMPETENCE AND ACCESS TO DEBT FINANCE

4.4.3.1 TYPE OF MANAGERIAL COURSES UNDERTAKEN

The study also sought to find out types of managerial courses undertaken by the respondents. The findings are shown in table 4.13

The table 4.13 Type of managerial courses undertaken

Course	Frequency	Percent
Business Management	**20**	17
Entrepreneurship	**15**	**13**
Human Resources	**55**	46
Accounting	**10**	08
Marketing	**20**	17
Total	**120**	**100**

The findings revealed that 11(46%) of respondents had undertaken human resource management course, 4(17) took business management course, same as those who took marketing courses, 3(13%) undertook entrepreneurship, while 2(08%) undertook accounting courses. As portrayed in the table 4. 13 above, the bulk of the respondents had taken human resources as a popular managerial course. This result shows that most of the respondents had not taken entrepreneurship as relevant managerial course to the successful running of their firms.

4.4.3.2 REASONS FOR NOT UNDERTAKING MANAGERIAL COURSES

The study also sought to find out reasons for not undertaking managerial courses by the respondents.

Table 4.14 Reasons for not undertaking managerial courses

Reasons	Frequency	Percent
High Cost of Training	59	49
Non- availability of course (s)	26	22
Lack of training Institutions	23	19
Don't need a Management Course	12	10
Total	**120**	**100**

The findings revealed that 47(49%) of respondents revealed a high cost of training, 21 (22) cited non availability of courses, 18 (19%) indicated lack of training institutions, while 10 (10%) cited that they don't need a management course. From the table above most of the respondents indicated that they could not undertake managerial courses due to high costs of training, that management courses were not available, while a few indicated that training institutions were not available, others never saw the need for taking a management courses. This means that most MSEs owners lack management skills as brought about by Martins and Staines (2008) who established that lack of managerial experience and skills led to MSEs failure in south Africa.

4.4.3.3 MANAGERIAL COMPETENCE AND ACCESS TO DEBT FINANCE

The study sought to determine whether managerial experience by the firm helped it to access debt finance measured by the number of years one had been in operation.

Table 4.15 Managerial competence and access to debt finance

No. of years	Application Approval	Percent	Application Rejected	Percent	Total
Below 4	11	25.6	50	64.9	61
5-10	8	18.6	18	23.3	26
11-15	9	20.0	06	7.8	15
16-20	7	16.2	03	05	10
Above 20	8	18.6	0	-	08
Total	**43**	**100**	**77**	**100**	**120**

The findings revealed that financial request rejection was higher when the owner's number of years in business was below 4 years as indicated by 50 (64.9%). The findings are shown in table 4.14.As portrayed in table 4.14 the percent of financial request rejection is higher when the owner's number of years in business is below 4 years while those who have been in operation for more than 20 years get access to loans easily. This agrees with Martin and Staines (2008) who argued that lack of managerial experience, skills and personal qualities led to MSEs failure.

4.5 LOGISTIC REGRESSION

In this study, logistic regression was used to analyze the relationship between accesses to debt finance and factors influencing access to debt finance. The research in this study, sought to establish the extent to which each variable influenced a firm's access to debt finance.

Table 4.16 Variables in the Equation

Variables	B	S.E.	Wald	df	p-value.	EXP(B)
Collateral security	0.214	0.310	0.475	1	0.490	1.238
financial information	1.906	.383	24.785	1	0.000	6.726
managerial competence	-0.663	0.346	3.667	1	0.055	0.515
Constant	-2.733	.768	12.653	1	0.000	0.065

The Variables in the table contains the coefficients for the fitting regression line and other relative information about the coefficients. The equation of the line from the output is

$logit(y) = a + b_1x_1 + b_2 x_2 + b_3x_3$

$=-2.733+0.214x_1 +1.906x_2-0.663x_3$

The Variables in the Equation as shown in Table 4.16 has the wald statistic and associated probabilities which provide an index of the significance of each predictor in the equation. The Wald statistic has a chi-square distribution. We take the significance values and if less than 0.05 reject the view that the variable does not make a significant contribution to a change in the dependent variable (access to debt finance).In our case, we note that collateral security does not contribute significantly to the prediction (p = 0.49) as well as managerial competence (p = 0.055) which is in contrary to Hisrich and Drnovsek (2002), who argued that Managerial experience measured in terms of education and managerial experience positively affects performance of the firm. However it was noted that financial information significantly affect dependent variable which in our case is access to debt finance (p=0.000).

The Exponential (B) column in Table 4.16 presents the extent to which increasing the corresponding measure by one unit influences the odds ratio. Exponential (B) is interpreted in terms of the change in odds. If the value exceeds 1 then the odds of an outcome occurring increase; if the figure is less than 1, any increase in the predictor leads to a drop in the odds of the outcome occurring. For example, the Exponential (B) value associated with Collateral security is 1.238.Hence when Collateral security is raised by one unit (rating) the odds ratio is 1 times as large and therefore MSEs are 1 more times likely to access loans due to Collateral security.

4.6 DISCUSSION

The study to establish whether Collateral security pledged by firms managed to enhance access to debt finance revealed that respondents who pledged Collateral security managed to secure debt finance by (87.8%) and only 12.2 % of those who never pledged Collateral security secured credit finance. This agrees with Bhuiya etal (2001) who argued that with more wealth inform of assets land and livestock, access to bank credit is increased. Furthermore Collateral security reduces the riskiness of the loan by giving the lender claims on tangible assets (Bongheas et al, 2005). According to Coco (2000), Collateral security is the lenders second line of defense which can be used the firm to solve the problem of asymmetry in valuation of project's risks and the cost of supervising the borrowers behavior. Thus, firms that invested heavily in tangible assets tended to have a higher financial leverage as they could borrow at lower interest rates given that the debt is fully secured with such assets (Barbosa and Moraes, 2004). According to Zeller (1994) there is a link between individual resources and access to bank credit.

Concerning financial information and access to debt finance, the findings revealed that72.5% of the respondents who kept financial information had their applications approved while 91.3% of those who did not maintain financial information had their applications declined. This agreed with the studies by Sarapaivanich and Kotey (2006) who argued that lack of adequate information by MSEs led to information asymmetry and credit rationing. Information asymmetries and imperfect information made lenders provide insufficient credit to all sound or bankable propositions (Stigliz and Weiss (1981).However regression analysis contradicts these findings where it was noted that its p-value was less than 0.05 hence there was a significant prediction. In addition, Kitindi et al (2007) acknowledges that creditors, banks and lenders used financial information provided by firms to analyze their performance and predict future performance.

Concerning managerial competence and access to debt finance, the findings showed that the bulk of financial request rejections were higher when the firm owner's had been in business for a period less than 4 years as indicated by 64.9% of the respondents and nil when one had been in business for a period over 20 years. In addition the regression analysis showed that managerial competence significantly predicted change in access of debt financing among the MSEs. This agrees with Martin and Staines (2008) who argued that lack of managerial experience, skills and personal qualities led to MSEs failure. Moreover, education is one of the factors that impact positively on the growth of firms (Kings and McGrath, 2002). Thus entrepreneurs with large stock of human capital in terms of education and training are better placed to adapt their enterprises to changing business environment. Managerial competence as measured by education, managerial experience and knowledge of business positively affects MSEs' performance (Hisrich and Drnovsek, 2002).

5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTIONS

This chapter brings out the summary of the study findings based on research objectives, the conclusion, recommendations and areas for further research.

5.2 SUMMARY

The first study objective sought to establish the relationship between the Collateral security and access to debt finance by MSEs in Chwele Town. It was established that most of the respondents had not pledged Collateral security for finance while. Most of the indicated that the nature of the Collateral security offered was private property which included their land. The study further established that respondents who could not provide Collateral security had their finance requests declined. From the regression analysis it was established that Collateral security and access to debt finance are positively related.

The second objective aimed at establishing the relationship between financial information maintained by the firm and access to debt finance by MSEs in Chwele Township.It was established that most of the MSEs owners did not maintained their business records and that the records maintained were mostly business plan, income statements and balance sheet. On access to debt finance, the study found out that most firms which kept financial information had their applications for debt finance approved while those that never maintained financial information had of the application declined. Thus the denial rate for debt finance was high for the firms that did not keep financial information. The analysis of regression revealed that financial information and access to debt finance had a positive relationship. Thus, a firm that maintains financial information was likely to obtain debt finance compared to one that does not.

The last objective sought to establish the link between managerial competence of firm's owner and access to debt finance by MSEs in Chwele Township. In the study, it was found that most firm owners had an education level up to KCSE while a few

had bachelor's degree. In terms of experience, most respondents had operated their firms for a period less than 4 years while a view had and experience above 20 years. On access to debt finance, respondents who had been in operation for a period less than 4 years had their financial request declined while for those in operation for over 20 years was accepted. Regression analysis on managerial competence with access to debt finance established a positive relationship.

5.3 CONCLUSIONS

The study found out that Collateral security is one of the factors that influence access to debt finance. A firm that pledges collateral security for debt finance is more likely to be successful in its financial requests than one that does not. It was evidently that Collateral security requirement is a key factor for MSEs to succeed in accessing debt finance from financial Institutions.

The study also established that there is a positive relationship between financial information maintained by a firm and access to debt finance. The Information a firm provides to the financier portrays the latter's ability to meet the financial obligations in terms of Interest and principle repayments as and when they fall due. In the study, firms that did not maintain financial Information faced a higher rate of debt finance applications decline.

Concerning managerial competence and access to debt finance the result of regression analysis has shown that there is a positive relationship between managerial competence and access to debt finance. Measured in terms of educational level and work experience, highly educated business owners with more work experience were more favored for debt finance by lenders and used more debt finance in their enterprises.

5.4 RECOMMENDATIONS

The purpose of this research was to explore factors that influence access to debt finance by MSEs in Chwele Township Bungoma County, and come up with recommendations. Chwele Township has 256 registered MSEs in operation distributed in the extraction, manufacturing and service Industries. The MSE sector contributes immensely to job creation, poverty alleviation, savings and economic growth of the area. There is therefore need to support the growth of MSEs in the area which in turn can support the government's efforts in the realization of the country's Vision 2030.

The researcher recommends the following measures that may revitalize and spur the growth of the sector through debt finance.

MSEs should mobilize savings which is necessary to acquire and own assets which they can pledge as Collateral security for debt finance. Collateral security is used by lenders to reduce the riskiness of the loan and in solving the problems of asymmetry in evaluating projects and monitoring borrower's behavior.MSE owners/managers should also improve themselves by attending training courses in financial Management and Accounting. This will enable them to be able to prepare detailed financial statements which may be required by commercial banks when seeking debt finance.

Commercial banks should engage in publicity campaigns to make MSE owners aware of the products and terms of credit especially in rural towns like Chwele as some of them may be in need of finance but lack information on credit facilities provided by lending institutions.

The government should also intensify efforts to assist MSEs firms by offering more education and training through Kenya Institute of Business Training and Kenya Industrial Estates to improve on their Managerial Competence and providing affordable finance for those in need of finance.

The government institutions that provide finance to MSEs should undertake to monitor the use of such finance to promote efficiency and effectiveness in the use of the finance provided.

The government should also appeal to the commercial banks to reduce Interest rates on lending as they not only affect the cost of the loans but also performance of MSEs. Entrepreneurial centres, colleges and vocational Institutions should be set up in the area for MSEs to offer short courses and consultancies for practical training as a way of enhancing managerial competencies.

5.5 AREAS FOR FURTHER RESEARCH

The findings in this study are in no way exhaustive. The following are the areas suggested for further research.

a) The influence of networking by the firm's owner on access to debt finance by micro and small enterprises in Chwele Township Bungoma County.

b) The impact of firm's size on access to debt finance by MSEs in Chwele Township Bungoma County.

REFERENCES

[1] Agnew,P(2003),Finance Bright Ideas; Aprimer on venture capital in Maine. Finance Authority of Maine, Augusta , p(UNU-WIDER).

[2] Amin, S., Jishnu, D. & Goldstein, G. (2008). "Are you being served?" The International Bank for Reconstruction, 1818 H. Street NW, Washington DC 20433.ISBN; 978-0-8213-7185-5.

[3] Atieno, R.(2009) Linkages, access to finance and performance of small-scale enterprises in kenya , Research paper No.2009/06.UNU World Institute for Development Economics Research (UNU-WIDER).

[4] Balkenhol, B. and Schütte, H. (2001), .Collateral security, Collateral security Law and Collateral security Substitutes,.ILO Social Finance Programme.Working Paper No. 26.International Labour Organization.

[5] Barbosa, E.G., and Moraes, C.C.(2004). Determinants of the firm's capital structure; The case of very small enterprises. Washington DC 20433.ISBN; 978-0-8213-7185-5.

[6] Bartlett, C.A. and Ghoshal, S. (2007). Managing across Borders: The Transnational Solution, *Harvard Business School Press*, Cambridge, MA.

[7] Beaver,G.(2002),Small Business, Entrepreneurship and Enterprise Development,Pearson Education, Prince Hall.

[8] Beck, T (2007).Finance Constraints of MSEs in developing countries: evidence, determinants and solutions. Journal of international money and Finance.

[9] Berger,A. and Udell , G (2000) ,Small business credit availability and relationship lending; The importance of bank organizational structure, Economic journal 1-36.

[10] Berger,A.N.&Udell,G.F.(1995), Relationship Lending and Lines of credit in small firms Finance,Journal of Business 69(3)

[11] Bernstein,L.A.(1993). Financial Statement Analysis-Theory, Application and Interpretation Chicago: McGraw-Hill Co. Inc

[12] Bester, H., (1985), .Screening vs. Rationing in Credit Markets with Imperfect Information,.*American Economic Review*, 75, pp850-855.

[13] Bhuiya Abbas, Mushtaque Chowdhury and Syed MasudAmed (2001), Micro Credit and Emotional Well being: Experience of poor rural women from Matlab,Bangladesh, World Development, 20(11).

[14] Bigsten, A. et al (2000), Credit constraints in manufacturing enterprises in Africa *Journal of African Economics.Vol.12*

[15] Boam, R. and Sparrow, P. (1992). Designing and Achieving Competency: ACompetency-based Approach to Developing People and Organizations,McGraw-Hill, London.

[16] Bongheas,S.,Mizen, P.and Yalcin, C.(2005). Access to external finance: Theory andevidence on impact of monetary policy and firm-specific characteristics. *Journal of Banking and Finance vol.30.*

[17] Boot, A.W.A. (2000), .Relationship Banking: What Do We Know?.*Journal of Financial Intermediation*, 9, pp7-25

[18] Bose, N. &Cotheren, R.(1997), Assymmetric information and Loan Contracts inneoclassical growth model. Journal of money credit bank,29(4).

[19] Bowen, M, Morara, M. and Mureithi, S. (2009), Management challenges among smalland micro enterprises, KCA Journal of Business Management, Vol 2, Nairobi.

[20] Boyatzis, R. E., Goleman, D., & Rhee, K. S. (2000).Clustering competence in emotional intelligence, *Insights from the emotional competence inventory.*

[21] Calderon, I., and Nickel, M. (1998).Technological innovations and Supervision in theDairy sector (English summary), *The Journal of Industrial Economics – Vol1, 151 – 164.*

[22] Cangemi J. P., Kowalski C. J., and Khan, K.H. (1998). "Leadership behaviours – NewYork," *University Press of America*

[23] Casser,G.(2004),The finance of business start –ups. Journal of Business Venturing.Vol .19(2)

[24] CEG (1999), National micro and small enterprise Baseline survey results conducted by CBS,ICEG and K-REP Holdings Nairobi

[25] Chandler,J.G.(2009),Marketing tactics of selected small firms in the East LondonCBD South Africa; University of South Africa.

[26] *Claessens, S. (2006). "Access to Financial Services: A Review of the Issues and Public Policy Objectives".* Oxford University Press

[27] Cochran,A.B.(1981) Small Business Mortality Rates; A Review of the literature. *Journal of Small Business Management (October)*

[28] Coco,G (2000).On the use of Collateral security. Journal of Economic Surveys, VOL.19

[29] Coleman, S.(2000).The liability of newness and small firm access to debt. Is a link *Journal of Entrepreneurial Finance and Business Venture. Vol.12 No.2*

[30] Cooper,D.R. &Schindler,P.S, (2003) Business Research Methods,New York; McGraw Hill incl.

[31] Correia,C. Flynn,D. Uliana,E. and Wormald,M.(2005). Financial Management.Lansdowne;Jute and Co.Ebadi,M. Thim,C.&Choong,Y.(2011) Impact of firm characteristics on capital structure of Iranian Listed Firms, European Journal of Economics, Finance and Administrative Science.

[32] Evans, J. St. B. T. (2008). Dual-processing accounts of reasoning, judgment and social cognition. *Annual Review of Psychology*, 59, 255–278.

[33] Falkena,H. et al(2002),Small and Medium Enterprises Access to Finance – A supply Side Regulatory Review By The Task Group of The Policy Board For Financial Services Regulation.(Online).

[34] Fatoki ,O. and Asah,F.(2011) The impact of the firm and entrepreneurial characteristics on access to debt finance by MSEs in King Williams' Town ,South Africa.Vol.6 No.8.

[35] Frese, M. & Fay, D. (2002).Personal initiative. An active concept for work in the 21st Century.

[36] FSD(2007),Financial Access In Kenya; Results of 2006 Financial Survey, Nairobi.

[37] Gerber-Nel, C. Nel, D. &Kotze, T.(2005),Marketing Research . Claremont : New Africa Books Ltd.

[38] Girabi,F.and Mwakaje,A.E,G.(2013),Impact of microfinance on smallholder farm productivity in Tanzania. The case of Iramba District, Asian Economic and Financial Review, Vol.3(2)

[39] Gitman,L.J.(2003),The principles of managerial finance .New York: Pearson Education Inc.

[40] Greenspan, A. (2002) Financial Literacy: A Tool for Economic Progress: The Futurist, Vol. 36, (4), 37-41.

[41] Henderson, R. (2000). Compensation Management in Knowledge – Based World,*Prentice – Hall Englewood Cliff*, NJ.using core management competencies; a pilot study," *Academy of Business and Administrative sciences, Emerging Economies International Conference Proceedings*, Budapest.

[42] Herrington,M. & Wood, (2003), Global Entreprenuership Monitor, South Africa Report (on-line).

[43] Hisrich,R.D&Drnovsek, M. (2002),Entrepreneurship and Small Business Research Journal of Small Business and Enterprise Development. Horne Van and Wachowic

[44] Hogarth, J., and Hilgert.A. (2002). Financial knowledge, experience and learning preferences: Preliminary results from a new survey on financial literacy. *Consumer Interests Annual,* 48, 1-7.

[45] Hogarth, J., and Hilgert.A. (2002). Financial knowledge, experience and learning preferences: Preliminary results from a new survey on financial literacy. *Consumer Interests Annual,* 48, 1-7.

[46] Honhyan,Y.(2009), The determinants of capital structure of MSEs : An Empirical Study of Chinese Listed Companies.(Online).

[47] Horne Van C.J.and Wachowicz (2006), Fundamentals of Financial Management, Pearson Education, Dorling Kindersley, 12th Edition, India

[48] International Fund for Agricultural Development (2010), Retrieved.

[49] Karns, L.A. and Mena, M.A. (1998). "Sharpening the performance management focus

[50] Kayanula, D and Quartey, P (2000), The policy environment for promoting small and medium-sized enterprises in Ghana and Malawi.France and Development Research Programme Working Paper series, No.15, May (Online)

[51] Kenya Institute for Public Policy Research and Analysis (2007), Policy Brief; Improving Public Policy Making for Economic Growth and Poverty Reduction, No.2(7), Nairobi.

[52] Kiira,A.R(2013), The Evaluation of the factors influence the access to Debt Financeby Tanzanian MSEs, European Jounal of Business and Management .Vol.5No.7

[53] Kimathi,J.(2009), Going it alone. Msafiri, Nov. 2009- Jan.2010: Edition 69

[54] Kinyanjui,M.N. (2006),Overcoming Barriers to Enterprise Growth; The experience of MSEs in Rural Central Kenya, Nairobi.

[55] Kitindi,E.G.,Magembe,B.A.S&Sethibe,A.(2007). Lending decision making and financial information: The usefulness of corporate annual report to lenders in Botswana. *International Journal of Applied Economics and Finance,1(2)*

[56] Kolb, B.(2008), Marketing Research; A Practical approach. SAGE Publication: London.

[57] Kothari, C.R. (2008). Research Methodology: methods and Techniques 2nd Ed.New Delhi, Washua Prakasha Publishers.

[58] Kothari,C.R.(2004).Research Mythology: Methods and Techniques, International Publishers,New Delhi.

[59] Livingstone,I.(2001).Small enterprises development in Cambodia; The role credit. In economic policy and manufacturing performance in developing Countries, ed

[60] Machirori, T. &Fatoki, O. (2013),The impact of Networking on Access to Debt Finance and Performance of Small and Medium Enterprises in South Africa, Journal of Economics , 4(2)

[61] Martin,G.&Staines,H(2008), Managerial competencies in small firm.(Online)
[62] McKee, K. (2004), Finance Development: Banking on Microenterprise. Policy Brief.USAID,Washington D.C.
[63] Mead,D.C.(1998),Micro and Small Businesses tackle poverty and growth (but indifferent proportions).Paper presented at the conference on enterprises in Africa:between poverty and growth. Centre for African Studies, University ofEdinburgh,26-27 May.
[64] Mijid,N.(2009).Gender ,race and credit rationing of small businesses evidence from the 2003survey of small business finance.(Online).
[65] Miller, M., Godfrey, N., Levesque, B. & Stark, E. (2009). The Case for Financial Literacy in Developing Countries: Promoting Access to Finance by Empowering Consumers. World Bank, DFID, OECD, and CGAP joint note,Washington, DC: World Bank
[66] Minniti, M & Bygrave, W. (2001).A dynamic model of entrepreneurial learning. Entrepreneurship Theory and Practice, 25 (3), pp. 5 – 16.
[67] Mugenda, O.M, Mugenda, A.G. (2003) Research Methods: *Quantitive and Qualitative approaches*, Nairobi: Acts Press
[68] Mugenda,M.A. and Mugenda,G.A.(1999),Research Methods; Acts Press, Nairobi.
[69] Musamali,M.M.and Tarus,D.K.(2013),Does the Firm Profile Influence Financial Access Among Small and Medium Enterprises in Kenya, Asian Economic and Financial Review, Vol.3(6).
[70] Myer,S.C.(1984).Capital Structure Puzzle. Journal of Finance.39(1).
[71] Myers, Stewart and Majluf, Nicholas S. (1984); Corporate Finance and Investments Decisions when Firms have Information that Investors Do Not Have, *Journal of Financial Economics*, Vol 13, No. 2, (June 1984), pp 187-221
[72] Nachmias,C.F.&Nachmias (1996), Research Methods in Social Sciences. Martin's Press ,New York.
[73] Namusonge, G.S.(1998) Determinants of growth oriented small and medium enterprises in Nairobi, Kenya. Unpublished PhD thesis, Jomo Kenyatta University of Agriculture and Technology.
[74] Nguyen, T.D.K &Ramachandran,N. (2006) Capital Structure in Small and Medium –Sized Enterprises: The case of Vietnam, A sean Economic Bulletin. (23)2
[75] Ntsika Enterprise Promotion Agency (2002), State of Small Business Development in South Africa, Annual Review.(On-line)
[76] Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill
[77] Nyhan, B. (1995). "Learning and the workplace: perspectives on competencedevelopment in European companies", paper delivered at a conference entitled:"*Global competencies – workplace outcomes"* at Darling Harbour Convention and Centre, Sydney, Australia.
[78] Obert,M. and Olawale.F (2010), Does Debt Really Matter on the Profitability ofSmall Firms: A perspective on small manufacturing firms in Bulawayo,Zimbabwe, African Journal of Business Management, 4(9) Oliver Morrissey and Michael Tribe, Cheltenham: Edward Elgar.
[79] Olomi, D.R (2005) Enhancing MSEs contribution to employment and poverty reduction within National Poverty Reduction Strategy, Workshop Paper on enhancing MSES's access to government procurement and food standard by Association of Tanzania Employers (ATE) , Regency Hotel ,Dar as salaam .
[80] Olufunso,O.F., Herbst,G. and Lombard, R.M.(2010). An Investigation into impact of usage of debt on profitability of small and medium enterprises in the Buffalocity municipality, South Africa, African Journal of Business Management,4(4
[81] Organization of Economic Cooperation and Development (2006).The MSEs Finance Gap.Vol.1 Theory and Evidence.
[82] Orodho, A.J. (2003). Essential of Education and Social Sciences Research method; Nairobi; Masola Publishers.
[83] Pandey, I.M. (1995), Essentials of Financial Management, Vikas Publisher , New Delhi, India.
[84] Penrose, E.T, (1995). Research on the business firm: Limits to the growth and expansion of Firms; *the art and practice of the learning organization.*
[85] Polit, DF &Hungler, BP. (1999).Nursing research; principles and methods.4th edition. Philadelphia: JB Lippincott
[86] Pretorius,M.&Shaw,G.(2004), Business plan in bank-decision making when finance new ventures in South Africa. South African Journal of Management science.
[87] Republic of Kenya (1986), Sessional Paper No.1 of 1986 on Economic Management for Renewed Growth, Nairobi, Government Printer
[88] Riding,A. ,George,H. & Roland, T.(1994) , The Canadian Small Business –Bank Interface: A Recursive Model , Entreprenuership Theory and Practice (summer)
[89] Sacerdoti,E.(2005),Access to Bank Credit in Sub-Saharan Africa; Key Issues and Reform Strategies, IMF Working Paper Series
[90] Sarapaivanich,N. &Kotey, B.(2006).The effect of financial information quality onability to access external finance and performance of MSEs in Thailand. Journal of Enterprising Culture,14(3
[91] Scott,D.F.(1972).Evidence on the importance of financial structure. Journal on financial management, 1(3)

[92] Shane,S.(2008),The importance of angel investing in finance the growth ofentrepreneurial ventures. Journal on financial management, 1(3)
[93] Sogorb-Mira, F. (2005), How MSES Uniqueness Affect Capital Structure: Evidence from a 1994-1998 Spanish Data Panel. Small Business Economics, 25(5)
[94] Stigliz, J.&Weiss,A.(1981).Credit rationing in markets with imperfect information
[95] Stoner, Greg L and Manz.(1995). Leadership for Self – Managing Work Teams; ATypology and Integrative Model, *Humans Relations (HR), 48, 47 – 70*.
[96] Zororo,M.(2011),Characteristics and motivation in female entrepreneurship. A case study of Botswana. University of Botswana Journal.

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Le Knowledge Risk Management « KRM », une approche de gestion des connaissances basée sur le risque : une synthèse des concepts et cadres d'analyse

[The Risk Management Knowledge "KRM" an approach to knowledge management based on risk : a review of concepts and analytical frameworks]

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ABSTRACT: Until a decade ago, sharing and utilizing knowledge has been regarded as a major contributor to an organization's competitive advantage. But more recently, different facets of managing organizational knowledge-related risks, or knowledge risk management KRM are fast gaining recognition for their role in bolstering an organization's competitive advantage. For any organization to deliver its products and services on time and on budget, while maintaining desired levels of quality and innovation, it needs to manage information and knowledge related risks. It is the unique and vital knowledge that keeps the day-to-day operations in motion, drives creativity and innovation, and sets it apart from the competition. That's why KRM focuses mainly on safeguarding knowledge, preventing knowledge loss, and minimizing the underutilization of organizational knowledge base.

KEYWORDS: Knowledge Management, Risk Management, Knowledge Risk Management.

1 INTRODUCTION

Dans la foulée de la récente crise financière mondiale et les défaillances d'entreprises, les acteurs exigent une plus grande surveillance des principaux risques auxquels l'entreprise pourrait être assujettie afin de préserver et renforcer la création de valeur. Une réponse à ces attentes croissantes est l'émergence d'un nouveau paradigme appelé "Enterprise Risk Management" ou « ERM» comme un système de contrôle interne qui corrobore la tendance affirmée de l'adoption d'une démarche globale du Risk Management, devenu explicite via la diversité des normes y afférentes, COSO 2 & COSO 3, FERMA, ISO 31000… Parallèlement, l'ère informationnelle des IT, du savoir et des compétences dans la quelle opèrent les entreprises du 21ème siècle leur impose d'aborder le partage et l'utilisation des connaissances comme un contributeur majeur d'avantages concurrentiels que celles-ci pourraient s'accaparer.

Compte tenu de l'importance de ces deux systèmes, Risk Management & Knowledge Management sont appelés, plus que jamais à fonctionner simultanément. La possibilité d'intégrer une politique de KM et une démarche RM existante ou envisagée mérite ainsi d'être explorée. Le concept knowledge risk management « KRM », encore très récent et en phase de construction répond à cette attente eu égard aux différentes facettes de la gestion des risques liés aux connaissances d'une organisation et dont le rôle est de plus en plus reconnu notamment comme source de compétitivité et d'avantage concurrentiel si recherché.

Le KRM se concentre, principalement sur la sauvegarde des savoirs, prévention de la perte de la connaissance, et la minimisation de la sous-utilisation des connaissances organisationnelles de base. Une gestion de l'information et des risques liés à la connaissance d'une entreprise est en effet devenue requise pour livrer ses produits et services dans les délais et le budget voulus, tout en maintenant les niveaux souhaités de qualité et d'innovation. Le KRM fera ainsi l'objet de ce document qui examine à travers une revue de la littérature d'abord les concepts de Connaissances et Knowledge Management, le Risk Management et les frameworks y afférents. En outre, ce travail de recherche présentera le concept de KRM et une analyse critique des modèles ayant traité du sujet.

2 LE KNOWLEDGE MANAGEMENT KM

2.1 NOTION DE « CONNAISSANCE »

L'une des façons de définir la notion de connaissance est de décrire la différence entre connaissance, information et données (Nonaka et Takeuchi, 1995 ; Wiig, 1999) (1). Cette différence est plutôt simple à expliquer (figure 1) ; les données sont des chiffres et des faits bruts, l'information représente des données traitées, et la connaissance consiste en des informations authentifiées (Shankar et al. (2)). Alavi et Leidner (2001) avancent que l'information est convertie en connaissance une fois qu'elle est traitée par l'esprit humain, et la connaissance devient une information une fois qu'elle est articulée et présentée sous la forme de texte, graphiques, mots, ou autres formes symboliques.

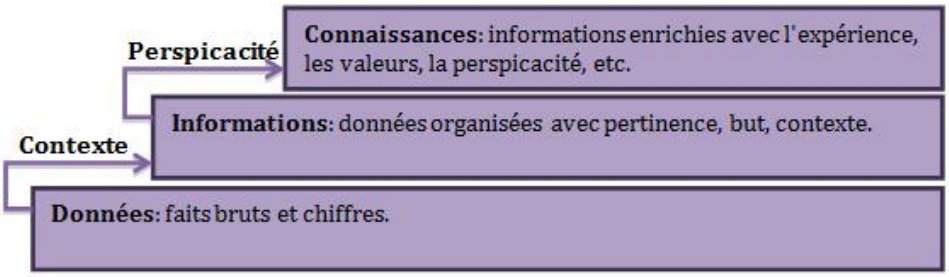


Figure 1: chaîne de valeur de connaissance

Source : Shankar et al, 2003

Pour Wiig (3), la connaissance est utilisée pour recevoir l'information, la reconnaître et l'identifier ; l'analyser, l'interpréter et l'évaluer ; synthétiser, faire des hypothèses et décider ; s'adapter ou adapter, planifier, et piloter. Il existe cinq perspectives pour appréhender la connaissance : un état d'esprit, un objet, un processus, une condition d'avoir accès aux informations, ou une capacité (Alavi & Leidner (4) (voir tableau 1).

Tableau 1: Perspectives de la connaissance (Alavi & Leidner 2001)

Perspective de la Connaissance	Explication
Connaissances versus des données et Informations	• Les données sont des faits, des chiffres bruts • Les informations sont des données traitées/interprétées • La connaissance représente des informations personnalisées
Etat d'esprit	La connaissance est l'état de savoir et de comprendre
Objet	Les connaissances sont des objets à stocker et manipuler.
Processus	La connaissance est le processus d'appliquer expertise.
Accès à Informations	La connaissance est la condition d'accéder aux informations.
Capacité	La connaissance est le potentiel d'influencer l'action.

2.2 LE KNOWLEDGE MANAGEMENT KM

Malgré une littérature abondante sur le KM, il n'existe toujours pas une définition universellement acceptée de ce concept (Earl et Manovas) (5). Le tableau 2 présente quelques définitions qui appréhendent le KM de manières totalement différentes. Ainsi, si certaines définitions mettent l'accent sur un KM axé sur la technologie, d'autres voient le KM comme un ensemble d'activités ou de processus de développement et d'exploitation des connaissances afin de réaliser ou d'améliorer des résultats spécifiques tels que les objectifs organisationnels, la valeur, la performance à long terme, le succès de l'organisation ou le Chiffre d'affaire.

Nous en retenons que le knowledge management peut être défini comme « la capacité organisationnelle à identifier, localiser (créer ou acquérir), transférer, transformer et distribuer les connaissances en avantage concurrentiel » (Walters, (6)).

Tableau 2: Définitions du KM

Auteur	Définition
Kongpichayanond (2009, p.382) Massa and Testa (2009, p.131)	Un processus en théorie générale du système avec quatre catégories, y compris l'acquisition et création des connaissances, la capture des connaissances, le stockage et la récupération, la diffusion des connaissances, le transfert et le partage, et l'application des connaissances que l'organisation décide de gérer pour réaliser à gagner CA.
Debowski (2006, p 16)	Le processus d'identification, de capture, d'organisation et de diffusion des compétences intellectuelles qui sont essentielles à la performance de l'organisation à long terme.
Jennex et Olfman (2006)	L'intelligence et l'effort du mangement dans l'utilisation des outils et des approches pour localiser, affiner, transférer, et appliquer les connaissances et l'expérience développées au sein de l'organisation.
James (2005, p 51)	L'identification, l'acquisition, l'utilisation, le support, la maintenance et la cession des actifs connaissances dans le but de créer de la valeur qui profite à toutes les parties prenantes.
Becerra Fernandez Gonzalez et Sabherwal (2004, p31)	Effectuer les activités liées à la découverte, la capture, le partage et l'application des connaissances afin d'améliorer, dans un rapport coût-efficacité, l'impact des connaissances sur l'atteint des objectifs de l'organisation.

Jusqu'à présent, plusieurs cadres théoriques et modèles du KM ont été développés. Nonaka et Takeuchi (7) ont conçu un modèle dynamique pour illustrer l'interaction entre deux types de connaissances : les connaissances tacites et les connaissances explicites. Probst (8) a mis au point un modèle descriptif intitulé «The building Blocks of KM». Dans ce modèle, le KM est visualisée comme un cycle dynamique qui tourne en permanence et qui comprend huit blocs de cycles internes et externes. Le modèle de KM de Fraunhofer IPK (Heisig, (9) s'intéresse aux processus organisationnels à grande valeur-ajoutée, dans lesquels l'amélioration des connaissances clés conduit à améliorer le fonctionnement organisationnel. Ce modèle se compose de quatre activités principales : production, stockage, distribution et application (Merits et al, 2003). Notez que dans la majorité des références, le KM consiste en quatre grandes étapes : création, stockage, Distribution et utilisation (Berryman,(10)).

3 GESTION DU RISQUE / « RISK MANAGEMENT »

3.1 LE RISQUE

L'examen de la littérature nous enseigne que le risque est une notion difficile à cerner et que sa définition a évolué dans le temps. En effet, les incertitudes qui affectent le sens du terme de risque viennent de loin. Wiederkehr (11) précise que l'étymologie en reste controversée. Le mot vient du latin sans doute, mais dérive-t-il de *resecare*, enlever en coupant, ou de *rixare*, se quereller. Durant de très nombreuses années, ce concept a été assimilé à celui de danger. Cette approche

conduisait implicitement à l'ignorance totale ou partielle des effets positifs de l'activité source du risque. Pour tenir compte de ces apports tout en prévenant les dommages potentiels, la définition du terme « risque » s'est ensuite déplacée vers celle d'événement probable ayant des conséquences. La présence d'une source de risque était rendue acceptable au regard de très improbables dommages qu'elle pouvait engendrer et des contributions positives qu'elle fournissait assurément.

La norme ISO 31000 (12) définit le risque comme l'effet de l'incertitude sur l'atteinte des objectifs. Cette définition déplace de nouveau la question du risque en imposant de spécifier les objectifs d'une activité dont l'atteinte pourrait être entravée par l'occurrence des circonstances incertaines. Ces nouvelles définitions ne remettent pas en cause les problématiques de traitement des dangers ou d'analyse des événements dommageables qui se basent sur l'importance des deux paramètres (probabilité et gravité) qui conditionne le niveau du risque (CNUCED (13)).

3.2 LE RISK MANAGEMENT

De façon générale, gérer le risque s'entend prendre les mesures nécessaires pour protéger l'ensemble du patrimoine (matériel, intellectuel et humain) de l'entreprise. Selon le COSO[1] (2004), la gestion des risques est un processus itératif constitué d'étapes qui ont pour conséquence de faciliter la prise de décision et améliorer la performance. Ces étapes comprennent l'identification, l'analyse, l'évaluation, le traitement, le suivi et la communication des risques. Ce processus permet aux organisations de maximiser les gains et minimiser les pertes.

Par ailleurs, le **Risk Management** est décliné, selon Digimind (14), comme un processus qui vise une maîtrise des risques auxquels est exposée une entreprise : ceux qui proviennent de son environnement mais aussi les risques internes à l'entreprise. Son objectif est de limiter au maximum l'expression et/ou l'impact de risques préjudiciables à l'entreprise, en lui permettant d'atteindre ses objectifs avec un niveau d'aléa accepté[2]. Cela consiste à identifier et évaluer les risques puis à développer diverses stratégies de traitement destinées à rendre le risque acceptable. Ces stratégies vont du transfert du risque à l'évitement en passant par la réduction des effets néfastes et l'acceptation de certaines conséquences du risque.

3.3 LES CADRES D'ANALYSE DU RISK MANAGEMENT

Enterprise Risk Management Framework « ERM » : Selon Pagach et Warr (2011), l'objectif principal de la gestion des risques est d'accroître la valeur pour les actionnaires à son maximum. Si, traditionnellement, les effets négatifs de l'exposition aux risques étaient la principale et unique préoccupation, et le travail de spécialiste de risque était seulement de diminuer cet impact négatif à son niveau minimum. Ces dernières années, le concept ERM (Enterprise Risk Management) a émergé et met l'accent plutôt sur les deux côtés positif et négatif du risque (Rochette, 2009).

Le COSO 2, considéré comme l'inventeur de ce cadre de référence « Enterprise Risk Management » Framework, définit la gestion des risques de l'entreprise comme un processus mis en œuvre par le conseil d'administration, les dirigeants et le personnel d'une organisation, exploité pour l'élaboration de la stratégie et transversal à l'entreprise, destiné à identifier les événements potentiels pouvant affecter l'organisation, maîtriser les risques afin qu'ils soient dans les limites du « Risk Appetite (**appétence au risque**)» de l'organisation, et fournir une assurance raisonnable quant à la réalisation des objectifs de l'organisation.

Pour Stokes (2004) et Woon, Azizan, et Samad (2011), l'ERM est un cadre de gestion des risques solide et dynamique, qui élève l'appétit pour le risque à la hausse « *Risk Appetite* » et dans lequel l'accent est mis sur la gestion des risques stratégiques liés aux opportunités et menaces et non seulement sur les risques opérationnels et financiers. Le COSO 2 (2004) est l'un des cadres de travail les plus populaires et mis en œuvre dans différentes entreprises partout dans le monde (Daud, et al., (15)). Il comprend huit éléments interdépendants que sont : l'Environnement interne, Définition d'objectifs, Identification des événements, Évaluation des risques, Réponses aux risques, Activités de contrôle, Information et communication et Pilotage.

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[1] COSO est l'acronyme abrégé de Committee Of Sponsoring Organizations of the Treadway Commission, une commission à but non lucratif qui établit en 1992 une définition standard du contrôle interne et crée un cadre pour évaluer son efficacité. Par extension ce standard s'appelle aussi COSO. Il est utilisé notamment dans le cadre de la mise en place des dispositions relevant des lois Loi Sarbanes-Oxley, SOX ou Loi de sécurité financière, LSF, pour les entreprises assujetties respectivement aux lois américaines ou françaises. Le référentiel initial appelé COSO 1 a évolué depuis 2002 vers un second corpus dénommé COSO 2 et plus récemment COSO 3.

[2] P. Vincent & B. Besson «Le Risk Manager et l'intelligence économique » Ouvrage collectif. ifie éditions- AMRAE 2010.

Risk Management Processes, RMP Framework : Actuellement, les experts du Risk Mangement recommandent de plus en plus à toutes les organisations de travailler dans un cadre formel RMP, Risk Management Process framework [3] qui est adaptée aux types spécifiques de projet et le contexte que l'organisation fait face.

Bien que l'histoire des cadres d'analyse remonte à la fin des années 50[4]. L'analyse des risques et l'élaboration de processus de gestion des risques (RMP Framework) ont parcouru un long chemin depuis la fin des années 1990. Les processus et les modèles y afférents ont également évolué sur une période de temps considérable aussi bien que les questions abordées. Cette perspective historique comprend surtout trois cadres de travail[5] développés dans le guide PRAM (Simon et al, 1997), le guide PMBOK (PMI, 2000), et le guide RAMP (Simon, 1998; voir aussi Lewin, 2002).

En réalité, il n'y a pas de différence significative entre ces différents cadres d'analyse. Les principales étapes de la planification, l'identification, l'analyse qualitative et quantitative, la réaction au risque, et de contrôle sont présentes dans toutes ces approches.

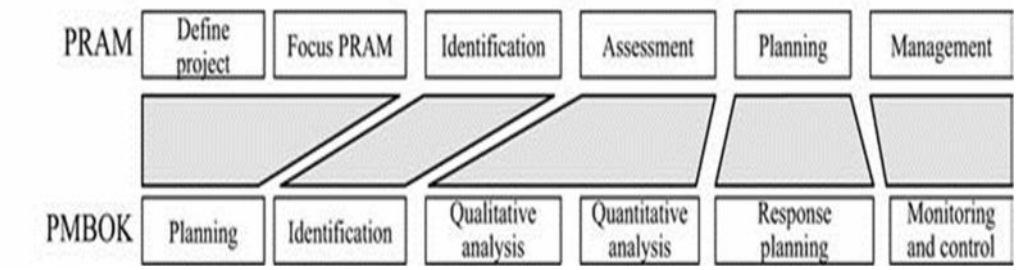


Figure 3: Comparaison des RM Processes

Le Risk Management Process « PMBOK » qui est interpelé dans le développement du KRM, Knowledge Risk Mangement dans la suite de cet article consiste en six étapes qui sont :

1. Planification : processus de prise de décisions et procédures du RM.
2. L'identification des risques : le processus d'identification des facteurs de risque importants et probables par rapport aux objectifs du projet, la détermination de leurs caractéristiques, et enfin la documentation des résultats.
3. L'analyse qualitative : et elle permet de donner la priorité aux facteurs de risque du projet selon l'échelle suivante : pas du tout important, pas important, moyennement important, important, et très important. Le résultat ne consiste pas en un calcul précis de la durée ou du coût mais plutôt permet d'ignorer les facteurs de risque les moins importants.
4. L'analyse quantitative : elle évalue la probabilité des facteurs de risque importants et examine leurs effets sur l'atteinte des objectifs du projet.
5. Réaction au risque : consiste à élaborer et sélectionner les réactions aux différents facteurs de risque afin d'accroître les opportunités et diminuer les menaces du projet.
6. Suivi et évaluation : consiste à suivre de manière continue les facteurs de risque identifiés et nouveaux.

4 KNOWLEDGE RISK MANAGEMENT « KRM »

Le knowledge risk management ou management des risques liés aux connaissances est un domaine de recherche académique très récent. Il est à la croisée deux champs distincts : le management des risques et le knowledge management. La littérature appréhende le KRM de deux manières. D'un côté, certains auteurs s'intéressent à la manière avec laquelle les

[3] Chris Chapman and Stephen Ward (2003),"Project Risk Management, Processes, Techniques and Insights" School of Management, University of Southampton, UK, John Wiley & Sons Ltd, England.

[4] PERT (Program Evaluation and Review Technique) initialement développé dans les années 1950.
GERT (Graphical Evaluation and Review Technique), Moder and Philips, 1970 ;
SCERT (Synergistic Contingency Planning and Review Technique, (Chapman, 1979)

[5]PRAM, project risk analysis and management (Simon et al., 1997; Association for Project Management, 2004), PMBOK, Project Management Book Of Knowledge (PMBOK Guide: PMI, 2000, chap. 11) and RAMP, Risk Analysis and Management of Projects (RAMP Guide, Simon, 1998; see also Lewin, 2002)

connaissances peuvent réduire les risques, permettant ainsi un meilleur management des risques. L'exemple à citer est celui de Zoysa et Russell (16) qui ont examiné la façon dont les connaissances peuvent participer à l'identification, la quantification et la réaction aux risques. En outre, Verhaegen et Otterson (17) ont étudié la manière avec laquelle les connaissances informent les décideurs. D'un autre côté, d'autres auteurs examinent comment le processus de gestion des connaissances peut améliorer la gestion des risques. Par exemple, Marshall et al. (18) ont identifié une série de « leviers » du KM qui permettent d'esquiver les difficultés financières liés à un mauvais management des risques. Ces leviers se situent à plusieurs niveaux du processus KM tels que le transfert de connaissances aux décideurs, l'amélioration de l'accessibilité aux connaissances, et l'intégration des connaissances dans les contrôles et les systèmes.

Neef (19) affirme qu'ils existent plusieurs similitudes entre Management du Risque et Knowledge Mangement ; tels que le fait que les deux nécessitent la perspicacité des employés, et accordent de l'importance à l'action et à l'effet d'expérience. L'auteur finit par conclure que le management des risques équivaut le KM. Les partisans de cette position recommandent d'emprunter les outils du KM tels que la cartographie des connaissances, la communauté de pratiques, et les experts, pour les utiliser comme base du KRM.

4.1 LES MODÈLES DU KRM

Comme le KRM est un concept nouveau, il existe peu de modèles voire d'auteurs qui ont abordé le sujet. Nous présenterons dans ce qui suit les quatre principales contributions en la matière.

- Zyngier (20) a mené une étude de cas dont le but est de renforcer les stratégies de KM en utilisant le management des risques comme fonction de gouvernance. Son travail permet d'assurer, en concevant des modèles de reporting et des procédures de management des risques, une rétroaction adaptée pour le système de KM. En d'autres termes, l'utilisation des outils du management des risques fournit un feedback organisé pour faire face aux facteurs de risque culturels et structurels de la stratégie de KM.

- **Tennessee Valley Authority [6](TVA) (21)** a lancé un projet pour le contrôle de l'attrition des connaissances de ses processus en 1999 et a élaboré un modèle de KRM nommé TVA (TVA, 2008 ; IAEA, 2006). Ce modèle (figure 2) est constitué de 3 étapes : l'évaluation du risque, la conception et l'implémentation d'un plan d'action, le suivi et l'évaluation. Parmi les références portant sur le KM et le management des risques, l'approche TVA est la plus complète (Jafari, (22)). Toutefois, cette dernière présente quelques limites. Tout d'abord, les résultats et réalisations de ce modèle ne sont pas présentés. Ensuite, ce cadre ne traite pas de l'analyse quantitative des risques de perte de connaissance.

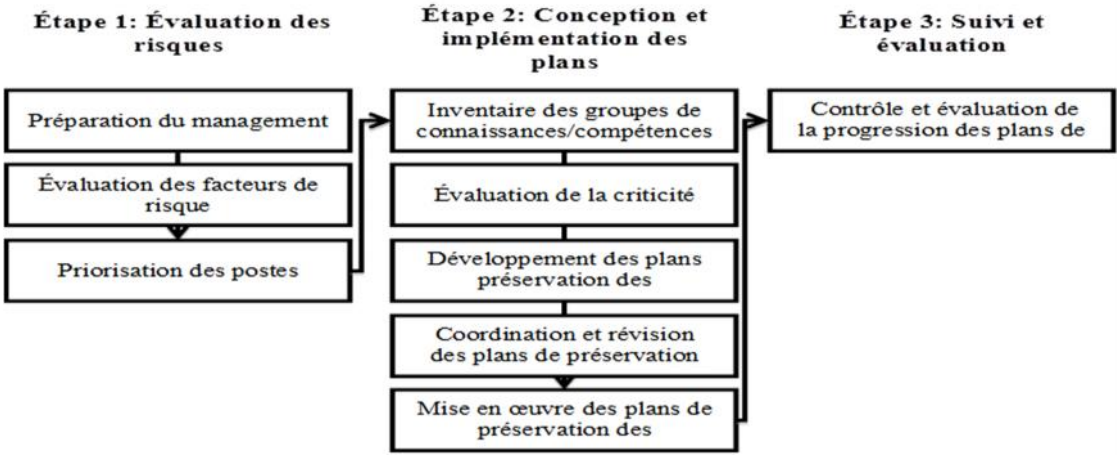


Figure 2 l'approche TVA du KRM. (Source TVA, 2008).

- Massingham (23) a mis au point un modèle de management des risques de connaissance pour l'ensemble des activités de l'organisation. Ce cadre conceptuel aborde les principales difficultés lors de l'utilisation de l'outil de risque management

[6] La Tennessee Valley Authority est une entreprise américaine créée en 1933 et chargée de la navigation, du contrôle des crues, de la production d'électricité et du développement économique de la vallée du Tennessee.

« les arbres de décision ». Même si le modèle de Massingham a élaboré des instructions pour traiter tous les facteurs de risque organisationnels, il ne traite pas l'analyse quantitative des risques liés à la perte de connaissances.

- Modèle KRM Jafari et al.

Jafari et al. (24) ont construit leur modèle (Figure 4) sur la base du cadre théorique TVA (le plus complet en matière de KRM), du modèle de Fraunhofer en KM (simple et universel), et de l'approche PMBOK en management des risques. Ce modèle stipule qu'on peut assure le suivi de la gestion des connaissances organisationnelles à travers l'identification, la hiérarchisation et la maîtrise des facteurs de risque liées à la connaissance « KFR »[7].

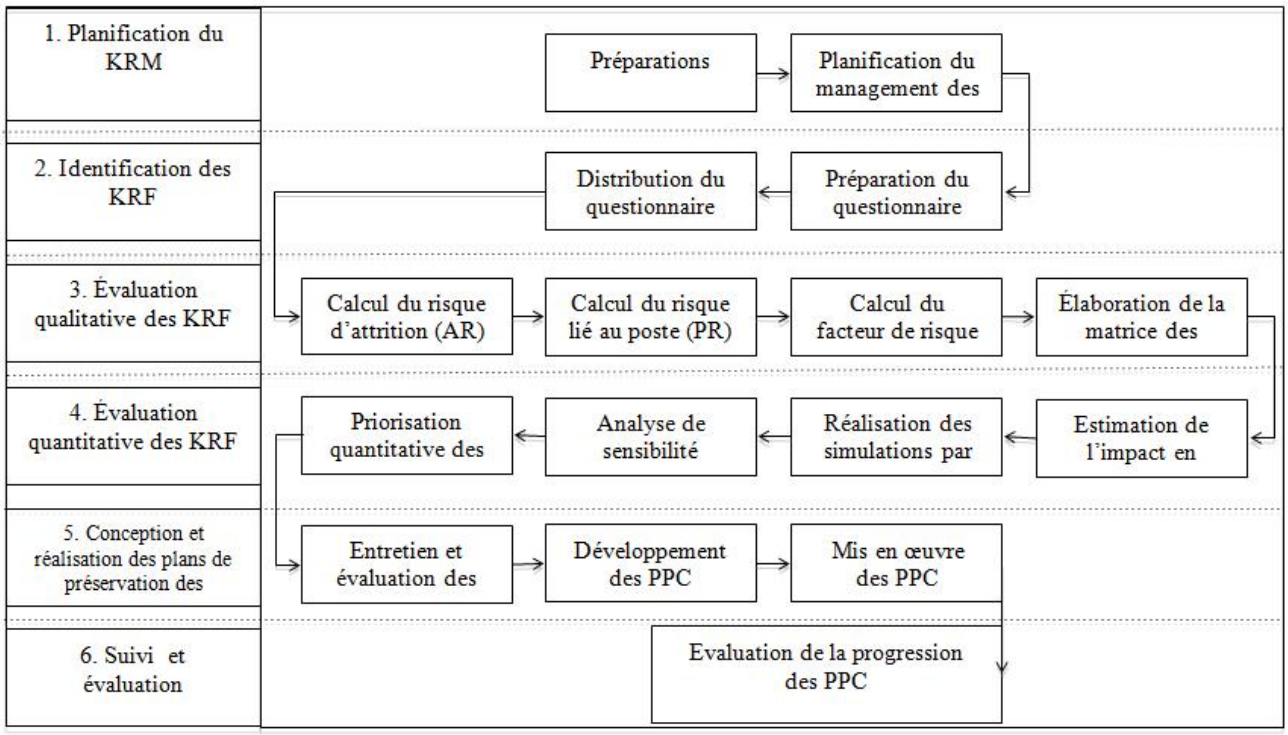


Figure 4. Modèle KRM Jafari et al. (2011)

Le modèle de Jafari et al. (2011) se compose de six étapes :

Étape 1 : *planification du KRM*. Cette étape vise principalement à influencer la culture organisationnelle et à acquérir l'engagement du top management. La réalisation des objectifs du management des risques passe nécessairement par la détermination des responsabilités, des pouvoirs et des politiques organisationnelles portant sur la façon de faire face aux KRF. Cette étape vise également à fixer le niveau de risque acceptable par l'organisation (Risk appetite). En outre, on doit choisir les techniques d'évaluation des risques, fixer l'échéancier des activités de management des risques, et estimer le budget nécessaire pour mettre en place le processus management des risques.

Étape 2: *identification des KRF*. Cette étape consiste à identifier les caractéristiques des KRF qui influencent les objectifs organisationnels. Selon TVA (2008), il y a deux sortes de KRF: les facteurs de risque d'attrition (AR[8]) et les facteurs de risque liés au poste (PR[9]). Les AR indiquent la date présumée à laquelle l'organisation perd ses ressources humaines. Les PR sont

[7] *Le modèle de Jafari et al. (2001) appelle les facteurs de risques liés à la connaissance KRF en référence à leur nom en anglais « Knowledge Risk Factors ».*

[8] *Abréviation issue de l'anglais Attrition Risk.*

[9] *Abréviation issue de l'anglais Position Risk.*

déterminés sur la base de l'unicité et de la criticité des connaissances des employés et en évaluant le degré de difficulté ou le niveau d'effort exigé pour que les employés soient remplacé (IAEA, (25)).

Étape 3*: évaluation qualitative des KRF*. Lors de cette étape, les individus ou les postes de travail qui peuvent entrainer la perte des connaissances de l'organisation doivent être identifiée. Dans la littérature de management des risques, le facteur de risque est calculé en multipliant deux facteurs : la probabilité du risque ou sa fréquence et la gravité du risque ou son impact (Tah et Carr, (26)). Dans le cas du modèle de Jafari et al. (2011) du KRM, la probabilité représente les AR ou les dates de perte de ressources humaines. Ces dates peuvent être déterminées sur la base des opinions des employés ou de leur âge et la date du début d'emploi dans l'organisation. Le tableau 3 montre les critères utilisés pour assigner une valeur à l'AR.

Tableau 3. Critères d'attribution du score AR (Source : l'IAEA, 2006)

Critère	AR
Départ des employés au cours de l'année	5
Départ des employés au cours des trois prochaines années	4
Départ des employés au cours des quatre prochaines années	3
Départ des employés au cours des cinq prochaines années	2
Départ des employés au cours des six prochaines années	1
Départ des employés au delà des sept prochaines années	0

Ce modèle considère la gravité du risque comme étant le facteur PR qui désigne la criticité et l'unicité de la connaissance détenue par la Ressource humaine ou son poste. L'évaluation du PR se fait sur la base des critères présentés dans le tableau 4 (IAEA, 2006). La valeur de PR fait appel à l'évaluation du supérieur direct et indirect portant sur les responsabilités, expériences, tâches formelles et informelles, missions récurrentes et autres éléments ayant une influence sur les connaissances individuelles. Le supérieur direct a la possibilité de consulter les autres membres de l'équipe, les clients ou toute autre partie prenante pour allouer le score PR (IAEA, 2006).

Tableau 4 Critères d'attribution du score PR (Source : IAEA, 2006)

Critère	AR
Compétences et connaissances indispensables et uniques. Ce sont les connaissances critiques sur les principaux processus de l'organisation, les connaissances organisationnelles spéciales, et les connaissances non documentées. Ce type de connaissances nécessite trois à cinq ans de formation et d'expérience. Les employés ou postes disposant de ces connaissances n'ont aucun remplacement disponible.	5
Compétences et connaissances indispensables. Ce sont les connaissances que d'autres employés connaissent mais d'une manière limitée. Certains documents existent à ce sujet. Pour les maitriser, ces connaissances nécessitent un à deux ans de formation et d'expérience	4
Compétences et connaissances fondamentales *et importantes*. Ce sont des connaissances documentées et que les autres employés de l'organisation ont. Le recrutement de nouveaux employés est possible et nécessite 6 à 12 mois de formation.	3
Compétences et connaissances qui peuvent s'acquérir par le biais des procédures. Il est nécessaire d'avoir des procédures évidentes et mises à jour, des programmes de formation disponibles et en mesure de rendre les nouvelles recrues prêtes à l'exercice de leurs fonctions en moins de six mois	2
Compétences et connaissances ordinaires. Ce sont les connaissances dont disposent les ressources humaines qui n'appartiennent pas à l'organisation. Pour les acquérir, on peut simplement recruter puisque ces connaissances nécessitent peu de formation.	1

Par conséquent, le facteur de risque total RF[10] peut être obtenu par la multiplication du facteur AR et du facteur PR comme le montre l'équation (1). Le tableau 5 présente l'interprétation des résultats obtenus par l'équation du RF:

$$RF = AR \times PR \qquad (1)$$

Afin d'augmenter la validité de la mesure des facteurs de risques liés aux connaissances KRF, le modèle de Jafari et al. (2011) se base sur l'évaluation des deux responsables directes (supérieur) et indirectes (manager). Ces évaluation du facteur de risque du supérieur direct et du supérieur indirect sont respectivement appelées RF_s et RF_m.

[10] *Abréviation issue de l'anglais Risk Factor*

Tableau 5 critères d'évaluation de RF_f (Source : adapté de l'IAEA, 2006)

Critère	AR
Zone 1. très haute importance: nécessite des réactions rapides dans un temps limite. Les réactions sont: élaboration du plan de préservation des connaissances, évaluation des connaissances et formation professionnelle.	20.01 à 25
Zone 2. haut importance: requiert le développement d'une Gestion prévisionnelle des emplois et des compétences afin de déterminer les méthodes et le calendrier de remplacement, d'orienter les efforts de recrutement, de formation et d'observation de titulaire actuel du poste.	15.01 à 20
Zone 3. importance modérée: nécessite l'élaboration de plans de relève pour les postes en question. Par exemple, le recrutement de nouveaux employés et élaboration des programmes de formation.	10.01 à 15
Zone 4. faible importance: nécessite l'analyse des fonctions des postes en question afin de déterminer la nécessité ou non de préparer la relève.	5.01 à 10
Zone 5. très faible importance: nécessite l'analyse des fonctions des postes.	1 à 5

Enfin, les valeurs attribuées au RF par le supérieur direct et indirect s'ajouteront ensemble selon l'équation (2). Le modèle attribue une valeur supérieure au coefficient RF_s et l'explique par le fait que les contacts le plus étroits se fait avec le supérieur directe, ce qui le rend plus à même de mesurer les facteurs AR et PR.

$$RF_f = 0,6 \times RF_s + 0,4 \times RF_m \quad (2)$$

Le facteur de risque global RF_f représente une évaluation exhaustive et complète du risque de perte des connaissances. Le modèle de Jafari et al. (2011) fait remarquer que la correction du facteur PR_s par un groupe d'employés est nécessaire parce que les superviseurs et les managers attribuent généralement une valeur supérieure de KRF aux employés les plus actifs. En d'autres termes, le fait que certains employés sont plus performants n'est pas une condition sine qua non pour que leurs connaissances soient critiques pour l'organisation.

Étape 4: *évaluation quantitative du KRF*. Cette étape nécessite l'analyse statistique des conséquences pour les employés ou les postes de travail dont le RF_f est supérieur ou égal à quinze (zone 1 et 2). Dans cette étape, l'ampleur de l'impact de chaque KRF sur les objectifs de l'organisation (en termes de temps, coût et qualité) sera déterminée au moyen d'entrevues avec des experts. Par la suite, les KRF critiques ayant les effets négatifs les plus catastrophiques devraient être identifiés par analyse de sensibilité. Cette analyse permettra de re-prioriser les KRF afin de développer les plans de préservation des connaissances.

Étape 5 *: Conception et réalisation des plans de préservation des connaissances*. Après avoir mené l'analyse qualitative et quantitative des risques, l'étape suivante consiste à réduire le risque de perdre les connaissances des employés qui ont le RF_f le plus importance. Dans la littérature du management des risques, les réponses aux facteurs de risque peuvent être classées en quatre groupes de réaction: évitement, transfert, atténuation ou acceptation des facteurs de risque (PMBOK, 2004). Le tableau 6 présente différentes options pour la réaction au risque de perte de connaissance.

Tableau 6. Méthodes de réponse aux KRF. (Source : IAEA, 2006)

Recrutement et travail temporaire	Coaching et formation	Re-engineering	Codification	autres réactions
-Recrutement ou transfert -Négociation avec les employés pour assumer plus de responsabilités -Recrutement d'employés à temps partiel, temporaires ou retraités.	- Formation sur simulateur -Vidéo et formation assistée par ordinateur. -Formation en milieu de travail -Mentorat, coaching, observation -Plan d'apprentissage -Ateliers de formation polyvalente.	-Amélioration des processus -Équipement à jour -Technologie intelligente -Suppression de tâches ou activités -Conception d'espaces ouverts qui encouragent la communication.	-Documentation -Procédures nouvelles ou mises à jour -Instructions en vidéo - Systèmes de soutien à la performance - Schématisation des concepts - Normalisation -Dossiers partagés, intranet - Dégager les enseignements et les meilleures pratiques.	-Rotation du personnel - compétences polyvalentes - climat d'apprentissage -Motiver par les primes - Rétention des RH.

Ainsi, la première priorité est d'acquérir et de préserver les connaissances des employés qui vont bientôt prendre leur retraite. Aussi ce plan doit être élaboré et mis en œuvre pour chacun des employés qui ont un RF_f de plus de 15 et dont l'analyse quantitative des risques montre un impact significatif sur les objectifs organisationnels. Ces employés peuvent obtenir une promotion, être remplacés ou quitter l'organisation pour une raison ou une autre, et cela peut aboutir à la perte de leurs connaissances inestimables.

Étape 6*: Suivi et évaluation*. Suite à la conception et mise en œuvre des plans de préservation des connaissances, le suivi du processus s'avère primordial. Un tel suivi suppose de :

- Faire le point sur les plans de préservation des connaissances.
- Identifier les postes ou les employés pour lesquels une réévaluation ou élaboration de ce plan est nécessaire.
- Revoir les critères de mesure des plans de préservation des connaissances :
  - Prévision des futures attritions probables ;
  - Nombre de positions prioritaires ;
  - Nombre de postes pour lesquels on doit élaborer le plan de préservation des connaissances ;
  - Achèvement des plans de préservation de connaissances ;
  - Indicateurs de mesurer des connaissances tels que de la performance ;
  - Evaluation de l'impact d'autres activités sur l'analyse des risques.
- Évaluer l'efficacité des plans de préservation des connaissances dans la réalisation des objectifs déterminés.

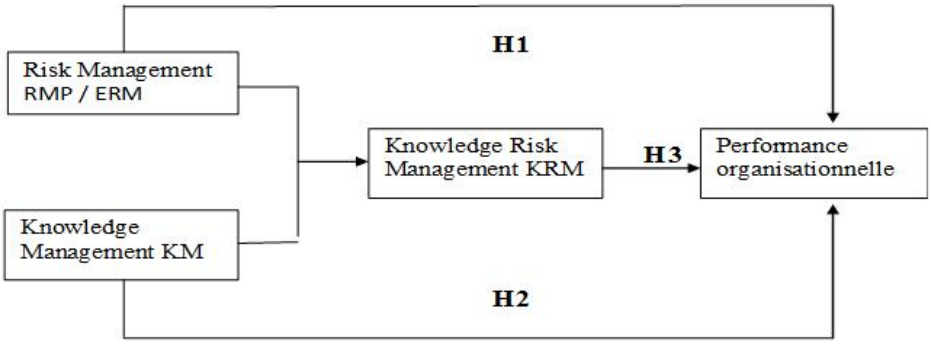
Cependant, le modèle de Jafari et al. (2011), bien qu'étant l'un des modèles les plus complets traitant du KRM, présente quelques difficultés quand à son application. D'abord la difficulté d'évaluer l'influence des KRF sur l'organisation et ses objectifs. Dans ce cas, le rôle des experts s'avère crucial dans la production de données fiables. Par ailleurs, il est à noter que la majorité des experts qui possèdent une connaissance critique sont des membres clés de l'organisation, et ont donc un temps limité. Ce qui pose le problème de transfert de ces connaissances. Aussi, l'analyse qualitative des facteurs de risque

liés aux connaissances comporte le biais de la subjectivité. La dernière critique à adresser à ce modèle est qu'il a seulement été testé sur un seul projet.

5 CONCLUSION

Aujourd'hui, la plupart des organisations font face aux challenges produits par la perte des connaissances et compétences de leurs ressources humaines. Inopportunément, ces connaissances ne sont pas documentées et l'acquisition de ces compétences nécessite des années d'expérience. Les connaissances peuvent être perdues par différents moyens: retraite, licenciement, ou démission. Cette recherche théorique présente le concept de KRM ainsi que les principaux modèles théoriques qui traitent du processus d'identification des connaissances critiques et de leur préservation. L'objectif de cette communication était de montrer que les menaces relatives à la perte des connaissances critiques à l'organisation peuvent être maîtrisées en développant un système de knowledge management basé sur une approche d'évaluation des risques. C'est dans ce sens où certaines solutions ont été présentées pour la préservation des connaissances critiques de l'organisation et la réduction du risque de les perdre. Les bases théoriques présentées dans cet article peuvent être appliquées à un large éventail d'organisations.

Enfin, nous jugeons en perspective qu'une étude du lien latent entre les deux systèmes Knowledge Management et Risk Management aussi bien que l'impact d'un système intégré KRM sur la performance organisationnelle mérite d'être exploré et pourrait faire l'objet de modélisation. Nous résumons dans le schéma ci après un modèle par étapes élaboré sur la base de trois hypothèses construites ci-dessus qui sous-tendent et guident cet exercice.



Les trois hypothèses qui pourraient guider la construction de modèle :

- **H1** Il existe une relation positive entre l'adoption d'une démarche de Risk Management et la performance organisationnelle.
- **H2** Il existe une relation positive entre l'adoption le Knowledge Management KM et la performance organisationnelle.
- **H3** La combinaison **du** Risk Management & Knowledge Management conduirait à une meilleure performance organisationnelle.

REFERENCES

[1] Wiig, KM 1999, 'What future knowledge management users may expect', Journal of Knowledge Management, vol. 3, no. 2, p. 155-65.
[2] Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. New York, NY: Oxford University Press.
[3] Shankar, R, Singh, MD, Gupta, A & Narain, R 2003, 'Strategic planning for knowledge management implementation in engineering firms', Work Study, vol. 52, no. 4, pp. 190-200.
[4] Alavi, M. and Leidner, D. E. (2001). Review: knowledge management and knowledge management systems: conceptual foundations and research issues. MIS Quarterly 25, 107-136.
[5] Earl, M 2001, 'Knowledge management strategies: toward a taxonomy', Journal of Management Information Systems, vol. 18, no. 1, pp. 215-34.
[6] Manovas, M 2004, 'Investigating the relationship between knowledge management capability and knowledge transfer success', Master of Science thesis, Concordia University.
[7] Walters, D 2002, Operations Strategy, Palgrave Macmillan, New York, p 7.
[8] Probst, G.B. (1998), "Practical knowledge management: a model that works", Prism, Second Quarter, pp. 17-30.

[9] Heisig, P. (2000, October). Process modelling for knowledge management. InEKAW Workshop on Common Approaches on Knowledge Management, 12th International Conference on Knowledge Engineering and Knowledge Management.
[10] Berryman, R. (2005), "KM in virtual organizations: a study of a best practices knowledge transfer model", PhD dissertation, North Texas State University, Denton, TX.
[11] Georges Wiederkehr (2010), Editorial "risque", Revue riseo.
[12] ISO 31000, Management du risque – Principes et lignes directrices, 2009.
[13] CNUCED, Dossier Spécial: Gestion des risques d'assurance dans la PME, 2012.
[14] Digimind, Risk Management, 2010
[15] Daud, W. N. W. D., Yazid, A. S., & Hussin, H. M. R. (2010). The Effect Of Chief Risk Officer (CRO) On Enterprise Risk Management (ERM) Practices: Evidence From Malaysia.
[16] Zoysa, S. and Russell, A.D. (2003), ''Knowledge-based risk identification in infrastructure projects'', Canadian Journal of Civil Engineering, Vol. 30 No. 3, pp. 511-22.
[17] Otterson, S. (2005), ''Transferring catastrophe risk management knowledge'', Risk Management, Vol. 52 No. 5, p. 46.
[18] Verhaegen, T. (2005), ''Knowledge makes risks manageable'', Business Insurance: Industry Focus, Vol. 3, pp. 16-17.
[19] Marshall, C., Prusak, L. and Shpilberg, D. (1996), ''Financial risk and the need for superior knowledge management'', California Management Review, Vol. 38 No. 3, pp. 77-102.
[20] Neef, D. (2005), ''Managing corporate risk through better knowledge management'', The Learning Organization, Vol. 12 No. 2, pp. 112-24.
[21] Zyngier, S. (2008), "Risk management: strengthening knowledge management", International Journal of Knowledge Management, Vol. 4 No. 3, pp. 19-32.
[22] Tennessee Valley Authority (TVA) (2008), "Knowledge retention", available at: www.tva.gov/ knowledgeretention.html (accessed August 2008).
[23] Jafari, M., Rezaeenour, J., Mazdeh, M. M., & Hooshmandi, A. (2011). Développement et évaluation d'un modèle de gestion de risques de connaissances pour les organismes axés sur le projet : une étude de plusieurs étape. Décision de gestion, 49(3), 309-329.
[24] Massingham, P. (2010), "Knowledge risk management: a framework", Journal of Knowledge Management, Vol. 14 No. 3, pp. 464-85.
[25] International Atomic Energy Agency (IAEA) (2006), "Risk management of knowledge loss in nuclear industry organizations", Vienna.
[26] Tah, J.H.M. and Carr, V. (2001), "Towards a framework for project knowledge management in the construction supply chain", Advance Engineering Software, Vol. 32, pp. 835-46.

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Teachers' Preparedness in the Integration of Information Communication Technology in Public Secondary Schools: A Case of Kieni East District, Nyeri County - Kenya

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ABSTRACT: The use of Information and Communication Technology (ICT) in and for education is rapidly expanding in many countries and is now seen worldwide as both a necessity and an opportunity for improving and enhancing the education offered to citizens across the globe (UNESCO, 2006).This study was conducted to investigate teachers 'preparedness in the integration of Information Communication Technology in public secondary schools in Kieni East District Nyeri County-Kenya. The objectives of the study are to (i) establish E-learning sustainability (ii) explore attainment of computer skills and (iii) establish funding strategies in place. Questionnaires were administered to teachers and students. Findings indicated that 90% of the teachers felt that learning computers contributes to the development of the country and especially vision 2030. The study revealed that 68% of the students had no access to internet though 95% can browse the internet using the computers. The level of teachers' preparedness and awareness is low. These findings indicate that majority of the teachers have not yet integrated ICT in the teaching learning process in public secondary schools in Kieni-East District.The study recommends that teachers are taken through workshops that target use of ICT in the teaching learning process. Teachers should be encouraged to buy personal computers which they can use while in and out of school to increase teachers' perception on ICT.

KEYWORDS: Information and communication technology, Teachers' Preparedness, Teachers' perception of ICT

1 INTRODUCTION

There is enough evidence from existing literature that "teachers are slow to recognize the benefits of new technologies" (Edyburn, 2000 in Zahari, 2005). In limited occasions that technology is used and is still not being used effectively by teachers and therefore it does not impact on learners' performance (Polly et al, 2010). This is a serious concern especially for science subjects and mathematics where learners' performance is usually low. According to Sang et al (2009) and Zhao & Cziko (2001), teachers' educational beliefs impact on their use of ICT. This was the result of a quantitative survey conducted by Sang et al (2009) on 873 primary school teachers from 11 Chinese provinces and municipalities, and of a literature survey by Zhao & Cziko (2001). Kumar et al (2008) conducted a survey of Mathematics, Science and English (MSE) teachers from 65 Malaysian secondary schools. A multiple regression statistical procedure was then used to model socio-demographic factors against AUC and technology acceptance constructs. It was found that, in addition to the attitude and motivation factor already mentioned above, gender; age and computer training have an effect on the Actual Usage of Computers (AUC) by teachers.

The rapid growth in Information Communication and Technologies (ICT) has brought remarkable changes in the education sector in the twenty-first century and affected demands of the modern society. Therefore there is need for all the stakeholders in the field of education to be well equipped with ICT in order to bridge the existing technology gap in teaching and learning processes. To successfully initiate and implement educational technology in the schools depends strongly on the teachers' support and attitudes. Some researchers studied the relationship between teachers' perceptions of the use of ICT and their actual integration of ICT into teaching and learning processes. Eugene (2006) explored the effect of teachers' beliefs

and attitudes towards the use of ICT in classrooms. An observation method was used to collect data on teachers' beliefs and attitudes. The study revealed that there was inconsistency between teachers' beliefs and their actual use of technology in the classroom. Teachers' beliefs and teaching practices were found not to match. Similarly, Simonson (2004) used a quantitative study to explore the beliefs of primary school teachers on the use of ICT in teaching. The result revealed that teachers' beliefs and attitudes were related to their use of technology. Also, Drent and Meelissen (2008) conducted a study about factors which influence the innovative use of ICT by teacher educators in the Netherlands. Their study revealed that student–oriented pedagogical approach, positive attitude towards computers, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher.

Research has shown that teachers' attitudes towards technology influence their acceptance of the usefulness of technology and its integration into teaching (Huang & Liaw, 2005). In EU Schoolnet (2010) survey on teachers' use of Acer netbooks involving six European Union countries, a large However, evidence suggests that small number of teachers believe that the benefits of ICT are not clearly seen. The empirical survey revealed that one fifth of European teachers believed that the use of ICT in teaching did not benefit their students' learning (Korte & Husing, 2007). A survey of UK teachers also revealed that teachers' positivity about the possible contributions of ICT was moderated as they became 'rather more ambivalent and sometimes doubtful' about 'specific, current advantages' (Becta, 2008, p.45). Teachers' computer experience relates positively to their computer attitudes. The more experience teachers have with computers, the more likely that they will show positive attitudes towards computers (Rozell & Gardner, 1999). Positive computer attitudes are expected to foster computer integration in the classroom (van Braak, Tondeur, & Valcke, 2004). However, while there are a number of studies on teachers' perceptions, skills and practices of ICT in secondary schools in developed countries, there is lack of study on teachers' preparedness in the integration of Information Communication Technology in public secondary schools in Kieni EastDistrict,Nyeri County- Kenya

1.1 PROBLEM STATEMENT

Evidence suggests that teachers' attitudes and beliefs influence successful integration of ICT into teaching (Hew & Brush, 2007; Keengwe & Onchwari, 2008). If teachers' attitudes are positive toward the use of educational technology, then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes. While it is shown that teachers' computer experience has a positive impact on the performance of students it is not clear the extent to which teachers' preparedness influences learners' performance. It is for this reason therefore that the researchers were prompted to investigate teachers' preparedness in ICT in public secondary schools in Kieni-East District Nyeri County-Kenya.

1.2 OBJECTIVES

The objectives of the study were to:

1) establish E-learning sustainability
2) explore attainment of computer skills and
3) establish funding strategies in place

2 METHODOLOGY

The study was conducted in public secondary schools in Kieni EastDistrict,Nyeri County- Kenya. Twenty seven teachers who had attended science congress and had accompanied students to the district venue. The sample size was made up of 16 males and 11 females. The study also engaged forty three students which included 29 male and 14 female students who participated in the science congress. Among the students 7% were in form one,4.7% in form two,32.6% in form three and the majority in form four(55.8%). The research design adopted in this study was descriptive survey design. Both qualitative and quantitative techniques were used. By qualitative techniques, the researcher included open ended items where the respondents were given an opportunity to express their views. The researcher established teachers' preparedness in the integration of information communication technology. Measures of central tendency such as mode, mean, median, frequency and standard deviation were used. Stratified random sampling technique was used in this study where there were two groups namely the science and mathematics teachers and students .The research study used triangulation methodology in data collection. Questionnaires, document analysis and researcher's own observation were used. One questionnaire was administered to the science teachers and the other one to students. The questionnaire allowed the researcher to reach a large sample in a short time and at a low cost as well as enabling the researcher to gather a wide range of information. The questionnaires had three sections namely, biographical data, closed ended statements on educational issues that respondents reacted to by ticking in the spaces provided, while open ended questions on the respondents' opinion about the

issues were included. Questions had a scale where SA stands for Strongly Agree, A means Agrees, stands for Neutral means Disagree and SD for Strongly Disagree. The key factors covered were on establishing E-learning sustainability ,exploring attainment of computer skills and establishing funding strategies in place. Three documents were analysed during the study at school level. They were the mark books for the opener and midterm examinations which were obtained from the class teachers. KCSE file from the academic dean provided national exam results for the sampled schools for two years and school registers for an update on the enrolment of form three students during the time of study. The DEO'S office provided a current list of registered secondary schools both private and public which included their enrolment. Data was analyzed using descriptive statistics. The researcher used descriptive statistical technique to calculate the frequencies, means and standard deviations of the collected data.

3 RESULTS

3.1 E-LEARNING SUSTAINABILITY

Regarding the contribution of learning computers to the development and attainment of vision 2030 ,97.6 % of the students(Figure 1) and 90% of the teachers agreed .

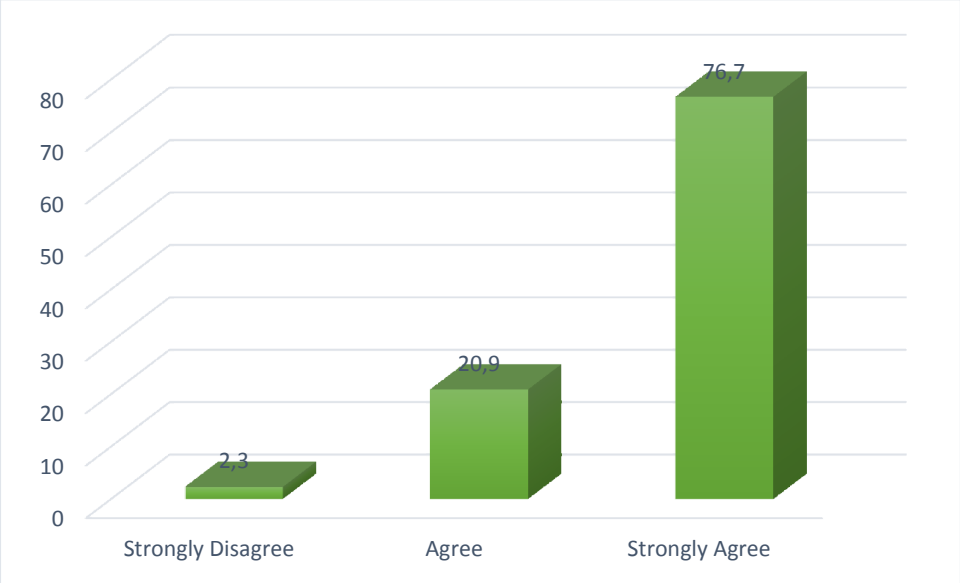


Figure 1:Contribution of Computers to Development and Vision 2030

The study found that 68.3% of the students did not have access to the computers while 19.5% and 12.2% had 3-4 and 1-2 exposure in schools.on the other hand 65.5% of the teachers had no access while 31% had between 1-3 hours .The researchers wanted to know where the students and the teachers used the computers and the findings showed that 71% used the computer laboratory,12.9% in the library and 16.1% in the classroom.In the case of teachers the researchers found that 65.5% used computers in the computer laboratory ,3.4% in the library .Students stated that 72.1% had an encounter with computers at home,18.6% at school and 9.3% in the primary school.The study further realized that 33.3% of the teachers did not have computers and 3.3 had personal computers(Figure 2).

The study realized that 17.2% of the schools did not have printers while 44.8 had very few Printers.Regarding internet connections in work stations data indicated that 27.6% had adequate while 51.7% had none, On the other hand 85.2% of schools had no usage of wikipedia while 14.8% had some usage .Further 75.9% of the teachers disagreed that the school organizes regular training on computers while 24.15 % agreed.The findings indicated that 24.1% of the teachers agreed that they had attended forums on e-learning organized for teachers recently while 75.9% had not.the study found that 32.1% of the teachers disagreed that there are teacher(s) who act as resource persons in e-learning while 67.8% agreed .Regarding confidence in using computers in lessons the response was that 55.1% teachers agreed while 44.8% disagreed,further 46.4% of the teachers used computers regularly in Regarding internet browsing the study showed that 92.6% of the students were good at it.Further 68.3% of the students were good at e-mailing while 55.2% of the teachers use computers regularly for correspondence through e-mail.The researchers found that 46.4% of the teachers agreed that they use computer in maintaining student performance records while 53.6% do not.Data indicated that 50% of the teachers agreed that getting skilled personnel to repair and service a computer is not a problem while 50% disagreed. Teachers(42.9%) agreed that they use computers only when required to do so gathering information for lessons while 53.6% did not.

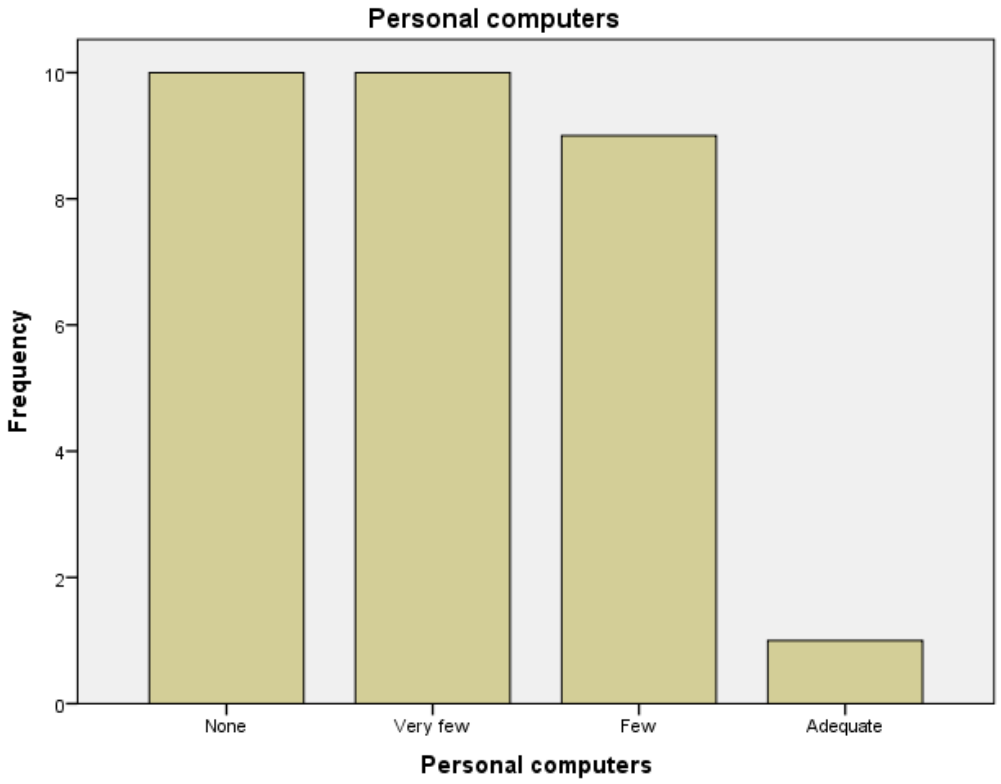


Figure 2: Teachers Personal Computers

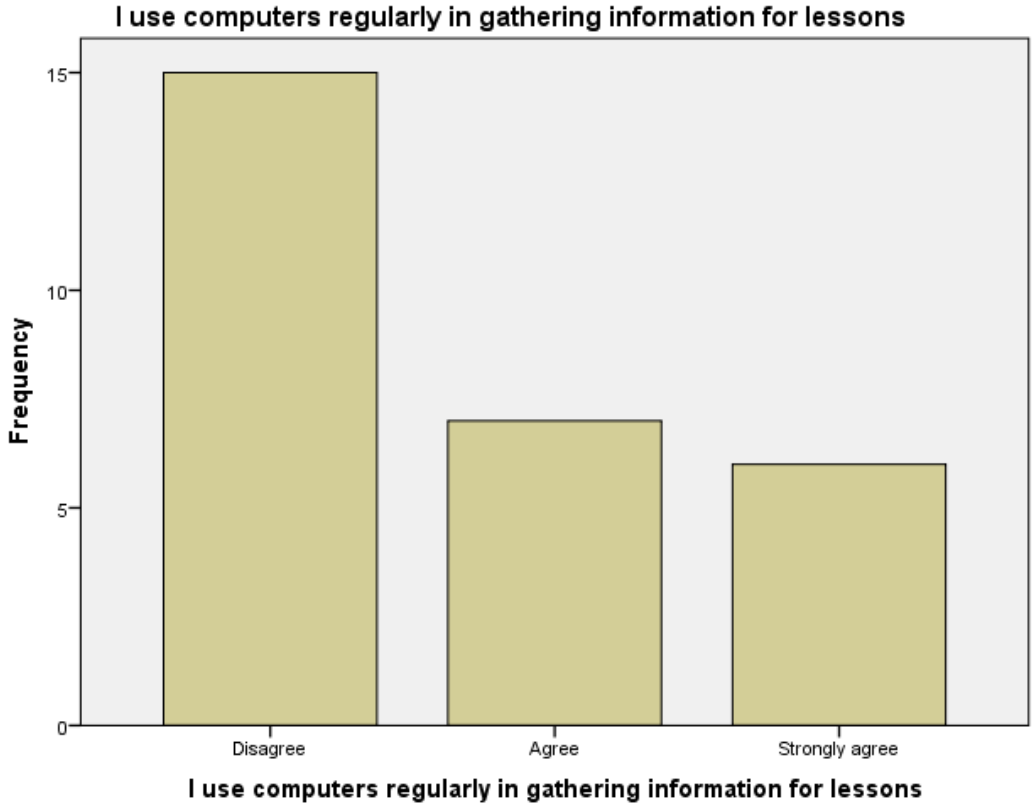


Figure 3: Use of Computer in Gathering Information

3.2 ATTAINMENT OF COMPUTER SKILLS

The study realized that majority (97.7%) of the students can open and shut the computers(Figure 4) while 93.1% of the teachers can freely open while 3.4% cannot. Data indicated that 93% of the students can create a document and save in the computer while 2.3% cannot.As far as teachers are concerned 79.3% of the teachers can create a document and save in the computer.The study indicated that 97.7% of the students agreed that they had the knowledge on the use of the computer keyboard while 82.7% of the teachers knew how to use the computer keyboard. Data revealed that 83% of the students can print and scan documents from the computer while 4.9% cannot.Further it was realized that 58.6% of the teachers could not print or scan a document from the computer and 72.4% of the teachers had some usage on exam past papers while 27.6% did not have any usage.

The research found that 44.2 % of the students had access to the computers and related technology usage for over four years while 55.8% had it in less than three years.The study indicated that 55.6% 0f the teachers had basic computer skills,25.9% had the certificate and 11.1% had diploma .The researchers found that 82.9% of the students were good at word processing while 2.4% were very poor.On the other hand 44.8% of the teachers were good at Word processing while the rest had no ability.Regarding the spread sheets (MS excel) 66.6% of the students were good while 26.9% of the teachers had the ability to use Spread sheets but 61.6% had no ability.Results on power point presentation showed that 75.6% were good at it while 28.6% of the teachers were good at power point while 57.1% had little or no ability.

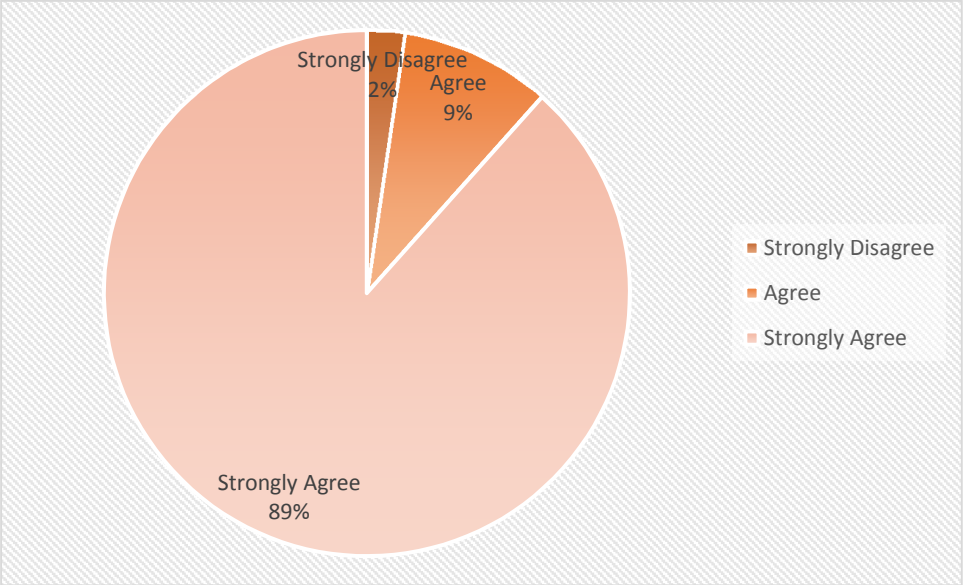


Figure 4:Opening and Shutting the Computer

Regarding the use email frequently 33.3% of the students used it very much, 38.1%used it much while 28.6% never used it at all. Regarding the social network 97.4% of the students were on the face book and 2.6% on the twitter**.** The study showed that 95.3% of the students browse the internet using the computer while 53.6% of the teachers were good at Internet browsing.The researchers wanted to know if the students could download photos using the computer and the responses were that 95.2% could and that 92.9% of the students agreed that they could chart with friends using the computer.Findings showed that 48.1% of the teachers agreed that they have within the school people who can create digital content from the curriculum while 51.9% disagreed.The usage of DVDs ,DCs,computers as well as power point was as follows,62.5%(Figure 6) ,76% CDs,71.5% and 16% respectively. Further the researchers found that 76% of the teachers had no usage on Radio ,55% had the usage on TV,66.7% had the usage in sciences and 70.4% had the usage in Languages.

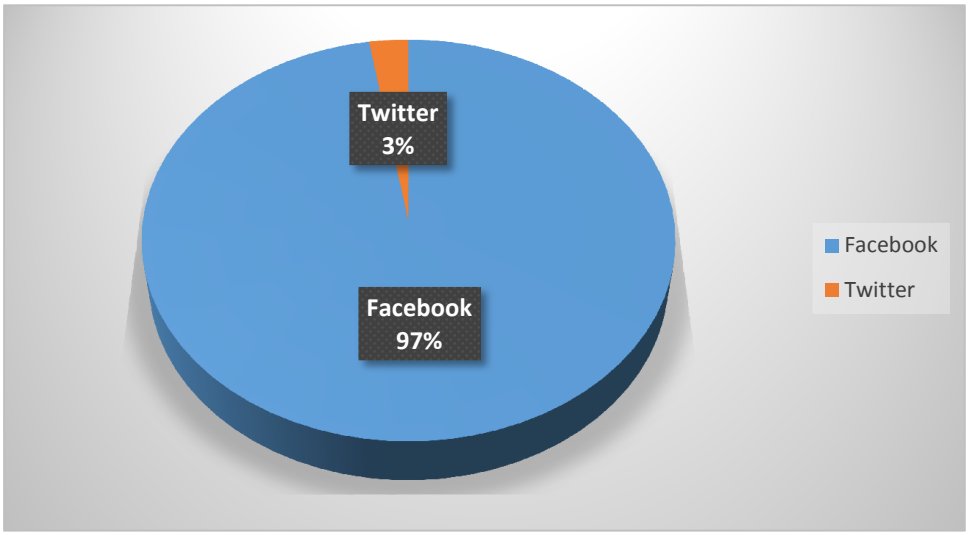


Figure 5:Social Network

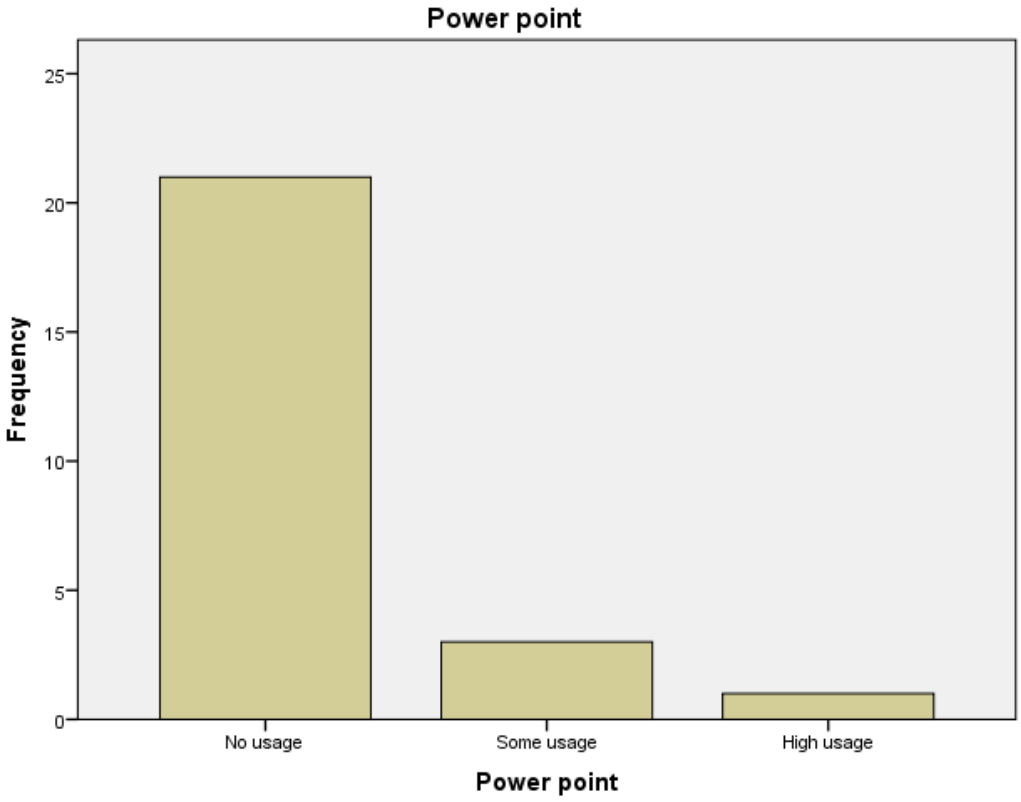


Figure 6:Power Point

3.3 FUNDING STRATEGIES IN PLACE

When students were asked about their opinion on parents' contribution to the funds for equipping the computer laboratory,7.2% disagreed,69.7% agreed while 81.2% of the teachers agreed and 10.5% disagreed.The researchers found that 17.9% of the teachers agreed that their school had benefited from government grant towards e-learning and 78.6% had not in that 12.5% of the teachers stated it was provided one time and 6.3% stated often. Further 82.1% of the teachers supported that the school should charge a levy on the students fees towards the development of e-learning. Regarding sources of funding the study found that 18.2% had received from government, 27.3% from corporate, and 9.1% from NGOs.

4 SUMMARY, CONCLUSION AND RECOMMENDATIONS

4.1 SUMMARY

There is lack of technical support and maintenance to the development of ICT in public secondary schools. Computer rooms are generally a feature of the larger schools. However, access by students to computers was found to be more than in the case of teachers. Schools were found to use a limited range of ICT peripherals, mainly printers and scanners., and digital cameras. Majority of teachers are not in a position to prepare lessons using the computers. Majority of the students had an encounter with computers at home as compared to teachers.Further the study realized that 58.6% of the teachers could not print or scan a document from the computer which are essential in the teaching learning process.Both students and teachers felt that parents' contribution to the funds for equipping the computer laboratory would be of great importance to schools.

4.2 CONCLUSION

Teachers in public secondary schools in kieni East district are not adequately equipped in ICT.This has an effect on the integration of E-learning in public secondary school.In the long run the academic performance of the public secondary schools may be affected where by a big difference may occur between schools that implement the E-learning and those which do not.Internet access is an issue in most schools.

4.3 RECOMMENDATIONS

- Schools and teachers should capitalize on regularly reviewing the use of ICT in their work particularly they should strive to ensure greater integration of ICT within teaching and learning activities in classrooms and other settings.
- Principals should encourage and facilitate suitable ICT training for teachers.
- Schools should provide all their teachers and students with an appropriate and equitable level of
- Experience of ICT.
- Schools should plan for the maintenance and upgrading of their ICT systems.
- Computer rooms, where they exist, should be used to maximum effect.
- Staff members and students should have adequate access to the internet.
- All the teachers should be encouraged to cultivate a positive attitude towards ICT.

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REFERENCES

[1] Becta (2008) Harnessing technology: Schools survey 2008. Retrieved 20 October 2011 from http://emergingtechnologies.becta.org.uk/uploaddir/downloads/page_documents/research/ht_schools_survey08_analysis.pdf. [Accessed 20th October 2011]

[2] Drent, M. & Meelissen, M. (2008) .Which factors obstruct or stimulate teacher educators to use ICT innovatively? Computers & Education, 51(1), 187-199.

[3] Eugene, J. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? Journal of Technology and Teacher Education, 14(3), 581-597.

[4] Hew, K. F. & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. Educational Technology Research & Development, 55, 223-253.

[5] Huang, H. M. & Liaw, S. S. (2005). Exploring users' attitudes and intentions toward the Web as a survey tool. Computers in Human Behavior, 21(5), 729-743.

[6] Keengwe, J. & Onchwari, G. (2008). Computer technology integration and student learning: Barriers and promise, Journal of Science Education and Technology, 17, 560–565.

[7] Korte, W. B. & Husing, T. (2007). Benchmarking access and use of ICT in European schools 2006: Results from head teacher and a classroom surveys in 27 European countries. E-learning Papers, 29(10), 1-6.

[8] Kumar, N., Rose, R.C. and D'SIiva, J.L. 2008. Predictors of Technology Deployment among Malaysian Teachers. American Journal of Applied Sciences. 5(9), pp. 1127-1134.

[9] Polly, D., Mims, C., Shepherd, C.E., Inan, F. 2010. Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. 26, pp. 863-870.

[10] Russell, M., Bebell, D., O'Dwyer, L. and O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation. Journal of Teacher Education, 54(4), 297-310.

[11] Sang, G., Valcke, M., Van Braak, J. and Tondeur, J. 2009. Factors support or prevent teachers from integrating ICT into classroom teaching: A Chinese perspective. Proceedings of the 17th International Conference on Computers in Education. Hong Kong: Asia-Pacific Society for Computers in Education.], pp. 808-815.

[12] Simonson, M. (2004). Technology use of Hispanic bilingual teachers: A function of their beliefs, attitudes and perceptions on peer technology use in the classroom. Journal of Instructional Technology, 31(3), 257-266.

[13] van Braak, J., Tondeur, J., & Valcke, M. (2004). Explaining different types of computer use among primary school teachers. European Journal of Psychology of Education, 19, 407–422.

[14] Zahari, Z. 2005, Enhancing Remedial Learners Reading through eLearning. Proceedings of the Second International Conference 2005: eLearning for Knowledge-Based Society, 4-7 August. Bangkok, Thailand, pp. 20.1 – 20.7

[15] Zhao, Y., Cziko, G.A. 2001. Teacher Adoption of Technology: A Perceptual Control Theory Perspective. JI. Of Technology and Teacher Education, 9(1), pp. 5-30.

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Gender Differences in Parental Involvement in Children's Learning in Public Secondary Schools: A Case of Kieni-West District, Nyeri County - Kenya

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ABSTRACT: The attitudes and aspirations of parents and of children themselves predict later educational achievement. International evidence suggests that parents with high aspirations are also more involved in their children's education (Gutman & Akerman, 2008). This study was set to investigate gender differences in parents' involvement in their children's learning in public secondary schools in Kieni-West District Nyeri County-Kenya. The objectives of the study were to: (i) Investigate gender difference in the nature of parental involvement in their children's learning; (ii) Establish gender differences in factors influencing extent of involvement children's learning and to (iii) Explore parents' views towards the teachers in their involvement in learning. One hundred and ten parents who had their children in public secondary schools were randomly selected. The research study employed a mixed method approach using both qualitative and quantitative techniques in collecting and analyzing data. The study used face to face interviews with fathers and mothers. The findings of the study indicated that 89% of the mothers participated in school events and activities compared to 83% of the fathers. Further findings indicated that 70% of the fathers communicated to their children in mother tongue while at home compared to 61% of the mothers. Majority of the fathers had attained secondary education while majority of the mothers had primary education. The study revealed that mothers experienced painful experiences during their time than the fathers. Major recommendations include among others attending parents teachers' conferences and encouraging parents to communicate to their children in English.

KEYWORDS: children's learning, gender differences, extent of involvement, teachers'parents' conferences.

1 INTRODUCTION

Parental involvement is a form of investment made by parents for the future benefit of their children (Smits & Hosgor, 2006). The more confidence parents instil in their children regarding success in school, the greater their involvement in their children's education (Eliason & Jenkins,2003). Parental involvement practices, regardless of other practices applied at home or at school, have been found to influence children's academic performance in school (Sanders & Lewis, 2004). Considering the vast development in the field of education, it is not surprising that parental involvement plays a major role in developing patterns of higher academic achievement in children. It is important to note that through their parents' participation, children not only gain cognitive and social development (Weis, Caspe & Lopez, 2006) but also develop positive attitudes and behaviours, talent, personality and potential skill development.

The quality and content of fathers' involvement matter more for children's outcomes than the quantity of time fathers spend with their children. Family learning can also provide a range of benefits for parents and children including improvements in reading, writing and numeracy as well as greater parental confidence in helping their child at home. The attitudes and aspirations of parents and of children themselves predict later educational achievement. International evidence suggests that parents with high aspirations are also more involved in their children's education. In 2007, around half of parents surveyed said that they felt very involved in their child's school life. Two thirds of parents said that they would

Corresponding Author: Ndirangu Lydiah

like to get more involved in their child's school life (Peters, Seeds, Goldstein & Coleman, 2008).Levels of parental involvement vary among parents, for example, mothers, parents of young children, Black/Black British parents, parents of children with a statement of Special Educational Needs are all more likely than average to be very involved in their child's education. Parental involvement in children's education from an early age has a significant effect on educational achievement, and continues to do so into adolescence and adulthood. The quality and content of fathers' involvement matter more for children's outcomes than the quantity of time fathers spend with their children (Siraj-Blatchford &Taggart, 2004).

Family learning can also provide a range of benefits for parents and children including improvements in reading, writing and numeracy as well as greater parental confidence in helping their child at home. The attitudes and aspirations of parents and of children themselves predict later educational achievement. International evidence suggests that parents with high aspirations are also more involved in their children's education.In 2007, around half of parents surveyed said that they felt very involved in their child's school life. Two thirds of parents said that they would like to get more involved in their child's school life (with work commitments being a commonly cited barrier to greater involvement).Lone parents and non-resident parents are both less likely than average to feel very involved.Parents are more likely to see a child's education as mainly or wholly their responsibility (28%) in 2007 compared to previous years, and nearly half (45%) of parents believed that they had equal responsibility with the school.Parents also now participate in a wider range of activities with their children. These include:doing school projects together (83%) making things (81%), playing sport (80%) and reading (79%) (Desforges & Abouchaar,2003).

Studies suggest that fathers' involvement has increased since the 1970s, particularly with children under the age of five. There is evidence,however, of great variation in levels of fathers' involvement, so that even though levels have increased on average, a substantial proportion of fathers recorded no daily direct interaction time with their children. This is likely to reflect, in part,changing family structures.When surveyed in 2007, mothers are more likely than fathers to say that they felt 'very involved' in their child's education (53% compared to 45%).5Nearly 70% of fathers want to be more involved in their child's education and even higher proportions of non resident parents (81%), who are predominantly male, are also keen for greater involvement.

Research suggests fathers are involved (more often than mothers) in specific types of activities in their children's out of school learning: such as building and repairing, hobbies, Information Technology, maths and physical play. A survey of parents in 2007 found that fathers help less often with homework than mothers, however amongst parents working full time there was no gender difference. Evidence suggests that the quality and content of fathers' involvement matter more for children's outcomes than the quantity of time fathers spend with their children. Fathers have a critical role to play in ensuring positive outcomes for their children(O'Brien and Shemilt,2003).

There is consistent evidence that fathers' interest and involvement in their children's learning (which was measured in terms of interest in education, outings and reading to the child) is statistically associated with better educational outcomes (controlling for a wide variety of other influencing factors). These outcomes included: better exam results, a higher level of educational qualifications, greater progress at school, higher educational expectations more positive attitudes (e.g. enjoyment) better behaviour (e.g. reduced risk of suspension or expulsion) at school.These positive associations exist across different family types, including two-parent families, single parent families and children with non-resident fathers. However, the specific outcomes and strength of effect can vary across family type.Research indicates that fathers' involvement is important not only when a child is in primary school but also when they are in secondary school and regardless of the child's gender (Harrisand Goodall ,2007).

Kieni-West district is a semi arid area and in most cases the residents experience prolonged drought. In most cases school events such as academic clinics,parents' teachers' meetings and annual general meetings are highly attended by mothers.On the other hand indiscipline cases are in most cases attended by the mothers while the prize giving days are attended by the fathers if the child be it a boy or girl is being awarded.It is for this reason therefore that the researchers were prompted to investigate the gender differnces in parents' involvement in their children's education both at home and in school in Kieni West District.

1.1 PROBLEM STATEMENT

Parental involvement in children's education from an early age has a significant effect on educational achievement, and continues to do so into adolescence and adulthood(Siraj-Blatchford &Taggart, 2004). While it is shown that fathers and mothers are involved in their children's education it is not clear the extent to which the mother or the father is involved. It is

for this reason therefore that the researchers were prompted to investigate gender differences in parents' involvement in their children's learning in public secondary schools in Kieni-West District Nyeri County-Kenya.

1.2 OBJECTIVES

The objectives of the study are to:

1) Investigate gender difference in the nature of parental involvement in their children's learning;
2) Establish gender differences in factors influencing extent of involvement children's learning and to
3) Explore parents' views towards the teachers in their involvement in learning.

2 METHODOLOGY

The research design adopted in this study was descriptive survey design. This method was relevant to the study because it involved frequency of answers to the same questions by different mothers and fathers.Both qualitative and quantitative techniques were used. By use of this design the researcher intended to report the status of parental involvement in their children's education as it were in the schools studied. The study targeted 110 parents in public secondary schools in Kieni-West District. Sampled parents comprised of a combination of parents of form three students who had been sampled and others who had not. A structured interview schedulefor sampled parents focused on their involvement in the academic achievement of their children. In this study qualitative data was derived from open-ended questions in the interview schedule. the research questions were categorized and a coding system developed based on collected data. The frequency with which an idea or description appeared was used to interpret gender difference.

3 RESULTS

3.1 BIOGRAPHICAL DATA

The sampled population consisted of 56(51%) mothers and 54(49%) fathers.

3.2 PARENTS' AGE

The findings of the study showed that 30% of the mothers were in the age bracket of 31 to 35 years while 36% were between 35 and 40 years of age (Figure 1). On the other hand 61% of the fathers were over 40 years of age (Figure 2) and the minority were in the range of 31 to 35 years.

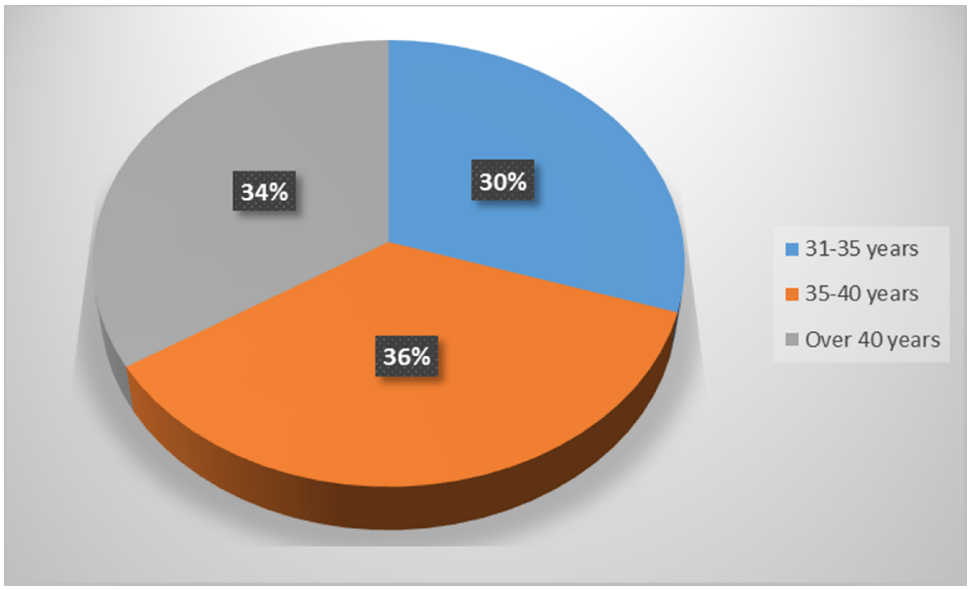


Figure 1: Mothers' Age (DATA 2013)

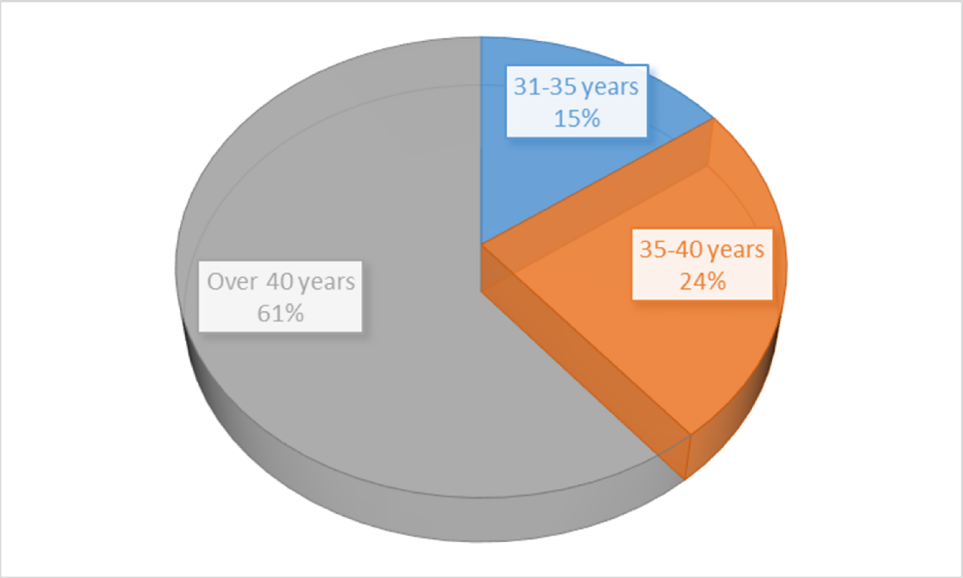


Figure 2: Father's Age (DATA 2013)

3.3 PARENTS' EDUCATION LEVELS

Regarding educational levels majority(39%) of the mothers had acquired primary education and 2% had post graduate education(Figure 3). Table 1 indicates that majority(50%) of the fathers had acquired secondary school education while only 2% had postgraduate education.

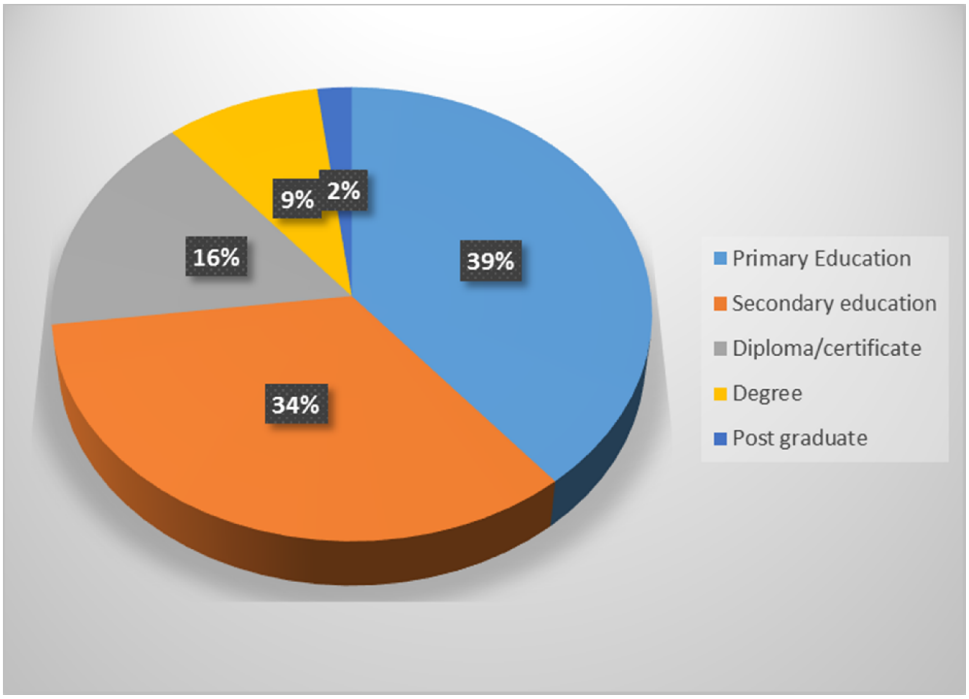


Figure 3: Mothers' Educational Levels (DATA 2013)

Table 1: Fathers' Educational Levels

Education	F	%
Primary Education	13	24
Secondary education	27	50
Diploma/certificate	8	15
Degree	5	9
Post graduate	1	2
Total		100

3.4 Parents' Income Levels

Figure 4 below shows that 67% of the mothers earned less than ksh 10,000 while 33% earned more than ksh. 10,000.The study revealed that 43% of the fathers earned more than ksh 10,000 while 39% earned less than ksh 10,000.

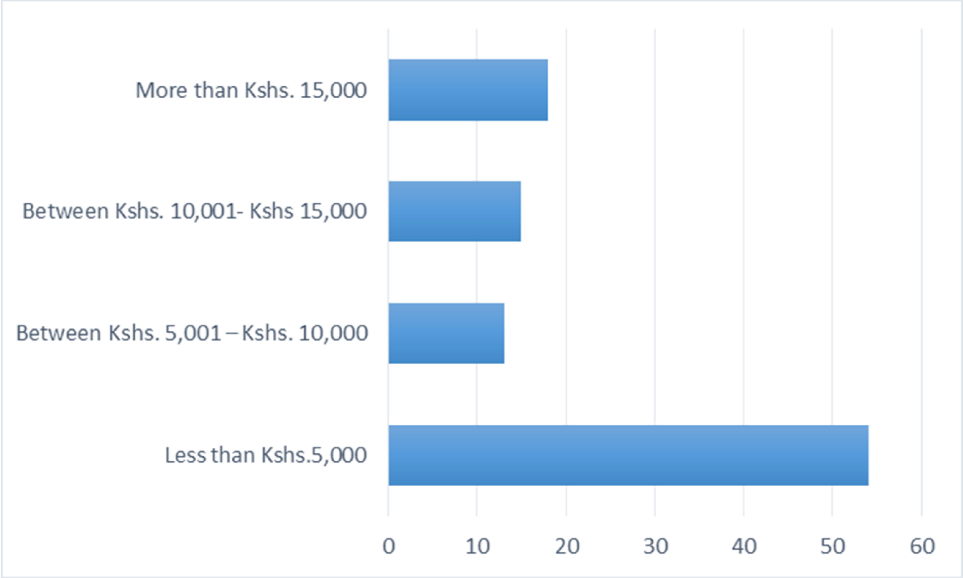


Figure 4: Mothers' Income Levels (DATA 2013)

3.5 Extent to Which Parents are Involved in their Children's Learning

Mothers were asked about their awareness of the parents' involvement programmes(Table 2) and the response was that 85% were aware while 15% were not. Figure 5 shows that 79% of the fathers were aware of the programmes while 21% were not.

Table 2: Mothers' Awareness

	F	%
Yes	46	85
No	8	15
	54	100

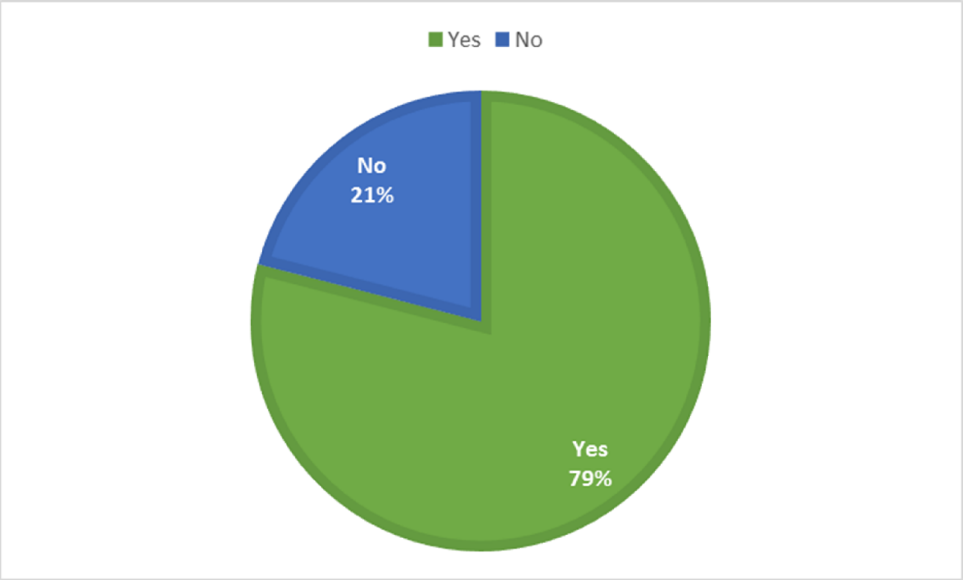


Figure 5: Fathers' Awareness (DATA 2013)

The study revealed that 89% of the mothers participated in school events and activities such as annual general meetings and academic clinics while 11% did not. Figure 6 shows that 83% of the fathers did participate in school events while 17% did not.

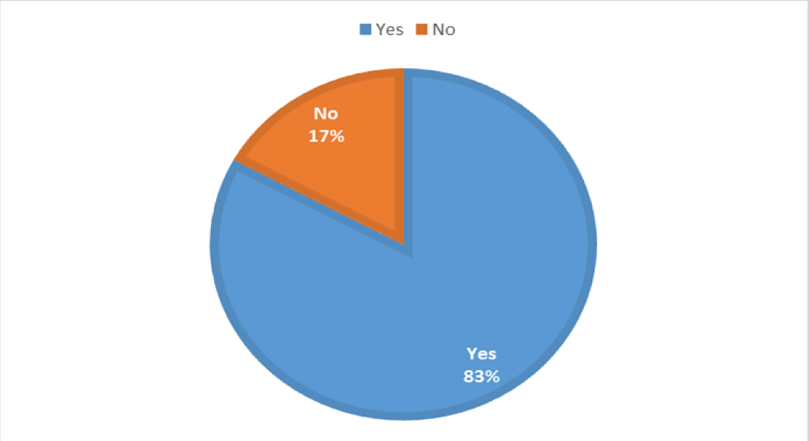


Figure 6: Fathers' Participation in School Events (DATA 2013)

Regarding monitoring of homework 73% of the mothers were involved while 27% were not.

Mothers were asked whether they engaged their children in holiday tuition and the response was that 75% did but 25% did not. Fathers were highly involved (74%) in engaging their children in holiday tuition while 26% were not. The researchers wanted to know how often the mothers checked on the performance of their children .The findings of the study showed that majority of the mothers (32%) did it on daily basis while 21% did it monthly (Table 4) while 24% of the fathers checked their children's performance on daily basis and 26% did it monthly(Figure 7).

Table 4: Checking of Performance by Mothers

	F	%
Daily	17	32
Twice per week	8	15
Weekly	3	6
After two weeks	14	26
Monthly	11	21
Never		

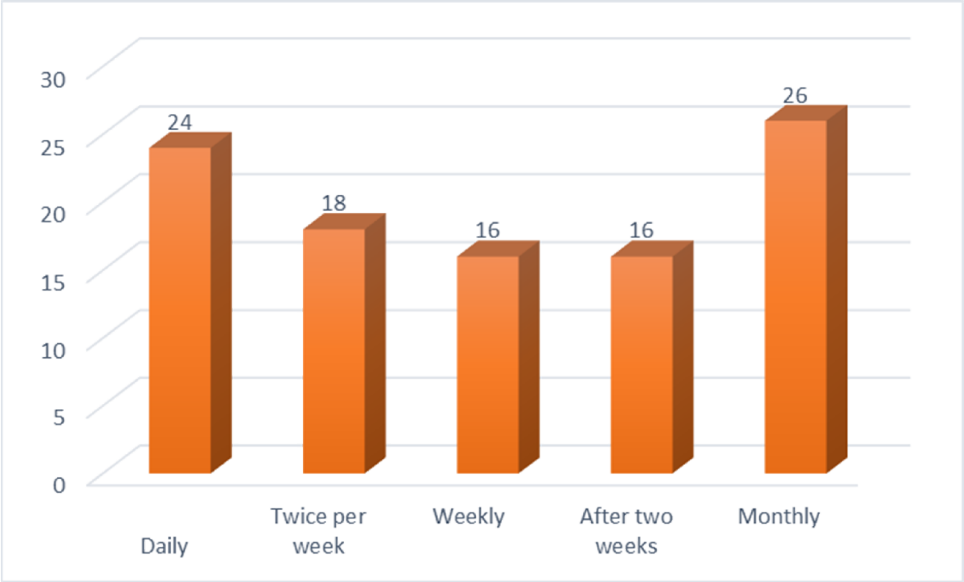


Figure 7: Checking of Performance by Fathers (DATA 2013)

The study found that 65% of the mothers were able to sustain their children in school throughout the term while 35% were not able. On the other hand 52% of the fathers were able to retain their children in school while 48%were not. Regarding visiting children in school to discuss the performance data showed that 27% of the mothers made it on a weekly as well as after two weeks. None of the mothers failed to discuss performance. Majority of the fathers visited their children's school on weekly basis to discuss academic progress while 12% did it monthly. Table 5 shows that majority of the mothers relied on farming (46%) while 415 were salaried. The study revealed that majority of the fathers (45%) were salaried and 40% relied on farming (Figure 8).

Table 5: Mothers' Sources of Income

	F	%
Salary	24	41
Funds	1	2
Farming	27	46
Others	7	11
		100



Figure 8: Fathers' Source of Income (DATA 2013)

Regarding the language spoken to the children the researchers found that 61% of the mothers spoke mother tongue while 12% spoke in English (Figure 9). Figure 10 indicates that 70% of the fathers spoke vernacular to their children while 20% spoke in Kiswahili remaining with 10% who communicated in English.

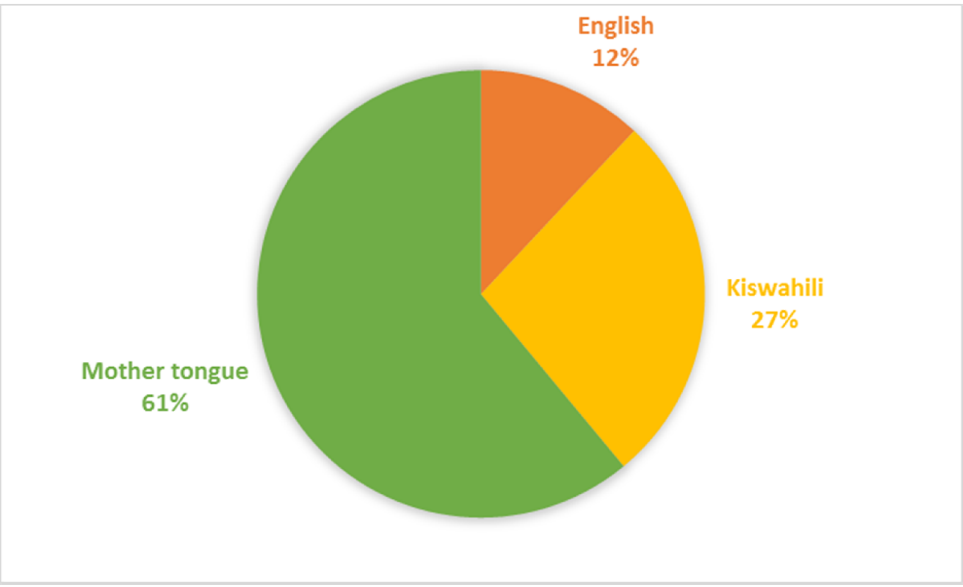


Figure 9: Language used by Mothers (DATA 2013)

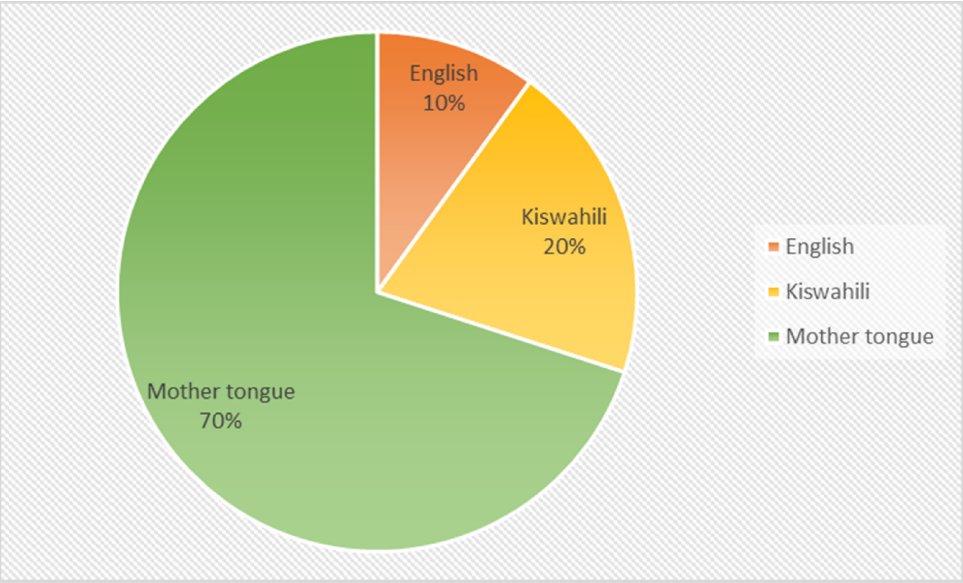


Figure 10: Language used by Fathers (DATA 2013)

Mother believed that their involvement was beneficial to the teachers in aiding in their children educational progress (89%) while 11% did not. The researchers revealed that all the fathers believed that their involvement is beneficial to the teachers in aiding their children educational progress. The study indicated that 46% of the mothers were often engaged in meaningful discussions about their children's education by the teachers while 16% were not. The study indicated that 47% of the fathers were oftenly engaged in meaningful discussions about their children's education while 2% were not and 38% were rarely involved. Response to the attendance of mothers to parents' teachers' conferences showed that 25% rarely attended while the same percentage never did it. The findings indicated that 31% of the fathers attended teachers' parents' conferences while 23% did not and 34% rarely did .

3.6 LEARNERS' FACTORS

Figure 11 shows that majority (64%) of the mothers were reminded about academic clinics by their children while 9% were not. The study revealed that 57% of the fathers were oftenly reminded by their children about the academic clinics in the school while 8% were never reminded.

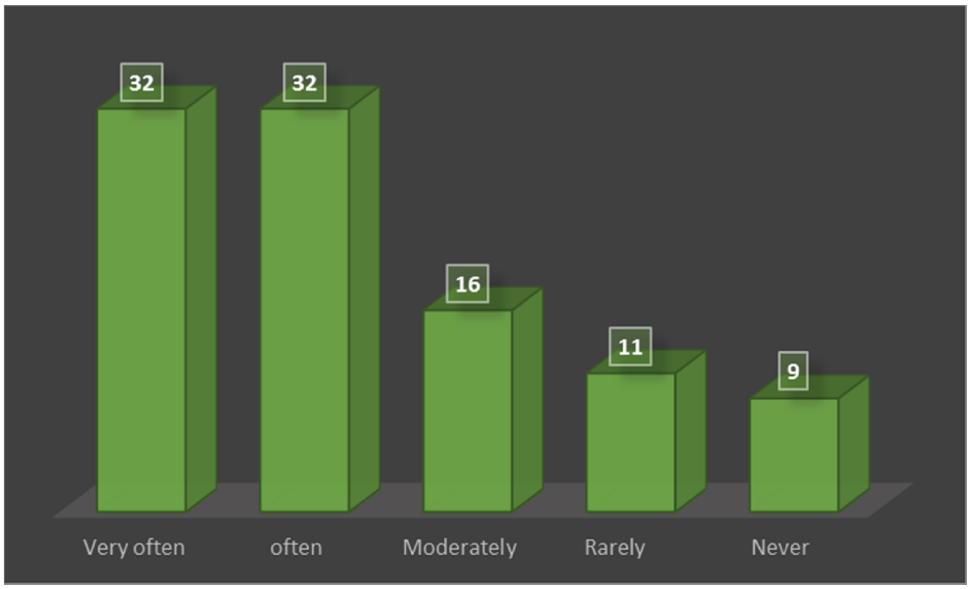


Figure 11: Mothers Reminded on Academic Clinics(DATA 2013)

Mothers were asked if their children brought newsletters and report forms to them and the results were that 91% did but 9% did not.Fathers reported that their children brought newsletters at home(87%) while 13% of them did not receive.The researcher wanted to know how often mothers discussed their academic progress with their children The findings indicated that 59% oftenly discussed while 26% rarely did it.Majority of the fathers(63%) oftenly discussed the academic progress of their children with the children while 9% never did so.Majority of the mothers (57%) worked more than eight hours in a day while 28% worked for eight hours which is the standard working time according to the International Labour Organisation.The findings of the study revealed that 50% of the fathers worked more than eight hours while 37% worked the standard time. Figure 12 shows that majority of the mothers (75%) stated that there was a good flow of information while 25% felt that this did not exist. The study found that 78% of the fathers felt that there was good flow of information between the parents and teachers while 12 % felt that this did not exist.

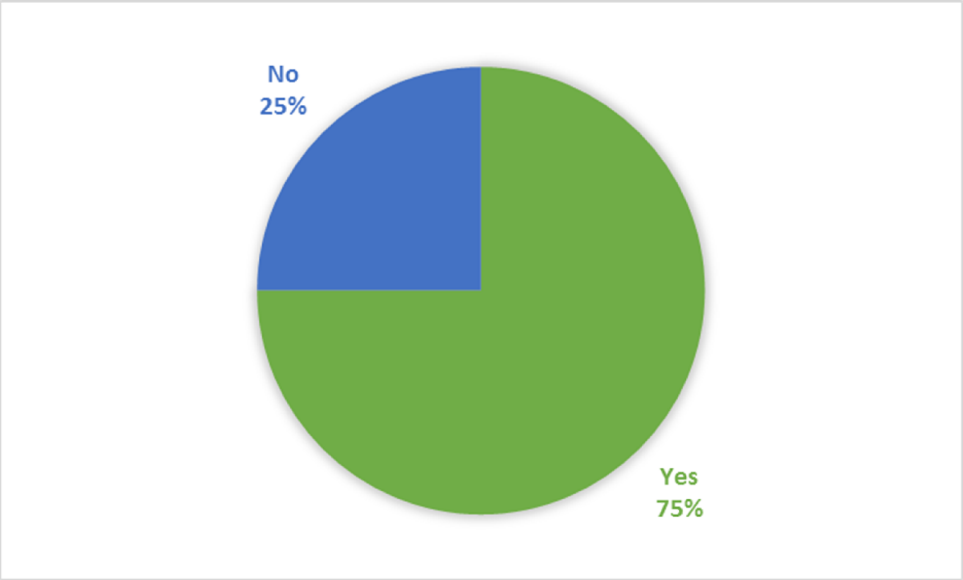


Figure 12: Mothers' Opinion on Information Flow(DATA 2013)

The findings of the study indicated that majority of the mothers (83%) had difficult and painful experiences during their school time while a minority (17%) did not. On the other hand 80% of the fathers suffered while 20% did not. The researchers found the all the mothers felt that parental involvement programmes can improve their relationship with their children in schools.On the other hand 96% of the fathers felt that organized parental involvement programmes can improve their relationship with their children while 4% felt it would not.

4 SUMMARY AND CONCLUSIONS

4.1 SUMMARY OF THE FINDINGS

The purpose of the study was to investigate gender differences in parents involvement in their children's learning in public secondary schools in Kieni West District of Nyeri County, Kenya. The results indicated that there are various ways in which mothers and fathers are involved in their children's learning but all at different extents. Regarding participation in school events the participation of the mothers was higher than that of the fathers. The findings of the study showed that mothers were able to sustain their children in school for a term and pay for holiday tuition to a greater extent than the fathers.The researchers found that majority of the fathers communicated in vernacular more than the mothers did.Majority of the mothers suffered during their school time as compared to the fathers though both mothers and fathers felt that parental involvement programmes were essential in their children's learning.

4.2 CONCLUSION

The findings of the study indicated that parents are involved in their children's learning at different levels.The mothers are highly involved as compared to the fathers. The study realized that even though mothers are more involved the academic

performance of girls is wanting. When parents are involved, children achieve more and everyone benefits in the sense that the school is recognized, parents have faith in the teachers and students are willing to stay. Parental involvement in their children's academic achievement yields positive academic outcomes ranging from early childhood throughout adolescence and beyond.

ACKNOWLEDGEMENT

In the course of writing this paper, we have received assistance from several people. We would like to appreciate the untiring contributions of certain persons for their support; encouragement and motivation which helped me bring this thesis into a reality. This paper would not be complete without the help and invaluable support of the Almighty God for giving us good health. We wish to express our sincere thanks to the principals, teachers, students and parents of Kieni-West District public secondary schools for their participation in this study.

REFERENCES

[1] Desforges, C and Abouchaar, A. (2003). The Impact of Parental Involvement,Parental Support and Family Education on Pupil Achievement and Adjustment: A Literature Review. DfES Research Report 433.
[2] Eliason, C. and L. Jenkins. 2003. A practical guide to early childhood curriculum. 7th ed. New Jersey: Prentice Hall.
[3] Gordon, A. M. and K. W. Browne. 1989. Beginnings and beyonds: Foundations in early childhood education. 2nd ed. New York: Delmar Publishers.
[4] Gutman, L.M. and Akerman, R. (2008). Determinants of Aspirations. Centre for Research on the Wider Benefits of Learning Research Report 27. London. Institute of Education.
[5] Peters, M., Seeds, K., Goldstein, A. and Coleman, N. (2008) Parental Involvement in Children's Education 2007. Research Report. DCSF RR034.
[6] Sanders, M. G. and K. C. Lewis. 2004. Partnerships at an urban high school:Meeting the parent involvement requirements of no child left behind. EJournal of Teaching & Learning in Diverse Settings 2(1): 78–98.
[7] Smits, J. and A. G. Hosgor. 2006. Effects of family background characteristics on educational participation in Turkey. International Journal of Educational Development 26: 545–560.
[8] Sylva, K Melhuish, E, Sammons, P Siraj-Blatchford, I and Taggart, B (2004) Effective Pre-School Education. Final Report. DfES. London: Institute of Education.

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Drosophila as a Model for Analyzing of Human Genetic and Pathogenic Related Diseases

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ABSTRACT: The fruit fly, *Drosophila melanogaster*, has been used to analyze genetics, development, and signaling for nearly a century. About 60% of the genes that are believed to cause human disease have found to a recognizable match in the genetic code of the common fruit fly (*Drosophila melanogaster*), and 50% of *Drosophila*'s protein sequences are similar to those of mammals. Fruit flies are mostly used in disease analysis of human because their gene and protein similarities are included in an organism with only four pairs of chromosomes, the X/Y sex chromosomes and three autosomes, numbered 2, 3 and 4. The advantages of using *Drosophila* are that they breed and mature rapidly, are inexpensive and easy to grow, produce several hundred offspring per generation, and need very little space. The fruit fly is also an ideal candidate for human disease studies because simple mutations cause obvious phenotype differences and its genome map has been fully sequenced.

KEYWORDS: Drosophila, model, human disease, genetic.

1 INTRODUCTION

In the recent year Drosophila is relied as a model organism and powerful genetic tools for the analysis of developmental genetics, signal transduction and cell biology studies. Drosophila was the model for Thomas H. Morgan's discoveries regarding the function of chromosomes in heredity. For his invaluable contribution he was awarded the Nobel Prize for Medicine in 1933 and expressed his gratefulness to Charles Woodworth and William Castle as pioneers of the *Drosophila* model [1]. In comparison with other organism fruit fly genetics presents a set of resources useful for gene discovery that are currently unavailable in other models' systems. It has a short life cycle, within 10 days from mating of adult flies, fertilized eggs are fromed, embryo development to first instar larvae that continued to second and third instar larvae, then pupal formation and subsequent eclosion to produce the next adults gradually [2]. Generally adults acquire reproductive maturity within a few hours of emerging from the pupal case and have a life span of 60 to 100 days under standard laboratory conditions. Therefore, genetic crosses and the completion of inbred lines needs considerably less time than do those of mammalian models. The fly genetics has also the unique advantage of balancer chromosomes that include multiple inversions and suppress meiotic recombination with a corresponding non rearranged chromosome. Compared with mammalian genomes, the *Drosophila melanogaster* genome is significantly small. Therefore, Drosophila using as a model decreases the time and increases the efficiency of screening. The size of its genome is about 5% of the tatal human genome and comprising 5 chromosomes X, Y, 2L/R, 3L/R, and 4. These encode about 125 million base pairs of DNA that consist of 13,000 predicted gene products [3], [4]. Drosophila is smaller organism than mouse and human but the genome of this fly has multiple spliced sites and use different promoter start sites, and genes are sometimes contained within the intronic sequences of other genes. So, the compact fly genome capable to produces similar gene products as like higher vertebrates. In fact, studies of *Drosophila* and human genomes have revealed that about 80% of human diseases in which the disease-related gene has been identified have an orthologue in *Drosophila* [5], [6], [7]. Similar homologous of human neurodegenerative disease genes are recognized in the *Drosophila* genome, the function of these genes can then be analyzed

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by generating mutations in the *Drosophila* homolog and then studying the resulting phenotypes. Cytogenetic analysis has directed to evaluate the complete mapping and sequencing of *Drosophila melanogaster* chromosomes, enabling it to use in an array of biological and biomedical investigations [8]. Thus, the study of human genetics and disease fruit fly can served as unique and sensitive model tools [9]. Its genetic screens have proceeded to the study of many mutant strains that have helped to understanding the visual and behavioral pathways, embryonic patterning, and the development of human diseases [9].

2 MAMMALIAN AND DROSOPHILA INTESTINAL PHYSIOLOGY

2.1 FOOD PASSAGE

Mammalians swallowed food moves the esophagus to the stomach, where food accumulated and digestion occurred. It then passes to the small intestine for nutrient uptake and later to the large intestine for further nutrient, water and electrolyte uptake. Finally, it arrives to the rectum and anus for excretion [10], in case of *Drosophila*, similarly activity has been observed. At first the ingested food moves to the foregut that stored temporarily in the crop; then it passes to the anterior midgut where nutrient absorption proceeds [11]. Passing through the middle midgut, which holds the iron and copper cells (Fe/Cu cells), a region of low pH, it transports through the posterior midgut for further absorption and through the hindgut and rectum, where water and electrolytes are exchanged, and finally arrives the anus for excretion.

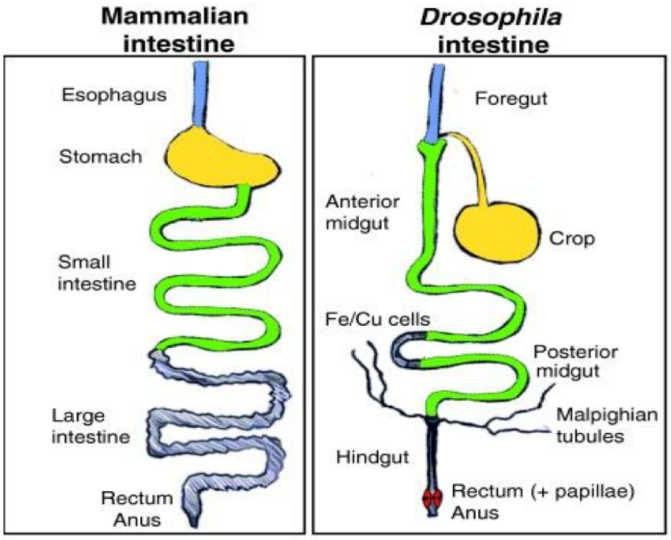


Fig. 1. *Similarities between the mammalian and Drosophila intestines. The similarities were found between the esophagus and the foregut (blue), the stomach and the crop (yellow), the small intestine and the midgut (green), and the large-intestine–rectum–anus and the hindgut-rectum-anus (gray) in mammals and Drosophila. Dissimilarities include the presence of the fly kidney-like malpighian tubules that empty into the gut, the rectal papillae (red), which are responsible for water absorption (not present in mammals), and the fly Fe/Cu cells, which are found in a region of low pH that believes to be functionally distinct from the low-pH stomach of mammals [12].*

2.2 INTESTINAL CELL DIFFERENTIATION AND REGENERATION

Both mammalian and fly guts have adult intestinal stem cells (ISCs) [13], [14], [15] and there are also similarities in cell composition and the signaling pathways that regulate intestinal regeneration (Figs 2 and and3).3). Enterocytes that uptake Nutrient and endocrine cells that produce hormone- are both present in flies and mammals **[**16], [17]. Other types of secretory cells that are found in the mammalian gut named mucus-producing goblet cells and the AMP-producing Paneth cells which have not been found in *Drosophila* midgut, but both the mucus and AMPs are originated from the *Drosophila* intestine [18], [19]. The *Drosophila* posterior midgut made up by a very simple lineage,only one type of mature absorptive cell, the enterocyte (as in mammals), and one main type of secretory cells called the enteroendocrine. On the other hand, the *Drosophila* midgut lacks of TA cells under normal homeostatic situations but such cells might exist under pathogenic conditions. Although asymmetric ISC divisions in the midgut make transient cells called enteroblasts, but these cells have no capacity to further cell division and become closely attach to ISC before maturation. Though the absence of crypts and villi , *Drosophila* midgut ISCs are situated basally and are broadly dispersed in the intestinal epithelium. But in case of mammals,

ISCs are typically intermingled with paneth cells and comprise a composite population of Lgr5-positive (Lgr5+) and Bmi1+ cells [12].

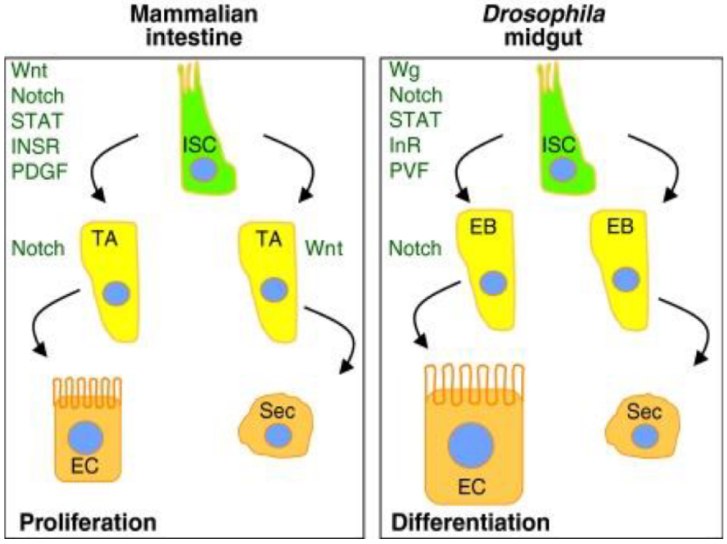


Fig. 2. *ISC lineages of mammalian intestine and Drosophila midgut, and the common pathways that control them. The Wnt/Wg and STAT pathways are responsible for ISC division. The additional similarities between the mammalian and Drosophila midgut ISCs have been shown. The midgut ISCs divide when the InR pathway is activated (i.e. following drug exposure) and in the presence of PVF growth factors (during aging). In addition, ISCs are regulated by the Notch pathway; however, Notch exhilarates ISC proliferation in mammals but causes them to differentiate in Drosophila midgut. On the other hand, Notch signaling is similarly required for the specification of enterocyte (EC) versus secretory (Sec) fate during the commitment of TA cells and enteroblasts (EBs). Wnt/Wg, which is needed for determination of secretory cell fate differentiation in mammals, is apparently not crucial for similarly specifying cell fate in the fly midgut [12].*

3 DROSOPHILA AS MODEL

3.1 ANALYSIS THE PARAOXONASE 1 EXPRESSION

The human Paraoxonases (PON) are a family of proteins (PON1, 2 and 3) and have a multiple enzymatic activities on distinct tissue expression profiles [20], [21]. Members of this gene family show it phosphortriesterase, esterase and lactonase activity to varying degrees [22], [23]. Among these PON, PON1 was originally named according to its capacity to hydrolyze paraoxon and other organophosphates, and has been found to associate with astounding number of traits and diseases that affect multiple organ systems [20]. While the phosphotriesterase function of PON1 is associated with organophosphate-degrading capacity [22]. Mutations in the human PON1 gene have been found to associate with aging and diseases of the cardiovascular, nervous, endocrine and gastrointestinal systems [24], [20]. PON1 can also hydrolyze acyl-homoserine lactones used by quorum-sensing bacteria to control multiple virulence factors during colonization of new environments [25], [26]. This association revealed that mutations in PON1 responsible for causing Crohn's disease and ulcerative colitis, or perhaps other phenotypes associated with the gut microbiota such as obesity and cardiovascular disease ([27], [28]. Drosophila melanogaster have no PON homologs that can offer an ideal model for studying the interactions in between PON genotype and host phenotypes [29]. Pezzulo et al. (2012) [30] hypothesized expression of PON1 in *D. melanogaster* and observed that PON1 alters the expression of multiple oxidative stress genes and decreases superoxide anion levels in the normal and germ-free *D. melanogaster*. It has also been noticed that the differences in the composition of gut microbiota, with a remarkable raise in levels of *Lactobacillus plantarum* and associated changes in expression of antimicrobial and cuticle-related genes. Generally expression of PON1 directly reduced the anionic levels of superoxide and altered bacterial colonization of the gut and its gene expression profiles, which highlights the complex nature of the interaction between host genotype and gut microbiota. Pezzulo et al. (2012) [30], also speculated the interaction between some genotypes and human diseases which were mediated by the presence of certain gut bacteria that induced specific immune responses in the gut and other surrounding host tissues.

3.2 GENETIC ANALYSIS OF INFLUENZA VIRAL-HOST INTERACTIONS

Influenza viruses are the family of orthomyxoviridae which infect vertebrates and are well known for the causative agents of the respiratory tract disease influenza. The outcomes of an influenza virus outbreak can be catastrophic, as evidenced by

the 1918 Spanish flu, which occurred approximately 50 million deaths worldwide [31],[32]. Generally, upper and lower respiratory tract were affect by the Influenza viruses when it invade and replicate inside the cells .Successful entry of the virus into a cell depends on two influenza virus proteins, one is hemagglutinin (HA) which binds to sialic acids on the surface of cells for attachment and another is matrix protein 2 (M2) which lowers the Ph inside the virion, allowing for viral uncoating. M2 changes pH due to its proton-transport activity. M2 is a small, type III integral membrane protein that acts as a proton pump [33], [31]. Adamson et al. (2011) [34], developed a new tool to study virus–host interactions that play key roles in viral replication and multiplication and to help identification of novel anti-influenza drug targets. It has been expressed the influenza virus M2 gene in *Drosophila melanogaster* through the UAS/Gal4 system and generated dose-sensitive phenotypes in the eye and wing. Adamson et al. (2011) [34], confirmed that the M2 proton channel is properly targeted to cell membranes in Drosophila tissues and functions as a proton channel by altering intracellular pH. They demonstrated the anti-influenza drug amantadine, which target site is the M2 proton channel and suppressed the UAS-M2 mutant phenotype when fed to larvae. During screening of a candidate gene they identified mutations in components of the vacuolar V1V0 ATPase that change the UAS-M2 phenotype. Over expressing of these specific V1 subunits altered the replication capacity of influenza virus in cell culture. Finally, this study makes a clear concept for using of M2 'flu fly' to identify new and previously unconsidered cellular genes as potential drug targets and better understanding of basic molecular mechanisms of influenza virology.

3.3 Identification and Analysis of Serpin-family Genes

The serpins family consists of more than 1,000 proteins, the main source those are plants, animals and viruses, but rarely found in fungi, bacteria, or archaea [35]. The serpin-fold contains of three β-pleated sheets with 8 or 9 short α-helical linkers whereas native serpins are in a metastable (stressed) configuration, which consists of a core structure with an exposed reactive centre loop (RCL) of 25-30 amino acids. The RCL express as ideal bait to the target proteinase which cleaves between two residues known as P1 and P1. Serpins have been frequently studied in mammals where they regulate many extracellular proteolytic cascades including, coagulation, inflammatory and complement pathways are controlled by α1-Antithrombin, α1-Antitrypsin and C1-Inhibitor, respectively [36], [37] while Plasminogen Activator Inhibitor-1 alters angiogenesis, affecting both wound-healing and tumor growth [38]. There have a linked group of non-inhibitory serpin-fold proteins which contains molecular chaperones and have a diverse functions, [39], hormone transport, chromosome condensation [40], tumor suppression [41], and storage proteins [42]. Garrett et al. (2009) [43], collected 188 orthologues serpins from 11 Drosophilid genomes and used synteny for searching new family members, increase the total number to 226, or 71% of the number of orthologues are expected for assuming complete conservation of total 12 Drosophilid species. The critical Reactive Centre Loop (RCL) sequence contained the target proteinase cleavage site, which was rigorously conserved in inhibitory serpins, although three differential sets of orthologues found as looser. On the contrary, RCL of non-inhibitory serpin orthologues were less conserved, with 3 exceptions that presumably bind to conserved partner molecules. The derived consensus hinge motif of Drosophilid inhibitory serpins, differ a little from that of the vertebrate consensus. Clusters of three genes are appeared to have presented in the *melanogaster* subgroup, *Spn28D*, *Spn77B* and *Spn88E*, each of them contained one inhibitory serpin orthologue that was found in all Drosophila's [43].

3.4 Analysis of Innate Immunity Pathways

Drosophila melanogaster has been proved as a successful model organism for the study of innate immunity. The power of Drosophila genetics offered basic discoveries, such as for Toll-like receptors (TLRs) in immunity that has a great impact in case of mammalian immunity research [44]. Drosophila reacts to pathogens at several levels [45]. At first Pathogens closely contact with epithelial barriers and produce a local immune response on the basis of reactive oxygen species and anti-microbial peptides (AMPs). If pathogens somehow) can across these barriers they produce two mechanisms of response. On one hand, there is a cellular-mediated immunity that plays phagocytosis of invading microorganisms which are leukocyte-like cells. On the other hand, a strong humoral immune response, that is activated on systemic infection. This is mainly a response of the fat body, an organ analogue to the mammalian liver, which secretes to the haemolymph a wide range of factors, including AMPs [46]. Toll is a transmembrane receptor which is a part of leucine-rich repeat subgroup of proteins that also hold Toll-IL-IR (TIR) domains [47], [48], [49]. The Toll pathway is facilitated by a serine protease cascade that proceeds to the processing of a Spaetzle. The physical interaction between Spaetzle and Toll commences an intracellular cascade that involves the adaptor proteins dMyD88 and Tube and the threonine-serine kinase Pelle. This leads to the degradation of Cactus and nuclear translocation of NF-_B-like transcription factors Dorsal and Dif, which ultimately control the expression of antimicrobial peptides. The expression of antimicrobial peptides basically regulated by toll signaling pathway of Rel family transcription factor called Relish. Two well-defined cascades have been found to involve in the activation of Relish [50],[51]. One is mitogen activated protein kinase (MAPK) signaling pathway that involves TAK1 and IKK

which implicate the phosphorylation of Relish and another pathway involving the caspase Dredd which has been shown to subsequently proteolytically activate Relish. Recently, the MAPK Jun N-terminal protein kinase has been shown to be both down-regulated by Relish and in the expression of innate immunity-related genes [52].

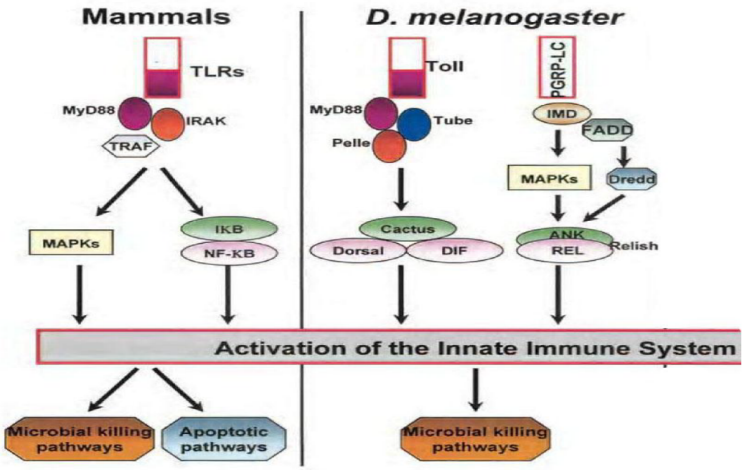


Fig. 3. *Comparison of the D. melanogaster innate immunity pathway with homolog pathways in mammals. In mammals and D. melanogaster, Toll-like receptors are important in the recognition of microbial pathogens prior to the elicitation of innate immune responses. The C. elegans Tol-1 receptor is apparently not associated in this process. The intracellular TIR domain of Toll communicates with a similar domain contained in the MyD88 conserved protein. In mammals, this leads to the activation of both MAPKs and NF-_B that ultimately acceleretes the innate immune system. Similarly, Toll activation triggers innate immunity in D. melanogaster through the activation of the NF-_B-like transcription factors Dorsal and DIF [53].*

3.5 HUNTINGTON DISEASE

Huntington's disease (HD) is the prototypic disease resulted by increasing of unstable CAG repeat, causing in expression of an extended polyglutamine tract near the amino terminus of a gene known as huntingtin [54]. Drosophila is reported as the first neurodegenerative disease model used a fragment of mutant ataxin-3/MJD10.This report was followed shortly by a model for HD using fragments of huntingtin [55]. Other researchers analyzed the effects of quasi-pure polyglutamine tracts expressed within the context of fly genes, such as *prospero* and *disheveled*. Models using expression of full-length ataxin-1 and -3 also have been revealed. Both candidate-based and unbiased genetic screens were launched in the fly to identify polyglutamine modifiers. Of them first observed modifier was hsp70 which misexpression of a human hsp70, HSPAL and dramatically suppresses the eye phenotype of SCA3 flies [56]. On the other hand, an unbiased transposon-based screen identified *Drosophila* HDJ1, an hsp40 where misexpression of HDJ1dramatically suppressed a quasi-pure polyglutamine phenotype [57]. *Drosophila* models have also been useful in validation of small molecule compounds predicted to suppress aggregation based on cell-based studies. Histone deacetylase inhibitors act as suppressors of mutant htt exon 1 toxicity in *Drosophila* and this analysis is used to validation of mouse models and several clinical trials of phenylbutyrate in Histone deacetylase [58], [59]. It was reported recently that inhibitor rapamycin can suppress htt-Q120 toxicity which has an acceptance autophagy role in polyglutamine disease [60]. Another studies identified that the Rho-associated kinase p160ROCK has an inhibitor role and act as a suppressor of mutant htt exon1 toxicity in the fly [61].

3.6 IDENTIFYING NEW ONCOGENE PARTNERS USING DROSOPHILA

Drosophila plays an important role for the screening of modifiers, enhancers or suppressors of human oncogenic protein functions on the basis of *in vivo* platform, illustrated by studies of AML. The pathogenesis of AML is thought to involve multistep genetic alterations in several genes that promote leukaemias [62].Chromosomal translocations analyses in bone marrow of AML patients have found that several transcription factors that are crucial for haematopoiesis also play important roles in leukaemogenesis. These include AML1, LMO2, SALL, MLL and SCl/Tal1, all of which are proteins with clearly recognized *Drosophila* orthologues [63]. The *t(8;21) (q22;q22)* chromosomal translocation creates the AML1-ETO fusion product which is found in ~12% of AML patients. Under normal conditions, AML1, RUNX-domain proteins were found to responsible for tissue-specific transcriptional activation at multiple steps during haematopoiesis, whereas ETO (RUNX1T1 and MTG8) acted as a transcriptional repressor. It is believed that the fusion product of AML1-ETO acts as a constitutive repressor

of AML1 protein function and inhibits myeloid differentiation while promoting proliferation of multilineage progenitors [63]. Interestingly, the *Drosophila* RUNX protein Lozenge is necessary for the differentiation of crystal cells. Two independent groups revealed human AML1-ETO in *Drosophila* haemocyte precursors and found that this results in enhanced proliferation of circulating progenitors, the formation of 'melanotic tumours and prevention of crystal cell differentiation. One group expressed those mutations in components of the Wnt4-Frizzled and Ca^{2+} signalling pathways raised AML1-ETO activity [64]. The other group recognized eight suppressor candidates, including Calpain B (CalpB), a Ca^{2+}-dependent protease [65]. In human cells CalpB was also found to interact with AML1-ETO [65], opening up the possibility that it might have a role in regulating leukaemogenesis. This functional investigation provides proof of principle that expression of human oncogenic factors in *Drosophila* haemocytes can assist to identify core regulatory networks whose dysregulation in humans responsible for the development of leukaemias.

3.7 DROSOPHILA MODELS OF PARKINSON DISEASE

Parkinson's disease (PD) is the second most common neurodegenerative disorder affecting more than 1% of the population over age 60. It is mainly characterized by the selective and progressive loss of dopaminergic neurons, accompanied by locomotor defects such as muscle rigidity, bradykinesia, postural instability, and tremor. Another pathological distinguishing mark of this disorder is the presence of cytoplasmic inclusions in the surviving DA neurons called Lewy bodies (LBs), which are mainly consisted of α-Synuclein and ubiquitin among other proteins [66], [67]. Although most PD cases are sporadic, several genes are found to associate with rare familial forms of the disease. Analyses of their function demonstrated that three types of cellular defects are found to involve in the formation and progression of PD and these are abnormal protein aggregation, oxidative damage, and mitochondrial dysfunction. Though PD models created in mice, fruit flies, and worms but Drosophila signed up as a very valuable model organism in the study of either toxin-induced or genetically linked PD. In Drosophila, several studies have expressed that pharmacological treatment could be used to model sporadic PD. One study revealed that chronic exposure to the pesticide rotenone, a mitochondrial complex I inhibitor, recapitulated key aspects of sporadic PD in Drosophila since it created neurodegenerative and behavioral defects [68]. Another study of rotenote-treated flies showed dose-dependent motor deficits quantified by a negative geotaxis test, which is commonly used to accomplish locomotor ability analyses in Drosophila, as well as selective loss of DA neurons in all the brain clusters. In a different study, paraquat exposure were found to reduce lifespan in flies as well as movement disorders such as resting tremors, bradykinesia, rotational behaviours, and postural instability, which mirror PD symptoms. The authors also revealed that such phenotypes were happened by selective loss of DA neuron clusters [69]. Thus, both studies robustly modelled environmental toxin-induced PD in Drosophila and provide useful tools for analyzing the mechanism of DA neurodegeneration.

3.8 THERAPEUTIC DRUG DISCOVERY

Drosophila has been extensively studied by researchers for decades, resulting in them ideal models for disease research and the screening of potential therapies. Genetic techniques have introduced reliable disease like fly models. Constructed models from these simple invertebrate organisms help to rapidly obtaining critical information and solving recent problem of molecule's effectiveness, toxicity and target before starting time-consuming clinical studies. Screening compounds of this manner plays an important role in the identification of pharmacological features directly, by which relevant potential effects for humans and other whole organisms can be assessed. Models for human diseases can be made in the fly by mutant generation, either by mutation in the fly homolog gene of a human disease-related gene or by expression of the human gene itself that introduce a scorable phenotype [70]. This Drosophila model can be directly used for the screening of small molecules that can rescue the phenotype or genetic screens that can identify the modifiers of the phenotype, all of which provide a new potential targets and models for a given disease. After priliminary screening, positive ideas can be achieved by testing of the additional fly models of the target disease. Significantly, the whole-organism validation research can be used for accomplishing the positive hits of traditional in vitro mammalian cell culture HTS and to rapid identification of compounds effectives [70].

REFERENCES

[1] S. E. Wilson-Sanders, "Invertebrate Models for Biomedical Research, Testing, and Education," Institute for Laboratory Animals Research, vol. 52, no. 2, pp. 126 – 152, 2011.

[2] M. J. Wolf and H. A. Rockman, "Drosophila, Genetic Screens, and Cardiac Function," Circulation Research, vol. 109, pp. 794-806, 2011.

[3] S. E. Celniker and G. M. Rubin, "The drosophila melanogaster genome. Annu. Rev," Genomics Human Genetic, vol. 4, pp. 89 –117, 2003.

[4] S. E. Celniker, L. A. Dillon, M. B. Gerstein, K. C. Gunsalus, S. Henikoff, G. H. Karpen, M. Kellis, E. C. Lai, J. D. Lieb, D. M. MacAlpine, G. Micklem, F. Piano, M. Snyder, L. Stein, K. P. White and R. H. Waterston, "Unlocking the secrets of the genome," Nature, vol. 459, pp. 927–930, 2009.

[5] M. E. Fortini, M. P. Skupski, M. S. Boguski and I. K. Hariharan, "A survey of human disease gene counterparts in the drosophila genome," Journal of Cell Biology, vol. 150, pp. 23–30, 2000.

[6] L. T. Reiter L. Potocki, S. Chien, M. Gribskov and E. Bier, "A systematic analysis of human disease-associated gene sequences in drosophila melanogaster," Genome Research, vol. 11, pp. 1114 –1125, 2001.

[7] S. Chien, L. T. Reiter, E. Bier and M. Gribskov, "Homophila: Human disease gene cognates in drosophila," Nucleic Acids Research, vol. 30, pp. 149 –151, 2002.

[8] L. I. Gilbert, "*Drosophila* is an inclusive model for human diseases, growth and development," Molecular and Cellular Endocrinology, vol. 293, pp. 25-31, 2008.

[9] K. M. Beckingham, J. D. Armstrong, M. J. Texada, R. Munjaal and D. A. Baker, "*Drosophila melanogaster*: The model organism of choice for the complex biology of multi-cellular organisms," Gravitational and space biology bulletin, vol. 18, pp. 17-29, 2005.

[10] D. G. Thompson and J. R. Malagelada, "Guts and their motions (gastrointestinal motility in health and disease)," Journal of Clinical Gastroenterology, vol. 3, pp. 81–87, 1981.

[11] R. S. Edgecomb, C. E. Harth and A. M. Schneiderman, "Regulation of feeding behavior in adult Drosophila melanogaster varies with feeding regime and nutritional state," The Journal of Experimental Biology, vol. 197, pp. 215–235, 1994.

[12] Y. Apidianakis and L. G. Rahme, "*Drosophila melanogaster* as a model for human intestinal infection and pathology," Disease Model Mechanism, vol. 1, no. 4, pp. 21–30, 2011.

[13] N. Barker, M. Wetering and H. Clevers, "The intestinal stem cell," Genes & Development, vol. 22, pp. 1856 –1864, 2008.

[14] E. Sangiorgi and M. R. Capecchi, "Bmi1 is expressed in vivo in intestinal stem cells," Nature Genetics, vol. 40, pp. 915–920, 2008.

[15] S. Takashima, M. Mkrtchyan, A. Younossi-Hartenstein, J. R. Merriam and V. Hartenstein, "The behaviour of Drosophila adult hindgut stem cells is controlled by Wnt and Hh signaling," Nature, vol. 454, pp. 651–655, 2008.

[16] C. Crosnier, D. Stamataki and J. Lewis, "Organizing cell renewal in the intestine: stem cells, signals and combinatorial control," Nature Review Genetics, vol. 7, pp. 349–359, 2006.

[17] B. Ohlstein and A. Spradling, "The adult Drosophila posterior midgut is maintained by pluripotent stem cells," Nature, vol. 439, pp. 470–474, 2006.

[18] N. Buchon, N. A. Broderick, M. Poidevin, S. Pradervand and B. Lemaitre, "Drosophila intestinal response to bacterial infection: activation of host defense and stem cell proliferation," Cell Host and Microbe, vol. 5, pp. 200–211, 2009.

[19] N. Vodovar, M. Vinals, P. Liehl, A. Basset, J. Degrouard, P. Spellman, F. Boccard and B. Lemaitre, "Drosophila host defense after oral infection by an entomopathogenic Pseudomonas species," Proceedings of the National Academy of Sciences USA, vol. 102, pp. 11414–11419, 2005.

[20] B. Goswami, D. Tayal, N. Gupta and V. Mallika, " Paraoxonase: a multifaceted biomolecule," Clinica Chimica Acta, vol. 410, pp. 1–12, 2009.

[21] D. M. Shih, Y. R. Xia, J. M. Yu and A. J. Lusis, "Temporal and Tissue-SpecificPatterns of Pon3 Expression in Mouse: In situ Hybridization Analysis," Advances in Experimental Medicine and Biology, vol. 660, pp. 73–87, 2010.

[22] O. Khersonsky and D. S. Tawfik, "Structure-reactivity studies of serum paraoxonase PON1 suggest that its native activity is lactonase," Biochemistry (Mosc), vol. 44, pp. 6371–6382, 2005.

[23] H. Jakubowski, "The role of paraoxonase 1 in the detoxification of homocysteine thiolactone," Advances in Experimental Medicine and Biology, vol. 660, pp.113–127, 2010.

[24] D. Boehm, M. Krzystek-Korpacka, K. Neubauer, M. Matusiewicz, I. Berdowska, B. Zielinski, L. Paradowski and A. Gamian, "Paraoxonase-1 status in Crohn's disease and ulcerative colitis. Inflamm," Bowel Disease, vol. 15, no. 1, pp. 93–99, 2009.

[25] C. K. Chun, E. A. Ozer, M. J. Welsh, J. Zabner and E. P. Greenberg, "Inactivation of a Pseudomonas aeruginosa quorum-sensing signal by human airway epithelia," Proceedings of the National Academy of Sciences USA, vol. 101, pp. 3587–3590, 2004.

[26] M. L. Estin, D. A. Stoltz and J. Zabner, "Paraoxonase 1, Quorum Sensing, and P. aeruginosa Infection: A Novel Model," Proceedings of the National Academy of Sciences, vol. 660, pp. 183–193, 2010.
[27] R. Caesar, F. Fak and F. Backhed, "Effects of gut microbiota on obesity and atherosclerosis via modulation of inflammation and lipid metabolism," Journal International Medicine, vol. 268, pp. 320–328, 2010.
[28] O. Koren, A. Spor, J. Felin, F. Fak, J. Stombaugh, V. Tremaroli, C. J. Behre, R. Knight, B. Fagerberg, R. E. Ley and F. Bäckhed, "Human oral, gut,and plaque microbiota in patients with atherosclerosis," Proceedings of the National Academy of Sciences USA, vol. 108, no. 1, pp. 4592–4598, 2011.
[29] D. A. Stoltz, E. A. Ozer, P. J. Taft, M. Barry, L. Liu, P. J. Kiss, T. O. Moninger, M. R. Parsek and J. Zabner, "Drosophila are protectedfrom Pseudomonas aeruginosa lethality by transgenic expression of paraoxonase- 1," Journal of Clinical Investigation, vol. 118, no. 9, pp. 3123–3131, 2008.
[30] A. A. Pezzulo, E. E. Hornick, M. V. Rector, M. Estin, A. C. Reisetter, P. J. Taft, S. C. Butcher, A. B. Carter, J. R. Manak, D. A. Stoltz and J. Zabner, "Expression of Human Paraoxonase 1 Decreases Superoxide Levels and Alters Bacterial Colonization in the Gut of Drosophila melanogaster," PLoS ONE, vol. 7, no. 8, pp. 43777, 2012.
[31] Palese, P., and Shaw, M. L., "Orthomyxoviridae: the viruses and their replication," In: D. M. Knipe, P. M. Howley, Lippincott, Williams, Wilkins, P. A. Philadelphia (Eds), in Fields of Virology, pp. 1647–1689, 2007.
[32] Wright, P. F., Neumann, G., and Kawaoka, Y., "Orthomyxoviruses,", In: D. M. Knipe, P. M. Howley, Lippincott, Williams, Wilkins, P. A. Philadelphia (Eds), in Fields of Virology, pp. 1691–1740, 2007.
[33] L. H. Pinto and R. A. Lamb, "The M2 proton channels of Influenza A and B viruses," Journal of Biological Chemistry, vol. 281, pp. 8997–9000, 2006.
[34] A. L. Adamson, K. Chohan, J. Swenson and D. LaJeunesse, "A Drosophila Model for Genetic Analysis of Influenza Viral/Host Interactions," Genetics, vol. 189, pp. 495–506, 2011.
[35] J. A. Irving, R. N. Pike, A. M. Lesk and J. C. Whisstock, "Phylogeny of the serpin super family: implications of patterns of amino acid conservation for structure and function," Genome Research, vol. 10, pp. 1845-1864, 2000.
[36] D. Bruce, D. J. Perry, J. Y. Borg, R. W. Carrell and M. R. Wardell, "Thromboembolic disease due to thermolabile conformational changes of antithrombin Rouen-VI," Journal of Clinical Investigation, vol. 94, pp. 2265-2274, 1998.
[37] M. Cicardi, L. Bergamaschini, M. Cugno, A. Beretta, L. C. Zingale, M. Colombo and A. Agostoni, "Pathogenetic and clinical aspects of C1 inhibitor deficiency, " Immunobiology, vol. 199, pp. 366-376, 1998.
[38] K. M. Providence and P. J. Higgins, "PAI-1 expression is required for epithelial cell migration in two distinct phases of in vitro wound repair," Journal of Cellular Physiology, vol. 200, pp. 297-308, 2004.
[39] T. R. Dafforn, M. Della and A. D. Miller, "The molecular interactions of heat shock protein 47 (Hsp47) and their implications for collagen biosynthesis," Journal of Biological Chemistry, vol. 276, pp. 49310-49319, 2001.
[40] S. A. Grigoryev, J. Bednar and C. L. Woodcock, "MENT a heterochromatin protein that mediates higher order chromatin folding, is a new serpin family member," Journal of Biological Chemistry, vol. 274, pp. 5626-5636, 1999.
[41] T. Liu, P. A. Pemberton and A. D. Robertson, "Three-state unfolding and self-association of maspin, a tumor-suppressing serpin," Journal of Biological Chemistry, vol. 274, pp. 29628-29632, 1999.
[42] J. A. Huntington, N. S. Pannu, B. Hazes, R. J. Read, D. A. Lomas and R. W. Carrell, "A 2.6 A structure of a serpin polymer and implications for conformational disease," Journal of Molecular Biology, vol. 293, pp. 449-455, 1999.
[43] M. Garrett, A. Fullaondo, L. Troxler, G. Micklem and D. Gubb, "Identification and analysis of serpin-family genes by homology and synteny across the 12 sequenced Drosophilid genomes," BMC Genomics, vol. 10, pp. 489, 2009.
[44] A. Iwasaki and R. Medzhitov, "Toll-like receptor control of the adaptive immune responses," Nature Immunology, vol. 5, pp. 987–95, 2004.
[45] B. Lemaitre and J. Hoffmann, "The host defense of Drosophila melanogaster," Annual Review Immunity, vol. 25, pp. 697–743, 2007.
[46] L. Teixeira, "Whole-genome expression profile analysis of Drosophila melanogaster immune responses," Briefings in Functional Genomics, vol. 11, no. 5, pp. 375-386, 2013.
[47] G. M. Barton and R. Medzhitov, "Toll-like receptor signaling pathways," Science, vol. 300, pp. 1524–1525, 2003.
[48] S. Janssens and R. Beyaert, "Role of Toll-like receptors in pathogen recognition," Clinical Microbiology Review, vol. 16, pp. 637–646, 2003.
[49] S. T. Qureshi and R. Medzhitov, "Toll-like receptors and their role in experimental models of microbial infection," Genes Immunology, vol. 4, pp. 87–94, 2003.
[50] J. A. Hoffmann and J. M. Reichhart, "*Drosophila* innate immunity: an evolutionary perspective," Nature Immunology, vol. 3, pp. 121–126, 2002.
[51] C. A. Brennan and K. V. Anderson, "*Drosophila*: the genetics of innate immune recognition and response," Annual Review Immunology, vol. 22, pp. 457–483, 2004.

[52] J. M. Park, H. Brady, M. G. Ruocco, H. Sun, D. Williams, S. J. Lee, T. Kato, N. Richards, K. Chan, F. Mercurio, M. Karin and S. A. Wasserman, "Targeting of TAK1 by the NF-kappa B protein Relish regulates the JNK-mediated immune response in *Drosophila,*" Genes & Development, vol. 18, pp.584–594, 2004.

[53] E. Mylonakis and A. Aballay, "Worms and Flies as Genetically Tractable Animal Models To Study Host-Pathogen Interactions," Infection and Immunity, vol. 73, no. 7, pp. 3833–3841, 2005.

[54] T. K. Sang and G.R. Jackson, "*Drosophila* Models of Neurodegenerative Disease," Journal of American Society Experimental Neurological Therapeutics, vol. 2*,* pp. 438–446, 2005.

[55] G. R. Jackson, I. Salecker, X. Dong, X. Yao, N. Arnheim, P. W. Faber, M. E. MacDonald and S. L. Zipursky, "Polyglutamine-expanded human huntingtin transgenes induce degeneration of Drosophila photoreceptor neurons," Neuron, vol. 21, pp. 633–642, 1998.

[56] J. M. Warrick, H. Y. Chan, G. L. Gray-Board, Y. Chai, H. L. Paulson and N.M. Bonini, "Suppression of polyglutamine-mediated neurodegeneration in *Drosophila* by the molecular chaperone HSP70," Nature Genetics, vol. 23, pp. 425– 428, 1999.

[57] P. Kazemi-Esfarjani and S. Benzer, "Genetic suppression of polyglutamine toxicity in *Drosophila,*" Science, vol. 287, pp. 1837–1840, 2000.

[58] J. S. Steffan, L. Bodai, J. Pallos, M. Poelman, A. McCampbell, B. L. Apostol, A. Kazantsev, S. E. chmidt, Y. Z. Zhu, M. Greenwald, R. Kurokawa, D. E. Housman, G. R. Jackson, J. L. Marsh and L. M. Thompson, "Histone deacetylase inhibitors arrest polyglutaminedependent neurodegeneration in *Drosophila,*" Nature, vol. 413, pp. 739 –743, 2001.

[59] R. J. Ferrante , J. K. Kubilus, J. Lee, H. Ryu, A. Beesen, B. Zucker, K. Smith, N. W. Kowall, R. R. Ratan, R. Luthi-Carter and S. M. Hersch, "Histone deacetylase inhibition by sodium butyrate chemotherapy ameliorates the neurodegenerative phenotype in Huntington's disease mice," Journal of Neuroscience, vol. 23, pp. 9418 –9427, 2003.

[60] B. Ravikumar , C. Vacher, Z. Berger, J. E. Davies, S. Luo, L. G. Oroz, F. Scaravilli, D. F. Easton, R. Duden, C. J. O'Kane and D. C. Rubinsztein, "Inhibition of mTOR induces autophagy and reduces toxicity of polyglutamine expansions in fly and mouse models of Huntington disease," Nature Genetics, vol. 36, pp. 585–595, 2004.

[61] S. K. Pollitt , J. Pallos, J. Shao, U. A. Desai, A. A. Ma, L. M. Thompson, J. L. Marsh and M. I. Diamond, "A rapid cellular FRET assay of polyglutamine aggregation identifies a novel inhibitor," Neuron, vol. 40, pp. 685– 694, 2003.

[62] H. Döhner, E. H. Estey, S. Amadori, F. R. Appelbaum, T. Büchner, A. K. Burnett, H. Dombret, P. Fenaux, D. Grimwade, R. A. Larson, F. Lo-Coco, T. Naoe, D. Niederwieser, G. J. Ossenkoppele, M. A. Sanz, J. Sierra, M. S. Tallman, B. Löwenberg and C. D. Bloomfield, "Diagnosis and management of acute myeloid leukemia in adults: recommendations from an international expert panel, on behalf of the European Leukemia," Blood, vol. 115, pp. 453–474, 2010.

[63] M. Crozatier and A. Vincent, "*Drosophila*: a model for studying genetic and molecular aspects of haematopoiesis and associated leukaemias," Disease Model Mechanism, vol. 4, no. 4, pp. 439–445, 2011.

[64] S. A. Sinenko, T. Hung, T. Moroz, Q. M. Tran, S. Sidhu, M. D. Cheney, N. A. Speck and U. Banerjee, "Genetic manipulation of AML1-ETO-induced expansion of hematopoietic precursors in a Drosophila model," Blood, vol. 116, pp. 4612–4620, 2010.

[65] D. Osman, V. Gobert, F. Ponthan, O. Heidenreich, M. Haenlin and L. Waltzer, "A Drosophila model identifies calpains as modulators of the human leukemogenic fusion protein AML1-ETO," Proceedings of the National Academy of Sciences USA, vol. 106, pp. 12043–12048, 2009.

[66] J. Jankovic, "Parkinson's disease: clinical features and diagnosis," Journal of Neurology, Neurosurgery & Psychiatry, vol. 79, no. 4, pp. 368–376, 2008.

[67] A. J. Lees, J. Hardy and T. Revesz, "Parkinson's disease,"The Lancet, vol. 373, no. 9680, pp. 2055–2066, 2009.

[68] H. Coulom and S. Birman, "Chronic exposure to rotenone models sporadic Parkinson's disease in Drosophila melanogaster," Journal of Neuroscience, vol. 24, pp. 48, pp. 10993–10998, 2004.

[69] A. Chaudhuri, K. Bowling, C. Funderburk, H. Lawal, A. Inamdar, Z. Wang and J. M. O'Donnell, "Interaction of genetic and environmental factors in a Drosophila parkinsonism model," Journal of Neuroscience, vol. 27, no. 10, pp. 2457–2467, 2007.

[70] U. B. Pandey and C. D. Nichols, "Human Disease Models in *Drosophila melanogaster* and the Role of the Fly in Therapeutic Drug Discovery," Pharmacological Reviews, vol. 63, pp. 411–436, 2011.

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Students' Attitude towards Receiving Training in Learning Strategies of Writing vs. their Writing Performance: The Case of Hawassa University Students

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ABSTRACT: This study was intended to examine the correlation between students' attitude towards leaning writing lessons through receiving training on the learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics. To this end, the selected Year-I students of Hawassa University were taught lessons of the Basic Writing Skills course with training in the strategies. At the end of the program, the students were made to fill in a five-point scale questionnaire intended to explore their attitude towards receiving training in the strategies, and to take a writing test. The correlations were examined through the Pearson product-moment correlation coefficient (r). To determine the strength of a correlation, the cut-off points suggested by Cohen were applied. Moreover, the coefficient of determination was computed to see the extent to which the students' attitude towards receiving training on the strategies predicts their writing performance. Thus, this research employed a quantitative-methods design. The Pearson r demonstrated that there was a strong positive correlation between the students' attitude towards leaning the writing lessons through receiving training on the strategies and their writing performance on each of the aspects of writing (r-values $\geq$ .766; p-value = .000)). The coefficient of determination also revealed that the students' attitude towards receiving training on the strategies predicts their writing performance at above 58%. Based on the findings, recommendations have been made.

KEYWORDS: attitude; receiving training; learning strategies of writing; correlation; writing performance.

1 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Hawassa University is a public university found in the South Nations, Nationalities and Peoples' Regional State of Ethiopia and is a comprehensive university engaged in the provision of all-round education, research, training and community service. The university has more than 64 first degree programs, 43 second degree programs and 4 PhD programs in various schools/colleges. Students of all the departments of Hawassa University, as is the case with students of other universities across the nation, particularly in the undergraduate studies, take English language courses such as Communicative English Skills-I, Communicative English Skills-II, Sophomore English, Basic Writing Skills, Advanced Writing-I, Advanced Writing-II and/or Report Writing.

The main objective of offering the English language courses to the students is to help them improve their proficiency as English is a medium of instruction and nearly all the teaching/learning and reference materials are written in it (Hailemichael, 1993; Gebremedhin, 1986). The written as well as oral communications and meetings within the university, usually, and communications with foreign learning institutions, always, are carried out in English. Moreover, formal as well as informal notices of the university usually appear in English. A great deal of information exchange, thus, takes place mainly in writing. It is also mainly writing that has been offered to the undergraduate program students of all the schools/colleges of the university.

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The university curricula, however, as is the case with other universities across the country, have not given room for the issue of training in learning strategies of English language in general and writing skills in particular. Learning strategies training has roots in cognitivism and humanism learning theories. Training in learning strategies of writing involves asking students to learn writing by receiving training on the strategies in which explanations are given to the students as to when (contexts), how and why the strategies can be used (Oxford, 1990).

Though the importance of writing in Ethiopian academic context has been felt and acknowledged, the researcher's experience in teaching and advising at Hawassa University shows that the writing performance of the majority of students is deteriorating alarmingly. This is particularly noticeable in tests/examinations, assignments and senior essay/thesis papers. At conferences and workshops conducted on issues related to English language teaching in general and writing skills teaching in particular, many instructors from other universities of the nation have also reflected that their students too seem to have difficulties in writing intelligibly and effectively. Italo's (1999) study, which corresponds with Geremew's (1999) findings, can be taken as an evidence to the this problem in which he concludes that the freshman program students at Addis Ababa University seem to have serious problems in writing in English.

1.2 OBJECTIVES OF THE STUDY

A vast body of research literature on the topic has confirmed that leaning writing through receiving training on learning strategies of writing improves students' writing skills. This is because training benefits students to learn the role of strategies in improving their writing skills and it improves their motivation to learn writing and belief about autonomous learning of writing, and thus they continue to use the strategies appropriately when they carry out writing tasks in and outside class (Wenden and Rubin, 1987; Oxford, 1990; Ze-sheng, 2008; Liang, 2009; McMullen, 2009; Zeleke, 2013). To this effect, students should have a positive attitude towards learning writing through receiving training on the strategies (O'Malley and Chamot, 1990; Oxford, 1990; Wenden, 1991). A research conducted by Zeleke (2013), the first local study in its kind, found that students have a positive attitude towards learning writing lessons through receiving training on learning strategies of writing. This is because students feel that they benefit from training to improve their writing skills by using the strategies appropriately as well as taking on more responsibility for their own learning of writing.

However, Zeleke (2013) did not examine the correlation between the students' attitude towards leaning the writing lessons through receiving training on the learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics. Hence, this study is intended to examine the correlation between students' attitude towards receiving training in learning strategies of writing and their writing performance on each of the aspects of writing with particular reference to Hawassa University students.

1.3 RESEARCH HYPOTHESES

The following null and alternative hypotheses were formulated about the correlation.

Null Hypothesis (Ho): There is no correlation between students' attitude towards receiving training in learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics;

Alternative Hypothesis (Ha): There is correlation between students' attitude towards receiving training in learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics.

1.4 SIGNIFICANCE OF THE STUDY

It is hoped that the findings of this study have the following importance. In the first place, it adds value to our knowledge that there is a strong positive correlation between students' attitude towards receiving training in learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics. Moreover, this study may serve as a springboard for future researchers interested to conduct similar studies on the other macro-language skills, grammar or vocabulary.

2 REVIEW OF RELATED LITERATURE

2.1 LEARNING STRATEGIES OF WRITING

Oxford (1990) has classified learning strategies of writing into the following groups based on various criteria.

2.1.1 MEMORY STRATEGIES

Memory learning strategies of writing include placing new words into a context, using key words, and structured reviewing. **Placing new words into a context** involves applying words that have been heard or read into a meaningful context as a way of remembering them. For example, learners may make a little story by using the new words.

Using key words to remember something requires learners to go through two steps. First, they should identify a familiar word in their own language that sounds like the new word. Second, they should create an image of some relationship between the new and familiar words. For instance, to learn the French word potage (soup), the English speaker can associate the word with a pot and then draw a pot that is full of potage. **Structured reviewing** involves carefully spaced intervals, at first close together and then more widely spaced apart. Learners might start, for instance, with a review of fifteen minutes after the initial learning, then twenty-five minutes afterward, an hour or two afterward, a day later, two days later, a week later, etc. so that they can become so familiar with the information and master it.

2.1.2 COGNITIVE STRATEGIES

The cognitive learning strategies of writing are different. **Using mechanical techniques** involves writing new words on one side of cards and their definitions or full sentences with the words on the other side and then moving the cards from one stack to another when the words are learned. This strategy also includes putting words that have been learned and words that need practice in separate sections of a notebook.

Repeating involves writing the same thing twice or more times. For example, when students carry out a piece of writing, they can repeat words or expressions, styles, tones, examples, evidences, etc. to tell us that they are emphasizing these to help them effectively discuss given ideas or concepts.

Formally practicing with sounds and writing systems focuses on practicing the writing systems of the target language, for example, by copying letters/words or copying or collecting paragraphs developed by using similar methods in the target and students' own languages to compare and contrast the paragraphs in terms of organization of ideas, subject matter treatment, language use, etc. This helps learners write paragraphs in the target language by effectively applying given methods, for it may be easy to understand about the methods from the paragraphs in their own languages.

According to Oxford (1990), "**Recognizing and using routine formulas and patterns** in the target language greatly enhance the learner's comprehension and production. Formulas are unanalyzed expressions, while patterns have at least one slot that can be filled with an alternative word" (P.72). When students carry out writing tasks, to help them maximize the attractiveness of their writing, they can collect, practice and employ commonly used expressions, structures and formats.

The **strategy of recombining** involves writing new meaningful sentences by arranging together words or expressions in new ways. For instance, a learner can recombine expressions such as going to the warehouse, going to the supermarket, attending a meeting, walking, and going to the cinema and write a little story about a woman who does all these things in the same morning.

Practicing naturalistically includes writing autobiography, interviews of family or friends, factual reports, stories, poems, diary, newsletters, magazines, simulated radio and television programs, letters, etc. in the target language. **Using sources for getting information** includes using dictionaries, grammar books, reference books, the internet, television news shows, radio programs, etc. to help learners improve their writing regarding word choice, grammar, mechanics, organization, content, etc.

Reasoning deductively involves using general rules and applying them to draw specific rules about a language while writing. It is a top-down strategy leading from general to specific. Reasoning deductively is a common and useful type of logical thinking. For example, to write given adverbs in the correct position, learners can use the general rule that adverbs usually appear before other adverbs, before adjectives, and after verbs they modify.

Translating involves using one's own language to prepare the first draft and then changing it into the target language. Writing a draft in one's own language may make him/her easily generate and organize ideas. **Transferring** involves applying one's grammatical knowledge of first language to second/foreign language or his/her knowledge from one aspect of a language to another aspect or conceptual knowledge from one field to another. For example, students can use this strategy

to help them understand or produce the four types of sentences, namely simple, compound, complex and compound-complex which are classified on the basis of grammatical structure. They can apply their knowledge about number and types of clauses (dependent/independent) and about types of coordinating conjunctions and/or punctuation marks of these sentences in their first/Amharic language to help them easily understand or produce sentences in English.

With regard to **taking notes** as a strategy, learners can take notes on some issues while reading texts in the target language to help them improve their writing skills. For instance, to help them write a similar descriptive essay about their own rooms at home, students can take notes about the uses of the room, its size, decoration, furniture, the size of its window, and how these are paragraphed. Thus, this could help them produce a descriptive essay that discusses all these.

Summarizing as a cognitive learning strategy of writing is making a condensed version of a paragraph or an essay. Writing a summary usually needs concentration. Learners need to apply the following procedures. First, they should identify the main ideas and the major supporting details of the text. Second, they should write the ideas in their own words.

Highlighting, another cognitive learning strategy of writing, is using a variety of emphasis techniques such as color underlining, CAPITAL LETTERS, big writing, **bold writing**, and using symbols to help one focus on such information. For example, learners can highlight the title and the introductory sentence of their paragraphs to help them effectively develop the theme and produce an appropriate concluding sentence respectively. This is because if they highlight these, they might pay attention to these and thus might not deviate from these. Learners can also highlight the topic sentence to help them write adequate and important supporting details. When they highlight the sentence, they can focus on it and thus might not move away from it and therefore can include adequate and appropriate supporting details.

To help them write effective paragraphs or essays, learners can **go through the following series of steps**: write down the main ideas they will discuss in the essay; arrange the ideas from the least important to the most important; develop the ideas into topic sentences and supporting details; draft the essay of an introductory paragraph, body paragraph/s, and a concluding paragraph; revise the essay; edit the essay by focusing on language and unity, coherence, and adequate development of the ideas and rewrite the essay by improving it.

2.1.3 COMPENSATION STRATEGIES

Compensation learning strategies of writing include selecting the topic, adjusting or approximating the message, coining words, and using a circumlocution or synonym. Students can practice writing by **choosing topics that interest** them; when they select topics, they need to consider their readers' interests, needs, and level of understanding.

Adjusting or approximating the intended messages is often used when learners cannot construct the most appropriate sentences. For instance, instead of producing the more difficult sentence: I would have liked to have visited Hawassa, but I could not go because I lacked the necessary funds, they can write I did not go to Hawassa, because I did not have money.

Coining words involves making up new words to communicate the intended ideas for which learners do not have the right words. For instance, learners can use tooth-doctor instead of dentist and paper-holder instead of notebook. When students write, they can **use a circumlocution or a synonym** if they could not produce a single word that can accurately reveal the intended concepts/ideas. A circumlocution is a roundabout expression that includes a group of words to express a single concept, and a synonym is a word that has exactly or nearly the same meaning in the same language. For example, if learners cannot think of the word briefcase, they can say leather package that holds papers.

2.1.4 METACOGNITIVE STRATEGIES

The metacognitive strategies of writing are as follows. When students learn to write, they can overview comprehensively a key concept, principle, or set of materials of writing tasks and associate these with what they have already known. **Over viewing comprehensively** often comprises three steps: knowing why an activity is being done, including necessary vocabulary, and making associations with what have already been known. For instance, getting ready to carry out a writing task, students can write a kind of brainstorming. They can also brainstorm in groups or participate in debates to generate ideas. Moreover, before learners rush to write paragraphs or essays, they can write down their ideas on a paper, without worrying about the correctness of the grammar and order of ideas.

Paying attention as a metacognitive learning strategy of writing is useful to improve one's writing. It has two modes: directed attention and selective attention. Directed attention can be equivalent to concentration which implies deciding generally to pay attention to a writing task and avoid distracters. Selective attention involves deciding in advance to focus on

particular aspects of writing such as content, organization, grammar, vocabulary, mechanics, tone, etc. Students can also make efforts to find out how to improve their writing skills by reading books.

Before learners rush to carry out a piece of writing, they need to break up the given time into some minutes and allocate these to different tasks such as to write down the main ideas, draft, revise and edit a paragraph or an essay. **Setting goals and objectives** as a metacognitive strategy of writing includes striving to improve one's writing skills in order to succeed in his/her study, write letters or scientific articles, etc.

Identifying the purpose of a writing task involves identifying the general nature of a writing task, its specific requirements, resources available, and the need for further sources before learners start writing. For example, if students are asked to write an argumentative essay, first they note that they want to beat readers' ideas. Then, they need to find counter arguments for each idea, adequately support each idea with evidences, and use appropriate language signposts to point out opposing arguments, state why the readers think like that, reach the turning point, and refute the opposing ideas. After checking if the learners have the necessary knowledge on these, they look for additional information from someone or somewhere.

Seeking practice opportunities, as a metacognitive strategy of writing, includes going to the target language cinema, attending a meeting where the language is spoken, communicating with pen-pals in the target language, etc.

Self-monitoring involves identifying errors of one's own writing and determining which ones cause serious confusions and then tracking the sources and eliminating such errors. Learners can help each other to monitor their writing errors, without instructor's direct intervention, and read and comment on each other's paragraphs or essays. They may ask their instructor to mark up serious errors and then themselves figure out the correct forms by helping each other and using reference materials.

The last metacognitive strategy of writing is **self-evaluation**. This strategy involves reviewing one's own paragraphs or essays by noting the style, content, language, etc. Students might also compare their paragraphs or essays with each other. Some important criteria for self-evaluation include sentence length, complexity of thoughts, power of arguments, organization, accuracy and social appropriateness.

2.1.5 AFFECTIVE STRATEGIES

Affective strategies of writing include using one's own progressive relaxation, deep breathing, listening to music, using laughter, making positive statements about one's own writing performance, taking risks wisely, rewarding oneself, listening to one's own body, using a checklist, writing a diary, and discussing one's feelings with someone else. **Progressive relaxation** involves tensing and relaxing all the main muscle groups one at a time. **Deep breathing** involves breathing low from the diaphragm. When students relax using progressive relaxation or deep breathing, they reduce anxiety and thus successfully accomplish their writing tasks. **Listening to music** before learners start to carry out especially a difficult writing task can put them in a positive mood. **Using laughter**, for example by using classroom activities such as role-plays, games, active exercises, jokes or watching movies, gives pleasure to learners and thus it helps them successfully accomplish their writing tasks.

Making positive statements to themselves about their performance before they start to carry out writing tasks can help learners feel more confident and thus do the tasks effectively. When they perform the tasks with confidence, their performance will be improved.

Taking risks wisely involves a conscious decision to take risks regardless of the possibility of making errors or encountering difficulties while writing. When it is said wisely, it means not unnecessary risk, like saying anything at all regardless of its degree of relevance; risk taking must be tempered by a good judgment. After learners have successfully accomplished especially difficult writing tasks, to help them keep on writing well, they can reward themselves for their performances by telling themselves that they have done well and that they deserve a rest, an entertainment, etc.

Listening to one's own body while writing involves thinking about one's own emotions: if he/she feels tension, anxiety, or fear, or if he/she tries to avoid or minimize the problems by taking appropriate actions. This could help him/her to successfully accomplish the tasks.

Before they start writing paragraphs or essays, learners can also set criteria such as content, organization, grammar, vocabulary and mechanics in the form of a checklist to assess their own progress and this could make them work hard because in the end they are to see their performance against the criteria by showing the paragraphs or essays to their classmates, friends, parents or neighbors or by referring to the print or electronic resources.

Writing a diary involves recording one's own feelings, attitudes and motivations about his/her practicing of writing and information about strategies one finds useful in the process of learning writing. **Discussing one's feelings with someone else,** before and/or while writing, regarding his/her feelings about the writing and problems he/she may encounter (e.g., unable to use the correct grammar or mechanics) in the process of writing helps him/her improve his/her writing skills.

2.1.6 SOCIAL STRATEGIES

Social strategies of writing includes asking instructor, cooperating with peers, cooperating with proficient writers of the target language, developing cultural understanding, and becoming aware of others' thoughts and feelings. When students carry out writing tasks, they can **ask their instructor for correction** of some errors. For example, they may ask their instructor to tell them if they are correctly ordering sentences to show how a story starts and ends. The instructor may say that no correction is needed. To help them successfully accomplish their writing tasks, learners can also **ask their instructor for clarification** on what to do, how to do, when to do, etc before/while doing the tasks.

Cooperating with peers involves a concerted effort to work together with other learners on a writing activity. Learners can ask and help each other how to improve their writing tasks. For instance, after they have completed writing, they can ask one another to read and correct their paragraphs or essays. **Cooperating with proficient writers of the target language** involves getting permanent or temporary persons who can help learners improve their writing skills. **Developing cultural understanding** involves learning about the culture of the target language people so that learners can know what is culturally appropriate to say in their writing.

With regard to **becoming aware of others' thoughts and feelings**, before/while writing paragraphs or essays, learners need to think about the thoughts and feelings of their readers; they should think about what their readers may like and dislike (e.g., ideas, words/expressions, examples, etc). Learners should keep in mind the readers they are writing to and trying to meet their needs and as a result they may pay attention to the learners' ideas.

2.2 APPROACHES TO LEARNING STRATEGIES TRAINING

2.2.1 NARROW FOCUS, BROAD FOCUS OR COMBINATION APPROACHES

Oxford (1990) discusses that learning strategies training can be conducted by using a narrow focus, broad focus, or combination approach. A narrow focus approach involves teaching students one or two learning strategies. This approach has the following benefits. Firstly, it makes the trainer to cover more learning strategies in short time as only one or two strategies are introduced at a time independently. Secondly, it minimizes the possibility of confusing students with different types of strategies because the strategies are introduced one by one. Thirdly, a narrow focus allows the instructor to accurately evaluate the effectiveness of training because he/she teaches each strategy separately. However, the downside of this approach is that it does not promote students' language learning because the strategies are not integrated to interact with one another.

A trainer who uses a broad focus approach introduces more learning strategies from all the classification groups. This approach requires a trainer to conduct the training by integrating different types of language learning strategies of each category so that learners could notice how the strategies interact with each other. A broad focus approach improves learners' belief about language learning. "However, this broad focus does not allow precise assessment of training effectiveness in reference to any specific strategy" (Oxford, 1990, p. 205).

A combination approach is an amalgamation of broad focus and narrow focus approaches. This approach involves some procedures. Firstly, the trainer provides students with all the language learning strategies of all the classification groups and asks them to rate the role of the strategies. Secondly, among strategies reported by students as useful, the trainer chooses strategies that are not too familiar and too strange. Then, a separate or an integrated and an implicit or an explicit training is conducted on the strategies. "This is an excellent way to approach strategy training. It gives learners the "big picture" at first, and then moves into specific strategies which the learners have chosen themselves. The element of learner choice in instructing structuring training is very important, since learning strategies are the epitome of learner choice and self-direction" (Oxford, 1990, p. 205).

2.2.2 SEPARATE VERSUS INTEGRATED APPROACHES

Learning strategies training can be carried out by using a separate or an integrated approach. A separate approach involves teaching learning strategies without incorporating them into the language lessons. According to O'Malley and

Chamot (1990), "Arguments in favor of separate training programs advance the notion that strategies are generalizable to many contexts…and that students will learn strategies better if they can focus all their attention on developing strategic processing skills rather than try to learn content at the same time…" (P. 152). However, according to some scholars such as Oxford (1990) this approach does not enhance students' language learning since students do not receive training on how and when to use strategies and on how to evaluate their learning as well as the success of strategies.

Wenden (1991), O'Malley and Chamot (1990) and Oxford (1990) believe that an integrated approach, unlike a separate approach, requires the trainer to teach strategies by including them into appropriate tasks of a language course. Students are shown when and how to use strategies and how to evaluate the importance of the strategies. O'Malley and Chamot (1990) state, "Those in favor of integrated strategy instruction programs, on the other hand, argue that learning in context is more effective than learning separate skills whose immediate applicability may not be evident to the learner…and that practicing strategies on authentic academic and language tasks facilitates the transfer of strategies to similar tasks encountered in other classes…". (P. 152).

2.2.3 IMPLICIT VERSUS EXPLICIT APPROACHES

A learning strategies training can be conducted by choosing an implicit or an explicit approach. An implicit approach is an embedded approach. The trainer who chooses this approach sets language tasks intended to make students employ learning strategies to help them successfully accomplish the tasks, but the trainer does not inform students about the role of the strategies and when and how to use the strategies (Wenden, 1991; O'Malley and Chamot, 1990; Oxford, 1990, Wenden and Rubin, 1987). This approach, according to O'Malley and Chamot (1990) and Oxford (1990), has two merits. Firstly, as the strategies are embedded, it minimizes the risk learners may oppose the training. Secondly, "An advantage cited for strategy training embedded in instructional materials is that little teacher training is required….As students work on exercises and activities, they learn to use the strategies that are cued by the textbook" (O'Malley and Chamot, 1990: 153). On the other hand, this approach has some drawbacks. According to O'Malley and Chamot (1990), it does not make students take on more responsibility for their own learning. Moreover, it does not make learners use strategies flexibly in a variety of contexts and maintain strategies overtime (Wenden and Rubin, 1987).

An explicit approach, unlike an implicit approach, requires the trainer to apply the following procedures: identifying language learning strategies by name, explaining/describing the importance of the strategies, demonstrating (through actual language tasks) in which contexts to use and how to use the strategies, and how to transfer the strategies into other contexts, making students practice the strategies, and asking students to evaluate the importance of the strategies in improving their language performance. With regard to this approach, Chamot (2005:123) writes, "Explicit instruction includes the development of students' awareness of their strategies, teacher modeling of strategic thinking, identifying the strategies by name, providing opportunities for practice and self-evaluation." According to Wenden and Rubin (1987), an explicit approach helps learners maintain strategies over time for a variety of learning contexts and thus they take on more responsibility for their own learning. In Oxford's (1990: 201) language, "the general goals of such training are to make language learning more meaningful, to encourage a collaborative spirit between learner and teacher, to learn about options for language learning, to learn and practice strategies that facilitate self-reliance."

2.3 PROCEDURES FOR CONDUCTING A LEARNING STRATEGIES TRAINING LESSON

There are several models suggested for conducting a language learning strategies training lesson by various scholars (Hosenfeld et al., 1981; Chamot and Kupper, 1989; Oxford, 1990; Wenden, 1991; Grenfell and Harris, 1999). Oxford (1990) writes that the instructor of a language learning strategies training lesson should follow the procedures below (note that only the model of Oxford is discussed here for being chosen for the present study): ask learners to do an activity without strategy training; ask learners if they have used any strategy while doing the activity, and ask them to evaluate the role of the strategy (if used); suggest and explain some useful strategies and the rationale for using the new strategies; ask learners to practice the strategies by doing the task again or through other language tasks; demonstrate how to transfer the strategies to new learning tasks; ask learners to practice the strategies in new learning tasks; ask learners to evaluate the importance of the strategies used, i.e., if they found the strategies useful in helping them successfully accomplish writing tasks.

2.4 ATTITUDE

Attitude can be stated as the positive/negative image one forms about something after he/she perceives it and forms opinions about it and when the opinions get very strong. Dandapani (2004:193) defines attitude as "a dispositional readiness to respond to certain situations, persons, objects or ideas in a consistent manner, which has been learned and has become one's typical mode of response." Chauble and Chauble, 2007; Albery et al., 2008; Hogg and Vaughan, 2002; Dandapani, 2004

discuss that attitude cannot be directly observed; it can only be inferred from responses made by a person. Moreover, attitude is not inborn trait; it is a result of education, perception and inspiration. Attitude is mainly described as positive or negative. The above scholars discuss that a person's attitude towards something (e.g., instructional method) is usually measured through a set of questions constructed on a five- point Likert Scale questionnaire. "Likert developed a more refined Likert Attitude Scale. It resembles a simple questionnaire, but involves refined techniques of item-selection. It is a series of statements either favorable or unfavorable on a five- point scale…Each response is given a numerical score. An individual's score is the sum of his ratings on all items" (Dandapani, 2004: 194).

3 RESEARCH METHODOLOGY

3.1 PARTICIPANTS

The participants of this study were 60 students (46 males, 14 females). They were between 18 – 21 years old. All of them completed Grade 12 and are currently in their Year-I program at Hawassa University, Ethiopia.

3.2 THE RESEARCH DESIGN

This study was intended to examine the correlation between students' attitude towards receiving training in learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics. To this end, the selected Year-I students of Hawassa University were taught lessons of the Basic Writing Skills course with training in the strategies. At the end of the program, the students were made to fill in a five-point scale questionnaire intended to explore their attitude towards receiving training in the strategies, and to take a writing test. The correlations were examined through the Pearson product-moment correlation coefficient (r). Moreover, the coefficient of determination was computed to see the extent to which the students' attitude towards receiving training in the strategies is related to their writing performance. Thus, this research employed a quantitative-methods design.

3.3 PREPARATION OF TEACHING MATERIAL

A teaching material on Basic Writing Skills course was prepared, based on the course syllabus, by choosing the combination, integrated and explicit approaches. It was prepared by using the model of Oxford (1990). Her model was chosen because it includes procedures that are easy to understand and thus preferred by many researchers. The teaching material asked the students to make use of the learning strategies of writing while completing sentences by writing appropriate subjects and predicates and rewriting sentences by correcting errors, completing paragraphs by writing appropriate topic sentences, concluding sentences and relevant details, rearranging jumbled sentences in logical orders and completing paragraphs by writing appropriate cohesive devices, completing essays by writing appropriate thesis statements and concluding paragraphs, identifying parts of an essay: introduction, body and conclusion, rearranging jumbled paragraphs in logical orders and writing essays to argue for/against. To validate the teaching material, comments were obtained from the researcher's most senior colleagues.

3.4 PREPARATION OF WRITING SKILLS TEST

A writing test was prepared by the researcher. It was constructed based on the course syllabus. The test was intended to measure the students' writing skills with regard to discussing relevant contents, organizing contents appropriately and using accurate grammar, appropriate vocabulary and correct mechanics. The students were asked to complete sentences by writing appropriate subjects and predicates and rewrite sentences by correcting errors, complete paragraphs by writing appropriate topic sentences, concluding sentences and relevant details, rearrange jumbled sentences in logical orders and complete paragraphs by writing appropriate cohesive devices, complete essays by writing appropriate thesis statements and concluding paragraphs, identify parts of an essay: introduction, body and conclusion, rearrange jumbled paragraphs in logical orders and write essays to argue for/against. To validate the test, comments were obtained from the researcher's most senior colleagues.

3.5 PREPARATION OF QUESTIONNAIRE

A questionnaire intended to obtain data on the students' attitude towards learning the writing lessons through receiving training on the learning strategies of writing was prepared by taking ideas from Gardner (1985), an authority of AMTB

(Attitude Motivation Test Battery) for Second Language Learning, and included items in which each item has five possible responses: strongly agree, agree, undecided, disagree and strongly disagree. The questionnaire included a cover page that discusses the purpose of the questionnaire and asks the students to read the items carefully and respond honestly and frankly. The researcher's most senior colleagues were requested to comment on the questionnaire regarding its validity. Cronbach Alpha was computed on SPSS (Statistical Package for the Social Sciences) version 20 to examine the reliability of the items of the questionnaire. The computation showed that the items were reliable at above 0.80. Cranach's alpha was chosen because the questionnaire has a five-point scale.

3.6 Selection of Study Setting and Departments

The researcher purposefully chose Hawassa University to which he is a member of staff. From the existing departments of the university, Mathematics and Management were randomly selected by drawing lots. The researcher used a simple random sampling because it allows a department to have equal chance of being selected; the probability of a department being selected is unaffected by the selection of another department. Thus, it is possible to be confident that the departments chosen represent all the departments of the university.

3.7 Administration of the Questionnaire

The questionnaire intended to collect data on the students' attitude towards learning the writing lessons through receiving training on the learning strategies of writing was administered after conducting the training to the Mathematics Department students for 30 hours (5 hours for 6 consecutive weeks) and to the Management Department students for a semester (5 hours for 16 consecutive weeks). Careful attempts were made to make the environment conducive to fill in the questionnaire.

3.8 Administration and Scoring of the Test

The writing test meant to measure the students' writing skills with regard to discussing relevant contents, organizing contents appropriately and using accurate grammar, appropriate vocabulary and correct mechanics was administered at the end of the program. Careful attempts were made to make the environment conducive for taking the test. The test paper of each student was corrected by two randomly selected English language instructors of the university who had received training on how to correct the test papers. The analytic approach was chosen to mark the compositions. This approach is preferred for being the most effective approach to achieve reliability. The rating scale used was the one provided by Heaton (1990). Heaton (1990: 146) describes the scale in this way: "The following rating scale is the result of considerable and careful research conducted in the scoring of compositions in the United States."

3.9 Methods of Data Analysis

In order to find the students' scores on the attitude questionnaire, the researcher applied the procedures used by prominent social science researchers of these days. First, for the questionnaire, values 1 to 5 were given for strongly disagree, disagree, undecided, agree, and strongly agree respectively so that the minimum scores a student would score is the number of the items of the questionnaire multiplied by 1, and the maximum scores a student would score is the number of the items of the questionnaire multiplied by 5.

In order to take the students' average scores on each of the aspects of writing, the following procedures were applied. First, Pearson r was conducted on SPSS version 20 to see the correlation of the scores given by the instructors. To determine the strength of a correlation, the cut-off points suggested by Cohen (1988), as cited in Greasley (2008), were applied. "As a general guideline, a value ranging from 0.1 to 0.4 would be classed as a weak correlation, and anything above 0.5 would be regarded as a strong correlation.... A value approaching zero indicates the absence of any relationship between two variables, in other words no correlation" (Greasley, 2008:80). Then, the students' average scores were taken since Pearson r computed showed that the correlation is significant at the .01 level (2-tailed); there was a strong positive correlation between the scores given by the instructors.

Lastly, Pearson's r correlation coefficient was computed on SPSS version 20 to examine the correlation between the students' attitude towards receiving training on the learning strategies of writing and their writing performance. To determine the strength of a correlation, the cut-off points suggested by Cohen (1988), as cited in Greasley (2008), were employed. The coefficient of determination was also computed to examine the extent to which the students' attitude towards receiving training on the strategies predicts their writing performance. In relation to this idea, Greasley (2008:82) says, "It is referred to as the coefficient of determination (r2), and provides a measure of the degree to which one variable

'predicts' the other by simply squaring the correlation value. You can then simply multiply this by 100 to give a percentage value."

4 RESULTS AND DISCUSSION

4.1 RESULTS OF PEARSON'S R CORRELATION COEFFICIENT

The following tables demonstrate the results of Pearson's r correlation coefficient computed to examine the correlation between the students' attitude towards receiving training on the learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics.

Table 1: Correlation of *SARTLSW and their Writing Performance on Content

		SARTLSW	Writing Performance on Content
SARTLSW	Pearson Correlation	1	.766**
	Sig. (2-tailed)		.000
	N	60	60
Writing Performance on Content	Pearson Correlation	.766**	1
	Sig. (2-tailed)	.000	
	N	60	60

**SARTLSW = Students' Attitude towards Receiving Training on the Learning Strategies of Writing*
***. Correlation is significant at the 0.01 level (2-tailed).*

Table 1 above depicts the correlation of the students' attitude towards receiving training on the learning strategies of writing and their writing performance on content. The table shows that the r-value is .766**. Thus, the r-value is closer to 1.000. The p-value is .000, and the correlation is significant at the 0.01 level (2-tailed). This indicates that there is a strong positive correlation between the students' attitude towards receiving training on the learning strategies of writing and their writing performance on content. That is, as the students' attitude towards receiving training on the strategies increases, their performance to discuss relevant contents in their writing increases as well. The coefficient of determination computed indicates that the students' attitude towards receiving training on the strategies predicts their writing performance with regard to discussing relevant contents at 58.6756%.

Table 2: Correlation of SARTLSW and their Writing Performance on Organization

		SARTLSW	Writing Performance on Organization
SARTLSW	Pearson Correlation	1	.841**
	Sig. (2-tailed)		.000
	N	60	60
Writing Performance on Organization	Pearson Correlation	.841**	1
	Sig. (2-tailed)	.000	
	N	60	60

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 2 above shows the correlation of the students' attitude towards receiving training on the learning strategies of writing and their writing performance on organization. In the table, it is indicated that the r-value is .841**, which is closer to 1.000; the p-value is .000, and thus the correlation is significant at the 0.01 level (2-tailed). This shows that there is a strong positive correlation between the students' attitude towards receiving training on the learning strategies of writing and their ability to organize contents appropriately. In other words, as students continue to develop a positive attitude towards

learning writing lessons in this way, their writing performance with regard to organizing contents appropriately gets improved accordingly. The coefficient of determination carried out reveals that the students' attitude towards receiving training on the strategies predicts their writing performance regarding organizing contents in logical orders at 70.7281%.

Table 3: Correlation of SARTLSW and their Writing Performance for Grammar

		SARTLSW	Writing Performance on Grammar
SARTLSW	Pearson Correlation	1	.936**
	Sig. (2-tailed)		.000
	N	60	60
Writing Performance on Grammar	Pearson Correlation	.936**	1
	Sig. (2-tailed)	.000	
	N	60	60

***. Correlation is significant at the 0.01 level (2-tailed)*

Table 3 above demonstrates the correlation of the students' attitude towards receiving training on the learning strategies of writing and their writing performance on grammar. As indicated in the table, the r-value is .936**. Thus, the r-value is closer to 1.000, and the p-value is .000. The correlation is significant at the 0.01 level (2-tailed). This tells us that there is a strong positive correlation between the students' attitude towards receiving training on the learning strategies of writing and their performance to write grammatically accurate sentences. That is to say, as the students' attitude towards learning the writing lessons through receiving training, their writing performance to produce grammatically accurate sentences increases as well. The coefficient of determination conducted shows that the students' attitude towards receiving training on the strategies predicts their writing performance with regard to using accurate grammar at 87.6096%.

Table 4: Correlation of SARTLSW and their Writing Performance on Vocabulary

		SARTLSW	Writing Performance on Vocabulary
SARTLSW	Pearson Correlation	1	.799**
	Sig. (2-tailed)		.000
	N	60	60
Writing Performance on Vocabulary	Pearson Correlation	.799**	1
	Sig. (2-tailed)	.000	
	N	60	60

***. Correlation is significant at the 0.01 level (2-tailed)*

Table 4 above demonstrates the correlation of the students' attitude towards receiving training on the learning strategies of writing and their writing performance on vocabulary. The table depicts that the r-value is .799**. Thus, the r-value is closer to 1.000. The p-value is .000, and the correlation is significant at the 0.01 level (2-tailed). This shows that there is a strong positive correlation between the students' attitude towards receiving training on the learning strategies of writing and their performance to choose appropriate vocabulary. That is to say, as the students' attitude towards receiving training on the strategies increases, their performance to come up with appropriate vocabulary increases too. The coefficient of determination computed indicates that the students' attitude towards receiving training on the strategies predicts their writing performance to choose appropriate vocabulary at 63.8401%.

Table 5: Correlation of SARTLSW and their Writing Performance on Mechanics

		SARTLSW	Writing Performance on Mechanics
SARTLSW	Pearson Correlation	1	.925**
	Sig. (2-tailed)		.000
	N	60	60
Writing Performance on Mechanics	Pearson Correlation	.925**	1
	Sig. (2-tailed)	.000	
	N	60	60

***. Correlation is significant at the 0.01 level (2-tailed)*

Table 5 above reveals the correlation of the students' attitude towards receiving training on the learning strategies of writing and their writing performance on mechanics. As shown in the table, the r-value is .925**. It is closer to 1.000, and the p-value is .000. The correlation is significant at the 0.01 level (2-tailed). This indicates that there is a strong positive correlation between the students' attitude towards receiving training on the learning strategies of writing and their performance to correctly spell, capitalize and punctuate. The coefficient of determination conducted shows that the students' attitude towards receiving training on the strategies predicts their writing performance with regard to correctly spelling, capitalizing and punctuating at 85.5625%.

4.2 MAJOR FINDINGS OF THE STUDY

Pearson's r correlation coefficient computed to examine the correlation between the students' attitude towards receiving training on the learning strategies of writing and their writing performance on each aspect of writing (content, organization, grammar, vocabulary and mechanics) revealed that there is a strong positive correlation (r-values $\geq$ .766, p-value = .000). As the students' attitude towards learning the writing lessons through receiving training on the strategies increases, their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics increases too. The coefficient of determination indicated that the students' attitude towards receiving training on the strategies predicts their writing performance at above 58%.

5 CONCLUSIONS

Based on the findings, this study concludes that there is a strong positive correlation between students' attitude towards learning writing lessons through receiving training on the learning strategies of writing and their writing performance to discuss relevant contents, organize contents appropriately and use accurate grammar, appropriate vocabulary and correct mechanics. That is, as students' attitude towards receiving training on the strategies increases, their writing performance on each of these aspects of writing increases as well.

RECOMMENDATIONS

The following recommendations have been made based on the conclusions of this study.

- While conducting training on learning strategies of writing, the instructor should use various techniques to help students develop a positive attitude towards learning writing lessons through receiving training on the strategies; as a result, their writing performance will be improved accordingly;
- Students should develop a positive attitude towards learning writing lessons through receiving training on learning strategies of writing so that they will benefit from training to improve their writing performance;
- Similar studies on the other macro-language skills, grammar or vocabulary can be conducted.

REFERENCES

[1] Albery, I. et al. (2008). Complete Psychology (Second Edition). London: Hodder Education.
[2] Chamot, A. (2005). Language Learning Strategy Instruction: Current Issues and Research. Annual Review of Applied Linguistics, 25 (6), 112-130.
[3] Chamot, A. and Kupper, L. (1989). Learning Strategies in Foreign Language Instruction. Foreign Language Annals, 22(1), 13-24.
[4] Chaube, S. and Chaube, A. (2007). Groundwork for Social Psychology (Vol. I and II – Combined). New Delhi: Neelkamal Publications Pvt. Ltd.
[5] Dandapani, S. (2004). General Psychology. New Delhi: Neelkamal Publications Pvt. Ltd.
[6] Gardner, R. (1985). Social Psychology and Second Language Learning: The Role of Attitudes and Motivation. London: Edward Arnold.
[7] Gebremedhin, Simon. (1993). Individualized Reading for E.A.P for Social Science First Year Students in Addis Ababa University. Unpublished PhD Dissertation, Addis Ababa University.
[8] Geremew, Lemu. (1999). A Study on the Requirements in Writing for Academic Purposes at Addis Ababa University: Four Departments in Focus. Unpublished PhD Dissertation, Addis Ababa University.
[9] Greasley, P. (2008). Quantitative Data Analysis using SPSS: An Introduction for Health and Social Science. O: OUP.
[10] Grenfell, M. and Harris, V. (1999). Modern Languages and Learning Strategies: In Theory and Practice. London: Routledge.
[11] Hailemichael, Aberra. (1993). Developing A Service English Syllabus to Meet the Academic Demands and Constraints in Ethiopian University Context. Unpublished PhD Thesis, Addis Ababa University.
[12] Heaton, J. B. (1990). Classroom Testing. Landon: Longman.
[13] Hogg, M. and Vaughan, G. (2002). Social Psychology (Third Edition). Harlow: Pearson Prentice Hall.
[14] Hosenfeld, C. et al. (1981). Second Language Reading: a Curricular Sequence for Teaching Reading Strategies. Foreign Language Annals, 14(5), 415-22.
[15] Italo, Beriso. (1999). A Comparison of the Effectiveness of Teacher versus Peer feedback on Addis Ababa University Students' Writing Revisions. Unpublished PhD Dissertation, Addis Ababa University.
[16] Liang, T. (2009). Language Learning Strategies --- The Theoretical Framework and Some Suggestions for Learner Training Practice. English Language Teaching, 2 (4),
[17] McMullen, M. (2009). Using Language Learning Strategies to Improve the Writing Skills of Saudi EFL Students: Will It Really Work. System, 37(1), 418-433.
[18] O'Malley, J. and Chamot, A. (1990). Learning Strategies in Second Language Acquisition. Cambridge: Cambridge University Press.
[19] Oxford, R. (1990). Language Learning Strategies: What Every Teacher Should Know. New York: Newbury House.
[20] Stephens, L. (2004). Advanced Statistics: A Self-Teaching Guide. New York: McGraw Hill.
[21] Wenden, A. (1991). Learner Strategies for Learner Autonomy: Planning and Implementing Learner Training for Language Teachers. New York: Prentice Hall.
[22] Wenden, A. and Rubin, J. (1987). Learner Strategies in Language Learning. New York: Prentice Hall.
[23] Zeleke Arficho. (2013). Training in the Learning Strategies of Writing: Its Effects on Students' Writing Skills. Unpublished PhD Dissertation, Addis Ababa University.
[24] Ze-Sheng, Y. (2008). Promoting Learner Autonomy Through Strategy-based Instruction. Sino-US English Teaching, 5 (12), 7-16.

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Electronic and chemical property of amorphous carbon, hydrocarbon, hydrogenated / hydrogen free carbon nitride: spectroscopic study

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ABSTRACT: The comparative study of chemical properties and electronic bond structure of amorphous carbon (a-C), hydrocarbon (a-HC), carbon nitride (a-CN_x) and hydrogenated carbon nitride (a-HCN_y) is reported here. The spectroscopic analyses suggest that the presence of oxide layer is not only the prime cause but the presence of nitrogen is partially responsible for the chemical shift towards higher binding energy. In x-ray photoelectron spectroscopy (XPS), C 1s spectra of a-HCN_y film shows higher chemical shifts compare to a-C, a-HC and a-CN_x. Raman spectra display a strong fluorescence effect of a-HC and a-HCN_y where as a-C and a-CNx exhibits a promising G and D band at room temperature. Fourier transform infrared spectroscopy (FTIR) spectra show a large NH-OH over lapping region in a-HCN_y compare to a-HC and a-CN_x film whereas it is negligible in a-C. FTIR spectra show that the a-C, a-HC and a-CN_x films are dominated by sp^2 bonded region while a-HCN_y is the mixture of sp^2, sp^3 and hydrogen bridging bond.

KEYWORDS: Carbon nitride, Hydrogenated carbon nitride, Amorphous carbon, Hydrocarbon, Chemical shift, XPS, FTIR.

1 INTRODUCTION

The plasma assisted hydrocarbon film deposition is of considerable interest from both a fundamental and potential applications point of view because of its interesting chemical and structural properties [1, 2, 3]. The variety of processes have been employed to deposit hydrocarbon films and among of these techniques the rf plasma deposition is the most widely used [4, 5]. It is well established that the properties of a-C:H films may be adjusted over a wide range and that the most important deposition parameter is the ion energy [2, 3]. Amorphous carbon is a disordered phase of carbon without long-range order containing carbon atoms mostly in graphite-like sp^2 and diamond-like sp^3 hybridization states, and its physical properties depend strongly on the sp^2/sp^3 ratio. There are many forms of sp^2-bonded carbons with various degrees of graphitic ordering, ranging from microcrystalline graphite to glassy carbon [6].

In plasma assisted deposition of hydrocarbon films the low energy (<500 eV) species can induces various surface processes, such as surface activation, chemical sputtering, hydrogen release and synergisms between different species [7, 8]. Polymer-like hydrocarbon films can be deposited in remote areas of fusion devices when the growth process is dominated by surface reactions of reactive neutral species, such as hydrocarbon radicals [9, 10]. On the other hand, theoretical prediction regarding the mechanical properties of β-C_3N_4 solids to those of diamond [11] attracted a great interest of research towards carbon–nitrogen composite materials. Synthesis and outstanding mechanical properties of C_3N_4 was claimed by Marton et al. [12] but still there is no conclusive evidence about the possibility of synthesizing such super hard crystalline solids. Amorphous carbon nitride (a-CN_{xd}) and hydrogenated carbon nitride films are expected to be applicable widely as, for example, super hard coating material with low friction coefficient [13-15], low band gap protective material on hard disks and read heads [16, 17], photoluminescence layers [18], carbon nitride nano-tubes [19-20], biosensor [21] and anti–

biomaterials [22, 23], or ultra low dielectric constant material [24]. In our previous work, we found that the dielectric constant is around 2.46 in case of amorphous hydrocarbon film (a-HC) deposited by CH_4/Ar DBD plasma process (the work was associated with the incorporation of -CH_3 unit in SiOCH film) [25]. The presence hydrogen eventually induces the extra charging effect on the surface region of the hydrocarbon film. The hydrogen is connected to C or N mostly to weak hydrogen bridging bond or vaan der Waals forces [26]

In this paper we report a comparative study of electronic bond structure and chemical composition of amorphous carbon, hydrocarbon, carbon nitride and hydrogenated carbon nitride film. Three important features have been compared; chemical shift of C 1s peak, bond structure (sp, sp2, sp3, NH etc) and florescence property of the four corresponding films (a-C, a-HC, a-CNx and a-HCNy).

2 EXPERIMENT

2.1. a-C and a-CN_x and samples

a-CNx film is deposited in DC magnetron sputtering system (DC-MS) with the sputtering of a graphite target under different partial pressures (in this case at 5 Pa) of nitrogen gas, that is attached to a high vacuum chamber (base pressure ~ 1×10^{-7} mbar). The film deposited at 5 Pa partial pressure corresponds to the N/C ratios is about 0.41. On the other hand amorphous carbon film was deposited by sputtering of graphite target in Ar buffer gas medium. The a-CN_x films were deposited on a p–type Si (100) substrate which was placed on the ground electrode. The typical film deposition time was 1 hours for all the deposited films. The magnetron discharge power was kept constant for all the measurement at 100 W. Similarly, a-C film is deposited in DC magnetron sputtering system (DC-MS) with the sputtering of a graphite target under different partial pressures (in this case at 5 Pa) of Ar gas, that is attached to a high vacuum chamber (base pressure ~ 1×10^{-7} mbar) [27].

2.2. a-HC and a-HCN_y samples

a-HCN_x film is deposited with CH_4:N_2 gas mixture ratios (1:3) in dielectric barrier discharge plasma. And a-HC film is deposited by CH_4/Ar gas mixture DBD plasma. Both the films were deposited on p–type Si (100) substrate which is placed on the ground electrode. The typical time duration of the film deposition is 1 hours for all the deposited films. The experimental set up of the dielectric barrier discharge has been explained in details elsewhere [ ]. Both the Ag electrodes are covered by dielectrics: the upper (powered) electrode is covered with aluminum oxide (ε ~ 10); the lower (grounded) electrode with a glass plate (ε ~ 3.8). Both electrodes were separated by 0.15 cm from each other. A small piece of Si (100) wafer was placed on the glass electrode. The upper electrode is connected to a home-built high voltage power supply, while the lower electrode is grounded. The chamber is pumped by a membrane pump down to about 10 mbar. Pressure inside the plasma chamber was controlled by two gas flow controllers for methane and nitrogen and by an adjustable needle valve between the chamber and the membrane pump. The experiments were performed with the chamber filled at a pressure of 300 mbar. The amplifier can be operated with maximum power of 500 W. Experiments were performed with the voltage of 10.5 kV (peak–to–peak) and with frequency of 5 kHz. The electrical power under these conditions was 4 W [27].

2.3. Film characterization

The typical film deposition time was 1 hours for all the deposited films. The deposited films have been characterized by three different techniques as follows:

X–ray photoelectron spectroscopy (XPS) measurements of the a-HCNx and a-CNx films were performed on a multi–technique 100 mm hemispherical electron analyser (VSW), using Al *Kα* radiation (photon energy 1486.70 eV) as the excitation source and the binding energy (BE) of Au (Au $4f_{7/2}$: 84.00 eV) as the reference. The XPS spectra were collected in a constant analyser energy mode, at a chamber pressure of 10^{-8} mbar and pass energy of 23.5 eV at 0.125 eV/step [28, 29].

Fourier transform infrared (FTIR) absorption spectra were obtained by means of a FTIR spectrometer Bruker (Vector 22) in transmission mode. The plain sample was placed in a vacuum chamber built inside the spectrometer in order to minimize the IR signal of water vapour, CO_2 content and noise. The measuring signal passed the optical way with an aperture diameter of 3 mm with spectral resolution 4 cm^{-1}. For optimal signal–to–noise ratio 50 scans were averaged per sample spectrum and apodized by applying of the Happ–Genzel apodization function for Fourier transformation. Interferograms were used with zero–filling factor of 0. The background spectrum was independently measured on a pure silicon substrate [28, 29].

Raman spectra were measured on a spectrometer that is oriented as a micro confocal system (Jobin Yvon, Model-LabRAM HR-800). The slit width was 400 µm and the confocal hole was 600 µm in diameter. A 632.18 nm red laser was used as a light source and a CCD as detector. The grating used in the spectrograph was 600 grooves/mm. The objective for focusing the light was 100X while the Raman configuration was in backscattering configuration [28, 29].

3 RESULTS

3.1. X-ray photo electron spectroscopy (XPS)

Figure 1a shows the full scale (260 eV to 1250 eV, with a break at 560 eV to 950 eV) XPS spectrum of a-C, a-HC, a-CN_x and a-HCN_y films. C 1s and O 1s peak on XPS spectrum is the common features for the four spectrums. In the inset of figure 1a, the zoomed area of N 1s peak intensity is illustrated. It shows that N 1s peak in a-HCN_y film is shifted to higher binding energy compare to a-CN_x film.

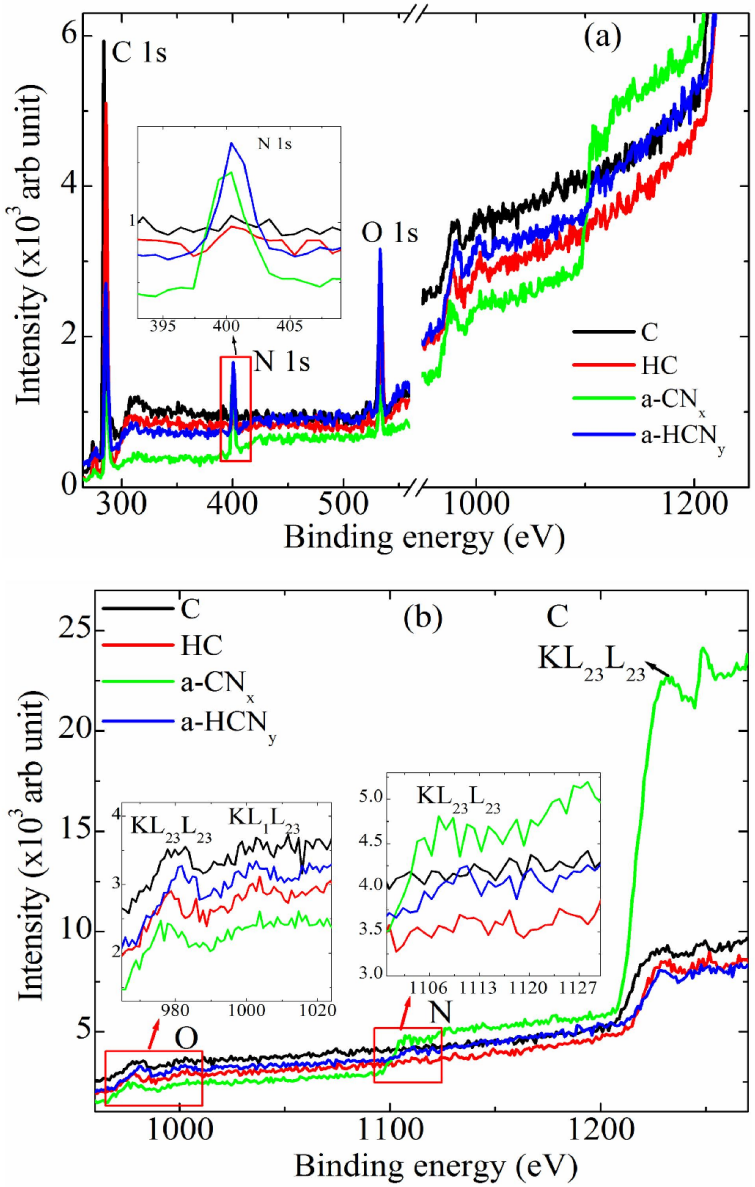


Figure 1. (a) Full scale (260 eV to 1250 eV, with a break at 560 eV to 950 eV) XPS spectrum of a-C, a-HC, a-CN_x and a-HCN_y films. In the inset of figure (a), the zoomed area of N 1s peak intensity is illustrated. (b) Auger lines (951 eV to 1270 eV) of the corresponding films and in the inset the zoomed area of O ($KL_{23}L_{23}$, KL_1L_{23}) and N ($KL_{23}L_{23}$) Auger lines are illustrated. The

intensity scales for the all the spectra are not the same. The XPS spectra were obtained with Mg $k\alpha$ X rays at 23.5 eV pass energy at 0.125 eV/step.

Figure 1b shows the Auger peak (or Auger transition) of O 1s ($KL_{23}L_{23}$, KL_1L_{23}), and C 1s ($KL_{23}L_{23}$) of the corresponding films. The Auger peak of N ($KL_{23}L_{23}$) shows only in a-CN_x and a-HCN_y films. K (1s) is the initial core hole location. L_1 (2s), L_{23} (2p) is the origin of relaxing electron and Auger electron (electrons that leaves ion). Auger lines of O 1s and N 1s is shown in the inset the zoomed area of O ($KL_{23}L_{23}$, KL_1L_{23}) and N ($KL_{23}L_{23}$) Auger lines are illustrated [30].

The Gaussian fits to the XPS lines resulted in to three or four different peaks for the C−1s line. The general strategy of the data evaluation was identical to those for standard spectroscopic techniques. Si (2p) with a Binding Energy (BE) = 99.3 eV was taken as a reference. The calibration details about this chemical shift are discussed in our previous work. The results shown below were corrected by subtracting the experimentally observed shift for all the analyses. A clear image of the possible chemical bonds between nitrogen and carbon can be deduced from the deconvolution of the individual C−1s, N−1s and O−1s lines into Gaussian-shaped lines. This indicates that the carbon is involved in chemical bonds with nitrogen [29].

Figure 2 shows the C-1s XPS peak of a-C, a-HC, a-CN_x and a-HCN_y films to understand the chemical shift and peak broadening. C 1s peak appears at 283.92 eV, 284.50 eV, 285.79 eV and 286.06 eV in carbon (graphite), a-HC, a-CN_x and a-HCN_y films, respectively. The C1s peak at 283.5 eV is taken as reference [30]. C 1s XPS peak of a-CN_x and a-HCN_y films showing higher chemical shift compare to a-C and a-HC films. The C−1s peak broadens and also becomes more asymmetric as N and H is connected to carbon. This is happens due to the anomalous surface charge distribution of the silicon substrate covered by the carbon film.

Figure 3 shows the XPS C 1s core–level spectra of a-C, a-HC, a-CN_x and a-HCN_y films. The deconvoluted C 1s XPS spectra show three sub-peaks in a-C and a-HC films whereas a-CN_x and a-HCN_y show four sub-peaks. The carbon peak at the binding energy range 283.50–284.5 eV is identified as originating from adventitious (extrinsic or accidental) carbon or graphitic carbon. The C 1s peak binding energy range at 287.38–288.92 eV is identified as originating from CO type bonds which are depending on the type of bonding such as ketones/aldehydes (–CO/–CHO), carboxyls (–COOH) and carbonates ($–CO_3$) [12, 28, 29, 30]. In figure 3 (a) the deconvoluted C 1s XPS spectra of a-C film exhibit three peaks at 283.94 eV, 285.67 eV and 288.37 eV are attributed to adventitious carbon, C=C and CO bonds, respectively. Similarly, C 1s XPS spectra of a-HC film shows three peaks at 284.50 eV, 286.12 eV and 288.79 eV are referred to adventitious carbon, C-H bond and ketones/aldehydes (–CO/–CHO), carboxyls (–COOH) bonds, respectively.

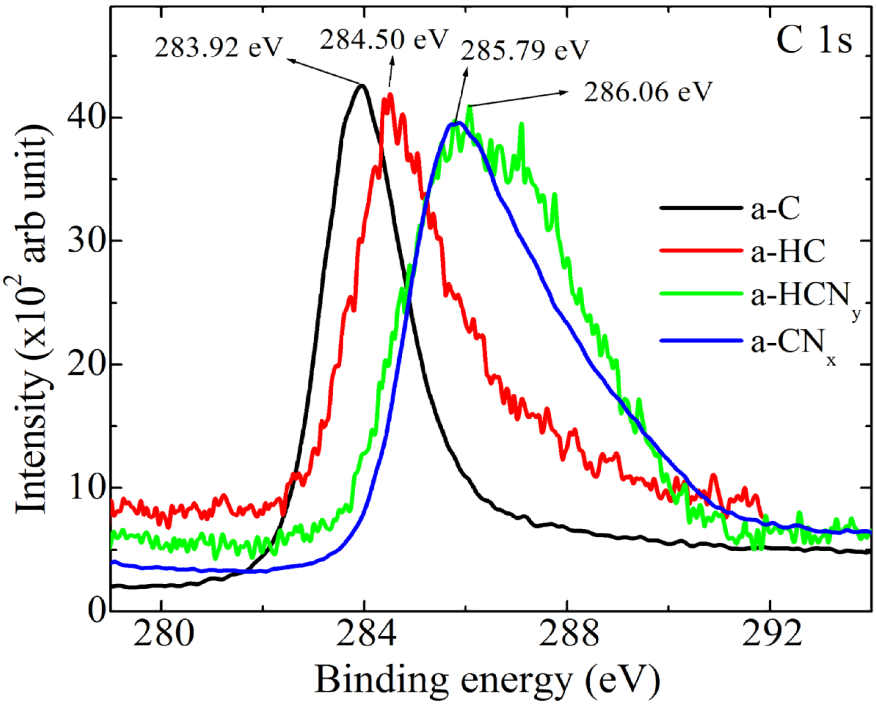


Figure 2. Typical C 1s XPS spectrum of a-C, a-HC, a-CN_x and a-HCN_y films. The intensity scales for the C spectra are not the same.

On the other hand deconvoluted C1s XPS spectra of a-CN_x and a-HCN_y films exhibits four sub-peaks. C 1s XPS peak of a-CN_x exhibits four sub-peaks at 285.74 eV, 287.56 eV, 289.34 eV and 291.53 eV which are assigned to C-C, C-N, C≡N and C-O bonds, respectively. Similarly, four sub-peaks are observed at 285.01 eV, 285.96 eV, 287.41 eV and 289.01 eV in C 1s peak of a-HCN_y films are assigned as C-C, C-N, C≡N and C-O bonds, respectively. The presence of NH group in the XPS of a-HCN_y film is mentioned by most of the previously published literature [12, 28, 29, 30].

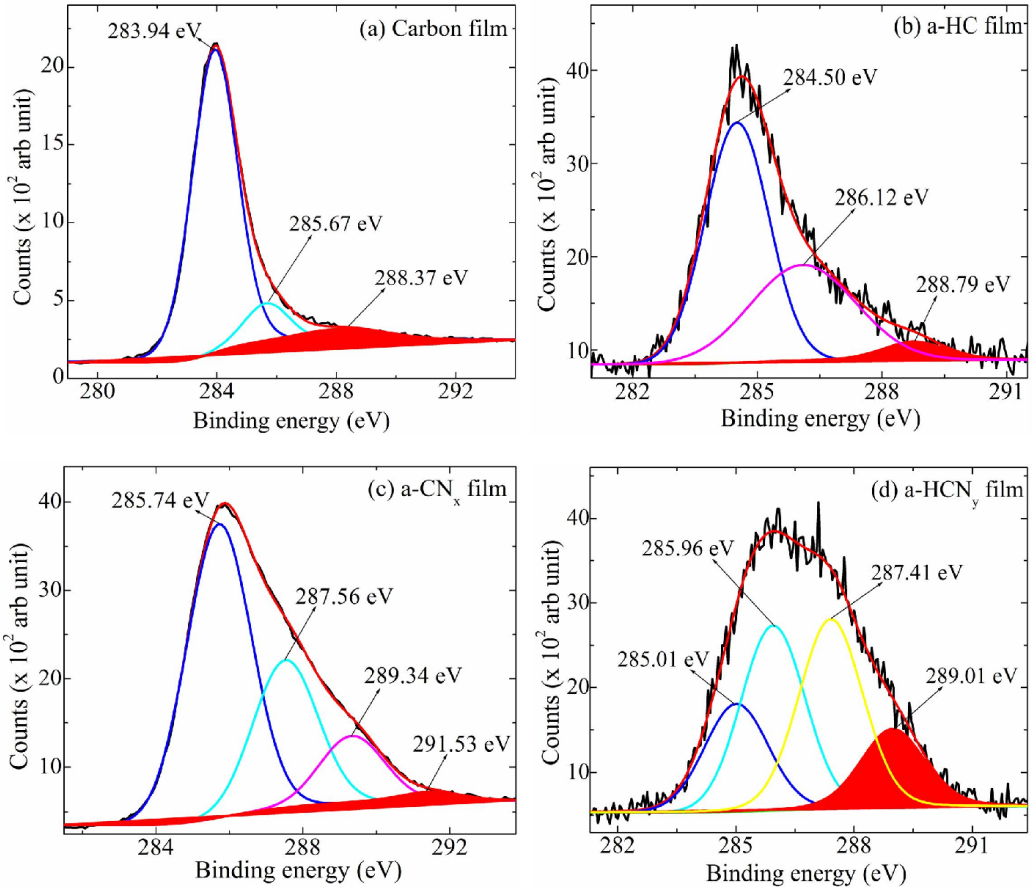


Figure 3. Deconvoluted C 1s XPS spectra of (a) a-C, (b) a-HC, (c) a-CN_x and (d) a-HCN_y films. C 1s XPS spectra obtained with Mg $k\alpha$ x rays at 23.5 eV pass energy at 0.125 eV/step. The red marked peak area is referred as oxide peak. The data are presented after inelastic background subtraction and using Gaussian fits. The intensity scales for the C spectra are not the same.

3.2. FT–IR absorption spectroscopy

FTIR absorption spectra were carried out in the range of 4000–1000 cm^{-1} for all the a–CN_x samples, deposited by DBD technique. The samples were categorized in three groups; a) absence of nitrogen in carbon film, b) presence of hydrogen in carbon film and c) presence of hydrogen and nitrogen in carbon film. Various absorption bands show the presence of N-H & O-H overlapping band (3750–3010 cm^{-1}), sp^3-$(CH)_n$ stretching groups (3000-2800 cm^{-1}), sp^1 –C≡N stretching (2295–2080 cm^{-1}), sp^2 phase associated C=N, C=C and C-N stretching band (1835–1495 cm^{-1}) and C–H_x bending vibration (1480–1365 cm^{-1}) [13, 26, 28, 29]. The assignments of these frequencies to their functional groups were carried out by comparison with the assignments reported in text books and literature [12, 28, 29, 30].

Figure 1, shows the FTIR spectra of a-C, a-HC, a-CN_x and a-HCN_x films measured at room temperature. FTIR of graphite spectra shows the sp^2 phase (-C=C-) structure but there is also a peak associated at 1103 cm^{-1} region is referred as Si-O-Si linkage network. It is due to in-homogeneity of the film surface and bare silicon surface. Such a peak is not observed in rest of the deposited film FTIR spectrum. Amorphous hydrocarbon (a-HC) film shows prominent sp^3 and sp^2 phase at 1803-1300 cm^{-1} and at 2820-3018 cm^{-1}. The peak in the range of 2820 cm^{-1} to 3018 cm^{-1} including two distinguishes sub-peaks. The peak at 2960 cm^{-1} and 2868 cm^{-1} are assigned as CH_2 asymmetric stretching vibration and CH_3 symmetric stretching vibration,

respectively. It can also be observed that, there is weak shoulder at 2952 cm^{-1} which may be due to CH_3 asymmetric stretching vibration [ ]. The absorption band at 3650–3132 cm^{-1} is referred as OH band and it appears due to oxygen adsorption and surface contamination.

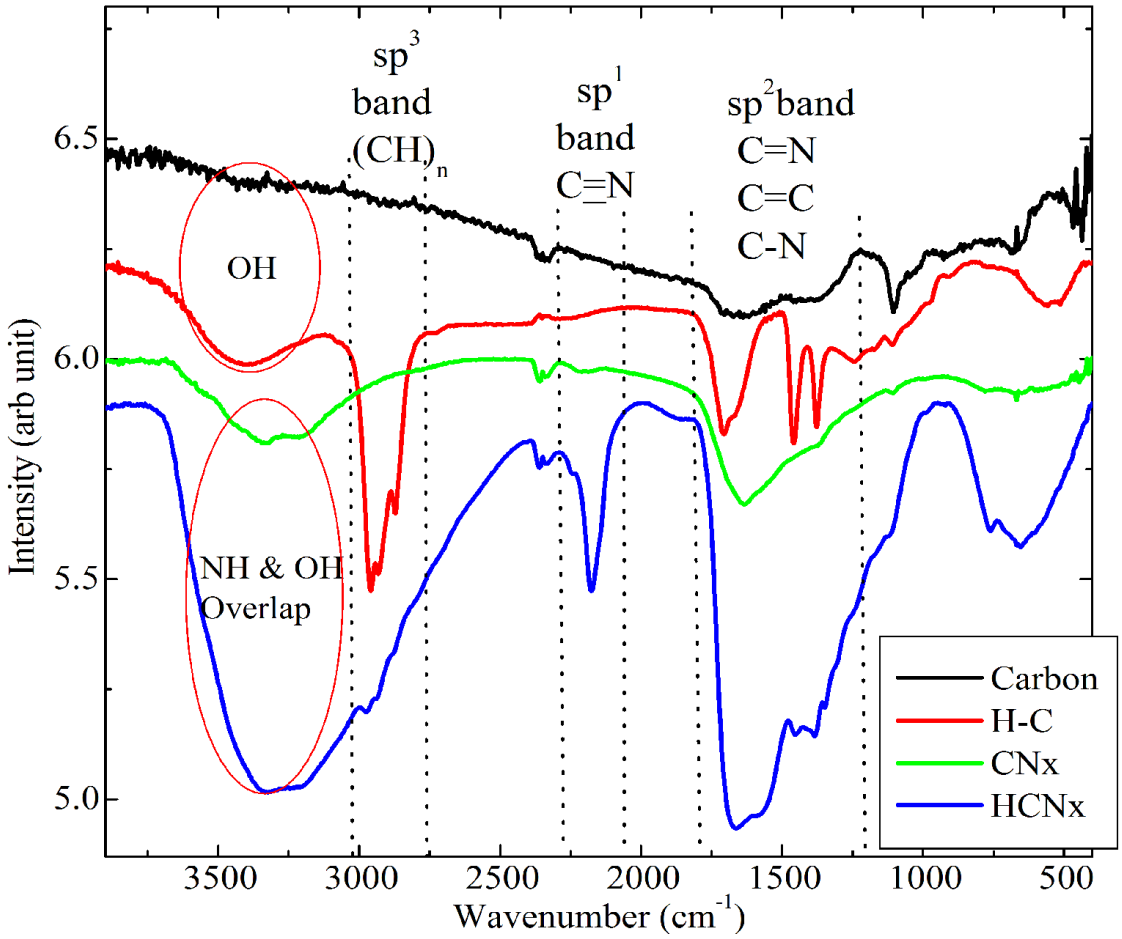


Figure 3. Deconvoluted C 1s XPS spectra of (a) a-C, (b) a-HC, (c) a-CN_x and (d) a-HCN_y films. C 1s XPS spectra obtained with Mg $k\alpha$ x rays at 23.5 eV pass energy at 0.125 eV/step. The red marked peak area is referred as oxide peak. The data are presented after inelastic background subtraction and using Gaussian fits. The intensity scales for the C spectra are not the same.

3.3. Raman spectroscopy

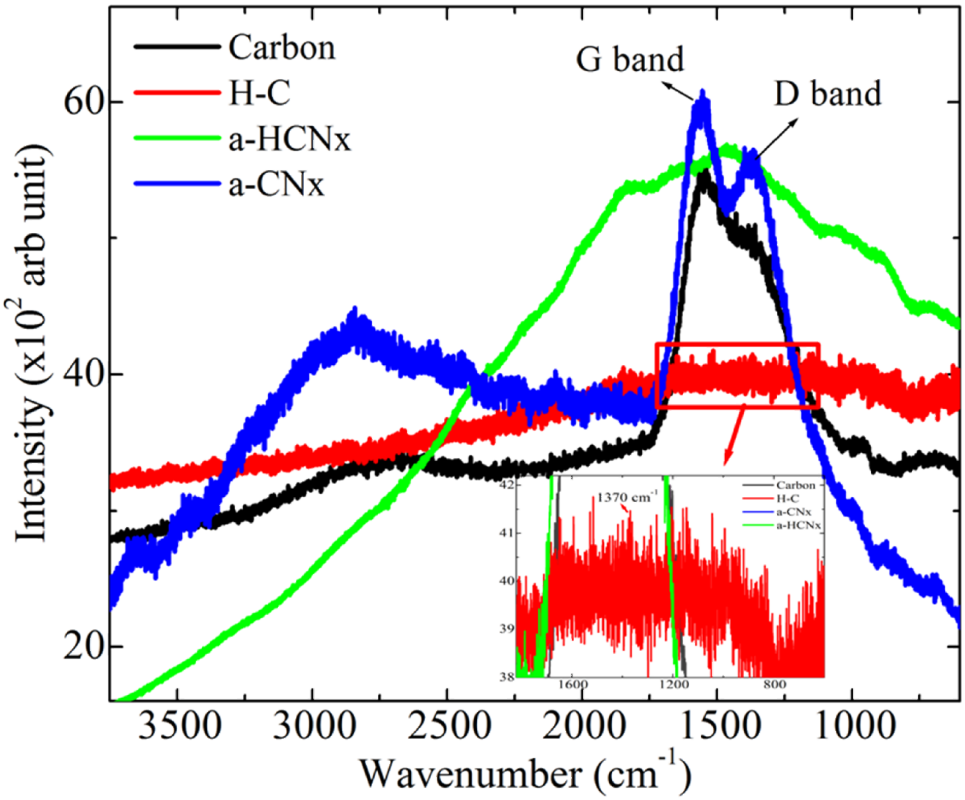


Figure 5. Raman spectra of carbon, a-HC, a-HCN and a-CN film deposited by different plasma deposition methods.

Fig. 2 shows the Raman spectra of a-HCN_x and a-CN_x film deposited at room temperature. A very strong fluorescence effect is observed in the case of the a-HCN_x film. On the other hand, the a-CN_x film shows a similar trend of fluorescence effect with a signature of graphite (G band, 1550 cm^{-1}) and disorder (D band, 1385 cm^{-1}) bands. The broad band at 2870 cm^{-1} might go back to NH/OH surface groups with strong hydrogen bonds. CH_2/CH_3 bands should be less broad and are also IR active but were not observed in the IR spectra of a-CN_x films (see above). Several oscillations were observed in the spectrum from 1800 cm^{-1} to 2700 cm^{-1} and 3400 cm^{-1} to 3600 cm^{-1}.

It was expected that the G band (sp^2 ordered) would dominate over the D band (sp^2 disordered) but in reality it did not show any big difference in the shifting with N concentration. In the case of a-C film, the graphite (G band, 1550 cm^{-1}) band is visible prominently with a distinguishable hump of a disorder (D band, 1385 cm^{-1}) band. But in the case of a-HC film the signature of G and D bands are seen with fluorescence effect.

4 DISCUSSION

The spectroscopic analyses suggest that the presence of oxide layer is not only the prime cause but the presence of nitrogen is partially responsible for the chemical shift towards higher binding energy. In x-ray photoelectron spectroscopy (XPS), C 1s spectra of a-HCN_y film shows higher chemical shifts compare to a-C, a-HC and a-CN_x. Raman spectra display a strong fluorescence effect of a-HC and a-HCN_y where as a-C and a-CNx exhibits a promising G and D band at room temperature. Fourier transform infrared spectroscopy (FTIR) spectra show a large NH-OH over lapping region in a-HCN_y compare to a-HC and a-CN_x film whereas it is negligible in a-C. FTIR spectra show that the a-C, a-HC and a-CN_x films are dominated by sp^2 bonded region while a-HCN_y is the mixture of sp^2, sp^3 and hydrogen bridging bond.

In fig 1b, Auger lines of KL_1L_{23} represent the Auger electron emitted from 2p orbital level. At the initial stage the incident x-ray/photon kick out one electron from K shell and to fill this core hole position one electron from L_1 (2s) orbit jump to K (1s) shell orbit. Due to this jump of electron from higher shell to lower shell the emitted energy enhance to kick another electron from L_{23} shell which is called Auger electron. Similarly, in case of $KL_{23}L_{23}$ peak represent the Auger electron emitted from 2p orbital level. Here the electron jump from 2p orbital (L_{23}) to K shell orbit to fill the initial core hole position. In this case the

emitted energy enhance to kick another electron from same orbital (2p) which is denoted as Auger electron of $KL_{23}L_{23}$ transition. Fig 2 shows that the nitrogen connected film exhibit higher chemical shift and here C1s peak appears at higher binding energy in XPS spectrum of a-CN_x and a-HCN_y films compare to the a-C and a-HC. Ofcourse there is oxygen contamination at the surface but it is common to all of the four films.

It is observed from fig 2 that the a-C and a-CN_x films (deposited in dc magnetron plasma) exhibit smooth C 1s curve where as a-HC and a-HCN_y films (deposited in DBD plasma) show the noise signal in the XPS spectrum. DBD films are highly porous and composed with island growth and it exhibits insulating property [CPL]. The presence hydrogen could induce the extra charging effect on the surface region of the film. The hydrogen is connected to C or N mostly to weak hydrogen bridging bond or vaan der Waals forces. As the film is exposed to the air the surface contamination take place and oxygen sit top of the surface by adsorption process and sometimes it reaction with the existing hydrogen (NH group) by weak interaction forces and for 'OH' bridge. The noise signal in XPS measurement happened due to surface charging effect, which means the surface electron are not flowing properly to complete the circuit. Even thin film can show such noise signal if there is hydrogen or oxygen present in the film [29].

All the four films have sp2 phase in common but there structure is different. Hydrocarbon film shows three different peaks (1705.16 cm^{-1}, 1458.22 cm^{-1} and 1377.13 cm^{-1}) where as amorphous carbon shows dominating graphitic band at named G (1630.21 cm^{-1}) and disordered D (1377.12 cm^{-1}) band in sp2 region. There are some common features in case of a-CN_x and a-HCN_x film regarding the sp1, sp2 and sp3 phases at room temperature, but they behave differently when they are annealed. Both show the NH-OH overlapped region at 3750–3010 cm^{-1}. The intensity of nitrile group (−C≡N) in a-CNx is very small compare to a-HCN_x film. The decrease in the intensity of the C-H stretching vibrations and the increase in the number of N-H stretching vibrations may be caused by the increase in the nitrogen content in the film where NH_n group gradually replaces the CH_n group and C=C becomes more active. The NH-OH overlapped tail is long enough up to 2500 cm^{-1} due to the presence of volatile phase and Hydrogen Bridge formed in between two molecular chains. This long tail absorption band is removed as annealing temperature approaches to 300 ^{0}C. The hydrogen bridge bonding breaks up due to heating and figure 3 (a) shows that the NH -OH overlapped tail is reduced and it end up with a band of 2950 cm^{-1} to 3570 cm^{-1}. Both a-CNx and a-HCNx film have common features regarding the sp^2 and sp^1 phases at room temperature. Both show the NH-OH overlapped region at 3650–3010 cm^{-1}. The intensity of nitrile group (−C≡N) in a-CNx is very low compare to a-HCNx film. a-HCNx shows a intense finger print region (1660 cm^{-1} to 1300 cm^{-1}) compare to a-CNx film. a-CNx and a-HCNx shows higher chemical shift compare to a-HC, a-C film. It is obvious that the presence of nitrogen is causing the extra chemical shift towards higher binding energy region. The electronegativity of O is about 3.56 where as N has 3.

5 CONCLUSION

The direct observation of our spectroscopic results (Fig 1-3) depict that the chemical shift (or binding energy shift towards higher region) of C 1s peak gradually increase successively from a-HC, a-CNx and a-HCNy film where graphite peak is taken as reference. The four corresponding films are deposited in oxygen free environment but there is 5 to 10% oxygen is present in those films due to adsorption or absorption at top layer. C 1s XPS spectra of a-HCNy film exhibit highest chemical shift out the four. a-CNx and a-HCNx shows higher chemical shift compare to a-HC, a-C film. It is obvious that the presence of nitrogen is causing the extra chemical shift towards higher binding energy region. Chemical shifts of C 1s peak is about 2.1 eV and 1.3 eV in XPS of a-HCNx and a-CNx film at room temperature, respectively. The fluorescence effect is due to the presence of organic matrix (Chemfors, NH, nitrile, C=N etc) in the deposited solid.

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REFERENCES

[1] J. C. Angus, P. Koidl, and S. Domitz, in Plasma Deposited Thin Films, edited by J. Mart and F. Jansen (CRC, Boca Raton), p. 89. 1986.
[2] P. Koidl, Ch. Wild, B. Dischler, J. Wagner, and M. Ramsteiner, Mater. Sci. Forum, vol. 52/53, pp. 41, 1989.
[3] J. Robertson, Surf. Coat. Technol. Vol. 50, pp. 185, 1992.
[4] J. L. Bredas and G. B. Street, J. Phys. C vol. 18, pp. L651, 1985.
[5] J. Robertson and E. P. O'Reilly, Phys. Rev. B vol. 35, pp. 2946, 1987.
[6] A. C. Ferrari and J. Robertson, Phys. Rev., B vol. 61, pp. 14095, 2000.
[7] C. Hopf, W. Jacob, A. von Keudell, J. Appl. Phys., vol. 97, pp. 094904, 2005.
[8] T. Schwarz-Selinger, M. Meier, C. Hopf, A. von Keudell, W. Jacob, Vacuum, vol. 71, pp. 361, 2003.
[9] W. Jacob, Thin Solid Films, vol. 326, pp. 1, 1998.
[10] E. Salancon, T. Dürbeck, T. Schwarz-Selinger, F. Genoese, W. Jacob, J. Nucl. Mater., vol. 376, pp. 160, 2008.
[11] A. Y. Liu, M. L. Cohen, Science, vol. 245 pp. 841, 1989**.**
[12] D. Marton, K. J. Boyd, A. H. Al–Bayati, S. S. Todorov, and J. W. Rabalais, Phys. Rev. Lett. Vol. 73 pp. 118, 1994.
[13] N. Hellgren, M.P. Johansson, E. Broitman, L. Hultman, J.E. Sundgren, Phys. Rev. B, vol. 59, pp. 162, 1999.
[14] D. Li, Y.W. Chung, M.S. Wong, W.D. Sproul, J. Appl. Phys., vol. 74 pp. 219, 1993.
[15] H. Yao, W.Y. Ching, Phys. Rev. B, vol. 50 pp. 11231, 1994.
[16] A. Mansour, D. Ugolini, Phys. Rev. B, vol. 47 pp. 10201, 1993.
[17] J. Robertson, Thin Solid Films, vol. 383 pp. 81-88, 2001.
[18] Zambov, L. M; Popov, C.; Abedinov, N.; Plass, M. F.; Kulisch, W.; Gotszalk, T. *Adv. Mater.*, 12 (2000) 656–660
[19] Wang J, Miller D R, Gillan G, Chem. Commun., vol. 19 pp. 2258-2259, 2002.
[20] Plass M. F, Popov C, Ivanov B, Mandl S, Jelinek M, Zambov L. M, *Appl. Phys. A*, vol. 72 pp. 21–27, 2001.
[21] Sung Pil Lee**,** Sensors, vol. 8 pp. 1508–1518, 2008.
[22] Majumdar A, Schröder K and Hippler R, J. Appl. Phys.*,* vol. 104 **pp.** 074702, 2008.
[23] A. Majumdar, Ramesh Ummanni, Karsten Schröder, Reinhard Walther, and Rainer Hippler, J. Appl. Phys., vol. 106 pp. 034702, 2009.
[24] Abhijit Majumdar, Sadhan Chandra Das, Thoudinja Shripathi, Rainer Hippler, Chem. Phys. Lett. , vol. 524 pp. 62-67, 2012.
[25] A. Majumdar, G. Das, N. Patel, P. Mishra, D. Ghose, and R. Hippler, J. Electrochemical Society*,* vol. 155 no. 1 pp. D22-D26, 2008.
[26] J. Houska 1, J.E. Klemberg-Sapieha, L. Martinu, Surf. Coat. Technol., vol. 203 pp. 3770–3776, 2009.
[27] Majumdar, A. and Hippler, R. *Rev. Sci. Instrum*., Vol. 78 pp. 075103–075108, 2007.
[28] A. Majumdar, G. Das, K.R. Basvani, J. Heinicke, R. Hippler, J. Phys. Chem. B, vol. 113 pp. 15734, 2009.
[29] Majumdar, A.; Schäfer, J.; Mishra, P.; Ghose, D.; Meichsner, J and Hippler R. *Surf. Coat. Technol.*, vol. 201 pp. 6437, 2007.
[30] John, F. Moulder et al. *Handbook of X–ray Photoelectron Spectroskopy*, Perkin–Elmer Corporation, 1992.

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Peripartum cardiomyopathy: A case report

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ABSTRACT: Peripartum cardiomyopathy (PPCM) is a rare cardiac disorder of unknown origin associated with a high risk of mortality (50%). Echocardiography confirms the diagnosis by showing a left ventricular dilatation and a decreased ejection fraction. Up to date, the treatment remains symptomatic. The authors report the case of a woman of 36 years old who presented a peripartum cardiomyopathy.

KEYWORDS: peripartum, cardiomyopathy, pregnancy, heart failure, left ventricular dysfunction.

1 INTRODUCTION

Peripartum cardiomyopathy (PPCM) is a dilated and hypokinetic cardiomyopathie occurring during pregnancy or after delivry with an estimated between 1/1000 and 1/4000 births. It has been defined as a new onset of heart failure in the month preceding or following delivry, without demonstrated aetiology nor previously known heart disease and without echocardiographic evidence of left ventricular (LV) dysfunction (LV ejection fraction <0,45). It's a multifactorial disease, immunologic, hormonal, and possibly viral mechanisms playing a determinant pathophysiological role. The classical clinical presentation is a rapid and unexpected onset of heart failure in a previously healthy woman, echocardiography being the key examination for positive and differential diagnosis, prognostication, therapeutic decision making, and follow-up. The potential severity of PPCM, and its unpredictable evolution in the first days following diagnosis, require that patients be referred to a tertiary care centre with a high skill in intensive cardiology care. Therapeutic management of PPCM does not offer any specificity when compared to other causes of acute or chronic heart failure (from diuretics to extracorporeal life support), except for ACE inhibitors, that are contraindicated before delivery. The high incidence of thromboembolic complications observed in the disease requires however rapid and curative anticoagulation and immunosuppressive treatment has been proposed in fulminant and highly inflammatory presentation, but its efficacy remains controversial. Very recently, promising results have been reported with bromocriptin-a prolactin secretion inhibitor for reducing 6 month morbidity and mortality, but these findings have to be confirmed in larger scale randomised trials. As for the long-term evolution, approximately half of the patients will heal, while half of the women will keep some degree of LV dysfunction, 25% of them developing moderate to severe chronic heart failure. We report a case of an acute lung edema secondary to a left heart failure at 37 weeks of gestation in a woman of 36 years old.

2 CASE HISTORY

Our case is about a 36 years old woman, low socioeconomic status, without medical history, Gravida 3 Para 3. The first and second pregnancies were natural deliveries at home without abnomality. In fact, the patient did not report a high blood pressure after her deliveries. The current pregnancy was poorly monitored. It was estimated at 37 weeks of gestation according to the last menstrual period. The patient was admitted to obstetric emergencies for acute dyspnea NYHA stage III of the New-York Heart Association (NYHA) associated to orthopnea, cough and frothy sputum. The overall examination showed an obese patient, conscious with profuse sweat, heart rate at 100 beats / minute, breath rate at 30 cycles / min with high blood pressure ranging from 180 to 160 mmHg for systolic and 120-110 for diastolic associated to neurosensory signs

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and importantt edema of the lower limbs. Besides, the patient reported a quick weight gain since a month. Urinary Dipstick looking for proteinuria was positive with 4 cross albumin which it was in favor of severe preeclampsia. The chest auscultation showed crackles at the base and summits. The obstetric examination revealed a fundal height at 35 cm with blubber, fetal heart sounds were well perceived. On palpation, the uterus was soft with cephalic presentation back to the left. There was no bleeding in the speculum examination. In the vaginal touch, the cervix was posterior, long, admitting the pulp of the finger with a mobile cephalic presentation and a flexible lower segment of the uterus. Ultrasound showed a cephalic presentation , the estimation of fetal weight was 3400 g , an anterior placenta , the quantity of amniotic fluid was normal Umbilical and cerebral Doppler were normal. The electrocardiogram showed sinus tachycardia at 110 beats / min with some atrial extrasystoles. Chest-X-rays radiography with abdominal protection was in favor of an acute pulmonary edema. Transthoracic echocardiography showed a dilated left ventricle, global hypokinesia and left ventricular dysfunction. Left ventricular ejection fraction was at 31% (Figure 1). The left atrium was dilated, the right cavities were non-dilated and the right ventricle systolic function was normal. On the Doppler, there was a mitral regurgitation grade I-II and a tricuspid insufficiency grade I with significant pulmonary hypertension. The pericardium was dry. These results were in favor of dilated cardiomyopathy. The patient was quickly put in condition (half sitting position, oxygen, urinary catheterization). She received loop diuretic (Furosemide) 40 mg intravenous and a antihertensive parenterally (calcic inhibitor). A biological assessment with : blood count with platelets, complete blood ionogram with liver function and renal function, C-reactiv protin (CRP), lipid profile, thyroid balance and cardiac enzymes was made. The blood count was unremarkable, the electrolytes, the liver and renal function tests were normal , CRP was elevated at 10.4 mg/l. The thyroid function was normal and the troponin IC was negative. A C-section was carried out under general anesthesia allowing the extraction of a newborn baby girl weighing 3200g Apgar 10/10 at 1,5 and 10 minutes of life. Examination of the newborn was unremarkable. After the C-section, the patient was transferred to the intensive care unit (ICU). Diuretic therapy was continued. The blood pressure remained high and calcic inhibitor continued parenterally. Prophylactic heparin therapy was instituted for the prevention of thromboembolic complication. An inhibitor of lactation (carbegoline) and a pressure bandage was in place to prevent breast engorgement. The blood pressure returned to normal in the third day of the postpartum period. After five days of hospitalization in ICU and a good clinical course, the patient was transferred to the cardiology department. She received Furosemide , beta-blockers and angiotensin converting enzyme inhibitor given orally as well as Proton-pump inhibitors, iron (curative dose) and prophylactic heparin. Clinically, improvement was observed. The Last transthoracic echocardiography before discharge found an ejection fraction of 32%.The patient was the sixth outgoing days within inhibitors converting enzyme, beta-blockers. Microprogestative pill was prescribed as a contraceptive.

3 DISCUSSION

Peripartum cardiomyopathy has been defined by the Working Group on Heart Failure of the European Society of Cardiology as an idiopathic cardiomyopathy manifested by signs of heart failure secondary to left systolic dysfunction between the last month of pregnancy and the five months following the delivery disease when no other etiology was found. Dilatation of the left ventricle is not compulsory but the left ventricular ejection fraction (LVEF) is almost always less than 45% [1]. Several risk factors for PPCM were identified: maternal age> 30 years, multiparity, multiple pregnancy, obesity, high blood pressure, pre-eclampsia [2]. In fact, in 1/3 of cases, no risk factor was found. Our patient had four of these risk factors: She was 36 years old, she was Para 3, obese with preeclampsia in her admission. The clinical picture of PPCM is systolic heart failure. Functional signs are dyspnea, cough, edema of the lower limbs. The cardiopulmonary auscultation found crackles or wheezes related to pulmonary congestion [3]. Our patient presented the same clinical picture. The differential diagnosis includes pulmonary embolism, pneumonia, infarction or aortic dissection. The electrocardiogram (ECG) usually shows sinus tachycardia, but atrial arrhythmias is not uncommon [4,5]. Besides, Left ventricular hypertrophy, ischemia in epicardial Q waves, ST segment changes may also see [6]. ECG our patient showed sinus tachycardia at 110 beats / min with some atrial extrasystoles. Chest-X-rays is not specific showing signs of heart failure and inconstant cardiomegaly. Successive radigraphy will allow to follow the evolution of congestive signs. In our case, chest-X-rays (made with protection of the abdomen) objectified an acute pulmonary edema. Echocardiography is the key examination for positive and differential diagnosis, prognostication, therapeutic decision making, and follow-up. She often found a left ventricular dilatation, decreased less than 45% ejection fraction (the left ventricular ejection fraction in our patient was 35%) and possible right ventricular disease associated [1]. Finally, it is often used to confirm the diagnosis of PPCM by eliminating pre-existing heart disease (hypertrophic, rheumatic valvular, ischemic). Biology is not specific. it assesses the severity of cardiac disease and follow the evolution: Troponin Ic or T related to myocyte necrosis, C-reactive protein (CRP) reflecting the scalability of inflammatory processes, transaminases, creatinine and lactate, to assess the visceral impact of heart failure. The evolution of the PPCM is often extremely fast and unpredictable with possibility of sudden onset of refractory cardiogenic shock in the first 24-48 hours. The treatment of PPCM in acute phase is symptomatic: it is that of all heart failure. It is to reduce preload and afterload and increase myocardial contractility. Several drugs are usable depending on the clinical and the period of

pregnancy. Decreasing the precharge can be provided by nitro-derivatives and diuretics. Angiotensin converting enzyme inhibitor are the best treatment to decrease afterload, but they are contraindicated during pregnancy because of the side effects on the foetus (oligoamnios, prematurity, bone malformation….)[7]. Amlodipine or hydralazine-nitro-derivatives association are alternatives during pregnancy. Beta-blockers are prescribed during tachycardia or arrhythmia. Dobutamine increases myocardial contractility without risk during pregnancy [8,9]. Therapeutic abortion may sometimes be justified in case of worsening heart failure despite optimal medical therapy. The total duration of this medical long-term treatment is not well defined. It must be at least a year and then based on data of the ultrasound monitoring. Some authors advocate unconventional treatments etiological as immunosuppressive (azathioprine, prednisolone), plasmapheresis, immunoglobulin, interferon or immunomodulation for patients who remain symptomatic under conventional medical treatment and in whom myocarditis is proved by endomyocardial biopsy [10]. A small randomized study published in 2010 has opened up new perspectives. This open study comparing 20 patients placed under bromocriptine (dopamine agonist anti-prolactin activity: 2.5mg two times a day over 15 days followed by 2.5 mg / day for 6 weeks) versus conventional treatment isolated, showed a benefit effect in terms of improvement in LVEF to 4 months. Other complications associated to PPCM include thromboembolic events which are found in nearly 50% of cases. The hypercoagulability secondary to pregnancy and blood stasis in dilated cavities promote the formation of thrombi. In fact, anticoagulation is justified and should be pursued as ejection fraction is less than 35% [11]. The management of the patients with PPCM is multidisciplinary including obstetrician, cardiologist, anesthetist and pediatrician. Childbirth can be done vaginally and epidural analgesia is then medically indicated, as it enables the reduction of myocardial work during labor and an improvement in cardiac function by decreasing load conditions. An indication for c-section may be raised by the obstetrician or in case of severe cardiac decompensation. General or regional anesthesia is then used, the goal remains to maintain a good hemodynamic stability. Spinal anesthesia alone is strongly discouraged because of the sudden hemodynamic changes it engenders and which can be fatal in this context. Epidural anesthesia and combined epidural spinal anesthesia are preferred. The regional anesthesia is preferred except in cases of emergency obstetric and contraindicated. If the PPCM occurs in the last months of pregnancy, in order to benefit the mother of a better therapeutic management, rapid extraction of the fetus is often indicated. If the cervix “is ready” and if maternal hemodynamic status permits, vaginal delivery may be authorized. Otherwise (cervix “closed” and / or heart failure NYHA class > I), a C-section is preferred [12]. Recurrence of PPCM during a subsequent pregnancy occurs in 25-100% of cases depending on the study [12]. Although it has no reliable predictor, the failure to recover normal LVEF waning of a first episode predispose to recurrence. Finally, the European Society of Cardiology recommends to [13]:

- Discourage a future pregnancy in a patient with ventricular sequelae post PPCM.
- Against state-of pregnancy if LVEF <50%.
- Perform a therapeutic abortion in case of deterioration of LVEF <50% in the 1st or 2nd quarter, due to the risk of heart failure may jeopardize the mother's prognosis.
- Perform echocardiography screening and regular monitoring in patients with a history of PPCM with normalization of LVEF, as well as in patients with a family history of cardiomyopathy or PPCM ascendants and collaterals in the first degree.

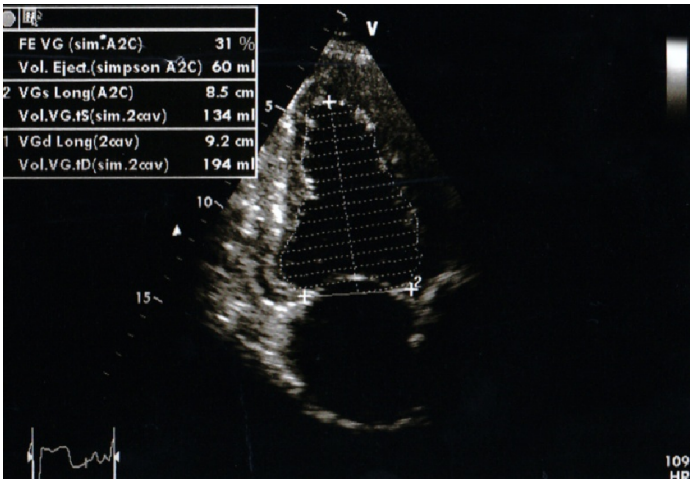


Figure 1: Echocardigraphy showing a dilated left ventricle, global hypokinesia and left ventricular dysfunction. Left ventricular ejection fraction is 31%.

4 CONCLUSION

Peripartum cardiomyopathy is a rare but serious disease in pregnant women. It is a hypokinetic dilated cardiomyopathy. Its pathophysiology is unknown and multifactorial. Its treatment is symptomatic, but must take into account the state of pregnancy. Angiotensin converting enzyme inhibitor are the treatment of choice but they are contraindicated during pregnancy. Other specific therapies are being evaluated based on etiological hypotheses. A Secondary normalization of ventricular function does not exclude a risk of recurrence in a subsequent pregnancy justifying a multidisciplinary long-term monitoring.

CONFLICTS OF INTEREST

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

REFERENCES

[1] Sliwa K, Hilfiker-Kleiner D, Petrie MC et al.Current state of knowledge on aetiology, diagnosis, management and therapy of peripartum cardiomyopathy: a position statement from the Heart Failure Association of the ESC working group on peripartum cardiomyopathy. Eur J Heart Fail 2010;12:767-78.

[2] Mielniczuk LM, Williams K, Davis DR et al. Frequency of peripartum cardiomyopathy. Am J Cardiol 2006;97:1765-8.

[3] Kishimoto C, Shioji K, Kinoshita M, Iwase T, Tamaki S, Fujii M, et al. Treatment of acute in ammatory cardiomyopathy with intravenousimmu-noglobulin ameliorates left ventricular function associated with suppres- sion of in ammatory cytokines and decreased oxidative stress. Int J cardiol 2003;91:173-8.

[4] Sakokibara S, Sekiguchi M, Konno S, Kusumoto M. Idiopathic post-partum cardiomyopathy: report of case with specials references to its ultrastructural changes in the myocardium as studied by endomyocardial biopsy. Heart 1970;80:385–95.

[5] Demakis J, RahimtoolS LI, Sutton GC. Naural course of peripartum cardiomyopathy. Circulation 1971;44:1053–61.

[6] Christopher SB, Barry DB. Peripartum cardiomyopathy: a comprehensive review. Am J Obstet Gynecol 1998;178:409–14.

[7] Pryde PG, Thorpe SS, Lamont CA. Angiotensin-converting enzyme inhibitors foetopathy. J Am Soc Nephrol 1993;3:1575–82.

[8] Murali S, Baldisseri MR. Peripartum cardiomyopathy. Crit Care Med2005;33(Suppl. 10):S340–6.

[9] Sliwa K, Fett J, Elkayam U. Peripartum cardiomyopathy.Lancet 2006;19(368):687–93.

[10] Kishimoto C, Shioji K, Kinoshita M, Iwase T, Tamaki S, Fujii M, et al.Treatment of acute inflammatory cardiomyopathy with intravenous immunoglobulin ameliorates left ventricular function associated with suppression of inflammatory cytokines and decreased oxidative stress. Int J Cardiol 2003;91:173–8.

[11] Kaufman I, Bondy R, Benjamin A. Peripartum cardiomyopathy and thromboembolism; anesthetic management and clinical course of an obese, diabetic patient. Can J Anaesth 2003;50:161–5.

[12] Bahloul M, Ben Ahmed MN, Laaroussi L et al.Myocardiopathie du peripartum : incidence, physiopathologie, manifestations cliniques,prise en charge therapeutique et pronostic.Ann Franc Anes Rea 2009;28:44-60.

[13] Oakley C, Child A, Iung B et al. Task force on the management of cardiovascular diseases during pregnancy of the European Society of Cardiology: expert consensus document on management of cardiovascular diseases during pregnancy. Eur Heart J 2003;24:761-81.

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Rescue Cervical Cerclage (RCC): A case report and review of literature

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ABSTRACT: The authors report the case of a 26 years old woman with a medical history of three late fetal loss (between 20 to 22 weeks) who benefit in her actual pregnancy a recue cervical cerclage at 20 weeks of gestation. It allowed the continuation of the pregnancy until 38 weeks after elective suture removal at 36SA. The patient give birth by natural delivery to a baby girl in good condition. Prophylactic cerclage was recommended to the patient in later pregnancies. Through this case and based on recent literature reviews, the authors discuss the indications, contraindications, technical aspects and prognosis of rescue cervical cerclage.

KEYWORDS: Rescue cervical cerclage, preterm labour, late miscarriage, Prolapsed fetal membranes.

1 INTRODUCTION

Preterm is defined as babies born alive before 37 weeks of pregnancy are completed. There are sub-categories of preterm birth, based on gestational age: extremely preterm (<28 weeks); very preterm (28 to <32 weeks) and moderate to late preterm (32 to <37 weeks). It is the most common cause of neonatal morbidity and mortality [1]. One of the various interventions that have been tried, cervical cerclage is the most beneficial. It is performed in an attempt to reduce the likelihood of late miscarriage and preterm delivery [2]. Emergency cervical cerclage is a procedure not commonly performed in general clinical practice [3]. It may be inserted when the patient presents with a cervix that is already dilated with the membranes bulging into the vagina [4]. Based on recent literature reviews many questions regarding the RCC are now answered but others still remain unanswered [5].

2 CASE HISTORY

Our case is about a 26 years old woman, Gravida 4, Para 0, with a medical history of three late fetal loss, (between 20 to 22 weeks). The patient was admitted at 20 weeks of gestation for uterine contractions. The overall examination showed a patient in good general condition, without fever and with normal blood pressure. Speculum examination showed a completely effaced cervix opened with membranes protruding into the cervical canal (photo 1). There was no bleeding. Ultrasound showed a scalable singleton pregnancy with normal biometrics and normal morphology, placenta was normally inserted and the quantity of amniotic fluid was normal. Infectious balance was normal and rhesus grouping was positive. After 48 hours of tocolysis by intravenous nicardipine, intramuscular delay progesterone and a broad-spectrum antibiotics, a rescue cervical cerclage was performed under spinal anesthesia using the technique of Mac Donald: Patient in Trendelenburg position, a slight pull on the cervix by a Forester clamp and slight pressure on the membranes with a small pad mounted on a clamp which facilitated their return in intrauterine. The follow-up was normal with tocolytic treatment and rest. It allowed the continuation of the pregnancy until 38 weeks after elective suture removal at 36SA. The patient gives birth by natural delivery to a baby girl in good condition. Prophylactic cerclage was recommended to the patient in later pregnancies.

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3 DISCUSSION

There is a confusion regarding the terminology of the cerclage procedure, the contemporary nomenclature identify three groups:

1- History indicated cerclage or prophylactic cerclage or elective cerclage: It is a prophylactic measure inserted in asymptomatic high-risk women based on risk factors ascertained in the obstetrical history, usually at 12–14 weeks of pregnancy.

2- Ultrasound-indicated cerclage or urgent cerclage: It is a therapeutic measure inserted in women usually asymptomatic with a short cervical length without cervical dilation with or without prior obstetrical complications, before 24 weeks of pregnancy. The short cervical length is discovered by transvaginal ultrasound.

3- Emergency or emergent or rescue cervical cerclage (RCC): It is essentially a salvage procedure to prolong gestation in women with dilated cervix and fetal membranes protruding into the cervical canal or past the cervical canal. The cervical changes and prolapsed membranes are identified by transvaginal ultrasound, speculum, or manual examination carried-out in the presence of symptoms such as vaginal bleeding, discharge, or pelvic pressure sensation. The insertion is performed in the mid trimester or early third trimester [5-9], like in our case.

Actually, it is certain from available literature that RCC is safe and has a role in the prevention of PTB in women with an incidental finding of premature cervical dilation and prolapsed fetal membranes [2,7,9,10]. It may prolong pregnancy by an average of 4–5 weeks [8]. Notably, a higher chance of cerclage failure is expected if cervical dilatation exceeds 4 cm or if the fetal membranes are bulging into the vagina [8]. The use of RCC in twin and multiple pregnancies is a big source of debate but it might be beneficial [8]. The RCC is performed when the cervix is dilated with fetal membranes protruding into the cervical canal or past the cervical canal. The cervical changes and prolapsed membranes are identified by transvaginal ultrasound or speculum examination. The insertion is performed in the mid trimester or early third trimester [2,4-8,10]. Before an RCC insertion all contraindications to RCC should be excluded, namely signs of established PTB, evidence of chorioamnionitis, heavy vaginal bleeding, preterm premature rupture of membranes (PPROM), evidence of fetal compromise, major fetal anomalies and fetal death [2,3,8]. The best timing for RCC insertion is unknown and an observation period of 12–24 hours before RCC insertion has been reported to ensure that PTB, abruption, and infection are excluded.

Different techniques of cerclage are described but no one has been shown to be superior [9,11]:

Transvaginal cerclage: The two most common techniques are Shirodkar and McDonald. A Shirodkar suture is a transvaginal purse string suture inserted after bladder mobilization above the level of the cardinal ligaments, and a McDonald suture is inserted lower, at the cervicovaginal junction, without bladder mobilization [5]. The McDonald technique is the most frequently employed and it is technically easier to perform in an emergency situation [8,9]. Application of transverse sutures from the anterior to the posterior parts of the cervix (Wurm technique) has also been described[8].

Transabdominal cerclage is often used in cases of a failed transvaginal cerclage. A suture is placed either laparoscopically or via a Pfannenstiel [5].

Occlusion cerclage, a procedure where the epithelial lining of the cervical canal is removed surgically and/or the external cervical is occluded using a continuous suture. It is still being performed despite a lack of evidence for its efficacy [5].

The prolapsed membranes must be replaced in the uterine cavity before the procedure to avoid the high risk of iatrogenic PPROM. This is accomplished least traumatically by placing the patient in the lithotomy position with a steep Trendelenburg tilt, combined with the administration of tocolytics, and allowing gravity to retract the membranes. Bladder overfilling through a urinary catheter can also help to reposition the membranes in the uterus. However, a full bladder tends to reduce exposure of the operative field and push the cervix higher up into the pelvis. Another option is to place a ring forceps or stay sutures of 00 silk or polyglycolic acid around the circumference of the external os, followed by gently pulling and shaking the cervix or traction on all stay sutures gathered in a parachute fashion to help ease the membranes back into the uterus. Invasive methods for reducing the fetal membranes include directly pushing them back with a smooth-surfaced device, such as a Foley catheter balloon (a 25-mL inflated bulb of a size-22 Foley catheter can be used to hold the membranes in the uterus while the cerclage is placed; it is deflated and removed just before the knot is secured), aninflated balloon of the type used for endoscopic preperitoneal dissection, or a metreurynter or mini metreu (a rubber balloon device) inside the cervical os. However, such techniques may be associated with an increased risk of iatrogenic PPROM. Alternatively, transabdominale amniocentesis and amnioreduction under ultrasound guidance can be performed to reduce the volume and pressure of the amniotic fluid in the prolapsed sac, thereby allowing the fetal membranes to retract back into the uterine cavity[8].

In perioperative, the use of short-term tocolytics, especially indomethacin for its anti-inflammatory and tocolytic effects, for 48 hours and the prophylactic administration of broad-spectrum antibiotics for a few days is support. However, it is difficult to recommend or refute the value of these treatments. A single course of corticosteroids is recommended in women with a pregnancy duration of 24 weeks or more to enhance fetal lung maturation. No studies are available comparing general with regional anesthesia for cerclage insertion and the decision should be individualized [8].

In postoperative, it is good practice for the patient to remain in the hospital for a postoperative observation period of at least 24 hours, because of the increased risk of complications such as PPROM, early PTB, abortion, and infection. On discharge, instructions are usually given to limit physical activity, avoid intercourse, and attend a prenatal clinic for assessment at 2-week intervals. Prescribe supplemental progesterone as empiric medical therapy, but it is noteworthy that there is no evidence to confirm that this is helpful. There are no studies assessing the usefulness of fetal fibronectin testing for the prediction of spontaneous PTB following RCC insertion[2,8]. A follow-up by transvaginal scan for cervical length is likely to be helpful in prolonging the pregnancy and thus improving outcome [3], but its efficacy is not assessed [5]. An elective suture removal at 36–37 weeks of pregnancy is preferable given the risk of cervical trauma should spontaneous labor occur with the suture in place, unless an elective cesarean delivery is to be performed with suture removal during the same setting, an evidence of infection, chorioamnionitis, preterm labour or an antepartum hemorrhage[2,8]. In women with PPROM between 24–34 weeks of pregnancy and no infection or PTB, it is advisable to delay suture removal for 48 hours. This allows completion of a prophylactic course of steroids for fetal lung maturation and/or arrangement of an in-utero transfer. However, it is not recommended to delay suture removal until the onset of labor, to avoid the risk of maternal and fetal sepsis. Importantly, delayed suture removal is not beneficial in women with PPROM before 23 and after 34 weeks of pregnancy[8]. The RCC is generally a safe procedure. The risk of perioperative complications is 0,6 % regardless of the indication or diagnosis, the intraoperative complications include anesthetic complications, and the postoperative complications include contractions and bleeding after cerclage placement (either immediate or remote) and fetal death. Other peripartum complications are chorioamnionitis (6.2%), preterm premature rupture of membranes (11-52%), preterm labour (20%), and delivery before 32 weeks' gestational age (8%). Cervical cerclage is associated with a higher rate of maternal side effects (vaginal discharge and bleeding, pyrexia). The caesarean section rates are also significantly higher after cervical cerclage (RR 1.19). These complications are however small and manageable [2,9]. The inherent risks of extending the pregnancy from previability to severe prematurity have to be considered. 40% of pregnant women delivered prior to 28 weeks' gestation. RCC often prolongs the pregnancy from previability to borderline survival in addition to the possibility of long-term adverse outcome related to severe prematurity [9].

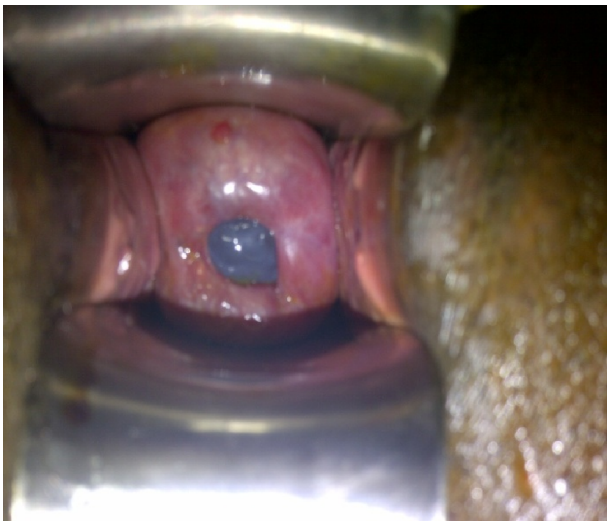


Photo 1: Fetal membranes protruding into the cervical canal.



Photo2: Cervix after cerclage by McDonald procedure

4 CONCLUSION

Actually, the question is no longer whether RCC should be placed but, rather, what the optimal circumstances surrounding its placement should be. The RCC is an effective and safe procedure to prolong gestation in women with advanced cervical changes. Although maternal and neonatal complications associated with rescue cerclage are well known. The decision to insert an RCC should be individualized and undertaken after comprehensive patient counseling and a review of the specific circumstances. The available evidence is limited, so future research are needed and many decisions should therefore be individualized and left to the clinician's discretion.

REFERENCES

[1] R. Simcox and A. Shennan. Cervical cerclage in the prevention of preterm birth. Best Practice & Research Clinical Obstetrics and Gynaecology . Vol. 21, No. 5, pp. 831–842, 2007

[2] Wanyonyi S. Cervical cerclage for prevention of preterm birth: A commentary. JOGECA 2013; 25(1): 13-16

[3] Purnima Deb, Nighat Aftab, Shabana Muzaffar. Prediction of outcomes for emergency cervical cerclage in the presence of protruding membranes. Obstetrics end Gynecology. Vol 2012, article 842841, 4 pages

[4] Andrea Liddiard, Sohinee Bhattacharya, Lena Crichton. Elective and emergency cervical cerclage and immediate pregnancy outcomes: a retrospective observational study. J R Soc Med Sh Rep 2011;2:91

[5] Story L, Shennan A, Cervical Cerclage: An Established. Intervention with Neglected Potential?,European Journal of Obstetrics & Gynecology and Reproductive Biology(2014), http://dx.doi.org/10.1016/j.ejogrb.2014.01.013

[6] Berghella. Technique of cervical cerclage. Am J Obstet Gynecol 2013

[7] Edward K. Chien. Prevention of periviable birth: Bed rest, tocolysis,progesterone, and cerclage. SEMINARS INPERINATOLOGY 37 (2013) 404–409

[8] Abu Hashim H, et al, A review of the contemporary evidence on rescue cervical cerclage, Int J Gynecol Obstet (2013), http://dx.doi.org/10.1016/j.ijgo.2013.08.02

[9] Taher Al-Jishi. The Perinatal Outcome in Saudi Women with Emergency Cerclage – a Prospective Study. UTMJ • Volume 90, Number 2, December 2012. P22-33

[10] Tae-Hee Kim et al.: Efficacy of Emergency Cervical Cerclage. Clinical Practice 2013, 2(1): 1-3

[11] Maria A. Giraldo-Isaza, Grace P. Fried; Sarah E. Hegarty, MPhil; Maria A. Suescum-Diaz, Arnold W. Cohen, Vincenzo Berghella, Comparison of 2 stitches vs 1 stitch for transvaginale cervical cerclage for preterm birth prevention. Am J Obstet Gynecol 2013;208:209.e1-9

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A Comprehensive Short Review on Polyurethane Foam

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ABSTRACT: Polyurethanes are versatile materials used widely in many applications. Annual production of polyurethanes is increasing day by day. The most important application of polyurethane covering its major market is polyurethane foam. Different type of foaming systems and foaming processes are used for synthesis of foam. There are two major types of polyurethane foam which are flexible foam and rigid foam. This review has been structured to present an overview of different types of foam, foaming systems, and processes used for production of foam. Also major applications of polyurethanes are presented.

KEYWORDS: Polyurethane foam, Flexible foam, Rigid foam, Cup foaming, Machine foaming.

1 INTRODUCTION TO POLYURETHANE

Polyurethanes are broad class of materials used widely in many applications. Polyurethanes are also written as PUR and also called as urethanes. They are characterized by urethane linkage -NH- C (=O) - O - . Polyurethanes are discovered by Otto Von Bayer & co-workers in 1937. The characteristic structure of urethanes is given as:

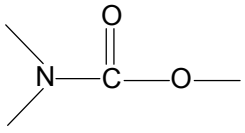


Fig.1. Structure of Polyurethane [1]

Polyurethanes are considered as esters or amide esters of carbonic acid. They are synthesized by the reaction of polyfunctional hydroxyl compounds with polyfunctional isocyanates. Structure of polyurethane formed from di hydroxyl compound and di isocyanate is given as [1- 3].

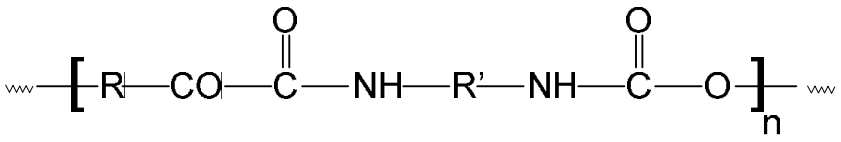


Fig.2. Polyurethane formed from di hydroxyl compound [1]

Globally, annual production of urethanes is about 8 million tons per year and is increasing yearly [4]. Polyurethane is a versatile polymer having unique chemistry with excellent mechanical and optical properties and has good solvent resistance [5]. Polyurethane foam covers almost 29% of the total market of polyurethane [6-7].

2 POLYURETHANE FOAMING SYSTEMS

Foaming systems are classified into three types based on the type of chemicals used in the synthesis process. These types are

- One step One shot system
- Quasi Pre polymer system
- Full Pre Polymer system

One step system and Quasi system are mostly used in foaming industries. One step process is used majorly while pre polymer system was used only in the early times of urethane industry. In one step system Component "A" and Component "B" are taken separately. Component "A" contains only polyisocyanate component while component "B" contains polyol, surfactant, blowing agent and catalyst. Both components are mixed which led to the formation of foam.

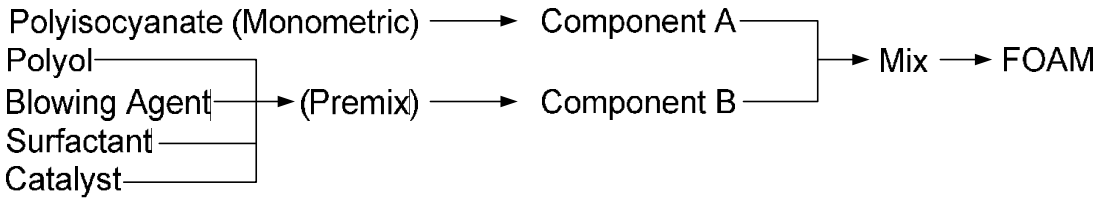


Fig.3. One step one shot system [1]

In Quasi Pre polymer system, in component "A" polyisocyanate component is taken with polyol and in component "B" rest of the ingredients are added with polyol which includes catalyst, blowing agent etc. Mixing forms a foaming product.

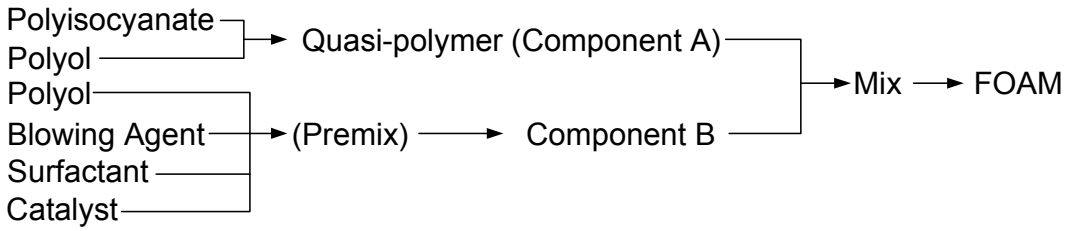


Fig.4. Quasi Pre polymer system [1]

In full prepolymer system in component "A" poly isocyantae component is taken and polyol is also added in it while in component "B" polyol is not added while the rest of chemicals like blowing agents, surfactants and catalyst are taken. Components A & B are mixed.

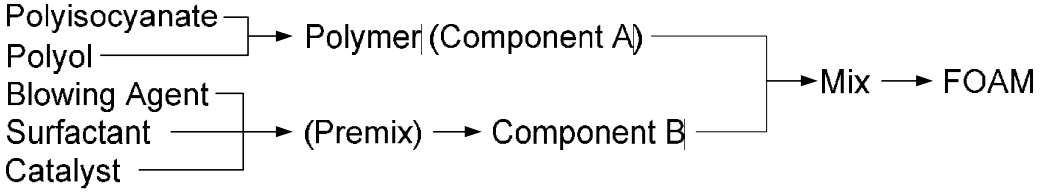


Fig.5. Full pre-polymer system [1]

These foaming systems show only two component system however in industrial processes there are modifications. For example in slabstock process three or four streams are employed carrying different reactants [1, 9].

3 FOAMING PROCESSES

Mainly three types of foaming processes are used, which are cup foaming, box foaming and machine foaming. Machine foaming is further classified into various foaming processes, which are large Box Foaming, Slabstock Foaming, Pour-in-Place Foaming, Sandwich Foaming and Molding, Spraying and frothing [1, 10, and 12].

4 TYPES OF POLYURETHANE FOAMS

Polyurethane foam is prepared by addition, condensation or cyclo-trimerization reactions. Different type of foams and their reactions are shown in table 1.

Table 1: Table showing different types of foam based on their synthesis reaction [1]

Foam	Reaction	Foam Property
Polyurethane	Poly addition	Flexible and rigid
Polyisocyanurate	Poly cyclotrimerization	Rigid
Polyamide	Poly condensation	Flexible and rigid
Polyimide	Poly condensation	Semi rigid and rigid
Polyurea	Poly addition	Flexible and rigid
Poly Carbodiimide	Poly condensation	Semi rigid

Polyurethane foam is classified into two types; flexible foam & rigid foam. These foams are further classified into various sub types in view of their applications [1]. All types of polyurethane foams are synthesized with the proper choice of polyol and isocyanate component. Table 2 shows the classification of polyurethane foam with respect to polyol component and functionality [1, 8].

Table 2: Classification of polyurethane foam w.r.t polyol and functionality [1]

Polyol	Rigid foam	Semi rigid foam	Flexible foam
OH No.	350-560	100-200	5.6-7.0
OH Equivalent No.	160-100	560-280	10,000-80
Functionality	3.0-8.0	3.0-3.5	2.0-3.1

4.1 FLEXIBLE POLYURETHANE FOAM

Flexible polyurethane foams are synthesized by slabstock process or by molding process. They are classified by the technique used for their synthesis and on the basis of polyol. Polyurethane foam synthesized by slab stock process is also called slab stock foam and it is classified into different types which are polyether foam, high-resilience foam, visco-elastic foam, super-soft foam, energy-absorbing foam, and flexible polyester foam; while molded foams are classified into two types' hot molded foam and cold molded foam [1, 13-17, 19-21].

4.2 RIGID POLYURETHANE FOAM

Rigid Polyurethane foam comprises a closed cell structure. At ambient temperature no heating is required to synthesize rigid foam. This type of foam has varying density values. Unique methods are used to synthesize this type of foam like spray foaming, and one component foaming. Rigid foams are further classified in to laminates, sandwich Panels, high density rigid foams and slab-stock rigid foam [1-2, 22, 23]. Flexible and rigid foam can also be synthesized on lab scale using cup foaming [24].

5 APPLICATIONS

Application of polyurethane material is determined by two important parameters which are density and rigidity of polyurethane material [24]. Major uses of polyurethane material are in making of plastics, cushions, foams, rubber goods, synthetic leathers and fibres. They are also used in furniture industry, construction, and shoe industry, medicinal and agricultural applications. Rigid polyurethane foams have large application area like in thermal insulation products such as refrigerators, freezers, refrigerated trucks, chemical and petrochemical plants, water heaters, portable ice boxes, and thermos bottles. Polyurethane foam is used in many environmental applications in pollution control and pollution prevention [1, 4, 6, 7, 22, and 23].

6 CONCLUSION

It can be concluded after reviewing the literature that polyurethanes are widely used in many industrial and domestic applications. Due to this reason annual production of polyurethanes is increasing day by day in the world. A major application of polyurethane is polyurethane foam covering its major market.

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REFERENCES

[1] Ashida, K., *Polyurethane and Related Foams: Chemistry and Technology*: Taylor & Francis, 2006.
[2] Oertel, G.A.L., *Polyurethane handbook : chemistry, raw materials , processing , application , properties*, Hanser Publishers ; Hanser/Gardner Publications, 1999.
[3] Szycher, M., *Szycher's handbook of polyurethanes*, Boca Raton: CRC Press, 1999.
[4] Matsumura, S., Y. Soeda, and K. Toshima, "Perspectives for synthesis and production of polyurethanes and related polymers by enzymes directed toward green and sustainable chemistry" *, Applied Microbiology and Biotechnology,* **70**(1): p. 12-20, 2006.
[5] Begum, M. and Siddaramaiah, "Synthesis and characterization of polyurethane/polybutyl methacrylate interpenetrating polymer networks" , *Journal of Materials Science*, **39**(14): p. 4615-4623, 2004.
[6] Rivera-Armenta, J.L., T. Heinze, and A.M. Mendoza-Martínez, "New polyurethane foams modified with cellulose Derivatives", *European Polymer Journal*, **40**(12): p. 2803-2812, 2004.
[7] Molero, C., A. de Lucas, and J.F. Rodríguez, "Recovery of polyols from flexible polyurethane foam by "split phase" glycolysis: Glycol influence"*,* Polymer *Degradation and Stability,* **91**(2): p. 221-228, 2006.
[8] Ashida, K, Thermosetting foams in handbok of plastic foams, Noyes Publications, 1995.
[9] Ashida K, Saiki K.: ACS Symposium series 669, 1997.
[10] J.L Lambach and W.A Gill, Proceedings of 33rd annual polyurethane technical conference, 1990.
[11] S. Hatano, N. Yasuda: Proceeedings of polyurethane world congress, France 1991.
[12] T.M Smeicinski, R.A Neff , "Visco-elastic foam: Impact of isocyanate upon foam morphology", API Polyurethanes technical conference, 2006.
[13] TeodorSocaciu, Mihai Simon, LiviuDorin Pop, ManuelFreitas, "Research and application of visco-elastic memory foam in the field of footwear manufacturing". *Scientific Bulletin of the PetruMaior University of TirguMures, Vol*. 7, No.2, 2010.
[14] Richard S. Schmidt: "NASA pressure relieving foam technology is keeping the leading inner-spring mattress firms awake at night". *Technovation* 29 **181-191**, 2009.
[15] Krupers, M.J., et al., "Formation of rigid polyurethane foams with semi-fluorinated diblock copolymeric Surfactants", *Polymer,* **39**(10): p. 2049-2053, 1998.
[16] Ligoure, C., et al., "Making polyurethane foams from microemulsions". *Polymer,* **46**(17): p. 6402-6410, 2005.
[17] Malak, S.F.F. and I.A. Anderson, "Orthogonal cutting of polyurethane foam", *International Journal of Mechanical Sciences,* **47**(6): p. 867-883, 2005.
[18] Sarier, N. and E. Onder, "Thermal characteristics of polyurethane foams incorporated with phase change Materials", *Thermochimica Acta*, **454**(2): p. 90-98, 2007.

[19] Marsavina, L. and T. Sadowski, "Dynamic fracture toughness of polyurethane foam", *Polymer Testing*, **27**(8): p. 941-944, 2008.
[20] Singh, R., P. Davies, and A.K. Bajaj, "Identification of Nonlinear and Viscoelastic Properties of Flexible Polyurethane Foam", *Nonlinear Dynamics*, **34**(3-4): p. 319-346, 2003.
[21] Urgun-Demirtas, M., D. Singh, and K. Pagilla, "Laboratory investigation of biodegradability of a polyurethane foam under anaerobic conditions", *Polymer Degradation and Stability*, **92**(8): p. 1599-1610, 2007.
[22] Yick, K.-l., et al., "Study of thermal–mechanical properties of polyurethane foam and the three-dimensional shape of molded bra cups", *Journal of Materials Processing Technology*, **210**(1): p. 116-121, 2010.
[23] Yang, C.G., L. Xu, and N. Chen, "Thermal expansion of polyurethane foam at low temperature", *Energy Conversion and Management*, **48**(2): p. 481-485, 2007.
[24] Shoaib Suleman, S. M. K., Tahir Jamil, Waqas Aleem, Muhammad Shafiq and Nafisa Gull, "Synthesis and Characterization of Flexible and Rigid Polyurethane Foam" , *Asian Journal of Applied Sciences,* **2**(5): p. 701-710, 2014.

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EFFECT OF WELDING PROCESSES ON MECHANICAL AND METALLURGICAL PROPERTIES OF HIGH STRENGTH LOW ALLOY (HSLA) STEEL JOINTS

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ABSTRACT: High Strength Low Alloy (HSLA) steels were developed primarily for the automotive industry to replace low-carbon steels in order to improve the strength-to-weight ratio and meet the need for higher-strength construction grade materials. During this period, micro-alloyed or HSLA steels became an indispensable class for different applications like automobile industry, ship building, line pipe, pressure vessels, building construction, bridges, and storage tanks. Different welding techniques are used in this study to evaluate the mechanical properties of weldments of HSLA steel. Weldments are prepared using three welding processes such as shielded metal arc welding (SMAW), flux cored arc welding (FCAW) and friction stir welding (FSW). Friction stir welding (FSW) is a solid state technology that has attracted considerable interest since it was invented at TWI in 1991. Structural integrity issues in welding of HSLA steels are associated with different problems encountered in friction stir welding of these steels. The other important problem in welding HSLA steels is to prevent brittle fracture of welded joints due to increased strength of HSLA steels. The solid state characteristics of FSW eliminate the susceptibility of porosity and cracking. The objective is to determine the best welding process for HSLA steel by evaluating weld metal microstructure and mechanical properties including weld metal tensile strength and Charpy V-notch impact toughness are investigated. Charpy impact and tensile tests are performed on standard notched specimens obtained from the welded and main sections of the material. The hardness distribution measurements on the differently welded specimens are conducted in order to gain a deep insight of different welding processes.

KEYWORDS: Shielded metal arc welding; Flux cored arc welding; Friction stir welding; High strength low alloy steel.

1 INTRODUCTION

Structural integrity issues in welding of HSLA steels are associated with different problems encountered in fusion welding of these steels. These problems are cracking, residual stresses, distortion and fatigue damage. Among all the problems encountered during welding; cracking is the most common. The other important problem in welding HSLA steels is to prevent brittle fracture of welded joints due to increased strength of HSLA steels. Brittle fracture is caused by structural transformations in the welded joint and the heat-affected zone (HAZ) and also by impurities dissolved in the metal mainly due to hydrogen. The solid state characteristics of FSW attracted considerable interest due to the elimination of the

susceptibility of porosity and cracking. HSLA steels became an indispensable class for different applications like automobile industry, ship building, and pipe line, pressure vessels, building construction, bridges and storage tanks.

Welding HSLA Steels of these classes of high impact resistance require strict welding conditions to realize their characteristic potential also in the welds and in their heat affected zone (HAZ). The solid state characteristics of FSW attracted considerable interest due to the elimination of the susceptibility of porosity and cracking. Friction stir welding (FSW) is a relatively new solid state joining process and is the focus of constant attention in joining low and high temperature materials [1]. FSW has appeared as an easy, ecological and promising productive welding method that reduces material waste and avoids radiation and harmful gas emissions, usually associated with the fusion welding processes [2]. FSW technology has been extensively implemented in the fabrication of aluminium structure components for space vehicles, aircraft, automotive, and naval applications. Though FSW process is successful in joining these relatively soft materials and expanding the application of this process to harder, stronger materials such as carbon steels, stainless steels, and titanium alloys, it has proven difficult owing to the propensity of the tool to degrade during the welding process [3].

Much of the degradation may be attributed to the high heat (temperature of around 1200^{o} *C)* and stresses generated during friction stir welding of these high strength materials [4]. However, the development of wear resistant tool materials will benefit the FSW process and pave way for the rapid implementation in the fabrication of ferrous structures and structures made from other refractory materials. Recently, there has been considerable interest in exploring the use of FSW for joining steels and other higher-melting temperature materials. Many fundamental aspects of the process still remain unanswered, e. g. the bonding nature of joint and materials flow pattern during welding [5]. Few papers (6-15) are available on friction stir welded carbon steels, but there is a need for further experimental research to understand the fundamental mechanisms associated with the weld formation process and the welding quality. Hence, this preliminary investigation was carried out to understand the microstructural changes, tensile and impact toughness properties and fracture location of friction stir welded HSLA steel and compare these characteristics with SMAW and FCAW joints.

2 EXPERIMENTAL

The rolled plates of HSLA steel with thickness of 5 mm were cut to the required dimensions (100 mm × 150 mm) by abrasive cutting as shown in the Fig.1a. The chemical composition and mechanical properties of HSLA steel are provided in Table 1 and 2 respectively.

Table 1. Chemical composition of base metal

C	Mn	P	S	N	Si	Cr	Mo	Ti	V	Nb	Ni	Cu	Al	W
0.08	1.42	0.006	0.001	0.015	0.19	0.001	0.02	0.016	0.032	0.035	0.69	0.126	0.032	0.04

Table 2. Mechanical properties of base metal

0.2% offset Yield Strength (MPa)	Ultimate Tensile Strength (MPa)	Elongation (%) in 25 mm gauge length	Impact Toughness in (J) @ RT	Hardness of base metal @ 0.5 kg load (HV)	Fracture Location
594	638	20	61	270	Centre

The microstructure of parent metal (Fig.1c) is composed of ferrite, and few pearlites. A nonconsumable rotating tool made of tungsten based alloy shown in Fig.1d was used to fabricate FSW joints. The tool was manufactured through powder metallurgy route having a shoulder diameter of 24 mm and a tapered pin, tapering from 12 mm at the shoulder to 8 mm at the pin tip. Trial experiments and macro structural analysis were carried out to find out the feasible range of FSW process parameters. Thermocouple located at Advancing Side and Retreating Side of the middle plate and it was interfaced with Lab View software to record the heat generated during welding (fig.1.e &1.f).

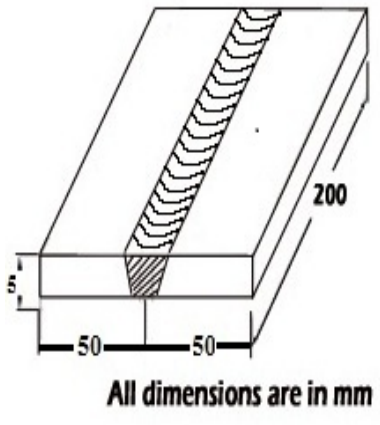


Fig.1a: Joint design

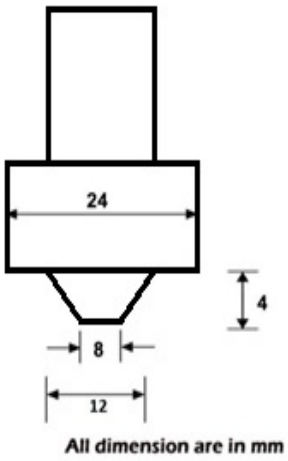


Fig.1b: Tool design

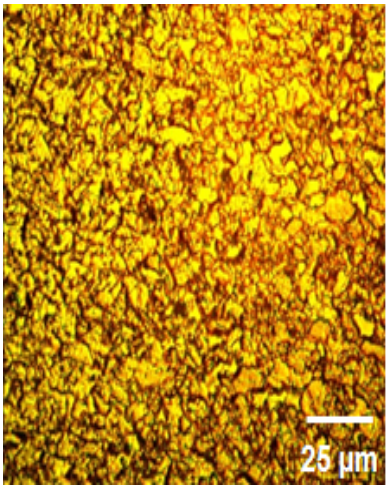


Fig.1c: Base metal microstructure



Fig.1d: Tungsten based alloy tool

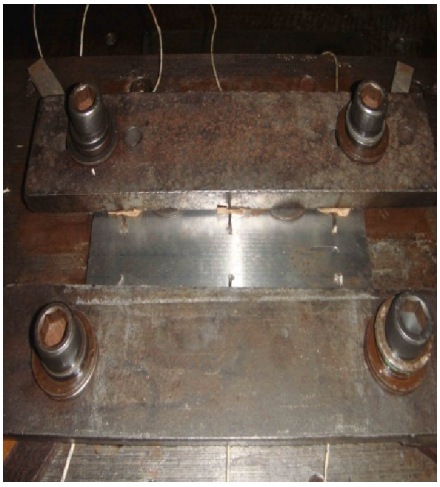


Fig.1e: Thermocouple location

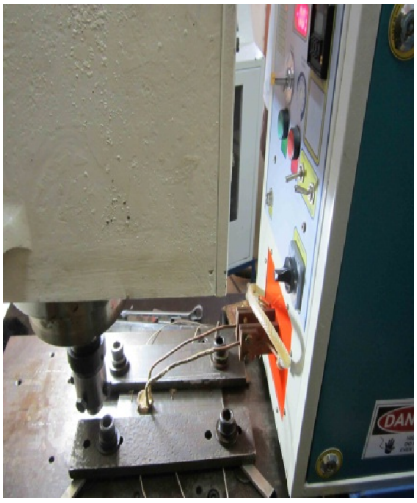


Fig.1f: Induction Preheating Source

Fig. 1. Photograph of Joint design, Tool design, Base metal microstructure Tool, Thermocouple location, and Preheating source

The Friction stir welding conditions and parameters (to get defect free welds) presented in Table 3 have used to fabricate the joints for further investigation. The welded joint of HSLA material using FSW is displayed in Fig.2.

Table 3. FSW conditions and parameters

Joint Name	Preheating Temperature (^{0}C)	Tool Rotational Speed (rpm)	Welding Speed (mm/s)	Axial Force (kN)	Heat input, kJ/mm
Joint-A	100	600	30	15	1.58



Fig.2. Fabricated joint using FSW process

The SMA and FCA Welding conditions and parameters (to get defect free welds) presented in Table 4 were used to fabricate the joints for further investigation. The welded joints of HSLA by using SMAW and FCAW are displayed in Fig.3 & 4. The ASTM E8M-04 guidelines were followed for preparing the test specimens. Tensile test specimens were prepared to evaluate the transverse tensile properties such as yield strength, tensile strength, and elongation. Electromechanical controlled universal testing machine (Make: FIE Bluestar, India; Model: UNITEK-94100) of 100 KN capacity was used for tensile testing in each condition, three specimens were tested and the average is presented.

Table 4. SMA and FCA welding conditions and parameters

PARAMETER	SMAW	FCAW
Preheating temperature/˚C	100	100
Electrode Baking temperature/˚C	300	-----
CO_2 gas flow rate/(L.min^{-1})	----	12
Filler diameter/mm	4	1.6
Current/A	113	105
Voltage/V	23	20
Heat input, kJ/mm	1.13	1.4

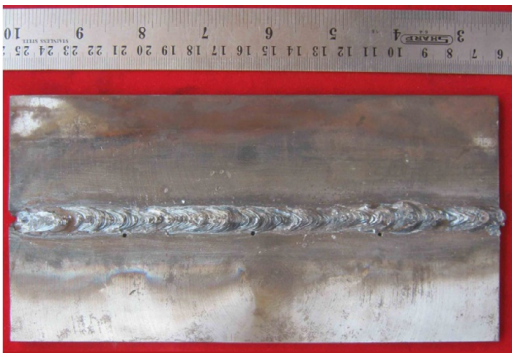


Fig. 3. Fabricated joint using SMAW process

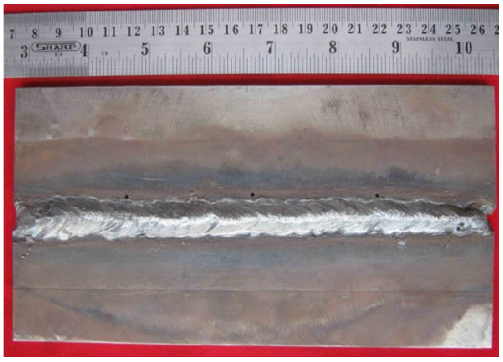


Fig. 4. Fabricated joint using FCAW process

The Charpy impact specimens were prepared to the dimensions shown in Fig. 5b to evaluate the impact toughness of the weld metal and hence the notch was placed (machined) at the weld metal (weld center) as shown in Fig.5. The plate thickness was small and sub size specimens were prepared. Impact testing was conducted at room temperature using a pendulum-type impact testing machine (Enkay, India).The amount of energy absorbed in fracture was recorded, and the absorbed energy is defined as the impact toughness of the material. ASTM E23-04 guidelines were followed for preparing and testing the impact specimens. Vicker's microhardness tester (Make: Shimadzu, Japan and Model: HMV-2T was used for measuring the hardness of the weld metal with a load of 0.5 N for 15 s. The specimens for metallographic examination were sectioned to the required sizes from the joint comprising weld metal, HAZ (heat-affected zone), and base metal regions and polished using different grades of emery papers. Final polishing was done using the diamond compound (1 pm of particle size) in the disc polishing machine. Specimens were etched with 5% of Nital solution to reveal the microstructure of FSW joints.

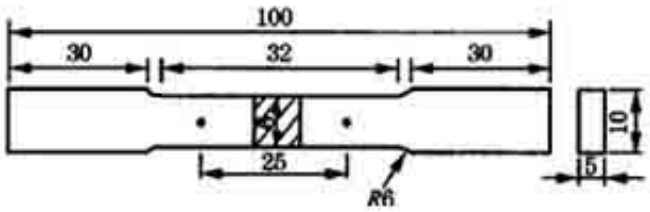


Fig 5a. Smooth Tensile specimen details

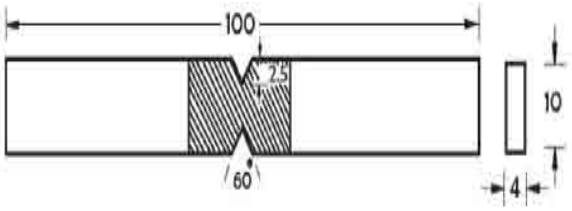


Fig 5b. Notch Tensile specimen details

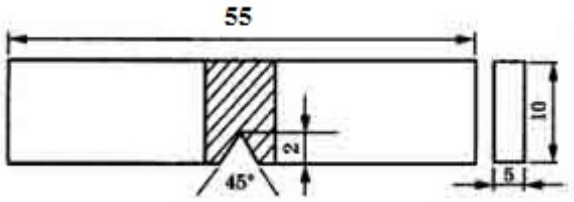


Fig 5c. Impact specimen details

Fig. 5. Dimensions of various test specimens

Micrograph examination was carried out using a light optical microscope (Make: MEJI, Japan; Model: MIL-7100) incorporated with an image analyzing software (Metal Vision).

3 RESULTS AND DISCUSSION

3.1 TENSILE AND IMPACT TOUGHNESS PROPERTIES

The transverse tensile properties of the welded joints of three tensile specimens were tested in each joints and the average is presented in Table 5.

Table 5 Transverse tensile and impact properties of the joints

Joint	0.2% offset Yield Strength (MPa)	Ultimate Tensile Strength (MPa)	Notch tensile strength (MPa)	NSR ratio	Elongation (%) in 25 mm gauge length	Impact Toughness in (J) @ RT	Hardness of weld metal @ 0.5 kg load (HV)	Fracture Location
FSW	525	595	740	1.24	10	36	380	BM
SMAW	536	610	922	1.51	16	21	356	BM
FCAW	515	588	885	1.50	13	19	334	BM

The yield strength and tensile strength of unwelded parent metal are 594 MPa and 638 MPa respectively. But the yield strength and tensile strength of friction stir welded are 525 MPa and 595 MPa, respectively. This indicates that there is a 7 % reduction in strength values due to an increase in prior-austenite grain size in reheated and isothermally held specimens [6]. Similarly, the yield strength and tensile strength of shielded metal arc welded joints are 536 MPa and 610 MPa, which are 4.5 % lower compared to parent metal. However, the yield strength and tensile strength of flux cored arc welded joints are 515 MPa and 588 MPa, which are 8 % respectively. Spanos et al. used dilatometer and high-resolution microscopy, confirming the presence of acicular ferrite and lath martensite as a function of peak temperature and cooling rate during welding [7]. Of the three types of welded joints, the joints fabricated shielded metal arc welding process exhibited higher strength values.

During tensile test, all the specimens invariably failed in the unwelded region. This indicates that the weld region is comparatively stronger than other regions and that the joint properties are controlled by weld region chemical composition and microstructure. Fonda et al. observed higher hardness in areas where the prior-austenite grain size was relatively smaller than that close to the fusion line [11]. Inclusion of tungsten in the pin influenced region resulted in the reduction of ductility and impact toughness of the weld metal. Three charpy impact toughness test specimen results were averaged and the results are presented in Table 5. The impact properties of base metal is 62 J at room temperature, when it welded with FSW process, the weld metal exhibited 36 J which is 40% lower than the base metal and the lowest impact strength was achieved in the joints fabricated by fusion welding process compared with the FSW process.

3.2 HARDNESS

The hardness across the weld cross section was measured using a Vickers Micro-hardness testing machine, and the values are presented in Figure 6. The hardness of base metal (unwelded parent metal) in its initial condition is 270 VHN. But the hardness of the joints made by FSW, SMAW, and FCAW process are in the weld metal region were 406, 298 and 285 VHN respectively.

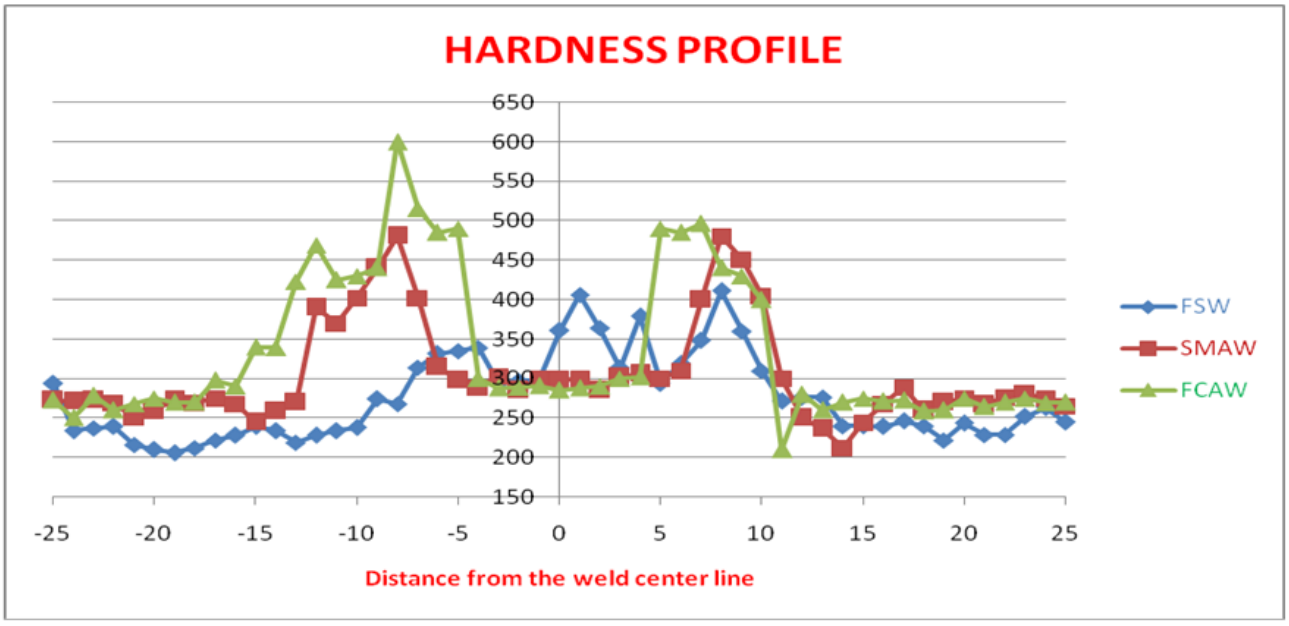


Fig. 6. Microhardness survey of all the Three Joints

This suggests that the hardness is increased in the weld metal region of joint made by friction stir welding process due to welding thermal cycle. Fig.6 shows the hardness variations across the weld. The micro hardness decreases from Centre of welded joint to matrix invariably in all the three joints. From Fig.6 (moving from left to right WM, HAZ and BM), it can be understand that the raise in micro hardness value in the weld zone and the falling of hardness value towards the base metal is due to the presence of coarse distorted micro structure invariably in all the three joints. The hardness profile (Fig.6) shows the welded joints are in agreement with the resultant strength properties at intermediate and highest strength levels respectively.

3.3 MACROSTRUCTURE AND MICROSTRUCTURE

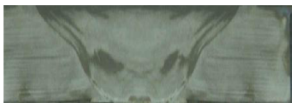
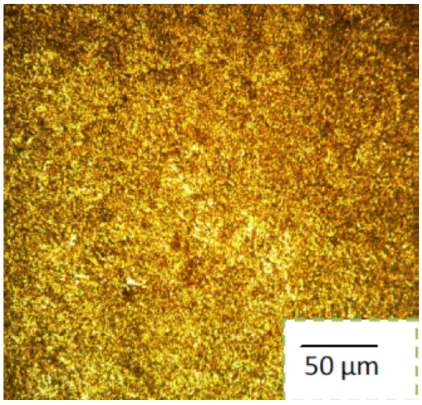
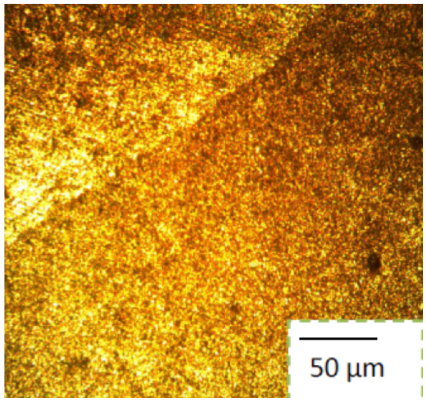
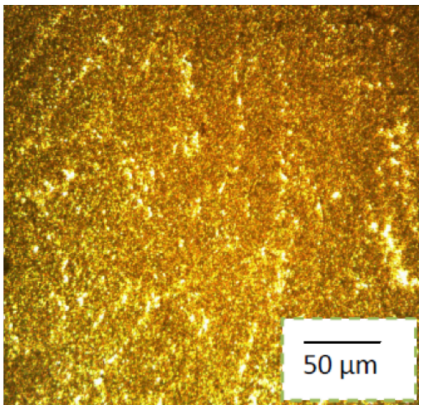
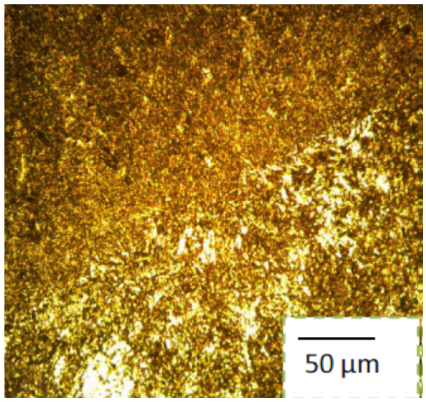
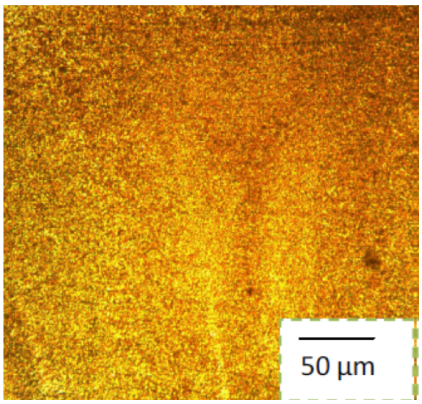
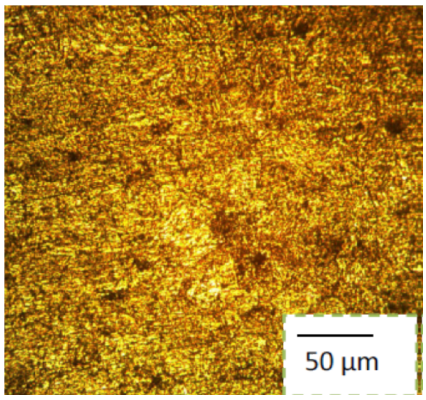
Welding process	Macrostructure	Micrographs	
FSW	 a.	 b.	 c.
SMAW	 d.	 e.	 f.
FCAW	 g.	 h.	 i.

Fig. 7. Macrostructure and Optical Micrographs of all the Three Joints

The macrostructure of the FSW joint was displayed in Figure 7. There is no macro level defect at the cross section of welded joints. The availability of different zones is clearly visible. Figure 7 (a-i) represents the macrostructures and microstructures of different locations of FSW, SMAW, and FCAW joints namely advancing side heat affected zone (ASHAZ), advancing side thermo mechanically affected zone (ASTMAZ), stir zone (SZ), retreating side thermo mechanically affected zone (RSTMAZ), retreating side heat affected zone (RSHAZ), weld metal (WZ), heat affected zone (HAZ) respectively.

Figure.7(a-b) shows macrostructure and microstructures of the various regions in the friction stir welded joint and figure.7 (d-f) are the corresponding macro and microstructures of the shielded metal arc welding respectively. Similarly, figure.7(g-i) is the corresponding macro and microstructures of the flux cored arc welding respectively. Since, the intense of heat and mechanical action is more in the TMAZ and SZ both Advancing Side (AS) and Retreating Side (RS) of the FSW joint. So, the micro structural fruition in these zones is considered to be discussed initially.

The ASTMAZ microstructure presented in Figure 7b reveals the sudden change in grain orientation due to the metal excavation from this zone to deposit in the retreating side. Whereas in SZ shows the presence of fine ferrite laths dispersed in bainitic matrix is clearly visible in Figure 7c. The microstructure taken at the weld metal and interface region of shielded metal arc welded joint which consists of accicular ferrite morphology figure 7(f and g). In figure 7 (h) the WZ microstructure of joint welded flux cored arc welding was clearly depicts the presence of sudden change in orientation of grains and coarse columnar ferrite attributed to the higher heat and mechanical action involved in this region. Figure 6i represents the microstructure of HAZ at this higher heat results coarse ferrite laths with bainitic structures.

4 CONCLUSIONS

In this investigation, an attempt was made to identify the best welding process for HSLA steel by evaluating weld metal microstructure and mechanical properties including weld metal tensile strength and Charpy V-notch impact toughness. From this investigation, the following important conclusions are derived:

- From the three welded joints are fabricated by shielded metal arc welding process exhibited higher strength values and the enhancement in strength value is approximately 20% compared to joints made by FCAW and FSW processes due to the presence of retained austenite located between bainite packets whereas lath martensite located at prior austenite grain boundaries. The retained austenite could be the key for the enhancement of the tensile strength of this joint.
- The three weld joints are fabricated by FSW process exhibited 50 % higher impact toughness compared to the joints fabricated by fusion welding processes and this is due to the amount of M-A constituents and the ferrite laths in bainitic matrix.
- A refractory tungsten based tool was successfully used to make butt-joint weld in 5 mm thick HSLA steel. However pin and the shoulder exhibited severe plastic deformation and excessive wear after weld length.
- The present trials indicate that the friction stir welded is technically feasible for joining HSLA steel for a desirable combination of high strength and without compromising the impact toughness properties.

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REFERENCES

[1] Fujii H , Cui L, Tsuji N, et al. Friction Stir Welding of Carbon Steels [J]. Mater Sci Eng, 429A(1/2) : 50, 2006,.
[2] Enomoto M. Friction Stir Welding: Research and Industrial Applications [J]. Weld Int, 17(5): 341, 2003.
[3] Park S H C, Sato Y S, Kokawa H , et al. Ebride Formation Induced by pcBN Tool Wear in Friction-Stirwelded Stainless
[4] Gan W, Li Z T, Khurana S. Tool Materials Selection for Friction Stir Welding of L80 Steel [J]. Sci Tech Weld Join, 12(7) 610, 2007.
[5] Zhu X K, Chao Y J. Numerical Simulation of Transient Temperature and Residual Stresses in Friction Stir Welding of 304L Stainless Steel [J]. J Mater Process Technol , 146(2): 263, 2004.
[6] S.W. Thompson: 40th MWSP Conf. Proc., ISS, Warrendale, PA, pp. 663-73, 1998.
[7] G. Spanos, R.W. Fonda, R.A. Vandermeer, and A. Matuszeski: Metall. Mater. Trans. A, vol. 26A, pp. 3277-93, 1995.
[8] O. Grong: Metallurgical Modelling of Welding, The Institute of Materials, London, pp. 409-11, 1997.
[9] C.E. Cross, O. Grong, S. Liu, and J.F. Capes: in Applied Metallography, G.F. Vander Voort, ed., Van Nostrand Reinhold, New York, NY, pp. 197-210, 1986.
[10] P.L. Harrison and R.A. Farrar: Int. Mater. Rev., vol. 34, pp. 35-51, 1989,.
[11] R.W. Fonda, G. Spanos, and R.A. Vandermeer: Proc. 4th Int. Conf. on Trends in Welding Research, ASM INTERNATIONAL, Materials Park, OH, pp. 277-82 , 1995.

[12] O.R. Myhr and O. Grong: Acta Metall. Mater., vol. 38, pp. 449-60, 1990.
[13] L.E. Svensson: Control of Microstructures and Properties in Steel Arc Welds, CRC Press, Boca Raton, FL, pp.101-06, 1994.
[14] S. Ravi, V. Balasubramanian, and S. Nemat Nasser, Fatigue Life Prediction of Strength Mis-matched High Strength Low Alloy Steel Welds, Mater. Des., 27, p 278–286, 2006.
[15] R.E. Dolby: Weld. J., vol. 58, pp. 225s-238s, 1979.
[16] D. Radaj: Heat Effects of Welding, Springer-Verlag Publications, Heidelberg, pp. 100-03, 1992.
[17] J.C. Ion, K.E. Easterling, and M.F. Ashby: Acta Metall., vol. 32, pp. 1949-62, 1984.
[18] M.R. Krishnadev, J.T. Bowker, J.T. McGrath, V.K. Vasudevan, and K.D. Challenger: Proc. 2nd Int. Conf. on Trends in Welding Research, ASM INTERNATIONAL, Materials Park, OH, pp. 799-803, 1989.
[19] M.R. Krishnadev, W.L. Zhang, and J.T. Bowker: Proc. 3rd Int. Conf. on Welding Research, ASM INTERNATIONAL, Materials Park, OH, pp. 599-603, 1992.
[20] V. Balasubramanian and B. Guha: Sci. Technol. Weld. Join., 4, 265, 1999.

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A Comparative Study of Scheduling Algorithms for Multiprogramming in Real-Time Systems

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ABSTRACT: Scheduling algorithms allow one to decide which threads are given to resource from moment to moment. Various process scheduling algorithms exist and this paper focuses on the scheduling algorithms used for scheduling processes in a multiprogramming system namely First-Come-First-Served (FCFS), Round Robin (RR), Shortest Job First (SJF), Shortest Remaining Time First (SRTF) and Lottery scheduling. Each algorithm has been discussed and a comparison was made on the basis of eight (8) parameters significant in processes scheduling. In fact, compared to other papers, this research made use of more parameters for the analysis. These parameters include CPU utilization, throughput, waiting time, response time, fairness, starvation, predictability and preemption. From this analysis, we showed that there is actually no scheduling algorithm satisfying the conditions of an ideal algorithm and concluded that further studies which improve current scheduling algorithms need to be done.

KEYWORDS: First-come-first-served, Round robin, shortest job first, shortest remaining time first and Lottery scheduling.

1 INTRODUCTION

In multiprogramming the sharing of computing time among programs is controlled by a clock, which interrupts program execution frequently and activates a monitor program. The monitor saves the registers of the interrupted program and allocates the next slice of computing time to another program and so on. Switching from one program to another is also performed whenever a program must wait for the completion of input or output. Thus although the computer is only able to execute one instruction at a time, multiprogramming creates the illusion that programs are being executed simultaneously, mainly because peripherals assigned to different programs indeed operate in parallel. Scheduling is the method by which threads, processes or data flows are given access to system resources. This is usually done to load balance and share system resources effectively or achieve a target quality of service. The need for a scheduling algorithm arises from the requirement for most modern systems to perform multitasking (executing more than one process at a time) and multiplexing (transmitting multiple data streams simultaneously across a single physical channel).

2 BACKGROUND

Before going further into the analysis of algorithms used to schedule processes for multiprogramming systems, a glance at what makes scheduling and multiprogramming systems is indispensable. That simply means a close definition and overview of concepts surrounding scheduling and a multiprogramming system.

Scheduling is a key concept in computer multitasking and multiprocessing operating system design, and in real-time operating system design. It refers to the way processes are assigned priorities in a priority queue. This assignment is carried

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out by software known as a scheduler. In multiprogramming systems, the running task keeps running until it performs an operation that requires waiting for an external event (e.g. reading from a tape) or until the computer's scheduler forcibly swaps the running task out of the CPU. Multiprogramming refers to multiple processes from multiple programs while multitasking is reserved to mean multiple tasks within the same program that may be handled concurrently by the operating system (OS). In fact, multiprogramming systems are designed to maximize CPU usage. The objective of multiprogramming is to have some process running at all times and to maximize CPU utilization [1], that is, keeps the CPU busy as much as possible by having it work on more than one program at a time. While in a single-processor system, only one process can run at a time; others must wait until the CPU is free and can be rescheduled, in multiprogramming systems, more than one program can run at a time. Therefore, to attain the objective in multiprogramming system, scheduling is a fundamental function for multiprogramming operating-system. The CPU, being one of the primary computer resources used in a multiprogramming system needs to be scheduled. And its scheduling is central to the operating-system design [2]. That is because the CPU scheduling will determine which processes run when there are multiple run-able processes (multiprogramming concept). In real-time systems, some waiting tasks are guaranteed to be given the CPU when an external event occurs. Real time systems are designed to control mechanical devices such as industrial robots, which require timely processing.

3 RELATED WORKS

Developing scheduling algorithms and understanding their impact in practice have been of interest since the early 1970s. Researchers have shown that, combining more than one scheduling technique improves performance [3]. In their paper [2], Neetu et al. presented a state diagram that depicts the comparative study of various scheduling algorithms for a single CPU and showed which algorithm is best for the particular situation. Their paper gave a representation on what is going on inside the system and why a different set of processes is a candidate for the allocation of the CPU at different times. In a nutshell, the objective of their paper was to analyse the high efficient CPU scheduler on design of the high quality scheduling algorithms which suits the scheduling goal. However, they were not able to arrive at a definite conclusion. Besides this work, Edwin et al. in [4] studied the scheduling of tasks in computer systems which utilize imprecise (partial) computations. In their system, tasks arrive randomly during run-time. Each task has two levels of computation time requirement: the full level computation requirement and the reduced level computation requirement. They finally devoted their attention to develop an explicit formula for the practically important performance metrics such as the normalized mean task waiting time, the mean task served computation time, and the fraction of tasks fully processed. Another paper closely related to our paper is [6]. In their paper, Ankur et al. made a comparison of existing scheduling algorithm on the basis of seven parameters namely preemption, complexity, allocation, application, waiting time, usability, and type of system. They also observed that there is no one algorithm satisfying all the seven basis parameters chosen for analysis and suggested needs for improvement. However, no direction for the improvement was provided and has been referred to as future works. In addition to these related papers, K.M. et al., in [7] surveyed research on scheduling algorithms, reviewed previous classifications of scheduling problems and presented a classification scheme. Using a uniform terminology for scheduling strategies and the new classification scheme, they identified trends in scheduling research and finally concluded their work by presenting a methodology for developing scheduling strategies. This and others papers [8, 9, 10, 11, 12], though not related to our paper, presented scheduling algorithms used in other computing fields.

4 METHODOLOGY

4.1 SCHEDULING CRITERIA

Scheduling criteria are used to compare scheduling algorithms in multiprogramming systems.

The criteria used in this paper include:

CPU utilization: This is the percentage of time that the CPU is busy. CPU utilization refers to a computer's usage of processing resources, or the amount of work handled by a CPU. Actual CPU utilization varies depending on the amount and type of managed computing tasks. Certain tasks require heavy CPU time, while others require less because of non-CPU resource requirements. CPU utilization may be used to gauge system performance. For example, a heavy load with only a few running programs may indicate insufficient CPU power support, or running programs hidden by the system monitor - a high indicator of viruses and/or malware.

Throughput: This is the number of processes completed in a unit of time. It is the average rate of successful processes completed over a specified period of time. It is measured in bits per second (bps).

Waiting time: This is the total amount of time that a process is in the ready queue waiting in order to be executed. Sometimes the waiting time could be short and at other times it could be long.

Response time: This is the time between when a process is ready to run and its next I/O request. It is the time from the submission of a request until the first response is produced (i.e., the amount of time it takes to start responding, but not the time that it takes to output that response).

Fairness: This is the criterion that ensures that each process has an equal chance of being executed as the other. With fairness brought to the fore no particular process has a so-called preference or unfair advantage over the others.

Starvation: This is a problem encountered in multitasking where a process is perpetually denied necessary resources. Without those resources, the program can never finish its task.

Starvation is usually caused by an overly simplistic scheduling algorithm. For example, if a (not very well designed) multi-tasking system always switches between the first two tasks while a third never gets to run, then the third task is being starved of CPU time. The scheduling algorithm, which is part of the kernel, is supposed to allocate resources equitably; that is, the algorithm should allocate resources so that no process perpetually lacks necessary resources.

Predictability: This is the criterion used to determine the next process to be executed after the process currently being executed.

Operating systems may feature up to three distinct types of schedulers: a long-term scheduler, a mid-term scheduler and a short-term scheduler. This simply suggests the relative frequency with which these functions are performed and are not the aim of this paper. Thus, more details about these three types of schedulers can be found in [1]. Besides, an extensive study on scheduling algorithms used in a multiprogramming system was carried out and described in the subsequent sections.

Preemption: This is the act of temporality interrupting a task being carried out by the system, without requiring its cooperation, and with the intention of resuming the task at a later time. It is normally carried out by a privileged task or part of the system known as a preemptive scheduler, which has the power to preempt, or interrupt, and later resume, other tasks in the system.

4.2 SCHEDULING ALGORITHMS

4.2.1 FIRST COME FIRST SERVED (FCFS)

First-Come-First-Served algorithm is known as the simplest scheduling algorithm. Here, processes are dispatched according to their arrival time on the ready queue. Classified as non-preemptive scheduling algorithm, it runs to completion once admitted to the CPU. Therefore, it refers to as « run until done » and uses FIFO (First-In-First-Out) algorithm to carry out the task. In other term, it means that one program runs non-preemptively until it is finished (including any blocking for I/O operation). That is, keep the CPU until done. Therefore, the FCFS scheme is not useful in scheduling interactive users because it cannot guarantee good response time. Simple to write and understand; its major drawback is that the average time is often quite long. Also, the FCFS is unfair in the sense that long jobs make short jobs wait and unimportant long jobs make important short jobs wait. However, it is more predictable than most of the other schemes since it offers time. As a matter of fact, the FCFS is rarely used as a scheme in modern operating systems but it is often embedded within other schemes.

4.2.2 ROUND ROBIN SCHEDULING (RR)

As noted above, though FCFS scheme is potentially bad for short jobs; RR scheme solves this problem by providing each process a small unit of CPU time known as quantum time which varies from 10 – 100 milliseconds. RR is also one of the simplest scheduling algorithms for processes in an operating system. In fact, after quantum expires, the process is preempted and added to the end of the ready queue. The major advantage of RR is fairness whereby each job gets an equal amount of the CPU. And its drawback is the average waiting time. The average waiting time can be bad especially when the number of processes is large. For example, let N be the number for processes in ready queue and time quantum is Q milliseconds, therefore each process gets 1/N of the CPU time. RR offers better performance for short jobs but context-switching time adds up for long jobs. Also, if the chosen quantum is: too large, response time suffers and if too small, throughput suffers and percentage overhead grows.

4.2.3 SHORTEST JOB FIRST (SJF)

Shortest Job First (SJF) is a scheduling algorithm that selects the waiting process with the smallest execution time to execute next. Another name for SJF is Shortest Process Next Algorithm. Shortest job first is advantageous because of its simplicity and because it maximizes process throughput (in terms of the number of processes run to completion in a given amount of time). However, it has the potential for process starvation for processes which will need a long time to complete if short processes are added continuously. Highest response ratio next is similar but provides a solution to this problem. Shortest job next scheduling is rarely used outside of specialized environments because it requires accurate estimations of the runtime of all processes that are waiting for execution. It is provably optimal as regards the minimization of the average waiting time. It works for both preemptive and non-preemptive schedulers.

The SJF is also called Shortest Next-CPU-Burst First. Unlike other scheduling algorithms, this algorithm assumes that information about a process's burst length is stored between the times when it is ready. In keeping with the need for efficiency, only a small amount of information is stored and only a simple calculation is performed. We can weigh the previous expectation (representing all previous bursts) and the most recent burst with any two weights that add up to 1, e.g., say 0.5 and 0.5, or 0.9 for previous expectations and 0.1 for actual time for most recent CPU burst.

The expected burst length is calculated as follows:

a(t) = actual amount of time required during CPU burst t

e(t) = amount of time that was expected for CPU burst t

e(t+1) = expected time during the next CPU burst

then... $e(t+1) = 0.5 * e(t) + 0.5 * a(t)$

4.2.4 SHORTEST REMAINING TIME FIRST (SRTF)

Shortest remaining time first is a method of CPU scheduling that is a preemptive version of shortest job first scheduling. In this scheduling algorithm, the process with the smallest amount of time remaining until completion is selected for execution. Since the currently executing process is the one with the shortest amount of time remaining by definition, and since that time should only reduce as execution progresses, processes will always run until they complete or a new process is added that requires a smaller amount of time. Shortest remaining time is advantageous because short processes are handled very briskly. The system also requires very little overhead since it only makes a decision when a process completes or a new process is added, and when a new process is added the algorithm only needs to compare the currently executing process with the new process, ignoring all other processes currently waiting to execute. However, it has the potential for process starvation for processes which will require a long time to complete if short processes are continually added, though this threat can be minimal when process times follow a heavy-tailed distribution. Synonymous to shortest job first scheduling, shortest remaining time first scheduling is rarely used outside of specialized environments because it requires accurate estimations of the runtime of all processes that are waiting for execution.

With the SRTF when a process arrives at the ready queue with an expected CPU-burst-time that is less than the expected remaining time of the running process, the new one preempts the running process. A process may mislead the scheduler if it previously ran quickly but now may be CPU intensive (the SRTF algorithm fails very badly for such a case). The SRTF algorithm provably gives the highest throughput (number of processes completed) of all scheduling algorithms if the estimates are exactly correct.

4.2.5 LOTTERY SCHEDULING (LOT)

Lottery scheduling is a probabilistic scheduling algorithm for processes in an operating system. Processes are each assigned some number of lottery tickets, and the scheduler draws a random ticket to select the next process to be executed. The distribution of tickets need not be uniform; granting a process more tickets provides it a relative higher chance of selection. This technique can be used to approximate other scheduling algorithms, such as shortest job next and Fair-share scheduling. Lottery scheduling solves the problem of starvation.

Giving each process at least one lottery ticket guarantees that it has non-zero probability of being selected at each scheduling operation. On average, CPU time is proportional to the number of tickets given to each job. For approximation in SJF, most tickets are assigned to short running jobs, and fewer to longer running jobs. To avoid starvation, every job gets at least one ticket. Implementations of lottery scheduling should take into consideration that there could be a large number of

tickets distributed among a large pool of threads. To have an array of tickets with each ticket corresponding to a thread may be highly inefficient.

5 ANALYSIS OF SCHEDULING ALGORITHMS FOR MULTIPROGRAMMING SYSTEMS

The assignment of the software, known as scheduler, used to assign priorities in a priority queue consists of mainly, CPU utilization – to keep the CPU as busy as possible. Throughput – number of process that completes their execution per time unit. Waiting time – amount of time a process has been waiting in the ready queue. Response time – amount of time a process takes from when a request was submitted until the first response is produced.

An ideal scheduling algorithm is one which:

i. Minimizes response Time that is elapsed time to do an operation (job); response time is what the user sees (e.g. time to echo keystroke in editor, time to compile a program, real-time tasks). It must meet deadlines imposed by the World.

ii. Maximizes throughput: refers to jobs per second; throughput relates to response time, but are not identical. Minimizing response time will only lead to more context switching than if you maximized only throughput.

iii. Minimizes overhead (context switch time) as well as efficient use of resources (CPU, disk, memory, etc.) and;

iv. Maximizes fairness that is sharing CPU among users in some equitable way; not just minimizing average response time.

The following table shows the analysis of the different algorithms described in section 5.2

	Algorithms	**FCFS**	**RR**	**SJF**	**SRTF**	**LOT**
1	CPU Utilization	Low	Medium	Higher	Requires very little overhead since it only makes a decision when a process completes or a new process is added	CPU time proportional to the number of tickets given to each job
2	Throughput	Traded off for better Response Time	Bad when the chosen quantum is small	Traded off for better Response Time	Gives the highest throughput of all scheduling algorithms.	Probabilistic guarantee of throughput proportional to ticket allocation.
3	Waiting Time	The average waiting time is large	The average waiting time is large as compared to others algorithms	The average waiting time is small compared to other algorithms	The average waiting time is large	Low waiting time
4	Response Time	Good	Bad when the number of processes is large	Good	Good	Good
5	Fairness	Unfair for long jobs make short jobs wait and unimportant long jobs make important short jobs wait	Fair	Unfair	Unfair	Fair
6	Starvation	No potential for starvation	Free-starvation	Long running CPU bound jobs can starve	Has the potential for process starvation for processes	Solve the problem of starvation
7	Predictability	More predictable	Predictable	Impossible to predict the amount of CPU time a job has left	Impossible to predict the amount of CPU time a job has left	Less predictable
	Preemption	Nonpreemptive	Preemptive	Handles preemptive and nonpreemptive	Preemptive	Can be preemptive or non-preemptive.

6 CONCLUSION

This paper establishes the fact that an ideal scheduling algorithm should minimize the response time, maximize the throughput, minimize the overhead (in terms of CPU utilization, disk and memory) and maximize fairness. However, it is palpable from this paper that none of the scheduling algorithms considered satisfies all of the aforementioned requirements. Hence, the contribution to knowledge made by this paper is that based on the most prioritized requirement of a particular user, the scheduling algorithm that best satisfies that requirement as outlined in this paper can be selected for use thereby allowing the user get awesome results without having to waste valuable time.

In future, another researcher can do further research in order to discover another scheduling algorithm that will be ideal thereby satisfying all the aforementioned requirements and consequently offering optimum satisfaction to the user.

REFERENCES

[1]. Silberschats, A, P.B. Galvin and G. Gagne (2012), Operating System Concepts, 8th Edition, Wiley India.
[2]. Neetu Goel, R.B. Garg; A Comparative Study of CPU Scheduling Algorithms; Internal Journal of Graphics & Image Processing, Vol. 2, Issue 4, November 2012.
[3]. C.L. LIU, JAMES W. LAYLAND, Scheduling Algorithm for Multiprogramming in a Hard-Real-Time Environment, Journal of the ACM, Vol. 20, Issue 1, Jan. 1973, PP. 46 – 61.
[4]. Edwin K.P Chong, Wei Zhao, Performance Evaluation of Scheduling Algorithms for Imprecise Computer Systems; Journal of Systems and Software, 1991.
[5]. K. L. Krausse, V. Y. Shen, H. D. Schwetman, A task-scheduling algorithm for a multiprogramming computer system: published in Proceeding SOSP '73 Proceedings of the fourth ACM symposium on Operating system principles, PP. 112 – 118; ACM New York, NY, USA 1973
[6]. Ankur B., Rachhpal S., Gaurav, Comparative Study of Scheduling Algorithms in Operating System; International Journal of Computers and Distributed Systems, Vol. No. 3, Issue I, April – May 2013.
[7]. K. M. Baumgartner, B. W. Wah, Computer Scheduling Algorithms: Past, Present, and Future, Journal Information Science; Elsevier Science Inc.:, Vol. 57 – 58; Sept./Dec. 1991; PP. 319 – 345.
[8]. Aarti Singh, Manisha Malhotra; A Comparative Analysis of Resource Scheduling Algorithms in Cloud Computing, American Journal of Computing Science and Engineering Survey, Pubicon Open Journal, 2013, PP. 14 – 32.
[9]. Tong Li, Dan Baumberger, Scott Hahn, Efficient and Scalable Multiprocessor Fair Scheduling Using Distributed Weighted Round-Robin, Published in Proceeding, PPoPP' 9 Proceedings of the 14th ACM SIGPLAN symposium on Principles and Practice of parallel programming, PP. 65 – 74.
[10]. Junchao Xiao, Leon J. Osterweil, Qing Wang, Mingshu Li, Dynamic Scheduling in Systems with Complex Resource Allocation Requirments;
[11]. Kartik Gopalan and Tzi-Cker Chiueh, Multi-Resource Allocation and Scheduling for Periodic Soft Real-Time Application, In Proceedings of Multimedia Computing and Networking 2002.
[12]. Krithi Ramamritham and John A. Stankovic, Scheduling Algorithm and Operating Systems Support for Real-time Systems, published in Proceedings of the IEEE (Vol. 82, Issue 1; Jan 1994, PP. 55-67.

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Evaluating the Effect of Distance on Specific Absorption Rate Values inside a Human Head Model

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ABSTRACT: When using electronic devices such as mobile phone, invisible electromagnetic waves are generated. These waves can be absorbed by lossy material such as human body tissues. The radio frequency field emitted from mobile phones penetrates the exposed tissues and the absorbed energy is converted to thermal energy. This thermal effect can cause harm by increasing the temperature of corresponding tissue, and damaging biological tissue, especially those of head and brain. This paper presents a critical analysis of Specific Absorption rate (SAR) at 900MHz and 1800MHz (2G-GSM) communication frequencies by considering the various gap distances between a numerically simulated human head model and source of radiation (i.e. mobile phone). It is shown here that by increasing the distance between user and mobile phone the effect of absorbed radiations can be minimized. All the numerical results are obtained by making the use of Finite Element Method (FEM).

KEYWORDS: Penetration depth, dielectric properties, finite element method, SAR, radiations.

1 INTRODUCTION

Mobile phones have become an essential part of our daily life. But excess of anything is always harmful. Due to rapid growth in the field of mobile communication technology the effect of electromagnetic radiation on human health is a subject of recent interest and research. Regular and long term uses of mobile phones may lead to detrimental health effects. Generally a mobile phone consists of an omni-directional antenna which ideally radiates in all directions. These radiations are absorbed by nearby biological tissues especially of head. This absorbed energy is then converted into thermal energy and causes the rise in temperature of corresponding tissue. Absorption of radiations beyond a certain limit may also lead to adverse health effects. In [1] authors have reported that a very small temperature rise in hypothalamus of 0.2–0.3°C leads to altered thermoregulatory behavior. However, since the normal active heat transfer is very effective in regulating temperature in the brain, a temperature rise of up to 3.5°C in the brain is harmless and does not cause any physiological damage [2]. A measure of this absorbed radiation is provided by Specific Absorption Rate (SAR) which is defined as the power absorbed per mass of the tissue in watts/kg. When exposed to radiations human head is considered as the most sensitive part of the entire human body. Therefore most of the research has been carried out only on human head. The temperature increase inside the human head, however, cannot be measured directly. In order to overcome this difficulty, a well-known bioheat equation was proposed by Pennes [3] for following the time variation of temperatures in different biological tissues. Pennes suggested that the dissipation of the temperature is due to conduction with other tissue types, convection through blood perfusion rate and radiation to the surroundings.

Different countries follow different standards for specific absorption rate (SAR) analysis. In United State, for exposure to RF energy from wireless devices, the allowable Federal Communications Commission (FCC) SAR limit is 1.6 W/kg, averaged over 1gram of tissue for duration of 30 minutes [4]. While in Europe, according to International Commission of Non-ionizing Radiation Protection (ICNIRP) the allowable SAR limit is 2W/kg, averaged over 10 gram of tissue for duration of 6 minutes [5].

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Additionally IEEE C95.1 gives recommendation to prevent harmful effects in human beings exposed to electromagnetic fields in the frequency range from 3 kHz to 300 GHz [6]. The most important aspect for performing the analysis of SAR is the selection of the method to carry out the required measurements. Experimental methods to evaluate SAR are quite costly and also time consuming. It is against the law and moral to expose a human being to electromagnetic radiations for experimental purpose. Moreover, numerical analysis through simulations provides more flexibility to analyze the same. Therefore several different kinds of models can be used to investigate SAR and heating effects. These include Finite Element Method (FEM), Finite Difference Time Domain Technique (FDTD), Finite Difference Method (FDM), Method of Moments (MoM) etc. to make predictions without needing laboratory tests. Among these methods FDTD [7] and FEM [8] are popular choice for performing the numerical analysis of SAR, as these models have shown very accurate results. Also between the two, FEM is found to be a more powerful technique for handling problems involving complex geometries due to its flexible tetrahedral meshing scheme when compared with cubic Yee-type grids of FDTD method.

This paper presents a measure of SAR and corresponding rise in temperature inside a human head model exposed to frequency range used in GSM-900 AND GSM-1800 mobile phones.

2 METHOD AND MATERIALS

In present work a realistic human head model through numerical simulation is developed. Radiation comes from a patch antenna of a mobile phone which is placed on the left side of the head at a distance of 0 cm and 1cm as shown in Fig. 1. SAR is the basic parameter that is taken into consideration for the evaluation of the exposure hazards in the radio frequency and microwave range. “Specific” refers to the normalization to mass, and “absorption rate” refers to the rate of energy absorbed by the object. SAR can be calculated by Equation (1) as follows:

$$\mathrm{SAR} = \frac{\sigma \mathrm{E}^2}{\rho} \tag{1}$$

Where, σ is electrical conductivity (S/m), E is electric field intensity (V/m), and ρ is the density of the tissue (Kg/m^3). The first step in the analysis of electromagnetic radiation with human head is the determination of the induced internal electromagnetic field and its distribution. Thereafter, rise in temperature within the human head will be analyzed. The system of governing equations is solved numerically using the finite element method. 900 and 1800MHz spectrum are widely used in the field of GSM mobile communication. The maximum power that GSM phones are permitted to transmit are 2W (900MHz) and 1W (1800MHz). However, the average power transmitted by a phone is never more than one eighth of these maximum values (0.25W and 0.125W respectively).

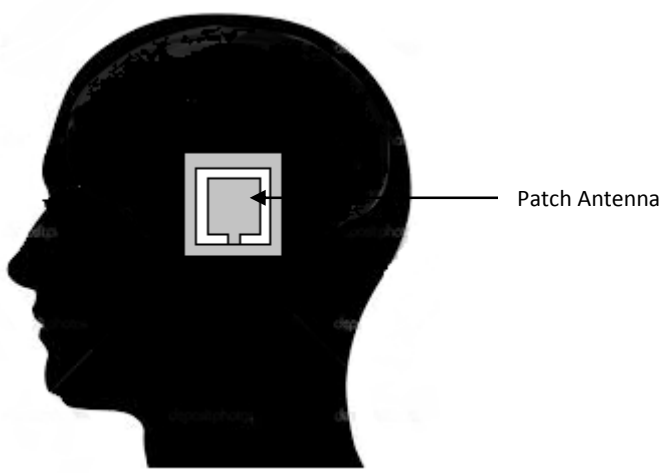


Fig. 1. Human Head Model with Source of Radiation

In this study, a square patch antenna is considered as a source of electromagnetic radiations and is placed at the left side of the head model at a distance of 0cm and 1cm. Fig. 1 is illustrating the human head model exposed to radiations from a mobile phone which consists of square patch antenna. A finite element model of a problem gives piecewise approximation to

the governing equations. The basic premise of this method is that a solution region can be analytically modeled or approximated by replacing it with an assemblage of discrete elements. Since, these elements can be put together in a variety of ways; they can be used to represent exceedingly complex shapes. The method is very flexible since the elements can be chosen to closely conform the original geometry of material boundaries. Dielectric properties of brain tissue are tabulated in Table 1. These dielectric parameters are taken from [9].

Table 1. Dielectric Properties of Brain Tissue

Frequency	Type of tissue (Brain)	
	ε_r	σ (S/m)
900 MHz	45.805	0.765
1800 MHz	43.545	1.153

3 ANTENNA AND HEAD MODEL DISTANCE VARIATION

A very important parameter that affects the energy absorbed in the biological tissues when exposed to radiation from mobile phone is the distance between the antenna and tissue. The rate at which radiations emitted from a source of electromagnetic radiation passes through a surface at a distance d from the source is proportional to 1/d^2. This is known as the Inverse Square Law. According to this law the radiation flow falls off rapidly as the distance between the radiating source and receiving tissue increases. According to [10] if the distance between the antenna and human head increases then the value of SAR decreases. Not only the distance but also the size, type of antenna and its efficiency affect the SAR values [11]. In [12] a comparative study has been performed among patch, monopole and dipole antenna and patch showed the least radiations effect. Therefore a patch antenna is selected here as a source of electromagnetic radiations.

Radio waves become less penetrating into the body tissues as the frequency increases. It is observed that due to short wavelength at higher frequencies radio power penetrates to small distances. Higher the frequency lesser will be the depth of penetration. When tissues are exposed to radiation depth of penetration depends on frequency and electrical properties of tissue and is given by following Equation (2):

$$\delta = \sqrt{\frac{1}{\pi \mu \sigma f}} \tag{2}$$

Where, δ is the penetration depth (m), μ is the tissue magnetic permeability (H/m), σ is the tissue electric conductivity (S/m), and f is the RF source frequency (Hz). Depth of penetration is inversely proportional to the frequency and conductivity of the material. Thus at higher frequency absorptions of radiations become superficial and remain confined to head surface only. Table 2 shows the results obtained for SAR and corresponding rise in temperature at a distance of 0 cm and 1cm between antenna and head model.

Table 2. Peak SAR and Rise in Temperature at Different Distances Between Head model and Mobile Phone

Frequency (MHz)	Distance 0 cm		Distance 1 cm	
	Peak SAR (W/kg)	Rise in Temp (^{o}C)	Peak SAR (W/kg)	Rise in Temp (^{o}C)
900	0.405	0.028	0.192	0.007
1800	0.625	0.017	0.276	0.004

From these results it is clear that mobile phone operating at 1800 MHz frequency is safer to use than mobile phone operating at 900MHz.

4 CONCLUSION

This paper presents the evaluation of effect of distance between head model and mobile phone on SAR values and corresponding rise in temperature in a human head model at 900MHz and 1800MHz frequencies. This paper has shown that even a small variation of 1cm in the distance between user and mobile phone can have a great impact on SAR values and corresponding rise in temperature. Also at higher frequency the strength of radio wave to penetrate inside the tissues

reduces. And finite element method is found to be an effective technique to perform the numerical analysis of complex geometries.

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REFERENCES

[1] E.R. Adair, B.W. Adams, G.M. Akel, "Minimal changes in hypothalamic temperature accompany microwave-induced alteration of thermoregulatory behavior", *Bioelectromagnetics,* vol. 5, pp. 13–30, 1948.

[2] J. Wang, and O. Fujiwara, "FDTD Computation of Temperature Rise in the Human Head for Portable Telephones," *IEEE Transaction on Microwave Theory Tech.,* Vol. 47, pp. 1528–1534, 1999.

[3] H.H. Pennes, "Analysis of tissue and arterial blood temperatures in the resting human forearm", *J. Appl. Physiology,* vol. 85, 1998.

[4] FCC, OET Bulletin 65, "*Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields,*" Edition 97- 01, 1997.

[5] ICNIRP, "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (upto 300 GHz)," *Health Phyics*, vol. 74, pp. 494-522, 1998.

[6] IEEE, "IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 KHz to 300 GHz," *IEEE Standard C95.1*, 2005.

[7] K.S. Yee, "Numerical solution of initial boundary value problem in solving maxwell's equations in isotropic media," *IEEE Trans. Antennas Propagation*, vol. AP-14, pp. 302-307, 1966.

[8] J. Cousty, S. Verdeyme, M. Aubourg and P. Guillon, "Finite elements for microwave device simulation: application to microwave dielectric resonator filters", *IEEE Trans. Microwave Theory. Tech*, vol. 40, pp. 925-932, 1992.

[9] D.Andreuccetti, R.Fossi and C.Petrucci, 1997, An Internet resource for the calculation of the dielectric properties of body tissues in the frequency range 10 Hz - 100 GHz, *Website at http://niremf.ifac.cnr.it/tissprop/. IFAC-CNR, Florence (Italy)*, Based on data published by C.Gabriel et.al in 1996.

[10] Mohammad Rashed Iqbal Faruque, Mohammad, Tariqul Islam, Norbahiah Misran, "SAR analysis in human head tissues for different types of antennas", *World Applied Sciences Journal*, vol. 11, pp. 1089-1096, 2010.

[11] Mohammad Rashed Iqbal Faruque, Norbahiah Misran, Rosdiadee Nordin, Mohammad Tariqul Islam and Baharudin Yatim, "Estimation of specific absorption rate and temperature increases in the human head due to portable telephones," *Scientific Research and Essays,* Vol. 6, pp. 1209-1215, 2011.

[12] Adel Z. El Dein, Mohamed A. A. Wahab, Mohamed M. Hamada, T. H. Emmary, "The Interactions between the mobile handset antenna of various types and the human head," *Mobile Computing,* vol. 2, pp. 21-28, 2013.

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Influence of both media carbon source and strains variety on the Biofilms formation ability by *Pseudomonas aeruginosa*

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ABSTRACT: The ability of biofilms formation was studied by utilizing fifty *Pseudomonas aeruginosa* strains isolated from both environmental and hospital samples. The support utilized for strains fixation was in polystyrene and contained two liquid media: Luria-Bertani and Mineral Medium supplemented with Hexadecane as the sole source of carbon and energy. The results obtained showed that the Biofilms-forming ability depend on both media carbon source and the *P. aeruginosa* strain variety. When the carbon source is hard to degrade or toxic, like hexadecane or derived substrates, the formed biofilms presented a high density; however, when the carbon is easy to degrade by the strains; like that one of L.B medium, the formed biofilms have a slight density. Furthermore, this density is also influenced by the strains although they belonged to the same species; at this purpose, the ERIC - PCR analysis, showed that *P. aeruginosa* strains studied are various because their profil ERIC present a percentage of similarity which not exceeds 60%.

KEYWORDS: Biofilm, carbon source, growth, *Pseudomonas aeruginosa*, ERIC-PCR.

1 INTRODUCTION

Among the strategies to clean up pollutants, it is widely recognized that biological treatments, so called bioremediation technologies, have the advantage over chemical and physical treatments in terms of their compatibility with global cycles and thus less impact on the environment [1].

One of the options for effective clean-up methods of contaminated sites is the use of carrier materials so as to maintain sufficient activity of inoculants during prolonged periods. There are several reports demonstrating that immobilized or encapsulated cells effectively degrade pollutants at the contaminated sites [2],[3]. However, the cellular and molecular mechanisms underlying these technologies are largely unknown [4].

In natural environments, bacteria often exist in closed association with surfaces and interfaces, where they form biofilms. Biofilms are structured microbial communities formed on the surface of solid materials or interfaces [5]. It has recently been pointed out that environmental microorganisms exist predominantly as biofilms and gain high tolerance to physical, chemical, and biological stresses [6].

Biofilm-associated cells exhibit specific gene expression, controlled many times by quorum sensing systems, or dormancy, to allow their increase in resistance [7], [8], [9], [10], [11]. Thus, forming biofilms is considered a natural strategy of microorganisms to construct and maintain a favorable niche in stressful environments [12], [13].

The aim of this study is to demonstrate the performance of some *Pseudomonas aeruginosa* (*P. aeruginosa*) strains isolated from both environmental and hospital samples to form biofilms on surface containing a carbon source toxic or hard to degrade. The genetic relationship between the *P. aeruginosa* strains forming biofilms was appreciated by the analysis of their Enterobacterial repetitive intergenic consensus (ERIC) sequences.

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2 MATERIALS AND METHODS

2.1 INOCULATION, ISOLATION AND IDENTIFICATION OF BACTERIAL STRAINS

All bacterial strains used in this study belonged to *P. aeruginosa* species. They are isolated in city and area of Meknes (Morocco) from clinical and environment samples. The clinical samples were coming from hospital services, they included pus and respiratory secretions and were taken by using sterile swabs. The environment samples include soil and water. All sampling were caring out during the year 2012.

Water samples were inoculated directly in Petri dishes containing King A, King B medium or citrimide agar. For soil samples, we performed a suspension of 10% (w/v) in sterile distilled water, and then the supernatant is inoculated as before. Swabs containing the pathological specimens are suspended in 1ml of sterile physiologic water; this later is inoculated as the water samples. All inoculated media were incubated at 30°C during 24h to 48h.

The bacterial colonies obtained were examined to identify those belonging to the species *P. aeruginosa*. The identification tests are primarily morphology, Gram, oxidase enzyme, production of pigments pyoverdin and pyocyanin and growth at 42° C. The confirmation was done by the gallery system "API 20NE" (BioMérieux, Marcy l'Etoile, France).

2.2 BIOFILMS ASSAYS

P. aeruginosa strains isolated during this work were tested for "Biofilm assay". The culture media utilized are different: the first is Luria-Bertani (LB) which enabled a good strains growth; the second is the mineral medium (M.M) supplemented with 0,5% of hexadecane as the sole source of carbon and energy. This medium was chosen because his carbon source is slightly toxic toward *P. aerugionsa* strains.

The M.M is containing in g/L: KH_2PO_4: 0.68; $MgSO_4.7H_2O$: 0.35; Na_2HPO_4: 1.7; $CaCl_2$: 0.02; NH_4NO_3: 1; $FeSO_4$: 0.004. The media was supplemented with a solution (0, 01% final concentration) of trace elements containing in g/L: $CuSO_4$: 0.05; H_3BO_4: 0.1; $MnSO_4$: 0.1; $ZnSO_4$: 0.1; Na_2MoO_4: 0.1; $CoCl_2$: 0.1. The pH was adjusted to 7.

The Biofilms assay was performed in microtiter plates of polystyrene according to the crystal Violet method as described by Stepanovic *et al*. [14]. Briefly, 4 µL of overnight culture was inoculated into 200 µL of medium culture in a 96 polystyrene microstate plate wells. All the samples were prepared in triplicate for each sampling time with a negative control containing no strains; the plates were incubated at 37˚C during 24 hours. They were subsequently washed threefold with sterile distilled water, left to dry at room temperature, added with crystal violet (200µL/well) and incubated for 15 minutes at room temperature. Then, each well was washed with sterile distilled water threefold and left to dry at room temperature.

Biofilms formation was evaluated by reading the absorbance (optical density) of each well using a spectrophotometer (BIO-RAD Laboratories PR 2100), at a wavelength of 490 nm. Based on the optical density (ODi) of the samples and on the average of optical density of the negative control (ODc), the samples were classified as strong (4xODc < ODi), moderate (2xODc < ODi ≤ 4xODc), weak (ODc < ODi ≤ 2xODc) or non-producer of biofilm (ODi < ODc).

2.3 MOLECULAR BIOLOGY AND PCR AMPLIFICATION TECHNIQUES

2.3.1 PREPARATION OF DNA TEMPLATE FOR PCR

Preparation of DNA template for PCR: Total DNA was extracted by suspending 4-5 colonies of overnight culture of *P. aeruginosa* isolates growing on LB agar (Bio-Rad, Marnes-la-Coquette, France) in 500µL of DNase- and RNase-free water (Invitrogen, Paisley, UK). The suspension was boiled at 100°C for 10min in thermal block (Polystat 5, Bioblock Scientific, France), then centrifuged at 19000 x *g* for 5min. An aliquot of 1 µL of the supernatant was used as DNA template for PCR.

2.3.2 GENOTYPING OF *P. AERUGINOSA* STRAINS BY ERIC- PCR

Enterobacterial repetitive intergenic consensus (ERIC) analysis was performed using the primer ERIC-2 (5'-AAGTAAGTGACTGGGGTGAGCG-3') and ERIC 1R (5'- ATGTAAGCTCCTGGGGATTCAC-3') as previously described [15]. Each PCR reaction was carried out in a 25 µL volume using 1.5 U of *Taq* DNA polymerase (Promega, Madison, Wis, USA) in the reaction buffer provided by the manufacturer containing 2.5 mM of $MgCl_2$, 50 µM of each deoxynucleoside triphosphate, 10% of dimethyl sulfoxide, 1.7 mg/mL of bovine serum albumin, 2 μM of the selected primer and 5 μL of the DNA template. Aliquots (10 μL) of each PCR product were subjected to an electrophoresis on 1.5% agarose gel.

The similarity of the ERIC-PCR banding patterns was analyzed by the Dice coefficient, and the data obtained were analyzed by the unweighted pair group method with arithmetic average (UPGMA) clustering using the Pearson correlation coefficient (Biochemistry and Biotechnology Department, Rovira i Virgili University, Tarragona, Spain) (http://genomes.urv.cat/UPGMA/index.php).

2.4 STATISTICAL ANALYSIS

The results were analyzed with descriptive statistics wherever appropriate Khi square test and Fisher's exact test were used to evaluate the statistical significance of the differences in the result. A *p*-value of <0.05 was considered statistically significant. Statistical analysis was performed using SPSS v20.0 software.

3 RESULTS

3.1 ISOLATION AND IDENTIFICATION OF BACTERIAL STRAINS

Among bacterial strains isolated, a total of 50 strains are Gram-negative, oxidase positive, showing growth at 42 ° C and producing pyoverdine and pyocyanin on king A and king B as well as on citrimide agar mediums. They were capable of denitrification and were identified as *P. aeruginosa* strains using classical tests. Thirty five of them are from the environment and fifteen are from hospitals. Theses strains are indicated Pa in the text and preceded with the letter E or H in case of Environmental or Hospital origins.

3.2 ATTACHMENT OF *P. AERUGINOSA* STRAINS TO POLYSTYRENE SURFACE

When using LB medium, all *P. aeruginosa* strains showed a high growth, but their attachment to the surface polystyrene varied greatly according to incubation time. Thus, at first incubation time (2h to 4h) the fixation amount unregistered was high (about 50%) and then began to decrease when incubation time increased; it reached negligible percentages after 18h of incubation. The attachments experiences results for the 50 *P. aerugionsa* strains are illustrated in figure 1.

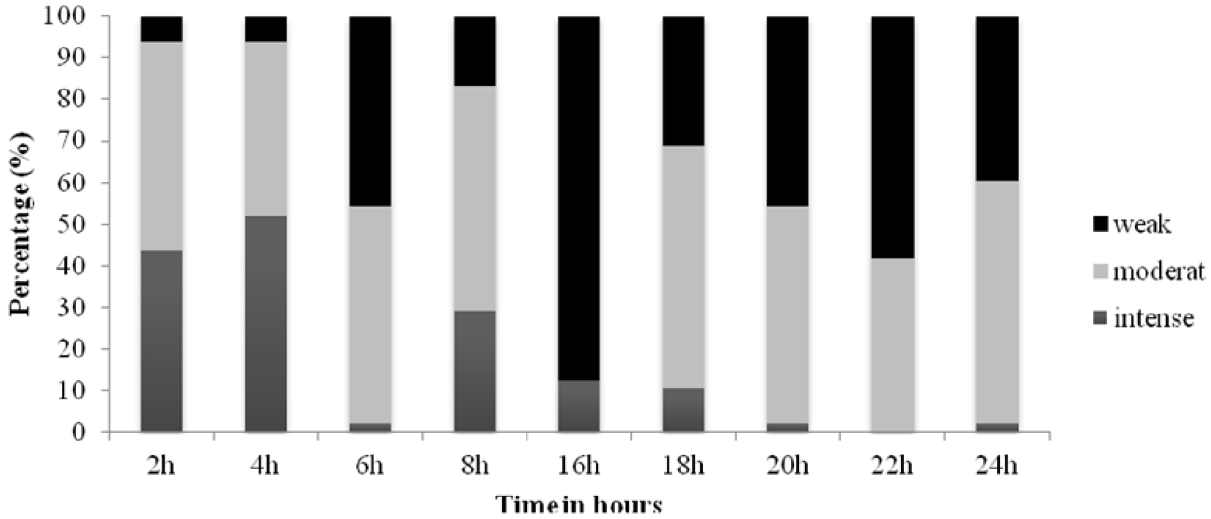


Fig. 1. Kinetic of biofilm-forming ability in L-B Medium for 50 P. aeruginosa strains studied

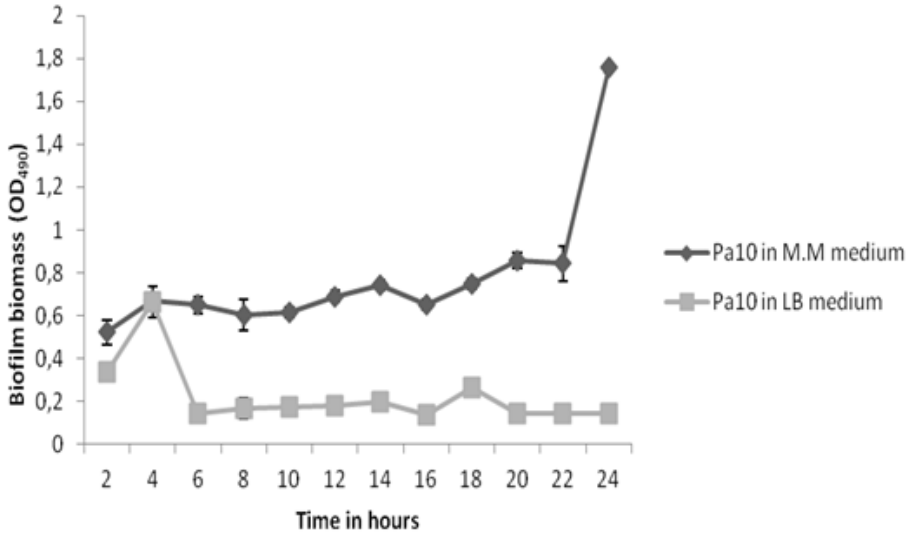
We have compared the ability of environmental and hospital *P. aeruginosa* strains to form biofilms in L.B medium at different incubation times; thus, we have noted various biofilm-forming abilities, although the strains have the same origins (Environmental or hospital). At this purpose, some strains formed biofilms strongly, and other moderately or weakly. The results obtained are registered in table I.

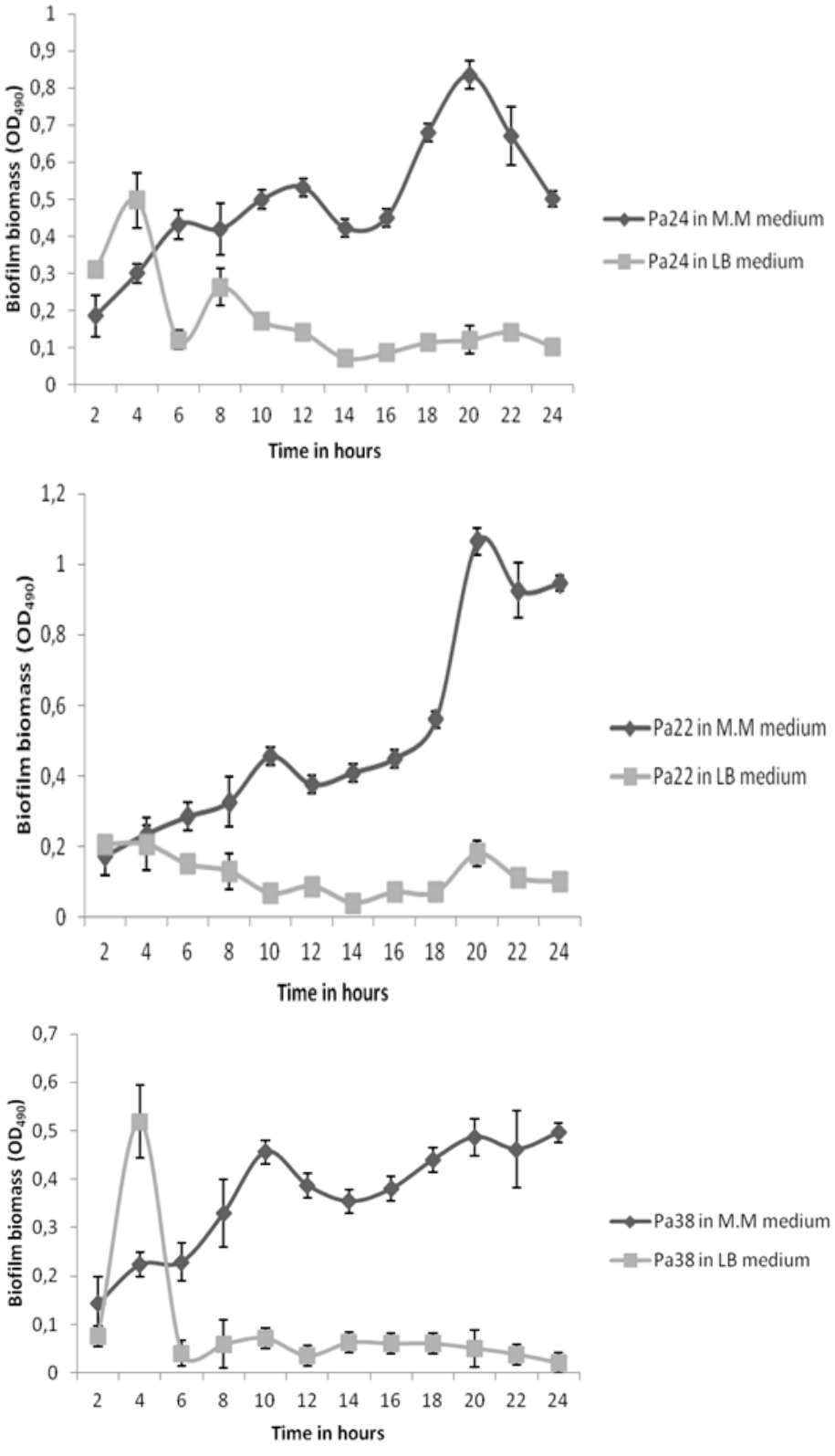
Table 1. Comparison of biofilm-forming ability in LB medium for P. aeruginosa strains isolated from hospital and environmental samples

Time in hours (h)	Biofilm-forming ability (%)								
	Strong			Moderate			Weak		
	Environmental strains	Hospital strains	*p*	Environmental strains	Hospital strains	*p*	Environmental strains	Hospital strains	*p*
2h	51.4	23.1	0.07	48.6	53.8	0.74	0	23.1	0.01
4h	54.3	54.3	0.61	42.9	38.5	0.78	2.9	15.4	0.17
6h	2.9	0	1	54.3	46.2	0.61	42.9	53.8	0.49
8h	25.7	38.5	0.7	62.9	30.8	0.04	11.4	30.8	0.18
16h	0	0	-	11.4	15.4	0.65	88.6	84.6	0.71
18h	11.4	7.7	1	60	53.8	0.7	28.6	38.5	0.50
20h	2.9	0	1	54.3	46.2	0.6	42.9	53.8	0.49
22h	0	0	-	40	46.2	0.7	60	53.8	0.70
24h	2.9	0	1	60	53.8	0.7	37.1	46.2	0.57

It appears that more than 50% (51 to 54%) of environmental strains possess a strong ability to form biofilms during the first hours (2 to 4h) of incubation, but this percentage decreased and reached 2,9 % after a period of 18h. For strains having the same origin, the ability of biofilms-forming is also variable. So, we note the values of 54,3% and 2,9% for the same incubation time (4h). However, it is important to note than more of 80% of *P. aeruginosa* strains showed a weak biofilm-forming ability just at 16h of incubation and then began to decrease with time for reaching the value around 37%.

Then, we have tested the biofilm-forming ability in M.M supplemented with 0,5% hexadecane but only for five *P. aeruginosa* strains. These strains grew in presence of hexadecane as the sole source of carbon and energy but at variable intensity. Three of them are from environmental origin: *EPa10, EPa22* and *EPa45*; the two other are from Hospital origin: *HPa 24* and *HPa38*. The results obtained varied according to strains. So, after 24h of incubation, the maximum O.D reached the value of 1.8 for the strain *EPa10* and the minimum was 0.9 for the strain *HPa24* (figure 2). Surprisingly, the strain that reached a high D.O value was that presented a high growth. Furthermore, the difference of biofilm-forming between M.M. and L.B. medium was very clear and outstanding. Thus, the five *P. aeruginosa* strains studied formed a developed biofilm under hexadecane growth.




Biofilm biomass (OD_{490})
Time in hours
Pa24 in M.M medium
Pa24 in LB medium
Pa22 in M.M medium
Pa22 in LB medium
Pa38 in M.M medium
Pa38 in LB medium

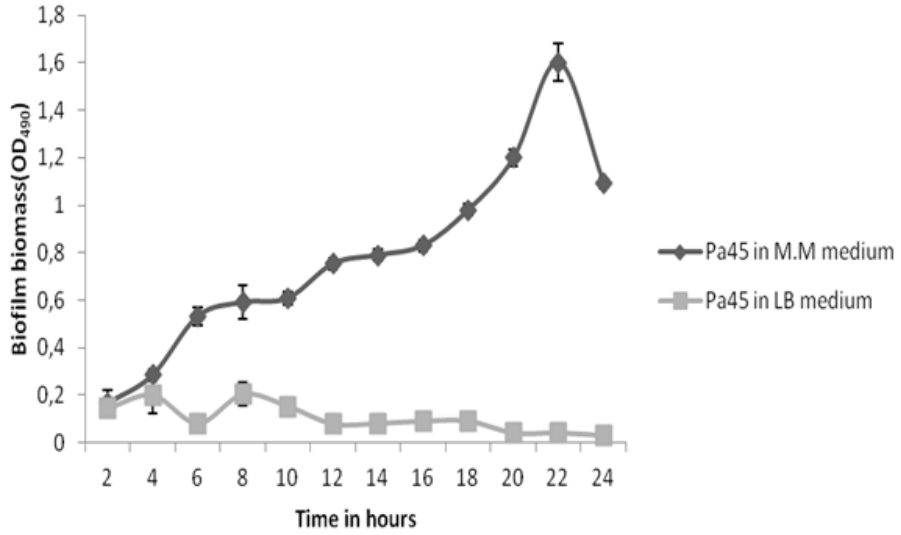


Fig. 2. Quantification of the biofilm biomass by crystal violet staining (OD_{490}) in the presence of L.B medium or M.M supplemented with hexadecane in microtitre plates during 24h of incubation.

The formation of biofilms has been visualized with the crystal violet staining, particularly designed as a ring more usually dense around the top of the wells in the surface liquid (S-L) interface. However, a small amount of biofilms has been observed in the bottom of wells. This was observed for the two mediums studied. But the visual difference was manifested by the fact that L.B. medium biofilms formation was discontinuous over the time, while for the M.M. media, the biofilms formation was low at the beginning and then continues to increase until the end of the experiment, especially for *EPa10* strain (Figure 2).

Therefore, we noted that L.B. medium, which allow good growth for all bacterial strains, enabled only a weak biofilm density. In contrast, the M.M medium, which contains carbon source not easily utilized by the bacterial strains, enabled high biofilms density. So, it emerges from these results that the nature of carbon source influenced the ability of biofilm formation and these ability is influenced by the variety of *P. aeruginosa* strain. In another way, we can say that the heterogeneity in the Biofilm-forming ability demonstrates the genetic diversity into the species of *P. aeruginosa* studied.

In order to appreciate the phylogenetic relationship between five *P. aeruginosa* strains chosen for this study, we have analyzed the bacterial genome by ERIC technique. The ERIC-PCR profile obtained is illustrated in figure 3.

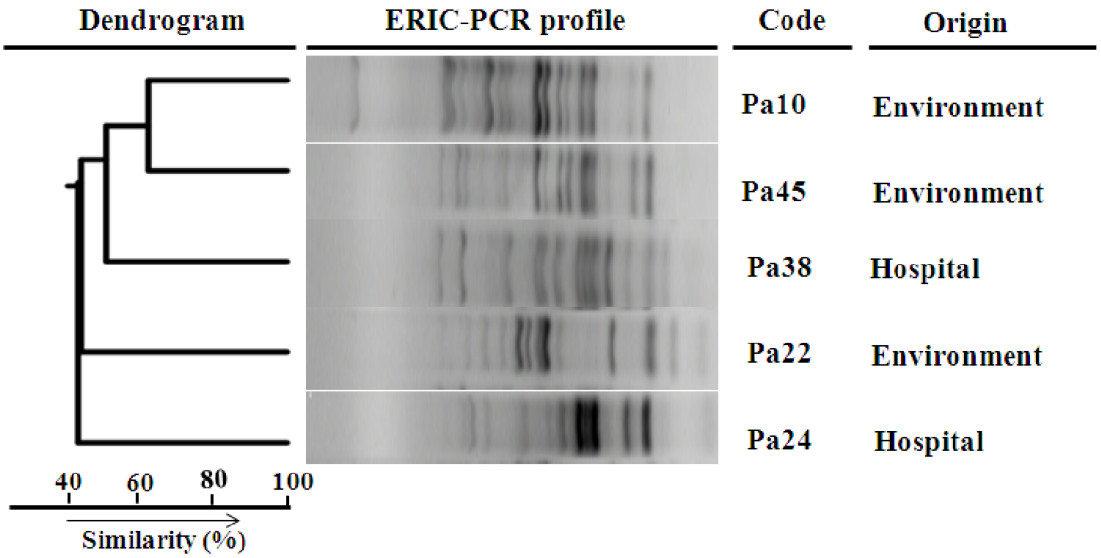


Fig. 3. Dendrogram based on ERIC-PCR profile of five hexadecane degrading P. aeruginosa

The interpretation of ERIC-PCR patterns was based on the criteria of Tenover et *al.* [14]. Thus, the strains showing more than three DNA fragment variations and a similarity of <80% at dendrogram analysis were considered to represent different ERIC-PCR types, while one- to three-fragment differences and a similarity of >80% upon dendrogram analysis were considered to represent ERIC-PCR pattern subtypes.

Based on these criterions, we can suggest that the similarity of the studied strains is about 40% to 60%. So, these strains represent various subtypes belonging to *P. aeruginosa* species.

4 DISCUSSION

The formation of biofilms by *P. aeruginosa* strains has been reported by many workers. Thus, Gross *et al.* [16], Davey et *al.* [17], Ramsey and Whiteley [18], Toutain *et al.* [19] reported that many bacterial species enabling O.D like or higher than 0,8 belonged to *Pseudomonas* genus. These reports are consistent with our results (Figure 2).

Meliani and Bensoltane [20] reported that all bacterial strains are able to produce biofilms; however, these latter varied from an almost invisible film to a thick structure depending on the presence of carbon source. Furthermore, according to Stepanović *et al.* classification [14] the *Pseudomonas* isolates having an OD_{590} ranging from 0.29 to 0.35 were categorized as having moderate biofilms. These results are also consistent with those obtained in our study but in the presence of LB medium. However, when the culture medium become relatively toxic (such growth in hexadecane presence), *P. aeruginosa* strains reply to stress by forming strong biofilms. This latter phenomenon can be explained by the fact that medium containing hexadecane become toxic after 10h of incubation, because the accumulation of short chain alkanes derived from initial substrate (hexadecane).

Previous studies indicated that Pseudomona*s* biofilms formed in a 96-well microtiter dish declines after about 10h of incubation, probably because of presence and increase of cells but in planktonic forms [21]. However, in this study, and in presence of hexadecane medium, *P. aeruginosa* strains decreased in planktonic forms and simultaneously increased in fixated form after a period of 8 to 10h. During this period, the liberation of short chains alkanes (alkanes with carbon C6 to C10) in medium stimulates probably the biofilms formation.

Some biosurfactants (such rhamnolipids molecules) stimulate the attachment and/or detachment of bacteria from the surface of xenobiotics by influencing the hydrophobicity of the bacterial cell surface or the surface of the xenobiotic [22], [23], [24]. We hypothesized; therefore, that the surfactants could influence *P. aeruginosa* cell-to-cell and/or cell-to-surface interactions [25]. However, it's important to signal that biosurfactants are generally synthesized by bacterial strains for faciliting hydrocarbon biodegradation and growth. So, their levels increase with high levels of biodegradation. Nevertheless, these molecules seem also taking place in cases of cell-cell interaction or cell-surface interaction and subsequently in formation of biofilms; this phenomenon occurred at the end of bacterial growth when the carbon source become in failure [17].

The biofilms formation implies the fixation of bacterial strains to a given support. During our study, the *P. aeruginosa* strains tested did not have the same fixation degree, because the O.D recorded was variable according to strains; some strains posses a high potential fixation. This result can be explained, among others things, by the fact that probably these strains expressed highly the genes involved in biofilms formation, such Pilis and Flagels synthesis genes. It is interesting to note that, if such strains, colonized hospital environmental, they can generate a serious problem for health public because of nosocomial infections (infections acquired at a hospital). At this purpose, about 60–70% of nosocomial infections are associated with biofilms formation [28]. Furthermore, Biofilm infections are difficult to eradicate with antimicrobial treatment, and in vitro susceptibility tests show considerable resistance of biofilm cells to killing [29].

The strains studied are various and this is confirmed by their variable ERIC-PCR profile. So, the patterns amplification obtained showed a genetic diversity within strains of *P. aeruginosa* studied. The similarity percentage varied between strains without exceeding the value of 65% (case of strains EPa10 and EPa45). Taken as whole, the *P. aeruginosa* strains isolated are not similar and belong at variables subtypes.

The ERIC-PCR technique appears to be a more reliable typing strategy for *P. aeruginosa* than are other novel PCR-based typing methodologies [26]. Also Wolska and Szweda [27] confirm that among all currently used methods, the ERIC-PCR seems to be a powerful tool for the study of *P. aeruginosa* isolates diversity.

5 CONCLUSION

The *P. aeruginosa* strains isolated in Morocco from environmental and hospital samples possess the ability to form biofilms in presence of both L-B and MMH mediums. However, this ability varied according to medium and strain type. When the medium carbon source is relatively toxic (like hexadecane) toward *P. aeruginosa* strains, theses later grew and formed a developed biofilm as the response to this stress. The kinetic of biofilm formation increased according to time and toxicity intensity of carbon source. The type of strains influenced also the biofilm formation ability, indeed the strain *EPa10*, although it belonged to *P. aeruginosa* species, it presented a biofilm type greatly developed in comparison with the others of the same species.

REFERENCES

[1] Alexander M., Biodegradation and Bioremediation, *Academic Press*, 2nd Ed (1999) London.

[2] Moslemy P., Neufeld R.J., Giot S.R., Biodegradation of gasoline by gellan gum-encapsulated bacterial cells. *Biosci. Bioeng*, 80 (2002) 175–184.

[3] Mrozik A., Piotrowska-Seget Z., Bioaugmentation as a stratergy for cleaning up soils contaminated with aromatic compounds. *Microbiol. Res*., 182 (2010) 2675–2679.

[4] Shimada K., Itoh Y., Washio K., Morikawa M., Efficacy of forming biofilms by naphthalene degrading Pseudomonas stutzeri T102 toward bioremediation technology and its molecular mechanisms. *Chemosphere* 87 (2012) 226–233.

[5] Watnick P., Kolter R., Biofilms, city of microbes, *J. Bacteriol*. 13 (2000) 20–26.

[6] Gorbushina A.A., Broughton W.J., Microbiology of the atmosphere-rock interface: how biological interactions and physical stresses modulate a sophisticated microbial ecosystem. *Annu. Rev. Microbiol.* 63 (2009) 431–450.

[7] Gilbert P., Collier P.J., Brown M.R., Influence of growth rate on susceptibility to antimicrobial agents: biofilms, cell cycle, dormancy, and stringent response. *Antimicrob. Agents Chemother*. 34 (1990) 1865–1868.

[8] Donlan R.M., Costerton, J.W., Biofilms: survival mechanisms of clinically relevant microorganisms. *Clin. Microbiol. Rev*. 15 (2002) 167–193.

[9] Rani S.A., Pitts B., Beyenal H., Veluchamy R.A., Lewandowski Z., Davison W.M., Buckingham-Meyer K., Stewart P.S., Spatial patterns of DNA replication, protein synthesis, and oxygen concentration within bacterial biofilms reveal diverse physiological states, *J. Bacteriol*. 189 (2007) 4223–4233.

[10] Iijima S., Washio K., Okahara R., Morikawa M., Biofilm formation and proteolytic activities of Pseudoalteromonas bacteria that were isolated from fish farm sediments, *Microbial. Biotechnol.* 2 (2009) 361–369.

[11] Dickschat J.S., Quorum sensing and bacterial biofilms. *Nat. Prod. Rep*. 27 (2010) 343–369.

[12] Thompson I.P., van-der-Gast C.J., Ciric L., Singer A.C., Bioaugmentation for bioremediation: the challenge of strain selection. *Environ. Microbiol*. 7 (2005) 909– 915.

[13] Shemesh M., Kolter R., Losick R., The biocide chlorine dioxide stimulates biofilm formation in *Bacillus subtilis* by activation of the histidine kinase KinC. *J. Bacteriol*. 192 (2010) 6352–6356.

[14] Stepanovic S., Vukovic D., Hola V., Di Bonaventura G., Djukic S., Irkovic I. C. And Ruzicka F, Quantification of biofilm in microtiter plates: overview of testing conditions and practical recommendations for assessment of biofilm production by staphylococci. *Journal Compilation.* 115 (2007) 891–9.

[15] Versalovic J., Koeuth T., and Lupski J. R., Distribution of repetitive DNA sequences in eubacteria and application to fingerprinting of bacterial genomes, *Nucleic Acids Research*, 24 (1991) 6823 -6831.

[16] Gross R., Hauer B., Otto K., Schmid A., Microbial Biofilms: New Catalysts for Maximizing Productivity of Long-Term Biotransformations, *Biotechnol. Bioeng*. 98 (2007) 1123–1134.

[17] Davey M.E., Caiazza N.C., O'Toole G.A., Rhamnolipid surfactant production affects biofilm architecture in *Pseudomonas aeruginosa* PAO1, *J. Bacteriol*. 185 (2003) 1027–1036.

[18] Ramsey M.M., Whiteley M., *Pseudomonas aeruginosa* attachment and biofilm development in dynamic environments, *Mol. Microbiol*. 53 (2004)1075–1087.

[19] Toutain C.M., Caiazza N.C., O'Toole G.A., Molecular basis of biofilm development by Pseudomonads, (2001), In: Ghannoum M., O'Toole G.A., editors, Microbial biofilms, Washington, *DC: ASM Press*, p 43–64.

[20] Meliani A. and Bensoltane A., Enhancement of Hydrocarbons Degradation by Use of Pseudomonas Biosurfactants and Biofilms, *J. Pet. Environ. Biotechnol.* 5 (2014) 2157-7463.

[21] O'Toole G. A., and Kolter R., The initiation of biofilm formation in *Pseudomonas fluorescens* WCS365 proceeds via multiple, convergent signaling pathways: a genetic analysis, *Mol. Microbiol*. 28 (1998) 449–461.

[22] Rosenberg E., Exploiting microbial growth on hydrocarbons- new markets, *Tibtech.* 11(1993) 419–424.

[23] Al-Tahhan R.A., Sandrin T.R., Bodour A.A., and Maier R.M., Rhamnolipid-induced removal of lipopolysaccaride from *Pseudomonas aeruginosa*: effect on cell surface properties and interaction with hydrophobic substrates, *Appl. Environ. Microbiol.* 66 (2000) 3262–3268.

[24] Garcia-Junco M., De Olmedo E., and Ortego-Calvo J.J. Bioavailability of solid and non-aqueous phase liquid (NAPL)-dissolved phenanthrene to the biosurfactantproducing bacterium *Pseudomonas aeruginosa* 19SJ. *Environ. Microbiol.* 3 (2001) 561–569.

[25] Neu T. R., Significance of bacterial surface-active compounds in interaction of bacteria with interfaces, *Microbiol. Rev*. 60 (1996) 151–166.

[26] Kidd T. J., Grimwood K., Ramsay K. A., Rainey P. B., and Bell S. C., Comparison of Three Molecular Techniques for Typing *Pseudomonas aeruginosa* Isolates in Sputum Samples from Patients with Cystic Fibrosis, *Journal Of Clinical Microbiology*. 49 (2011) 263–268.

[27] Wolska K. and Szweda P., A comparative evaluation of PCR ribotyping and ERIC PCR for dertemining the diversity of clinical *Pseudomonas aeruginosa* isolates, *Polish Journal of Microbiology*, 57 (2008) 157- 163.

[28] Bryers, J.D., Medical Biofilms, *Biotechnol Bioeng.*, (2008) 100(1): 1–18.

[29] Maira-Litran T, Allison D G, Gilbert P. An evaluation of the potential of the multiple antibiotic resistance operon (*mar*) and the multidrug efflux pump acrAB to moderate resistance towards ciprofloxacin in *Escherichia coli* biofilms. *J Antimicrob Chemother*. (2000) 45: 789–795.

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Social Capital and Human Resources Development: A Knowledge, Attitudes and Practices (KAP) Analysis

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ABSTRACT: The scope of human resource development has become global and holistic and sociological concepts and perspectives have been incorporated to get a good knowledge of the social networks, values norms and other social as well as political institutes of the society which affect in one or another way the individuals, organizations and even nations. The core purpose of the study was to study the knowledge, attitude, and practice of PIDE students about social capital as a crucial factor in determining shape and pace of human resources development. Pakistan being a developing country is in dire need of trained, skilled, and educated work force. We tried to find out that the global changing trends do have an effect over here in Pakistan by using the KAP analysis. Structured questionnaire was used to collect primary data from the respondents (PIDE students) selected through simple random sampling. Focus Group Discussions (FGD's) was also held for M.Sc., M.Phil. and PhD students. The results explained a lack of knowledge on the part of students about social capital or its importance. The social capital was an unheard word for the students of all level and they render it less important for any particular development policy. This baseline survey has opened up new vistas of opportunities for further digging up of Social capital.

KEYWORDS: Social Capital, Human Resources Development, KAP Analysis.

1 INTRODUCTION

The post-crash world (The world after the financial meltdown) demands new ways to deal with old questions, both physical and meta- physical. The globalization of the commodity and financial markets and international division of labour is pushing the old demarcation of space and time towards altogether new frontiers. To meet this new evolving spatial and temporal reality, all disciplines of knowledge are facing a dilemma of scope and spread, a problem of both ontology and epistemology. The neoclassical "Methodical individualism", as a methodology of analysing the nature of reality, has got a severe brunt with rising dissent from all the corners of scholars (Varoufakis and Arnsperger, 2006). The new behavioural and Experimental Economics School are winning new admirers even in the heart of United States, the bastion of neoclassical Economics.[1] A paradigm shift (As explained by Thomas Kuhn in the "The structure of Scientific Revolution) is on way not just in Economics, Development Economics and Human Resources Development (HRD) but also in all disciplines of social sciences. The evolution of HRD from the enclaves of Human resource management (HRM) cannot be comprehended by overlooking

[1] The Rational Animal: How evolution made us smarter than we think by Douglas T. Kenrick, Vladas Griskevicius is an important reading regarding this change of paradigm happening in the field of Economics.

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the changing patterns and dimensions of knowledge creation and accumulation through the Hegelian principle of *Thesis, Anti-Thesis* and *synthesis.*

The clear-cut division of social sciences into disciplines is rebutted by the adherents who insist on looking reality as a "whole". The implications (of looking at reality as a whole) for the discipline of HRD are consequential. It has initiated a strong and relentless debate over the defining the scope of HRD (Lee, M, 2001). The main thrust of the HRD in past has remained largely to spark the hidden potentials and capacities of the citizens (IHRD), Workers/Employees and labour force at large. However, as new research in sociology[2] , Economics[3] and Development Economics[4] proved the importance of social structures, institutions, and level of development in determining the outcomes for both individuals and nations, The social environment in which humans as agents live, act and procreate moderate their interactions. These new findings, which certainly owe their existence to the failure of neoliberal policies in developing world, provided the raw material required for the emergence of HRD as a distinct field for tapping the unused human potential.

Economics usually and conventionally elaborated and emphasized the importance of accumulation of physical capital as mandatory component for economic development. All previous models and theories (Harrod-Domar and Solow models) were characteristically accentuated the importance of accumulation of Physical capital for the "catching-up", desired by all developing nations. However, the outcomes of policies designed, pursued, and implemented in this spirit (i.e. Import substitution) could not meet the standards presupposed by policy-makers all over the world. The "Performance lacunae" gives the impetus to diverge research into new dimensions in Economics and brought froth the "Human Capital Theory". Therefore, the policy narrative under the onslaught of "Market counterrevolution" take a tilt and comprehensive, national HRD plans were become the most sought ingredients for nurturing human skills all around the globe (Shinbok et al.)

Human beings for material, spiritual and emotional furtherance knit social relations. These social relations through the march of history stratified into hierarchical and horizontal networks and structures. Individuals extract capital, distinctively due to their social positioning in these networks and structures, usually comprehended as social capital(Bourdieu, 2008). Social capital is taken both as economic and sociological concept that inhere within the social networks of society as an actual or potential resource available to individuals (Bourdieu, 1985). It can also be defined as a spatial or structural advantage accrues to individual in form of quality as well as equality of opportunity, within a well-functioning, politically stable, and socially cohesive society. As natural resources endowed by nature gives a platform to future progress and prosperity, the social capital also acts as a launching pad for human development. (Coleman 1988). Nevertheless, different forms of social capital and their corresponding functions in particular context require an in-depth analysis of the mechanism through which it helps as a tool of social integration, bonded solidarity and development.

Pakistan's HDI rank is constantly dropping for the last couple of decades (Recently it is at 146th position). The unemployment is increasing and according to Economic Survey of Pakistan (2012-2013), it has touched the mark of 8% per annum and increasing by every passing year. The deteriorating social and Economic indicators are causing both misery and instability, which is one of the factors affecting terrorism and extremism[5]. A cursory look at the age composition can tell that most of the population lies in between the age bracket of 15-35(Economic Survey 2012-13). The urbanization rate is highest and according to the projections of government of Pakistan, 140 million peoples will be living in cities by 2030[6]. Can this increasingly urban and young population provide the "demographic dividend"? This question needs serious attention of all stakeholders in Pakistan.

A multi-ethnic and cultural polity, it (Pakistan) needs to tap the potential of these human resources. The social and political structures of past (colonial legacy), traditional hierarchies, uneven development fuelled the divergence in different regions in Pakistan. A comprehensive, inclusive national HRD plan, on the lines of South Korea is required for a consistent and stable economic growth. The plan of paper will go as following a) literature review, separately for HRD and Social Capital b) Survey results and discussion c) FDG's results and interpretation d) conclusion.

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[2] *The Social Structures of Economy by Bourdieu (2005) provides an insightful relation of social cosmos and economic exchange.*
[3] *The emergence of new Institutional Economics reveals the importance of institutions in production and exchange.*
[4] *I would endorse the view of Naqvi (1993) that development economics is a separate paradigm and discipline from Economics*
[5] *Shahid javid Burki, Inequality and Extremism. Daily tribune 24th feb 2014.*
[6] *Economic Survey of Pakistan, Chapter12, population, labor force and Employment.2012-2013.*

2 RATIONALE OF THE STUDY

The idea of this study came into being while we were taking an elective course of Human Resource Development. We were shocked when we found out during our research that the ministry of Human resource Development do not have any single preliminary study (national or regional) on Human Resource development , expecting a national policy was totally absurd[7]. Very few studies were found relevant to Pakistan or conducted by Pakistani researchers. The national commission for Human Development (NCHD) is private public partnership initiative lacked any serious research or policy endeavour taken since its creation in 2002[8]. As noted above, new insights proved that both research methodologies and policy narratives must be context specific for better outcomes. That status of the Pakistan is completely different from other South Asian and South –East Asian countries, which have national and state level ministries and national plans for HRD. Therefore, it seemed (Both then and now) appealing and rational to us, that investigation must begin from bottom and in a more holistic framework, which can provide insights for national Development policy at large.

3 RESEARCH QUESTION

- What is the status of common sense knowledge and perceptions of research students at PIDE?
- What importance they attribute to Social capital in developing Human Resource development?

4 METHODOLOGY

The metamorphosis in the discipline of HRD and in the theoratical conception of social capital (A missing link) demands a through and comprehensive review of the literature. The unavailability of any prior research (in Pakistan) also makes it mandatory to delve into an exploratory design and methodology. Social capital in Pakistan is mostly read, taught, and researched in the context of civil society organizations and Rights advocacy. It did not get considered or treated as a policy tool or a missing link as Fine (2002) explained. Therefore, it was logical first to have a preliminary knowledge about the perceptions, attitudes, and practices of students, fellows, and researchers at PIDE[9]. To supplement the KAP survey Focus group discussion was also arranged to bridge the lacuna of information in survey sample. Out of the total population of 400 students, hundred respondents were selected randomly. Students from all levels (MSc to PhD) and departments were contacted both for questionnaire distribution and for FGD participation. An advertisement was made through Facebook and notice board for finding participants who have knowledge about Social Capital and Human Resource Development, unfortunately Very few responses were received. Therefore a FDG conducted by nomination and acceptance by the participants.

Table 1 Data Collection Methods

Data Collection Method	Participants/Respondents	Number of participants/respondents	Sampling Procedure	Inclusion Criteria
Survey	Students	66	Random Sampling	Student, fellow of PIDE
FGD1	Students, fellows, researchers	6	Purposive	Student' researcher at PIDE
FGD2	As above	6	Purposive	As above

[7] *http://www.ophrd.gov.pk.*
[8] *http://www.nchd.org.pk.*
[9] *Majority of public policy makers, research analysts comes from this institute in Pakistan.*

HUMAN RESOURCES DEVELOPMENT

Human resource development is quite an old field of profession but increasingly becoming a new discipline of knowledge (Swanson, 2001). HRD as a distinct field of knowledge passes through many evolutionary periods. Nadler (1970) defined HRD as a series of activities organized to conduct a behavioural change. The underlying theory was psychological while the intent was to change behaviour in such a way that improves performance. Maclagan (1983) defined it as the process of learning through training of individuals to prepare them for their present and future jobs. The key concepts are training and development and underlying theory was too psychological. Smith (1990) by using the core theories of Economics, Psychology, and performance system defined it as the process of organizing and developing human resources of an organization for the benefit of both the individual and organization. Swanson (1995) defined it as a process of unleashing human expertise through organization development and personal training and development for improving performance. Then the new challenges posed to the organizations, individuals and nation states have changed the whole picture for HRD professionals and theorists. These new forces which challenged the old thinking and suggested new roles and needs which the HRD have to prove its vitality as a distinct discipline of knowledge were expansion of trade, outsourcing, globalization, and responsiveness of trans-national organizations and HRD professionals towards these historical new challenges (Devdas et al 2008). Hartenstein (1999) showed that HRD has to recognize, address, support, and humanize the global culture and enabling the individual to operate in it. Globalization has also highlighted the uneven economic and social development and underlying disparities in skills and education were made more visible specifically among developing nations (Stiglitz, 2002; UNDP, 2003b; World Bank, 2003). HRD which was once confounded to the organizational goals suggested new roles of building new systems to face the uncertainties, system development for organizational renewal and knowledge creation to knowledge management for the purpose of making organization more competitive Rouna et al.(2003). The emerging new need of ' T shape' skills also required by HRD professional that combines the vertical knowledge of HRD itself and horizontal connection with other disciplines (Marsick, 2007).

The direct challenges to HRD as identified by (Rouna et al. 2003) are a) Organizational presence and recognition b) evaluation and return on investment c) HRD's identity (core competencies and advantages) d) HRD stakeholders (to whom it may serve such as organization, community, individual or nation).

Therefore, HRD widens its boundaries to meet the challenges thrusted upon it by the structural, political, and historical forces. Its scope subject matter and underlying theoretical paradigms transformed themselves to a new level. HRD acquired new names like IHRD, GHRD, and NHRD describing international, global, and national dimensions human resource development respectively. Another classification of differentiating between 'new' from 'old' practices is categorized as 'MHRD and THRD' modern and traditional human resources development (Devdas et al. 2003).

The quality of human resources played an important role in human development and key to a nation's future. The annual publication of UN and national governments of Human development resources report pushed the HRD once a component of HRM into a separate policy institution for a comprehensive policy for the skill development (Metcalfe & Rees 2005). International organizations like ILO (2003) pin pointed the duty of national government for HRD strategy implementation. The concept of learning and human capital development in local and social context also incorporated in the realm of NHRD. Therefore, government agencies especially in developing and transitional societies have also drawn on international codes for learning devised by ILO and OECD (Kuruvilla etal. 2002; Ashton et al, 2002). "*Learning and training for work in a knowledge society (*ILO, 2002) and *Knowledge management in the learning society" (*OECD, 2000) is good examples of strategy documents that have influenced the national policy development. Middle East countries like Bahrain, Jordan, Kuwait, Oman and United Arab Emirates all devised national human resource development programs to answer the growing global requirements (UNDP, 2003b; Metcalfe & Rees, 2005). Even the developed countries as USA, Japan, and France are also launched their NHRD plans. USA followed a decentralized approach to promote human resource development. Education, labour, and Energy departments controls the vocational educational for adults, employment, and job training and human resource development in science and technology respectively. While the federal policy focuses on certain classes and vulnerable groups state governments are generally focusing their residents (Kim, lee, Jung, 2009). The Educational Reform Plan for the 21st century (2001) laid the foundation for the national human resource development in Japan. New laws by the Diet (Japanese parliament) enacted in 2002 in order to develop a comprehensive policy for consolidating the training and skill development in universities, schools and colleges. Malaysia also developed Ministry of Entrepreneur and Cooperative Development (MECD) to develop skill entrepreneurship which can meet the challenging demands of global and competitive economy in which work has become highly sophisticated and evolving technology always required new skills to earn a livelihood (Othman, 2009).

NHRD is closely linked with the HD (human development) (Wang & Swanson 2008). However, HD springs out from NHRD, as aforementioned scholars argue. Therefore, in order to formulate a sound NHRD policy it has to be stood on strong

theoretical ground. However, either this discipline will develop its own theory or follow a multi-dimensional path of incorporating other disciplinary theories is yet unresolved. Swanson (2001) purposed that HRD should base its theoretical framework on Economics, Psychology, and System theories. While NHRD can base itself or take help from Development Economics, Anthropology, Political science and Development sociology (Wang & Swanson 2008). While the other school of thoughts with the argument that to define HRD is to play into the hands of the socio-political demands of our times. Lee (2001) in her seminal article ' A refusal to define HRD' reject all efforts of defining HRD with the argument that the common western philosophical world-view of looking at reality and entities as defined and finished products is dated back to Parmenides. Nevertheless, the Heraclitean world-view of looking at reality and phenomenon not as *being* but as a *process* is the way to look forward. Therefore, it will be unwise to put desired meanings to the concept of HRD. Nevertheless, in order to devise and develop a national plan for HRD local culture, belief system, attitudes and the nature of social interactions is getting serious attention all over the world.

SOCIAL CAPITAL

The classical economics identified Land, Labor and Capital as resources to economic growth. In 1960's neo-classical economists, T.W.Shultz and Gary Becker identified another resource which is necessary for the better and efficient use of all three other resources that resource termed as Human capital (Woolock, 1998). Social capital is determine by the social structure, networks and institutions of a society that how they interact with each other and with the individual. The intangible world of these networks and institutions also provides an inherent resource to the individuals, communities, and societies/nations, named as Social Capital. The social capital has two prophets, Pierre Bourdieu and James Coleman, while one high priest Robert Putnam[10]. Bourdieu mostly configured social capital with cultural capital as a measure of class distinction and preservance of social hierarchy. While Coleman and Putnam both looked it as a "Missing link", a promoter of civic engagement, economic development, and liberal democracy.

During recent years, the concept of social capital has become one of the most popular export from sociology into everyday language generally and HRD specifically. In spite of its recent popularity, social capital is not new for 'Economic Sociologists' and its use has dated back to Durkheim and Marx (Portes 1998). However, its modern meaning and use become pervasive after the failure of development policies in 'Third world and old communist countries' (Woolock, 1998). The miserable conditions and prevalence of poverty existed in all these countries, most of the social scientists agreed due to lack of trust, information and reciprocity inheres within the social networks of these societies (Woolock, 2000).

The social capital defined by Lin (2001) is simply the investment in social relations for realizing profit at the market place. Nevertheless, this definition limit social capital to just an economic incentive accrues to individual. While it remains silent on the civic and political aspect of community and State-society relationship. Pierre Bourdieu (1985) defines social capital as *"the sum of resources, actual or potential (virtual) that accrues to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition*". Here social capital used in context of spilling over benefits to individuals by the virtue of their position held within the social networks. In addition, this acquaintance heavily affects the future of the individual. Quality of the information received by the individual is exclusively defined by the status of networks he/she belonged (Bourdieu, 1986, 1992). The individual freedom and human agency to influence the structures of society and his/her vertical mobility is completely denied (Jenkin, 2000). Coleman (1988) identifies the Functionalist dimension of social capital. He describes it as the resource embedded within the social structure available to all actors (individuals or groups), and aid towards the micro-macro transition without elaborating the social structure details through which occurs (i.e. underground study circles of Bolsheviks in Russia and then popular revolt of 1917). Social Network theorists define it as simply one's non-rational ties (Woolock 1998). Public-choice theorists seeks relation between state and society reciprocal but the conservative like Fukuyama purposes an inverse relation between state intervention in economy and functioning of social capital (Fukuyama, 1992).Fukuyama (2001) identifies a relation between historical cultural norms and values with economic development. He linked the Weber's theory of Protestant ethics and rise of Europe with recent rise of China and Confucian ethics embedded in Chinese cultures. Nevertheless, every culture is a complex mix of elements which back or hinders development. It depends which one is being studied. Social capital is present in a society in several forms. It can be embedded within the structure of society as being the obligations, expectations, and trustworthiness of structures, in the form of potential information channel by reducing the cost of information for the members and as a

[10] *John Harriss , depoliticizing development the world Bank and Social Capital.*

norms and effective sanctions giving security, control, and cohesion to its structures and members (Coleman 1988, Kastz and Lazarsfled 1995).

Most empirical and theoretically coherent advances were made in 1990's namely Ethnic entrepreneurship studies (micro-level) and comparative institutionalist studies of state-society relations (Macro-level) (Woolock, 1998). This study provides new angles to study social capital as a resource present between the macro and micro structure of society. Woolock (1998) synthesized as,

"*At the micro level, I will henceforth refer to embedded- ness (i.e., intra-community ties) as Integration, and autonomy (i.e., extra-community networks) as Linkage. Embedded -ness (i.e., state-society relations) at the macro level will be referred to as Synergy, while autonomy (i.e., institutional coherence, competence, and capacity) will be identified as Organizational Integrity*".

At the micro level, the social capital is "Bonding" of intra-community (familial) relationships and "Bridging" Extra-community (distant associates, friends, acquaintances, or groups) relationships in order to expand the resource pool for individual. While, the credibility and capability of state in building inclusive institutions gives the required "Linkages" gives the right set of "Equal opportunity" to individual and collective actors to move towards a stable livelihood. That is why World Bank (2003) defined it as a whole of institutions, networks, relationships, and norms guarding and shaping the quality of society's interactions.

Social Capital and Human Resources and Economic Development:

HRD can be split into its two most important constituent parts a) Health b) Education. Then the effect of social environment on the capacity and skill building can be analysed. Social dimension do not take the required attention for development theory and policy narrative during the height of cold war (Woolock, 2000). The end of cold war and rise of market fundamentalism (Todaro, 2010) was resulted in trade liberalization and increased demand for skilled labor. Social dimension included into the discourse of development by providing opportunities to individual for better future (Woolock, 2001).Education for developing human resources gain the focus. Some studies found that most important type of social capital is formal and informal education that links generations of people (Montgomery, 1990).

The link between the social capital and health is very ubiquitous and pervasive. A healthy person can utilize his/her potential more efficiently and more vigorously. There is a very close relationship between the health and education. There is considerable evidence that good education of mother leads to good health of a child. Health status of child also helps in good school performance. Healthy work force means more productive, less absents and more wages which will leads towards higher income. The role of health in economic growth is critically important. The physical and psychological health of individual and its impact on economic activity has been extensively researched in last decade. Campbell et al (1999) finds out that the society or community with social capital (dense social networks, civic activity) is healthier and feels an obligation to help each other. The Britain NHS (National Health Survey 2003) study of youngsters and children shows that the sense of belonging, bonding with friends and good family relationships (social capital) is what children gives worth. In addition, the presence of it (Social capital) can have plausible and positive psychological effects on children. Kawachi (1996) finds out that the professional men in US without social networks were likely to die of cardiovascular diseases. The poverty, inequality, and lack of state health facilities in developing world too make the social networks more important in combating diseases and accident. Social capital at community level also increases the working capacity of individual and specifically in developing societies increased the income, efficiency, and cohesion of community.

Schmidt and Robinson (1995) found that social capital reduce the transaction cost of society. In market economy, the flow of information among the" actors" is important therefore, presence of healthy networks reduces the cost of disseminating of information. Fafchamps and Mintens (1999) discovers crucial bonds to understand social capital as an informal channel for acquiring an insurance against liquidity risks among the traders of Madagascar. Reid and salmen (1999) study identify trust as a key factor in the success of agriculture extension in Mali. They identified the good mix of micro/macro and structural/cognitive form and scope of social capital. The trust between farmers among themselves, trust on extension workers and the trust of extension worker on national organizations improve the quality of work (Grootaert, 2001).This study also identified crucial links between the micro and macro level of social capital and how both reciprocate each other. In rural communities another empirical study by Isham and Kahkonen(1999) identify that social capital just not increase the livelihood of farmers but also increase access to good and services which shows the characteristics of public good. The villages with high level of social capital with active associations and civic participation made it possible to work together for the supply of piped water. Bates (1999) studied at macro level the role of social capital in bonding different ethnic groups into a nation. He also purposed that the party who has won the election should not form government alone but also give space to other local and regional power. Sharing of power at national level reduce the danger of ethnic conflict.

5 RESULTS AND DISCUSSION

KAP SURVEY

The response rate of the survey was neither quite high nor low but satisfactory. The sample of 100 students was taken from PIDE. The questions in the question paper was categorized in three categories; Knowledge, Attitude and Practices of students how they perceive social capital, how it affects their attitude and daily life activities and how it affects in developing human resources. The questions were asked covering three dimensions of social capital; Bonding, Bridging and Linking.

All the three components of KAP survey separately are discusses separately

KNOWLEDGE

Most of the respondents have heard read or listened about social capital (fig.1). When asked about the reason of ignorance, majority answered; lack of interest. Those who replied in affirmative, when asked how they would define the impact of social environment on availability of opportunities to individual, 23% replied ambiguously which reflect lack of conceptual knowledge of social capital. All of the PhD respondents, because of their higher experience and years of study were more familiar with Social capital. The students with less year of education were less acquainted with it. 87% of the respondents believed that Social environment especially at family and community level motivate, provide resource, disseminate information, and offer opportunities to individual for better future. While "linking" dimension of social capital was somewhat answered either negatively or unenthusiastically which reflects lack of trust over state institutions and an evident apathy towards state. 13% of the respondents believed that there is no link between the health and social cohesiveness of a community whereas 44% were agree on this stance. The female respondents particularly were more "neutral" in responding to this question. The reason can be less socialization opportunities available to them.

46% of the respondents were agreeing that trust could play an important role among community members or colleagues which can increase efficiency of individual and ultimately of that organization whereas 43% were strongly agree. A strong tendency was present in the results that "bridging" of resources can help is mutually beneficial for sharing parties. This act of reciprocity was admired and liked by the respondents but on the same hand 53% respondents also assumed that the act of reciprocity in general is reduced in last five years in their communities.

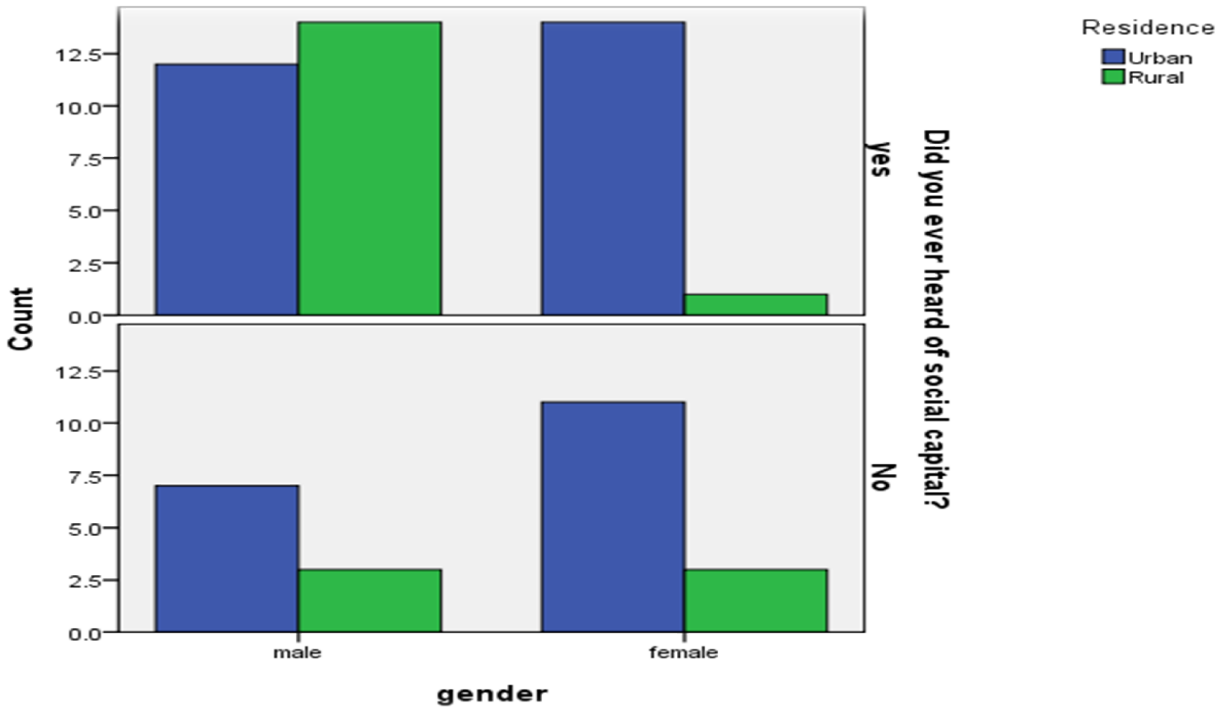


Fig.1 Information about Social capital, Gender and Residence Based

The respondents were mostly familiarized to social capital through formal education (53%), 23% heard it in TV programmes, while 24% of the respondents read it in newspaper article or during supplementary reading. The unfamiliarity with the concept is relatively high in females living in urban areas, no appropriate justification can be provided except the lack of introduction to Economics or social sciences during undergraduate and high school education. PIDE and Quaid-e-Azam University both are premier public institutes and are in close vicinity of each other. There is a

Table.2 Coordination Failure among Institutions and need of reciprocity

Act of reciprocity between PIDE & QAU will help the both institutes.

Count

Residence			Act of reciprocity between PIDE & QAU will help the both institutes.					Total
			Strongly agree	agree	neutral	disagree	strongly disagree	
Urban	gender	male	*11*	*6*	*2*		*0*	*19*
		female	*7*	*14*	*3*		*1*	*25*
	Total		*18*	*20*	*5*		*1*	*44*
Rural	gender	male	*6*	*9*	*1*	*1*		*17*
		female	*1*	*3*	*0*	*0*		*4*
	Total		*7*	*12*	*1*	*1*		*21*

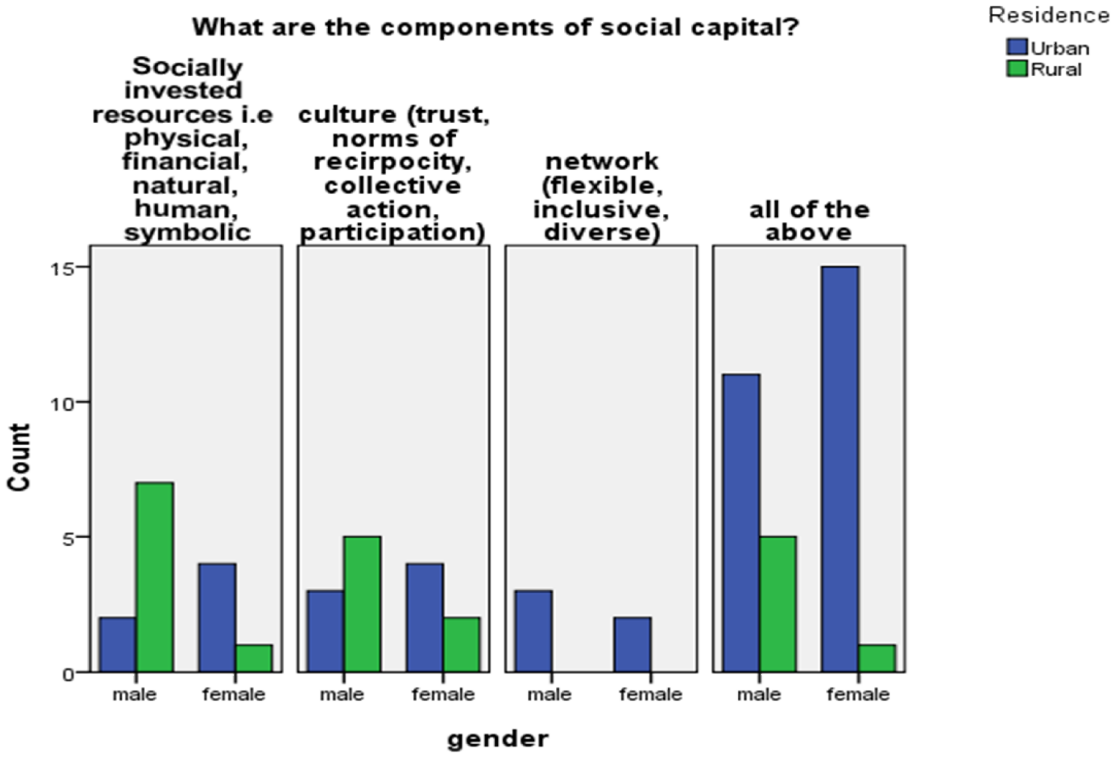


Fig.2 components of Social capital

The above figure clearly reflects that most of the respondents were confused about the exact conception of social capital, and what are its components? This finding also re-enforce the hypothesis that social capital is very much least understood concept. Even in the premier institute, the marginal and ambiguous understanding reflects the poor state of Human Resource Development.

ATTITUDES AND PRACTICES

If the knowledge about Social capital and its affect upon Human resources development was marginal, the attitudes of respondents towards social aspect of community life were strongly positive. Most of the respondents emphasized that the imposition of law and effective provision of justice is a pre-requisite of economic development; they endorse the general opinion (influenced by popular narratives spread through globalization) that value collective action, prize institutional stability and recommend civic engagement. As below, it is noted that overwhelming majority of the respondents emphasized the importance of cooperation between law enforcing agencies and citizens

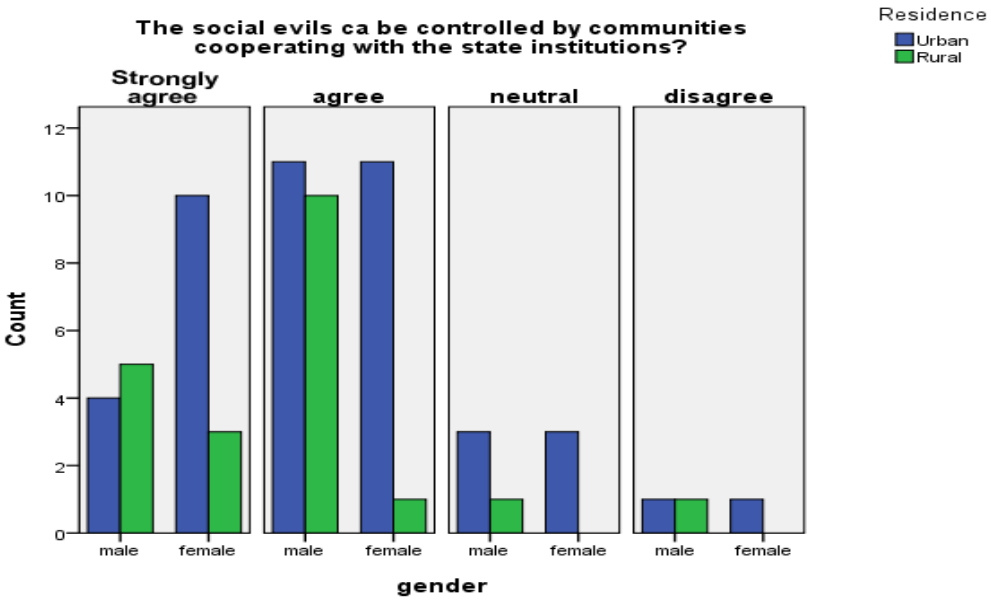


Fig.3 Attitude about linking community with State for controlling crime rate

However, the next response about the same dimension (linking) of social capital was altogether different, overwhelming majority of the respondents replied in negative when asked about helping the police in enforcing the law (Fig.4). The reason of such dissonance in perceptions and opinions can be equated to trust deficit between citizen and state institutions. This trust deficit is one of the most important (linking dimension of social capital) but lacking thing, which certainly not just a problem of Pakistan but a norm of all Post-Colonial States.

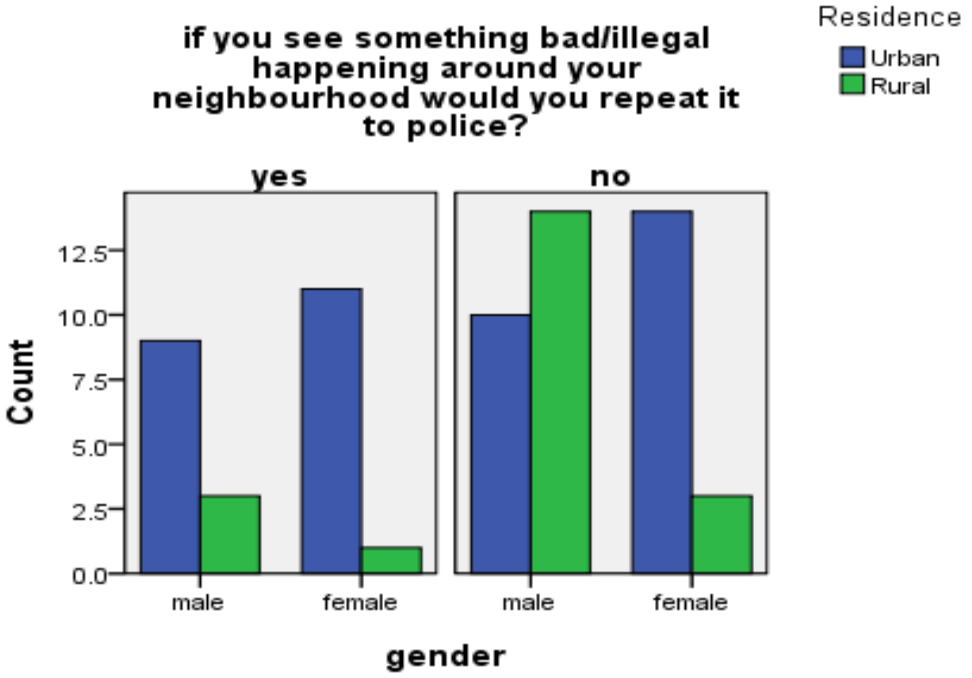


Fig.4 Contradiction between beliefs and action (attitude and Practise)

One empirical finding (fig5) reflects the trend in practices of the respondents, a lack of linking social capital across the communities. Most of the respondents did not donate blood at large and especially not to people other than relatives or acquaintances.



Fig.5 Social relation across the community (vertical) is limited

The educational institutes according to most of the respondents can play the most important role in developing, enhancing and consolidating the social cohesion. This response is not unique because the survey population is itself

belonging to an educational institution. However, the lack of linking capital, strong horizontal ties, trust deficit, lack of confidence on state institutions is a common thread present in most of the present. Why is the case? Fig.6 below can best answer this question.

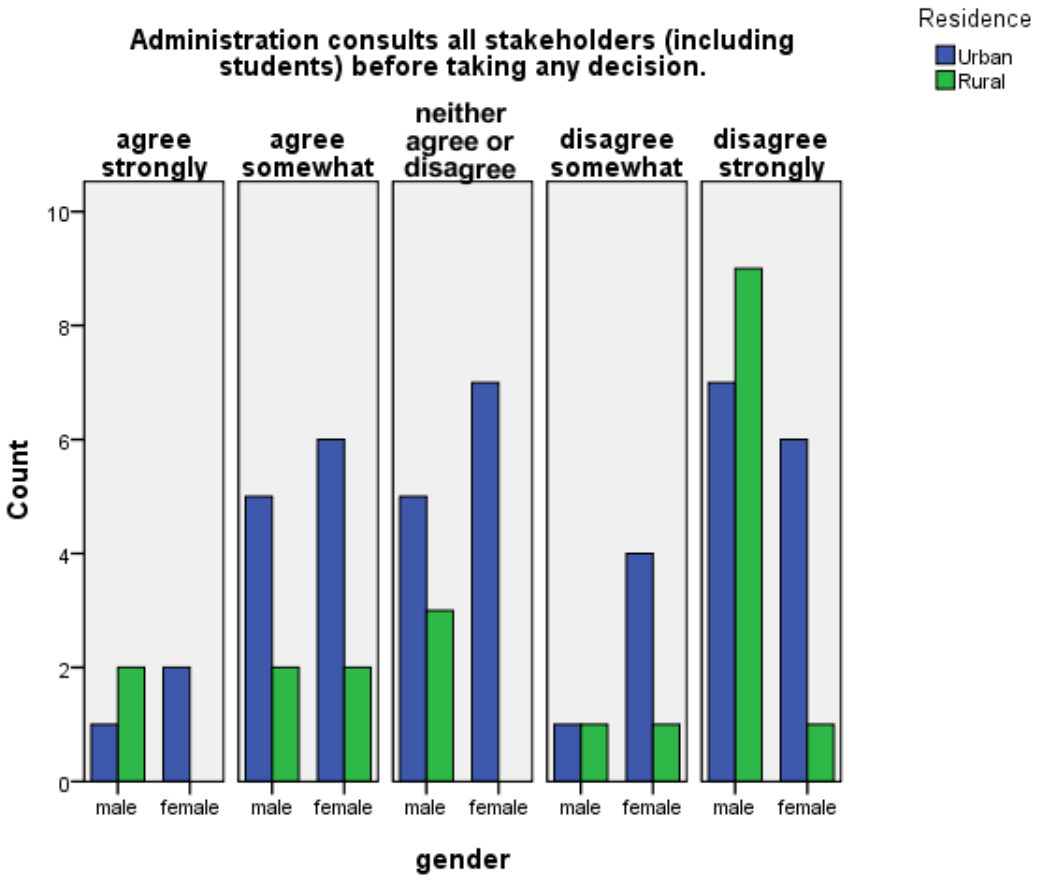


Fig.6 Decision making Process at PIDE

The lack of trust among the administration / public institutions and common people is due to lack of participation by those for whom the decisions has been taken. The argument for non-professionals can be made of that they do not have the information and education leading towards best possible outcomes. However, the universities and research institutes are also not giving any space to more democratic and participatory decision making process. This has surely reflected causally in trust deficit and reduced social cohesion resulting in inefficient outcomes.

FOCUS GROUP DISCUSSION

Focus group discussions were also conducted in order to grasp the clear and original understanding of how people see social capital and relationship between social capital and human resources development. Here, I would just elaborate the different themes emerged during the discussions.

Q.1. WHAT IS SOCIAL CAPITAL?

- *Institutions, relations, perceptions, culture, and cultural environment, collective behaviour, norms, ethics.*

All the above answers (codified) explaining one or another aspect of social capital. Some are very ambiguous; few respondents even treated social capital as a behavioural variable. Any theoretical knowledge about the theory of social capital was missing; although, all the participants were research fellows and at least M.Phil. in Economics, development studies and Environmental Economics.

Q.2. HUMAN CAPITAL AND SOCIAL CAPITAL, WHAT ARE THE DIFFERENCE AND COMPLEMENTARITIES.

- *Social Capital is an outward approach while human capital an inward approach. Work Ethics are learned by society through family……..*
- *Human capital is part of social capital….Public relationing is also social capital which every human learns*
- *They both lead one to other. Social and human capitals, they are complementary.*

The participants' responses themselves explain that they differentiate between both capitals. However, responses carry the muddled conception of social capital.

Q.3. DOES SOCIAL CAPITAL HAS ANY IMPORTANCE AS AN ECONOMIC POLICY VARIABLE.

- *Formal Institutions always depends for efficient working on informal institutions……*
- *Civic Responsibility is obligation of citizen to the state……*
- *Social values effect the decision making of the rational man……Price is just not the determining factor of demand….*
- *Social capital is not necessary but sufficient condition……*

The heightened responses themselves tell a story. The status of social capital in primary policy framework is not very prominent. However, at policy implementation level, it can provide a strengthening environment.

Q.4 HOW SOCIAL CAPITAL HELPS IN BUILDING INSTITUTIONS THAT IS MORE INCLUSIVE.

- *If social capital is a determining factor of institution building then it might…..*
- *Power structures must be studied…..*
- *Students exchange programmes between high rank universities and public universities can play an important role……*

The extractive institutions are themselves the result of skewed power structures. Moreover, the extractive institutions themselves are result of a negative and exclusive social capital (Bourdieu, 2005). The understanding of respondents about institutions, their forms, and evolution was also rudimentary and second hand. This reflects the influence of neo-classical economics in teaching and research.

Q.5 CAN SOCIAL CAPITAL HELPS IN DEVELOPING HUMAN RESOURCES IN A MARKET ECONOMY.

- *No, there is no need for social capital; the problem lies with policy implementation.*
- *Flaw is with policy, but the lacking frontier is education.*
- *Education system in Pakistan creates parochial mind set and inhibits or blocks the spread of ideas…..*

The quality of education according to the respondents is the most important contributing factor of human resource development. Unfortunately, the education system is fragmented into different systems (National, American, and Traditional), curriculums are of low quality and teaching staff less qualified. The crux of their arguments showed that social capital definitely one of the important policy variable for HRD.

Q.6. IS SOCIAL CAPITAL GENDER BLIND OR IT AFFECTS WOMEN NEGATIVELY.

- *No, the male dominance is more pronounced and the density of horizontal relations makes life difficult for women….*
- *The female headed households remained mostly poor, lacked access to new information and remain laggard in adopting any new technology. The reason is the normative structure of society….. (Opinion of a researcher on Climate change).*

The women respondents especially were more vocal on this issue, because they faced more difficulties and existing social structures and relationships harms them most.

6 CONCLUSION

The result and discussion section demonstrated certain patterns in opinions, attitudes, and practices of the students and research scholars about conception, functioning, and importance of social capital. The human resources development has more studied as mere outgrowth of Economics, not itself as a discipline of studies. The patterns of responses can be concluded as; firstly, the social capital is one of the least read, understood, and researched topic in PIDE. Secondly, the opinions and the practices have shown a clear divergence. Thirdly, the education considered as the most important human resource that helps individual in combat against poverty and improving living standards in a modern economy. Lastly, the social capital never looked as a potential link that can improve the policy narrative and its implementation in Pakistan.

One of the most chief difficulties we faced during this research was availability of any prior research and analytical framework that helps in systematically defining social capital in local context. The present political instability in Pakistan definitely pushing the academia about finding new ways to look at the old grand questions of growth, development, stability, equity , production and distribution. Definitely, social capital do have something to offer in this regard.

REFERENCES

[1] Adler, P. S. and S. W. Kwon (2002), "Social Capital: Prospects for a New Concept." Academy of management review 27(1): 17-40.

[2] Bates, R. (2002), "Human Resource Development Objectives." UNESCO Encyclopedia on Life Support Systems

[3] Bourdieu, P. (2008), "The Forms of Capital." Readings in economic sociology: 280.

[4] Coleman, J. S. (1988), "Social Capital in the Creation of Human Capital." American journal of sociology: 95-120.

[5] Devadas, U. M., A. D. Silong, et al. (2011), "Human Resource Development and the Contemporary Challenges of the World" Journal of Management Policy and Practice 12(5): 128-141.

[6] Evans, P. B. (1997), “State-Society Synergy: Government and Social Capital in Development” University of California at Berkeley, International and Area Studies.

[7] Fafchamps, M. (2004), “Social Capital and Development” Department of Economics, University of Oxford

[8] Fafchamps, M. and B. Minten (1999), "Relationships and Traders in Madagascar" The Journal of Development Studies 35(6): 1-35.

[9] Fine, B. (2002), "The Developmental State is Dead—Long Live Social Capital" Development and change 30(1): 1-19.

[10] Frank, A. G. (1973), “Sociology of Development and Underdevelopment of Sociology” Afrografika Publishers.

[11] Fukuyama, F. (1995), "Social Capital and the Global Economy" Foreign Aff. 74: 89

[12] Fukuyama, F. (2001), "Social Capital, Civil Society and Development" Third world quarterly 22(1): 7-20

[13] Grootaert, C. and T. Van Bastelaer (2001), "Understanding And Measuring Social Capital: A Synthesis Of Findings And Recommendations From The Social Capital Initiative." Social Capital Initiative Working Paper(24).

[14] Helliwell, J. F. and R. D. Putnam (1995), "Economic Growth And Social Capital In Italy" Eastern Economic Journal 21(3): 295-307.

[15] Isham, J. and S. Kähkönen (1999), "What Determines the Effectiveness of Community-Based Water Projects" Social Capital Initiative Working Paper 14.

[16] Kim, S. B., Y. H. Lee, et al. (2009), "A Comparative Study of National Human Resource Development Plan Implementation Systems in Korea, the United States, and Japan."

[17] Knack, S. and P. Keefer (1997), "Does Social Capital have an Economic Payoff? A Cross-Country Investigation" The Quarterly journal of economics 112(4): 1251-1288.

[18] Korte, R. (2012), "Exploring the Social Foundations of Human Resource Development A Theoretical Framework for Research and Practice." Human Resource Development Review 11(1): 6-30.

[19] Krishna, A. and N. T. Uphoff (1999). “Mapping and measuring social capital: A conceptual and empirical study of collective action for conserving and developing watersheds in Rajasthan, India” World Bank, Social Development Family, Environmentally and Socially Sustainable Development Network

[20] Lee, M. (2001), "A Refusal to define HRD" Human Resource Development International 4(3): 327-341.

[21] Lin, N. (1999), "Building a Network Theory of Social Capital." Connections 22(1): 28-51.

[22] Lin, N. (2002), “Social Capital: A Theory of Social Structure and Action” Cambridge University Press.

[23] Metcalfe, D. B. D. and C. J. Rees (2005), "Theorizing Advances in International Human Resource Development" Human Resource Development International 8(4): 449-465.

[24] Nahapiet, J. and S. Ghoshal (1998), "Social Capital, Intellectual Capital, and the Organizational Advantage" Academy of Management Review: 242-266.

[25] Portes, A. (2000). "Social Capital: Its Origins and Applications in Modern Sociology." LESSER, Eric L. Knowledge and Social Capital. Boston: Butterworth-Heinemann: 43-67.
[26] Portes, A. (2000), “The Two Meanings of Social Capital” Sociological Forum, Springer
[27] Putnam, R. (2001), "Social Capital: Measurement and Consequences." Canadian Journal of Policy Research 2(1): 41-51
[28] Putnam, R. D. (1995). "Tuning In, Tuning Out: The Strange Disappearance of Social Capital in America." PS-WASHINGTON- 28: 664-664.
[29] Swanson, R. A. and E. F. Holton (2001), “Foundations of Human Resource Development” Berrett-Koehler Publishers
[30] Wang, G. G. and R. A. Swanson (2008), "The Idea of National HRD: An Analysis Based on Economics and Theory Development Methodology." Human Resource Development Review 7(1): 79-106.
[31] Woolcock, M. (1998). "Social Capital and Economic Development: Towards a Theoretical Synthesis and Policy Framework" Theory and society 27(2): 151-208.
[32] Woolcock, M. and D. Narayan (2000), "Social Capital: Implications for Development Theory, Research, and Policy." The World Bank Research Observer 15(2): 225-249.

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The Intelligence of E-CRM Applications and Approaches on Online Shopping Industry

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ABSTRACT: E-CRM (electronic customer relationship management) is a derivation from CRM techniques which influenced direct marketing technology and call centre to promote massively created products and services to small sub-segments of market. When CRM techniques are incorporated in e-commerce environment it becomes E-CRM which involves building a strong and sustainable customer relationship by using Internet. It is a strategy which is purely based on Internet and software development, it requires to create essential integrated software suite to deal with all kinds of customer related issues like customer services, sales and marketing field support. The essential parts of E-CRM are to focus on building new customer base, segmentation of high valued customers, enhancing the profitability of existing customer and maximize the value and life of profitable customers.

KEYWORDS: E-CRM, Electronic customer relationship management, customer relationship, I.T CRM.

1 INTRODUCTION

CRM is an essential business strategy for maintaining and acquiring the existing and potential customer over the long term, a variety of channels exist for interacting with customers within this framework, one of them is electronic which is commonly known as e-commerce or online business. E-commerce does not replace existing call centre or sales force over the fax but it is simply another expansion of business.

The E-CRM or electronic customer relationship management includes all the CRM purposes with the use of the net settings i.e., intranet, extranet and internet. Electronic CRM is related to all sorts of managing relationships with customers making utilization of information technology (IT).

ERP (Enterprise Resource Planning) is widely applicable software which tremendously grew in the period of 1990s. ERP system connects numerous legacy systems that were used to support backend operation in order to make access of information easily available throughout the organization by all effective users, for that purpose the organizations deploy specialized application servers each to perform of dedicated and specific task and function. ERP systems enable the data from each department to integrate and store it on one place so that it can be easily accessible by each department. ERP systems are not design to manage marketing data (e.g. consumer behavior data, marketing campaign etc.) regardless of the fact that these are helpful in providing back end support. On the contrary, CRM systems were precisely designed for front end application and can be implemented quickly. E-CRM is advanced by internet. It provides features that are effectual to the business organization and attractive to customers. There are very delicate differences lies between E-CRM and CRM but it is important. It concerns with the interfaces with users and other systems and its underlying technology. For instance, most of the E-CRM systems give the opportunity to customers to place order, request additional information about products, review purchase history, check order status, sends email and lots of other activities by providing them a self service browser based window. These features give freedom to customers considering the place and time. With E-CRM, customers are not bound to contact the company in the regular business hours and companies are not obligated to give live customer support for customer request and enquiries.

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This research paper was written to describe and explain critical technology issues of E-CRM in easiest way without compromising the accurateness. The principal dissertation can be highlighted by the topic: E-CRM is a new concept of Relationship Marketing. E-CRM systems allow companies to develop one-to-one relationship with thousands of customers. Companies provide value that is on going to its customers and regularly gain their trust, loyalty and confident by the numerous interactions made. Companies now have the ability to practice it on an extraordinary scale with minimum cost.

The Five Engines of E-CRM

The E-CRM initiatives are increased and management of every major company would have to formulate and implement an E-CRM strategy quickly in order to have a competitive edge. Senior executives and general managers drive the E-CRM activities in most of the companies because it is an enterprise wide concept.

Companies face the challenging problems to develop a strong technology infrastructure in a limited time and minimum cost because E-CRM has the important potential to build a sustainable customer relationship. An immediate action is to buy standardized or mass produced application, associate and integrate database of online purchase information and web traffic and implement the E-CRM initiative, but usually, these kinds of effort gone in vain. Many recent researches demonstrates that 39 percent of online purchasers failed to order online, 66 percent of loaded online shopping orders were discarded before checkout process and less than 5 percent of unique visitors actually become customers.

A five engine comprehensive software platform is the more effectual and sound approach that makes implementation of E-CRM effective in business process. These five engines are:

1. The Customer centered Information Database – it involves consolidation and integration of information about millions of customers with permissions, preferences and useful information to the customers.
2. The Segmentation and Analysis Engine – To analyze the different customer types and segment them according to their characteristics in order to build a sound marketing campaign strategy. (See figure 1)
3. The Personalization Engine – to customize the overall customer experience; make preferred personalization by customers, providing offers and messages to each customer
4. The Transaction Engine – To facilitate the transaction of purchase or return between customer and company or exchanging information about transaction.
5. The Promotion Engine – It involves delivering information like new deals and offers proactively to the customers' via media of their choice. (See figure 1)

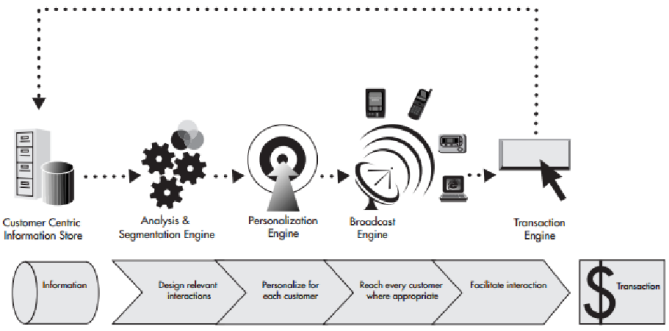


Figure 1

E-CRM MEGATRENDS

Focus on this E-CRM scenario: A customer visits a traditional (physical) store and registers at a kiosk. After returning to home, the customer receives an email with the subject of "thank you for visiting" along with a special offer. The delighted customer clicks on the link mentioned in email and open the website of online store, there he or she gets suggestion from a virtual shopping assistant and started to design own wardrobe. After few days, the customer receives a software generated phone call that tells him or she about the preferred cardigan is now available. The customer immediately purchase that product by pressing described key on his or her phone and picks the package from the store later on.

There are three key trends highlighted the E-CRM movement in this scenario:

1) Every business provides latest information (offers and deals) to its customers
2) The importance of direct marketing is increasing
3) The growth of "the Value Exchange" - non-commercial interactions between companies and its customers. The above mentioned trends are E-CRM Megatrends.

Trend 2:

The influence of direct marketing strengthen the brand and it will always be important, as brands effectively built through one-to –one direct marketing. Mass marketing is economical but its compress the value proposition. But there is no need to compress the value proposition when bandwidth is available to customize and maximize the message to each potential customer as multichannel offer presentment, cheap multi-media and integrated analysis of campaign makes the direct marketing more economically viable and superior than to standardized mass marketing efforts. (See figure 2) A significant transformation of marketing expense is at hand. A recent research of the automobile industry by McKinsey indicates that direct marketing campaigns would consume 80% of the marketing expense in years to come.

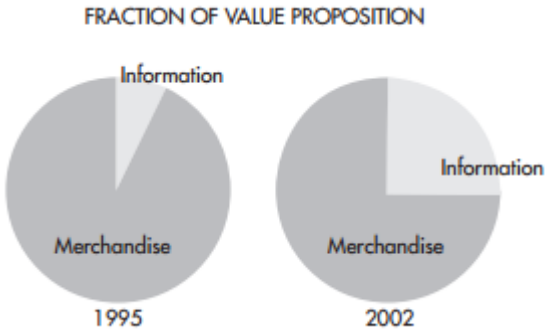


Figure 2

2 CONCLUSIONS

E-CRM is not restricted to only operates on internet but it goes beyond web to devices like, PDAs, mobile phones, land line phones, pagers, WAP phones and set-top TV boxes. It increased the way of communication to the customers by integrating its services to several other mentioned devices or medium. The modern version of shopping of early shop-keeper shifts smoothly from store, to web, to any device and enabling itself to serve possibly anywhere to the customers.

Companies with useful customer information have competitive edge over factors of production like labor, capital and technology and it make company to formulate effective strategies that provide value to its customers in today's surplus ridden economy. Useful customer information and strong relationship have become rare factors. Companies that collect and organize data regarding customers and use them effectively to build and maintain the trusted relationship ultimately win the competition in the marketplace. E-CRM technology is a long term strategic investment is neither flexible for continuous rollout for E-CRM functionality nor its cost effective. Although, the five engine based comprehensive software platform, which includes customer database, analysis and segmentation, personalization, transaction and promotion engines can establish fundamentals to gain competitive advantage.

REFERENCES

[1] Ab Hamid, N. R. (2005). E-CRM: are we there yet? Journal of UK Academy of Business, 6(1), 51-57.
[2] Adebanjo, D. (2003). Classifying and Selecting e-CRM Applications: An Analysis-Based Proposal. Management Decision, 41(6), 570-577. http://dx.doi.org/10.1108/00251740310491517 Antonelli, C. (1991). The diffusion of advanced telecommunications in developing countries. Research Policy, 23(3), 253-254. http://dx.doi.org/10.1016/0048-7333(94)90046-9 Bentley, A. (1999). Sales through service. International Journal of Customer Relationship Management, 1(4), 337-334.

[3] Berry, L. (1983). Relationship Marketing. Paper presented at the Proceedings of Services Marketing Conference, Chicago.

[4] Berry, L. (1995). Relationship Marketing of Services - Growing Interest, Emerging Perspectives. Journal of the Academy of Marketing Science, 23(4), 236-245.

[5] Blery, E. K., & Michalakopoulos, M. G. (2006). An e-CRM application in the telecommunications sector: A case study from Greece. EuroMed Journal of Business, 1(2), 5-14. http://dx.doi.org/10.1108/14502190610750135 Chan, S., & Lam, J. (2009). Customer Relationship Management on Internet and Mobile Channels: An Analytical Framework and Research Directions. Idea Group Inc.

[6] Chen, L., & Sukpani, N. (1998). Assessing consumers' involvement in Internet purchasing. The International Journal of Organizational Innovation, 1(2). Cho, Y., Im, I., Hiltz, S. R., & Fjermestad, J. (2001). Causes and outcomes of online customer complaining behavior: Implications for customer relationship management (CRM). Paper presented at the Proceedings of the Seventh Americas Conference in Information Systems (AMCIS), Boston.

[7] Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

[8] http://dx.doi.org/10.1007/BF02310555 Fjermestad, J., & Romano, N. C. (2003). Electronic customer relationship management: revisiting the general principles of usability and resistance: an integrative implementation framework. Business Process Management Journal, 9(5), 572-591. http://dx.doi.org/10.1108/14637150310496695 Fornell, C. (1992). A national customer Retention barometer: The Swedish experience. Journal of Marketing, 56(1), 6-21.

[9] Forrester. (2001). [Online] Available: http://www.forrester.com Gilbert, D. C. (1996). Relationship marketing and airline loyalty schemes. Tourism Management, 17(8), 575-582.

[10] http://dx.doi.org/10.1016/S0261-5177(96)00078-7 Greenstein, S. M., & Spiller, P. T. (1995). Modern telecommunications infrastructure and economic activity: An empirical investigation. Industrial and Corporate Change, 4(4), 647-665. http://dx.doi.org/10.1093/icc/4.4.647 Hair, J. F., Money, A. H., Samouel, P., & Page, M. (2007). Research methods for business. England: John Wiley and Sons, Inc.

[11] Reichheld, F. F., & Schefter, P. (2000, July-August). E-loyalty: your secret weapon on the Web. Harvard Business Review, 105-113.

[12] Robert, W. P., & Daunt, R. P. (2006). Factors Influencing the Effectiveness of Relationship Marketing. Journal of Marketing, 70(4), 136-153. http://dx.doi.org/10.1509/jmkg.70.4.136 Romano, N. J. (2001). An agenda for electronic commerce customer relationship management research. Paper presented at the Proceedings of the Seventh Americas Conference in Information Systems, Boston, MA. Shan, L. P., & Lee, J. (2003). Using e-CRM for a Unified View of the Customer. Communications of the ACM, 46.

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A Comparative Study of Data Mining Process Models (KDD, CRISP-DM and SEMMA)

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ABSTRACT: Data Mining is about analyzing the huge amount data and extracting of information from it for different purposes. From the last few years the field of Data Mining becomes prominent and makes huge growth. There are different standard models for data mining. All these models are defined in sequential steps. These steps help in implementing the data mining tasks. In this paper we will compare these models and give brief understanding about them.

KEYWORDS: Knowledge, Applications, Patterns, Modeling, Information.

1 INTRODUCTION

Over the last few years the field of data mining [1] becomes very important for different industries, co-corporations and businesses etc because of its ability to use huge amount of data that had previously no use and makes analysis and predicting trend and patterns. Basically the risk of wasting the wealthy and valuable information contained by the big databases was arise and this requires the use of adequate techniques to get useful knowledge [2] so that the field of data mining had been emerged in 1980's and is still making progress. With the emergence of this field different process models were introduced. These process models guides and carry the data mining tasks and its applications.

Efforts were made to use data mining process models that may guide the implementation of data mining on big or huge amount of data. In our paper we mainly focuses on three most popular data mining process models and these models are Knowledge Discovery Databases (KDD) process model, CRISP-DM and SEMMA. These three models are mostly practiced by the data mining experts and researchers. In this paper we will elaborate these models. We will do comparative study of these models and try to explain that what insight of them is.

2 OVERVIEW OF KDD, CRISP-DM AND SEMMA

The Knowledge Discovery Databases (KDD) model is an iterative and interactive model [3]. It has total nine steps. It refers to finding knowledge in data and emphasizes the high level of specific data mining method.

Cross-Industry Standard Process for Data Mining (CRISP-DM) [4] was launched in late 1996 by Daimler Chrysler (then Daimler-Benz), SPSS (then ISL) and NCR. This models the refines over the years. It has six steps or phases.

Sample, Explore, Modify, Model, Assess (SEMMA) [5] model was developed by SAS institute. It has five different phases.

2.1 THE KDD PROCESS MODEL

The KDD or Knowledge Discovery Databases [6] is the process of extracting the hidden knowledge according from databases. KDD requires relevant prior knowledge and brief understanding of application domain and goals. KDD process model is iterative and interactive in nature. There are nine different steps or stages of this model and these are given below.

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2.1.1 DEVELOPING AND UNDERSTANDING OF THE APPLICATION DOMAIN

This is the first stage of KDD process in which goals are defined from customer's view point and used to develop and understanding about application domain and its prior knowledge.

2.1.2 CREATING A TARGET DATA SET

This is the second stage of KDD process which focuses creating on target data set and subset of data samples or variables. It is an important stage because knowledge discovery is performed on all these.

2.1.3 DATA CLEANING AND PRE-PROCESSING

This is the third stage of KDD process which focuses on target data cleaning and pre-processing to complete and consistent data without any noise and inconsistencies. In this stage strategies are develop for handling such type of noisy and inconsistent data.

2.1.4 DATA TRANSFORMATION

This is the fourth stage of KDD process which focuses on transformation of data from one form to another so that data mining algorithms can be implemented easily. For this purpose different data reduction and transformation methods are implemented on target data.

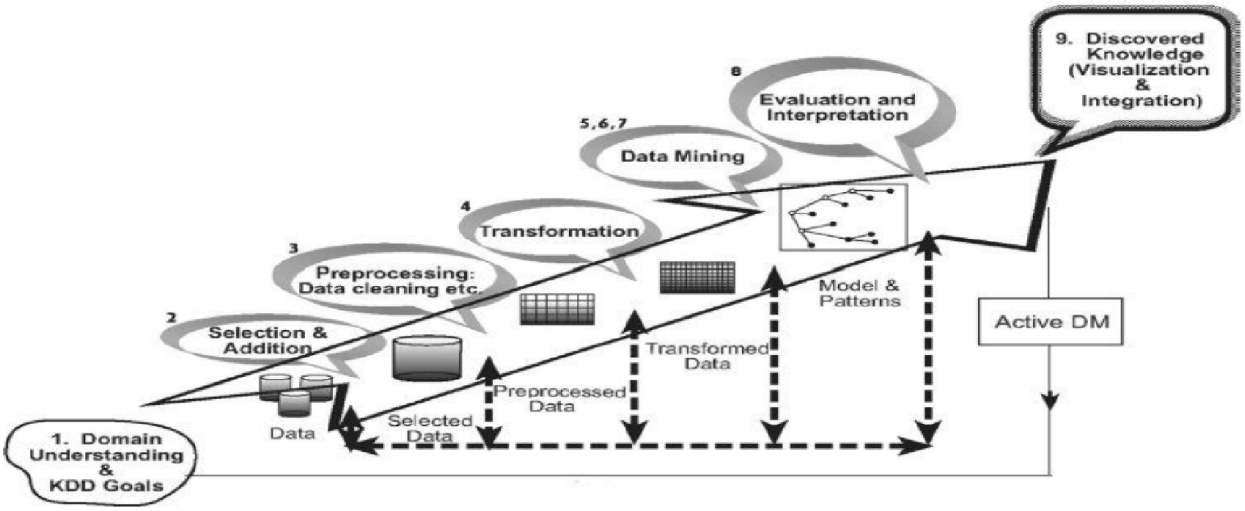


Fig. 1. Knowledge Discovery Databases (KDD) Process Model

2.1.5 CHOOSING THE SUITABLE DATA MINING TASK

This is the fifth stage of KDD process in which appropriate data mining task is chosen based on particular goals that are defined in first stage. The examples of data mining method or tasks are classification, clustering, regression and summarization etc.

2.1.6 CHOOSING THE SUITABLE DATA MINING ALGORITHM

This is the sixth step of KDD process in which in which one or more appropriate data mining algorithms are selected for searching different patterns from data. There are number of algorithms present today for data mining but appropriate algorithms are selected based on matching the overall criteria for data mining.

2.1.7 EMPLOYING DATA MINING ALGORITHM

This is the seventh step of KDD process in which selected algorithms are implemented.

2.1.8 INTERPRETING MINED PATTERNS

This is the eighth step of KDD process that focuses on interpretation and evaluate of mining patterns. This step may involve in extracted patterns visualization.

2.1.9 USING DISCOVERED KNOWLEDGE

This is the last and final step of KDD process in which the discovered knowledge is used for different purposes. The discovered knowledge can also be used interested parties or can be integrate with another system for further action.

2.2 THE CRISP-DM PROCESS MODEL

CRoss-Industry Standard Process for Data Mining (CRISP-DM) was developed by Daimler Chrysler (then Daimler-Benz), SPSS (then ISL) and NCR in 1999, CRISP-DM 1.0 version was published and is complete and documented. It provides a uniform framework and guidelines for data miners. It consists of six phases or stages which are well structured and defined [7]. These phases are described below.

2.2.1 BUSINESS UNDERSTANDING

This is the first phase of CRISP-DM process which focuses on and uncovers important factors including success criteria, business and data mining objectives and requirements as well as business terminologies and technical terms.

2.2.2 DATA UNDERSTANDING

This is the second phase of CRISP-DM process which focuses on data collection, checking quality and exploring of data to get insight of data to form hypotheses for hidden information.

2.2.3 DATA PREPARATION

This is the third phase of CRISP-DM process which focuses on selection and preparation of final data set. This phase may include many tasks records, table and attributes selection as well as cleaning and transformation of data.

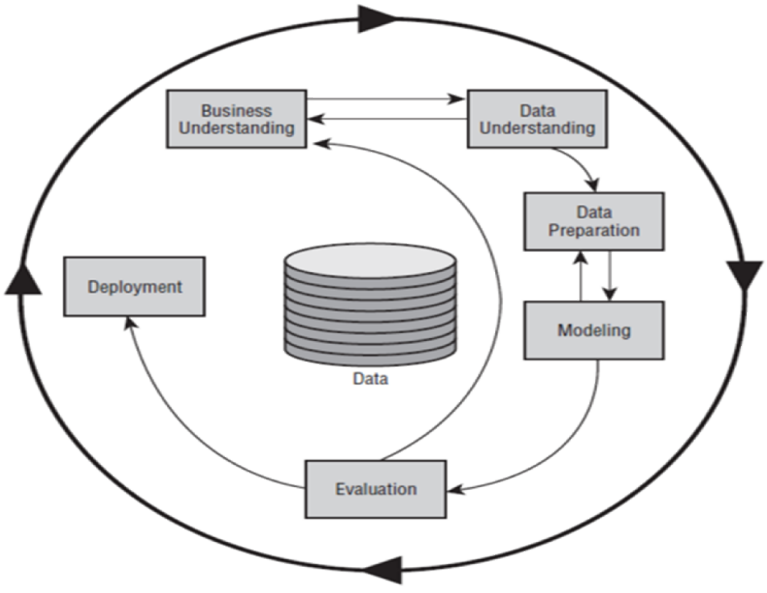


Fig. 2. CRISP-DM Process Model

2.2.4 MODELING

This is the fourth phase of CRISP-DM process selection and application of various modeling techniques. Different parameters are set and different models are built for same data mining problem.

2.2.5 EVALUATION

This is the fifth stage of CRISP-DM process which focuses on evaluation of obtained models and deciding of how to use the results. Interpretation of the model depends upon the algorithm and models can be evaluated to review whether achieves the objectives properly or not.

2.2.6 DEPLOYMENT

This is the sixth and final phase of CRISP-DM process focuses on determining the use of obtain knowledge and results. This phase also focuses on organizing, reporting and presenting the gained knowledge when needed.

2.3 THE SEMMA PROCESS MODEL

The SEMMA stand for (Sample, Explore, Modify, Model, and Access) is data mining method developed by SAS institute. It offers and allows understanding, organization, development and maintenance of data mining projects. It helps in providing the solutions for business problems and goals. SEMMA is linked to SAS enterprise miner and basically a logical organization of the functional tools for them. It has a cycle of five stages or steps.

2.3.1 SAMPLE

This is the first and optional stage of SEMMA process which focuses on sampling of data. A portion from a large data set is taken that big enough to extract significant information and small enough to manipulate quickly.

2.3.2 EXPLORE

This is the second stage of SEMMA process which focuses on exploration of data. This can helps in gaining the understanding and ideas as well as refining the discovery process by searching for trends and anomalies.

2.3.3 MODIFY

This is the third stage of SEMMA process which focuses on modification of data by creating, selecting and transformation of variables to focus model selection process. This stage may also looks for outliers and reducing the number of variables.

2.3.4 MODEL

This is the fourth stage of SEMMA process which focuses on modeling of data. The software for this automatically searches for combination of data. There are different modeling techniques are present and each type of model has its own strength and is appropriate for specific situation on the data for data mining.

2.3.5 ACCESS

This is the fifth and final stage for SEMMA process focuses on the evaluation of the reliability and usefulness of findings and estimates the performance.

3 COMPARATIVE ANALYSIS OF KDD, CRISP-DM AND SEMMA

There are nine, six and five stages for KDD, CRISP-DM and SEMMA process model respectively. By examining all the three data mining process models they clearly shows that they are somehow equivalent to each other even SEMMA is directly linked to the SAS enterpriser miner software and CRISP-DM Daimler Chrysler (then Daimler-Benz), SPSS (then ISL) and NCR. The comparison between them shows that

- The KDD process step "Developing and Understanding of the Application Domain" can be identified with "Business Understanding" phase of CRISP-DM process.
- The KDD process steps "Creating a Target Data Set" and "Data Cleaning and Pre-processing" can be identified with "Sample" and "Explore" stages of SEMMA respectively, and/or these can be identified with "Data Understanding" phase of CRISP-DM.
- The KDD process stage "Data Transformation" can be identified with "Data Preparation" stage of CRISP-DM and "Modify" stage of SEMMA process respectively.
- The three stages of KDD "Choosing the suitable Data Mining Task", "Choosing the suitable Data Mining Algorithm" and/or "Employing Data Mining Algorithm" can be identified with "Modeling" phase of CRISP-DM and/or "Model" stage of SEMMA process respectively.
- The KDD process step "Interpreting Mined Patterns" can be identified with "Evaluation" phase of CRISP-DM process and/or "Assessment" stage of SEMMA process respectively.
- The KDD step "Using Discovered Knowledge" can be identified with "Deployment" phase of CRISP-DM process.

The comparison of these models is given in below table.

Table 1: Summary of KDD, CRISP-DM and SEMMA Processes

Data Mining Process Models	KDD	CRISP-DM	SEMMA
No. of Steps	9	6	5
Name of Steps	Developing and Understanding of the Application	Business Understanding	----------
	Creating a Target Data Set	Data Understanding	Sample
	Data Cleaning and Pre-processing		Explore
	Data Transformation	Data Preparation	Modify
	Choosing the suitable Data Mining Task	Modeling	Model
	Choosing the suitable Data Mining Algorithm		
	Employing Data Mining Algorithm		
	Interpreting Mined Patterns	Evaluation	Assessment
	Using Discovered Knowledge	Deployment	----------

4 CONCLUSION

Our study was on comparison between KDD, CRISP-DM and SEMMA data mining processes. As we know most of the researchers and data mining experts follow the KDD process model because it is more complete and accurate. In contrast CRISP-DM and SEMMA or mostly company oriented especially SEMMA that is used by SAS enterprise miner and integrate with their software. However, study shows that CRISP-DM is more complete as compare to SEMMA. All and all these process models guides and helps the people and experts to know that how they can apply data mining into practical scenarios.

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We will like to thank our Parents and Family members. It is due to their support and guidance that encourage us to write this paper.

REFERENCES

[1] Han, J. and Kamber, M. "Data Mining: Concepts and Techniques. Second Edition", Morgan Kaufmann Publishers, San Francisco, 2006.

[2] Chen, M. et al, "Data Mining: An Overview from a Database Perspective.", IEEE Transactions on Knowledge and Data Engineering, Vol. 8, No. 6, pp 866-883, 1996.

[3] Brachman, R. J. & Anand, T., "The process of knowledge discovery in databases.", AAAI Press / The MIT Press. 1996.

[4] Chapman, P. et al, "CRISP-DM 1.0 - Step-by-step data mining guide." SPSS, 2000.

[5] SAS Enterprise Miner – SEMMA. SAS Institute, 2014 [online] available: http://www.sas.com/technologies/analytics/datamining/miner/semma.html (September 2014.)

[6] Usama Fayyad et al., "From Data Mining to Knowledge Discovery in Databases" American Association for Artificial Intelligence, 1996.

[7] Colin Shearer, "The CRISP-DM Model: The New Blueprint for Data Mining", JOURNAL of Data Warehousing, Volume 5, Number 4, page. 13-22, 2000.

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Standard Public Information Centre for Effective National Development: Case Study of Communities Dwellers in Kogi-West Senatorial District, Kogi State, Nigeria

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ABSTRACT: Public information center store information resources to meet information needs of public. The purpose of the study is to investigate whether the communities' dwellers in Kogi-West Senatorial District in Kogi State of Nigeria need standard public information center. Also to know their information needs and preferred information resources. Descriptive survey design was adopted. Instruments for data collection are questionnaire and personal interview. Simple percentage was used for data analysis; where 50% and above is considered agreed and accepted while 50% and below is considered not agreed and rejected. At of 700 respondents accidentally selected 683 (97.5%) want establishment of standard public information center while, 27 (3.8%) show no interest. Those that want the establishment their information needs cut across agriculture, business, health, politics, and education; and their preferred information resources are books & papers, television, radio, resource persons, and Internet. Recommendations were proffered to enable effective establishment of standard public information centers in the communities understudy.

KEYWORDS: Public information center, Public library, Information needs, Information sources, Kogi- west senatorial district, Kogi state, Nigeria.

1 INTRODUCTION

The levels of development of every nation solely depend on their level of having access to information. Information is life; light; and knowledge. When there is no information people are deformed, blind, mislead, unexposed and fall victim of avoidable mistakes. Information is needed in all spheres of life to facilitate decision making and engender progress [1]. In the same vein, information is not a luxury; nor is it fashionable gadgetry but an essential instruction for development [2]. So, one cannot but agreed that everybody need information for decision making and development. It is also imperative to note that information needs of every individual in a society vary. Information needs are basically depend on the nature of jobs or activities individual engaged in; and they use different information seeking behaviors to acquire their precise information needs. Information seekers in a community acquired their information needs strategically from print and electronic information resources which are housed in public information center. This mean that standard public information center must have adequate information resources to cover all occupations and activities of people where it is established while, the building of the center most be properly designed to suit the needs. This is essential for communities' dwellers in states of a nation.

1.1 KOGI-WEST SENATORIAL DISTRICT, KOGI STATE, NIGERIA

Kogi State is one of the 31 states in Nigeria. It was created under the regime of Major General Ibrahim Badamasi Babagida in 1991. At Present, the state has 21 Local Government Areas which are divided into three senatorial districts. These are:

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Kogi-West, Kogi-East and Kogi-Central. The communities' dwellers in the districts are not different from others in the world at large. Though there might be variation in languages, cultures, status, exposure to education and possibly the climatic changes but their information needs can still be group under distinct categories and acquired from standard public information center. Hence, the communities' dwellers in Kogi-west senatorial district are grouped under the following local government areas: Ijumu, Kabba-Bunu, Yagba-West, Yagba-East, Mopamuro, Kogi, Lokoja. So, it is very imperative to access the communities' dwellers in Kogi-west senatorial districts from their local government area head quarters. Because it is believes that all under communities more have representation in their local government area.

2 BRIEF LITERATURE REVIEW

2.1 PUBLIC INFORMATION CENTER

Public information center is synonymous to public library. It is a centre where information resources and services are readily made available to both literate and non-literate members of a community or public. In Nigeria, its services oriented mostly established and funded by State and Local Government Authorities. They are largely classified as non-income generating government establishment; but to make people acquire their information needs [3]. That is, its' stored both print and non-print information resources to promote the intellectual and recreational activities of people in a community. "Reference [4] noted that, the center housed both print and non-print information resources which have both education and social roles to play in people's life as it is doors are widely opened to all people regardless of the race, religion, languages, racks or status and occupations". In the same view, public information center is a place where people can go to make talk, hear, listen to varieties of discussion, music and watch cinema shows [5]. Hence, one cannot but agreed with the opinions of the scholars that public information centers can help a nation to development. More to these, the objectives of public information center as recommended by UNESCO are:

- To promote and stimulate reading for pleasure and recreation;
- To support and reinforce programmes such as adult and fundamental education;
- To provide education services for children;
- To provide service for special groups of people in the community, as disabilities; and
- To assist rural educational transformation measure [6].

However, to achieve the above objectives there must be a well established public information center equipped with different information resources that can be used or consulted to meet the information needs. Public library- public information center requires special governance from qualified professionals for administrative and casual works; while its' building is not a thing apart, but three dimensional representation of service concept [7]. That is; site selection must involve critical evaluation to avoid excessive slop, powerful drainage pattern and noise. While, fund rising can be from philanthropists, and government [8]. It is also imperative to note that, the basic design of the building structure such as forms and functions, style and space allotment, equipments and furniture should be considered based on the activities or occupation of the current population and future advancement of the community. "Reference [9] noted that staff to work in public information center should be both non-professionals and professionals who will able to manage its activities effectively". This implies that the staff should be ready to work and use interpersonal, conceptual, analytical and technical skills in their designated responsibility.

2.2 INFORMATION NEEDS AND INFORMATION RESOURCES

Both literate and non-literate members of a community desire information to meet their needs. This is because information is a product that provides knowledge or intelligence about a need. It is worth noting that, the nature of activities everyone engaged in defined their information needs. Hence, information needs can be referred to as necessity of life to achieve happiness and fulfillment. It is important to note that, the information needs of people in a defined community include agriculture, education, health, politics and business while, the information gathered and preserved on these needs can be made available in public information centre for the seekers through television, internet, radio, books and papers [10]. It is also worthy to note that, public information center doors are widely open for children, pupils, students, adults, professionals, researchers and lecturers, policy makers and planners, artisans, and physically challenge people [11].

3 STATEMENT OF THE PROBLEM

Public information center is a designed for information accumulation and dissemination through available information resources. A standard availability of information resources will enable everybody to acquire their information needs. Hereby, leads to development. However, if there is no standard public information center in a community, the dwellers will not have access to information to meet their needs. Hereby, put them into state of information darkness, not current, unexposed to new knowledge and innovation on their interest while, development will remain unachieved. Hitherto, affect national development. Despite all these, it is of great concern that no study seems to have been holistically carried out on it in Kogi-West. This justifies the present study and the problem of the study put in question form is: what is the state of public information center, if any, in Kogi-West senatorial district, Kogi State, Nigeria?

4 RESEARCH OBJECTIVES

The following objectives guide the study. To know:

1. if the communities dwellers understudy want establishment of standard public information center
2. educational qualification of the communities' dwellers understudy
3. information needs of the communities' dwellers understudy
4. preferred sources of information for communities' dwellers understudy

5 SIGNIFICANCE OF THE STUDY

The findings of the study will be of benefit to groups of people such as Kogi State government, library & information providers, researchers, and library & information science students. To Kogi state government, they we know if the communities' dwellers in the constituency understudy need standard public information center. To library and information providers, it will help them to know the information needs of communities' dwellers and hereby provide the public information center with information resources to meet their needs. To researchers and students of library and information science it will be a reference point.

6 RESEARCH METHODOLOGY

Descriptive survey design was employed for this study. The instruments of data collection are questionnaire and personal interview. A total copy of questionnaire used is Seven hundred (700). The total 700 copies were divided into 7 for each of the local government areas in Kogi-west senatorial district to have 100 copies. Accidental method was used for administered and collection of data. This was carried out in each of the local government headquarters. As its' believed that each community under each local government must have representative in their local government head quarters. The data gathered was analyzed using simple percentage on each item in the tables. Where 50% and above were considered Agree (considerable) while, below 50% where considered disagree (not considerable). Hence, the data collected through interview from the respondents were used to buttress the discussion of the findings.

7 DATA ANALYSIS

7.1 WANT ESTABLISHMENT OF STANDARD PUBLIC INFORMATION CENTER

Table 1: Whether the Respondents Understudy Want Establishment Standard Public Information Center

	Response rate	Percentage (%)
Yes	683	97.5
No	27	3.5
Total	700	100

Source: Field Survey

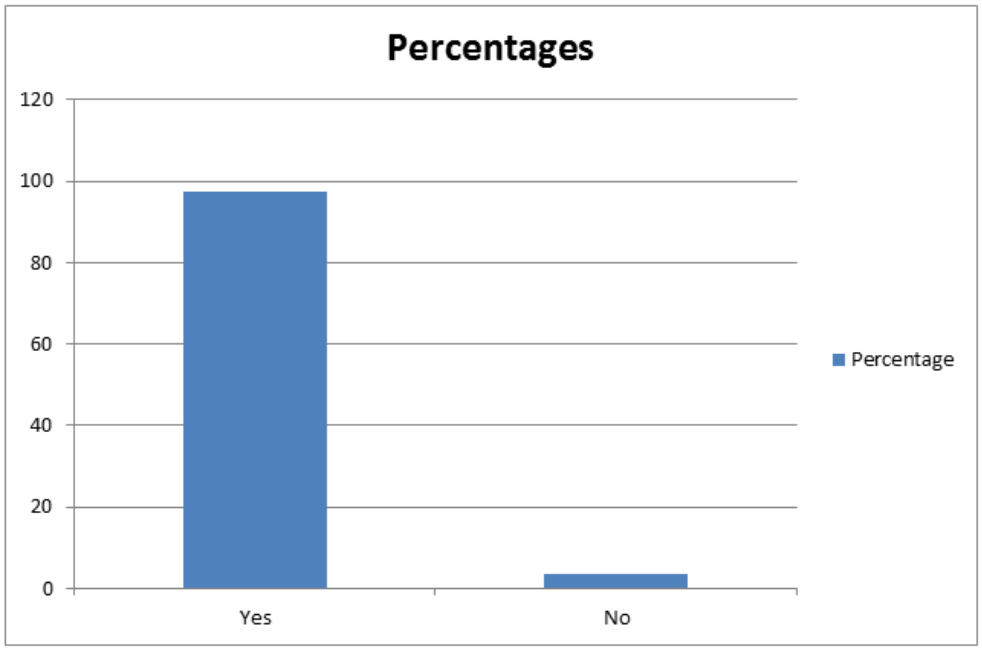


Fig.1: Colum Chart Showing the Percentage of the Respondents on Establishment of Standard Public Information Centre

From table 1 and its chart above, "Yes" has 683 (97.5%) while, "No" has 27(3.8%). Yes option is higher. This shows that the communities' dwellers want establishment of standard public information center.

7.2 EDUCATIONAL QUALIFICATION OF RESPONDENTS UNDERSTUDY

Table 2: Educational Qualification of Respondents Understudy

Education qualification	Response rate	Percentage (%)	Rank
Primary School graduate	367	52.4	3rd
Secondary School graduate	507	72.4	2nd
Tertiary institution graduate	339	48.4	4th
No education qualification (uneducated)	537	76.7	1st

Source: Field Survey

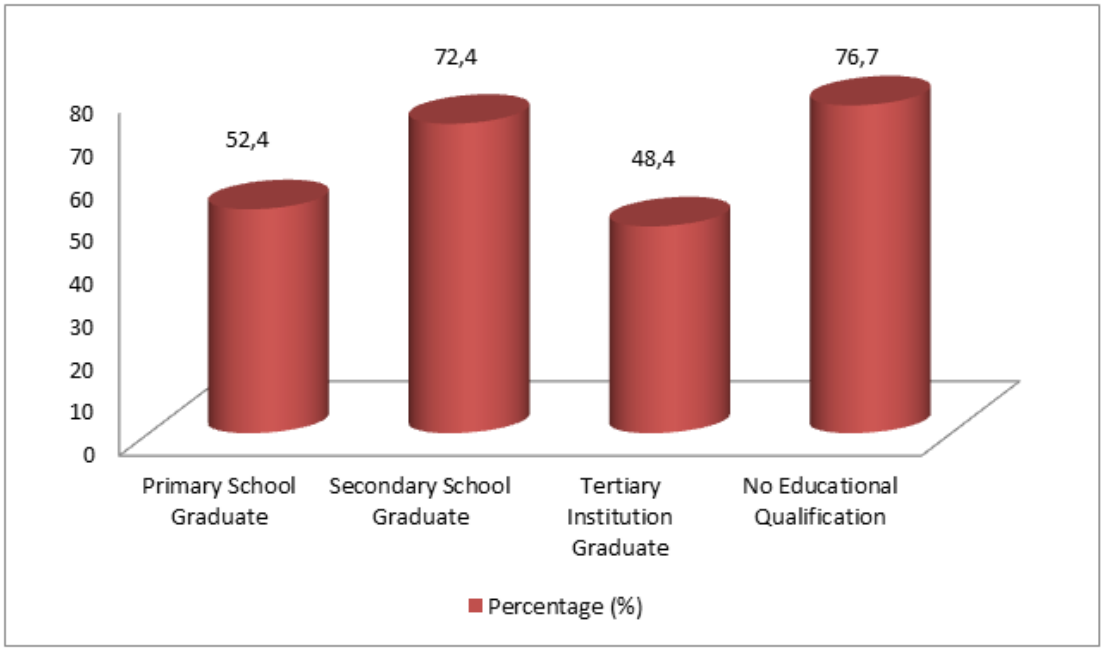


Fig. 2: Column Chart Showing Educational Qualification of Respondents Understudy

From table 2 and its chart above, "uneducated" has 537(76.7%), "secondary school graduate" has 507 (72.4%), "primary school graduate" has 367 (52.4%) and "tertiary institution graduate" has 339(48.4%). The uneducated constitute the highest percentage while, tertiary institution graduate is the least.

7.3 INFORMATION NEEDS OF THE RESPONDENTS UNDERSTUDY

Table 3: Information Needs of the Respondents Understudy

Information Needs	Numbers of respondents	Percentage (%)	Rank	Remark
Health Information Needs	517	73.8	3rd	Agreed
Business Information Needs	583	83.2	2nd	Agreed
Political Information Needs	510	72.8	4th	Agreed
Agriculture Information Needs	655	93.5	1st	Agreed
Education Information Needs	485	69.0	5th	Agreed

Source: Field Survey

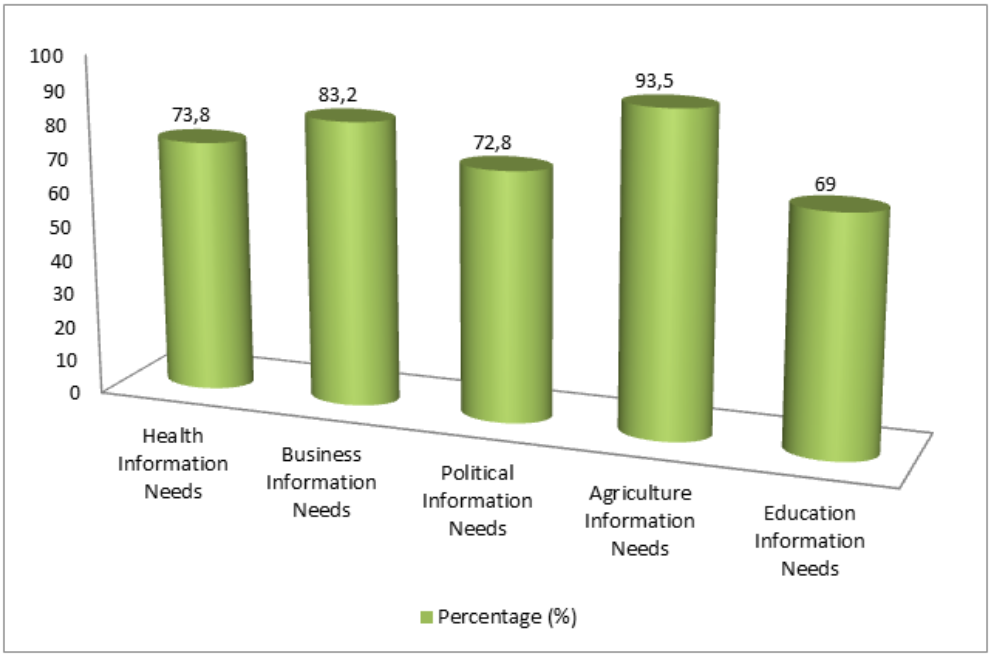


Fig. 3: Column Chart Showing Information Needs of the Respondents Understudy

From table 3 and its chart above, "agricultural information needs" has 655(93.5%), "business information needs" has 583 (83.2%), "health information needs" has 517(73.8%), "political information needs" 510(72.8%) and "education information needs" has 485 (69.0%). Agricultural information needs ranked highest, while educational information needs ranked least. But they are all considered needed because they are all above 50% as a cut off percentage for consideration.

7.4 PREFERRED SOURCES OF INFORMATION FOR THE RESPONDENTS UNDERSTUDY

Table 4: Preferred Sources of Information for the Respondents Understudy

Sources	Numbers of Respondents	Percentage	Rank	Remark
Television	540	77.1	2nd	Accepted
Internet	281	40.1	5th	Not Accepted
Radio	531	75.8	3rd	Accepted
Books and Papers	620	88.5	1st	Accepted
Resource person	390	55.7	4th	Accepted

Source: Field Survey

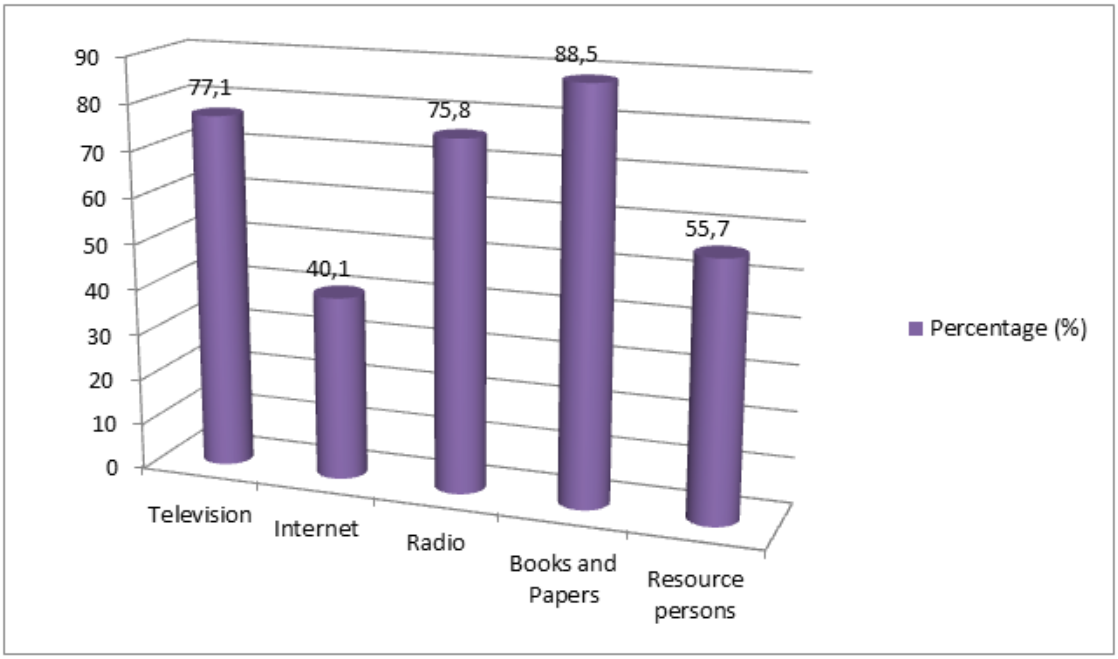


Fig. 4: Column Chart Showing the Preferred Sources of Information for the Respondents Understudy

From table 4 and its chart above, "books and papers" has 620 (88.5%), "television", has 540 (77.1%), "radio", has 531(75.8%), resources persons" has 390(55.7%) and "Internet" has 281(40.1%). Hence, they are above 50% as cut off percentage, considered accepted except Internet.

8 DISCUSSION OF THE FINDINGS

8.1 ESTABLISHMENT OF PUBLIC INFORMATION CENTER, EDUCATIONAL QUALIFICATION AND INFORMATION NEEDS

Based on the findings of the study and the interpretation of the data obtained from questionnaire and personal interview the researchers discovered that the communities' dwellers in local government areas in Kogi-West senatorial district of kogi State, Nigeria need establishment of standard public information centers while, they delighted much on information related to agriculture, education, business, politics and health regardless of their educational qualification. On agricultural information, the study reveals that, there were literate farmer in the areas. This categories need information on latest implements, seedlings, presented in a book form, magazine, journals, bulletins, CD- Rom, hand bills while, the illiterate want information presented in pictorial form, audio visual, audio. On business information, most of the community dwellers engaged in buy and sell of goods and services. Interview shows they're interested on commercial related advertisement this would help them to obtain information on sources and application of goods and services.

Furthermore, on health information, World Health Organization says "health is wealth". The service of the public health department in the state could not be over emphasized. This was demonstrated in the way the respondents appreciated the effort of the health department in the dissemination of health related information services. Nevertheless, in the public information center all the materials both print and electronic format that are related to health are needed. On educational information need, education is not receiving proper attention in the area. This was further understood when interview shows that there are dilapidated school buildings, lack of books, teaching aids and inadequate infrastructures. All these culminate to a great number of school drop outs in the areas. On politics, people need information on political issues in the country. From interview the way people are into politics is getting much both the literate and non-literate members of the community. Some people in the community have chosen politics as their occupation.

8.2 SOURCES OF INFORMATION NEEDS

It was discovered that not all the dwellers has different information sources on their own to generate their information needs. Despite they referred television, resource person, internet café, radio, books and paper as their sources of information. Therefore, majority of the community dwellers want information from television but it's expensive to purchase

and maintain. Moreover, outage of light does not allow those that have television set to use it effectively. Substitute to this, is generator plants and with the economic turbulence of the country causing escalation of petrol price. Using of internet café, the respondents that uses this source complains on how expensive it is. Moreover, is rarely available within the local communities. Finally, facts generated through interview shows that there is no good library in schools also they did not have public information centre.

9 SUMMARY OF MAJOR FINDINGS

1. It was discovered that, majority of the respondents want standard public information center to be established.
2. It was discovered that the number of illiterate are higher but they need education; while the educated respondents also need information. These call for establishment of standard public information center
3. The information need of the dwellers cuts across agriculture, business, health, politics and education. This shows that, the information to be acquired and stored in the public information system after its establishment should covered all the information needs of the respondents
4. The research shows that books & papers, television, radio, resource persons are the preferred sources of information to meet their needs. While, internet were less considered though is needed.

10 IMPLICATION OF THE STUDY

Everyone in a community needs information. Having standard public information center is of great important to the general public regardless of status, educational qualification or otherwise [5]. More to this, adequate information resources both print and non-print based on occupations or activities of the people to be made available in public information center is of great value [4]. Hence, it is very imperative to note that, if there is no standard public information center with well equipped information resources will cause the communities dwellers not to acquire their information needs. Hereby, affect the national development because information is a powerful holistic product to support development.

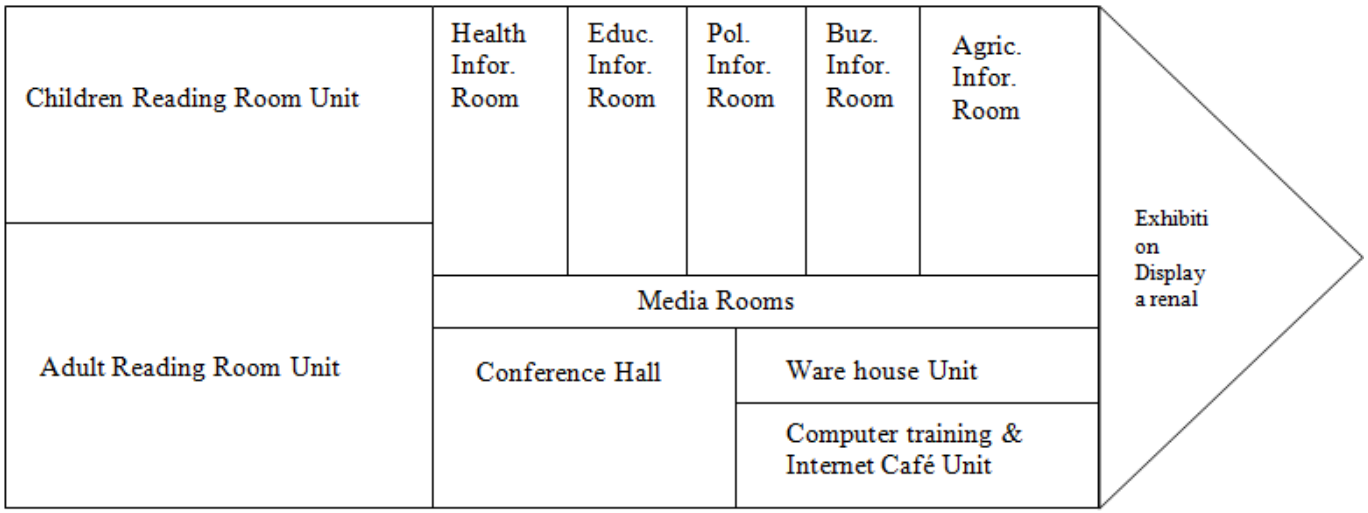
11 CONCLUSION

For effective national development, information services must be duly felt by everyone through standard public information center in every community. This is because information needs of every group can be determine, acquire, and store at the center for use; and its doors are widely open to general public. Finally, it was discovered that, there is no standard public information centre in local communities in Kogi-West senatorial district. This is a pathetic issue because it could have been the store house to make information needs of the communities' dwellers available in different sources and also present them in the best format needed.

12 RECOMMENDATIONS

The following recommendations are proffered to enhance achievement of the research findings

1. The philanthropist, local and state government of Kogi State should endeavor to establish standard pubic information centre in the communities and site them where there is less noise and the area should be of good drainage pattern.
2. Both paraprofessionals and professionals librarian should be employed in order to meet up the demands for efficient and effective of local community information dissemination.
3. Library management should sensitizing the general public on the existence and importance of the public information centre materials and services available through bulletin, public lecture, exhibition and film show.
4. Information resources to be provided at the center should include books and papers, television, radio, internet, resource person that will cover the dwellers information needs.
5. There should be provision for standby generator in case of power outage in the centers.
6. There should be human and electronic security system in the established centers
7. The management should work with local cultural institutions, ministries, such as Ministry of Education, Agriculture, Health and Commerce on domestic and International issues, in order to have up-to-date information in the centre
8. Architectural design of the standard public information centre should be built on below skeletal outlay.



REFERENCES

[1] E. A. Aloli, "Information needs of Rural Business Women in Plateau State, Nigeria". *Zaria Journal of Librarianship,* vol.7, no.1&2, pp. 2, 2004.
[2] M. Elmadre, "Information as the Fourth Vital Element and Its Influence on the Culture of People", *Journal of information Science*, vol. 13, no. 3 pp.150-151, 1985.
[3] I. M. Ogbonna, Public Library Services Provided by the Enugu State Library Board from 2007-2010: A Statistical Report. *Nigerian Libraries,* vol. 44, no.1, pp.73-88, 2011.
[4] N. Yusuf, *National and International Library planning,* London: Dowes & Bowes, 2002.
[5] B. Luckham, *Library and Society.* London: Wonson Makinta, 1981.
[6] H. O. Iwuji, "Librarianship and Oral Tradition". *Africa International Review*, vol. 22, no. 1, pp.53-55, 1990.
[7] K. Krishan, *Library Administration and Management,* 2nd Ed. New Delhi, Mc Graw-Hill, 2004.
[8] P. E. Edwin, *Local Public Library Administration,* 2nd Ed. Chicago, American Library Association, 1980.
[9] L. O. Aina, *Library and Information Science Text for African.* Ibadan, Third world information service Ltd., 2004.
[10] L. O. Aina, *Agricultural Information in Africa.* Ibadan, Third world information service Ltd., 1995.
[11] K. Whittaker, *The Basic of Library Based on User Services*. London: Association Publishing Ltd., 1993.

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Challenges facing human resources succession planning in Tanzania's work organizations: The case of public and private work organisations based in Dar es salaam region

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ABSTRACT: This paper aimed at assessing factors affecting human resource succession planning in Tanzania public and private organizations. The study aimed at finding answers to the following four objectives ;assessment of extent of human resources succession planning activities in Tanzania's work organizations; examining of the challenges facing human resources succession planning in the Tanzania work organizations; assessment of the positive factors influencing human resources succession planning in Tanzania work organizations; and looking at strategies used for enhancing the application of human resource succession planning in Tanzania work organizations. The study employed a sample of 60 respondents upon whom questionnaire, key informants, focus group discussions (FGDs) as well as documentary reviews were administered. Random, clustered and stratified sampling techniques were used to build a viable sample from the target population. The data collected were analyzed through excel and SPSS tools. Study findings indicate that majority of the respondents did not have knowledge on the concept of human resource succession planning and how it works in their organizations. Few organizations surveyed conducted succession planning but how effective and regularly done in the organizations remained questionable. Conclusively, the study findings both showed and recommended that human resource succession planning played an important role for the organization development and therefore ,driven by top management commitment and consistent purposive continuous training programs ,attracting and recruiting potentially capable employees, Effective strategic leadership, management development and improving budget were among the strategies identified to be suitable for enhancing effective human resource succession planning in the surveyed organizations.

KEYWORDS: succession planning; human resource development; management development; strategic leadership.

1 INTRODUCTORY BACKGROUND

1.1 BACKGROUND TO THE RESEARCH PROBLEM

Succession planning was first introduced by Henri Fayol who believed if succession planning needs were ignored, organizations would not be prepared to make necessary transitions (Rothwell, 1994; 2000; 2002; 2010). Succession planning allows an organization to prepare for the absence, departure, death, retirement, or termination of an individual; it provides for continuity of culture and the evolution of necessary skills for an organization (Armstrong, 2005); originally used to anticipate smooth transitions to the top levels in organizations, it has evolved into a process that many organizations view it as a critical activity for key positions across all functions and levels; succession planning refers to ensuring business continuity by keeping strategic positions filled by requisite competent and motivated workforce and strategists. While operational definitions vary, the core meaning has remained the same throughout the decades as the process of succession planning evolved. The Modern business environment requires businesses to be sufficiently robust and resilient by setting in place and implementing strategic plans that ensures continuity and avoidance and /or minimization of disastrous risks (Mullins, 2010; Armstrong, 2005; Capelli, 2000)

1.2 CONCEPTUAL RESEARCH MODEL

This study will be guided by the researcher's conceptual model as designed because it takes into account many aspects in relation to the factors affecting human resources succession planning in Tanzania organizations (Issa, 2007). This include determinants of succession planning; effectiveness of succession planning; challenges facing succession planning, organization performance as well as available opportunities for enhancing human resource succession planning(Arthur and rousseau,1996;novak,2007;). Effectiveness of succession planning is indicated by Organizational survival, Continuity and viability; Determinants of succession planning include HR Policy, Committed managers, Organization culture, Organizational readiness, Managers/managerial and organizational competencies (Armstrong, 2005; Issa, 2007; Richardson, 2006). Challenges of succession planning include Sufficient talent pipeline, Inability to motivate and retain key employees, Ineffective business practices, Limited information about employees, Failure to address company future needs and organization performance being indicated by Productivity, Stability, Sustainability as well as Sales (Issa, 2007; Jackson and schuler, 1990).Therefore, in totality of the above components the exercise of human resource succession planning can be achieved as planned.

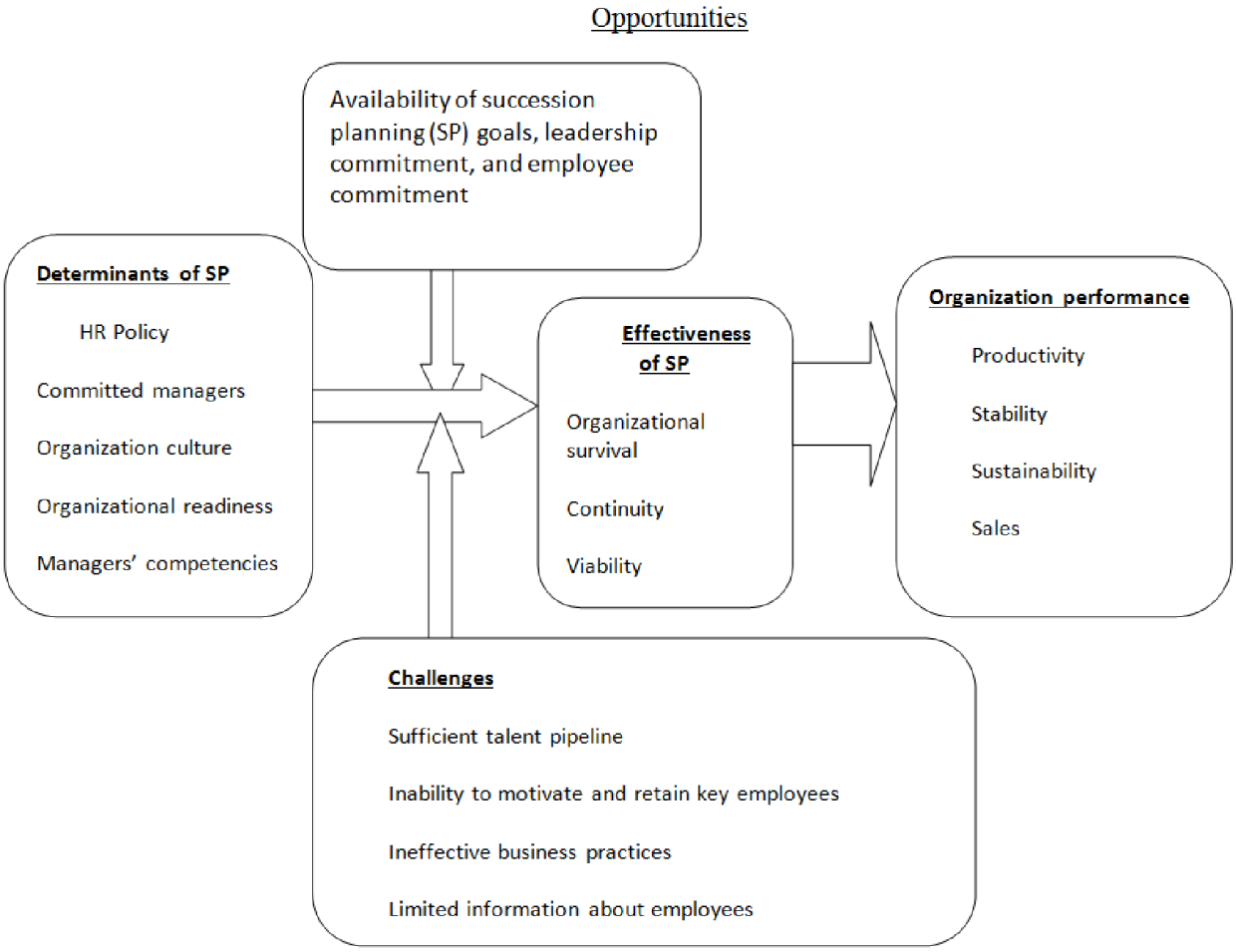


Figure 1 Conceptual research Model for Succession Planning

Source: research Design, 2013

2 RESEARCH DESIGN AND METHODOLODY

2.1 SAMPLE AND DATA

The central point of this step are to determine the specific population that will be surveyed, to decide on an appropriate sample, and to determine the criteria that will be used to select the sample (Kothari, et al., 2012). The research was undertaken within two main groups of people in the selected organizations. First group comprised the selected organizations

management teams and the second group comprised the remaining employees who were neither in a senior nor junior management positions

The research collected data from sixty (60) people from selected organizations management teams and employees who were not in any management cadres. Three sampling techniques were employed in this study. These were random, cluster and stratified sampling techniques. The selected target populations were stratified basing on age, sex, education level, working experience as well as their marital status. They were randomly selected and clustered according their status. The sample elements selected were based on the representation of population of the interest group. Both primary and secondary data were collected and applied to generate findings and conclusion

2.1.1 PRIMARY DATA

This data were directly collected from the field. Data was collected from the sample population through survey; employing questionnaires, FGDs as well as interviews of the key informants. Data was expected from the main groups as mentioned before i.e selected organizations management teams and employees who were not holding any managerial posts.

2.1.2 SECONDARY DATA

Secondary data for this study were collected from books, journals, reports and newspapers, both published and unpublished, as well as from online sources.

2.2 DATA COLLECTION INSTRUMENTS

During this study, structured and unstructured questionnaires were used in data collection. Kothari, et al (2012) defines questionnaire as a set of questions that are drawn up to meet the objectives of the survey. Most of the questionnaires were carefully designed to avoid responses that might be biased in favour of the study objectives. They were also prepared according to the status of the target group. Questionnaire were chosen by the researcher because it encouraged great honest, possibilities of enquiring absent attitude and opinions, they could be written for specific purpose, within a short time, one could collect a lot of information as well as its possibilities of mailing them made them economic in term of costs.

2.3 DATA ANALYSIS METHODS

Both qualitative and quantitative approaches were used during data analysis. Statistical Package for Social Sciences (SPSS) and excel were used in data analysis and processing. The researcher interpreted the data in accordance with the quality of arguments made rather than quantity of the respondents with the same opinions. The questionnaires were classified in terms of the answers that were similar so as to reduce the work of analysing each questionnaire. The aim of interviewing was to allow the researcher to interact and elicit person's perspectives. The assumption is that the person's perspective was meaningful, knowledgeable and able to be made explicitly

2.4 UNIT OF ANALYSIS

The unit of analysis is the major entity that is being analysed in the study. It is the 'what' or 'whom' that is being studied. During this study, the principal means of data collection was via a survey of the challenges facing human resource succession planning in the selected organizations. The researcher selected some of the directorates and departments from the Tanzania public and private work organizations believed to provide the required information on the topic. This was done to limit the research and make it more manageable.

3 STUDY FINDINGS, ANALYSIS AND DISCUSSIONS

3.1 DATA PRESENTATION

This section aims at discussing the respondents' profile to enable the study establish the extent of judgement one might have in the area of the study. Among the researched respondents' characteristic include sex, age, marital status, and the education level and working experience of each respondents in their respective organizations.

3.1.1 STATISTICAL DESCRIPTION OF THE RESPONDENTS

The study was aimed to investigate whether different organizations do conducted human resource succession planning in their daily operations. To achieve this, a number of organizations were picked for the study. Study findings indicate that the following organizations including public and private were surveyed during this study as indicated by the table 4.1 below. 9 (15%) of the respondents were from TAZARA. 5 (8.3%) of the respondents were from TANESCO, ILO, TPA, SUA, MUHAS and NSSF respectively as indicated in the table below. 3 (5%) were from immigration department. 7 (11.7%) of the respondents were from the Open University of Tanzania. 4 (6.7%) of the respondents were from Total Tanzania Limited and SONGAS. 2 (3.3%) of the respondents were from University Computing Centre Limited. Only 1 (1.7) of the respondent was from the Tanzania Cotton Board. The statistics above shows that despite the difficulties in accessing information required from a number of selected organizations for the study, a representative sample were obtained. Majority of the respondents were from TAZARA and the Open University of Tanzania. The rationale behind this was thought to be associated with the intimacy relationships between the researcher and respondents. This simplified the exercise of questionnaires distributions and collection. However, other organizations did not accept to feel questionnaires while other respondents did not return the filled questionnaires on time

Table 1 Organization or structure of the Respondents

Organization of the respondents	Frequency	Percent	Valid Percent	Cumulative Percent
TAZARA	9	15.0	15.0	15.0
TANESCO	5	8.3	8.3	23.3
ILO	5	8.3	8.3	31.7
IMMIGRATION	3	5.0	5.0	36.7
TPA	5	8.3	8.3	45.0
SUA	5	8.3	8.3	53.3
OUT	7	11.7	11.7	65.0
MUHAS	5	8.3	8.3	73.3
COTTON BOARD	1	1.7	1.7	75.0
SONGAS	4	6.7	6.7	81.7
UCC LIMITED	2	3.3	3.3	85.0
TOTAL TANZANIA LIMITED	4	6.7	6.7	91.7
NSSF	5	8.3	8.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.1.1 RESPONDENTS BY AGE

Age of the respondents was considered to be important in assessing challenges facing human resource succession planning in Tanzania work organizations using a case study of 35 selected public and private organizations. The study revealed that the age distribution of the respondents favoured the group between 41-50 years which comprised 29 (48.3%) of the total respondents. The study findings statistics implies that the selected institutions preferred the age group between 41 to 50 years. The assumption behind their preference was that they most of them were public owned which employed their man power under the contract of permanent and pensionable. Permanent and pensionable allows employees to feel their employments are secured. Also, others worked with the private organizations which have better remunerations to the employees. Therefore, employees did not see any needs of quitting from their jobs. Table 2 illustrates.

Table 2 Respondents by age

Age of respondents	Frequency	Percent	Valid percent	Cumulative percent
20 to 30 years	11	18.3	18.3	18.3
31-40 years	12	20.0	20.0	38.3
41-50 years	29	48.3	48.3	86.7
51-60 years	8	13.3	13.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings,(2013)

3.1.1.2 RESPONDENTS BY SEX

The research wanted to know sex distribution of respondents in order to ascertain their non-business of the sample. Table 2 presents sex distribution of the sample for this research. Over two thirds comprising 76.7% of respondents were males. This was the results of given socio - cultural issues in Tanzanian where males are favoured in employment. Nature of the study also was expected to provide more rooms for males in the sample.

Table 3 Respondents by sex

Sex of the respondents	Frequency	Percent	Valid Percent	Cumulative Percent
Male	46	76.7	76.7	76.7
Female	14	23.3	23.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings,(2013)

3.1.1.3 RESPONDENTS BY MARITAL STATUS

Marital status was considered as an important element during this study. The findings revealed the following: - 11 (18.3%) of total respondents were single. 44 (73.3%) were married respondents. Only 2 (3.3%) were divorced respondents. 3(5%) of the respondents were widows/widowers. These figures reveal that there was a massive difference of marital status of different respondents during this study.Therefore, married employees were found to be the most preferable by different organizations surveyed (Table 4).

Table 4 Marital Status

Marital status	Frequency	Percent	Valid percent	Cumulative percent
Single	11	18.3	18.3	18.3
Married	44	73.3	73.3	91.7
Divorced	2	3.3	3.3	95.0
Widow	3	5.0	5.0	100.0
Total	60	100.0	100.0	

Source: research findings,(2013)

3.1.1.4 RESPONDENTS BY EDUCATION LEVEL

Again education level was considered as an important attribute when assessing challenges facing human resource succession planning in Tanzania work organizations. This was because, education was assumed to have a crucial role in enabling respondents to understand different questions on the challenges facing human resource succession planning in Tanzania work organizations. The study found that 5 (8.3%) of the respondents had qualifications of diploma. 40 (66.7%) of respondents were degree holders. 14 (23.3%) of respondents had a master degree. Only 1(1.7%) of the remaining respondent had other qualifications which were PhD qualification. Therefore, the statistics indicate that all categories of education were considered by the surveyed organizations during recruitment. However, two third of the respondents had a bachelor degrees. Therefore, this statistics implies that most of the organizations preferred graduates employees. Table 5 illustrates the above findings.

Table 5 Education Level

Education Level	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	5	8.3	8.3	8.3
Graduate	40	66.7	66.7	75.0
Masters degree	14	23.3	23.3	98.3
Any other	1	1.7	1.7	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.1.5 RESPONDENTS BY WORK EXPERIENCE

Respondents were asked to state their work experience with respective organizations. The study statistics indicate that 17 (28.3%) worked with their respective organizations for the period of less than four years. 22 (36.7%) worked between five and ten years with the respective organizations. 3(5%) of the respondents worked with the respective organizations for the period between 11 and 14 years. 18 (30%) of the remaining respondents worked for their organizations for the period over 14 years. The statistics shows that there was a good combination of experienced and less experienced in the selected organizations. However, the big number of the respondents was from the mid experienced employees which comprised more than one third of total respondents. Interestingly, respondents with massive experience were the second and this implies that the organizations selected had some form of succession planning which encouraged employees to stay. Table 6 illustrates the above statistical findings

Table 6 Working experience of the respondents

Work experience	Frequency	Percent	Valid percent	Cumulative percent
Less than 4 years	17	28.3	28.3	28.3
5-10 years	22	36.7	36.7	65.0
11-14 years	3	5.0	5.0	70.0
Above 14 years	18	30.0	30.0	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.1.6 RESPONDENTS BY DEPARTMENT

Department of the respondents in the selected organizations were also important in understanding challenges facing them in conducting human resources succession plans. The aim of considering departments was due to the fact that different employees had a different understanding on different matters related to their organizations. Since succession planning is a human resource technical jargon, other departments were consulted to solicit information on the matter. The study revealed that 16 (26.7%) of the respondents were from the departments of human resource management of the selected organizations. 15 (25%) of the respondents were from the finance departments. 4 (6.7%) of the respondents were from the procurement and supplies units. 14 (23.3%) of the respondents were from operations departments which included teachings in the higher learning institutions. 6 (10%) of the respondents were from marketing departments. 5 (8.3%) of the remaining respondents were from the internal audit departments of the selected organizations. Therefore, the statistics above indicates that to solicit the required information on challenges facing human resources succession planning, all major departments were consulted. However, the large number of the respondents was picked from human resources, finance as well as operations departments. The assumption behind this statistics is that the departments which had a higher number of respondents had knowledge of human resource succession planning attained from the learning institutions. Table 7 illustrates the above statistical findings.

Table 7 Respondents departments

Department	Frequency	Percent	Valid Percent	Cumulative Percent
HRM	16	26.7	26.7	26.7
Finance	15	25.0	25.0	51.7
Procurement and supplies	4	6.7	6.7	58.3
Operations	14	23.3	23.3	81.7
Marketing	6	10.0	10.0	91.7
Internal audit	5	8.3	8.3	100.0
Total	60	100.0	100.0	

Source: research findings, (2013)

3.1.2 ANALYSIS AND DISCUSSION OF THE FINDINGS

The extent of human resources succession plans activities in Tanzania work organizations; challenges facing human resources succession planning in the Tanzania work organizations; the positive factors influencing human resources succession planning in Tanzania work organizations as well as strategies for enhancing the application of human resource succession planning has been analysed and discussed under this part

3.1.2.1 FINDINGS ON THE EXTENT OF HUMAN RESOURCES SUCCESSION PLANNING (SP) ACTIVITIES IN TANZANIA WORK ORGANIZATIONS

Awareness of succession planning, organization practises of SP, degree level of succession planning for each organization, frequency of succession planning in each organization as well as the importance of succession planning in each organization are presented under this part.

3.1.2.1.1 AWARENESS OF SUCCESSION PLANNING (SP)

The study was interested in understanding awareness of the respondents on the concept of human resource succession planning and how was working. The study findings show that 13 (21.7%) of total respondents from the selected organizations were aware on the human resource succession planning and how was working. 44 (73.3%) of the respondents had no knowledge on succession planning as being used in the organizations. Only 3 (5%) of the respondents did not understand what the question sought from them. The statistical findings signify that three quarters of the respondents had no knowledge on the concept of succession planning at least for different levels. See table 4.8 below as illustrates the above study findings.

Table 8 Awareness of succession planning (SP)

Knowledge of the respondents on SP	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	13	21.7	21.7	95.0
No	44	73.3	73.3	73.3
I don’t know	3	5.0	5.0	100.0
Total	60	100.0	100.0	

Source: research findings, (2013)

3.1.2.1.2 ORGANIZATION PRACTICES OF SP

The researcher was interested in understanding if the organization surveyed practiced human resource succession planning. The study findings indicate that 20 (33.3%) of the respondents showed that their respective organizations practised human resource succession planning. 31 (51.7%) of the respondents shows that the organizations did no conduct succession planning. 9 (15%) of the respondents did not know the question. From the statistics above, the study findings implies that most of the organizations did not human resource succession planning. Only few organizations conducted succession planning. However, the question remains to what levels of succession planning, how effective and regularly done in the organizations. Table 9 illustrates the above statistical findings.

Table 9 Practices of Succession planning (SP)

Practices of SP in the organizations	Frequency	Percent
Yes	20	33.3
No	31	51.7
I don't know	9	15.0
Total	**60**	**100.0**

Source: research findings, (2013)

3.1.2.1.3 DEGREE LEVEL OF SUCCESSION PLANNING (SP) FOR EACH ORGANIZATION

The respondents were asked to choose from the statements which sought to explore information on the degree level of succession planning in their respective organizations. The study findings indicate that only 5 (8.4%) of the respondents agreed that human resource succession planning their organizations were strongly well done and satisfactory. 18 (30%) of the respondents indicated that human resource succession planning in their organizations were well done and satisfactory. 20 (33.3%) of the respondents indicated that human resource succession planning were fairly done and not satisfactory to the stakeholders. While the remaining 17(28.3%) respondents showed that their organizations did not have human resource succession planning in place. The statistics implies that one third of the respondents were not satisfied with their organizations human resource succession planning. Therefore, the statistics signify that many respondents were not satisfied with practice of human resource succession planning in their respective organizations.

Table 10 Degree level of succession planning (SP)

Degree level of SP	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly well done and satisfactory	5	8.4	8.8	6.8
Well done and satisfactory	18	30.0	30.5	37.3
Fairly done but not satisfactory	20	33.3	33.9	71.2
Not done at all by the company	17	28.3	28.8	100.0
Total	60	100.0	100.0	

Source: research findings, (2013)

3.1.2.1.4 FREQUENCY OF SUCCESSION PLANNING (SP) IN EACH ORGANIZATION

The study aimed to exploit information on the frequency the organizations conducted succession planning. The study findings indicate that only 1 (1.7%) of the respondent indicated that succession planning in the respective organization was conducted on daily basis. 5 (8.3%) of the respondents indicated that heir organizations conducted succession planning at least once a week, once a month, once after six months respectively as indicated in the table below. 3 (5%) of the respondents showed that their organizations conducted succession planning on quarterly basis. 20 (33.3%) of the respondents indicated that their organizations conducted human succession planning at least once a year. 21 (35%) of the respondents indicated that their organizations did not have succession planning. Therefore, one third of the total respondents did not show if their organization practicing human resource succession planning. The statistics implies that many organizations did not practice human resource succession planning. They did not have strategic plans of succeeding their potential employees who were nearly exit door of their organizations.

Table 11 Frequency of Succession planning (SP)

Frequency of Succession planning	Frequency	Percent	Valid Percent	Cumulative Percent
Every day	1	1.7	1.7	1.7
At least once a week	5	8.3	8.3	10.0
At least once a month	5	8.3	8.3	18.3
Quarterly	3	5.0	5.0	23.3
After 6 months	5	8.3	8.3	31.7
At least once a year	20	33.3	33.3	65.0
Never done in the organization	21	35.0	35.0	100.0
Total	60	100.0	100.0	

Source: research findings, (2013)

3.1.2.1.5 IMPORTANCE OF SUCCESSION PLANNING IN EACH ORGANIZATION

The study aimed to explore the importance of succession planning in each organization surveyed .respondents were asked to rank if they thought succession planning to be very important, important or not important at all. The study findings revealed that 42 (70%) of the respondents agreed that succession planning. 15 (25%) of the respondents showed that succession planning was important for the organization development. Only 3 (5%) of the respondents did not see any importance of succession planning. Therefore, the study finding implies that human resource succession planning played important role for the organization development. Hence, all organizations should understand the paramount role played by human resource succession planning for their survival. Table 12 illustrates the above findings.

Table 12 Importance of succession planning

Importance of succession planning	Frequency	Percent	Valid Percent	Cumulative Percent
Very important	42	70.0	70.0	70.0
Important	15	25.0	25.0	95.0
Not important at all	3	5.0	5.0	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

During the FGDs which comprised 8 members, 6 (75%) out of 8 pointed out that succession planning help the organization to make the paths for advancement visible to employees. They further pointed out that SP can motivate employees to perform with advancement in mind. They can also more readily see where their work or role “fits” in the larger context of the organization. They further contented that workforce and succession planning provided the means for achieving overarching program goals of the surveyed organizations. They pointed out that program goals would not be achieved without the right number of people with the right skills in the right place at the right time in their organizations.

Likewise, the key informants from surveyed organizations who were seniors and human resource professionals provided information on the importance of SP. They argued that a succession plan creates pathways to appropriate promotion and candidate selection by matching organizational needs with qualified talent, both internal and external. It is also a means to monitor and reward performance and professional development. They further argued that succession planning can result in improved placement in hiring processes, and improved leadership through development and skilled recruitment.

The study findings are supported by the study and words of Rothwell, W. J. et al., (2000) contended that succession management has become an important talent management initiative at companies around the world. He argued that for some companies, succession management was a strategic process that minimized leadership gaps for critical positions and provided opportunities for top talent to develop the skills necessary for future roles. With other companies, succession management was a constant struggle, viewed as an administrative exercise rather than as a competitive advantage.

Furthermore, the study findings replicate what was revealed by Armstrong (2010) when researched on the effectiveness of succession planning in organization management. The study addressed the importance of succession planning for the organizations’ survival, which depends on the continuous supply of competent, experienced and well trained managers. In addition to that Boxall, and Purcell (2003) argued that workforce planning was a broad strategy that influenced departments

divisions, or agency's entire workforce. They added that succession planning often works hand in hand with knowledge transfer concepts, since developing new leaders means that the knowledge of current leaders will be shared before retirement, promotion, or other attrition with those who will follow in their footsteps.

The study findings is supported by the study findings of Jackson and Schuler (1990) which revealed that planning for HR needs help to ensure employees to have the skills and competencies business needs to succeed. An HR plan works hand in hand with business plan to determine the resources you needed to achieve the business's goals. Jackson and Schuler (1990) researched on human resource planning. They urged that human resource planning has traditionally been used by organizations to ensure that the right person is in the right job at the right time. They argued that under past conditions of relative environmental certainty and stability; human resource planning focused on the short term and was dictated largely by line management concerns.

3.1.2.2 FINDINGS ON THE CHALLENGES FACING HUMAN RESOURCES SUCCESSION PLANNING IN THE TANZANIA WORK ORGANIZATIONS

Awareness of SP challenges available in each organization, ineffective business practices, lack of effective company vision, inactive periodical succession plan are discussed under this part to be among of the challenges facing human resources succession planning in the Tanzania work organizations.

3.1.2.2.1 AWARENESS OF SP CHALLENGES AVAILABLE IN EACH ORGANIZATION

The study investigated knowledge of the respondents on different challenges which were facing human resource succession planning in each organization surveyed. The study findings show that 33 (55%) of the respondents were aware on the number of challenges which were facing human resource succession planning in the surveyed organizations. 3 (5%) did not agree whether human resource succession planning in the selected organizations faced any challenge. 24 (40%) of the respondents did not know anything about the question asked. The study findings signify that half of the respondents were knowledgeable on different challenges faced succession planning in their organizations. Also, the concept of human resource succession planning was new to a large number of the respondents as illustrated in the table 4.13. Therefore, the study findings confirm that awareness on the concept itself was a problem to the employees. Hence implementing succession planning in the selected organizations remains a myth.

Table 13 Challenges of SP

Awareness of SP challenges	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	33	55.0	55.0	55.0
No	3	5.0	5.0	60.0
I don't know	24	40.0	40.0	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.2.2 INEFFECTIVE BUSINESS PRACTICES AND LACK OF EFFECTIVE COMPANY VISION

Furthermore, ineffective business practices and lack of effective company business vision among the surveyed organizations was thought to be among the challenges. The respondents were asked to rank how the above two concepts affected human resource succession planning in their respective organizations. The study findings shows that 41(68.3%) of the respondents showed that ineffective business practices among of the surveyed organizations affected succession planning of human resources. 16 (26.7%) showed that ineffective business practices affected little the organizations effort of carrying out succession planning. Only 3 (5%) of the respondents showed that ineffective business practices had no effect to the organization succession planning among the surveyed organizations. Therefore, the study findings confirm that effective business practices of the organizations had a positive influence on the succession planning. On other hand, ineffective business practices of the organizations affects them negatively in carrying out succession plan of human resources.

Likewise, effective company vision was thought to among the challenges of succession planning in the surveyed organizations. The study findings shows that 24 (40%) indicated that lack of effective company vision strongly affected human resource succession planning in the surveyed organizations. 28 (46.7%) of the respondents showed that lack of effective company vision little affected human resource succession planning. 8(13.3%) of the respondents argued that SP was not affected by the lack of effective vision among the surveyed organizations. The large number of respondents indicated

that on one way or another, lack of company vision among the surveyed organizations affected their efforts in conducting human resource succession planning. Table 4.14 illustrates the study findings above.

Table 14 Ineffective business practices and lack of effective company vision

Ineffective business practices	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Strongly affect	41	68.3	26.7	**95.0**
Little affect	16	26.7	26.7	**26.7**
Not affected at all	3	5.0	5.0	**100.0**
Total	**60**	**100.0**	**100.0**	
Lack of effective company vision				
Strongly affect	**24**	**40.0**	**40.0**	**40.0**
Little affect on SP	28	46.7	46.7	86.7
Not affected SP at all	8	13.3	13.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

Despite the numerous benefits of a formalized succession planning process, companies have failed to make it a top priority. In order to achieve results, companies needed to start with the basics, create a strong process and then invest in the tools and technology to inspire a talent development mindset in their organization. During this study, the following were raised to be among the challenges which were facing human resources succession planning in the Tanzania work organizations

During the FGDs held in some of the selected organizations, group members when asked what they thought to be challenges human resource succession planning were facing in their organizations revealed the following. They pointed out that increasing tight labour markets were among the challenges they were facing. They showed that increasing tight labour markets forced their organizations to institute succession planning particularly, in their top positions.

FGDs also pointed out that securing the required employees who were talented and skilled for the organizations were another challenge which they faced. Findings from this study replicate study findings done by Mullins (2010) and Porter (1985) after reviewing succession planning in various organizational settings ranging from private to public sector. They argued that it was becoming increasingly challenging for organizations to obtain qualified and talented staff. Succession planning was often introduced as a way to attract and employ such staff. The findings of this study demonstrated a meaningful relationship between organizational requirements such as managers' commitment, organizational culture, organizational readiness, and managers' competencies with the implementation of succession planning (Armstrong, 2005; Luthans and kreitner, 1975)

Furthermore, the study findings indicated that lack of commitment among the senior officials of the selected organizations was a serious challenge faced human resource succession planning. Most of the respondents showed highest degree of dissatisfaction on the managerial practices towards succession planning. They hinted that some senior managers were afraid from losing their positions once they have mentored their employees for the senior managerial positions

Key informants from the departments and directorates of human resource management and administration of the surveyed organizations revealed that succession planning of the human resource was a new to many of them. Therefore, conducting effective human resource succession planning was difficult to them. They were still learning what the concept comprised. The study findings from the key informants are supported by the study findings of Mayo (2001) which pointed out that the need for workforce and succession planning was having a significant impact on the human resources management function particularly in the public sector. Workforce and succession planning demand a level of strategic planning that was still new to many public sector organizations. This requirement for a strategic approach to the workforce coupled with the need to address global issues affecting workforce supply will require human resources practitioners to act as internal consultants in their agencies. And strategic workforce planning skills and the ability to predict and meet the needs of the agency for a capable and trained workforce expanded the role of HR and its usefulness to line managers in the organizations.

3.1.2.3 FINDINGS ON THE POSITIVE FACTORS INFLUENCING HUMAN RESOURCES SUCCESSION PLANNING IN TANZANIA WORK ORGANIZATIONS

Sufficient talent pipeline in the selected organizations, effective business practices in the organizations, availability of effective company vision and addressing future needs of the organizations as well as active periodical succession plan in the selected organizations are discussed under this section.

3.1.2.3.1 SUFFICIENT TALENT PIPELINE IN ORGANIZATION

Talent of the employees was also considered in assessing factors influencing human resources succession planning in Tanzania work organizations. The respondents were asked to show their responses on the influence of sufficient talent pipeline in the surveyed organizations. The study findings indicate that 19 (31.7%) of the respondents showed that sufficient talent pipeline in the organization surveyed very strongly influenced human resource succession planning. 19 (31.7%) of the respondents showed that sufficient talent pipeline in the surveyed organizations strongly influenced human resource succession planning in the company. 14 (23.3%) of the respondents indicated that sufficient talent pipeline in the organizations had a weak influence on human resource succession planning in the selected organizations. From the above findings, the study confirms that sufficient talent pipeline in the organization had a strong influence on the organizational human resource succession planning. Table 15 illustrates the above findings.

Table 15 Sufficient talent pipeline in organization

Sufficient talent pipeline in the organization	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	19	31.7	31.7	31.7
Strongly influence	19	31.7	31.7	63.3
Weak influence	14	23.3	23.3	86.7
No influence at all	8	13.3	13.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings,(2013)

3.1.2.3.2 EFFECTIVE BUSINESS PRACTICES IN ORGANIZATION

Effective business practices of the selected organizations was another factors considered to have positive influence on the human resources succession planning in Tanzania work organizations. The respondents were asked to rank the influence of effective business practice in organizational human resources succession planning. The study findings indicated that 30(50%) of the respondents indicated that effective business practices of the surveyed organizations very strongly affected human resource succession planning. 17 (28.3%) of the respondents showed that effective business practices of the selected organizations had a strong influence on the human resource succession planning. 10 (16.7%) of the respondents indicated that effective business practice had a weak influence on the human resource succession planning among the surveyed organizations. Only 3 (5%) of the respondents did not acknowledge the influence of effective business practices in human resource succession planning among the selected organizations. The findings confirm that effective business practices in the selected organizations play an important role in implementing human resource succession planning. Table 16 illustrates the above study findings.

Table 16 Effective business practices in organization

Effective business practices	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	30	50.0	50.0	50.0
Strong influence	17	28.3	28.3	78.3
Weak influence	10	16.7	16.7	95.0
No influence at all	3	5.0	5.0	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.3.3 AVAILABILITY OF EFFECTIVE COMPANY VISION

Company vision was also considered to be among the positive factors influencing human resources succession planning in Tanzania work organizations. Respondents were asked to state how availability of company vision influenced human resource succession planning in their organizations. The study findings indicate that 30 (50%) of the respondents showed that that availability of effective company vision have very strong influence on the human resource succession planning among the selected organizations. 10 (16.7%) of the respondents indicated that effective company vision had a strong influence on human resource succession planning in the selected organizations. 17(28.3%) argued that effective company vision had a weak influence on the human resource succession planning in the selected organizations. Only 3(5%) of the respondents did not see any influence of company vision towards human resource succession planning. Therefore, despite small number of respondents not associating company vision to human resource succession planning, yet the two had strong correlations. That means if the company had no vision, then it difficult to plan its manpower requirements including succession planning of the potential employees. Table 17 illustrates the above findings.

Table 17 Availability of effective company vision

Availability of effective company vision	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	30	50.0	50.0	50.0
Strong influence	10	16.7	16.7	66.7
Weak influence	17	28.3	28.3	95.0
No influence at all	3	5.0	5.0	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.4 FINDINGS ON THE STRATEGIES FOR ENHANCING THE APPLICATION OF HUMAN RESOURCE SUCCESSION PLANNING (SP)

To understand strategies used by the selected organizations in enhancing the application of human resource succession planning the following issues were taken into consideration. First the study sought to explore if respondents were aware on the availability of strategies in enhancing SP in the organizations. Second issues was assessing on how attracting and recruiting potential employees enhanced SP in the selected organizations. Third was how the effective leadership and management development enhanced the SP. Also, setting enough budgets for human resource development was investigated. Furthermore, determinants of effective SP were considered as well as contribution of effective SP on organization performance was investigated.

3.1.2.4.1 AVAILABILITY OF ORGANIZATION STRATEGIES IN ENHANCING SP

The study aimed to find strategies used by the organization in enhancing human resource succession planning. Information was obtained through seeking knowledge level of the respondents. The findings indicate that 23 (38.3%) of the respondents were aware on different strategies used by their companies in enhancing human resources succession planning. 14 (23.4) of the respondents did not agree on the availability of strategies used by their organizations in enhancing human resource succession planning. Other 23 (38.3%) did not understand what the question sought. From the above statistics, the study learned that the number of respondents who agreed on the availability of strategies in enhancing succession planning and those who did not understand the question in the selected organizations were equal. Table 18 provides illustration of the above findings.

Table 18 Availability of organization strategies in enhancing SP

Strategies of enhancing SP	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	23	38.3	38.3	38.3
No	14	23.4	23.3	61.7
I don't know	23	38.3	38.3	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

Seven (87.5%) members from the FGDs indicated that among the strategies used by the organizations surveyed in enhancing human resource succession planning include: - participatory approach used by the management in trying to install the system of succession planning, increasing budget on human resources as well as attracting the best employees from other organizations. The above findings are supported by the study of Belcourt,and Mcbey et al.,2007) which revealed that five key strategies of succession planning including aligning succession planning with business strategy; assessing leadership potential using the 3Cs; involving the talent in the planning; mixing development, experience/coaching/training and casting a wider net for succession.

3.1.2.4.2 ATTRACTING AND RECRUITING POTENTIAL EMPLOYEES

Attracting and recruiting potential employees from different sources were considered to be among strategies used by the surveyed organizations in enhancing the application of human resource succession planning. The respondents indicated that attracting and recruiting potential employees' strongly facilitated succession planning in the organizations. 31 (51.7%) of the respondents who were above half strongly supported the above strategy in enhancing the application of human resource succession planning as illustrated in the in the table 19.

Table 19 Attracting and recruiting potential employees

Attracting and retaining potential employees	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	31	51.7	51.7	51.7
Strong influence	19	31.7	31.7	83.3
Weak influence	10	16.7	16.7	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.4.3 EFFECTIVE LEADERSHIP AND MANAGEMENT DEVELOPMENT

Establishing effective leadership and management development was considered to be another strategy used in enhancing the application of human resource succession planning. 39(65%) of the respondents which was nearly two third of total respondents argued that the strategy had very strong influence in enhancing the application of human resource succession planning in the surveyed organizations. The study findings imply that the role of effective leadership cannot be ignored for the effectiveness of human resource succession planning in any work organizations. Table 20 provides illustration based on the findings from the study area.

Table 20 Effective leadership and management development

Effective leadership and management development	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	39	65.0	65.0	65.0
Strong influence	11	18.3	18.3	83.3
Weak influence	10	16.7	16.7	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.4.4 BUDGET FOR SP

Since succession planning requires resource including human resources and financial resources, budget was considered to be a paramount strategy in enhancing the application of succession planning in the surveyed organizations. The respondents were asked what they thought to be the level of influence by improved budget in enhancing human resource succession planning. The findings indicate that 26 (43.3%) of the respondents showed that budget had a very strong influence on effectiveness of human resource succession planning in any work organization. 20 (33.3%) indicated that budget had a strong influence on the effectiveness of succession planning of human resources in the organizations. 14 (23.4%) of the respondents indicated that budget played weak role in enhancing application of human resource succession planning among the selected organizations. From the above statistics and as illustrated in the table 21 below proves that budget played an important role in enhancing human resource succession planning in the surveyed organizations.

Table 21 Budget for HRD

Budget for HRD	Frequency	Percent	Valid Percent	Cumulative Percent
Very strong influence	26	43.3	43.3	43.3
Strong influence	20	33.3	23.3	66.7
Weak influence	14	23.4	23.4	100.0
Total	**60**	**100.0**	**100.0**	

Source: research findings, (2013)

3.1.2.4.5 CONTRIBUTION OF EFFECTIVE SP ON ORGANIZATION PERFORMANCE

The respondents were asked if effective succession planning contributes to the organization performance. The aim of this question was to solicit information on their acknowledgement of human resource succession planning in their organizational performance. The study findings indicate that 43 (71.7%) of the respondents strongly agreed that effective human resource succession planning have a lot to contribute in the organization performance. 17 (28.3%) of the respondents agreed on the contribution of effective human resource succession planning to the organization performance. However, no respondent who didn't agree on the contribution of effective human resource succession planning on the organization performance. Therefore, from the above response, it is evidenced that effective human resource succession planning play an important role in improving organization performance. Table 22 illustrates the above study findings.

Table 22 Contribution of effective SP on organization performance

Contributes of SP to the organization performance	Frequency	Percent
I strongly agree	43	71.7
I agree	17	28.3
I disagree	0	0
I strongly disagree	0	0
Total	**60**	**100.0**

Source: research findings,(2013)

4 CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

Succession planning has become one of the most significant human resource management responsibilities within today's organizations. Given the current business environment for many organizations, no one can afford to attract, invest in and then lose its high potential employees; the best way to address these challenges is to maintain a viable culture and management style which recruit, motivate, retain and develop potentially capable employees who can remain in the driver's seat of organizational excellences and performance (Kotler and Heskett ,1995).

4.2 RECOMMENDATIONS

- To put in place strategic succession plans that provides a disciplined and structured approach for ensuring matching HR needs with organisational survival and competitive needs (Diamond,2006);
- Organisations should embark on frequent training on issues related succession planning and organise clear deliberate communication plans and sessions to inform opportunities for identifying with company mission and vision through individual career growth such as understudying and participation in strategic decision making
- Organisations should consider human resource succession planning as a vital and critical part of their daily routines in their organizations

4.3 AREAS FOR FURTHER STUDY

The study findings did not exhaust all technicalities of human resources succession planning.The study explored only challenges which faced human resource succession planning in the public and private organizations which were limited to ten organizations. Therefore, it is hereby recommended to extend the study to other companies and institutions including those located up country and that the main theme should be to explore the best practices in succession planning. One undisputable fact is that HR succession planning is key to organizational change and development (Armstrong, 2005)

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REFERENCES

[1] Mullins, J.L. (2010).Management and organizational behavior, pearson education limited, Edinburgh, England
[2] Armstrong, M. (2005).A Handbook of Human Resource Management Practice,Vol. 9, Kogan Page limited Publishers
[3] Capelli ,P. (2000).A market –driven approach to retaining talent, Harvard business review, Jan-Feb,pp 103-11
[4] Rothwell ,W. J (2010). Effective Succession Planning, Ensuring Leadership Continuity and Building Talent from Within. 4th edition, American Management Association, New York.
[5] Arthur, M. B., & Rousseau, D. M. (Eds.). (1996).The boundaryless career: A new Employment principle for a new organizational era. Oxford: Oxford University Press
[6] Mayo,A (2001).The human value of the enterprise: valuing people as assets, Nicholas brealey,London
[7] McGregor (1960).The human side of the enterprise, McGraw-hill, New York
[8] Ulrich,D and Lake,D (1990).organizational capability: competing from inside out,wiley,New York
[9] Porter.(1985).Competitive advantage: Creating and sustaining superior performance, Free press, New York
[10] Belcourt, M. and K. McBey (2007) Strategic Human Resource Planning, Thompson Nelson, Fourth Edition.
[11] Kotler J.P. and Heskett, J.L. (1995).”Corporate culture and performance”.New York: The Free Press.
[12] Jackson, E.S. and Schuler, S.R (1990).Human Resource Planning: Challenges for Industrial/Organizational Psychologists, New York University
[13] Diamond A (2006). Finding success through succession planning. Sec. Manage., 50(2): 36–39.Vol.4 (10), pp. 2140-2149
[14] Issa H.H. F (2007). Reforming Human Resource Development in Tanzania –Issues, Challenges and Lessons, Public Service Management, Tanzania
[15] Novak, J.M (2007) .Competency-based Succession Planning: A Strategic Approach to Addressing Human Capital Challenges, E-Gov. Institute Knowledge Management Conference, Washington, DC.
[16] Richardson, M. A (2006).Recruitment Strategy Managing/Effecting the Recruitment Process, Government of the Republic of Trinidad and Tobago
[17] Rothwell, W. J (1994) Effective Succession Planning: Ensuring Leadership Continuity and Building Talent from Within. New York: AMACOM.
[18] Rothwell, W. J (2000). Effective succession planning: Ensuring leadership continuity and building talent from within (2nd ed.). New York: AMACOM
[19] Rothwell, W.J. (2002). Putting success into your succession planning. *Journal of Business Strategy*, 23(3), pp.32-38
[20] Boxall,P. and Purcell,J. (2003).Strategy and human resource management,palgrave Macmillan,Basingstoke
[21] Luthans, F and Kreitner, R (1975).Organizational Behavior modification,Scott-Foresman,Glenview,III

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CONTRIBUTION A L'INVENTAIRE DES CHAUVES SOURIS DANS LE RIFT ALBERTIN

[SURVEY CONTRIBUTION OF BATS IN THE ALBERTIN RIFT]

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ABSTRACT: The Albertin Rift is an ecoregion which extends from the North of Albert Lake in Blue Mountains to the South extreme of Tanganyika Lake. This area attracts the attention of scientists. In fact it is characterized by an endemic, specific wealth and vey and very high vulnerable. We would like to contribute to the knowledge of taxa of the earth's biodiversity and aquatic one according to the logic: "World Conservation Monitoring Center", as regards to conservation. We have also listed from bats twenty three species and two under orders in four sites. The order of Megachiroptera is represented by only one family where as in the one of Microchiroptera, we have found six families and ten species'. The demoeological parameters have shown that if is the Kahuzi Biega National Park and its vicinities with a superior abundance seem to have a great specific resource. Then, come the forest reserve of Bururi in Burundi and the mountain of Misotshi-Kabogo. At last we have the Community Reserve of Bushema. The indication of Shannon diversity confirms these facts. The similarity quotient of Sorensen proves to be higher between the Kahuzi Biega National Park and Bushema, afterwards between Misotshi-Kabogo and Bushema. It's feeble between Bururi-Kahuzi and Bururi-Bushema. All the species inventoried are important according to their role in the troffic chain. Some are predators, for example the Microchiroptera (insectivorous) and they are all preys of carnivorous like the birds, snack …

KEYWORDS: Ecoregion, Mammal, Megachiroptera, Microchiroptera, Frugivorous, Predator, Endemic.

RÉSUMÉ: Le Rift Albertin est une écorégion qui s'étend depuis le nord du Lac Albert dans les Monts Bleu jusqu'à l'extrême sud du Lac Tanganyika. Cette zone attire l'attention des naturalistes et scientifiques. En effet, il est caractérisé par une richesse spécifique endémique et vulnérable très élevée. Nous voulons contribuer à la connaissance des taxa de la biodiversité terrestre et aquatique selon la logique de la conservation. Nos inventaires chez les chauves-souris ont montré la présence de 23 espèces, sept familles et deux sous ordres dans quatre sites. Les Megachiroptera sont représentés par une seule famille et 13 espèces alors que les Microchiroptera avec six familles et 10 espèces. Les paramètres démoécologiques montrent c'est le Parc de Kahuzi-Biega (Patrimoine mondial) plus environs avec une abondance élevée semble avoir une grande richesse spécifique. Viennent ensuite la Réserve Forestière de Bururi (Burundi) et les plateaux de Misotshi-Kabogo. En dernière position c'est la Réserve Communautaira de Bushema-Irangi. Les indices de diversité de Shannon confirment ces faits. Le quotient de similarité de Sorensen s'avère supérieur entre Kahuzi-Biega et Bushema, vient après Kabogo et Bushema, puis entre Kabogo et Bururi, Kabobo et Kahuzi-Biega, Bururi-Bushema et finalement faible entre Bururi-Kahuzi et Bururi-Bushema. Toutes les espèces recensées sont importantes au vue de leur rôle dans la chaine trophique. Les unes sont prédateurs, par exemples les Microchiroptera (Insectivores) et tous sont proies des carnivores.

MOTS-CLEFS: Ecorégion ; Mammifère ; Megachiroptera ; Microchoroptera ; Frugivore ; Prédateurs ; Endémique.

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1 INTRODUCTION

Les chauves-souris sont des mammifères de l'ordre de Chiroptera. Elles sont reparties dans deux sous ordres : les Megachiroptera et les Microchiroptera. Les premiers, frugivores et nectariens, ont de gros yeux, une griffe développée à l'index et sont dépourvues de queue. Tandis que les seconds, insectivores, ont de petits yeux, une griffe atrophié à l'index et possèdent une queue [1]. Ces animaux sont de petites, très discrets, de mœurs souvent nocturnes. Leur rôle est d'une importance capitale dans la chaîne trophique. En effet, les uns sont prédateurs des insectes et les autres disséminent des graine. Malgré leur importance écologique, la loi de l'environnement les classe dans la troisième catégorie ; ceux qui ne sont protégés ni totalement ni partiellement.

La République Démocratique du Congo renferme un pourcentage très élevé de la biodiversité mondiale. Toutefois, elle n'a aucune stratégie nationale pour gérer un grand nombre d'espèces [2] Pour Word Conservation Monitoring Center (WCMC en sigle), il faut absolument connaitre tous les taxa aquatiques et terrestres des milieux naturels à conserver. C'est le cas en R D Congo du Parc National de Kahuzi Biega (Patrimoine mondial), de la Réserve Communautaire de Bushema des plateaux de Misotshi-Kabogo dans la chaîne de Mitumba et en République burundaise, la Réserve Forestière du Burundi ou les inventaires biologiques sur les chiroptères ne se sont jamais effectués.

La présente étude se subdivise en deux orientations. D'abord la recherche fondamentale qui a pour objectif de contribuer à la connaissance de la biodiversité suivant la philosophie de « Albertine Rift Conservation Society » (ARCOS) et répondre à la proposition de « Critical Ecosystem Paterneship Fund concernant l'intégration des monts du Rift Albertin sur la liste clé de la biodiversité. Ensuite la recherche appliquée qui consiste à associer les populations locales des aires d'études dans les divers travaux de terrains par la pratique de l'éducation environnementale.

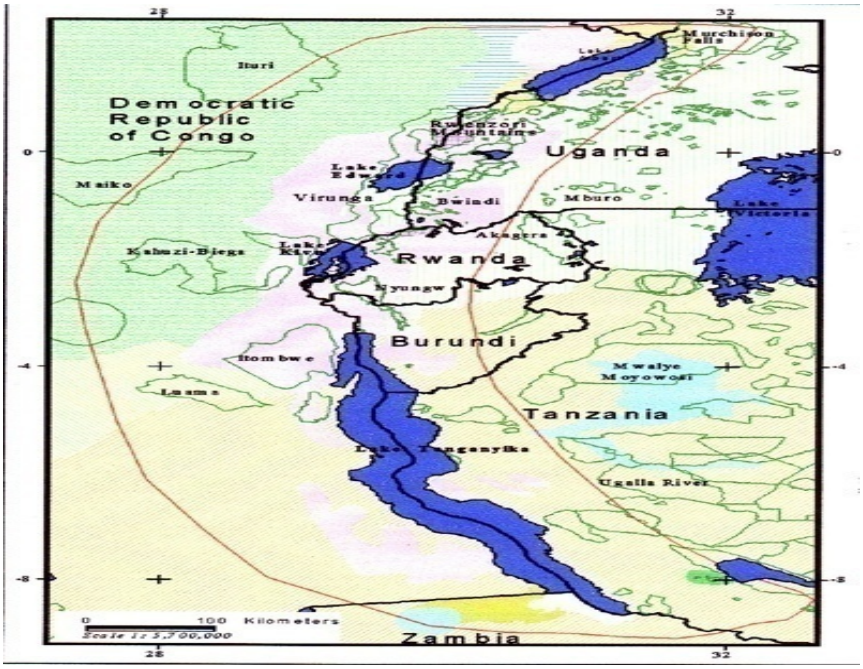


Fig . 1 Rift Albertin [3]

Le Rift Albertin est une région de Grands Lacs Africains en Afrique Centrale réputée pour sa richesse faunistique et floristique [3] [4] [5]. World Wide Found (WWF) la qualifie d'» Ecorégion « et Conservation International l'a surnommé « Point chaud de la biodiversité « . Il est localisé depuis les Monts Bleux au Nord dans le Districts d'Ituri, Province Orientale en RD. Congo (2°N, 30°30'E) jusqu'à l'extrême sud du Lac Tanganyika (9°S;30°30'E) [6]

2 MATERIEL ET METHODES

2.1 MILIEUX D'ÉTUDE

2.1.1 LA RESERVE COMMUNAUTAIRE DE BUSHEMA.

Cette concession se trouve à l'Est de la République Démocratique du Congo. Ici, nous avons travaillé dans les sites de :

- A Karambi dans une Galerie forestière à 2^{o} 53' 24,7'' S, 28^{o} 27'13,1'' E et 825 m avec comme flore dominante *Alchornea cordifolia* et *Bellucia macrophylla*.
- A Buhahire-Laylay dans une forêt secondaire à 01°54'26.3''S, 028°30'07.30''E et 1023 m avec comme plantes dominantes *Uapaca* sp, *Myrianthus arborea, Cynometra alexandri*, *Chrysophyllum sp*, *Vernonia conferta, Elaeis guineensis, Urera camerouneensis.*

2.1.2 LE PARC NATIONAL DE KAHUZI BIEGA.

Dans ce patrimoine mondial situé à l'est de la RD. Congo nos inventaires ont été menés dans les hautes altitudes plus précisément.

- Vers le Secteur de Tshibati et les environs de Lwiro: 2°13' 37,6''S/ 2°13'01,4''S 23°47'20''E / 28°46''42,6'' E, 2034 m.
- Au Mont Kahuzi c'est dans une forêt secondaire (2°12'7''S, 28°40'44''E à 2600 m) avec comme plantes dominantes ; Tricalysia sp, Nuxia floribunda, Agauria salicifolia, Macaranga kilmandscharica, Polygala ruwenzoriensis, Podocarpus usambarensis, Chassalia subochreatas, Sericostachys scandes, Sinarundinaria alpina, Mikania cordata, (Kerbis et al. 2010).

2.1.3 DANS LES PLATEAUX DE MISOTSHI-KABOGO

Ces massifs se trouvent dans la Chaine de Mitumba à l'Ouest du Lac Tanganyika. Là nous avions travaillé [6]

- A environs quatre Km au Sud-Ouest du village Talama dans une forêt humide à 4°59'29''S, 29°4'49''E à 1950 m.
- Aux alentours du village Mizimu, 5°27'59''S, 29°17'16''E à 790 m.

2.1.4 LA RESERVE FORESTIERE DE BURURI AU SUD-EST DE LA REPUBLIQUE DU BURUNDI [7]

- La Vallée de Nyagataruga à 1785 m.
- La Vallée de Mmushuzwi à 1 880 m
- Le Secteur de Ruhinga à 2170 m.

2.2 CAPTURE DES INDIVIDUS POUR UNE OBSERVATION INDIRECTE.

Comme ces animaux sont de petites tailles, de mœurs discrets et se ressemblent au niveau de genre, pour les étudier il faut d'abord les capturer morts ou vivants à l'aide des filets japonais.

2.3 IDENTIFICATION ET PREPARATION DES SPECIMENS

Certaines espèces étaient identifiées sur terrain par observation de la peau au-dessus (dos) ou sur le bord ventral, la position de la queue…D'autres identifications étaient faites ou confirmées un utilisant diverses clés [1] [8] [9]. Ensuite, on passait à la morphométrie par les mensurations linéaires en millimètre et pondérales en gramme [10]. Les mensures standards suivantes étaient prises : longueur totale, de la queue, du pied, de l'oreille et le poids du corps.

Le sexe, l'âge ainsi que la condition de reproduction étaient aussi notés. Les individus étaient préparés soit comme peau (Empaillage) et squelette, soit comme crâne dans l'alcool éthylique, et corps dans le formol, soit encore conservé comme individu entier dans le formol. La conservation des tissus pour des études génétiques ultérieures était faite dans des tubes contenant une solution physiologique tampon DMSO (Diméthyle Sulfoxyde).Chaque individu recevait un numéro de terrain et une fiche indiquant la localité de capture, la date, les noms du collecteur et toutes les informations concernant l'identification ci-hauts.

2.4 ANALYSE DES DONNEES SUR LES PARAMETRES DEMOEECLOGIQUES.

2.4.1 RICHESSE SPÉCIFIQUE,

Nous avons identifié les spécimens jusqu'au niveau d'espèce.

2.4.2 ABONDANCE

Elle est donnée par la formule suivante.

$$\sum \frac{ni}{N} \times 100$$

ni = espèce par genre récolté

N = total des espèces capturés.

2.4.3 DOMINANCE ET DIVERSITE DE SHANNON.

Ces deux paramètres ont été donnés par le logiciel Past 2

2.4.4 COMPARAISON DE BIOTOPE.

La similarité d'un site à un autre a été calculée par le coefficient de similarité de Sorensen par la formule suivante :

$$Q.s.= \frac{2c}{a+b} \times 100 \quad [11]$$

a = nombre espèces localisés dans le site A

b = nombre espèces trouvées dans le site B

c = nombre espèces présentes à la fois dans les sites A et B.

2.5 EDUCATION ENVIRONNEMENTALE.

Les populations locales avaient participé activement à tous les processus relatifs aux inventaires.

3 RESULTATS

Les résultats de cet inventaire sont représentés dans les figures et tableaux ci-dessous

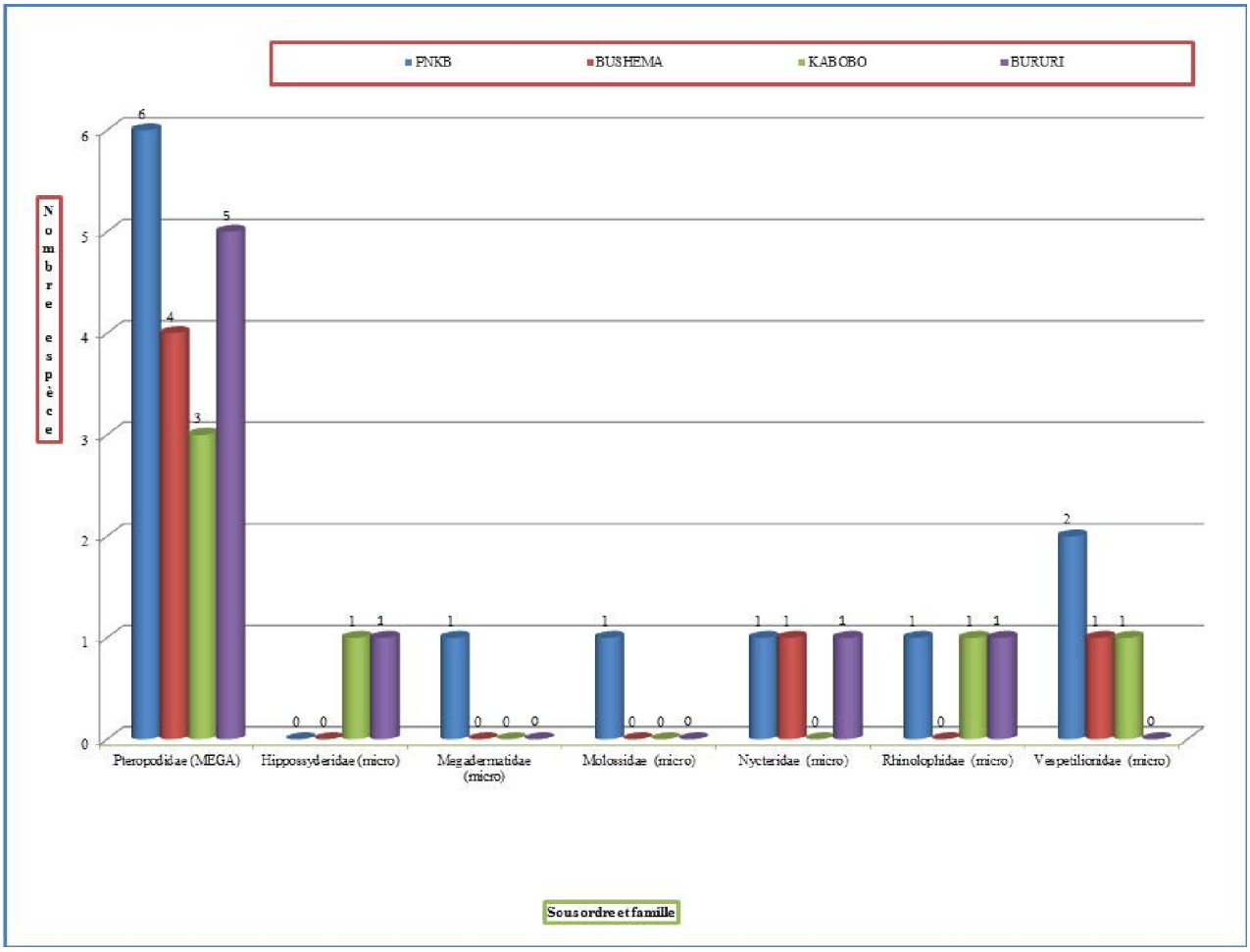


Fig . 2 Nombre d'espèces par famille dans chaque biotope.

Sur ce graphique, sept familles sont présentes. Une seule, celle de Pteropodidae, se trouve dans le sous ordre de Megachiroptera. Les individus de celui-ci ont été capturés dans toutes les aires de nos investigations. C'est surtout dans la partie haute du Parc Nationale de Kahuzi Biega (Patrimoine mondial) et ses environs où les plus grand nombre sont représentés. Les Megadermatidae ainsi que les Molossidae, du sous ordre de Microchiropera, n'ont été visibles uniquement que dans le site du Parc National de Kahuzi Biega et ses environs. A part la famille de Hippossyderidae, toutes les familles de Microchiroptera ont tété inventoriées dans tous les sites sauf dans les hautes altitudes du Parc National de Kahuzi Biega et environs.

Tableau 1. Richesse spécifique des Megachiroptera dans les différents sites.
I=PNKB et environs, II=Bushema, III=Misotshi Kabogo et IV=Bururi.

N°	Espèces	I	II	III	IV
01	***Roussettus aegyptiacus***	X			X
02	***Roussettus lanosus***				X
03	***Myonycteris tarquata***	X	X		
04	***Myonycteris angolensis***				X
05	***Eidolon helvum***	X	X	X	
06	***Stenonycteris lanosus***	X			
07	***Lissonycteris angolensis***	X			
08	***Casinycteris argynnis***		X		
09	***Plerote anchetae***		X		
10	***Epomophorus labiatus***	X			X
11	***Epomophorus wahlbergi***				X
12	***Hypsignathus monstrosus***			X	
13	***Megaloglossus woermani***			X	

Toutes les espèces reprises sur ce tableau sont de la famille de Pteropodidae. Les 12 premières sont des frugivores tandis que la treizième est une nectarienne. Sur les 13 espèces de Megachiroptera, le site **I** avec six espèces semblent être plus diversifié. Viennent ensuite le site **IV** où nous avons inventorié cinq espèces, le site **II** qui en a quatre et finalement le site **III** représenté par trois espèces.

Tableau 2. Espèces des Microchiroptera dans les différents sites.
I=PNKB, II=Bushema, III=Misotshi Kabogo et IV=Bururi.

N°	Espèes	Famille	I	II	III	IV
01	*Hipposideros ruber*	**Hippossideridae**			X	X
02	*Lavia frons*	**Megadermatidae**	X			
03	*Chaerophon chapini*	**Molossidae**	X			
04	*Nycteris arge*	**Nycteridae**	X	X	X	X
05	*Rhinolophus kahuzi*	**Rhinolophidae**	X			
06	*Rhinolophus willardi*				X	
07	*Rhinolophus clivosus* zuluensis					X
08	*Pipistrellus nanus*	**Vespertilionidae**	X	X		
09	*Hypsugo eisentrauti*				X	
10	*Myotis welwitschii*		X			

Tous ces Mirohiroptera sont des insectivores reparties dans six familles parmi lesquelles deux (Rhinolophidae et Vespertilionidae) ont chacune trois espèces, tandis les autres n'en possèdent qu'une seule espèce. Sur les 10 espèces qui représentent de Mircochiroptera, six sont localisées dans le site **I**. Ce dernier est suivi de site **III** avec quatre espèces. Vient ensuite le site **IV** où nous avons inventorié trois espèces et finalement le site **II** représenté par deux espèces.

Tableau 3. Indices démoécologiques dans les différentes aires d'étude.

	PNKB et environs	Bushema	Misotshi-Kabogo	Bururi
Nombre de famille	6	2	4	3
Nombre d'espèces	12	5	6	7
Abondance	40	16	20	23
Dominance	0,3056	0,68	0, 333	0,551
Diversité de Shannon	1,474	0,5004	1,242	0,7963

La partie inventorié dans le Parc National de Kahuzi Biega et ses environs avec 16 espèces, avec comme paramètre démoéologique : dominance 40 et diversité de Shonnon 1,474 est plus élevé par rapport aux autres sites. Quant à la Réserve Communautaire de Bushema, les indices sont faibles.

Tableau 4. Coefficient de similarité entre les sites

	PNKB et environs	**Bushema**	**Misotshi-Kabogo**	**Bururi**
PNKB et environs	---	44	21	10
Bushema	44	---	30	14
Misotshi-Kabogo	21	30	---	26
Bururi	10	14	26	---

Dans le but de voir en quel point les différentes aires d'investigations sont similaires, nous avons calculé le coefficient de similarité. Il ressort du tableau 4 que le couple Parc National de Kahuzi Biega plus ses environs avec la Réserve communautaire de Bushema, suivi des Plateaux de Misotshi Kabogo et la Réserve communautaire de Bururi ont des coefficients de similarité élevés. Ce coefficient est très faible pour les couples Réserve forestière de Bururi au Burundi-Parc National de Kahuzi Biega plus environs et cette même Réserve du Burundi avec Bushema.

4 DISCUSSION

Il n'y a aucun inventaire antérieur sur les Chiroptera dans tous nos sites. Donc impossible de fournir des interpretations sur les differences constatées dans les captures aussi bien que sur la distribution spatiale, qualitative et quantitative. Toutefois en considérant la richesse spécifique, deux nouvelles espèes endémiques du Rift Albertin ont augmenté la liste : le *Rhinolophus kahuzi* et le *R. willardi* décrits respectiement en 2013 par [6]. C'est le *Nycteris arge* (Nycteridae, Mirochiropera) qui a large distribution. En effet elle est commune. Les familles, de Rhinolophidae et Vespertillonidae (Microchiroptera), sont les plus réprésentées, chacune trois espèces ; la première comprend le *Rhinolophus kahuzi, R. willardi* et *R. clivosus zuluensis*, alors que dans la seconde *le Pipistrellus nanus, Hypsugo eisentrauti* et *Myotis wilwitschii.* Comme la richesse spécifique est fonction de la diversité des espèces, Kahuzi (Abondance 40, indice de Shannon 1,474 et dominance 0,3056) est plus riche avec 12 espèces. Tandis que Bushema qui est moins diversifié (Abondance 16, indice de diversité de Shannon 0,5004 et dominance 0,68), nous y avons localisé 6 espèces. D'après la 2° *loi biocénotique de Thienemann*, dans une région qui offrent des conditions favorables aux divers taxa, se développe des nombreux espèces. Tandis que dans les régions qui offrent des conditions extrêmes, peu d'espèces peuvent y vivre [11]. Leur importance écologique se justifie dans la chaine trophique car ils sont soit prédateurs des insectes ou proies des carnivores ou encore disséminateurs des graines et pollens.

5 CONCLUSION

A l'issue de cette étude sur les inventaires des chauves-souris, petits mammifères de l'ordre de Chiroptera dans quatre sites du Rift Albertin nous savons que cette écorégion acquise une richesse spécifique très élevée de ces animaux. En effet, la présence de plusieurs espèces de sous ordre de Megachiroptera (Frugivores et nectariens) ajouté à cela celle de Microchiroptera (Insectivores) dans toutes les aires où nos investigations ont été mené confirment ces constats. Les paramètres démoécologiques évalués par les calculs de la dominance, de l'indice de diversité de Shannon ainsi que du coefficient de similarité de Soerensen indiquent les caractéristiques de chaque site. Dans l'environnement, leur importance s'avère d'une importance capitale étant donné qu'ils jouent un rôle dans l'équilibre naturel. Les sont prédateurs et détruisent ainsi un nombre incroyable d'insectes. D'autres sont responsables de la dissémination des graines. Tous sont

proies de certains oiseaux, serpents et autres carnivores. La contribution de ce travail se résume à la connaissance et la protection d'un des taxa des ressources naturelles.

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REFERENCES

[1] Kingdon, J., "*The Kingdon Field Guide to African Mammals*". Midsonor Norton. pp. 476, 2003.

[2] Kaleme P. K., Bate J., Kerbis P. J., Mwanga, M. J. & Ndara, R. B. " *Small mammal diversity and habitat requirements in the Kahuzi- Biega National Park and surrounding areas, eastern Democratic Republic of Congo*". Integrative Zoology 2: 239-246, 2007.

[3] Mwanga, J., « *Programme Biodiversité des Ecosystèmes Aquatique et Terrestres dans le Rift Albertin (P.BEATRA). Rapport de la session de formation juillet-aout* » (Inédit). pp.105, 2005.

[3] Kuper W., Sommer J.H., Lovett J.C., Mutke J., Linder H.P., Beetje H.J., Van Rompaey R. S. A. R., Chatellam C., Sosef M. & Barthlott W. "*Africa's hotspots of biodiversity redefined*". Annals of the Missouri Botanical Garden **91**:525-535, 2004.

[4] Orme C.D.L., Davies R., Burges M., Eigenbrod F., Pickup N., Olson V.A., Webster A.J., Ding F-S., Rasmussen P.C., Ridgely R.S., Statterfield A.J., Bennett P.M., Blackburn T.M., Gaston K.J. & Owens T.P.F. "*Global hotspots of species richness are not congruent with endemism or threat*" . Nature **463**: 1016-1019, 2005.

[5] Plumptre A.J., Davenport T.R.B., Behangana H., Kityo R., Eilu G., Ssegawa P., Ewango C., Meirte D., Kahindo C., Herremans M., Kerbis Peterhans J.C., Pilgrim J., Wilson M., Languy M. & Moyer D. "*The biodiversity of the Albertine Rift*". Biological conservation **134**: 178-194, 2007

[6] Kerbis Peterhans, J. C., Fahr, J., Huhndorf, M. H., Kaleme, P., Plumptre, A. J., Marks, B. P. & Kizungu, R. "Bates *(Chiroptera) from the Albertin Rift eastern Democratic Republic of Congo, with the description of tow new species of the Rhinolophus maclaudi group*". Bonn zoological 62(2): 186-202, 2013

[7] Kerbis Peterhans, J. C., Hutterer, R., Mwanga, J., Ndara, B., Davenport, L., Balagizi, K., I. "African shrews to the Albertine Rift: Two new species of *Myosorex (Mammalia: Soricidae) from Burundi and the Democratic Republic of Congo* "Journal of East African Natural History 99(2): 103-128, 2010.

[8] Schouteden, H., « *Faune du Congo Belge et du Ruanda-Urundi I* « . Annales du Musée du Congo Belge, série N°8, Sciences Zoologiques Vol 1.Tervuren. 1948

[9] Stanley B., "*Tanzanian Mammal Key*", 2001.

[10] Dippenaar, N. J., "*Variation in Crocidura mariquensis (A. Smith, 1844) in Southern Africa, Part 1. (Mammalia: Soricidae)"*. Animals of Transvaal Museum 32:1-34, 1977.

[11] Bachelier, G., « *La vie animale dans les sols* ». Office de la Recherche Scientifique et technique Outre-Mer. Paris. pp. 279, 1963.

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LES MUSARAIGNES OUTILS DE CONSERVATION DU RIFT ALBERTIN (EST DE LA REPBLIQUE DEMORATIQUE DU CONGO)

[SHREWS TOULS OF CONSERVATION IN ALBERTINE RIFT (EAST OF DEMOCRATIC REPUBLIC OF CONGO)]

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ABSTRACT: This study has been conducted in Albertin Rift, East Democratic Republic of Congo at Misotshi Kabogo (790m – 1950m of altitude) sites located within Mitumba mountain chaine at the west side of Tanganyika Lac and Kahuzi (2200m – 3308m of altitude) a mountain of Kahuzi Biega National Park in the east of Kivu Lac at the. The goal consisted of fournishing the information related to status of these small mammals of the species of Soricidae family. The specimens had been collected with the help of 11 pitfalls that were escaped into soil and spaced at 5m from each other on the same transect and baited by meat or fish. The laboratory helped to identify and to analyse data and some were carried out to museum. Some species of *Crocidura, Myosorex, Scutisorex, Suncus and Sylvisorex* had been captured. Musisi swamp in Kahuzi region is known to be the richest in abundance. *Crocidura olivieri* is the only species found in the both sites. Only four species are located in Misotshi-Kabogo and eighteen specifically in Kahuzi. Three new species have been described; *Myosorex jejei* at Kahuzi localised in the tow habitats. To this is added some vulnerable, endemic, nearly endemic and poorly known or data deficient.

KEYWORDS: Soricidae, Rift Albertin, Kabogo, Kahuzi, diversity, abondance, status.

RESUME: Cette étude a été menée dans le Rift Albertin à l'Est de la République Démocratique du Congo dans les sites de Misotshi-Kabogo (altitude 790m à 1950m) dans la chaine de Mitumba à l'ouest du Lac Tanganyika et celui de Kahuzi (altitude 2200m à 3308m) une montagne du Parc National de Kahuzi Biega (Patrimoine mondial) partie oidentale du Lac Kivu. Le but consistait à fournir les renseignements relatifs aux statuts de petits mammifères de la famille de Soridae. Le collecte des spécimens s'effectuait à l'aide de petits seaux enfouis dans le sol, espacés de 5m par tansect et appâtés par la viande ou le poisson. L'identification et l'analyse des données se faisaient au laboratoire. Quelques espèces de *Crocidura, Paracrocidura, Myososrex, Suncus et Sylvisorex* ont été capturées. L'abondance est plus élévée dans le Marais Musisi de la région de Kahuzi. Trois nouvelles espèces ont été décrites. Il s'agit *Myosorex jejei* à *Kahuzi, Crocidura lwiroensis* et *Myosorex kabogoensis* à

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Misotshi-Kabogo Le *Crocidura olivieri* est l'unique espèce localisé dans les deux sites à la fois. Nous avons des espèces vulnérables, endémiques, presque endémiques et peu connues.

MOTS-CLEFS: Soricidae, Rift Albertin, Kabogo, Kahuzi, diversité, abondance, statuts.

1 INTRODUCTION

En République Démocratique du Congo, les aires protégées occupent 13% du territoire national. D'ici 2015, ils doivent atteindre un total de 15% [1]. Ce projet très ambitieux est-t-il réalisable? En plus quelle est la place de ces animaux de la famille de Soricidae couramment appelés musaraignes dans le processus d'érection des nouvelles aires protégées? Proies et prédateurs, les petits mammifères en général et les musaraignes en particulier, font parties de la chaîne trophique. Ils sont par la voie de conséquence utile dans la conservation de l'environnement. La RDC renferme un pourcentage significatif de la biodiversité mondiale, mais pas de stratégie nationale pour gérer un grand nombre d'espèces [2].

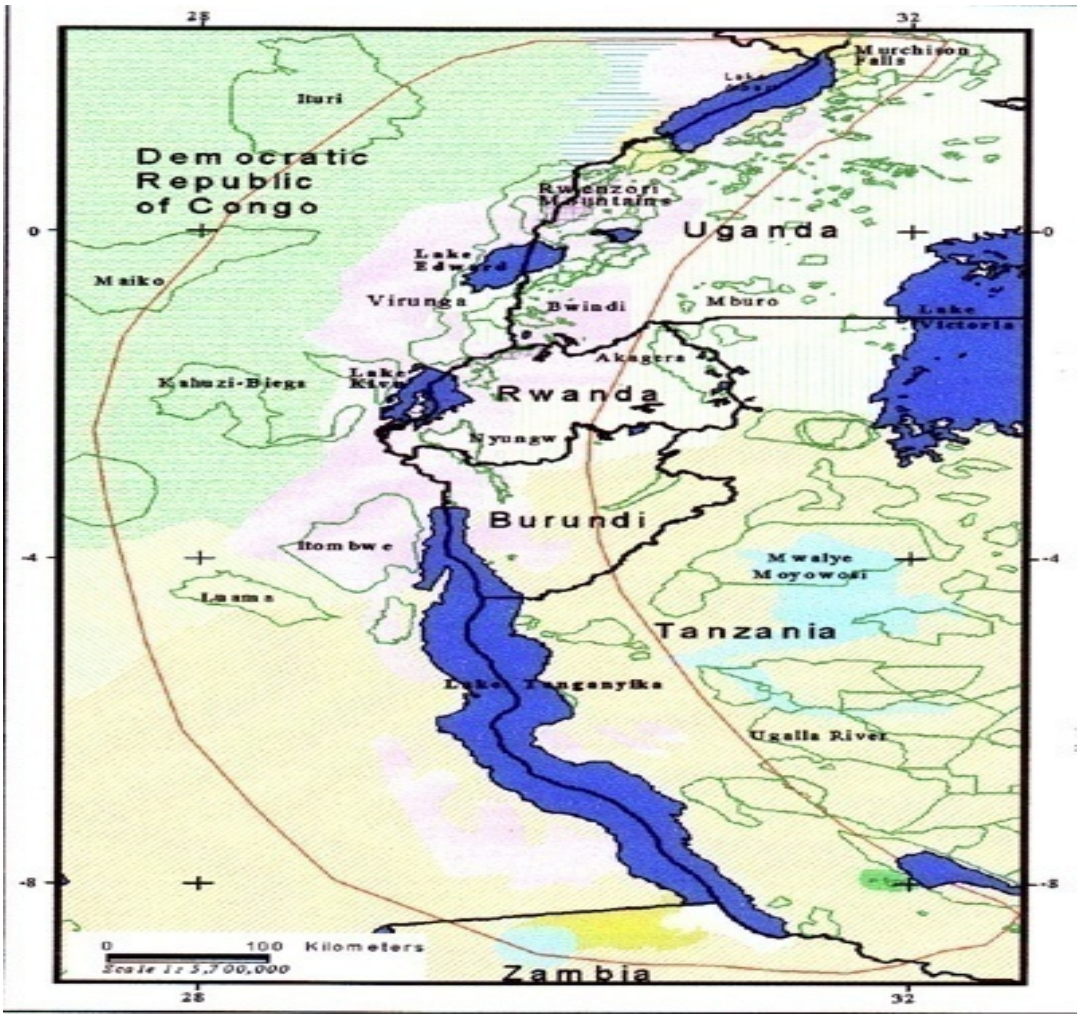


Fig 1. Rift Albertin [3]

Le Rift Albertin, où est localisée notre aire d'investigation, se situe depuis les Monts Bleus au Nord (2°N, 30°30'E) jusqu'à l'extrême sud du Lac Tanganyika (9°S, 30'30''E) [4]. Il couvre la Région de grands Lacs africains. Le World Wide Found (WWF) qualifie cette partie de l'Afrique d' « Ecorégion » et Conservation International l'a surnommée « Point chaud de la biodiversité » Ce Rift a été récemment déclaré une zone importante pour la conservation à cause de sa haute richesse en endémique et de vulnérables [5]. En plus, il figure parmi les sept sites les plus importants pour la conservation des Oiseaux [6]. Si aujourd'hui

nous nous intéressons aux Soricidae, c'est tout simplement parce qu'il y a quelques années, le concept de conservation était réservé uniquement aux oiseaux. On parlait de Zone d'Importance pour la Conservation « ZICO » [7]. Aujourd'hui, ce concept est élargi à tous les taxa [1]. Donc, les musaraignes aussi sont concernées. Cependant, très peu de recensements biologiques relatifs à ces petits mammifères ont été effectués dans la partie congolaise du Rift Albertin. En 1950 des inventaires sur les vertébrés ont été menés dans le site de Kabobo au Nord Katanga. Les petits mammifères en général et la famille de Soricidae en particulier n'étaient pas concernés. Les mérites de cette expédition résident dans la description de l'oiseau *Apalis kaboboensis* [8]. Nos inventaires biologiques sur les petits mammifères en 2007 dans ce même site ont permis de décrire deux nouvelles espèces de Soricidae : le *Crocidura lwiroensis* et le *Myosorex kabogoens.* Nous y avons aussi signalé la présence de petits mammifères endémiques et vulnérables du Rift Albertin [9].

A Kahuzi (Sud-Kivu), les résultats de nos inventaires de 2005 à 2007, ont confirmé la présence d'une nouvelle espèce de Soricidae, le *Myosorex jejei* [10] ainsi que celle de petits mammifères localisés avant notre expédition [11] , [2].

Cette étude a été motivée par les différentes philosophies de trois Institutions internationales. C'est d'abord celle d'Albertin Rift Conservation (ARCOS) qui insiste sur la promotion de la recherche, de l'information, de la protection de cet Ecorégion. Ensuite, celle du Critical Ecosystem Paterneship Fund (CEPF) qui stupile que les montagnes du Rift Albertin soient intégrées sur la liste clé de la biodiversité [4]. Enfin, celle du World Conservation Monitoring Center (WCMC) qui exige la connaissance de tous les taxa des domaines ou reserves à concerver. Tout ceci avec comme objectif primordiale de contribuer non seulement à la conservation de la biodiversité tant aquatique que terrestre dans le Rift Albertin, mais aussi à l'évolution de la science par la description de nouvelles espèces.

2 MATERIELS ET METHODES

2.1 MILIEU D'ÉTUDE

2.1.1 MISOTSHI-KABOGO

Ce site est localisé dans le Parc en gestation de NGAMIKKA (NGA : Entité de Ngandja dans la Province du Sud-Kivu et MI : Mont Misotshi, la plus haute montagne dans cet entité, K : entité Kabili dans la Province du Katanga et KA : Mont Kabobo qui a le sommet le plus élevé de cette partie) dans la partie orientale de la République Démocratique du Congo vers les massifs de Mitumba. Sa superficie est estimée à ± 200.000 hectares. Il est localisé en République Démocratique du Congo entre le Territoire de Fizi (Province du Sud Kivu) et le District de Tanganyika (Province du Katanga). Au Nord, il est limité par la Rivière Kilombwe, au Sud par la Rivière Lukunga, à l'occident par le Bloc Forestier du Bassin du Congo et à l'orient par le Lac Tanganyika [10]. Les différents habitats y visités sont situés :

- Approximativement à 45 Km au Nord Est de Kalemie et 3 Km du village Mizimu vers le Lac Tanganyika, Province de Katanga, à l'est de République Démocratique du Congo, dans une forêt de montagne à1250 m, 5°28'45''S et 29°16'22''E.
- A plus ou moins 2.5 Km vers le Sud-Ouest de Talama dans une forêt secondaire sèche à 1600 m, 4°59'05''S et 29° 5'34''E.
- Région du Mont Misotshi, à au moins 4 Km Sud-Ouest du village Talama vers le Lac Tanganyika, à l'est de la République Démocratique du Congo dans une forêt humide à 1950 m, 4°59'29''S et 29°4'49''E.
- Aux alentours de Mizimu à 790m, 5°27'59''S et 29°17'16''E

2.1.2 KAHUZI

C'est la montagne la plus élevé du Parc National de Kahuzi Biega (PNKB). La superficie de ce parc est de 600.000 hectares et elle se trouve à cheval entre les Provinces du Sud, Nord Kivu et du Maniema. Nous y avions travaillé dans les biotopes suivants [10].

Marais Musisi au pied du Mont Kahuzi à 2200 m, 2°16'Sud et 28°41'Est.

- Forêt secondaire à 2260 m, 2°12'Sud et 28°40'Est.
- Une pente presque nue sur le flanc oriental à 2800 m, 02°15'Sud et 028°40'Est.
- Au sommet du Mont Kahuzi à 3308 m, 2°15'Sud et 28°40'Est.



Fig 2.Mont Kahuzi : Photographie Franc Ribas

2.2 MODE D'OBSERVATION

Nous avions utilisés la méthode d'observation indirecte pour collecter les données parce que ces animaux sont non seulement de petites tailles, mais sont aussi discrets, se ressemblent jusqu'au niveau, sont presque tous de mœurs nocturnes et ne sont pas protégés par la loi de l'environnement. Ceci étant, pour mener des études biologiques de Soricidae, il faut d'abord les attrapés morts ou vivants.

Myosorex *Sylvisorex* *Suncus* *Crocidura*



Fig 3 . Benjamin NDARA Ruziga

2.3 TRAVAUX DE TERRAIN

Pour capturer les spécimens, nous avions utilisé une combinaison de pièges incluant les clapettes standards (ou casses dos) de marque <Museum special> et <Victor Rat traps>, le Sherman et les petits seaux (ou pitfall buckets). Deux à quatre pièges à rats étaient placés à chaque station distante entre elle de 5m. Quant aux petits seaux, nous placions 11 par transect. Ils étaient enfuis dans la terre avec le bord supérieur au niveau du sol. Une barrière était fixé entre eux afin d'éviter les musaraignes de passer dans l'espace entre ces pièges [2]. L'appât était constitué d'un mélange de beurre d'arachide avec le quaker, les bananes, les grains d'arachide, le manioc, le poisson, la viande fraiche ou l'huile de sardine. Les contrôles journaliers se faisaient deux fois chaque jours ; très tôt le matin pour capturer les individus nocturnes et tard dans l'après-midi pour les diurnes. Les pièges restaient sur place pendant 4 à 5 jours [10]. Quelques spécimens nous ont été fournis par la population locale surtout pour les espèces que nos pièges ne peuvent pas capturer.

2.4 TRAVAUX DE LABORATOIRE

Nous avions procédé d'abord par la prise des mesures standards qui nous permettait d'obtenir des données biométriques concernant les mensurations linéaires en millimètre et pondérales en gramme. Il s'agit de la longueur totale, longueur de la queue, longueur de l'oreille, longueur de la patte arrière et du poids [12]. Certaines identifications étaient confirmées en utilisant les clés d'identification de Schouteden [13], Meester & Setzer [14] et de Kingdon [15]. La condition reproductive pour chaque spécimen mâle était déterminée par la position (scrotale ou abdominale) des testicules. Quant à la femelle, il fallait déterminer la présence ou l'absence des embryons, des cicatrices placentaires, du nombre plus de l'état et

de la position (axiale, abdominale ou inguinale) des mamelles. Tous les spécimens étaient préparés comme peau et squelette pour les animaux non endommagés. A défaut, c'est le squelette seulement ou bien le crane qui étaient gardés soit dans le formol (5%) soit dans l'alcool éthylique (90%). La taxonomie génétique effectuée au Field Museum de Chicago avait servi pour confirmer l'identification par les études d'ADN des tissus prélevés sur chaque spécimen et gardé dans une solution conservatrice, le diméthyle sulfate oxyde (DMSO).

2.5 GESTION ET ANALYSE DES DONNEES

2.5.1 RICHESSE SPÉCIFIQUE

La présence et l'identification des spécimens jusqu'au niveau nous avait permis d'évaluer la richesse spécifique par site.

2.5.2 STATUTS DES SORICIDAE

Pour la plupart des individus, nous avons obtenu les status sur la Liste Rouge de l'Union International pour la Conservation de la Nature [7].

2.5.3 CONSIDÉRATIONS DÉMO ÉCOLOGIQUES

2.5.3.1 L'ABONDANCE

Ce paramètre a été calculé à l'aide de la formule $A = \frac{ni}{N} \times 100$

n= nombre d'espèce par genre et N = nombre total de genre.

2.5.3.2 INDICES DE DIVERSITE ET DE DOMINANCE

Pour calculer la diversité spécifique dans différents sites nous avons utilisé l'indice de Shannon Weaver et la dominance données par le logiel Past 2.exe

3 RESULTATS

Tableau 1. Composition spécifique des Soricidae dans différents types d'habitat

Espèce	MISOTSHI-KABOGO (Altitude)				MONT KAHUZI (Altitude)			
	790	1250	1600	1950	2200	2260	2800	3308
Crocidura dolichura (Peters, 1876)			X					
C. fuscomurina (Heuglin, 1865)		X						
C. hildegradea (Thomas, 1904)						X		
C. kivuana (Heim de Balsac, 1968)					X		X	
C. lanosa (Heim de Balsac, 1968)					X			
C. litoralis					X			
C. lwiroensis (Kerbis & Hutterer2013)		X						
C. nigrofusca (Matschie, 1895)					X	X		
C. niobe (Tomas, 1906)					X	X	X	
C. olivieri (Lesson, 1827)	X	X			X	X	X	
C. stenocephala (Heim de Balsac, 1979)					X			
C. turba (Dollman, 1910)						X		
Myosorex jejei (Kerbis et al., 2010)					X		X	X
M. babaulti (Heim de Balsac & Lamotte, 1956)					X			
M. kabogoensis (Kerbis & Hutterer 2013)				X				
M. blarina (Thomas, 1906)					***X***			
Scutisorex somerini (Thomas, 1910)						*X*		
Suncus megalura (Jentink, 1888)					***X***			
Sylvisorex granti (Thomas, 1907)					***X***			
S. lunaris (Lonnberg & Gyldenstolpe, 1925)					***X***	***X***	***X***	
S. vulcanorum (Hutterer & Verheyen, 1985)					***X***	***X***		
S. megalura (Thomas, 1907)								

Légende : X = Présence.

Le tableau 1 nous livre des informations relatives à la richesse spécifique dans les sites de Misotshi-Kabogo et Kahuzi. Nous y avions identifié 22 espèces de *Soricidae* dans les proportions suivantes : 55 % de *Crocidura*, 18 % de *Myosorex*, 4,5 % de *Scutisorex*, 4,5 % de *Suncus* et de *Sylvisorex* 18 %. Ensuite, ce même tableau nous renseigne que seul le *Crocidura olivieri* est commun car il est présent dans tous les habitats. En plus, il indique que le marais Musisi au pied du Mont Kahuzi (Secteur de Mugaba) renferme 69 % d'espèces parmi lesquelles les *Crocidura* sont les plus représentés avec 12 espèces. Ils sont suivis par les *Sylvisorex* et les *Myosorex* représentés chacun par quatre et trois espèces, le *Scutisorex* et le *Suncus* chacun avec une espèce.

Le Marais Musisi est le meilleur biotope pour les *Soricidae* Enfin, ce tableau nous indique que le *Crocidura olivieri* a une très large distribution par rapport à d'autres taxons.

Tableau 2. Espèces endémiques du Rift Albertin et vulnérables

Espèces	**Endémique**		**Vulnérable**	
	E du R.A.	***P.E.***	***V***	***N.E.***
Crocidura dolichura				***X***
C. fuscomurina				*X*
C. hildegradea				*X*
C. kivuana	*X*		***X***	
C. lanosa	*X*			*X*
C. litoralis				*X*
C. lwiroensis	***X***		***X***	
C. nigrofusca				*X*
C. niobe	***X***			*X*
C. olivieri				*X*
C. stenocephala	***X***		***X***	
C. turba				*X*
Myosorex babaulti	***X***			*X*
M. blarina	***X***			*X*
M. jejei	***X***		***X***	
M. kabogoensis	***X***		***X***	
Scutisorex somerini		***X***		*X*
Suncus megalura	***X***			*X*
Sylvisorex granti		X		X
S. lunaris ruandae	X		X	
S. megalura				X
S. vulcanorum	X		X	

Légende :E = endémique RA = Rift Albertin, PE = Presque Endémique, V = Vulnérable, NE =Non en danger.

Le Crocidura lwiroensis, le Myosorex jejei et le M. kabogoensis sont nouvelles à la science. Concernanl les statuts IUCN, les espèces suivantes sont vulnérables: Crocidura stenocephala, C. kivuana, Sylvisorex blarina, S. lunaris ruandae et S. vulcanorum. 12 espèces sont endémiques. Il s'agit de tous les quatre Myosorex. En plus de Crocidura kivuana, C. lanosa, C. stenocephala, C. niobe, C. lwiroensis, Suncus megalura, Sylvisorex lunaris ruandae et S. vulcanorum. Deux espèces sont presque endémiques ; Scutisorex somerini et Sylvisorex granti.

Tableau 3. Abondance des espèces par genre

	A : Misotshi-Kabogo (Altitude)				Tot	B : Mont Kahuzi (Altitude)				Tot	TOT : A+ B
	790	1200	1600	1950		2200	2260	2800	3308		
Crocidura	4,54	13,63	4,54	0	22,71	31,81	18,18	13,63	0	63,62	86 ,33
Myosorex	0	0	0	4,54	4,54	13,63	0	4,54	4,54	22,71	27,25
Scutisorex	0	0	0	0	0	0	4,54	0	0	4,54	4,54
Suncus	0	0	0	0	0	4,54	0	0	0	4,54	4,54
Sylvisorex	0	0	0	0	0	18,18	9,09	4,54	0	31,81	31,81
Total	4,54	13,63	4,54	4,54	27,25	68,16	31 ,81	22,71	4,54	127,22	154,47

Le tableau 3 nous renseigne sur l'abondance des espèces par genre est supérieure chez les *Crocidura*, suivie de *Sylvisorex* et *Myosorex*. Il nous montre aussi que la richesse spécifique est élevée dans le marais du PNKB par rapport aux autres sites.

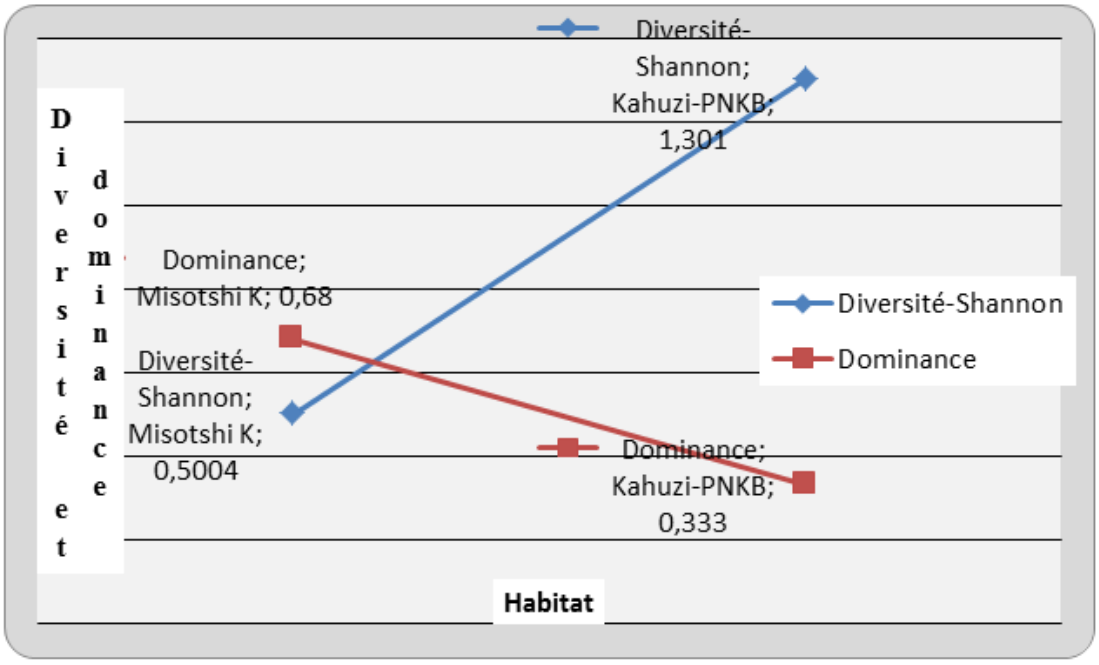


Fig 4 : Indice de diversité de Shannon et Dominance par habitat

Il ressort de la figure 1 que la Région de Kahuzi qui a un indice de diversité de Shannon1,3001 est plus diversifié que Misotshi-Kabogo dont l'indice de Shannon est 0,5004. Mais la dominance de 0,68 est plus significative à Misotshi-Kabogo qu'à Kahuzi où elle est de 0,333. L'augmentation de la diversité entraine la diminution de la dominance.

4 DISCUSSION

Comme aucun inventaire sur les Soricidae n'a été effectué dans ces deux sites, il n'est pas possible de comparer les résultats. La région de Kahuzi est beaucoup plus riche que celle de Misotshi-Kabogo en ce qui concerne la présence spécifique. Le plus grand nombre d'espèces a été récolté dans le marais à *Cyperus* de Musisi. Dans le site de Misotshi Kabogo, nous avons trouvé seulement deux espèces vulnérables sur les quatre recensées. Alors qu'à Kahuzi, nous avons pu localiser cinq espèces vulnérables. Des espèces endémiques ont été recensées dans les deux sites. Il n'y a pas d'espèces presque endémiques localisées à Kabobo tandis qu'à Kahuzi, elles sont concentrées dans le marais et ses environs. Les nouvelles espèces pour la science ont été décrites dans les deux sites. Il s'agit de *Myosorex jejei* au Mont Kahuzi tandis qu'à Misotshi-Kabogo c'est le *Crocidura lwiroensis* et le *Myosorex kabogoensis*. Sans doute que des inventaires intensifiés peuvent fournir d'autres étant donné que le Rift Albertin est réputé très riche en biodiversité. Dans les deux sites, nous avons observé la présence de plusieurs espèces de Soricidae qui ne sont pas bien connues. C'est le Marais Musisi qui en compte le plus grand nombre. La richesse spécifique diminue sensiblement avec l'altitude.

Le *Crocidura olivieri* est très commun, il se retrouve presque partout en Afrique Subsaharienne avec une fréquence élevée. Au point de vue spécifique, les espèces de *Crocidura* sont les abondantes et elles s'adaptent facilement à tous les biotopes. En plus, les espèces de *Crocidura* sont numériquement plus nombreux partout. En considérant la population localisée à Musisi uniquement, nous remarquons que 31 % d'individus récoltés sont des *Crocidura*, 18 % de *Sylvisorex*, 14 % des *Myosorex* et 5 % de *Suncus*.

Ils sont suivis par ceux des *Sylvisorex* et *Myosorex*. Tandis que les espèces de *Scutisorex* et *Suncus* sont les moins abondantes. Parmi les 12 espèces de *Crocidura*, huit ont comme statuts « data déficients ». Elles sont peu connues et ne sont pas en danger. C'est le cas du *Suncus megalura* et celui de *Scutisorex somerini*. Nous savons seulement qu'ils sont presqu'endémiques. En d'autres termes, ils sont présents ailleurs en abondance, alors que dans nos milieux d'études, ils sont rares. Parmi les quatre espèces de *Sylvisorex*, les *granti* et *megalura* ne sont pas vulnérables. Ils sont non en dangers mais intéressants pour la conservation parce qu'ils sont endémiques au Rift Albertin.

5 CONCLUSION

Certaines espèces ont une importance pour la conservation car elles sont à la fois vulnérables et endémiques du Rift Abertin. Nous avons le *Myosrex jejei*, *M. kabogoensis*, *Sylvisorex blarina*, *S. lunaris ruandae*, *S. vulcanorum*, *Crocidura kivuana*, *C. stenocephala* et *C. lwiroensis, C. kivuana* (endémique au Kahuzi uniquement), Les *Crocidura* et *Myosorex* ont une même abondance lorsque l'on considère la vulnérabilité. Ils sont suivis de *Sylvisorex*. Concernant l'endémisme, la situation est plus élevée pour les *Crocidura* que les *Myosorex*. Des enquêtes plus intensifiées s'avèrent importantes pour vérifier ce constat. Le statut d'un grand nombre d'espèces de Crocidura est encore mal connu. La majorité des espèces inventoriées notamment *Myosorex babaulti, M. blarina, Crocidura dolichura*, *C. lanosa, C. fuscomurina*, *C. hildegradea*, *C.litoralis*, *C. nigrofusca*, *C. niobe*, *C. olivieri*, *C. turba*, *Suncus megalura*, *Sylvisorex megalura, S. granti* et *Scutisorex somerini* ne sont pas en danger. Ils sont classés dans la catégorie des animaux avec data déficients. Les nouvelles espèces sont plus remarquables pour les *Myosorex* par rapport aux *Crocidura*. Etant donné que les statuts d'un grand nombre d'espèces de *Crocidura* est encore mal connu, des études biologiques relatives aux petits mammifères de ce genre sont à encourager. La dominance s'avère supérieure à Misotshi-Kabogo (0,68) que dans la Région de Kahuzi (0,3333). Ceci explique tout simplement une faible présence de population dans le premier site par rapport au second. Le marais est confirmé comme biotope préférentiel des Soricidae. Il s'avère impérieux d'attirer un peu plus d'attention pour la conservation de ce milieu.

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REFERENCES

[1] CHIFUNDERA, K., *"Conservation implication following the discovery of four species from the Itombwe Natural Reserve, Eastern Democratic Republic of Congo"*. Herpetological Review 43 (2): 253-259, 2012.

[2] KALEME, P. K., BATES, J., KERBIS, P.J., MWANGA, M. J., & NDARA, R. B., *" Small mammal diversity and habitat requirement in the Kahuzi-Biega National Park and surrounding areas, eastern Democratic Republic of Congo"*. Integrative Zoology 2: 239-246, 2007.

[3] MWANGA, J., *« Programme Biodiversité des Ecosystèmes Aquatique et Terrestres dans le Rift Albertin (P.BEATRA). Rapport de la session de formation juillet-aout »* (Inédit). pp.105, 2005.

[4] KERBIS PETERHANS, J.C., HUHNDORF, M.H., PLUMPTRE, A.J., KALEME, P., & NDARA, B*. 2013. Mammals, other than bats, from the Misotshi-Kabogo highlands (eastern Democratic Republic of Congo), with the two new species (Mammalia: Soricidae).* Bonn zoological Bulletin 62 (2): 203-219, 2013.

[5] PLUMPTRE A.J., DAVENPORT T.R.B., BEHANGANA H., KITYO R., EILU G., SSEGAWA P., EWANGO C., MEIRTE D., KAHINDO C., HERREMANS M., KERBIS PETERHANS J.C., PILGRIM J., WILSON M., LANGUY M. & MOYER D. *"The biodiversity of the Albertine Rift"*. Biological conservation **134**: 178-194, 2007.

[6] Orme C.D.L., Davies R., Burges M., Eigenbrod F., Pickup N., Olson V.A., Webster A.J., Ding F-S., Rasmussen P.C., Ridgely R.S., Statterfield A.J., Bennett P.M., Blackburn T.M., Gaston K.J. & Owens T.P.F. *"Global hotspots of species richness are not congruent with endemism or threat"* . Nature **463**: 1016-1019, 2005.

[7] IUCN. Biodiversity in Sub-Sahara: *"Africa and its Islands Conservation. Management and Sustainable use*. *Occasional papers of the IUCN species Survival"*. Commission, No 6. 1990.

[8] PRIGOGINE, A., *« La faune ornithologique du Massif du Mont Kabobo »*. Annales du MuséeRoyal du Congo Belge, Tervuren. Série 8, 85: 1-47, 1960.

[9] KERBIS PETERHANS, J.C., HUHNDORF, M.H., PLUMPTRE, A.J., KALEME, P., & NDARA, B*. «Mammals, other than bats, from the Misotshi-Kabogo highlands (eastern Democratic Republic of Congo), with the two new species (Mammalia: Soricidae)".* Bonn zoological Bulletin 62 (2): 203-219, 2013*.*

[10] KERBIS PETERHANS, J. C., HUTTERER, R., MWANGA, M. J., NDARA, R. B., DAVENPORT, L., BALAGIZI KARHAGOMBA, I., & UDELHOVEN, J. African shrews endemic to the Albertine Rift: *"Two new species of Myosorex (Mammalia: Soricidae) from Burundi and the Democratic Republic of Congo"*. Journal of East African Natural History 99(2): 65-74. 2010.

[11] RAHM, U. *« Les mammifères de la Forêt Equatoriale de l'Est du Congo »*. Annales du Musée Royale de l'Afrique Centrale, série N°8, Sciences Zoologiques, N149-Tervuren. 1966.

[12] STANLEY, W. T. & HUTTERER, R. *"A new species of Myosorex Gray, 1832 (Mammalia: Soricidae) from the Eastern Arc mountain, Tanzania"*. Bonner Zoologische Beiträge 49: 19 –29, 2000.

[13] SCHOUTEDEN, H. *« Faune du Congo Belge et du Rwanda Urundi* I. Annales du Musée du Congo Belge, série N°8, Sciences Zoologiques. Vol 1, Tervuren. 1948.

[14] MEESTER, J. & SETZER, H. W. *"The mammals of Africa, identification manual"*. Smithsonian Institution. Press, Washington. 1971.

[15] KINGDON, J. *"The Kingdon Field Guide to African Mammals"*. Midsonor *Norton.* 2003.

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Post Occupancy Evaluation, Performance Building Tool: Case of University Facilities in Algeria

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ABSTRACT: This paper explores post occupancy evaluation (POE) strategies with regard to performance of university buildings in Algeria. Essential methods of post-occupancy evaluations are reviewed. Implementation of broad principles of POE in the specific context of university facilities was applied. It endeavours to underline how post occupancy evaluation strategies can assist central government and local authorities in the higher education sector to respond to the challenge of developing a better built environment. Finally, key findings through a field work are presented.
Last but not least, it aspires to hand over the capacity to provide consistent 'evidence based' information to be incorporated into design guidelines, and inform future higher education facility decisions makers. Arguably tough, the potential as well as the limitations of the scope will require further exploration in use.

KEYWORDS: Post Occupancy Evaluation (POE), Feed Back, Assessment, University Facilities, Building performance.

1 BACKGROUND

The provision of university buildings has always been a major interest of the central government. Since the early days of independence, Algeria has faced an immense growth of student numbers, increasing from 5,000 on the eve of the independence (1962) to over 1.200.000 students at present, (MESRS, 2014). A vast expenditure is still being allocated to university buildings in Algeria, regardless of what have been achieved so far, over the last thirteen years, and neither post occupancy evaluation (POE) studies, nor appraisals or assessments studies have been made available to those who are involved in designing university buildings.

There is little specialised work and literature about post occupancy evaluation and appraisals of university buildings in relation to their various architectural aspects. Evaluative studies, for which the Architectural Branch of the Ministry of Higher Education is held responsible, have always been characterised by being unable to encompass the different variables entering into the design process of universities. Many gaps has yet to be bridged; the provision of continuous and specific information which derives from rigorous evaluative works (POE) and empirical evidence to architects and other mainly concerned with the design of this building type are either unreliable or non-existent. Reliable statistical data, documented university briefs and plans are either non-existent or inaccessible to architects, (Krada. 2005).

At present there exists an exceptional opportunity for improvement in practically all spheres connected with university buildings in Algeria. Universities are attempting by various means to meet the challenge of a socio-economic 'take off'. The urgency to quest for a sustainable and yet performance based buildings is an ultimate goal and an utmost requisite constraints of a today information based society that aspire for best in a world of ferocious contest in an unforeseeable paths.

University buildings are highly dynamic institutions. Furthermore, studies surrounding this subject indicated that university accommodation is most prone to change as well as most expensive to provide, enhance, renovate and run

2 NEED FOR POST OCCUPANCY EVALUATION STUDIES

As noted by Zimmerman and Martin, "The over-arching benefits from conducting POEs are the provision of valuable information to support the goal of continuous improvement". Implicitly then, that conduction a POE within the Algerian context would become an urgent task in order to set forth any sound basis for enhancement of the quality of the built environment in relation to university facility, (Zimmerman and Martin ,2001).

As will be discussed the opportunity to assess building performance versus design objectives. However a more essential, but equally forceful reason is the need to demonstrate a commitment to continuous quality improvement of both the project procurement process and its outputs.

Literature unveiled that Post Occupancy Evaluation (POE) is an important factor of the building process. (Preiser, 2002). There is logic to the argument that one purpose for the evaluation of buildings in-use must be the provision of essential feedback to inform future actions.

Post-occupancy evaluation (POE) is a diagnostic tool and system which allows facility managers to identify and evaluate critical aspects of building performance systematically.

This system has been applied to identify problem areas in existing buildings, to test new building prototypes and to develop design guidance and criteria for future facilities. Outlines the numerous benefits of POE, including better space utilization, as well as cost and time savings. Highlights the primary effect of POE database development outcomes on Academic Facility Performance Feedback.

In the forgoing article we shall review the specialised literature in order to unveil some aspects relating to POE as a Performance Based Approach.

At thorough literature search undertaken for this purpose tends to pin out that at present, the debate about a one all encompassing definition on POE performance based approach is far from having found the consensus in both terms concepts and applicability alike. Nonetheless, literature evidence stressed that information gained from POEs can provide not only insights into problem resolution but also provide useful benchmark data with which other projects can be compared, (Stanley, L. 2001).

This shared learning resource provides the opportunity for improving the effectiveness of building procurement where each institution has access to knowledge gained from many more building projects than it would ever complete. In doing so, methods in current use and their relevance to the design of university building will be highlighted. Another concern along these lines will lie on the identification of major POE methods liable to enhance quality of the built environment.

International experience in the field of POE is opportunely taken into account for the sake of making better living and built environments. Furthermore, concepts and tools in current use are specifically discussed; this to underscore the venues capable to set forth a POE performance based approach framework in relation to meet evaluation objectives in relation to the forgoing topic, (Preiser and Vischer 2005).

3 POST-OCCUPANCY EVALUATION: A CHRONOLOGICAL GLANCE

Post-occupancy evaluation of educational buildings and has nearly a forty-year history. The Building Performance Research Unit (BPRU) at the University of Strathclyde appraised over fifty comprehensive schools in Scotland during the 1960s. The bulk of data generated since then provided seminal determinants of post-occupancy evaluation applied to school buildings. Techniques that related space and its organization to people's responses, space use, costs, services and movement were developed. (S.S.B.R.T.,1976)

In the United States, Rabinowitz reported on a diagnostic post-occupancy evaluation conducted in four schools in Columbus, Indiana that looked comprehensively at technical, functional and behavioural aspects of each school. Data collected through observation, photography and surveys was compared to existing standards (Prieser, Rabinowitz & White, 1988).

In an effort to standardize the evaluation of educational facilities, a guide was first developed by the Council of Educational Facility Planners International (CEFPI in 1986) that provides evaluative criteria for administrators and community leaders to measure the quality of facility for general condition and suitability for education. Over 125 items affecting the functioning of educational buildings are offered in six areas: sitting, structural and mechanical features, plant maintainability, school building safety and security, educational adequacy and environment for learning.

The stated purpose of the appraisal includes the performance of a post-occupancy evaluation, to formulate a permanent record to document deterioration, to highlight specific appraisal needs, examine the need for new facilities or to evaluate the need for renovation, as well as to serve as an instructional tool. (Lee, A. and Barrett, P, 2003).

Since that, the concept has gained universal approbation and is nowadays frequently used. There are also many other abbreviations meaning same process: Building Evaluation (BE), Facility Performance Evaluation (FPE), and different types of customer satisfaction surveys. In connection with customer surveys certain aspects have to be taken into daylight.

4 WHAT IS POST OCCUPANCY EVALUATION?

Post Occupancy Evaluation (POE) is acknowledged and longed-for as a process that can "enhance, and help to describe, the performance of the built environment ", (Preiser, 1989). Briefly, it's a process of "evaluating buildings in a systematic and accurate way after they have been occupied for some time, (Gonzales et al, 1997).

It is also characterised by all-inclusive and yet thorough assessment of a building. However, POE methods spin around the study of the efficiency lying in **the users / environments** interface. (Bechtel et. al. 1987).

POEs are more than "customer surveys"; they are absorbed in the profound building essence. It is obvious but this systematic investigation and analysis of the structure and relationships between design objectives and occupants' experiences is taken into consideration in future development efforts.

Another way of looking is the verification purposes. We need to be sure that the intensions of the design have really become true.

We need to determine whether the finished building actually meets the specified attributes. Therefore, post occupancy evaluation methods are needed (Margulis 1996). As mentioned earlier, POEs are useful to everyone who comes into contact with a building. POE is a powerful diagnostic tool that allows people to learn about their past, mistakes and successes alike (Preiser 1988).

The purpose of the POE tool is simple: it helps practitioners to avoid repetitive mistakes.

Evaluation and feedback are the cornerstones for the continuous improvement in building procurement. Good feedback is an intrinsic part of good briefing and design of buildings.

Preiser and Vischer argued that post occupancy evaluation concentrate mainly on user satisfaction.

"It is essentially a systematic process guided by research covering human needs, building performance and facilities management", (Preiser and Vischer 2005).

5 POST OCCUPANCY EVALUATION PROCESS.

The specialized literature brought to light three types of POE's: Diagnostic, Indicative and Investigative. They all serve purposefully the enhancement of building performance. (Preiser, W., Rabinowitz, H., and White, E 1988)

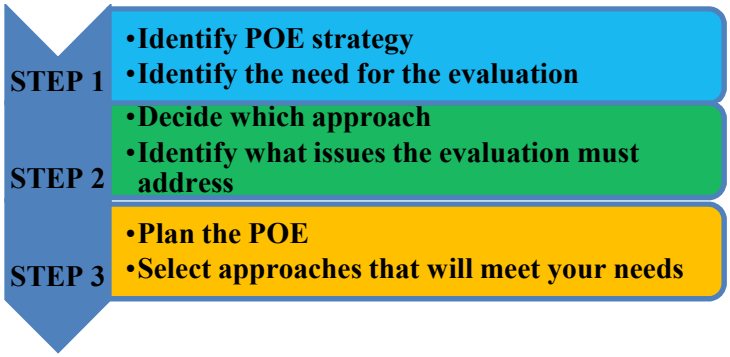
POEs can be used no matter what is the building type? Whether applied on newly achieved buildings or on a retrofit basis, Zimring stated "that POEs are flexible enough namely in terms of: scale, resources, goals, methods, evaluator expertises, and evaluator interests". Most POE's are backboned on a four key drivers: defining goals, data collection, and data analysis and, Outcomes presentation. (Zimring et al. 1980).

Evidence driven from table 1 below tends to suggest that most POE's methods hub around user satisfaction in both aspects: functional performance and building performance.

Table 1. Overview of existing POE approaches

Designation Method	Tools and techniques used	Focus
De Montfort method	- Forum - Walkthrough	Broadly covers the process review and functional performance
CIC Design Quality Indicators	- Questionnaire	Functionality, building quality/impact
Overall Liking Score	- Questionnaire ; (Hardcopy/web based) - 7 point scale	Occupant survey. Sectors incl. educational Diagnostic tool
PROBE	- Questionnaire/- Focus groups/- Visual surveys - Energy assessment - Evaluation Performance of systems	User satisfaction / occupant survey Systems performance Benchmarks developed
BUS Occupant survey	- Building walk -through - Questionnaire backed up by focus groups	Occupant satisfaction productivity
Energy Assessment Reporting Methodology	- Energy use survey - Data collection e.g. from energy bills	Energy use and potential savings
Learning from experience	- Facilitated group discussions or interviews	Team learning from its experience

Table 2. Post Occupancy Evaluation Process Overview



Source: Blyth, A and Worthington J, Managing the brief for better design, Spon Press, 2001

6 CASE STUDY PRESENTATION

The arch vaulted stressing the ultimate use of POE in the context of university facilities in Algeria is "to consider the extent to which a building or facility satisfies the needs of its end users and to identify ways in which design, performance and fitness for purpose can be improved", (Turpin-Brooks and Viccars, 2006).

Cooper has made the case clear that "without a process in place to obtain feedback from a building's performance, having been constructed with new systems, in new ways with unknown outcomes, then it effectively remains a prototype", (Cooper, 2001).

Moreover he stressed that "to fully understand if a building is truly effective, feedback needs to be sought by those using it.

Bordass and Leaman underscored that a major technique or tool when undertaking case studies, lies in the use User satisfaction / occupant survey, (Bordass and Leaman, 2005).

Examination of the relevant literature, pointed that Constantine campus remained the most comprehensive case that could arguably be worth studied so as to induce generic design and technical data that could be applied nationwide with regard university facilities.

The choice of Constantine campus site appeared to be most suitable, in many respects, regarding student's population, academic pattern and scientific activities, the many visits on, brought up us to conclude

- Second largest student population of the country.
- Comprehensive enough to offer suitable data base with regard to User satisfaction / occupant survey.
- There seems to be that initial design schemes obeyed to an extent to most detailed guidance,
- Availability of resources to conduct the present field work.

In order to investigate what lessons can be learned, three broad aims were defined for the proposed case study. These were:

i. To examine whether the array of standards and norms found in the relevant literature and official guides complies with those in current use.
ii. To assess user satisfaction and attitudes with regard to both functional requirements and environmental sustainability.
iii. To examine the extent to which the initial design has allowed for flexibility and adaptability.

According to the Social Services Buildings Research Team (S.S.B.R.T) Report on the 'Appraisal of Buildings', methods and approaches of evaluating the performance of a building vary in relation to the type of appraisal to be undertaken, such as: descriptive, environmental, technical, model or psychological. In congruence with the lines suggested by the S.S.B.R.T the model approach seemed most likely to achieve the three aims ser out above.

This evaluation strategy combined several techniques of data gathering, which are: observations, interviews, questionnaires and physical measurements. These were also mentioned in various studies involving evaluation of buildings such as those by D. Canter, D. Manning and R. K. Yin., Canter,1966), (Manning,1968) and (Yin,1984). However, before discussing the techniques outlined above it is first necessary to lay down the criteria which made possible the choice of laboratory sample to be studied.

The significance of a POE strategy depends strongly on "what is to be reviewed, the level of detail that is needed and when the evaluation is to be carried out. The focus of a POE can be considered in terms of three broad areas: **Process, Functional Performance and Technical Performance",** (Blyth and Worthington, 2001).

6.1 CHOICE OF SAMPLE

As the scope of the prevailing discourse could not encompass all university facility (for practical reasons as well for resources) the criteria of size and academic pattern, were decisive in selecting the type of pedagogical space within which the case study took place. The paper's main focus is on laboratory facilities, contacts were made with different university users' in order to arrange formal visits to a number of laboratory facilities. Consequently 30 laboratories were selected from the chemistry and the physics schools respectively. Their choice was completely random as none of the laboratory sizes found in use conforms to the standard size of Algerian university laboratory facilities of 30 students. While chemistry Laboratories were organic chemistry (average 40 students) and inorganic chemistry (64 average students), physics Laboratories were general physics (38 students) and electronics (20 students). The prime reason for dismissing biology laboratories was simply the difficulty of getting in touch with the Head of the Biology School during the course of the preparation of the study. Many contacts were unfruitful tough we showed a strong willingness and many appointments were aborted for unreleased reasons. It was felt prudent not to take any step further without due permission. Particular attention should be drawn to the interest showed by various members of staff of both schools visited.

6.2 OBSERVATION

For the first source of collecting data, direct observation in a given environment can be carried out using various techniques. The choice of a particular technique is argued to be connected to the type of information sought. According to Zeisel there are five devices suited to recording behaviour observation including notations (verbal description and diagrams), precoded checklists, maps and floor plans, photographs and video or films, (Zeisel J., 1984). Further, Yin reckons that whether it is a casual or a formal observation, in order to increase the reliability of observational evidence, the procedure must be conducted with more than one observer, (Yin R. K., 1984).

In the present case study, observations were made of both components of the laboratory facility built environment (space and activity), to gain access to the events and groups involved and ultimately to record both the physical features of the laboratories and users' attitudes. These were achieved by means of a combination of different tools. Checklists for every

laboratory were used to provide a better understanding of some of the physical requirements of the visited laboratories. Additionally, floor plans and maps of the corresponding premises were found useful in locating several physical items (furniture, equipment, fenestrations, etc.). Finally, in order to palliate possible shortcomings of the above two devices (i.e.: checklists and floor plans), photographs were taken to capture subtleties that naked-eye based methods may not record.

6.3 INTERVIEWS

Yin argued that 'one of the most important sources of case study information is the interview'. There are different forms of interviews in use, of which the most common are the open-ended and the focused interviews respectively. For this particular case, focused interview, also called semi-structured, were chosen rather than the former type since the chief aim was to corroborate or dismiss certain points already made in previous chapters, (Yin R. K., 1984).

6.4 INTERVIEWS WITH HEADS OF SCHOOLS

Focused interviewed with Heads of the chemistry and physics schools respectively were carried out. The overriding aims were first to identify the range of scientific activities that take place within each school's laboratories and second, to establish the level of use of laboratory space. Finally, to show any request for change made by either school or the extent of its fulfilment.

6.5 INTERVIEWS WITH THE USERS

The same procedure was followed with members of staff including tutors, technicians and the estates officer as well as with students. These helped to examine students' attitudes towards the working conditions in terms of health, safety and convenience standards. The other intention was to find out the nature of change that could possibly have taken place since the laboratories were built and subsequently what are (were) the laboratory's compartments most prone to change and how often do (did) these changes (if any) occur.

6.6 MEASUREMENTS OF PLANS

Measuring plans is another form of compiling data. It involves the measurement of various physical attributes of laboratory space, so that they can be compared against the recommended ones. The main aim was to investigate whether there were any variations or affinities with the standards and norms found in the relevant literature and other official guides.

6.6.1 SPACE ALLOCATION IN LABORATORIES

1. Area of room
2. Area of lab
3.Acoustic
4.Services:
5.Elect, Gas, water,
6.Fire safety
7.Benches
8.Finishes
9.Doors
10. Fenestration

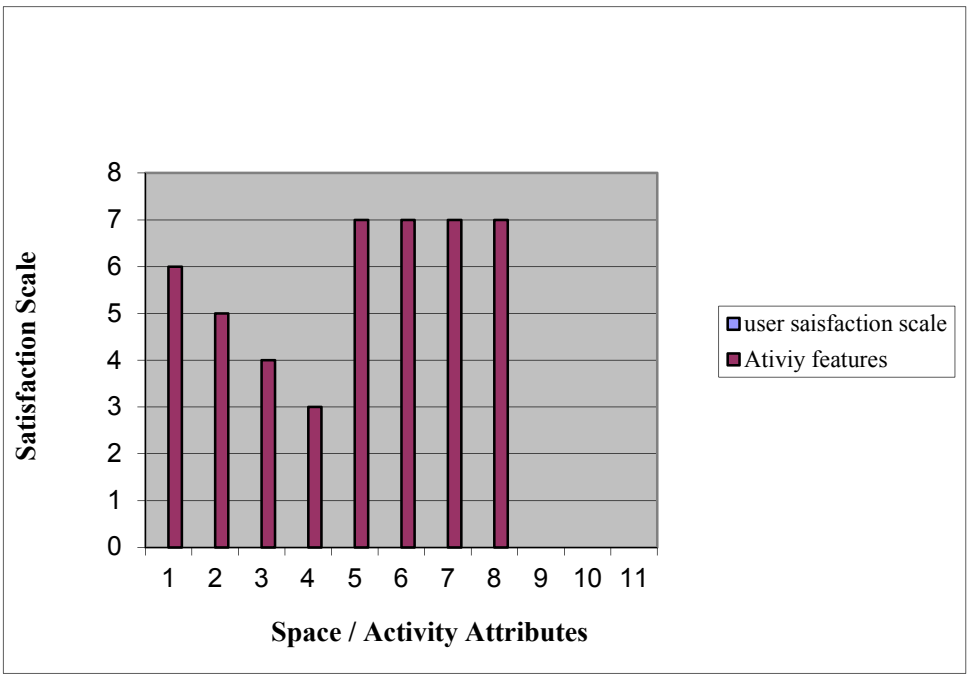


Fig. 1. User's satisfaction

Table 3. Comparison of the Recommended Usable Areas per Student with those Currently in Use. in Four Laboratories Types.

Discipline	Recommended standard (sq. ft)	Standard in Use (sq. ft)	Above/ below recommended standard (sq. ft)
Organic chemistry	45	13.07	Below
Inorganic chemistry	45	12.94	Below
General physics	45	19.62	Below
Electronics	45	20.93	below

6.6.2 THE SERVICES

Table 4. Comparison of Recommended Bench Dimensions With Those in Current Use in the Four Laboratories.

Bench features	Standard in Use (m)	Recommended Standard (m)	Above/ Below Recommended Standard (m)
Length	3.6	3.05 / 3.95	Match
Width	0.8 (double)	0.6 (single)	Below
Height	0.8	0.7	Below
Gangways	0.9	1.8	Below

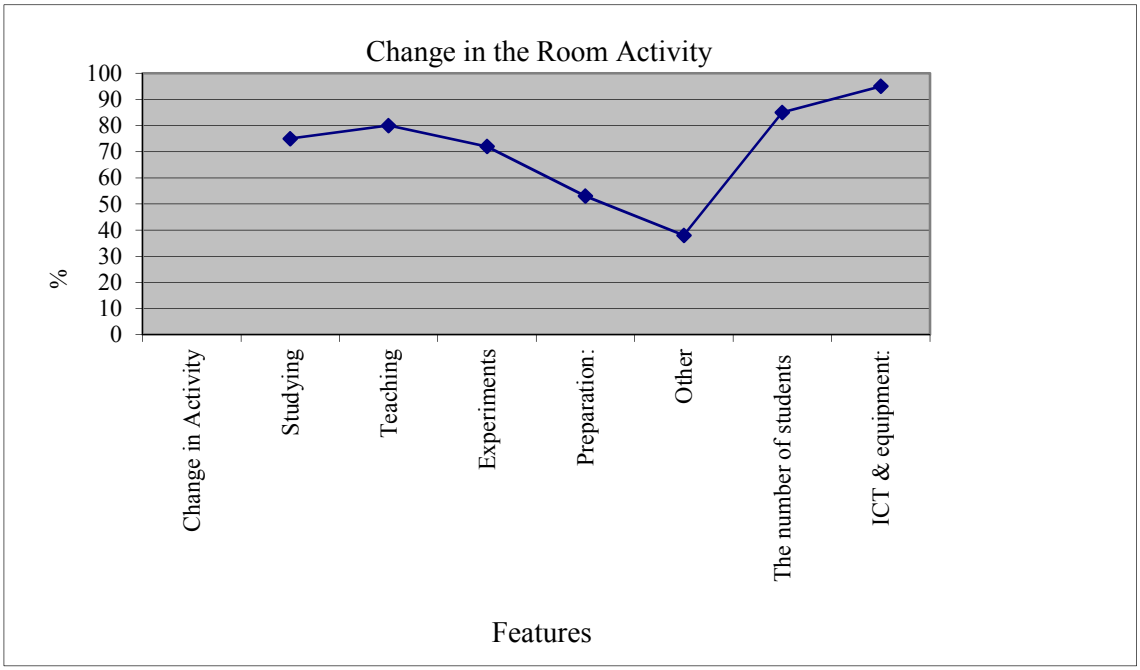


Fig. 2. Recurrent change in activity

7 CONCLUSIONS AND FINDINGS

Although the sample of laboratories assessed during the course of this of this case study was small, and thus bound to limit the extent of the evidence derived from it, it has nevertheless given a fruitful insight that post occupancy evaluation strategy is an utmost valuable process. We made the case clear, to identify ways in which design, performance and fitness for purpose can be improved.' (Turpin-Brooks and Viccars, 2006).

The physical survey showed that, the usable area per student as well as some bench measurements appeared to be inadequate in most places visited. The environmental survey, on the other hand, brought to light that fume extractions and room temperature control were liable to create environmental discomfort such as disagreeable smells and over-heating. As far as the second aim is concerned, the user's survey indicated that the range of facilities provided as to support laboratories procedures seemed to respond satisfactorily to users requirements.

Finally, the study inferred a key issue, that the building stock failed in many instances to meet the activity's changing requirements. Further, it was found that the link of the services to the fabric acted as a serious constraint to flexibility and adaptability in use.

This paper set out the urgency to undergo post-occupancy evaluation as a method of evaluating the performance of university buildings and facilities within the Algerian context.

REFERENCES

[1] Bechtel R., Merans R. and Michelson W. (1987). Methods in Environmental & Behavioural Research. NY: Van Nostrand
[2] Reinhold.
[3] Blyth, A and Worthington J, (2001), Managing the brief for better design, Spon Press
[4] Bordass, W. and Leaman, A. (2005), "Making feedback and post-occupancy evaluation routine 3:case studies of the use of techniques in the feedback portfolio", Building Research and Information, Vol. 33 No. 4, pp. 361-75.
[5] Canter D.(1968), 'On Appraising Building Appraisals', Architects' Journal, (21 December 1964), p.1547-50.
[6] Gonzales M., Fernandez C., and Cameselle J., (1997). Empirical Validation of a Model of User Satisfaction with Buildings and Their Environments as Workplaces. Journal of Environmental Psychology, vol.17 1997, pp 69-74.
[7] Cooper, I. (2001), "Post-occupancy evaluation – where are you?", Building Research and Information, Vol. 29 No. 2, special issue: Post-occupancy evaluation, pp. 158-63.
[8] Krada S. El A., (2), " A performance Based Approach With Regard to University Buildings Facilities in Algeria", University of Constantine 3,.

[9] Lee, A. and Barrett, P. (2003). Performance Based Building: First International State-of-the-Art Report. CIB Development Foundation Publication 291. Nov.
[10] Manning D. (1968), 'Appraisal of Building Performance: their Use in the Design Process', Architects Journal.
[11] Margulis, S.T. (1996). Project feedback: Occupants' opinions about industrialized, performance based housing. In Proc 3rd CIB- ASTM-ISO-RILEM International Symposium, Tel Aviv, Israel, Becker. R. and Paciuk, M. (Eds), Vol. 2, 7- 71.
[12] Ministere de l'Enseignement Supérieur & de la Recherché Scientifique, (2014).
[13] Preiser, W., Rabinowitz, H., and White, E. (1988). Post-occupancy Evaluation. NY: Van Nostrand Reinhold
[14] Preiser, W. and Vischer, J. (2005) *Assessing Building Performance, Elsevier*, Butterworth Heinemann
[15] Stanley, L. (2001). "Preface", Learning from our buildings: a state-of-the-practice summary of postoccupancy evaluation, Washington DC, National Academy Press, v-vi.
[16] Turpin-Brooks, S. And Viccars, G. (2006) 'The development of robust methods of post occupancy evaluation', Facilities, Vol. 24 No. 5/6, pp. 177-196
[17] Yin R. K., (1984) Case Study Research: Design and Methods, (London, Sage Publications Inc.,.
[18] Zeisel J. (1984), Inquiry by Design, Cambridge, Cambridge University Press.
[19] Zimmerman, A., and Martin, M. (2001). "Post-Occupancy Evaluation: Benefits and Barriers", Building Research & Information, 29(2), 168.

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Enjeux de la démarche programmatique: Dans le processus de conception architectural

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ABSTRACT: Le propos que tentons de développer s'apparente à un véritable plaidoyer pour le recouvrement de la démarche programmatique en tant qu'étape impérative et incontournable dans le processus global de conceptualisation et de mise en œuvre des projets d'architecture.

KEYWORDS: démarche programmatique, conception architectural.

1 INTRODUCTION

La banalisation planifiée de nos lieux accompagnés de leur perpétuel inachèvement demeure incontestablement la résultante d'une politique basée sur un économisme étroit, une formation académique aux antipodes de contexte socio-économique national et un fatalisme archaïque et réducteur. L'argument fallacieux qui consiste à confiner les ***besoins humains et les aléas du temps*** à une géométrie implacable et irrationnelle ne suffit plus à contenir la complexité croissante et souvent pressante des ***besoins en matière d'espace bâtit Construit*** de la communauté. Il est inutile de chercher loin des exemples de projets entachés de defaults de déterminisme et d'économisme.

Jamais encore, en Algérie, ***l'environnement bâti n'avait été aussi problématique*** et ***jamais moins sure son assise existentielle.*** Il n'est plus raisonnable de s'obstiner à porter exclusivement un effort sur le maintien de démarches et de conceptions anachroniques. La pertinence de ce préambule, puise sa raison d'être d'une double interrogation. La première dérive de l'impérieuse nécessité d'appréhender les questions liées à la démarche programmatique architecturale comme une question centrale dans le processus de conception architectural et qui mérite qu'on s'y attache. La deuxième motivation qui impact l'intérêt d'y recourir est la capitalisation gargantuesque de l'information scientifique fiable susceptible de contribuer à transcender les affres des réflexes archaïques.

Le propos que tentons de développer s'apparente a un véritable plaidoyer pour le recouvrement de la démarche programmatique en tant qu'étape impérative et incontournable dans le processus global de conceptualisation et de mise en œuvre des projets d'architecture.

A l'évidence, longtemps laissé pour compte dans le cursus universitaire dans notre pays depuis plus de vingt ans déjà, sans qu'un audit expert ne puisse jamais rendre compte pourquoi ***la programmation architecturale a été simplement radiée des contenus de formations***.

Dans le monde anglo-saxon aussi bien qu'en Europe (en France particulièrement) la programmation architecturale en tant que contenu de formation est parfaitement intégrée dans les modèles de formations à l'instar du LMD en Algérie.

Dans le monde professionnel l'exercice de la profession programmiste en Algérie n'existe même pas. On s'évertue, chaque jour qui passe, à perpétuer des improvisations de programmes à des ampleurs sans précédents.

Paradoxalement, sous d'autres cieux on ne peut entamer la conception sans un préalable dument concerté expertisé et enfin approuvé que soit la démarche programmatique Mieux encore, cette dernière (la démarche programmatique) fait l'objet de commande au même titre que les études de maitrise d'œuvre.

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Du reste, le processus de programmation ne peut en aucun cas se substituer au processus de conception; une démarche appropriée est indispensable et souvent dépréciée.

Cette communication s'attèlera les objectifs ci-contre :

I. Faire connaitre les enjeux de la démarche programmatique.
II. Exposer les différentes phases de la démarche programmatique.
III. Identifier la place de la démarche programmatique dans le processus de conception.

Au regard de William Penna, la programmation est un processus basé sur une démarche dite : « ***Problem Seeking».***

« ***Le but de la programmation architecturale est de définir les conditions précises de l'intervention du maître d'œuvre et d'anticiper les conditions de vie et de fonctionnement dans le bâtiment ou projet à réaliser ».***

La programmation intervient donc depuis l'émergence de la première idée jusqu'à la livraison du projet, voire au delà. Elle est adaptée aux grandes comme aux petites opérations. La complexité d'une opération n'est pas forcément proportionnelle à sa taille.

Les questions préalables auxquelles le maître d'ouvrage doit répondre. Les questions sont généralement simples dans leurs formulations, mais s'avèrent souvent complexes dans leurs réponses :

- Quels sont les besoins réels ?
- Quel service faut-il développer et pour qui ?
- La construction d'un nouveau bâtiment est-elle la réponse la plus opportune ?
- Ce projet est-il cohérent avec le champ urbain global ?
- Quel site ? Quelle cohérence par rapport au projet urbain ? Quelle valorisation ?
- Quel budget d'opération ? De fonctionnement ? Pour quel service rendu ?
- Quelles exigences techniques ? Environnementales ? Urbaines ?
- Architecturales ?

La démarche programmatique est une approche méthodologique visant à améliorer la formulation de la demande du Maître d'Ouvrage. Cette démarche peut garantir un retour sur investissement probant. Souvent les Maîtres d'Ouvrage (MO) imposent, volontairement aux architectes, des changements tardifs. L'impact de pareilles conduites ne peuvent que porter préjudices à la qualité de la conception architecturale et par conséquence à la production architecturale.

Ces adjonctions tardives, lorsqu'elles ont lieu, sont liées au fait que la demande originale (***programme***) du MO occulta certaines exigences pertinentes au regard des objectifs de l'opération ; exigences qui n'ont pas été identifiées ou qui ont été écartés pour laisser la place à d'autres exigences moins importantes.

En Algérie plus qu'ailleurs, ***l'injonction programmatique est courante*** dans beaucoup de cas. Il est clair que les effets peuvent impacter significativement la performance du projet et la qualité finale du bâtiment escomptée en termes notamment :

- De délais d'études techniques.
- De surcouts budgétaires divers (études et réalisations).
- Délais de réalisations et de livraison de la commande.
- Relation conflictuelle entre MO & MOE.

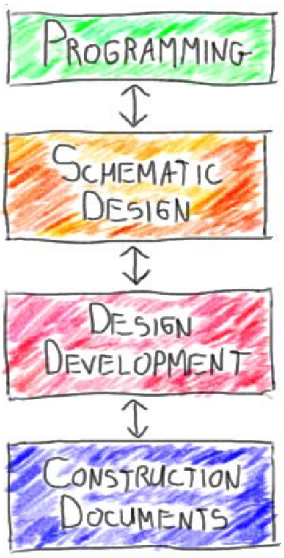


Fig. 1. La Démarche Programmatique une Etape Importante dans le Processus de Conception

2 DEFINITION DES ENJEUX



Fig. 2. Matrice Programmatique (Pena W., 2006)

FONCTION	• Usager • Activités • Relations
FORME	• Site • Environnement • Qualité
ECONOMIE	• Cout Prévisionnel • Budget fonctionnel • Surcouts de maintenance
TEMPS	• Passe • Présent • Future

La Démarche Programmatique : Un Processus Collégial et Pluridisciplinaire

L'exercice de la démarche programmatique est une action de groupe, elle est collégiale et pluridisciplinaire. L'intersubjectivité est l'axe de révolution dans la préparation de cette phase du processus de conception.

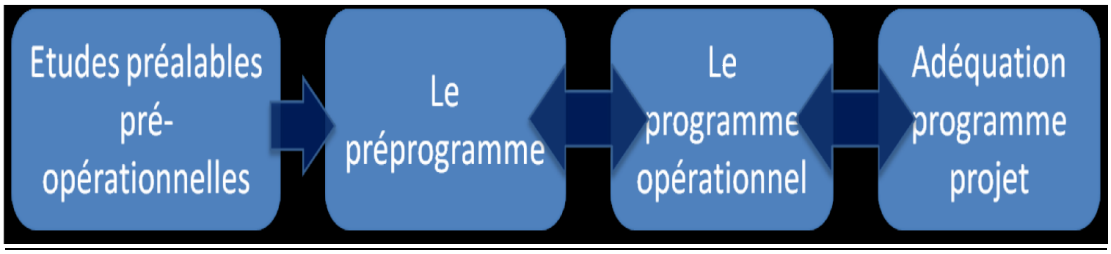
La programmation architecturale (PA) fait partie d'un ensemble plus vaste et complexe d'étapes nécessaires à la réalisation de l'édification du bâtiment. Elle est considérée par plusieurs auteurs et praticiens œuvrant dans le domaine de la construction comme un élément essentiel de ce processus de réalisation.

Se situant au tout début du processus, et dans bien des cas en tant que première étape, la PA a comme objectif premier de prévoir en amont de la conception du projet les éléments essentiels et constitutifs d'une bonne architecture :

« The architectural program is the document in which the identified values, goals, facts, and needs are presented. »

Le processus de programmation architecturale ne peut en cas se substituer au processus de conception. ***La phase de programmation est complexe et multidimensionnelle***. Il est également important d'adopter une démarche structurée. La Démarche programmatique qui doit amener le MO (le client) à se poser les bonnes questions qui lui permettront d'identifier les exigences les plus pertinentes et de fournir un programme plus complet et plus robuste à la maîtrise d'œuvre.

Hershberger (1999), argua que « dans la plupart des cas, la maîtrise d'ouvrage a des difficultés à répondre aux questions de l'architecte sur ses besoins. Ceci est souvent du au manque d'études préalables qui permettent de mieux comprendre l'origine, la justification et l'importance de certains besoins, ***L'architecte se retrouve dans la nécessité de poser le problème en même temps qu'il essaye de le résoudre, ce qui ne donne souvent pas les meilleurs résultats***,



3 LES ETUDES PREALABLES PRE-OPERATIONNELLES

La qualité de la réponse du maître d'ouvrage confronté à des choix dépend de sa capacité à mener des études préalables, qui s'appuient sur un ***audit expert en rapport avec les objectifs architecturaux du projet***. Ce sont les éléments théoriques, techniques et pratiques, nécessaires à l'élaboration des études préalables pré opérationnelles qui seront développés. L'éventualité de la mise en application d'outils d'évaluation post occupationnelle afin de mettre en relief les plus et les moins d'opérations similaires antécédentes serait d'un apport distinctif dans cette quête. (Schwartz, 2012)

4 DÉVELOPPEMENT DU PRÉPROGRAMME

Les études préalables sont destinées à évaluer l'opportunité du projet et à en étudier la faisabilité. Si l'étude préalable valide l'opportunité de l'opération, elle permet également de définir le contenu et les objectifs qui seront transcrits traduit dans un **préprogramme**. Les exigences fonctionnelles et techniques sont traduites sous forme d'organigrammes et de tableaux de surfaces, éventuellement complétés de certaines spécifications (exigences environnementales,...). La démarche pré-programmatique traverse et soutient l'ensemble du processus amenant à la réalisation du cadre bâti. Elle part de la commande pour aboutir à l'occupation des locaux en passant par plusieurs étapes. Le ***Préprogramme*** n'est pas figé et s'adapte aux différentes phases de la démarche, tout en conservant les objectifs majeurs

- *Le préprogramme comme document de travail aboutissement des premières investigations*
- *Le programme opérationnel, document complet et approfondi qui développe le pré programme et qui sera donné aux architectes pour la conception du projet*
- *L'introduction et la problématique (les problèmes posés)*
- *Les données sur l'existant / le contexte*
- *La définition des objectifs généraux*
- *L'image qualitative du projet*
- *Typologie / hiérarchie / sommaire des surfaces et des activités*
- *Les schémas de fonctionnement*
- *Les performances requises*

5 PROGRAMME OPÉRATIONNEL

- Une approche sur les coûts
- Le dossier d'appel à candidatures (rédaction et contenu)
- La commission technique (rôles et missions)
- Les critères de jugement (adéquation au programme)

Table 1. Valeurs Ajoutées De la Démarche Programmatiques

QUI ?	• **D'où vient la demande ?** • **Qui a décidé d'engager un projet ?**
QUOI ?	• **Que veut-on construire ?**
POUR QUI ?	• **Quels seront les utilisateurs ?** • **Les usagers ? Quel public ?** • **Qui gérera le bâtiment ?**
POURQUOI ?	• **Répondre à une demande de la population ?** • **Améliorer, créer, remplacer un équipement ?**
COMMENT ?	• **Quel financement ? Quels partenaires ?** • **Faut-il prendre un Assistant à Maîtrise d'Ouvrage ?**
OÙ ?	• **Quel site ? Quelles sont les contraintes d'urbanisme,** • **les contraintes techniques...** • **Qui est propriétaire du terrain, des différentes parcelles ?**

L'étude de programmation comprend généralement deux étapes principales :

6 LES ETUDES PREALABLES ET EL PREPROGRAMME

L'étude les coûts d'investissement et de fonctionnement constitue un préalable et un outil ***d'aide à la décision***. Elle peut conduire à poursuivre, à différer ou à arrêter le projet, selon ses conclusions. Le préprogramme sert de base à la programmation détaillée qui constitue l'étape suivante.

Dans le cas qui nous intéresse, tout porte à croire que cette *sous étape* est quasiment inexistante car sinon comment expliquer le tâtonnement implicite dans les choix initiaux de programme.

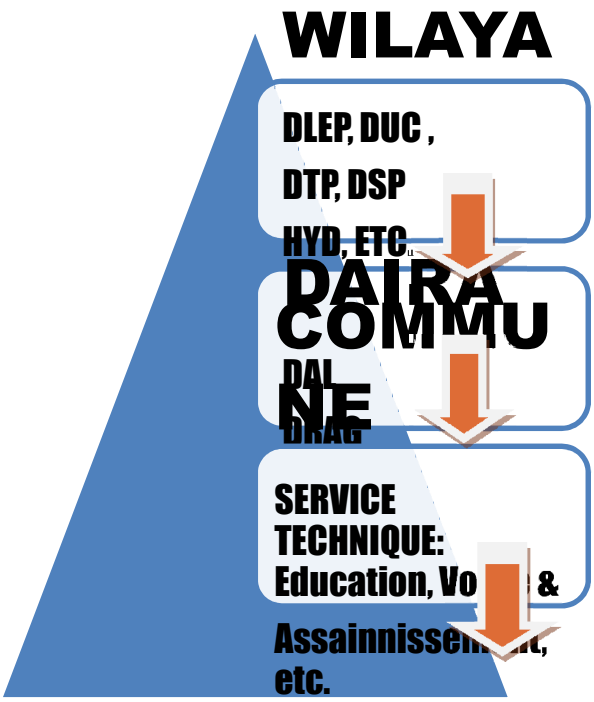


Fig. 3. Organigramme Décisionnel LOCAL

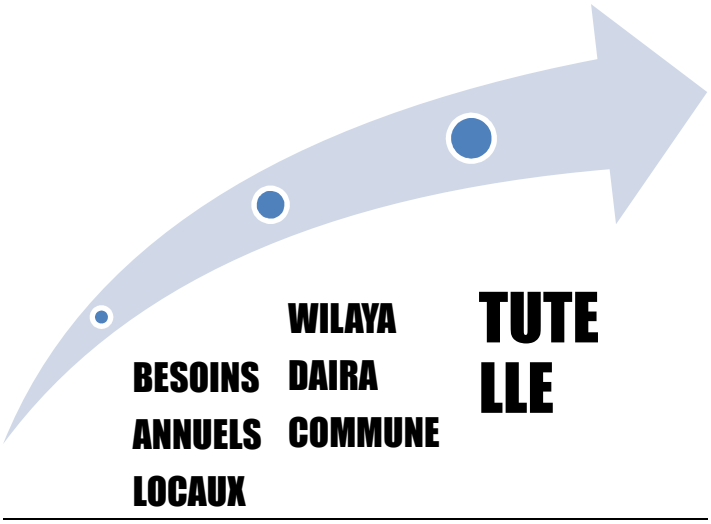


Fig. 4. Autorisation Programme

LA FORMULATION DES BESOINS EST EVALUEE EN FONCTION DE LA GRILLE D'EQUIPEMENT EN FONCTION DU RATIO D'HABITANT DANS LA WILAYA / DAIRA / COMMUNE

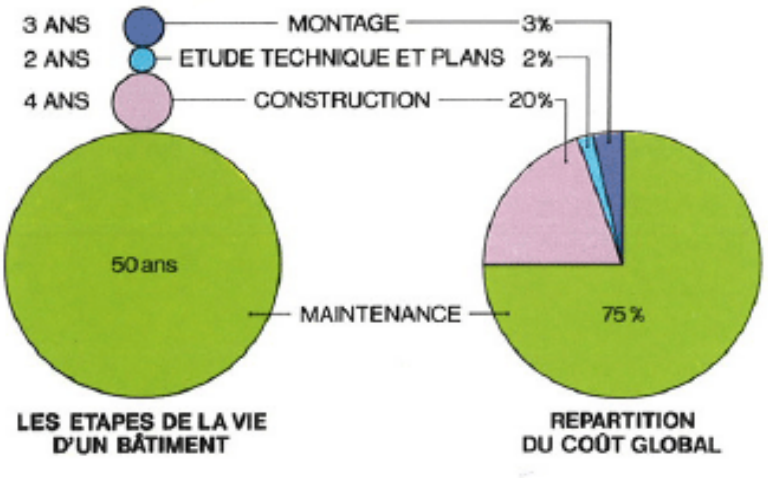


Fig. 5. 75% des dépenses sont souvent négligées (hallucinants)

Table 2. La Grille d'équipement : Un Instrument Obsolète

Type de structure urbaine	Equipement	Surface (m^2)	Emplois Induits
UB 1900 Habitants	-***AEF (9 classes***) -commerce de 1ere nécessité -terrain de sport.	5400 RDC des immeubles 3218	15 02
UV 5700 Habitants	-***EF360*** -commerce de 1ere nécessité. -salle de sport spécialisé -salle de sport (20*15) -***maison de jeunes. (250)***	5000 RDC des immeubles 3218 1000 575	30 10 05 02
GUV 11400 Habitants	-centre de santé -jardin d'enfant -terrain de football - centre culturel -maison de jeune (400) -hôtel des postes (3eme classe)	800 1700 7800 575 1038 700	36 20 02 05 15 05
Quartier 33300 Habitant	**-lycée** **-polyclinique** **-maternité (60 lits)** **-centre psycho-pédago** **-salle OMS** **-salle de sport spécialisé** **-piscine 25 m** ***-cinéma (350*150)*** ***-centre culturel*** ***-commerce complémentaire*** ***-S.N.N.G.A*** ***-centre commercial*** **-hôtel des postes** **-central téléphonique** **- sureté urbain** **-protection civile** ***-mosquée***	**44000** **1500** **3000** **1460** **3500** **1500** **906** **1000** **1100** **4995** **3000** **2000** **700** **1500** **1000** **666** **2000**	75 101 40 02 13 06 10 10 20 356 100 132 05 10 17 12 02

- ***L'objectif avoué de la grille d'équipement est de ressortir les besoins et les manque des quartiers en équipements et en logements.***
- ***Première application de cette grille d'équipement en 1970.***
- ***Aucun audit n'a été publié à ce jour afin d'évaluer les déficiences et/ou disfonctionnements dans son application.***

Table 3. Cas d'exemple Les besoins théoriques de la commune de Sidi Amar (ANNABA) en 2011 (d'après la grille d'équipement)

Désignation	Equipements	Surface (m^2)	Ratio		Emplois Induits
			M^2/Hbt	M^2/log	
Ville 87321 habitant	-technicum	25000	0.250	1.875	300
	-institut technologique	10000	0.100	0.750	120
	-CFP 300		0.159	1.192	78
	-hôpital 240 lits	5900	0.150	1.125	268
	-centre psycho-pedag	15000	0.007	0.056	50
	-centre de sauvg. Jeun	750	0.040	0.300	60
	-salle OMS	4000	0.070	0.525	13
	-salle de sport spécialisée	7000	0.018	0.135	06
	-piscine 25 m couverte	2600	0.020	0.150	18
	-stade 6/8 couloirs	2000	0.300	2.250	02
	-cinéma (1000 places)	30000	0.030	0.225	10
	-maison de culture	3600	0.042	0.314	20
	-hôtel (2*150 lits)	4196	0.100	0.750	60
	-commerce spécialisé	10000	0.100	0.750	300
	-hôtel des postes (recette hors classe)	10000	0.012	0.090	07
	-central téléphonique	1200	0.024	0.130	10
	-siège APC	2400	0.026	0.195	100
	-partis et organisation de masse	2600	0.015	0.112	10
	-gestion des infrast	1500	0.015	0.112	50
	-tribunal	1000	0.025	0.187	100
	-direction antennes adm et divers	20000	0.050	0375	300
	-abattoirs, halles, aires de stockage	200000	0.200	1.500	50
	-cimetière				

7 LE PROGRAMME ARCHITECTURALE ET TECHNIQUE DETAILLE

C'est le document qui sera remis au maître d'œuvre, ou aux équipes de maîtrise d'œuvre dans le cadre d'un concours architectural.

Il comprend généralement les éléments suivants :

- Une présentation générale de l'opération : rappel du contexte, présentation du maître d'ouvrage, préprogramme fonctionnel, surfaces globales, contraintes et exigences particulières.
- Les contraintes urbaines et de terrain : règlement du PLU, sondages de sols, exigences urbaines (dessertes, stationnements, etc.).
- Le programme architectural et technique détaillé : fiches détaillées par local et entités fonctionnelles précisant les caractéristiques techniques, architecturales et fonctionnelles souhaitées (surface, destination, descriptif d'utilisation, liaisons,...).

8 CONCLUSION

Face à une prise de conscience des concepteurs des nombreux enjeux sociaux, économiques et environnementaux, on observe un profond renouvellement des processus de programmation, de conception, et de fabrication du projet architectural. Le contexte de production de l'architecture durable, bien que marqué par une complexification du processus de conception du projet (R. Prost, 1995), ouvre L'opportunité d'approches transversales et intégratives. C'est ainsi qu'en même temps que l'on constate un besoin d'élargissement du cadre de conception [J-J. Terrin, 2009], la collaboration entre

ingénieurs et architectes constitue un enjeu essentiel des mutations conceptuelles et organisationnelles dans la fabrication du projet architectural. (A. Picon, 1997)

L'essor du numérique et le développement des innovations technologiques renforcent les interactions, les flux, facilitant l'interdisciplinarité par le partage d'outils

REFERENCES

[1] Pena W; Problem Seeking An Architectural Programming Primer, John Wiley & Sons, Inc, 2006.
[2] Hershberger R; "Programming "in Excerpt from The Architect's Handbook of Professional Practice, 13th edition, 2000.
[3] Vanneyrre S, & Schwartz T.,, Séminaire de Formation : « La programmation architecturale au Service du projet de Construction », CRP Henri Tudor, 2012.
[4] American Institute of Architects. "Programming" in The Architect's Handbook of Professional Practice, 13th edition, John Wiley & Sons, Inc, 2000.
[5] American Institute of Architects, Standard Form of Agreement Between Owner and Architect without a Predefined Scope of Architect's Services, B 102, 2007.
[6] American Institute of Architects, Standard Form of Architect's Services: Programming, B 202, 2009.
[7] Prost R ; Concevoir, inventer, créer: Réflexions sur les pratiques, Paris L'Harmattan, collection Villes et Entreprises, 1995.
[8] Terrin J.J ; Conception collaborative pour innover en architecture, Processus, méthodes, outils, Paris L'Harmattan Sciences Humaines et Sociales, Questions Contemporaines, 2009.
[9] Castells M., The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I, Cambridge, MA, 1996.
[10] SIMON H., A., Sciences des systèmes, sciences de l'artificiel,), Paris, Dunod, 1991.
[11] Coté P., Goulette J-P., Marques S., Programmation architecturale et architecture virtuelle, Intermédialités : histoire et théorie des arts, des lettres et des techniques / Intermediality: History and Theory of the Arts, Literature and Technologies, n° 13, 2009, p. 77-88.
[12] Hilaire J. , « La programmation d'un bâtiment public : quelques conseils », L'Agence Technique Départementale de l'Allier, juin 2007,
[13] Duerk D-P., Architectural Programming: Information Management for Design, New York, John Wiley & Sons, Inc., 1993, p. 8.
[14] Paul, L., A., "ARE Practice Exam: Multiple Choice Divisions", AIA; Professional Publications Inc., 1998

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Architecture of Server Virtualization Technique Based on VMware ESXI server in the Private Cloud for an Organization

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ABSTRACT: The recurring theme of server virtualization being a bundled single virtual machine file – consisting of the operating system, applications and settings – easily stored, deployable or transportable within the bounds of its operating parameters, the Achilles heel of such a VM (virtual machine) file is the likelihood of its getting corrupt or irrecoverably lost. Such disastrous occurrences are not unheard of, and are regularly tackled using a system of data backups to extenuate loss or corruption of entire VM files. However, the backing up process of VM files itself can compound recurring costs at an unexpected rate in the form of frequent acquisition of storage hardware in which to store the VM files. In this paper first we shows, a detailed cost comparison that based on power and cooling has been drawn in a table format between physical server and VMware server [VMware esx], secondly we analyze the role that the Billboard Manager has to play in shuttling the VM files in a secure and encrypted manner so as to extract the maximum operating potential of server virtualization and virtualization storage system in a private cloud domain.

KEYWORDS: virtual machine, operating system, storage, Billboard Manager, VMware, virtualization, private cloud.

1 INTRODUCTION

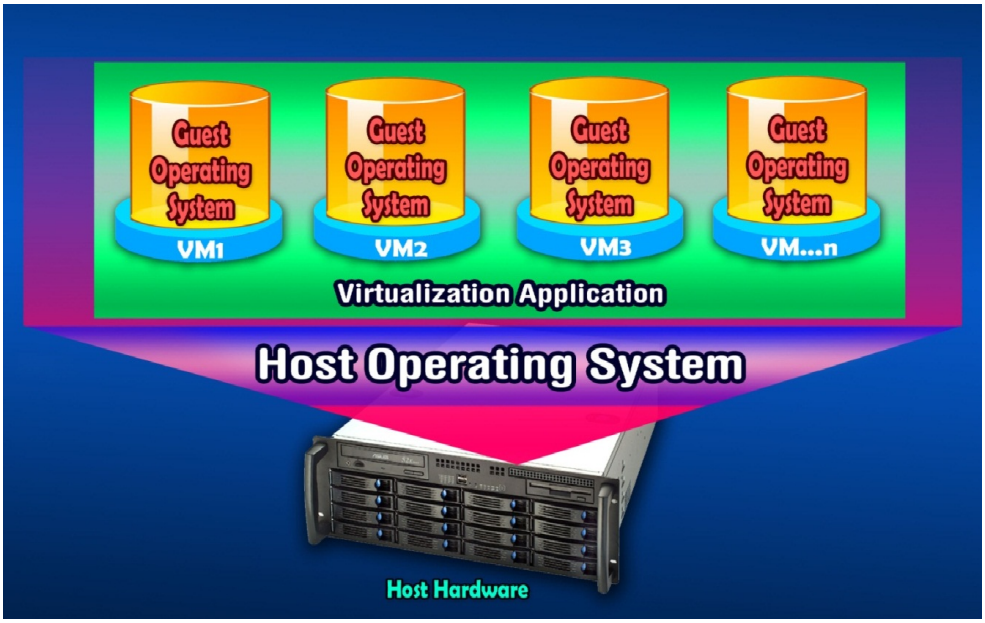
Virtualization is a core enabling technology of the Scalable Enterprise. Simply put, virtualization decouples software from hardware and presents a logical view of physical hardware to software. In other words, a single server can act and behave as multiple, independent servers. Virtualization and cloud computing are key features of any advanced agency infrastructure and, if done right, will reduce complexity and cost while improving the delivery of applications and services to the end user. The main purpose of using virtualization technology is to consolidate workloads so that one physical machine can be multiplexed for many different users. This improves the efficiency of an overall data center by allowing more work to be done on a smaller set of physical nodes [1], and also improves the per-server energy efficiency because even idle servers consume a great deal of energy [2]. In this paper, we focus on the server virtualization, and a proposed model that help us to encrypt and store all VM in a suitable storage area place. A virtual server is a logical representation of physical server in software. With server virtualization techniques, you can construct a virtual computing environment with multiple virtual machines on even a single Physical server, in which all virtual machines with varied environments share the same and flexibly configure various environments while simultaneously isolating the impact from malfunctioning user-software [3]. For example, we can install different operating systems like Linux, Window and UNIX, into individual virtual machines hosted in the same physical server. In this way, applications developed in varied environments can be run on a single physical server, leading to great flexibility of server configuration. Server virtualization is generally involved with server consolidation and cluster, which aims at making the management of massive datacenter environments substantially easier [4]. With the rapid growth of data stream, large computational clusters are deployed in many companies, which lead to heavy burden of management and instability of systems. For example, hundreds of global data centers suffer from severe interruption of services every year

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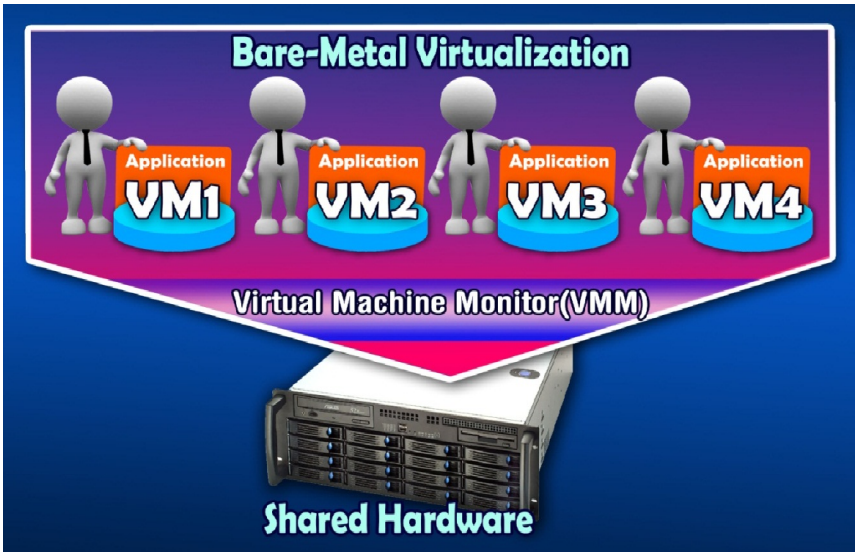
due to mistake operations of users, viruses, hardware failures, and natural disasters. Therefore, simplifying the datacenter management and fully utilizing the computing capability of large computational clusters become main issue in both industry growth and research. Employing server virtualization as computing environments provides a promising solution to these challenges, which allows administrators to more flexibly and accurately allocate the computing resources. While virtualization provides many conveniences, it comes at a cost. The hypervisor which manages the virtualization platform incurs some overhead simply because of the layer of abstraction it must add between a VM and the physical resources it makes use of [5]. Further, since many VMs may run on one physical machine, performance isolation is critical to ensure that competing VMs do not negatively impact one another. For example, a CPU scheduler in the hypervisor must provide a fair amount of time to each VM and prevent a greedy VM from hurting others [6, 7].The choice of hypervisor does not only apply to an enterprise's private data center—different cloud services make use of different virtualization platforms. Amazon EC2, the largest infrastructure cloud, uses Xen as a hypervisor, but Microsoft Azure uses Hyper-V and VMware partners use ESX. Recently, Google launched its own IaaS cloud that uses KVM as a hypervisor [8]. The rest of the paper is organized as follows. Section 2 provides virtualization approaches, Section 3 describe the Advantages of Virtualization Section 4 describes the VMware workstation. In Section 5, Describe about the encrypted data storage analysis, in Section 6, describes related work, in Section 7 describe the proposed work and Section 8` concludes the paper.

2 VIRTUALIZATION APPROACHES

In a traditional environment consisting of physical servers connected by a physical switch, IT organizations can get detailed management information about the traffic that goes between the servers from that switch. Unfortunately, that level of information management is not typically provided from a virtual switch. Basically, the virtual switch has links from the physical switch via the physical NIC that attaches to Virtual Machines. The resulting lack of oversight of the traffic flows between and among the Virtual Machines on the same physical level affects security and performance surveying. There are several common approaches to virtualization with differences between how each controls the virtual machines. The architecture of these approaches is illustrated in Figure 1



(a) Operating system-based Virtualization



(b) Application-based Virtualization



(c) Hypervisor-based Virtualization

Fig. 1. Virtualization Approaches

2.1 OPERATING SYSTEM-BASED VIRTUALIZATION

In this approach (Figure 1.a), virtualization is enabled by a host operating system that supports multiple isolated and virtualized guest OS's on a single physical server with the characteristic that all are on the same operating system kernel with exclusive control over the hardware infrastructure. The host operating system can view and has control over the Virtual Machines. There are several weaknesses for this architecture. One of main weaknesses is the performance degradation. When a virtual machine performs I/O operations from guest operating system, all these operations must be interpreted by the host operating system before arriving to hardware. This will increase extra CPU overhead and lead to performance degradation.

2.2 APPLICATION-BASED VIRTUALIZATION

An application-based virtualization is hosted on top of the hosting operating system (Figure1.b). This virtualization application then emulates each VM containing its own guest operating system and related applications. This virtualization architecture is not commonly used in commercial environments. Security issues of this approach are similar to Operating system-based.

2.3 HYPERVISOR-BASED VIRTUALIZATION

A hypervisor is one of many virtualization techniques which allow multiple operating systems, termed guests, to run concurrently on a host computer, a feature called hardware virtualization. It is so named because it is conceptually one level higher than a supervisor. The hypervisor presents to the guest operating systems a virtual operating platform and monitors the execution of the guest OS (guest operating systems). Multiple instances of a variety of operating systems may share the virtualized hardware resources. Hypervisor is installed on server hardware whose only task is to run guest operating systems. Unlike the hosted architecture in which the virtual machines are installed within the hosted operating system, a virtual machine in bare metal architecture is installed directly on hardware. The virtualization layer directly controls the hardware and manages guest operating systems. Successive commercial software's following this architecture includes VMware ESXi, Citrix Xen Server and Microsoft Hyper-V. Since the bare metal model directly implements the virtualization in the hardware level, the system overhead transferring operation signal from guest operating system to the hardware is less than the hosted model. In addition, since the size of basis management software is very small (generally, 32M), the resource used by the virtualization layer can be ignored. Moreover, since the virtual machines are not built within a host operating system, the probability of malfunction is significantly reduced. However, there are still some drawbacks for the bare metal model, while it is more flexible and reliable for various applications. One of main drawbacks lies in that the bare metal virtualization architecture requires the support of hardware. Nonetheless, no all the physical servers provide such supports. In addition, the configuration of this model is also more complex than the hosted model. The hypervisor is available at the boot time of machine in order to control the sharing of system resources across multiple VMs. Some of these VMs are privileged partitions which manage the virtualization platform and hosted Virtual Machines. In this architecture, the privileged partitions view and control the Virtual Machines [11].

3 ADVANTAGES OF VIRTUALIZATION

There are several advantages to virtualization across several dimensions:

3.1 SECURITY

By compartmentalizing environments with different security requirements in different virtual machines one can select the guest operating system and tools that are more appropriate for each environment. For example, we may want to run the Apache web server on top of a Linux guest operating system and a backend MS SQL server on top of a guest Windows XP operating system, all in the same physical platform. A security attack on one virtual machine does not compromise the others because of their isolation.

3.2 RELIABILITY AND AVAILABILITY

A software failure in a virtual machine does not affect other virtual machines.

3.3 COST

It is possible to achieve cost reductions by consolidation smaller servers into more powerful servers. Cost reductions stem from hardware cost reductions (economies of scale seen in faster servers), operations cost reductions in terms of personnel, floor space, and software licenses. VMware cites overall cost reductions ranging from 29 to 64% [26].

3.4 ADAPTABILITY TO WORKLOAD VARIATIONS

Changes in workload intensity levels can be easily taken care of by shifting resources and priority allocations among virtual machines. Autonomic computing-based resource allocation techniques, such as the ones in [27], can be used to dynamically move processors from one virtual machine to another.

3.5 LOAD BALANCING

Since the software state of an entire virtual machine is completely encapsulated by the VMM, it is relatively easy to migrate virtual machines to other platforms in order to improve performance through better load balancing [28].

3.6 LEGACY APPLICATIONS

Even if an organization decides to migrate to a different operating system, it is possible to continue to run legacy applications on the old OS running as a guest OS within a VM. This reduces the migration cost.

4 VMWARE WORKSTATION

Virtualization is a proven software technology that is rapidly transforming the IT landscape and fundamentally changing the way people compute. Today, with powerful processing capabilities of X86 computer hardware just to run a single operating system and a single application, which makes most computer hardware resources are not fully utilized. Use of virtualization technology, a single physical machine can run multiple virtual machines, which can be shared between multiple environmental resources of the computer. Virtual machine is a tightly isolated software container; VMware Workstation virtualization software maps the physical hardware resources to virtual machine resources. So each virtual machine has its own CPU, memory, disk and network interface cards. In addition to the virtual machine can connect to the physical network adapter, CD-ROM devices, hard drives and USB devices, VMware Workstation can emulate other hardware. For example, the ISO file and it can be. Vmdk files, respectively, as CD-ROM and hard disk loading, we can also host to a virtual network adapter configured to use Network Address Translation (NAT), rather than for each virtual machine is allocated an IP addresses. Therefore, the virtual machine with the physical hardware does not have a lot of unique advantages:

4.1 COMPATIBILITY

The same physical machine, virtual machine carries its own guest operating systems and applications, and has all the components on the physical computer. Therefore, the virtual machine with all standards x86 operating systems, applications and device drivers are fully compatible, so that you can use virtual machines to run on physical x86 computers running all the same software.

4.2 ISOLATION

While virtual machines can share a computer's physical resources, but they remain completely isolated from each other, just as they are different physical computer. For example, if a single physical server with four virtual machines, and one of the virtual machine crashes, the other three virtual machines are still available. The availability and security, virtual environment applications running much better than in the traditional reason for non-virtualized applications running on the system, isolation is an important reason.

4.3 ENCAPSULATION

Virtual machine is essentially a software container, it will set of virtual hardware resources and operating system and all applications bundled or packaged in a package. Package to a virtual machine with exceptional mobility and ease of management. For example, you can move virtual machines from one location to another location and copy move and copy just the same as any other software.

4.4 INDEPENDENT OF THE HARDWARE

Virtual machine is completely independent of their underlying physical hardware. For example, you can configure the virtual machine exists on the underlying hardware and physical components of a completely different virtual components. The same physical server, each virtual machine can even run different types of operating systems [9].

5 ENCRYPTED DATA STORAGE

Since data in the cloud will be placed anywhere, it is important that the data is encrypted. We are using secure co-processor as part of the cloud infrastructure to enable efficient encrypted storage of sensitive data. One could ask us the

question: why not implement your software on hardware provided by current cloud computing systems such as Open Cirrus? We have explored this option. First, Open Cirrus provides limited access based on their economic model (e.g., Virtual cash). Furthermore, Open Cirrus does not provide the hardware support we need (e.g., secure co-processors). By embedding a secure co-processor (SCP) into the cloud infrastructure, the system can handle encrypted data efficiently (see Figure 5). Basically, SCP is a tamper-resistant hard-ware capable of limited general-purpose computation. For example, IBM 4758 Crypto-graphic Coprocessor (IBM) is a single-board computer consisting of a CPU, memory and special-purpose cryptographic hardware contained in a tamper-resistant shell, certified to level 4 under FIPS PUB 140-1. When installed on the server, it is capable of performing local computations that are completely hidden from the server. If tampering is detected, then the secure coprocessor clears the internal memory. Since the secure coprocessor is tamper-resistant, one could be tempted to run the entire sensitive data storage server on the secure co-processor. Pushing the entire data storage functionality into a secure co-processor is not feasible due to many reasons. First of all, due to the tamper-resistant shell, secure co-processors have usually limited memory (only a few megabytes of RAM and a few kilobytes of non-volatile memory) and computational power (Smith, 1999).Performance will improve over time, but problems such as heat dissipation/power use (which must be controlled to avoid disclosing processing) will force a gap between general purposes and secure computing. Another issue is that the software running on the SCP must be totally trusted and verified. This security requirement implies that the software running on the SCP should be kept as simple as possible. So how does this hardware help in storing large sensitive data sets? We can encrypt the sensitive data sets using random private keys and to alleviate the risk of key disclosure, we can use tamper-resistant hardware to store some of the Encryption/decryption keys (i.e., a master key that encrypts all other keys). Since the keys will not reside in memory unencrypted at any time, an attacker cannot learn the keys by taking the snapshot of the system. Also, any attempt by the attacker to take control of (or tamper with) the co-processor, either through software or physically, will clear the co-processor, thus eliminating a way to decrypt any sensitive information. This framework will facilitate (a) secure data storage and (b) assured information sharing. For example, SCP scan be used for privacy preserving information integration which is important for assured information sharing [10].

6 RELATED WORKS

Many studies were dedicated to provide a secure virtualized environment in cloud computing. Here are some of them: In [12], the authors proposed security architecture to protect the cloud based. The idea is based on virtualization; it is called Advanced Cloud Protection System (ACPS). It consists of a monitor key kernel or middleware component that is able to detect any modification to the kernel data and code. It also checks the behavior and the integrity of cloud components via logging and periodic checksum verification of executable files and libraries to manage monitoring cloud entry points. The system is implemented using open source code Open ECP and Eucalyptus. VMware ESX server (hypervisor) runs on the bare hardware and provides ability to create VMs and move them from one PM to another using VMotion [13]. It requires the PM to have shared storage such as SAN or NAS. The cited paper [14] provides an overview of the memory management scheme employed in the ESX server. VMWare has the Virtual Center which provides a management interface to the virtual farm. Although some metrics are provided by the Virtual Center, they are not fine-grained and require extensive human interaction for use in management. Resource management of these virtual machines still needs to be addressed in a cost effective manner whether in a virtual server farm or in a grid computing environment as pointed out in [15]. A complete outline on various researches and trends in cloud computing has been presented in [16].The authors discuss a scheme for secure third party publications of documents in a cloud. Next, the paper will converse secure federated query processing with map Reduce and Hadoop, and discuss the use of secure co-processors for cloud computing. Finally, the authors discuss XACML implementation for Hadoop and discuss their beliefs that building trusted applications from untrusted components will be a major aspect of secure cloud computing [17]. A good report has been presented in [18]. Another good report on various architectural strategies is used by cloud computing in oracle white paper [19].

7 PROPOSED WORK

In the wake of intensive use of server hardware and allied resources, the two factors which weigh in during operations are power and cooling. At any given point of time, for any server virtualization to be classified as being a success, the overriding consideration is efficacy. Unbridled consumption of power can be a cause of great concern for businesses seeking an all-round optimization and utilization of resources. In a private cloud computing environment, where data processing and storing take place on a 24x7 basis, it is hardly a wonder that cooling would be of paramount concern, in addition to regulation of power consumption. Studies have shown that operating temperatures can soar significantly inasmuch within a virtualized environment as without. Therefore, it becomes inevitable that hardware resources be closely monitored and run in an environment which does not allow a server virtualization system to run at “hot” temperatures for any length of time. In

our proposed work first we want to show a detailed cost comparison that based on power and cooling has been drawn in a table format between physical server and VMware server [VMware esx] in fig2.In this table all figures and estimations are near approximations. Actual figures may vary. Servers require a high amount of cooling. It has been estimated that cooling costs alone amount to almost a good proportion of the actual power consumed during operation. It has been estimated, based on detailed calculations as presented in the, that server virtualization would help save a lot of money over a three-year period. Secondly we define hypervisor-secure virtualization as protection of a VM's data, and provide a concrete architectural solution which describe in fig3. The focus of the protections is on the storage, as this is where data resides, during a VM's execution.VM Data would be channeled through the secure co-processor for encryption. The Billboard Manager would then position the encrypted data in locations which it calculates to be optimum considering the parameters within which it has been designed to operate. Cryptographic co-processors help in defining the security protocols and implement them. A dedicated set of hardware forms a Cryptographic co-processor which can only take care of either encryption or decryption [20]. Billboard Manager helps to choose the appropriate storage location to store the encrypted data. A major part of our system is Billboard Manager which is to handle a large number of storage nodes. Billboard Manager knows the available blank space of cloud storage. Necessary collected encrypted data sends different suitable cloud storage.

BILLBOARD MANAGER FOLLOWS THIS ALGORITHM.

1) BM stores all information about Cloud storage Nodes like capacity, IP address, and shortest node distance and any kinds of information about the nodes.

2) All Cloud nodes send periodic information to BM.
   a) Channel capacity
   b) Storage space

Both of the information varies time to time and also area to area.

3) Now for t=0, compare storage capacity if the storage capacity >0

   Continue;
   Else stop

4) Compare storage capacity, choose the maximum one.

5) If the storage capacity of the two Cloud nodes to handover is same,

6) Compare the data rate. Choose the highest data rate.

   Else go back to 4

7) Repeat 4-6 every time while choosing a new cloud storage node to handover.

8) Make a list of the available cloud storage node and store it to BM

9) Now BM again makes a list of available cloud storage node based on free space.

10) Now comparing the best cloud storage node to send the data.

11) Now the connection is established.

Here we have launched 10 numbers of physical servers into two numbers of VMware ESX servers, for this cost of power and cooling became decreased. we have also shown a detailed cost comparison that based on power and cooling has been drawn in a table format between previous status (10 numbers of physical server) and present status (2 numbers of VMware server esx servers) in table1. In this table all figures and estimations are near approximations. Actual figures may vary. Thus we see the actual benefit for this migration, a lot of money is saving for this technology.

Table1 - Cost comparison table [21, 22, 23, 24]

COST OF POWER: PHYSICAL SERVER VS VMWARE V SPHERE DEPLOYMENT		
Charge description: physical Server	**Qty/Amt**	**Unit**
Power Rating/ Physical Server	0.5	Kw / Hr
Hours / Day	24	Hours
Days / Year	365	Days
Years Considered maintenance cycle for one server	3	Year
Total power Consumed per server	13140	Kw / Hr / Server
Approx. unit rate of commercial electrical Supply	9.00	Rs./ kW/ hr
Total cost of power per server	118260.00	Rs./ Server
Charge description: Virtual Server [VMware ESX]	**Qty/Amt**	**Unit**
Power Rating /Physical Server for Virtualization	1.5	kW/hr
Hours/Day	24	Hours
Days/ Year	365	Days
Years Considered Par Maintenance cycle for one server	3	Years
Total power consumed per server	39420	kW/hr/server
Approx. unit rate of commercial electric supply	9.00	Rs./kW/hr
Total cost of power per server	354780.00	Rs./Server
Number of physical server required in our scenario	2	Server
Therefore, total power cost to be met over 3 year	709560.00	Rs.
Savings expressed in terms of power cost over 3 years	**473040.00**	**Rs.**

COST OF COOLING: Physical Server vs. VMware vSphere deployment		
Charge description: Physical server	**Qty/Amt.**	**Unit**
Total cost of power required for cooling per server (approx.)	118260.00	Rs./Server
Number of physical servers required in our scenario	10	Server
Approximate effective rate of power required per server	0.75	
Therefore, total power cost for cooling to be met over 3 year	886950.00	Rs.
Charges description: Virtual Server [VMware ESX]	**Qty.**	**Unit**
Number of physical server required in our scenario for Virtualization	2	Server
Approximate effective rate of power required per server	0.75	Factor
Therefore, total power cost for cooling to be met over 3 years	177390.00	Rs.
Savings expressed in terms of power cost for cooling over 3 years	**709560.00**	**Rs.**

Savings Expressed in tems of power cost over 3 years	**473040.00**
Savings Expressed in tems of power cost for cooling over 3 years	709560.00
Total savings spread over 3 years with VMware vSphere Virtualization	**1182600.00**

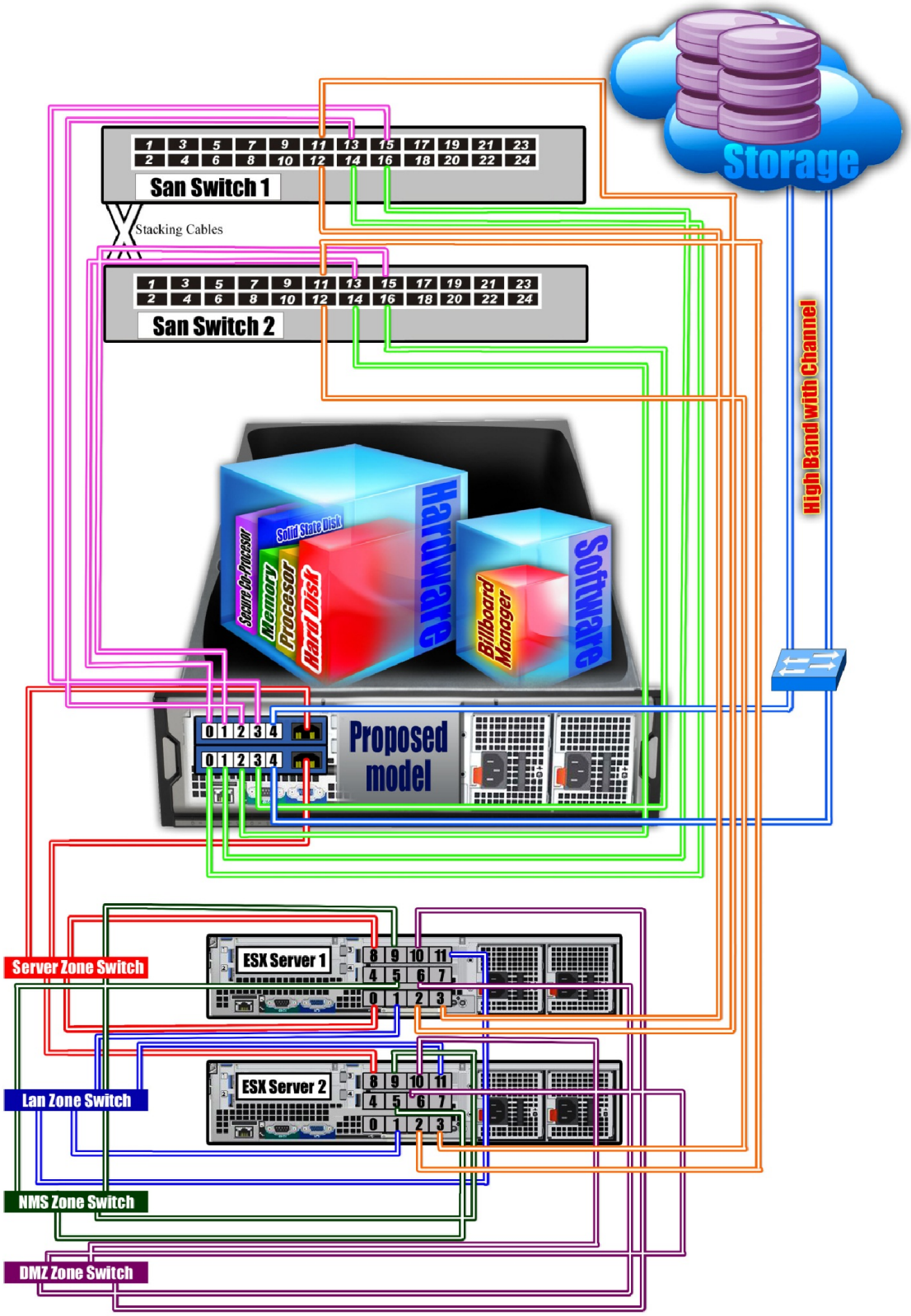


Fig.2. A Secure Cloud Datacenter Architecture

8 CONCLUSION

With rapid strides taken by businesses in order to survive and, indeed, thrive, so has the demand to deploy IT assets to support such has spiraled upwards. However, the pace of acquisition of IT assets – both hardware as well as software – have seen an emergence, of what is known in industry parlance, as "server sprawl". This is a phenomenon which sees low server utilization coupled with high system procurement and management costs – an unwanted and potentially crippling effect for businesses which operate on a basis of just-in-time principle. Studies conducted have revealed that the negative effects of "server sprawl" can be mitigated by a system of "server virtualization". The backing up process of VM files itself can compound recurring costs at an unexpected rate in the form of frequent acquisition of storage hardware in which to store the VM files. In this paper, we analyze the role that the Billboard Manager has to play in shuttling the VM files in a secure and encrypted manner so as to extract the maximum operating potential of server virtualization and virtualization storage system in a private cloud domain. Introduction of the Billboard Manager can play a pivotal role by optimizing the load demands placed on the individual physical server hardware as well as operations concerning the virtual machines hosted on them. Optimization of read/write cycles to be determined by the Billboard Manager would lead not only to a cooler operating cycle of the hardware, but would also result in a more "best-used" approach for the individual hardware resource itself.

REFERENCES

[1] Vijayaraghavan Soundararajan and Kinshuk Govil, "Challenges in building scalable virtualized datacenter management," SIGOPS Oper. Syst. Rev., vol. 44, no. 4, pp. 95–102, Dec. 2010.

[2] Luiz André Barroso and Urs Hölzle, "The case for energy-proportional computing," Computer, vol. 40, no.12, pp. 33–37, Dec. 2007.

[3] V. Chaudhary, M. Cha, J. Walters, S. Guercio, and S. Gallo, "A comparison of virtualization technologies for hpc," in Advanced Information Networking and Applications, 2008. AINA 2008. 22nd International Conference on, March 2008, pp. 861 –868.

[4] S. A. Herrod, "Systems research and development at VMware," SIGOPS Oper. Syst. Rev., vol. 44, pp. 1–2, December 2010.

[5] Timothy Wood, Ludmila Cherkasova, Kivanc Ozonat, and Prashant Shenoy, "Profiling and modeling resource usage of virtualized applications," in Proceedings of the 9th ACM/IFIP/USENIX International Conference on Middleware, New York, NY, USA, 2008, Middleware '08, pp. 366–387, Springer-Verlag New York, Inc.

[6] Ludmila Cherkasova, Diwaker Gupta, and Amin Vahdat, "Comparison of the three cpu schedulers in xen," SIGMETRICS Perform. Eval. Rev., vol. 35, no. 2, pp. 42–51, Sept. 2007.

[7] Diego Ongaro, Alan L. Cox, and Scott Rixner, "Scheduling i/o in virtual machine monitors," in Proceedings of the fourth ACM SIGPLAN/SIGOPS international conference on Virtual execution environments, New York, NY, USA, 2008, VEE '08, pp. 1–10, ACM.

[8] Google Compute Engine, "http://cloud.google.com/compute," 2012.

[9] Xuyi Wei, Based on VMware technology's Campus network cloud platform technology research, 2012 IEEE International Conference on Computer Science and Electronics Engineering.

[10] C.Kishor Kumar Reddy, P.R Anisha, K. Srinivasulu Reddy, S. Surender Reddy, Third Party Data Protection Applied To Cloud and Xacml Implementation in the Hadoop Environment With Sparql, *IOSR Journal of Computer Engineering (IOSRJCE)* ISSN: 2278-0661 Volume 2, Issue 1 (July-Aug. 2012), PP 39-46.

[11] Farzad Sabahi, Secure Virtualization for Cloud Environment Using Hypervisor-based Technology, *International Journal of Machine Learning and Computing*, Vol. 2, No. 1, February 2012.

[12] Lombardi, F., Di Pietro, R.: Secure virtualization for cloud computing. *Journal of Network and Computer Applications*, 34(4), (2011).

[13] http://www.vmware.com/

[14] C.A. Waldspurger, "Memory resource management in VMware ESX server," Proceedings of the Fifth Symposium on Operating Systems Design and Implementation (OSDI'02), 2002.

[15] R. J. Figueredo, P. A. Dinda, and J. A. B. Fortes, "A case for Grid Computing on Virtual Machines" Proceedings of the 23rd International Conference on Distributed Computing Systems, 2003.

[16] Mr. D. Kishore Kumar, Dr. G. Venkatewara Rao, Dr. G. Srinivasa Rao, Cloud Computing: An Analysis of Its Challenges & Security Issues, *International Journal of Computer Science and Network (IJCSN)* Volume 1, Issue 5, October 2012.

[17] Kevin Hamlen, Murat Kantarcioglu, Latifur Khan, Bhavani Thuraisingham, Security Issues for Cloud Computing, *International Journal of Information Security and Privacy*, 4(2), 39-51, April-June 2010.

[18] Robert Gellman, —WPF REPORT: Privacy in the Clouds: Risks to Privacy and Confidentiality from Cloud Computing, February 23, 2009.
[19] Oracle White Paper in Enterprise Architecture – Architectural Strategies for Cloud Computing.
[20] Praveen Ram C, Sreenivaasan G, Security as a Service (SasS), Securing User Data by Coprocessor and Distributing the Data,978-1-4244-9008-0/10/$26.00 ©2010 IEEE
[21] Why Virtualize: Server Consolidation, Business Continuity http://www.vmware.com/virtualization/why-virtualize.html
[22] Why Choose VMware Virtualization for your Virtual Infrastructure http://www.vmware.com/technical-resources/advantages/
[23] No Compromise, Cost Effective VMware Storage for the SMB http://virtualizationreview.com/white papers/2012/02/drobo-no-compromise-cost-effective-vmware-storage-for-the-smb.aspx?tc=page0
[24] Gartner: PCs Out, 'Personal Cloud' In by 2014 – Virtualization Review http://virtualizationreview.com/articles/2012/03/22/personal-cloud-by-2014.aspx
[25] Farzad Sabahi, Secure Virtualization for Cloud Environment Using Hypervisor-based Technology, *International Journal of Machine Learning and Computing,* Vol. 2, No. 1, February 2012.
[26] VMware, "Consolidating Mission Critical Servers," www.vmware.com/solutions/consolidation/mission critical.Html
[27] M.N. Bennani and D.A. Menasc´e, "Resource Allocation for Autonomic Data Centers Using Analytic Performance Models," Proc. 2005 IEEE International Conference on Autonomic Computing, Seattle, WA, June 13-16, 2005
[28] R. Uhlig et. al., "Intel Virtualization Technology," IEEE Internet Computing, May 2005, Vol. 38, No. 5

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RELATIONSHIP BETWEEN INTEREST RATE AND HOUSEHOLD'S SAVINGS IN PAKISTAN

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ABSTRACT: The present study is undertaken to examine the impact of interest rate, inflation rate and per capita income on household's saving in Pakistan for the period of 1981 to 2011. The study uses simple descriptive statistics to analyze the trend in household's saving. It also uses advance techniques of time series econometrics for modeling the household's saving function. It includes Granger causality test (Block erogeneity test), Johanson Co-integration, and general to specific methodology for modeling the appropriate Vector Error correction model. The applications of the techniques are based on the order of integration of time series data. It is, therefore, the reason that Augmented – Dickey Fuller test has been carried out for testing the order of integration of the time series variables, and thereby, selecting the estimation techniques for estimating parameters of the model. The careful inspection of the data reveals that all the variables are non-stationary at level, stationary at their first difference. Based on this characteristic of the data Johnson co-integration technique has been used for estimation, rather than simple OLS which is biased at the present case. The empirical results show that there exist equilibrium in long run relationship among per capita income, inflation, interest rate and household's saving. There is also significant error correction component which reveals that system reverts to its long run equilibrium in response to external shocks. These results are as per economic theory. On the basis of empirical evidence, it is suggested that inflation rate may be kept low so that real interest rate may be stimulated for accelerating rate of household's saving rate.

KEYWORDS: Economy, Interest rate, per capita, income, household, saving, Pakistan.

1 INTRODUCTION

Saving is the difference between income and consumption. It is the postponement of current consumption for future consumption instead of or it is the substitution of current consumption for having more bundles of goods in future. Saving and consumption are the two sides of the same coin. The decision to save and consume are inter-related, and there are a number of factors which may influence individual's preference for saving and spending. These factors include interest rate or rate of return on saving, inflation rate, spending habits of a society etc. National saving is the amount of money which is not spends by a nation or country. It is the difference between national income of a country minus its consumption on various goods and services. National income of a county can be calculated by different ways such as national income at current market prices, constant market prices or base year prices and factor cost. The concept of national saving can also vary accordingly, for instance national saving at market prices would be obtained or nominal national saving is resulted. Similarly, real national saving or national saving at constant prices is the amount obtained after deducting aggregate consumption from national income at base year prices, (Bishop & Cassidy, 2012). National saving has three main components such as household saving, corporate saving and government saving. Household saving is the aggregate amount which is saved done by all households in a county or it is the summation of savings of all households in a country. It is obtained by deducting household consumption from after tax household income or it is the difference of household disposable income and it's spending on various durable and non-durable goods and services. The household disposable income is the difference of personal income from all sources and direct taxes or income taxes. Household's spending is the expenditure of a household for the purpose of obtaining direct satisfaction or utility. Household saving is the aggregate amount of income which is not spent by all

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households in a country, (Bishop & Cassidy, 2012). Corporate saving is the second important component of a national saving. It is the amount of after tax profit which is not distributed among shareholders. The concept of after tax profit can be defined as the amount of gross profit of a corporation minus corporate income tax. Like individual income tax, there are corporate income taxes which are imposed on the income or profit of corporation as its name indicates. It is very important for a corporation to keep aside amount of profit as saving so that it can be used when it is highly needed. It reduces corporation dependence on market or bank for financing her investment needs. It, therefore, reduces its elasticity of demand for loan in various business environments, (Bishop & Cassidy, 2012). Pakistan's saving rate is not very impressive. It has been classified among those countries which are characterized by low saving rate. The highest saving rate of 21.3 percent in 1972 is lower than the regional countries with similar income and social structure, (State Bank of Pakistan , 2007-08). There are a number of factors which are probably considered to be the main determinants of low saving rate in Pakistan. On the basis of economic theories, these factors include economic growth, demographic structure, fiscal stance of the government, real rate of return, expected inflation rate, state of financial sector, cultural and psychological issues etc, (State Bank of Pakistan , 2006). Saving rate is also dependent on real rate of return on deposits which depends on nominal interest rate, inflation rate and expected inflation rate. If nominal interest is higher than the inflation rate, and if it is expected that inflation rate would be consistently lower than nominal interest rate, then saving would increases because real rate of return on deposit would be positive and net household's wealth would grow in future. Similarly, there are cultural and psychological factors which may also affect saving of a country, such as, consumption habits. If society is consumption oriented i.e. if society prefers to spend lavishly may be either due to lack of foresight or lack of vision, then saving rate is expected to be lower.

STATEMENT OF THE PROBLEM

National saving plays vital role in economic growth and development of a county. It is the supply of funds for investment projects of a country. If there is regular supply of loan available for investors, there would be smooth business operations and hence would result in expansion of productive capacity of an economy. If there is expansion of productivity at higher sustained rate. With opening of new and new employment opportunities of a country, unemployed labor would be absorbed in production process and thereby increase the overall productivity of inputs. As standard of living directly depends on rate of expansion of national economy, therefore, national economy would share the aggregate prosperity among the neglected and marginalized segment of the society. The long run impact of high sustained saving rate can be viewed as lower poverty, abundant facilities of health and education which result in even more productive human resources in future, high growth with low unemployment and massive incentive for research and development, technical spillover and higher standard of living. Household's saving constitute a single larger component of national saving of Pakistan. Fluctuations in household saving can greatly affect the performance of national economy through ups and downs in availability of national saving for investment in the country. In other words, household saving is the largest component of national saving which can cause business cycle with significant fluctuations in planned investment in Pakistan. In this context, the determinants of household's saving are vital to investigate in the Pakistan or in other words, it is very urgent to know the leading factors which can fluctuate the household saving at macroeconomic level. The response of household's saving to various macroeconomic environments in both short run and long run is crucial to be known to policy makers in order to prepare policy packages for smooth uplift of national economy. There are a number of studies which are related to the determinants of national savings and its link to investment and economic growth in various settings; however, the studies related to analyses of factors which can cause considerable fluctuation in household's saving are not properly analyzed using longer time series data with standard macro-econometric models. This study is an attempt to investigate the short and long run response of household saving to the leading factors in Pakistan and a constitute useful investigation in the light of its importance for national economy.

OBJECTIVES OF THE STUDY

- To analyze pattern of household's savings in Pakistan, over a long period of time.
- To assess the role of interest rate in determination of level of household's savings in Pakistan

2 REVIEW OF LITERATURE

Summer (1982) estimated the interest elasticity of saving that depends on the life-cycle hypothesis from a consumption function incorporating data on the after-tax real rate of interest. It shows a positive relationship between saving and interest rate. Ali (1985) extends his earlier study to estimate income and price elasticities of household's consumption and saving for Pakistan using Extended linear Expenditure system approach. He extends sample from 1979 household's income and expenditure survey. He quantifies the consumer responsiveness to the change in income and relative commodity prices using

single equation model. He estimates one demand equation at a time. This approach has a numbers of advantages, but its major shortcoming lies in the difficulty and of driving consistent estimates of parameters because he ignores the problem of interdependence among different goods. The empirical results can be used for studying polices effects at micro level. Khatkhate (1988) divides developing countries in three groups, depending on whether they had positive real interest rate, moderately negative real interest rate and strongly negative real interest rate. He estimates the response of saving rate to these types of interest rates and concludes that saving rate is high for positive real interest countries vice versa. Kazmi (1990) examines the causes of low saving rate in Pakistan compared with the persistently rising rates in the regional countries. The factors of low saving rate are the outcomes of many economic, demographic, political, social, cultural and religious factors. In which some factors are quantitative and other are qualitative. However socio-political and religious factors are basically the leading factors responsible for low saving rate in Pakistan. Burney & khan (1992) test the hypothesis of low saving in Pakistan for last two decades. They argue that there are many factors behind it. These include socioeconomic and administrative factors, which are responsible for it. High propensity to consume due to introduction of new products in the market that is also a major factor for low saving in the economy. These factors slow down the saving rate in economy. Empirical results show that saving depend on it dependency ratio, education, employment, opportunities, earning status of the household, profession, residential factor and secondary earning sources. Lavoto (1992) analyses the impact of the interest rate on the saving rate in the developing countries. He also compares the interest elasticity of saving in the United States with the developed countries. Wealth effect outweigh in importance with the elasticity of substitution between present and future consumption. Study reveals that interest elasticity of savings is high and the value of substitution's elasticity is slow. Siddiqui & Siddiqui (1993) argue that household's saving is vital for economic for progress and prosperity. In his study, they discuses that in 1960-90 rate of the household's saving in the total national saving is about 83 percent and the Gross domestic product is about 6.6 percent to 10 percent. This is the highest rate of household's saving that emerged in the history of Pakistan. Empirical results indicate that there are many factors, which are responsible for it. Firstly, capital formation helps in increasing labor productivity and future's income. Secondly, changes in the economic and demographic factors also increase the household's saving more rapidly than consumption. Smyth (1993) implies that there are economic factor that motivate household's saving. On the one hand, future demands for credit can motivate household's savings but on the other hand, supply of saving also creates demand for credit. The study is carry out in the rural area of Nakuru District The choice of a rural region as area of study is based on the fact that a majority of the household's live in the rural areas, and hence the investment demand for loan will contribute to the increase household saving as well as growth and development agricultural sector. The research study analyzed savings behavior among is monetary savings among farmers, entrepreneurs and teachers whose members live in the rural areas of Nakuru District over the period of November 2005 to May 2006. Azam et al (2010) examine relationship between saving and investment which is important for the socioeconomic development of the country via capital accumulation. The study shows that during 1970-2009 there has been downward trend in household saving for many developing countries. The empirical finding of study reflects that there is a positive impact of the per-capita income on the national saving and there is negative impact of inflation. The conclusion of the study is simple that there may be increase in the level of the per-capita which can increase household saving and can accelerate economic. They also discuses that unemployment, increase in the population growth, decrease in the economic growth and other supply shocks especially in food and energy supply also slow down the saving rate in Pakistan.

PROFILE OF PAKISTAN'S ECONOMY

Pakistan came into existence at 14th August of 1947. It is situated in South Asia. Its neighboring countries include India, Iran, Tajikistan, Afghanistan, and China. Pakistan is a developing country and one of the 27th largest economy in the world[1] (Economy Watch, 2010). The value of Pakistan's GDP based on purchasing power parity (PPP), is $488.4 billion in fiscal year 2011 as compared to $474 billion and $459.9 billion in fiscal year of 2010 and 2009 respectively[2]. Real growth rate of GDP is 3 percent in fiscal year 2011, whereas, it recorded as 3.1 percent and 1.7 percent in the fiscal year of 2010 and 2009 respectively (Central Intelligence Agency - CIA , 2012). Pakistan is dependent on agriculture sector[3] which accounts for more than one fifth of output and two – fifths of employment level (Central Intelligence Agency - CIA , 2012). It contributes 21

[1] *It is on the basis of Purchasing power parity (PPP).*

[2] *Estimates are in US dollars*

[3] *Manufacturing is the third largest sector in Pakistan's economy. It accounts 18.5 percent to GDP and 13 percent to total employment. Large Scale Manufacturing dominates the whole industrial sector. It contributes to GDP by 12.2 percent and contains 66 percent of total sectoral share (Ministry of Finance, 2009-10).*

percent to GDP and generates productive employment opportunities for 45 percent of country's labor force. Almost, 60 percent of the rural population depends for their livelihood on agriculture sector, (Ministry of Finance, 2011-12; p-17). Table No.1 Shows a brief sketch of behaviors of leading macro-economic variables in Pakistan, namely GDP, agriculture, manufacturing, commodity producing sector, services sector, national saving and percentage change in consumer price index (CPI). Average annual growth rates in 1960s to 2000s are reported. The behavior of Gross Domestic Product (GDP) is volatile. GDP growth rate in 1960s is 6.8 percent, and falls to 4.8 percent in 1970s. It makes it minus two percent fall during 1970s. GDP growth recovers to 6.5 percent in 1980s; however, it falls back to 4.6 percent in 1990s. There has been only 0.7 percent rise in growth during 2000s as compared to 1990s. There are several factors which may be considered as pulling factors of GDP growth such as war with India during 1960s, again there had been tensions in East Pakistan during 1970s, and even East Pakistan got a status of an independent state as a Bangladesh. There are policies of nationalization and privatization in 1980s and 1990s coupled with Afghan war in 1980s. Recent war on terror which started in 2001 and continue till date also suffered Pakistan economy a lot.

Table No. 3.1: Growth Rates of Leading Macro-Economic Indicators of Pakistan
(Annual average at constant factor cost in percent)

Indicators/Time	1960s	1970s	1980s	1990s	2000s
GDP	6.8	4.8	6.5	4.6	4.7
Agriculture	5.1	2.4	5.4	4.4	3.2
Manufacturing	9.9	5.5	8.2	4.8	7.1
Commodity producing sector	6.8	3.9	6.5	4.6	4.3
Services sector	6.7	6.3	6.7	4.6	4.3
Unemployment Rate	…..	…..	1.4	5.7	6.8
National savings at Market prices	…	11.2	14.8	13.8	15.8
CPI (percent)	3.2	12.5	7.2	9.7	7.3

Source: Economic Survey of Pakistan (2012-13)

Like GDP growth rates, growth of agriculture, manufacturing and services sectors also show the similar pattern over 1960s to 2000s. The growth of agriculture, manufacturing, and services sectors is 5.1 percent, 9.9 percent and 6.7 percent in 1960s respectively. Similarly, with the falls in GPD growth in 1970s, there had been significant downsizing in above three sectors with 2.4 percent for agriculture, 5.5 percent for manufacturing, and 6.3 percent for services sector. National saving has important implication for growth and development in Pakistan (see Table No3.1). The growth rate of national saving has been 11.2 percent in 1970s, increases to 14.8 percent in 1980s. It falls to 13.8 percent in 1990s and rises to 15.8 percent in 2000s. The growth rate of GDP has been closely related with the growth rate of national savings. GDP growth rate has been lower when growth of national savings has been decreased and vice versa (See Figure No 3.1). The relationship between national saving and CPI inflation is also shown in the Figure No 3.1. It is evident that inflation rate inversely affect growth of national savings. If inflation rate is high, the growth rate of national saving has been low. It may be due to the channel of real rate of return on deposits. Economic theory predicts that if inflation rate is higher than the nominal market interest rate, there would be negative rate of return on saving, therefore, national saving falls.

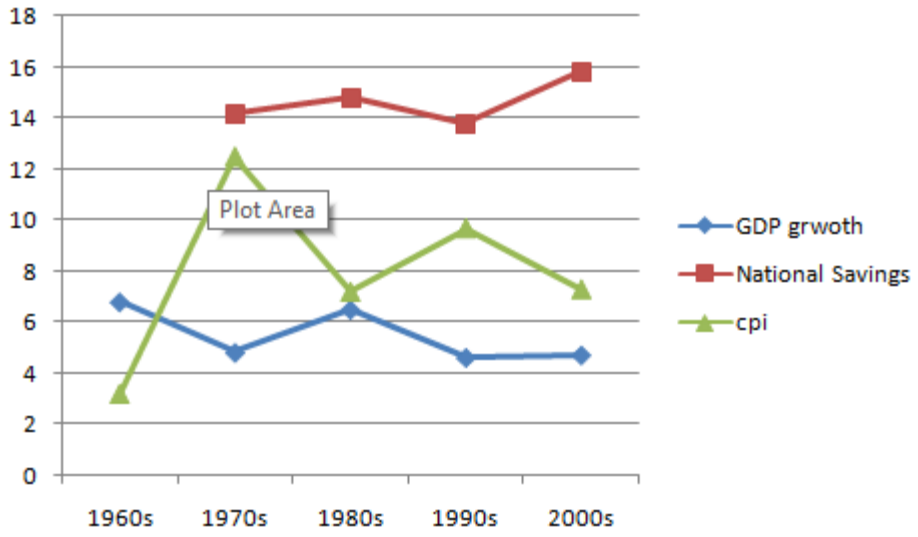


Figure No 3.1: GDP growth at constant market prices, growth of National saving at current market prices and CPI inflation rate.

Source: Table No 3.1

The present dynamics of Pakistan's economy reveals that it is tripped into low growth – high inflation and unemployment zone. It is due to the reason that efforts for poverty reduction and enhancement of living of standard have not been remained fully profitable. Increasing food prices coupled with overall double digit inflation, the level of poverty increased to 50 percent of the total population in FY11, (Central Intelligence Agency - CIA , 2012).

GDP growth is the key yardstick to judge expansion of productivity among the countries with the similar condition of social and economic set-ups. GDP growth rate of Pakistan is under pressure from 2005 to 2011 comparing it with its similar counter parts, (See Table No.3.2). For instance, Pakistan's GDP growth rate has been continuously falling from 9 percent in 2005 to 2.4 percent in 2011 with a little improvement in 2010. On the other hand, real GDP growth rate of China has been continuously increasing from 11.3 percent in 2005 to 14.2 percent in 2007. There has been a little pressure on china's real GDP growth from 2008 till 2011; however, overall performance is outstanding in the region even in spite of recent financial crises. Figure No 3.2 presents a sketch of growth rates of some of the regional countries on the basis of the data in Table No 3.2. The average growth rate of Chinese economy is 10.97 percent during 2005 to 2011, followed by 8.48 for Indian economy, and 6.45 percent for Sri Lanka. The last seven years average of growth rate for Bangladesh is 6.24 percent, while it is only 4.74 percent for Pakistan. Pakistan stands at last among china, India, Sri Lanka and Bangladesh in the growth performance of the national economy. It means that Pakistan's economy is very sensitive to global economic development than the other countries just mentioned above. This high sensitivity of national economy to global economic performance is the key parameter of business cycles in Pakistan.

Table No 3.2: Regional Comparison in Real GDP Growth Rates (Percent)

Year	China	India	Sri Lanka	Bangladesh	Pakistan
2005	11.3	9.0	6.2	6.3	9.0
2006	12.7	9.5	7.7	6.5	5.8
2007	14.2	10.0	6.8	6.3	6.8
2008	9.6	6.2	6.0	6.0	3.7
2009	9.2	6.8	3.5	5.9	1.7
2010	10.3	10.1	8.0	6.4	3.8
2011	9.5	7.8	7.0	6.3	2.4

Source: Annual Report (2011, P -1), State Bank of Pakistan

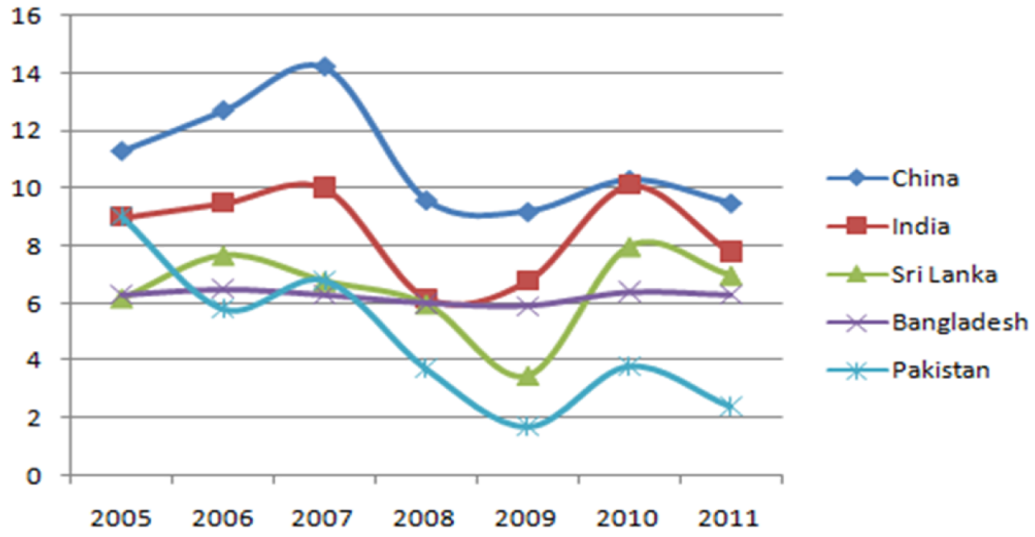


Figure No 3.2: Real GDP Growth Rates (Percent)

Source: Annual Report (2011, P -1), State Bank of Pakistan

Apart from the sensitivity of Pakistan economy to global economic performance, there are some other structural factors which also keep it depressed in terms of productivity growth and development. There is a long list of such factors, however, some most important factors which are inadequate tax system, trade barriers with neighboring countries, incompetency and inefficiency of public corporations or state owned enterprises, lack of sound privatization well, and inappropriate model for human resource development and social protection. The objective of sustaining high growth, low inflation and external payment viability requires removing these structural barriers, (Economic Survey of Pakistan 2011-12)

THEORETICAL FRAMEWORK

Farhan & Akram (2011) develops a theoretical model for testing effects of interest rate on houshold saving. The model includes three indepent variables such as Per capita income, interest rate, consumer price index with Household savings as a dependent variable. Household saving constitutes a single larger component of national saving of Pakistan. Fluctuations in household saving can greatly affect the performance of national economy through ups and downs in availability of national saving for investment in the country. In other words, household saving is the largest component of national saving which can cause business cycle with significant fluctuation in planned investment in Pakistan. In this context, the determinants of household saving are vital to investigate in the Pakistan or in other words, it is very urgent to know the leading factors which can fluctuate the household saving at macroeconomic level. The response of household saving to various macroeconomic environments in both short run and long run is crucial to be known to policy makers in order to prepare policy packages for smooth uplift of national economy. The relationship between independent variables to dependent variable has been explained, one by one, in sufficient detail.

(a) PER CAPITA INCOME AND HOUSEHOLD'S SAVING

Per capita income and household's saving have positive relationship between them. If the per capita income increases household savings also increase and vice versa. Farhan & Akram (2011). This is known as income effect of inducing saving. Keynes argues that marginal propensity to consume (MPC) is between zero and one, which means that additional income may not be consumed fully.

(b) INTEREST RATE AND HOUSEHOLD'S SAVING

Interest rate and household's saving are also positively related with each other. If the interest rate increases more it induce savers to save more. Farhan & Akram (2011)There are different definitions of interest rate, e.g. lending rate; deposit rate has been used as proxy for interest in the present study. When Interest rate increases, people are encouraged to save more and consume less just to earn more return on deposit. There is a positive relationship between National Saving and rate of interest.

Understanding the response of personal saving to changes in interest rates is central to many issues in economic policy. For example, a reduction in the budget deficit would probably cause interest rates to decline. If personal saving declined as a result, the overall increase in national saving would be less than the reduction in the budget deficit. Alternatively, contractionary monetary policy generally causes interest rates to rise. If personal saving increases as a result, the corresponding fall in consumer spending helps to slow down economy. As a final example, changes in the tax rates can raise or lower the net-of-tax return to saving. The effect of these changes on the amount of saving may play an important role in tax collection. The interest elasticity of saving is defined as the percent change in saving resulting from a one-percent change in the interest rate. There is disagreement among economists about both the sign and magnitude of this elasticity, as existing theory and empirical evidence do not appear to offer any clear conclusions. David & Mackinnon (1990).

(C) CPI AND HOUSEHOLD'S SAVING

Consumer price index and household's savings have negatively related. If CPI increases it decreases the saving rate and vice versa. Farhan & Akram (2011) Consumer Price Index number measures the average rate of Prices in the economy. If Price levels in the economy increases it has two implications:

(i) Due to an increase in Price Level, Producers charge high prices of their product to earn more profits which raise National Saving. There is positive relationship between Consumer Price. Index and National Saving from Producer point of view. Hasnain et al (2006) have also found positive relationship between National Savings and inflation rate.

(ii) Due to an increase in Price Level, Consumers have to pay higher prices and these results in low domestic saving. Hence national saving may fall. From Consumers point of view, there is negative relationship between Consumer Price Index and National Saving. Kazmi (1993) has found negative relationship between National saving and inflation rate. So the Consumer Price Index number influences positively and negatively the National. Figure 4.1 links the interest rate, inflation

Rate, per capita income to household's saving in Pakistan. In below figure shows positive relationship between per-capita income and Interest rate with household savings. And negative relationship of CPI with household savings.

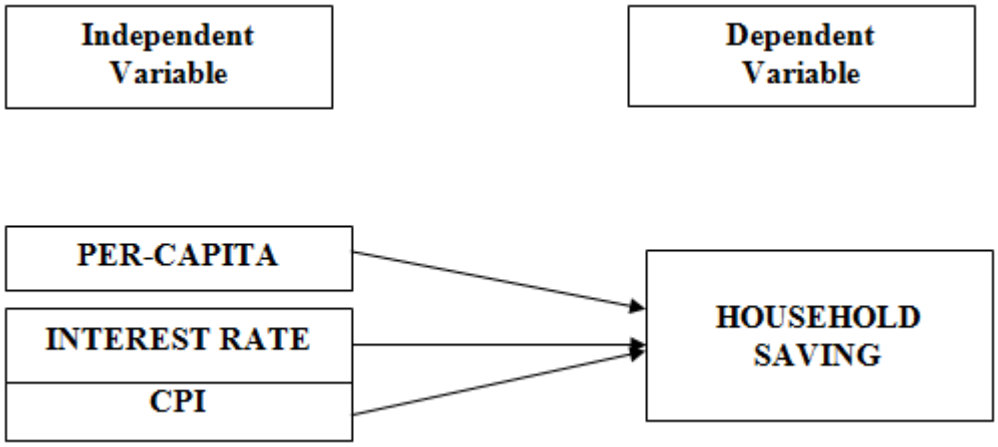


Figure 4.1 Household savings relationship with Per-capita income, interest rate And CPI

Source: Author' Construction using MS office

HYPOTHESIS OF THE STUDY

Based on the review of literature and theoretical framework, the following relationship has been hypothized.

1) Interest rate positively affects household saving.
2) There is positive relationship between per capita income and household saving.
3) There is negative relationship between inflation rate and household saving.

3 RESEARCH METHODOLOGY

This study use Farhan & Akram (2011) empirical model to assess short and long run determinants of household's savings. In the present case, substantial modifications have been made to their model for making it more appropriate in the current context. These modifications are: Firstly, dependency ratio has been excluded from the model because per capita income has been used instead of income level. As per capita income is the income level divided by population, therefore, dependency ratio may exhibit significant mutlicollinearity, if use combined with per capita income, which would hamper consistency of the estimates. This is one of the reasons that present study contributes to the modeling of household's saving in Pakistan. Secondly, since present study uses time series data, therefore estimation techniques need to be consistent with the standard properties of time series data. One of them is the existence of unit root in the time series data. If time series data contains unit root, then Ordinary Least Square (OLS) cannot be used to report consistent and efficient estimates. Therefore, Augmented Dickey Fuller (ADF) test has been used to check the existence of unit root in the data. However, in case of evidence of unit roots in the data, Johanson (1998) co-integration technique can be used to estimate short and long run response of household's savings to various factors including interest rate. These two modifications contribute to the validity of the estimates.

The maximum possible number of years of time series data has been collected, that is, from 1981 to 2011 which make it of 30 years data. In this context, the study is restricted to the total of four variables for ensuring sufficient degree of freedom for macro econometric modeling. Out of these four variables, inflation rate, interest rate and per capita income are independent variables whereas; household's saving is the dependent variable. Econometric properties of the estimates are checked using various tests.

ECONOMETRIC MODEL

The present study uses Farhan & Akram (2011) empirical model to assess the short and long run determinants of household's saving. In the present case, substantial modifications have been made to their model to make it more appropriate in the current context of Pakistan. These modifications are: First, dependency ratio has been excluded from the model because per capita income has been used instead of income level. As per capita income is the income level divided by total population, therefore, dependency ratio may exhibit significant mutlicollinearity, if used combine with per capita income, which would hamper consistency of the estimates. This is one of the reasons that present study contributes to the modeling of household savings in Pakistan. Secondly, the present study deals with time series data, so it is most likely that there may be evidence of Unit Root in the data. If Unit root exist in the data, then Ordinary Least Square cannot be used to estimate the co-efficient. It is one of the reason that Co-integration based modeling techniques has been used to report more efficient and consistent estimates. The macro econometric modeling starts with testing for direction of causality, stationarity and co-integration i.e. testing for existence of long run relationship and constructing appropriate robust error correction model for household saving as a dependent variable. First, direction of causality among variables would be tested using Granger Causality test (Granger, 1969) which is outlined by Karlsson et al., (2002) as given in equation (1) to equation (4):

$$LnHS_t = a_{10} + \sum_{i=1}^{n} a_{1i} LnPCi_{t-i} + \sum_{i=1}^{n} a_{2i} LnCPI_{t-i} + \sum_{i=1}^{n} a_{3i} LnIR_{t-i} + \varepsilon_{1t} \quad (1)$$

$$LnPCi_t = a_{10} + \sum_{i=1}^{n} a_{1i} LnHS_{t-i} + \sum_{i=1}^{n} a_{2i} LnCPI_{t-i} + \sum_{i=1}^{n} a_{3i} LnIR_{t-i} + \varepsilon_{2t} \quad (2)$$

$$LnCPI_t = a_{10} + \sum_{i=1}^{n} a_{1i} LnHS_{t-i} + \sum_{i=1}^{n} a_{2i} LnPCi_{t-i} + \sum_{i=1}^{n} a_{3i} LnIR_{t-i} + \varepsilon_{3t} \quad (3)$$

$$LnIR_t = a_{10} + \sum_{i=1}^{n} a_{1i} LnHS_{t-i} + \sum_{i=1}^{n} a_{2i} LnPCi_{t-i} + \sum_{i=1}^{n} a_{3i} LnCPI_{t-i} + \varepsilon_{4t} \quad (4)$$

Where "LnHS" is the log of household's saving at current market prices, "LnPCi" is the log of per capita income at market prices, "LnCPI" is the log of consumer price index and "LnIR" is the weighted average rate of return on deposits.

Equation (1) to equation (4) can be estimated by ordinary least square (OLS) method to find out causal relationships among the variables. For instance, if lag terms of "LnHS" and "LnPCi" in equation (1) and equation (2) are statistically significant as group, then there is bilateral causality between "LnHS" and "LnPCi". It means that per capita income would

cause household's saving and vice versa. On the basis of economic theory, it is highly possible that household's saving may cause per capita income increase through investment multiplier.

Similarly, other equations can also be interpreted in the similar ways. For instance, if "LnHS" in equation (1) and "LnCPI" are significant as a group, then there are evidence of bilateral causality between inflation and household's saving. The impact of inflation rate on saving is well documented in literature. If inflation rate is higher than nominal interest rate, then there is negative real rate of return on saving deposit. The negative real rate of return on deposits mean that the value of saving deposit falls over a time. In this case, inflation rate has negative impact on household's saving or it discourage household's to save more. It means that negative rate of return on saving makes the current consumption more attractive than the future consumption.

The dynamic effects of per capita income, interest rate and inflation rate on household saving have been estimated using Johansen (1988) and Johansen et al., (1990) co-integration approach. The Johansen (1988) and Johansen et al., (1990) multivariate co – integration approach has been based on the following steps. First, the estimation of unrestricted vector – autoregressive model (VAR) is required as explained by Halda et al., (2010), as given below,

$$y_t = \sum_{i=1}^{p} \Pi_i y_{t-i} + \varepsilon_t \qquad (5)$$

The equation (5) is the unrestricted VAR model, where, "$\mathbf{y_t}$" represent all "N" variables of the model which is four in the present case, that is, per capita income, interest rate, inflation rate and household saving . ∏ is the N*N matrix of coefficients and "εt" is a vector of random shocks to the system. It is assumed that "εt" is normally distributed with zero mean and constant variance. The VAR model (5) can be written in its error correction (ECM) form as given in equation (6)

$$y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Pi_i \Delta y_{t-i} + \varepsilon_t \qquad (6)$$

Where ∏ = - (I - $\sum_{i=1}^{p} A_i$) and $\Pi_i = -\sum_{j=i+1}^{p} A_j$ and "I" is an identity matrix. If all the variables are integrated of order one i.e. non stationary of same order, than Δy_t are stationary. The estimated coefficients of equation (6) are consistent if the assumption that variables are co-integrated is not violated, then Πx_{t-1} is also stationary or integrated of order zero.

The rank of ∏ shows number of co-integrating vectors, for instance, if ∏=0, then matrix is null or there is no co-integrating vector at all, and equation (6) shrink to usual first difference VAR model. If ∏=1, then it would means that there is one co – integrating vector, and Πx_{t-1} is the error correction term which shows how system revert to its long run equilibrium in response to any shock in the short run. For multiple co – integrating vectors, rank of ∏ can be in 0 < ∏ < n range, and there exist representation of ∏ such that ∏ = α . β′. Where α and β are both (n.r) dimension with "r" being rank of ∏. β represents the matrix of co-integrating vectors and α shows speed of adjustment to its long run equilibrium of the whole system.

Basically there are two tests, that is, trace statistic (λ_{trace}) and maximal Eigen value statistic (λ_{max}) which can be used to conclude about the number of co-integrating vectors in the whole system. Once the existence of long run relationship is identified, the next step is to estimate a representative Vector Error Correction model for household's saving as a dependent variable. This can be done by following general to specific approach to VECM i.e. a general VECM may be estimate in the first step. In the second step, the general VECM model may look for matching it with the standard theory. However, if there are some variables which are insignificant or having theoretically incorrect sign, they may be dropped, and yet another version of VECM model may be obtained. Following this general to specific approach, researcher can obtain such model which is more compatible with the standard theories of economics.

4 DATA ANALYSIS AND DISCUSSION

Household's saving rate and inflation are indirectly correlated, that is, at any given nominal interest rate in the market; high inflation rate reduces real interest rate and hence saving too. Similarly, at any prevailing nominal interest rate in the market, if inflation rate falls, it raises the real rate of return on saving. The household's saving response positively to this reduction in inflation rate because low inflation reduces cost of living, and hence increase saving.

Table No 5.1 shows N – way tabulation of consumer price index based inflation rate and log of household's saving. It is evident that high double digit inflation in the range of 20 to 25 percent discourages household's saving, as there is only one frequency out of 31 years which corresponds to a range of 20 to 25 percent inflation rate in the data. Similarly, if inflation rate is in range of 10 to 15 percent, then household's saving in range 10-11 and 11-12 are two and three times in the history respectively . Table No 5.1 also reveals that in past 31 years data, 20 correspondence of household's saving are observed in the range of inflation from 5 to 15 percent. It shows that moderate level of inflation promote household's saving in Pakistan.

Table No 5.1: N – Way tabulation of CPI and LnHS

Count		CPI				
		[0, 5)	[5, 10)	[10, 15)	[20, 25)	Total
LNHS	[10, 11)	1	2	2	0	5
	[11, 12)	2	3	3	0	8
	[12, 13)	0	2	4	0	6
	[13, 14)	5	2	0	1	8
	[14, 15)	0	1	3	0	4
	Total	8	10	12	1	31

Source: Author's calculation using Eviews 6.0 portable software

Interest rate is the rate of return on household's saving. Economic theory predicts that other things remain constant; household's saving is positively related to interest rate. Higher interest rate increases the opportunity cost of current consumption, and hence motivate household's to substitute current consumption over future consumption, and vice versa. Table No 5.2 shows the relationship between interest rate and household's saving. It is evident from the table that 6 and 18 correspondence of household's saving fall with the interest rate rang of 4 to 6 and 6 to 8 respectively. Similarly, there is 4 and 2 correspondence in the low range of interest rate which is from 0 – 2 and 2 – 4 respectively. This means that table no 5.2 favor a hypothesis that low interest rate discourage savers and vice versa.

Table No 5.2: N – Way tabulation of IR and LnHS

Count		IR					
		[0, 2)	[2, 4)	[4, 6)	[6, 8)	[8, 10)	Total
LNHS	[10, 11)	0	0	0	5	0	5
	[11, 12)	0	0	0	7	1	8
	[12, 13)	0	0	0	6	0	6
	[13, 14)	4	1	3	0	0	8
	[14, 15)	0	1	3	0	0	4
	Total	4	2	6	18	1	31

Source: Author's calculation using Eviews 6.0 portable software

Table No 5.3 shows the relationship among per capita income and household's saving. Economic theory predict positive effect of income on household saving, that is, other things constant; if household's income increase, then, its saving too. Table No 5.3 favors such theoretical relationship. There are total of four income brackets given in the table, that is, 8 – 9, 9 – 10 and 11- 12. There are five highest correspondences in front of 8 – 9 income range. It further rises to 6 and 7 correspondences in the income groups of 9 to 10 and 10 to 11. Similarly, there are three correspondences out of total of four correspondences in front of highest income group. This shows that income and household's saving are positively related.

Table No 5.3 N – Way of Tabulation of LnPCi and LnHS

		LnPCi				
Count		[8, 9)	[9, 10)	[10, 11)	[11, 12)	Total
LNHS	[10, 11)	5	0	0	0	5
	[11, 12)	5	3	0	0	8
	[12, 13)	0	6	0	0	6
	[13, 14)	0	0	7	1	8
	[14, 15)	0	0	1	3	4
	Total	10	9	8	4	31

Source: Author's calculation using Eviews 6.0 portable software

Table No 5.4 highlights the descriptive statistics of the key variables used in the model. Descriptive statistics convey a general picture of the data. Mean value of log of household's saving is the 12.41 approximately with a standard deviation of 1.24. The maximum value of log of household's saving is the 14.24, whereas, minimum value of log of household's saving is the 10.26. The value of Jarque – Bera test, a test of normality of distribution, is given by 2.14 with probability value of 0.34 which is enough high to accept alternative hypothesis of non-normal distribution of household's saving. The value of skewness is positive, which shows that distribution is positively skewed. Similarly, the value Kurtosis is lower than 3, which means that distribution is platykurtic, that is, distribution is flatter than a normal distribution with a wider peak or values are wide spread around mean value of log of household's saving. This type of analysis are very much relevant for selection of estimation technique for the estimating the econometric model.

The average value of log of per capita income during 1981 to 2011 is 9.66 approximately with maximum of 11.36 and minimum value is 8.08 with a standard deviation of 1.02. Standard deviation of log of per capita income is lower than log of household's saving which shows that observed data is more closed scatter to mean of log of per capita income than log of household's saving. Alternatively, it can be said that log of per capita income is more consistent series than log of household's income, or even in other words, log of per capita income shows less variations around its mean value than log of household's saving. However, it is positively skewed series which is reflected in the value of co-efficient of skewness with value greater than zero. The co-efficient of kurtosis is also less than three, which shows that distribution of log per capita income is platykurtic or non normal. The non-normality conclusion can also be drawn from the calculated value of Jargue Bera test which is 2.05 with probability value of 0.36. It means that, like log of household's saving, log of per capita income data also suffer from non – normality issue. Table No 5.4 also shows the descriptive statistics related to interest rate which is measured by weighted average rate of return on saving deposits. The average rate of return on saving, the interest rate, is 5.87 for the period of 1981 to 2011 in Pakistan. The highest interest rate during this period is 8.79 whereas lowest interest is 0.96 per annum. The standard deviation is 2.23, with value of skewness less than zero. It means that interest rate is more negatively skewed, and there is evidence that distribution of interest rate is normal distribution. It means that the observed interest rates, from 1981 to 2011, is closed scattered around mean values with reasonable peaks – which is often known as normal distribution. However, this conclusion is drawn at 10 percent level of probability, that is, the normality of distribution is only accepted at 10 percent level of probability.

Table No 5.4 Descriptive statistics of selected variables

	LNHS	LNPCI	IR	CPI
Mean	12.40218	9.655300	5.869355	8.574194
Median	12.23935	9.650014	7.110000	7.900000
Maximum	14.24135	11.35285	8.790000	20.80000
Minimum	10.26862	8.079308	0.960000	3.100000
Std. Dev.	1.231894	1.014534	2.238592	3.971059
Skewness	0.005024	0.137332	-1.0268	0.731765
Kurtosis	1.715747	1.771250	2.759258	3.863836
Jarque-Bera	2.130482	2.047637	5.522593	3.730503
Probability	0.344645	0.359221	0.063210	0.154857
Observations	31	31	31	31

Source: Author's calculation using Eviews 6.0 portable software

Finally, the behavior of inflation rate (based on consumer price index) is given in the table no 5.4. The average inflation in during 1981 to 2011 is 8.58 which is a single digit rate. However, there are very high and very low inflation rates in Pakistan as well. For instance, the highest inflation rate is 20.09 percent, which is really high enough too beloved that it might be harmful for growth, poverty and household saving. Similarly, lowest inflation, from 1981 to 2011, is 3.2 which is enough low. The value of skewness suggests that distribution of inflation is positively skewed; with leptokurtic distribution as value of kurtosis is greater than 3. It means that distribution of inflation is sharper than normal distribution, which is also reflected in the significant value of Jargue Bera test.

5 CONCLUSION

Saving is the engine of growth and prosperity. It is a source of financing investment in the country, which reduces dependence on foreign aid and loans. There are a number of definitions of saving in Pakistan, namely, public, private, corporate and household's saving. These definitions of saving are important for overall macro-economic performance of an economy. The analysis of saving trend in Pakistan shows that all these definitions of saving are volatile up to considerable extent. It is also concluded that, on the basis of trend analysis that private sector saving is the main driver of overall saving in Pakistan. Interestingly, out of private sector saving, household's saving is nearly 90 percent which highlight its importance in economic development of Pakistan. It is also evident that Pakistan's saving trend is low if compared with regional countries having almost same income level. It is due to low saving rate that saving – investment gap is high in Pakistan, and Pakistan is highly dependent on external borrowing to finance the increasing saving – investment gap. There are several reasons which can be explained for such dismal performance of low savings rate. However, trend analysis shows that lower growth of per capita income, high inflation particularly food inflation and low real interest rate are the main drivers of low saving rate in Pakistan. The quantitative analysis of 30 years past data shows that there are strong evidences that these variables are co-integrated. They contain long run equilibrium relationships. The Error Correction component shows that there may be disequilibrium in the short run, however, there is a significant Error correction component which revert the system back into equilibrium. It is also shown that the effects of independent variables are as per economic theory.

6 SUGGESTIONS

- Household's saving is sensitive to price changes, particularly, high food inflation cause household expenditure to rise, which reduce their ability to save more. It is, therefore, recommended that overall inflation, particularly, food inflation may be kept in desirable limits so that saving can be enhanced in Pakistan.
- Real interest rate is low in Pakistan. There are two basic reasons for this; first, inflation rate is high, and secondly, nominal interest on deposit is low. Indeed, the first argument is more valid as real interest means nominal interest rate minus inflation rate. Now if nominal interest is stable, there real interest rate fluctuates as result of inflation rate.
- Per capita income is the main driver of household saving in Pakistan, however, per capita income is not only low but also have slow growth rate as compared to the neighboring countries. There may be several factors which may account for low per capita income growth there are.
- One of them is the low productivity growth. Pakistan's real GDP is growing very slowly. Growth of real GDP is the main determinant of living standard of an economy.
    - There has been high population growth in the economy. If population growth is increasing, and GDP growth is falling, the resulting Per capita income will be low.
    - There has been high unproductive saving rate in Pakistan which may lead to Per capita income low.
- Pakistan is primarily consumption oriented society. Its economic growth is consumption led. There consumptions are made at the cost of low saving. There may be several factors which can be used to explain such phenomenon; however, there is less number of financial institutes in the rural areas of Pakistan which is also one of the hurdles. People in rural areas are not educated about the value of saving. There are early marriages and expansive traditions which adds more to the consumptions.
- Over 67 percent of population lives in rural areas of Pakistan, which is directly or indirectly dependent on agriculture sector. However, agriculture is highly pro-cyclical in nature. These fluctuations also cause variability in household income. In general, in periods of productivity losses, household depends on debt which is used to repaid in the time of boom in the agriculture sector, so overall saving remain depressed.

REFERENCES

[1] Abdelkhalek, T., Arestoff, F., de Freitas, N. E., & Mage, S. (2009). A Microeconometric Analysis of Household'ss Saving Determinants in Morocco. *Institut national de statistique et d'économie appliquée (INSÉA), Maroc* , Pp .1-18.

[2] Abid, S., & Afridi, G. S. (2010). Assessing the Household's Saving Pattern of Urban and Rural Household'ss in District Muzaffarabad. *Pakistan Journal of Life and Social Sciences* , Pp .137-141.

[3] Agrawal, P., Sahoo, P., & Dash, R. K. (2007). Savings behaviour in South Asia. *"Expanding Freedom: Towards Social and Economic Transformation in a Globalizing World"* , Pp . 1-36.

[4] Ahmad, M., & Asghar, T. (2002). Estimation of Saving behaviour in Pakistan using Micro Data. *The Lahore Journal of economics, vol 9, No.2* , Pp .73-98.

[5] Ahmad, M., & Asghar, T. (2002). Estimation of Saving Behaviour in Pakistan Using Micro Data. *The Lahore Journal of Economics, Vol.9, No.2* , Pp .73-91.

[6] Ali, M. S. (1985). Household's Consumption and Saving Behavior in Pakistan: An Application of the Extended Linear Expenditure System. *The Pakistan Development Review vol.xx1v, No.1* , Pp .23-37.

[7] Alves, N., & Cardoso, F. (Winter 2010). Household Saving in Portugal: micro and macroeconomic evidence*. *Economic Bulletin | Banco de Portugal* , Pp. 47-67.

[8] Azam, M., Khan, M., Khan, Z., Shafiqullah, Ali, S. I., & Qaiyum, A. (2010). Significance of National saving in the socio-economic development of Pakistan: 1974-2009. *Sarhad j. Agric vol.26, no.3, 2010* , Pp .413-417.

[9] Bishop, J., & Cassidy, N. (2012). Trends in National Saving and Investment . *Bulletin, Reseve Bank of Australia*

[10] Burney, N. A., & Khan, A. H. (1992). Socio-economic Characteristic and Household's Saving: An analysis of the Household's's Saving Behavior in Pakistan. *The Pakistan Development Review* , Pp . 31-48.

[11] Central Intelligence Agency - CIA . (2012). *Pakistan Economy*. Retrieved June 16, 2012, from The World Fact Book: https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html

[12] Chaudhry, I. S., Faridi, M. Z., Abbas, M., & Bashir, F. (2010). Short Run and Long Run Saving Behavior in Pakistan: An Empirical Investigation. *Journal of Money, Investment and Banking* , Pp .57-65.

[13] Christensen, L. (2012). How Are Interest Rates Affecting Household's. *All Graduate Reports and Creative Projects* , Pp. 200-215.

[14] Deaton, A., & Paxson, C. (1998). Saving and growth: another look at the cohort evidence. *Research Program in Development Studies Princeton University*, Pp .1-32.Economic survey of Pakistan (2011-12), P-2

[15] Economy Watch. (2010, March 29). *Pakistan Economy*. Retrieved June 15, 2012, from Economy Watch: http://www.economywatch.com/world economy/pakistan/

[16] Elmendorf, D. W. (1996). The effect of interest-rate changes on household's saving and consumption:a survey . *Federal reserve board* , Pp .1-84.

[17] Ersado, L., Alwang, J., & Alderman, H. (2000). Changes in Consumption and Saving Behavior before and after Economic Shocks: Evidence from Zimbabwe. *International Food and Agribusiness Management Association Conference, Chicago* , Pp .1-39.

[18] Farhan, M., & Akram, M. (2011). Does Income Level affect Saving Behaviour in Pakistan?An ARDL approach to co-integration for empirical assessment. *Far East Journal of Psychology and Business* , Pp .62-117.

[19] Fry, M. J. (1998). Saving, investment, growth, and financial distortions in pacific asia and other developing areas. *International economic journal volume 12, number 1* , Pp .1-24.

[20] Gaire, N. H. (2010). Real interest Rate and Saving Behavior in Nepal. *Banking journal,volume 2 (issue 1)* , Pp .16-34.

[21] Hagiwara, A. T. (2010). Have Filipino Households Become Less Prudent? *Asian Development Bank; 6 ADB Avenue, Mandaluyong City 1550, Philippines* , Pp. 1-22.

[22] Hussein, K. A., & thirlwall, a. P. (1999). Explaining differences in the domestic savings ratio across countries: a panel data study. *Jel classification: e21* , Pp 1-32.

[23] Kapoor, M., & Ravi, S. (2007). Expect of Interest Rate on Consumption. *Indian School of Business* , Pp. 1-19.

[24] Kazmi, A. A. (1990). A Study on Saving Functions for Pakistan: The Use and Limitations of Econometric Methods. *The Lahore Journal of Economics, Vol.6, No.2* , Pp .57-101.

[25] Hussein, K. A., & thirlwall, A. P. (1999). Explaining differences in the domestic savings ratio across countries: a panel data study. *Jel classification: e21* , Pp .1-32.

[26] Kapoor, M., & Ravi, S. (2007). Effect of Interest Rate on Consumption. *Indian School of Business* , Pp. 1-19.

[27] Khan, R. E., & Hye, Q. M. (2010). Financial sector reforms and household's savings in Pakistan: An ARDL approach. *African Journal of Business Management Vol.4 (16)* , Pp .3447-3456.

[28] Kibet, L. K., Mutai, B. K., Ouma, D. E., Ouma, S. A., & Owuor, G. (2009). Determinants of household saving: Case study of mallholder farmers, entrepreneurs and teachers in rural areas of Kenya. *Journal of Development and Agricultural Economics Vol. 1(7), pp. 137-143, October, 2009 ISSN 2006- 9774 © 2009 Academic Journals* , Pp. 137-143.

[29] Lavoto, B. N. (N.D.). The effects of interest rates on savings in the developing countries. *African journal* , Pp. 101-118.
[30] Malhotra, T. (2011). Proposal of research. A study of determination of saving in malaysia. *African journal of economics* , Pp. 1-40.
[31] Mohsin, H. M. (2011). The impact of monetary policy on lending and deposit rates in pakistan: panel data analysis. *The lahore journal of economics* , Pp .199-213.
[32] Nabar, M. (2011). Targets, interest rates, and household saving in urban china . *3 © 2011 international monetary fund wp/11/223* , Pp. 1-28.
[33] Nasir, S., & Khalid, M. (2002). Saving – investment behaviour in pakistan: an empirical investigation. *The pakistan development review* , Pp . 1-16.
[34] Nayak, S. (May 2013). *Determinants and pattern of saving behaviour in rural households of western odisha.* Rourkela – 769008, india: department of humanities and social sciences .
[35] Obayelu, O. A. (2012). Saving Behavior of Rural Households in Kwara State, Nigeria. *African Journal of Basic & Applied Sciences 4 (4):* , Pp. 115-123.
[36] Rehman, H. U., Bashir, F., & Afridi, M. Z. (2011). Savings behaviour in different income groups in pakistan: A Mrco Study. *International Journal of Hummanities and Social Sciences* , Pp. 268-277.
[37] Reinhart, C. M., & Tokatlidis, I. (2001). Before and After Financial Liberalization *Preliminary and incomplete* , Pp .1-52.
[38] Shahbaz, M., Ahmad, N., & wahid, A. N. (2010). Savings–investment correlation and capital outflow: the case of Pakistan. *Transition finance, banking and currency research* , Pp .80-97.
[39] Shaikh, S. A. (2010). Consumption & Savings Behavior in Pakistan. *JEL Codes E21, G11* , Pp .1-13.
[40] Siddiqui, R., & Siddiqui, R. (1993). Houshold Saving Behavior in Pakistan. *The Pakistan Development Review* , Pp .1281-1292.
[41] State Bank of Pakistan . (2006). *Trends in Financial Saving - Financial Stability Review .* Islamabad : State Bank of Pakistan, Government of Pakistan.
[42] State Bank of Pakistan . (2007-08). *Trends in financial savings - Financial Stability Reveiw .* Islamabad : State Bank of Pakistan, Government of Pakistan .
[43] State Bank of Pakistan . (2007-08). *Trends in financial savings - Financial Stability Reveiw .* Islamabad : State Bank of Pakistan, Government of Pakistan .
[44] State Bank of Pakistan . (2007-08). *Trends in National and Financial Savings - Financial Stability Review.* Islamabad : State Bank of Pakistan, Government of Pakistan .
[45] State Bank of Pakistan. (2012-13). *Economic Growth, Investment and Saving - State Bank of Pakistan Annual Report .* Islamabad : State Bank of Pakistan - Government of Pakistan
[46] Thaler, H. R. (1990). Psychology and savings policies. *Johnson Graduate school of Management Malot Hall* , Pp. 1-7.

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LES CRUES DE KIBE (TERRITOIRE DE MWEGA AU SUD – KIVU)

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ABSTRACT: The November 2009 and February 2010 flood waters of the River- fatal, devastating and historical with return estimated to 49 years- are the result of heavy rainfall in the side basins, the nature of the soil and the taken materials together with the presence of numerous ponds in the major bank/ bed of the Kibe River, although inhabited.

KEYWORDS: growth, bed, confluence, river, Kibe.

RESUME: Les crues de KIBE de novembre 2009 et de février 2010, mortelles, dévastatrices et historiques avec une période de retour estimée à 49 ans sont la résultante d'abondantes précipitations dans les bassins versants, de la nature du sol et des matériaux transportés ainsi que de la présence de plusieurs étangs dans le lit majeur de la rivière KIBE, pourtant habité.

MOTS-CLEFS: crue, lit, confluence, rivière, Kibe.

1 INTRODUCTION

Kibe est le nom de la rivière qui traverse la bourgade du même nom, qui la divise en deux et qui reçoit les affluents Mukulwe et Kaziki. Comme de coutume, c'est la rivière qui a prêté son nom à la localité. Deux versions ont été recueillies à propos de l'origine de Kibe. Selon les habitants de cette cité, le nom de Kibe signifie « la porte ». C'est cette porte qui a été ouverte à l'étranger qui cherchait asile sur une terre hospitalière. L'information faisait allusion à l'hospitalité du chef de groupement Banyakyungu, KISENGENYA, qui aurait accueilli les populations venues de l'amont de ce cours d'eau, notamment les Basile, et leur aurait permis de s'installer, sans condition sur ces terres.

Kibe veut dire effectivement « la porte » (luimbi). C'est une porte en ce sens qu'elle représente l'entrée et la sortie, car la rivière Kibe sépare deux blocs différents sur le plan pédologique et agricole pourtant constituant une même localité. En effet, la nature a décidé que la rivière Kibe s'érige en une frontière entre deux bandes de terres différentes : sa rive droite possède un sol sablonneux, moins bon pour l'agriculture mais regorgeant des ressources minières comme l'or (domaine de l'ex-SOMINKI) tandis que la rive gauche est favorable à l'agriculture.

Dans la nuit du 15 au 16 Novembre 2009, autour d'une heure du matin et le 7 Février 2010 à partir de 11 heures, les eaux de la Rivière Kibe, de ses affluents et des cours d'eau environnants avaient inondé le lit majeur épisodique de Kibe (Mwenga) et ses environs, forçant nombre d'habitants à se réfugier dans les contrées avoisinantes. Ces inondations mortelles, dévastatrices et historiques avec une période de retour estimée à 49 ans (dernière inondation en 1960) avaient sérieusement affecté le centre commercial de Kibe, faisant au moins trois morts, la destruction de plus de cent maisons et avaient freiné l'élan du processus de développement socio–économique du milieu déjà précaire. Les inondations de 1960 coïncidaient avec la montée spectaculaire des eaux des fleuves Congo et Nil communément appelée Crues centenaires du Congo-Nil (Devroey

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1962, Bultot et Dupriez 1987 ; Conway et Hulme 1993) ainsi que les hauts-niveaux des lacs Kivu et Tanganyika (Bergonzini 1998 ; Muvundja *et al.,* en prép.).

L'objectif du présent travail était d'analyser les causes et les effets des crues décrites ci-haut en vue de ressortir des recommandations applicables dans la prévention/adaptation à cette catastrophe naturelle liée aux crues de la rivière et les inondations subséquentes.

2 METHODOLOGIE

Pour prélever les données sur les coordonnées géographiques du site, nous nous sommes servi d'un GPS. Un décamètre nous a servi pour mesurer les longueurs et les largeurs du lit majeur épisodique de la rivière Kibe.

3 DESCRIPTION DU MILIEU D'ETUDE

3.1 SITUATION GÉOGRAPHIQUE DU SITE

Kibe est une bourgade du groupement de Banyakyungu en chefferie de Wamuzimu, territoire de Mwenga, massif d'Itombwe, en province du Sud–Kivu. Distant de 220 km de Bukavu et de 25 km de la cité aurifère de Kamituga sur la Route Nationale N°2 reliant la ville de Bukavu à Kasongo (en pleine réhabilitation au moment de l'étude), Kibe compte plus au moins 600 habitants, un marché et des boutiques alignées le long de la route. Il constitue un petit centre de ravitaillement pour des gens en direction de Kitutu ou de Kamituga.

Bâtie à la confluence des rivières Zalya et Kibe, la bourgade de Kibe est située à 680 m d'altitude par rapport à Bukavu (1460 m), soit une dénivellation de 780 mètres. En latitude, Kibe est situé à 3°10' de latitude Sud et 22°11' de longitude Est.

3.2 ASPECTS PHYSIQUES DE KIBE

La cité de Kibe est construite dans une plaine alluviale surplombée par un relief en amphithéâtre constitué des collines en demi–orange et des plateaux (Nyabulungu, Kalaga, Misanya et Kanguli) dont l'altitude est de plus au moins 1000 mètres.

Les plateaux de Kibe se localisent entre le relief montagneux de l'Est (Mont Mitumba) et les plateaux du Maniema ; ce qui justifie le sens de l'écoulement des cours d'eau (sens Sud–Ouest), du versant occidental du Mont Mitumba vers la rivière Elila.

Les paysages présentent des pentes avec de grandes saignées montrant la roche à nu qui témoigne de la mobilisation des formations meubles et de la végétation qu'elles portaient. Plus bas, les lits des torrents ont été labourés par l'ampleur des écoulements.

Par endroit, il existe d'îlots de végétation naturelle constituée par la forêt primaire et la forêt secondaire dont l'espace phare est le *Musanga sercopioide* communément appelé parasolier. La présence d'arbres à base de contreforts, la taille et le diamètre des arbres ainsi que la présence des épiphytes sont quelques preuves de taille qui témoignent de la présence d'un climat subéquatorial dans la contrée (Doumenge *et al.* 1997).

La localité de Kibe appartient au bassin hydrographique oriental du fleuve Congo. Le réseau hydrographique est dense à Kibe. Le taux de limnicité élevé s'explique par sa situation en latitude (3° de latitude Sud, donc proche de l'équateur), le couvert végétal intense contribuant aux précipitations par le mécanisme d'évapotranspiration (ETP). En effet, les précipitations mensuelles varient entre 100 et 250 mm/mois pour une moyenne annuelle de 2383 mm/an dans cette partie des Monts Itombwe (Fig. 1, Doumenge *et al.* 1997)

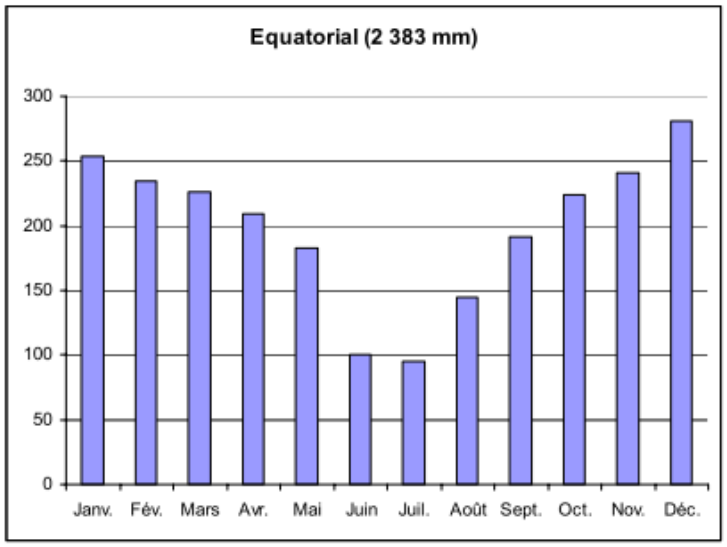


Fig.1. Précipitations mensuelles et moyennes annuelles du climat équatorial de l'axe Kamituga-Kitutu-Kilunga (Doumenge et al. 1997).

Le sol de Kibe présente une texture à prédominance sablonneuse permettant une intense infiltration. La région est caractérisée par de roches métamorphiques avec des affleurements des roches éruptives (basaltes, granites, roches vertes) comme le rapporte Doumenge *et al.* (1997). Cette texture à prédominance sableuse se modifie à plus au moins 2 mètres de profondeur par une structure à prédominance argileuse.

La conséquence est la présence de la nappe aquifère non loin de la surface du sol entravant ainsi le creusement des toilettes. L'absence des toilettes à Kibe prédispose la population à aller faire ses besoins dans les cours d'eau (Kibe, Kiziki, Zalya, etc). Cette situation rend le milieu insalubre et provoque les maladies d'origine hydrique observées dans la région (Choléra, dysenterie amibienne, bacillaire, etc.) surtout que les sources d'eau potable font défaut à Kibe et la population est obligée de boire l'eau impropre de Kibe et de ses affluents.

3.3 OCCUPATION SPATIALE

L'agglomération de Kibe compte plus ou moins 600 âmes. Des boutiques achalandées des produits manufacturées se localisent le long de la route nationale N°2. A l'arrière plan, les maisons d'habitation (plus ou moins 150 maisons), des églises, le centre de santé SIDEM/KIBE et 8 étangs piscicoles se localisent dans le lit majeur épisodique à moins de 2 mètres du lit mineur de la rivière Kibe.

Le processus d'occupation de l'espace à Kibe comprend trois étapes au regard de l'histoire socio–économique de notre pays. Après l'inondation de 1960, la population est venue des collines de Kalaga et de Kamalondo. Cette population a vécu en toute quiétude jusqu'aux dates fatidiques de novembre 2009 et de février 2010.

La deuxième étape d'occupation (1974) coïncide à la période où le village de Kibe était un marché de la SOMINKI (Société minière du Kivu). Les habitants de la rive droite de Kibe venaient vendre leurs produits agricoles aux agents de la SOMINKI qui se trouvaient sur la rive gauche.

La troisième étape (1996 à nos jours) correspond à la situation d'instabilité politique de notre pays et des guerres qui ont ravagé la contrée. Avec l'insécurité dans nos compagnes, selon les sources administratives locales, la population avait tendance à affluer vers les centres pour y trouver une sécurité relative. C'est ainsi que le centre commercial de Kibe a connu la concentration des nouveaux arrivants à la recherche de la sécurité et surtout du bien–être.

4 RESULTATS

4.1 MORPHOLOGIE ET DONNEES DU LIT MAJEUR EPISODIQUE DE LA RIVIERE KIBE

Tronçons	Distances		Altitudes	Coordonnées Géographiques	
	Longueur/m	Largeur/m	En m	Latitude en °	Longitude en °
RIVE GAUCHE					
AB	13,6	72	710	S 3° 10'	E 28° 11'
BC	35	72	695	S 3° 10'	E 28° 11'
CD	63	72	690	S 3° 10'	E 28° 11'
DE	68	72	689	S 3° 10'	E 28° 11'
EF	74,5	72	685	S 3° 10'	E 28° 11'
FG	51,5	72	683	S 3° 10'	E 28° 11'
GH	33,2	24	681	S 3° 10'	E 28° 11'
HI	51,3	24	680	S 3° 10'	E 28° 11'
IJ	281	38	680	S 3° 10'	E 28° 11'
JK (Pont)	28	25	680	S 3° 10'	E 28° 11'
KLMN	125	50	680	S 3° 10'	E 28° 11'
RIVE DROITE					
OP	420	65	704	S 3° 10'	E 28° 11'
PQ	250	52,6	680	S 3° 10'	E 28° 11'
OR	28	52,6	680	S 3° 10'	E 28° 11'
RS	129	55	680,9	S 3° 10'	E 28° 11'

La rivière Kibe entre dans le lit majeur vers 710 mètres d'altitude et traverse la plaine alluviale. Au–delà du pont sur la nationale N°2, elle s'étend sur 125 mètres jusqu'à la confluence avec Zalya comme l'indique la Figure.

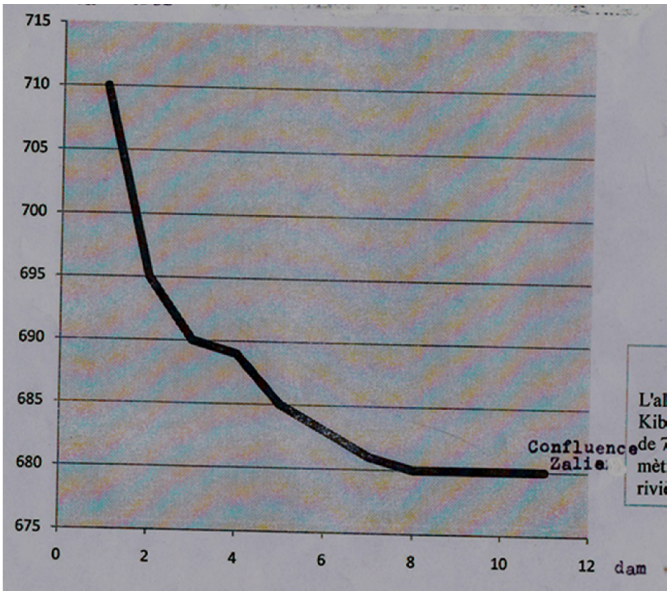


Fig.2. Profil en long du cours moyen et inférieur de Kibe.

MORPHOLOGIE DU LIT MAJEUR DE KIBE

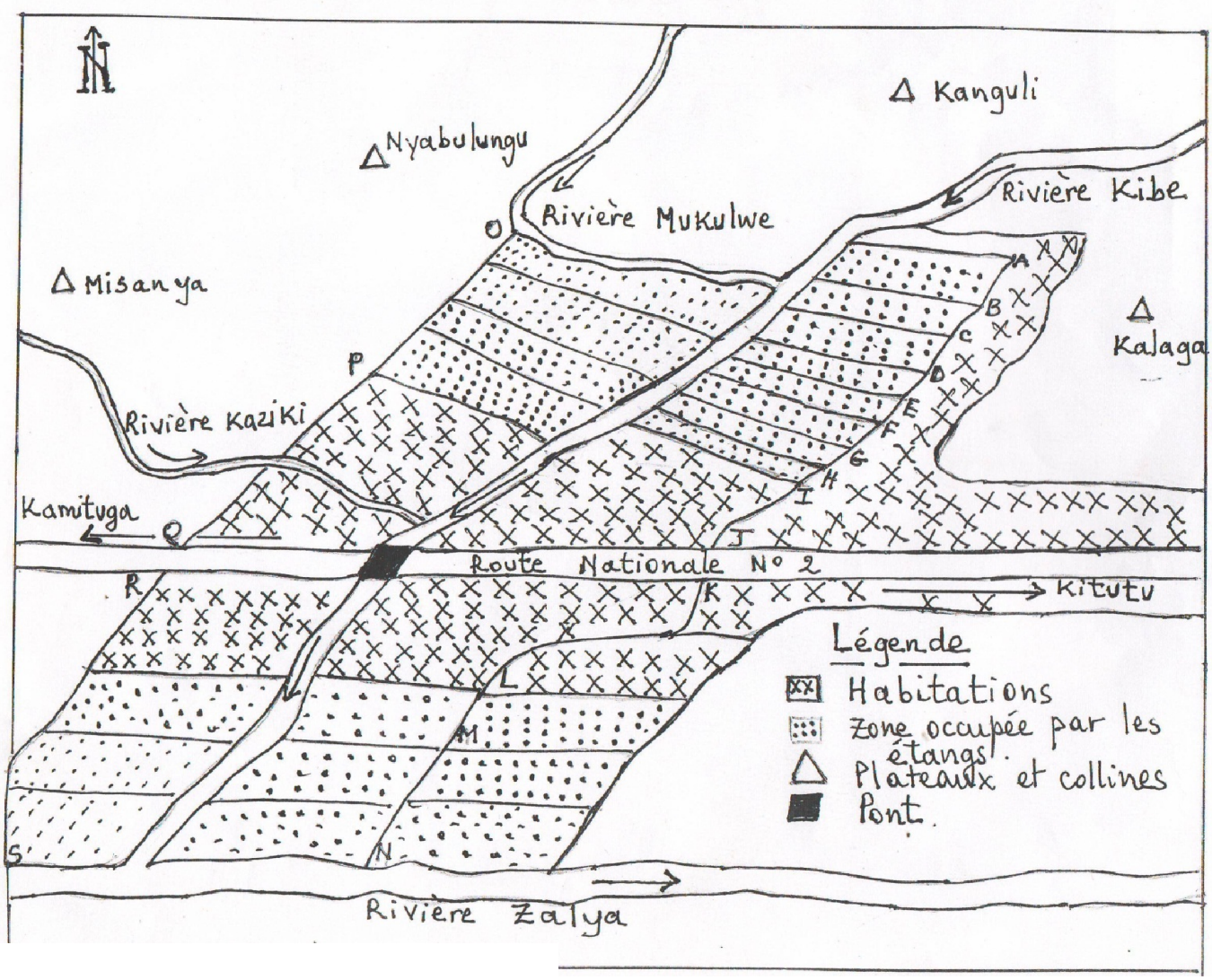


Fig. 3. Morphologie du lit majeur de Kibe

4.2 CAUSES ET EFFETS DES CRUES DE KIBE

Les crues de Kibe sont la conséquence des cours d'eau à régimes torrentiels résultant de la conjonction des facteurs ci–dessous :

- Les précipitations exceptionnellement abondantes dans les bassins versants de Zalya, Kibe et de leurs affluents. En effet, les pluies auraient au fil de temps amorcé des glissements de terrain vers l'aval transportant des terres meubles recouvrant les versants vers l'aval et emportant des matériaux importants (roches, arbres, débris divers). Ceux-ci s'étaient amassés et érigés en barrages contre les eaux, ce qui a permis de stocker d'importantes masses d'eaux en amont de Kibe avant que la puissance du courant n'ait réussi à ouvrir le barrage et à drainer toutes les eaux du réservoir. Ces eaux ont alors rempli le lit et débordé dans les vallées et la plaine alluviale de Kibe sous forme d'importants écoulements torrentiels charriant blocs de roches, arbres et débris divers. Ces masses d'eau et les matériaux transportés ont grossi les eaux de Kibe, provoquant ainsi des innondations. Les innondations ont été alourdies par l'interposition de la rivière Zalya (Fig.3) bloquant l'avancée des eaux de Kibe surtout comme le relief en pente de l'autre rive de Zalya ne permet pas l'élargissement dans le sens opposé de l'arrivée des eaux de la rivière Kibe.
- Les formations meubles argileuses du terrain, regorgées d'eau après les averses et sous l'impulsion de la pente ont glissé vers le bas-fond. Elles ont emportées avec elles les blocs de roches charriées ainsi que la végétation dans le lit mineur de Kibe, ce qui a provoqué des innondations.

- Après les averses dans le bassin versant de Zalya et des affluents, les rivières ont transporté des matérieaux volumineux dans leurs lits. Ainsi les matériaux transportés par Zalya ont constitué un barrage en aval de la confluence de Kibe. Cette dernière a capturé par déversement les eaux de la rivière principale Zalya, provoquant ainsi des innondations dans la bourgade de Kibe. Cette situation est fréquente lors de grandes crues des rivières alluvionantes lors des divagations sur leurs propres dépôts. La rivière où se déverse les eaux doit être déprimée. C'est le cas de la rivière Kibe.
- La présence de plusieurs étangs (8 étangs dans le lit majeur) de Kibe a favorisé la montée des eaux au sein du lit majeur. Les eaux d'innondation de Kibe ont balayé les étangs ; ce qui a permis l'accélération de leur énergie cinétique et par conséquent leur capacité de transport des matériaux a permis de laminer les maisons, la végétation, les personnes et animaux sur leur passage.

5 CONCLUSION ET SUGGESTIONS POUR L'AMENAGEMENT DE KIBE

L'essentiel de la partie habitable de la bourgade de Kibe correspond au lit majeur épisodique de la rivière Kibe. Dans l'ensemble, la zone est traversée par des cours d'eau à régimes torrentiels charriant de blocs de pierres, transportant des alluvions en temps des crues.

Les crues de Kibe sont la résultante d'abondantes précipitations dans les bassins versants de Zalya, de Kibe lui-même et de ses affluents, de la nature du sol, des matériaux transportés ainsi que de la présence de plusieurs étangs dans le lit majeur de Kibe, pourtant habité.

Les méthodes de protection envisagés dans les pays pauvres se sont avérées inefficaces ou archaiques dans le cas des catastrophes naturelles (construction des digues, dragage du lit des cours d'eau, lutte contre l'érosion et les innondations, etc). Il en résulte donc que tout travail d'aménagement dans la contrée de Kibe devrait tenir compte des facteurs suivants :

- Les travaux de stabilisation des pentes par le réboisement des bassins versants et par labour en suivant les courbes de niveau sur les fortes pentes ;
- Les travaux de stabilisation des pentes exigent une bonne connaissance des caractéristiques morphologiques et dynamiques des versants ;
- La construction des maisons en matériaux durables et allongés en hauteur capables de résister à l'eau lors de fortes inondations ;
- L'élaboration d'une carte de risques et de la vulnérabilité dues aux crues dans le secteur de Kibe dans le cadre de la cartographie des zones à risques ;
- L'installation à Kibe de l'information préventive consistant à renseigner la population sur les risques majeurs qui la menacent car une grande partie de la population ignore de s'être installée dans un secteur dangereux. L'information est fondamentale et concerne aussi bien l'Etat que les cadres locaux et bien sûr la population elle-même ;

La mise en place d'un mécanisme des mesures préventives et/ou de sauvetage pour les populations riveraines lors des catrosphes naturelles (langage technique, dialecte local, les consignes d'évacuation) ;

Comme la prévention et la protection contre les inondations sont inexistantes et parfois dépassées par l'ampleur de la catastrophe, une solution radicale reste la délocalisation des populations vers les hauteurs, au-dessus de Kibe et de Zalya.

REFERENCES

[1] Bergonzini, L., 1998. Bilans hydriques des lacs du rift Est-Africain (lacs Kivu, Tanganyika, Rukwa et Nyassa). Série Sciences Géologiques. Vol. 103, Musée Royal de l'Afrique Centrale, Tervuren (Belgique).
[2] Bultot, F. et Dupriez, 1987. Niveaux et débits du Fleuve Zaire à Kinshasa. Academie Royale de Sciences d'Outre-Mer (Belg.). Classe Sci,Thechn. in 4°,6,2, 49p.
[3] Conway, D. et Hulme, M., 1993. Recent fluctuation in precipitation and runnoff over the Nile sub-basin and their impact on main Nile discharge. Climatic Change 25:127-151.
[4] Muvundja, F.A., Wüest, A., Isumbisho, M., Kaningini, M.B., Pasche, N., Rinta, P., Schmid, M., 2013, Modelling Lake Kivu water level variations over the last seven decades. Submitted to Limnologica.
[5] Tricart. J, 1975, Principes et méthodes de la géomorphologie, Paris.
[6] Yvette. V, 2001, Géographie des risques naturels, bimestrielle.
[7] Doumenge et alii,1997, Les Monts d'Itombwe. D'une enquête environnementale et socio- économique à la planification d'interventions au Zaire,UICN,Suisse.

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Demand and Supply Analysis of parking in commercial Area: A Case Study Probortak More Area, Chittagong

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ABSTRACT: Transportation engineers and urban planners often report uncertain estimates as precise numbers, and unwarranted trust in the accuracy of these precise numbers can lead to bad transportation and land use policies. This paper presents data on parking and trip generation rates to illustrate the misuse of precise numbers to report statistically insignificant estimates. Beyond the problem of statistical insignificance, parking and trip generation rates typically report the parking demand and vehicle trips observed at suburban sites with ample free parking and no public transit. When decision makers use these parking and trip generation rates for city planning, they create a city where everyone drives to their destinations and parks free when they get there.

KEYWORDS: Demand and Supply, Parking, Commercial area.

1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Every day a significant percentage of drivers in single-occupancy vehicles search for a parking space. Additionally, less experienced drivers or out-of-towners further contribute to the increase of traffic congestion. The type of the planned activity, time of a day, day of the week, current congestion of particular routes, knowledge of city streets, and potentially available parking places have significant influence on a chosen parking search strategy[1]. Chittagong is one of the most important cities in Bangladesh. Because of the commercial activities the city has become a commercial hub of the country. Day by day the trade and business has increased. For this reason the number of private cars, trucks and other vehicles has been increasing day by day [2].So it is essential to improve the transportation system in this city. We have to consider every components of transportation system so that the city becomes more walk-able as well as attractive.

Parking is an essential component of the transportation system. Parking is the act of stopping a vehicle and leaving it unoccupied for more than a brief time. Parking on one or both sides of a road is commonly permitted, though often with restrictions [3]. Parking facilities are constructed in combination with most buildings, to facilitate the coming and going of the buildings' users.

1.2 GOALS AND OBJECTIVES OF THE STUDY

The objectives of this study are:

- To analyze the parking demand and supply in Probortak Area, Chittagong.
- To know the parking trend in this region.
- To Estimate the existing private and public parking supply. Identify whether or not there is an observed shortfall of parking.

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1.3 SCOPE AND LIMITATION OF THE STUDY

This report offers an overview of Probortak area's current parking requirements and compares them with industry standards as well as actual (observed) parking demand rates in several peer cities. In practice, many cities' minimum (and maximum) parking requirements – that is, how many parking spaces developers are required to construct as part of any development project –are not empirically linked to actual demand for parking at a particular development site. Parking requirements that do not reflect the contextual variability of parking demand incur unnecessary costs on both developers and cities, and create excesses of parking supply that may reduce an area's walkability and attractiveness.

Though the study is comprised of some objectives that are effective for the further development of parking of the study area it has few limitations. There is no available data of the parked cars in the concern authority. Lack of man power to survey the study area. The driver does not maintain the traffic rules. They parked their cars here and there. There are no proper rules for parking.

1.4 STUDY AREA PROFILE

This study is confined to the city of Chittagong. In order to understand the parking behavior and mode choice of motorists with respect to shopping as well as work trips in the city of Chittagong, surveys will be conducted at a commercial place named Probortak More Area. This area has some important markets. For example- Mimi super market, Afmi plaza, CSCR.

2 CONCEPTUAL BACKGROUND

2.1 PARKING

Parking is the act of stopping a vehicle and leaving it unoccupied for more than a brief time. Parking on one or both sides of a road is commonly permitted, though often with restrictions. Parking facilities are constructed in combination with most buildings, to facilitate the coming and going of the buildings' users.

2.2 PARKING TYPE

a. Parallel parking
b. Perpendicular parking
c. Angle parking/echelon parking
d. On street parking
e. off street parking
f. Valet parking



Figure 1: Mimi super market parking



Figure 2: Afmi plaza underground parking

2.2.1 PARALLEL PARKING

With parallel parking of cars, these are arranged in a line, with the front bumper of one car facing the back bumper of an adjacent one. This is done parallel to a curb, when one is provided. Parallel parking is the most common mode of street side parking for cars. It may also be used in parking lots and parking structures, but usually only to supplement parking spaces that use the other modes. [3]

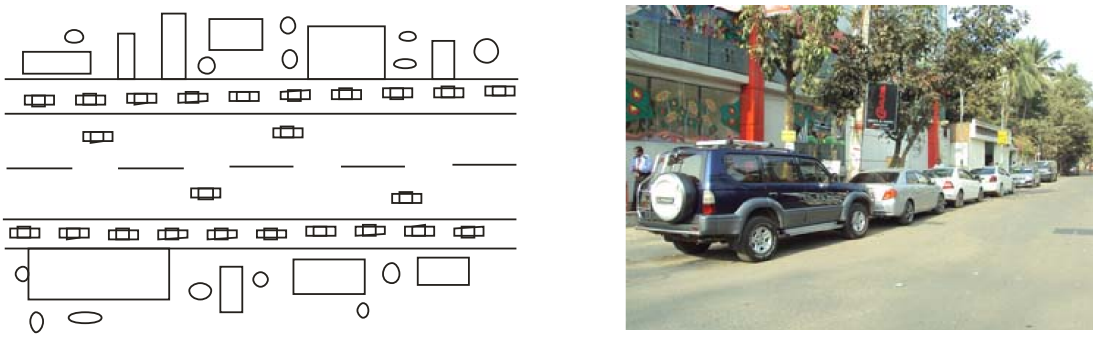


Figure 3: Plan of Parallel parking

2.2.2 PERPENDICULAR PARKING

With perpendicular parking of cars, these are parked side to side, perpendicular to an aisle, curb, or wall. This type of car parking is more scalable than parallel parking and is therefore commonly used in car parking lots and car parking structures. [3]

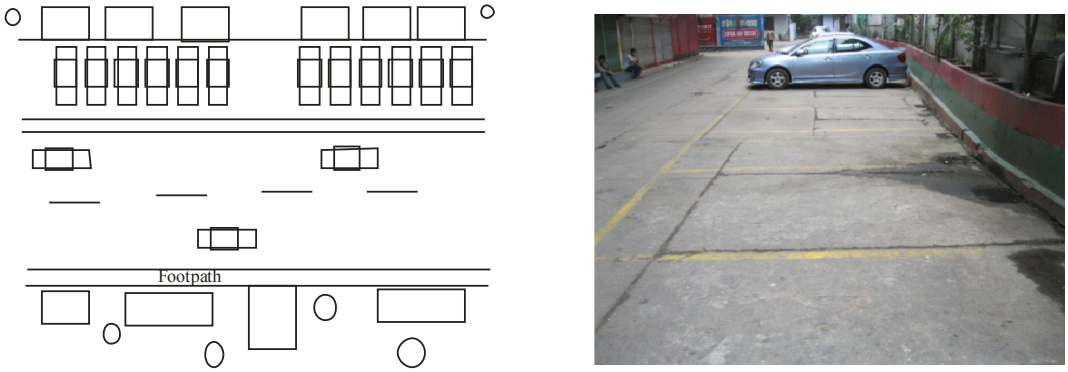


Figure 4: Plan of Perpendicular parking

2.2.3 ANGULAR PARKING

Angle parking, known as echelon parking in Britain, of cars is similar to perpendicular parking for these vehicles, except that cars are arranged at an angle to the aisle (an acute angle with the direction of approach). The gentler turn allows easier and quicker parking, narrower aisles, and thus higher density than perpendicular parking. While in theory the aisles are one-way, in practice they are typically wide enough to allow two cars to pass slowly when drivers go down the aisles the wrong way. [3]

2.3 PARKING SPACE

The width of angled and perpendicular parking spaces usually ranges from 2.3 to 2.75 metres (7.5–9.0 ft). For example, normal parking spaces in a city are 8.5 feet wide, while compact spaces are 7.5 feet wide. Because the boundary between parking space and driving area is not always well-defined, the length of a parking space is more difficult to establish. However, most angled and perpendicular spaces are considered to be between 3.2 and 5.5 metres (10 and 18 ft) in length. Parallel parking spaces are typically cited as being approximately 2.76 metres (9.1 ft) wide by 6.1 meters (20 ft.) long. [4]

2.4 TYPES OF PARKING SURVEYS

- Parking Space inventory
- Patrol Method by using surveys
- Questionaries' type parking usage surveys
- Cordon Count
- Photographic Methods

2.4.1 PARKING SPACE INVENTORY

The first steps in parking surveys are to collect data on the amount, types and location of space actually or potentially available for parking in an area. The area to be surveyed should first be delineated. The central business district is usually the area where parking surveyed is needed. The data on parking facilities should be recorded on the plans using suitable symbols. [5]

- length of kerb
- Number of parking spaces
- Street width.
- Location of bus stops, bus bays etc.
- Traffic management measures in force
- Numbers and types of parking signs for regulation of parking.
- Vacant or unused land suitable for temporary parking space.

2.4.2 PATROL METHOD BY USING SURVEYS

The purpose of using parking usage survey is to obtain data on extend of usage of parking spaces. The survey will include count of parked vehicles at regular intervals through a period, covering both the morning and evening peak period, and the parking accumulation and turn over. [5]

2.4.3 QUESTIONARIES' TYPE PARKING USAGE SURVEYS

The questionnaire types parking usage survey involves interviews with the drivers who use the parking facilities. As a result, it is possible to collect information on the extent, to which the existing facilities are being used, the parking requirements at the prices existing at the time of survey, the parking demand at different prices, the distribution of demand over area and time and the journey purpose of car parkers.

The survey can either be made by making enquiries amount of car owners living in the vicinity of the survey area, or by the making enquiries amount the drivers of car seen to park in the area at the time of the survey. [5]

2.4.4 CORDON COUNT

In this method, to be surveyed is demarcated by a cordon line which is crossed by the roads emanating from the area. Counting stations are established at these crossing points and a count is made of all the vehicles entering and living the area. The difference between two traffic gives the numbers of vehicles parked or in motion in the area. The counting can be manual or automatic. [5]

2.4.5 PHOTOGRAPHIC METHODS

The photographic method is finding useful application in parking surveys. The photographic method is used in aerial photography in producing maps. Survey to study the behavior of different aspects of road traffic such as speed, volume, concentration, accidents and geometric design. [5]

2.5 PARKING DEMAND

Parking Demand refers to the amount of parking that would be used at a particular time, place and price. It is a critical factor in evaluating parking problems and solutions. Parking demand is affected by vehicle ownership, trip rates, mode split,

duration (how long motorists park), geographic location (i.e., downtown, regional town centre or suburban), the quality of travel alternatives, type of trip (work, shopping, recreational), and factors such as fuel and road pricing.

2.6 PARKING SUPPLY

Parking supply refers to the amount of legal space provide for parking. It may be off street parking space or on street parking space.

Parking volume: The number of vehicles parking in a particular area over a given period of time is called parking volume. It is usually measured in vehicles per day. [5]

Parking load: The area under the parking accumulation curve during a specific period is called parking load. (Kadlyali, 2010)

Parking duration: The length of time spent in a parking space is called the parking duration.

Parking Index: Parking Index is the percentage of parking bays actually occupied by the parked vehicles as compared to the theoretical number available. [5]

Parking Index= $\frac{Number\ of\ bays\ occupied}{\text{Theoretical number of bays available}} * 100$

Parking turn-over: The rate of the usage of the available parking space is called parking turnover. Thus if there were 10 parking spaces used by 100 vehicles in a period of, say time 12 hours, then the parking turn over would be $= \frac{100}{10}$ vehicles per space in a period of 12 hours. [5]

3 METHODOLOGY

3.1 INTRODUCTION

A system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline. Unlike an algorithm, a methodology is not a formula but a set of practices.

3.2 SELECTION OF PROJECT

The selected project tropic is analysis of parking at Pobortok More in Chittagong, in case of Demand and Supply.

3.3 SETTLING OF GOAL AND OBJECTIVE

- To analyze parking demand and supply.
- To know the parking trend in this region.
- To estimate the existing public and private parking facilities.

3.4 LITERATURE REVIEW

Literature review for learning about different parking analysis method, how conduct this survey, what will be the benefits in this survey.

3.5 DATA COLLECTION

Data are collected from two sources

1. Primary data source 2.Secondary data source.

3.5.1 PRIMARY DATA COLLECTION

Primary data collected from field survey in different method such as parking space inventory, cordon survey etc.

Primary data includes:

1. Demand.
2. Supply.
3. Accumulation curve.

3.5.2 SECONDARY DATA COLLECTION

Secondary data collected from different types of report, internet etc.

Secondary data includes:

1. Method of survey.
2. Theoretical concept.

3.6 DATA ANALYSIS AND FINDINGS

By SPSS software and Microsoft Excel we analysis the data which collected from field survey. After input data we calculate demand and supply and draw an accumulation curve.

3.7 REPORT WRITING & PRESENTATION

After the final analysis, the study has prepared as a report and then the presentation of the

Report was prepared.

4 DATA PROCESSING

The data which is obtained by Probortak more area is analyzed through the SPSS software. The sample is taken by randomly. 60 drivers of different vehicles are taken as sample in different parking lot. Samples are also taken from the vehicle users who parked their vehicles on the street.

Table 1: Trip purposes in the Probortak more Area

Trip purpose				
Activity	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
To work	9	15.0	15.0	15.0
Shopping	**18**	**30.0**	**30.0**	**45.0**
Business	6	10.0	10.0	55.0
Personal affair	7	11.7	11.7	66.7
To eat restaurant	4	6.7	6.7	73.3
School/college/university	4	6.7	6.7	80.0
Service passenger	12	20.0	20.0	100.0
Total	60	100.0	100.0	

In Probortak more area, there are Mimi super market, Afmi plaza etc. As Probortak more area is one of the important marketing places so we see in the above table 30% of trip is done for marketing/ shopping purpose. Again we see that 20% of vehicles come here to serve the passengers. Different type of CNG, taxi and public bus come and parked the vehicles. Here people also come for their business (10%), to eat (6.7%), to do their personal work (15%) and also come Chittagong Medical College and Premier University (6.7%).

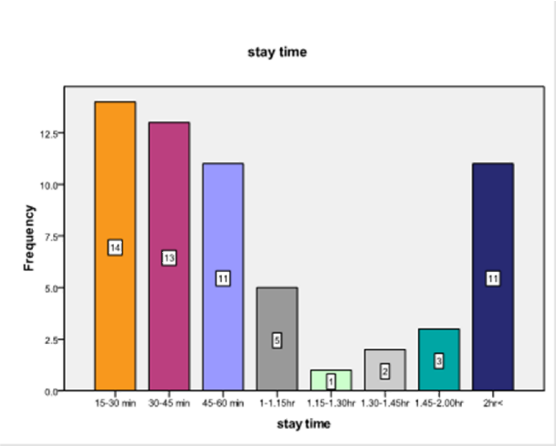


Figure 5: Time duration along which the vehicles are parked in the parking lot.

From the above bar chart we see that most of the vehicles (23.3%) stay 15 to 30 minutes in the parking lot. 21.7% vehicles stay 30 to 45 minutes and 18.3% vehicles stay 45 minutes to one hour.

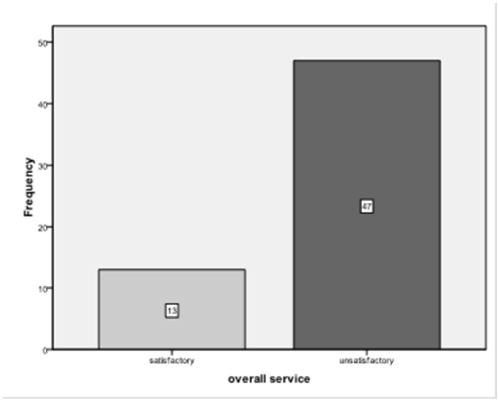


Figure 6: Overall parking facilities services

From this table and bar chart we see that almost 80% of parking facilities services is unsatisfactory. The vehicles users are not satisfied to the available parking facilities.

4.1 DEMAND AND SUPPLY ANALYSIS FOR WEEKEND-DAY

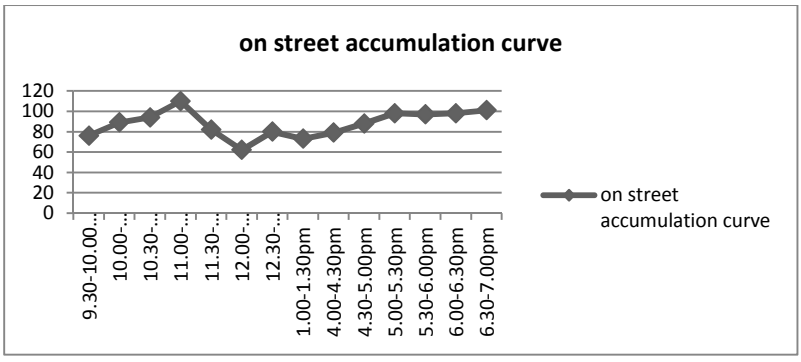


Figure 7: weekend day-on street parking accumulation curve

In pobortok more area illegal on street parking is very high because there is no facility for on street parking. In medical road most of vehicle parking on the street. Loading and unloading vehicle parking on street. Medical representative park their vehicle on road after a long.

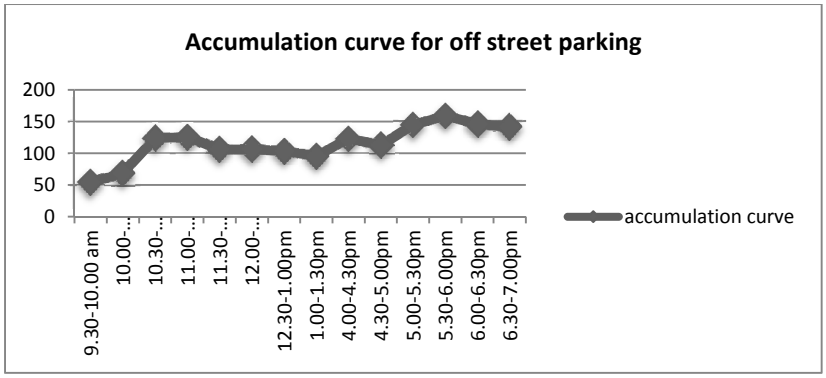


Figure 8: weekend day-off street parking accumulation curve

For off street parking we find highest parking vehicle in 10.30-11.30am and 5.00-7.00pm because in this time people come diagnostic center, and come market for buying.

4.2 ON STREET PARKING DEMAND (PEAK HOUR)

1 Car = 1 car, 2 Rickshaw = 1 car, 2 CNG = 1 car, 4 motor cycle = 1 car

On street parking demand-10.30-11.30 A.M (peak hour) =204 car per hour

On street parking demand-11.30-12.30 A.M (peak hour) =144 car per hour

On street parking demand-5.00-6.00 P.M (peak hour) =195 car per hour

On street parking demand-6.00-7.00 P.M (peak hour) =199 car per hour

Overall on parking demand (peak hour) =200+144+195+199/4 car per hour=184 car per hour

4.3 OFF STREET PARKING DEMAND (PEAK HOUR)

Off street parking demand-10.30-11.30 A.M (peak hour) =250 car per hour

Off street parking demand-11.30-12.30 A.M (peak hour) =212 car per hour

Off street parking demand-5.00-6.00 P.M (peak hour) =304 car per hour

Off street parking demand-6.00-7.00 P.M (peak hour) =288 car per hour

Overall off parking demand (peak hour) =250+212+304+288/4 car per hour= 264car per hour

Capacity or supply=280 car per hour

4.4 COMPARE BETWEEN OF STREET AND ON STREET PARKING ACCUMULATION CURVE IN WEEK DAY

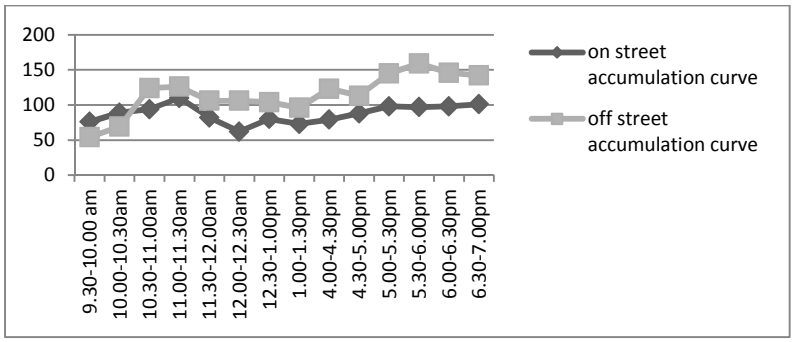


Figure 9: Compare between of street and on street parking accumulation curve in week day

Compare between two accumulation curve in weekend day we show that off street paring is high than on street parking. In weekend day most of the people come for marketing in afmi plaza and Mimi super market on car and parking on parking bay. Highest off street parking found 5.00-6.00 pm.

4.5 DEMAND AND SUPPLY ANALYSIS FOR WEEK-DAY

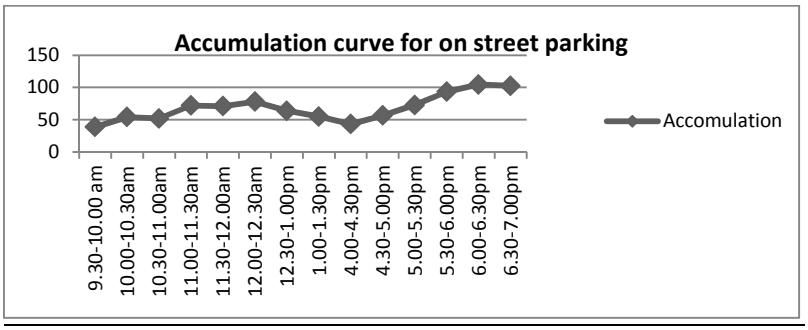


Figure 10: week day-on street parking accumulation curve

In week day accumulation curve show that highest on street parking found in 11.00-12.00am and 5.00-7.00pm.in weekend day morning time on street parking relatively low than weekend day because afmi plaza and Mimi super market close in Sunday and Monday up to 2.00 pm.

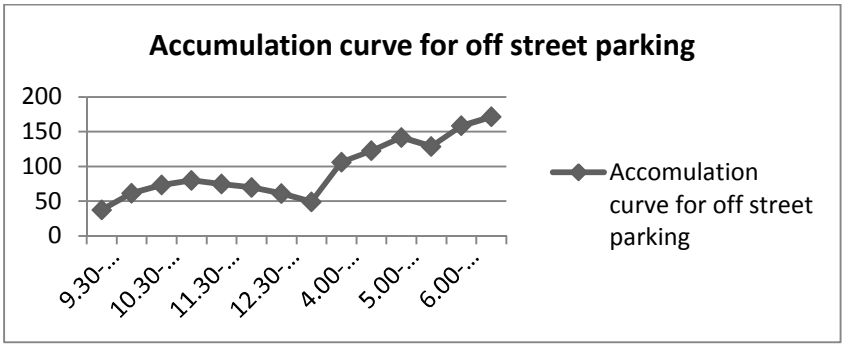


Figure 11: week day-off street parking accumulation curve

In week day off street parking also low in Sunday and Monday up to 2.0 pm.due to because afmi plaza and Mimi super market close in Sunday and Monday up to 2.00 pm.after 2.00 pm people come for marketing and number off street parking is increased.

4.6 COMPARE BETWEEN OF STREET AND ON STREET PARKING ACCUMULATION CURVE IN WEEK DAY

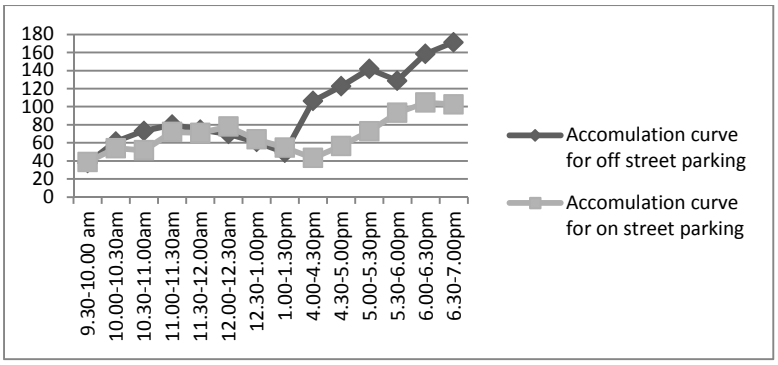


Figure 12: Compare between of street and on street parking accumulation curve in week day

Compare between off street parking and on street parking in week day show that on street parking is high than off street parking. In morning time people come for medical for treatment.

4.7 ON STREET PARKING DEMAND (PEAK HOUR)

On street parking demand-10.30-11.30 A.M (peak hour) =124 car per hour

On street parking demand-11.30-12.30 A.M (peak hour) =143 car per hour

On street parking demand-5.00-6.00 P.M (peak hour) =166 car per hour

On street parking demand-6.00-7.00 P.M (peak hour) =207 car per hour

Overall on parking demand (peak hour) =124+143+166+207/4 car per hour=160 car per hour

4.8 OFF STREET PARKING DEMAND (PEAK HOUR)

Off street parking demand-10.30-11.30 A.M (peak hour) =153 car per hour

Off street parking demand-11.30-12.30 A.M (peak hour) =144 car per hour

Off street parking demand-5.00-6.00 P.M (peak hour) =269 car per hour

Off street parking demand-6.00-7.00 P.M (peak hour) =329 car per hour

Overall off parking demand (peak hour) =153+144+269+329/4 car per hour= 224 car per hour

Capacity or supply=280 car per hour

4.9 COMPARISON BETWEEN WEEK AND WEEKEND DAY ACCUMULATION CURVE

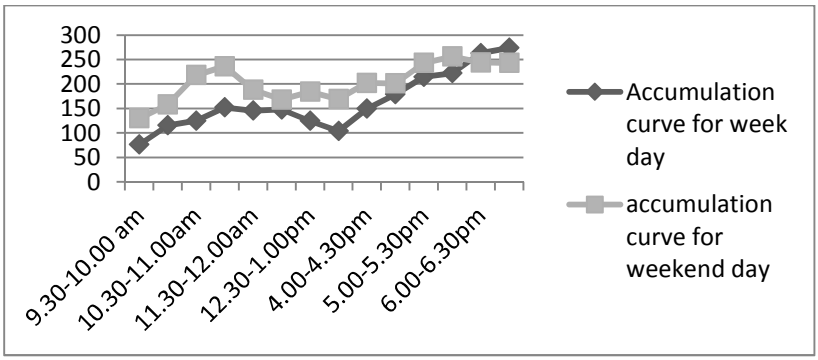


Figure 13: Comparison between week day and weekend day accumulation curve

Comparison between week day and weekend day accumulation curve we see that weekend day accumulation curve is higher than week accumulation curve. So the demand of weekend day is higher than week day.afmi plaza and Mimi super market being close up to 2.00pm in Sunday and Monday.

4.10 COMPARISON BETWEEN DEMAND AND SUPPLY BOTH WEEK AND WEEKEND DAY

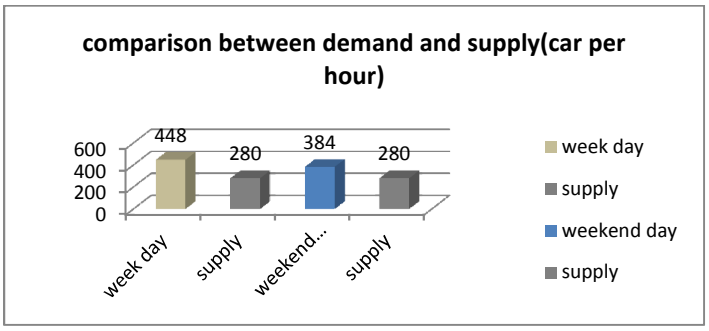


Figure 14: Comparison between demand and supply both week and weekend day

From the above figure we see that the demand for parking space is greater than the supply. Here we see that in the week day the demand is 488 cars per hour but the supply is 280 cars per hour which is almost half to meet the demand. We also see in the weekend day the demand for parking is 384 cars per hour but the supply is the same that means 280 which is very much less than the demand.

4.11 EXISTING PARKING CONDITION IN STUDY AREA

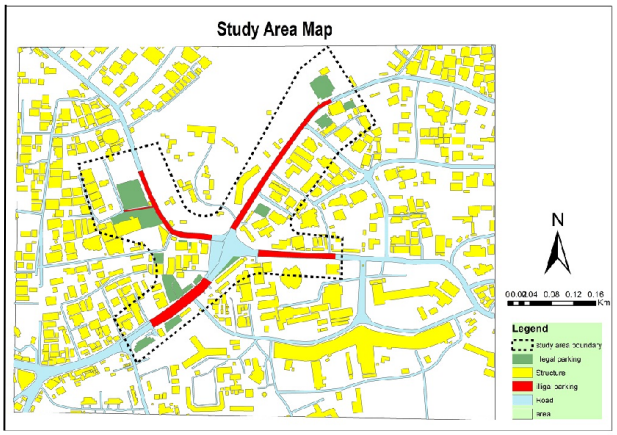


Figure 14: Existing parking condition in study Area

The study area map show that there are two types of parking mainly occur such as on street parking and off street parking. But most of the on street parking are illegal and create traffic congestion. This area is a mixed land use area so it needs proper parking management.

5 FINDINGS AND CONCLUSION

5.1 SUMMARY FINDINGS

Parking is one of the most important elements in transportation system. The parking demand and supply analysis of probartak more area will elaborate the future such type of study. From this study we find results which show us the parking trend and also the parking demand of this area.

From the analysis part we see that most of the cars are parked in three parking lots. These are Mimi super market parking lot, afmi plaza underground parking lot and CSCR diagnostic center. In the evening this lots are fulfilled by different vehicles and many time the vehicles users do not get space for vehicles.

The total capacity of this area is 280 cars per hour which is not sufficient to meet the demand of the vehicles. Even if we consider the off streets parking then there is also lack of parking spaces. On the other hand there is no on street parking lot in this area but there are a lot of vehicles which is parked besides the road. This is one of the most influential causes for jam. Again the road width is not sufficient. So if we there is lack of specific parking lot, we cannot be able to reduce the jam of this area. There are also some management problems in the parking lot. Sometimes police charge on street parking illegally.

5.2 CONCLUSION

This study highlights the parameters which influence the parking demand of an automobile owning household. It has been observed that each parameter has varied level of influence on parking demand for various locations. While looking at the aggregate level parking demand functions, similar location specific elasticity's have been observed. This clearly points to the fact that varied policy tools need to be adopted for parking demand management at various locations. The mode choice functions derived in this study reveal that parking supply characteristics can play a significant role in reducing automobile dependency. However, the relative influence of parking parameters does depend on the trip purpose as well as location, order and hierarchy of the destinations.

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REFERENCES

[1] Teodorovic, D. (2007). *Parking Space inventory Control: an Artificial Intelligence Approach.* Virginia.
[2] Rashid, M. M. (2012). Automatic Parking Management System and Parking Fee. *International Journal of Machine Learning and Computing* .
[3] Chakrabarti, S. a. (2010). Behavioral Characteristics of Car Parking Demand:A Case Study of Kolkata. *India Journal* .
[4] Russell, G. T. and Anthony, J.R. (1999) A parking search model, Journal of Transportation Research A. Vol. 32, No.3, 159-170.
[5] Kadlyali, D. (2010). *Traffic Engineering and Transport Planning.* New Delhi: Khanna Publisher.

Notice of Retraction

The authors of the following article have requested that it be retracted from publication in the *International Journal of Innovation and Scientific Research*:

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Performance Evaluation of RSA Algorithm in Cloud Computing Security

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ABSTRACT: In this research we propose a security algorithm for handling the security issues in cloud environments. Cloud computing is a large pool of easily and accessible virtualized resources, such as hardware, development platforms and services. Since Cloud Computing stores the data and provides resources in the open environment, therefore security has become the main obstacle which is hampering the deployment of Cloud computing framework. To ensure the security of data in cloud environment, we proposed a method by implementing RSA algorithm. After implementing RSA Algorithm, we have also analyzed the performance of our algorithm based on three parameters namely Time Complexity, Space Complexity and Throughput.

KEYWORDS: Cloud computing, Security, RSA Algorithm, Time complexity, Space complexity, Throughput.

1 INTRODUCTION

Cloud Computing is the key driving force in many small, medium and large sized companies [7-8]. Cloud computing has three delivery models named as Saas, Iaas, Paas and four deployment models such as private cloud, public cloud, hybrid cloud and community cloud as illustrated in figure 1.

As many cloud users seeks the services of cloud computing, the major concern is the security of their data in the cloud [13]. Data security is always of vital importance and plays an important role in trust worthiness of computing [10]. Due to the critical nature of cloud computing and the large amounts of complex data it carries, the need is even more important [9]. Hence forth, concerns regarding data privacy and security are proving to be a barrier to the broader uptake of cloud computing services [14].

Security and privacy are always a major concern in cloud computing environment [15]. Some of the security issues are Privacy and Confidentiality, Data integrity, Data location and Relocation, Data Availability, Storage, Backup and Recovery [16-17].

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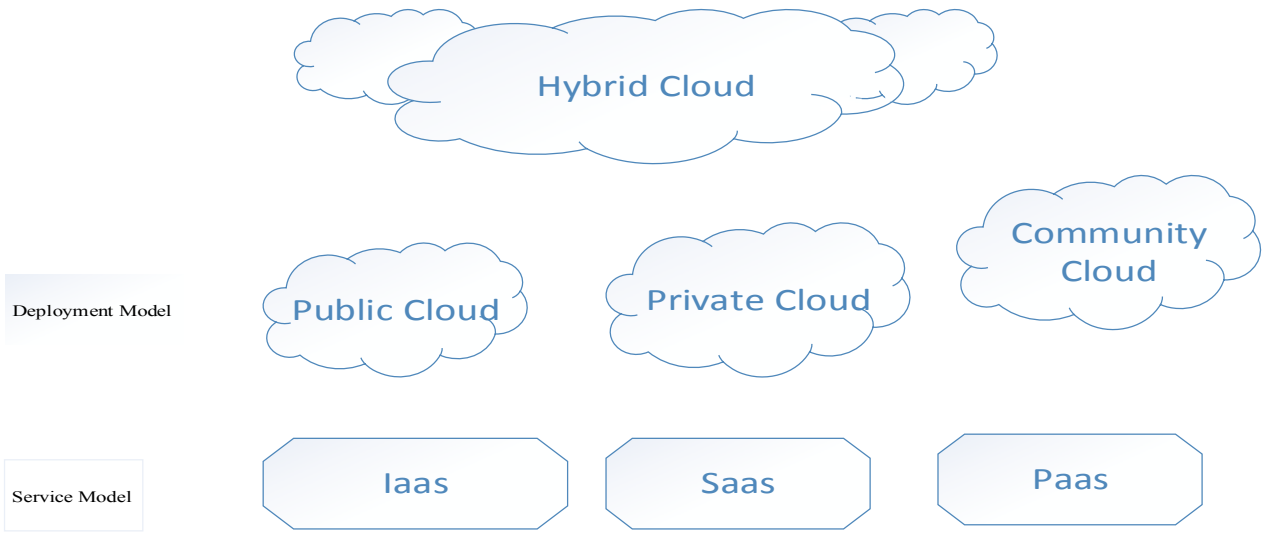


Figure 1: Cloud computing Deployment model & Service model

In our proposed work, we are using RSA algorithm to encrypt the data to provide security so that only the concerned user can access it [11-12]. By securing the data, we are not allowing unauthorized access to it. User data is encrypted first and then it is stored in the Cloud. When required, user places a request for the data for the Cloud provider, Cloud provider authenticates the user and delivers the data.

2 PROBLEM STATEMENT

The security of data of the user is prime responsibility of cloud provider. So, for efficient data security we need a mechanism that provides secure data encryption as well as secure shield against data theft. Different researches have focused on the fact that user generally has to access large volumes of data from the cloud in a secured manner. We need some algorithm that will help in efficient and speedy secured data access. In this study we do research on data security issues in cloud and provide a mechanism which ensures data security in cloud in an efficient way.

3 RESEARCH OBJECTIVES

- To develop a system that will Provide Security and Privacy to Cloud Storage.
- To establish an Encryption Based System for protecting Sensitive data on the cloud and Structure how owner and storage Service Provider to operate on encrypted Data.
- To create a System where the user store its data on the cloud the data is sent and stored on the cloud in encrypted form. As in normal cases in cloud computing when a user login to the cloud and they store data on cloud storage device the data stored on the server cloud is not much secure as it can be readable to anyone who has permission to access and leaving data vulnerable.
- To develop a retrieval System in which the data is retrieved by the user in encrypted form and is decrypted by the user at its own site using a public and private key encryption.

This paper discussed security issues in the cloud environment and our proposed solution. In related work we described how other people used security techniques in cloud and the analysis of success and failure they achieved. In fifth section of the paper we discussed overview of the proposed system which is followed by technique used for our experiment and experimental results. Conclusion, future work and references are given at the end.

The research paper has organized as; Section 1 elaborates Introduction and security issues in cloud. Section 2 elaborates problem statement. Section 3 discussed research objectives. Section 4 elaborates related work. In this section, we provide some related work in the area of cloud computing security. Section 5 elaborates our proposed work. In this section, we proposed a security technique which provides user with a secure way for his data on cloud. Section 6 discusses the Implementation and Results and the paper is concluded in section 7.

4 RELATED WORK

In this section, we provide some related work in the area of cloud computing security and cryptographic algorithm used in cloud computing security. Malakooti, et al [2] proposed a model which is based on the scrambling algorithm and multilevel encryptions. They have designed, implemented, and tested their security model on the image type of information that is to be stored on the cloud environment.

Arockiam, et al [1] proposed technique which emphasizes on improving classical encryption techniques by integrating substitution cipher and transposition cipher. Both substitution and transposition techniques have used alphabet for cipher text. In their proposed algorithm, initially the plain text is converted into corresponding ASCII code value of each alphabet.

Yang Xu, et al [4] proposed an agent-aid model by combining multi-agent system and decision-making theory toward working load balancing problem in large clouds. In their work, they put forward a novel model to balance data distribution to improve cloud computing performance in data-intensive applications, such as distributed data mining.

Mohamed, et al [3] makes evaluation for selected eight modem encryption techniques namely RC4, RC6, MARS, AES, DES, 3DES, Two-Fish, and Blowfish through their software to select the most suitable and the highest security encryption algorithm for secure cloud computing architecture.

Tirthani, et al [6] have contemplated a design for cloud architecture which ensures secured movement of data at client and server end. They used the non-breakability of Elliptic curve cryptography for data encryption and Diffie Hellman Key Exchange mechanism for connection establishment. Their proposed encryption mechanism uses the combination of linear and elliptical cryptography methods. It has three security checkpoints named as authentication, key generation and encryption of data.

Veerraju Gampala, et al [5] explore data security of cloud in cloud computing by implementing digital signature and encryption with elliptic curve cryptography. In their work authentication and encryption for secure data transmission from one cloud to other cloud is presented that requires secure and authenticated data with elliptic curve cryptography. Their proposed work contains steps like key generation, signature generation, encryption algorithm, decryption algorithm and signature verification.

5 PROPOSED WORK

In proposed work, we have to implement RSA algorithm and then analyze its performance based on different parameters such as Time complexity, Space complexity and through put. The proposed work will be carried out in two steps. First we will program the algorithm in Eclipse IDE with Java to get the results for different evaluation parameters and then we use Matlab to plot the results for these parameters. The obtained graphs will help us to study and analyze the efficiency of RSA algorithm for the above mentioned parameters. The implementation of RSA algorithm involves following steps:

- Key Generation
- Encryption
- Decryption

RSA is a block cipher, in which every message is mapped to an integer. RSA consists of Public-Key and Private-Key. In our Cloud environment, Pubic-Key is known to all, whereas Private-Key is known only to the user who originally owns the data. Thus, encryption is done by the Cloud service provider and decryption is done by the Cloud user or consumer. Once the data is encrypted with the Public-Key, it can be decrypted with the corresponding Private-Key only.

RSA uses modular exponential for encryption and decryption. RSA uses two exponents, e and d, where e is public and d is private. Let the plaintext is M and C is ciphertext, then at encryption n is a very large number, created during key generation process.

The RSA algorithm is a secure, high quality, public key algorithm. Following are the steps involved in key generation, encryption & decryption of system.

A) RSA Encryption

PLAIN TEXT : $M < n$

CIPHER TEXT : $C = Me \bmod (n)$

B) RSA Decryption

CIPHER TEXT: C

PLAIN TEXT: $M = Cd \bmod (n)$

Encryption/Decryption Equation of RSA

Key Generation

- Choose 2 large prime numbers, p & q
- Compute $n=p*q$
- Compute $\Phi(n) = (p-1) *(q-1)$.
- Choose e, relatively prime to $\Phi(n)$.
- Find d, such that $e*d=1 \bmod \Phi(n)$.

($e*d \bmod \Phi(n) = 1$ i.e.[$(e*d) / \Phi(n)$] reminder =1)

- The Public key is (n, e).
- The Private key is (n, d),

Key Generation steps of RSA Algorithm

In order to implement RSA in Eclipse software first of all a flow chart for the required algorithm was designed. This flow chart is given below:

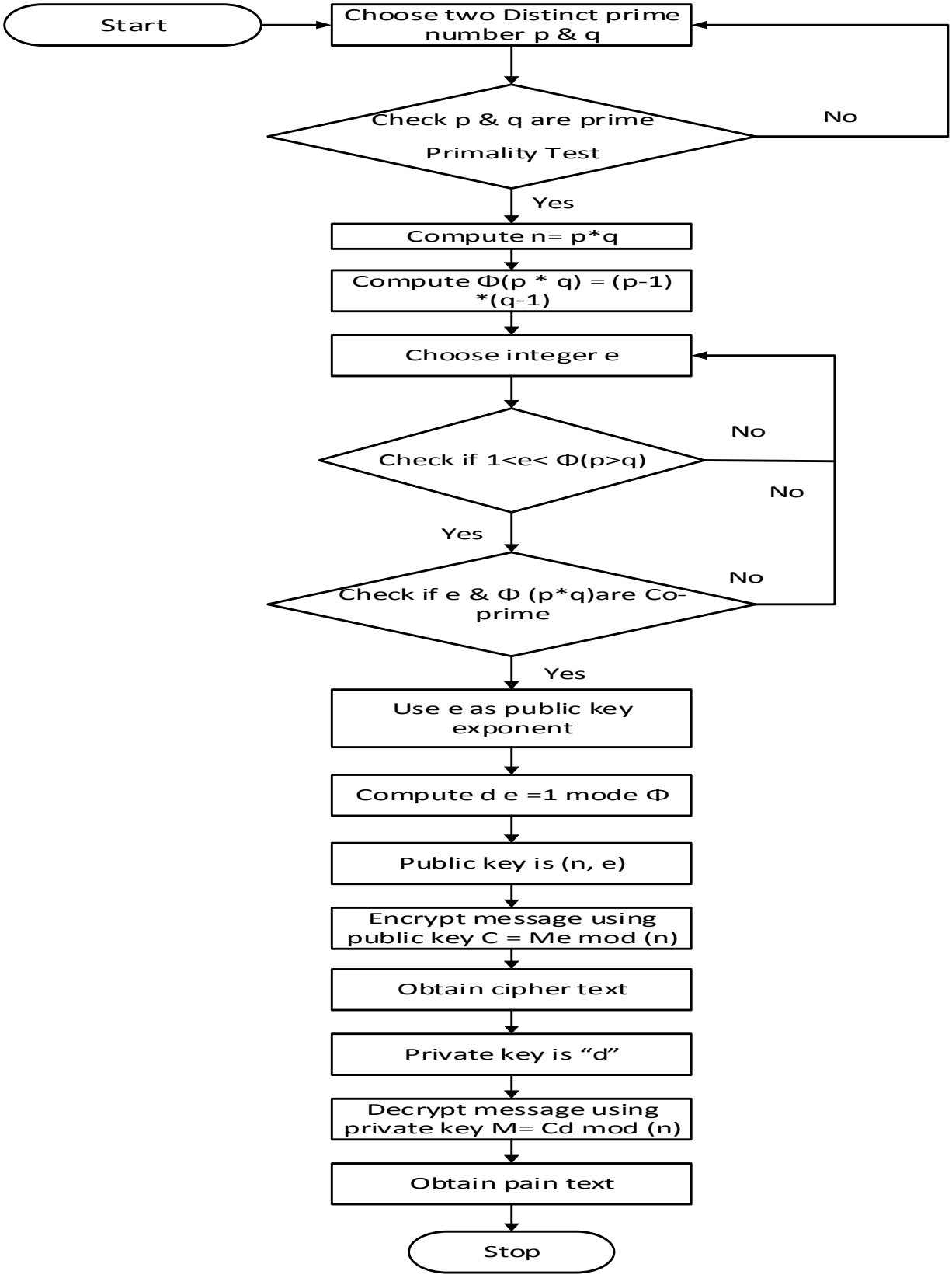


Figure 2: Flow chart of RSA Algorithm

The RSA encryption/decryption is just a modular exponentiation operation. This mathematical operation is represented as C=Me mod n, where C is cipher text, M is plain text, e is the public key exponent, and n is the modulus.

6 IMPLEMENTATION AND RESULTS

In this section we have evaluate our algorithm on parameters such as Time complexity, Space complexity and through put which will help us to analyze the efficiency of algorithm based on these parameters. These parameters can be used to check the effectiveness of RSA algorithm.

6.1 TIME COMPLEXITY

Time complexity is commonly calculated by counting the total operations performed by the system where each operation takes a fixed amount of time. An algorithm performance time may vary with different input size therefore it is a common practice to express the time complexity in worst case donated as T(n).For instance the algorithm with T(n)=O(n) has linear time complexity whereas T(n)=O(n^2) is nonlinear and T(n)=O(2^n) is exponential.

In our case we have computed the time complexity by varying the Private key length of the RSA algorithm and finding the required execution time for each Private key length.

The time complexity of RSA is analyzed by varying the private key length in bits and noting the execution time for each key length. A summary of the different key lengths in bits and their execution time is given in bits as shown in Table 1.

Table 1: Time Complexity

Private key length(bits)	Time in (ms)
64	86.00
128	91.33
256	110.33
512	142.67
1024	363.67
2048	2784.67

Graph can be shown as:

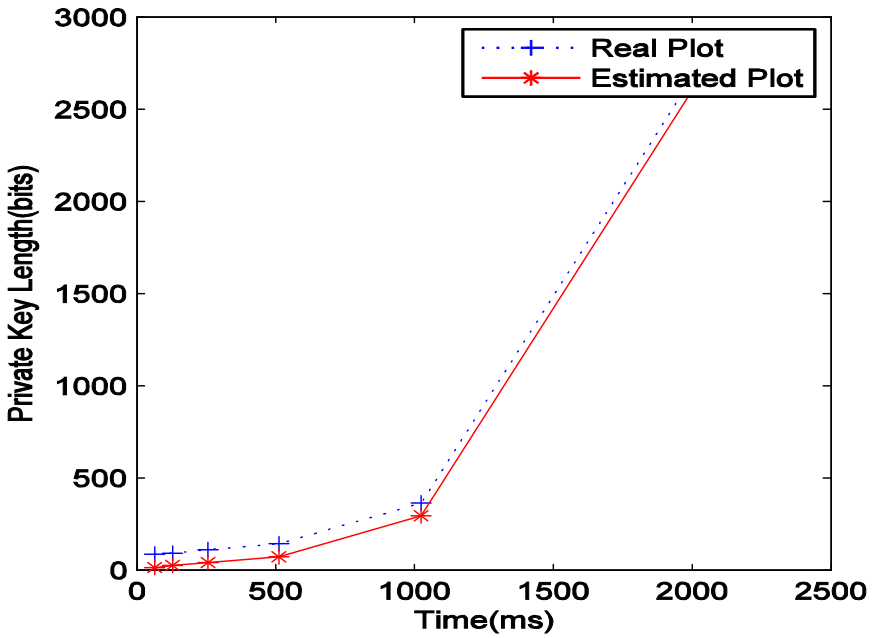


Figure 3: Time Complexity

Figure 3.shows the plot for Time vs Cipher length in bits for RSA algorithm. In order to find the relationship between time and Cipher length a polynomial equation of order two is proposed and was also compared with the original graph. As we can see that the estimated equation follows the simulated plot with very less error therefore it can be stated that the time complexity of RSA is O(n^2). It is also seen that as the size of Private key length increases the increase in time is nonlinear and exponential.

6.2 SPACE COMPLEXITY

Apart from Time complexity, space complexity is also an important measure to judge the performance of an algorithm. It is the amount of memory which the algorithm needs for performing its computations. A good algorithm keeps the amount of memory as small as possible. The way in which the amount of storage space required by an algorithm varies with the size of the problem it is solving. Space complexity is normally expressed as an order of magnitude, e.g. O(N^2) means that if the size of the problem (n) doubles then four times as much working storage will be needed.

We have analyzed the space complexity between private key length which is in bits and run time memory consumed by system. A summary of the different Private Key length in bits and run time memory taken by the system is given below in table 2.

Table 2: Space Complexity

Private key length (Bits)	Run time memory
128	345128
256	347224
512	347320
1024	348040
2048	348608
4096	349488
8192	351048

The graph plotted between Run time memory and Private Key length is shown in figure 4. As seen from the plot as length of private key increases the run time memory increases gradually. When the relationship is estimated between the private key length and run time memory it is found to be a polynomial equation of order 2 from which we can deduce that the space complexity of RSA can be expressed as S(n)=O(n^2)

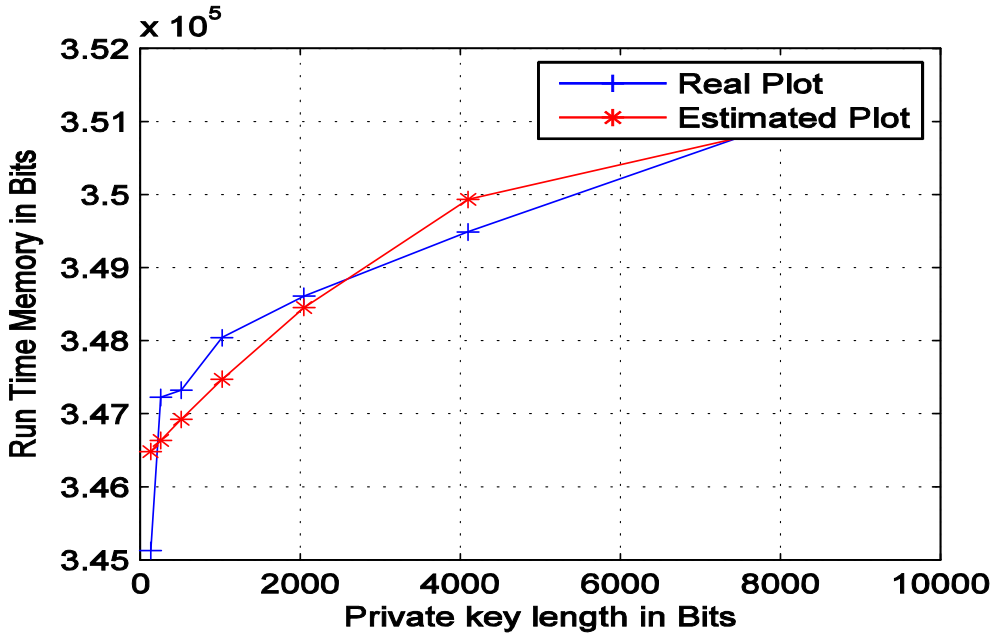


Figure 4: Run Time Memory Vs Private Key length plot of RSA algorithm

6.3 THROUGHPUT

In communication systems throughput is the rate of successful data delivery over a noisy communication channel. Throughput is usually measured in bits per second and sometimes we measure it in terms of packets per second. We have calculated the throughput of the algorithm by dividing the total data in bytes by encryption time. Higher the throughput higher is the efficiency of the system. Table given below gives us the comparison between the throughput and the message signal.

We have calculated the throughput for 32, 64,128 and 256 bytes of messages. In any cryptographic algorithm, it is essential to understand the size of the input and the size of output as this is one of the important property of an avalanche effect. Larger the size of the Ciphertext compared with the Plaintext, more secure is the Ciphertext against any Brute-Force attack. The table below gives us the throughput for different data length.

Table 3: Throughput

	Throughput for different Private Key Length					
Data Bits	**128 bits key length**	**256 Bits key length**	**512 bits key length**	**1024 bits key length**	**2048 bits key length**	**4096 bits key length**
32	205.13	186.04	136.75	102.56	48.854	7.120
64	457.14	372.09	256	205.13	71.99	10.82
128	914.28	684.49	514.056	315.27	182.33	16.77
256	1641.02	1361.70	1094.02	684.49	443.67	0.095

When we analyze the data from the above table we see that there is a tradeoff between through put and Private Key length. If we want to increase the throughput we have to decrease the Private key length and hence have to make compromise on the security of the data. The plot given below gives us a comparison for throughput for different data sizes.

The graph plotted for 32, 64,128 and 256 bytes of messages.is shown in figure 5. As seen from the plot it is clear that there is a tradeoff between through put and Private Key length. If we want to increase the throughput we have to decrease the Private key length and hence have to make compromise on the security of the data.

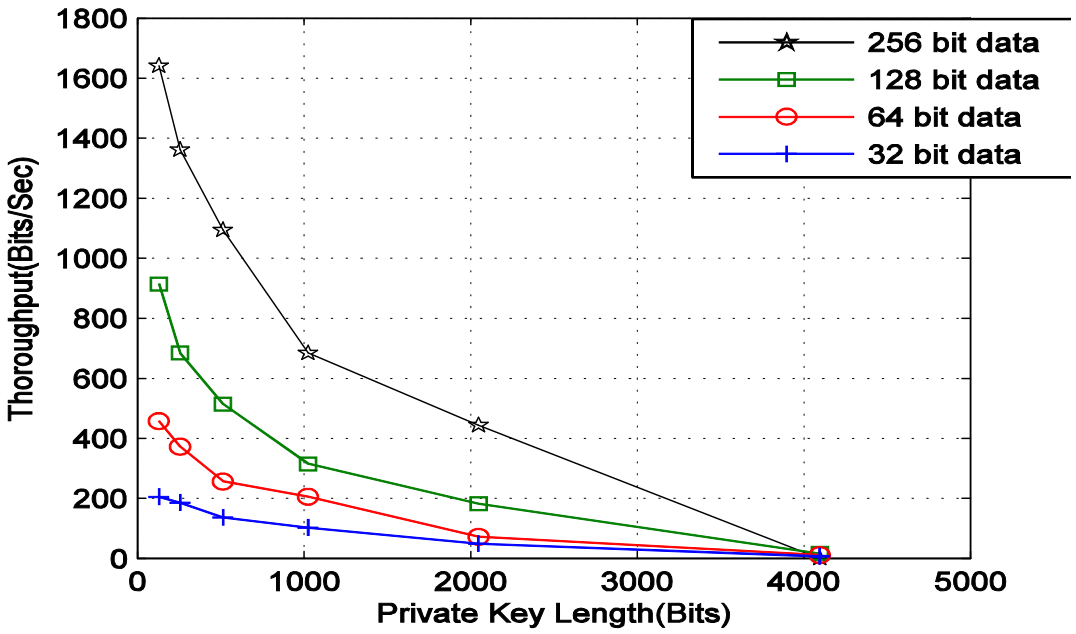


Figure 5: Throughput for 32, 64,128 and 256 data sizes

7 CONCLUSIONS

In this research paper we have discussed the security issues of cloud computing in detail. We have also discussed different encryption systems which are being proposed to address the security problem in cloud computing. Then we have proposed and implemented a security system based on RSA algorithm. We have evaluated its performance based on different parameters such as space complexity, time complexity and throughput. We have observed each efficiency parameter in detail by varying message packet length and private key length of our encryption scheme. By studying the obtained results and graphs it can stated safely that RSA encryption algorithm is a feasible solution for secure communication in cloud computing.

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REFERENCES

[1] Dr. L. Arockiam, S. Monikandan, "Data Security and Privacy in Cloud Storage using Hybrid Symmetric Encryption Algorithm", International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 8, August 2013.

[2] Dr. Mohammad V. Malakooti, NilofarMansourzadeh, "A Robust Information Security Model for Cloud Computing Based on the Scrambling Algorithm and Multi-Level Encryption", Proceedings of the International conference on Computing Technology and Information Management, Dubai, UAE, 2014, Islamic Azad University, UAE branch, Dubai, UAE.

[3] EmanM.Mohamed, Hatem S. Abdelkader, Sherif EI-Etriby, "Enhanced Data Security Model for Cloud Computing", The 8th International Conference on Informatics and Systems (INFOS2012) - 14-16 May, Cloud and Mobile Computing Track.

[4] Yang Xu, Lei Wu, Liying Guo, Zheng Chen, Lai Yang, Zhongzhi Shi, "An Intelligent Load Balancing Algorithm Towards Efficient Cloud Computing", AI for Data Center Management and Cloud Computing: Papers from the 2011 AAAI Workshop (WS-11-08).

[5] Veerraju Gampala, SrilakshmiInuganti, Satish Muppidi, "Data Security in Cloud Computing with Elliptic Curve Cryptography", International Journal of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-2, Issue-3, July 2012.

[6] NehaTirthani, Ganesan R, "Data Security in Cloud Architecture Based on Diffie Hellman and Elliptical Curve Cryptography", School of computing Science and Engineering, VIT, Chennai campus.

[7] Kevin Hamlen, Murat Kantarcioglu, Latifur Khan, Bhavani Thuraisingham, "Security Issues for Cloud Computing". The University of Texas at Dallas, USA, International Journal of Information Security and Privacy, 4(2), 39-51, April-June 2010.

[8] Anup R. Nimje, "Cryptography In Cloud-Security Using DNA (Genetic) Techniques", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue5, pp.1358-1359, September- October 2012.

[9] Danish Jamil, Hassan Zaki, "Cloud Computing Security", International Journal of Engineering Science and Technology (IJEST).

[10] RachnaArora, AnshuParashar, "Secure User Data in Cloud Computing Using Encryption Algorithms", International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, www.ijera.com , Vol. 3, Issue 4, pp.1922-1926, Jul-Aug 2013.

[11] Li Dongjiang, Wang Yandan, Chen Hong, "The research on key generation in RSA public- key cryptosystem", Department of Computer Science, North China Electric Power University, Beijing, China, Fourth International Conference on Computational and Information Sciences 2012.

[12] Ahmed E. Youssef, ManalAlageel, "A Framework for Secure Cloud Computing", Dept. of Information Systems, King Saud University, Riyadh, 11543, KSA.

[13] Engr: Farhan Bashir Shaikh, SajjadHaider, "Security Threats in Cloud Computing", 6th International Conference on Internet Technology and Secured Transactions, 11-14 December 2011, Abu Dhabi, United Arab Emirates.

[14] Dr. P. Dinadayalan, S. Jegadeeswari, Dr. D. Gnanambigai, "Data Security Issues in Cloud Environment and Solutions", World Congress on Computing and Communication Technologies 2014.

[15] NatanAbolafya, Secure Documents Sharing System for Cloud Environments, Master of Science Thesis Stockholm, Sweden 2012.

[16] Abdullah Al Hasib, AbulAhsan Md. MahmudulHaque, "A Comparative Study of the Performance and Security Issues of AES and RSA Cryptography", Third International Conference on Convergence and Hybrid Information Technology, 2008.

[17] Cloud Security Alliance, (2009) Security Guidance for Critical Area of Focus in Cloud Computing V2.1. [Online]. Available: https://cloudsecurityalliance.org/csaguide.pdf , accessed on Feb 2012.