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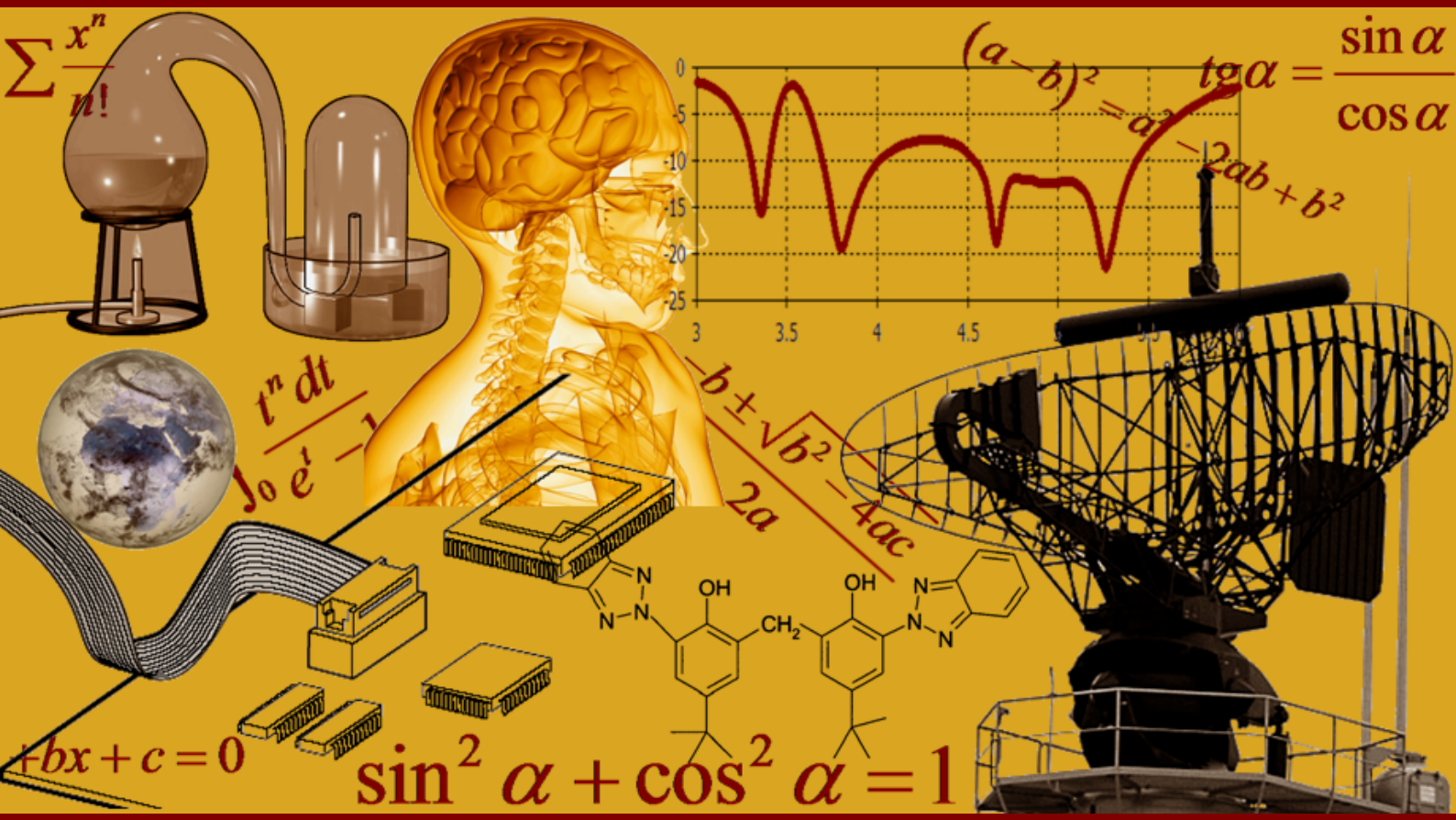

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A Novel Line Extraction Algorithm using 2D LiDAR for Ego-motion Estimation

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ABSTRACT: The paper proposes a convex hull-based algorithm for rapid line extraction from 2D LiDAR datas. It uses an algorithm to calculate feature points in LiDAR data frames. Geometric features contained in these feature points provide information for subsequent matching. Compared with traditional LiDAR matching algorithms, the algorithm is greatly improved in terms of iterations and matching precision. This algorithm finally was used to solve the ego-motion estimation of an indoor robot.

KEYWORDS: scan matching; feature extraction; mobile robot; ego-motion estimation

1 INTRODUCTION

1.1 MOTIVATION

Accurate estimation of motion parameters is important for the safety and task execution of intelligent robots [2]. Traditionally, robot ego-motion parameters are estimated in terms of speed, angle and position by means of an inertial sensor carried onboard. Inertial information is calculated from multiple integrals of parameters such as acceleration and angular velocity. These are easily affected by sensor errors, which are unbounded. Perceptual sensors, gathering information via systems such as LiDAR, are now widely used in intelligent robots to determine their position and motion.

1.2 PROBLEM DESCRIPTION

Computing the motion parameters of robots using LiDARs requires the transformation parameter, T , to be estimated by matching two frames of LiDAR data. Generally, two frames of data are represented by the model $\{\mathrm{m}_i\}_{i=1}^{N_m}$ and current data $\{S_i\}_{\mathrm{i}=1}^{N_s}$. Resolution of ego-motion parameters is a process of transforming $\{S_i\}_{\mathrm{i}=1}^{N_s}$ by using T to achieve the best alignment with $\{\mathrm{m}_i\}_{i=1}^{N_m}$.

If it is supposed that the robot is moving on a two-dimensional plane, Euclidean transformation of a three-dimensional parameter, $a=[\theta,t_x,t_y]$, is used to represent the motion parameter of the robot. The problem can be described as:

$$T(a;x)=T(\theta,t_x,t_y;X)=\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix}X+\begin{pmatrix}t_x\\ t_y\end{pmatrix} \tag{1}$$

The effect of alignment can be evaluated by an error function, which can be defined as:

$$\varepsilon^2(|X|)=||X||^2 \tag{2}$$

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The foundation of alignment is the correspondence between $\{m_i\}_{i=1}^{N_m}$ and $\{S_i\}_{i=1}^{N_s}$, which can be represented by $\phi(i)$, and so we can derive the error function：

$$E(a,\phi)=\sum_{i=1}^{N_d} w_i \varepsilon^2(|m_{\phi(i)}-T(a;s_i)|) \tag{3}$$

The parameter w_i represents the coincidence relation. It is set to 1 if there is a coincidence relation between points in the model, otherwise it is set to 0. We can see that $\phi(i)$ is also a parameter in the error equation, and generally we resolve the problem with iterative optimization. Specifically, we should resolve $\phi(i)$ on the basis of $\{m_i\}_{i=1}^{N_m}$ and $\{S_i\}_{i=1}^{N_s}$:

$$E(a)=\sum_{i=1}^{N_d} w_i \min_j \varepsilon^2(|m_j-T(a;s_i)|) \tag{4}$$

Then we calculate the ego-motion parameter $a=[\theta,t_x,t_y]$ on the basis of obtaining $\phi(i)$:

$$\hat{a}=\arg\min_a \sum_{i=1}^{N_d} w_i \min_j \varepsilon^2(|m_j-T(a;s_i)|) \tag{5}$$

1.3 RELATED RESEARCH

There has been extensive research on the estimation of ego-motion parameters derived from LiDAR systems. The Iterated Closest Point method (ICP) [1] put forward by Besl [3] and Zhang [4] is the most well-known. The ICP algorithm makes use of a nearest-neighbor search to solve the best coincidence relation for the current motion of the robot ($a=[\theta,t_x,t_y]$) in the process of computing $\phi(i)$. The method does not make use of the characteristics of the data itself, so it is easy to fall into a local minimum solution when the estimation of initial parameters is inaccurate. Another relatively well-known method is the NDT algorithm proposed by [5], which first meshes the data, then represents $\{m_i\}_{i=1}^{N_m}$ and $\{S_i\}_{i=1}^{N_s}$ with a multi-dimensional Gaussian distribution in each grid, and finally estimates ego-motion parameters using a method similar to ICP. Compared with ICP, the method performs feature extraction from raw data and has clear superiority in terms of operating speed. However, the size of the grid has a large influence on experimental effects and operating speed. Accuracy declines if the selected grid is too large, and the operating speed declines if the selected grid is too small. It is thought that ICP is a special case where the grid is very small in NDT. Due to the shortcomings in these raw data processing methods, much research on feature matching has subsequently been conducted.

1.4 MAIN CONTRIBUTIONS AND OUTLINE OF THIS PAPER

In this paper, a new feature extraction algorithm for 2D LiDAR sensing systems is proposed. Feature points within a single frame of LiDAR scanning data can be extracted online through linearization of LiDAR data. Because these feature points represent environmental information within a certain error range, they can be used to estimate the ego-motion parameters of robots.

This paper is structured as follows: Section Two reviews common linearization methods and compares their principles and effects. Section Three outlines the methods proposed in this paper and the steps required for their implementation. Firstly, a convex hull-based algorithm for rapid line extraction is described. Then, feature selection and feature association, based on linear portion segmentation results, are investigated. Finally, a nonlinear optimistic algorithm is derived to solve for ego-motion parameters. Section Four discusses the operating effects of linearization methods and the results of the solutions for ego-motion parameters.

2 PRIOR WORK

Many studies have been conducted on the image processing, data mining and 2D LiDAR sensing aspects of line extraction methods, which mainly involve the algorithms below:

The Split-and-Merge algorithm can be considered the oldest and most frequently used line segmentation method [6,7,8]. The algorithm has been used in image processing, feature detection and positioning, based on 2D LiDAR data. If the last point

of a line is selected, the algorithm is called Iterative-End-Point-Fit, and a linear portion can be obtained under a finite number of iterations through continuous segmentation.

The concept of an incremental algorithm [9], [10], [11] is very simple. Basically, new points are constantly added to a current straight-line model to see whether it continues to meet its line constraints. Straight-line models are generally calculated with the least square method, and criteria to identify whether it meets the line constraints are established from the maximum and total error distances between new points and the straight line. During actual implementation, to improve implementation efficiency, n points are added to the current straight line model, and will continue to be added as long as it meets the constraints. The n points added should be eliminated if the straight-line model constraints are exceeded, and should be added one by one.

The RANSANC [13] algorithm is not only used in line detection, but also widely used for the detection of various models in the field of computer image processing. The basic concept is to select several points of concentrated objects to construct the model, then detect which points belong to the model and which do not. Points that belong to the model are called interior points, and those do not are called exterior points. Interior points are used to calculate the model. If there are sufficient exterior points, one should continue to carry out these steps. The RANSANC approach was initially used in the construction of environmental maps and for robot positioning based on the processing of LiDAR data [12].

The Hough transform algorithm was initially used for line detection in images and was extended to detect various shapes including circles, ellipses and even non-parametric contours. The biggest difficulty of the Hough variation method lies in selecting a suitable parameter scale. Smaller parameter resolutions result in increased parameter space, which not only increases the calculated amount, but also generates false targets due to decentralized voting. The Hough variation method is mainly used in the processing of 2D LiDAR data, and map building [14], [15].

3 APPROACH

3.1 CONVEX HULL-BASED ALGORITHM FOR RAPID LINE EXTRACTION

This paper proposes a new algorithm for line extraction, which calculates the convex hull (CH) of data from a segment of discrete points. It surrounds the convex hull with two parallel linear portions. The two parallel lines obtained are linear portions to be solved. See the schematic diagram in Fig. 1.

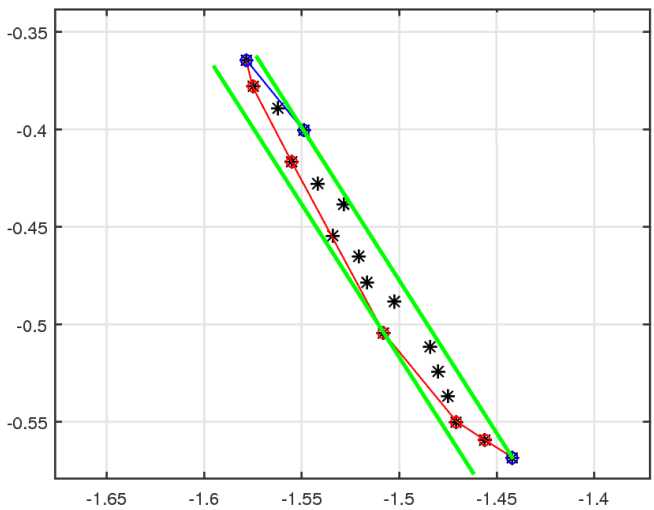


Fig. 1. schematic diagram of a convex hull

The black asterisks in Fig. 1 represent the original sampling points. The red line represents the outer contour of the data point set. The blue line (partly shaded) represents the inner contour, and the green lines represent the two extracted parallel line segments. The inner and outer contours represent contours far from, and near, the LiDAR. It can be seen from the schematic diagram that all original sampling points are distributed between the two parallel lines which tightly clamp them to achieve an efficient representation of discrete sequence points.

The classic convex hull algorithm is mainly used for convex hull solutions, and is not used much anymore. The new convex hull algorithm uses the extensions of a point-adding method and a divide-and-conquer algorithm. The divide-and-conquer algorithm, also known as QUICK-HULL (QH), is widely used in the calculation of two-dimensional and three-dimensional convex hulls. Many scholars hope to use parallel computing methods to improve the calculation speeds of convex hulls. The consolidation method in [16] can be used for parallel calculation of 2D and 3D convex hulls. In terms of data structure, the sub-results can be recorded with decision trees [17]. The parallel algorithm mentioned in [18] has reduced the complexity to $O(\log n)$, and extended its application from 2D to 3D.

LiDAR data is ordered in the direction of θ; therefore, the sorting process of the classical algorithm above is not needed. The contour furthest from the LiDAR is defined as the outer contour of the convex hull: H_{out}, and the one closest to the LiDAR is defined as the inner contour: H_{in}. Every time a new scanning point appears, it can be identified as belonging to $CH[P]$ or not. The convex hull algorithm for computing the complexity, $O(n)$, can be obtained by using the "turning right" characteristics of classical convex hull algorithms which do not need parallelization, and each scanning point needs to be calculated once. At the same time, in the process of calculating the convex hull, the linear portion to be solved can be calculated online. The algorithm is as follows:

Algorithm：Line detection algorithm based CH

Input：Point set $\{P_i\}_{i=1}^{N}$, $Dis_{Threshold}$

Output: $\{DP_i\}$

Initialization: $DP_1 = P_1$, $cnt = 1$

While $i \le N$

  Update convex hull, after add P_i to current point set；

  Calculate the width of convex hull: $Width_{CH} = Dis(H_{in}, H_{out})$

  If $Width_{CH} > Dis_{\text{Threshold}}$

    $cnt = cnt + 1$

    $DP_{cnt} = P_i$

End

The implementation process is demonstrated in Fig. 2.

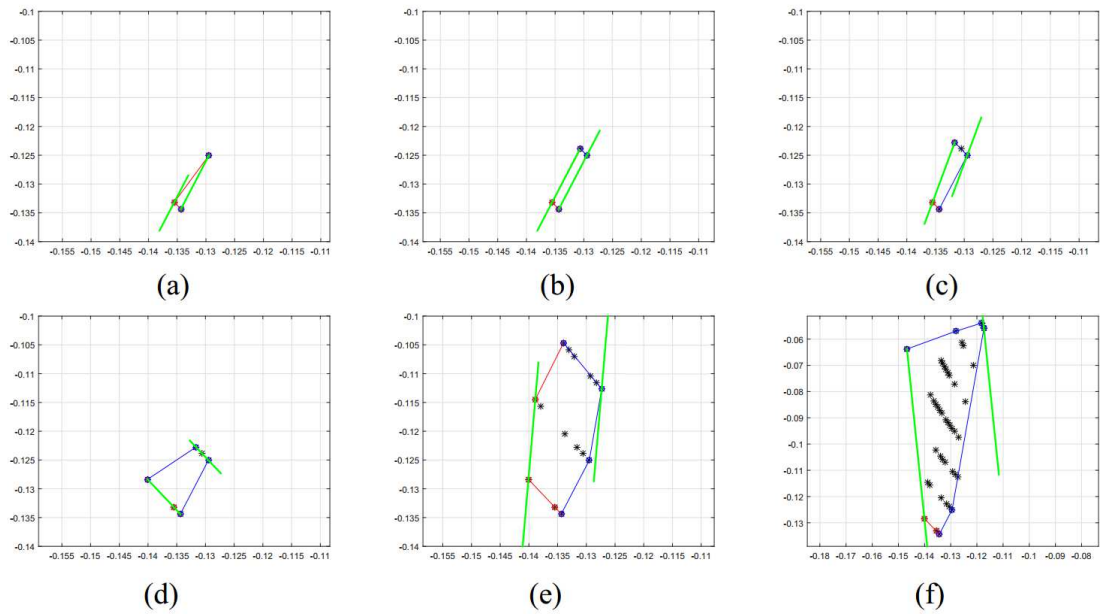


Fig. 2. process of a convex hull

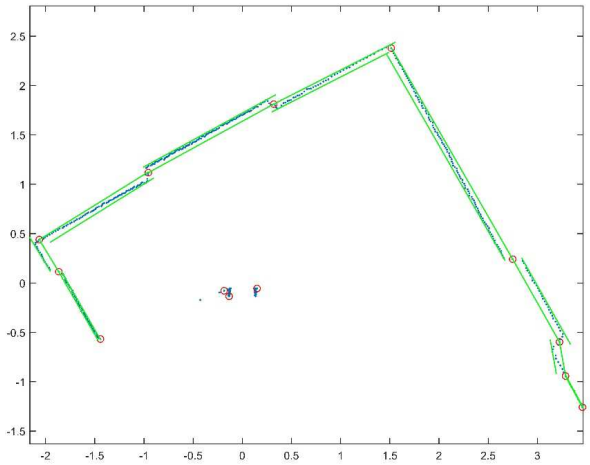


Fig. 3. result of our algorithm

Fig. 3 shows the results of our algorithm. The red points represent the spatial information of the environment.

3.2 FEATURE SELECTION

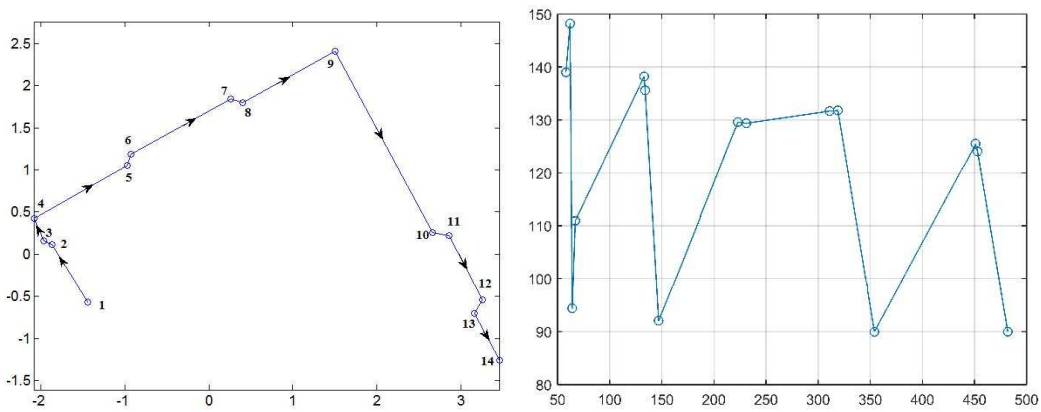
The convex hull-based 2D LiDAR data rapid line extraction algorithm proposed above can use two types of image features, i.e., linear portions and dominant points (Fig. 3). As the dominant point is the end point of a linear portion, the dominant point information represents the linear portion information completely. Accordingly, this paper will use dominant points to estimate robot ego-motion parameters.

After extracting the dominant point from the sequence point cloud, the dominant point is seen to be ordered and directional. That is, the dominant point is extracted clockwise and stored according to the extraction sequence, as shown in Fig. 4 (a). In order to take advantage of the special characteristics of the dominant point, the most intuitive feature is the angle between the two consecutive lines. Three adjacent dominant points constitute the angle θ.

The angle θ formed by the three dominant points can be easily obtained by using the law of cosines:

$$\theta = \mathrm{acos}\left(\frac{\overrightarrow{l_{ij}} \cdot \overrightarrow{l_{jk}}}{\left\| \overrightarrow{l_{ij}} \right\| \left\| \overrightarrow{l_{jk}} \right\|} \right) \tag{6}$$

Obviously the characteristic angle has rotation invariance, translation invariance and scale invariance. Fig. 4(b) shows the characteristic angle of the corresponding dominant points.



(a) (b)

Fig. 4. characteristic angle

Besides, the discrete curvature of the feature points can be selected as a feature, and can be calculated according to the method defined in [16]. That is, take the circle with P_i, P_j and P_k on it to approximate the osculating circle with P_k on it on the curve segment. As the radius of the circle represents the radius of curvature, the computing formula is as follows:

Assume that:

$$\begin{cases} s_1 = length(l_{ij}) \\ s_2 = length(l_{jk}) \\ s_3 = length(l_{ik}) \end{cases} \tag{7}$$

then,

$$\gamma = \frac{s_1 s_2 s_3}{\sqrt{(s_1+s_2+s_3)(-s_1+s_2+s_3)(s_1-s_2+s_3)(s_1+s_2-s_3)}} \tag{8}$$

Fig. 5 is the discrete curvature of the corresponding dominant points in Fig. 4.

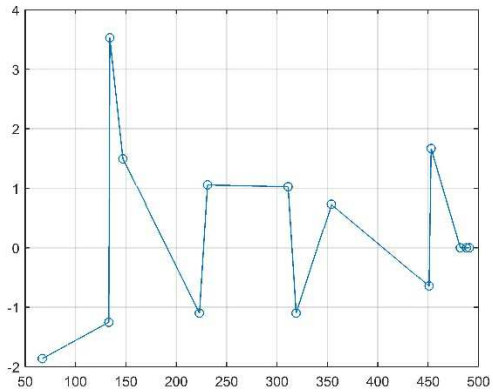


Fig. 5. discrete curvature

3.3 FEATURE ASSOCIATION

Assume that the feature points calculated in each frame data are static. Then, the relative motion of feature points between frames can be used to calculate the ego-motion parameters of a robot. So, it is very important to match the feature points from different frames. Feature data matching is usually based on the feature information contained in feature data, and the distances between feature points. Feature point matching is also known as data association, and has shown much promise for the navigation and positioning of robots. Common methods include threshold filtering, near neighbor data association, probability data association and multidimensional assignment data association. In this paper, multidimensional data iterative association [19] has been used.

The feature points proposed in the paper include the four-dimensional characteristic quantities of x, y, included angle θ, and discrete curvature γ. Together they constitute the characteristic quantity of a feature point: $[x, y, \theta, \gamma]'$

The weighted distance between two feature vectors can be defined as follows:

$$Dis_{ij} = \sqrt{w_1(x_i - x_j)^2 + w_2(y_i - y_j)^2 + w_3(\theta_i - \theta_j)^2 + w_4(\gamma_i - \gamma_j)^2} \tag{9}$$

Following the idea of the threshold method, if Dis_{ij} is less than a certain threshold, it is thought that a data association is established. However, due to the existence of sensor noise, the feature points between the two frames do not match perfectly, we use fractional correlation method for data association. Firstly, make use of data features which can be associated to solve the ego-motion parameters, and then transform current feature points to the coordinate system of a previous time for data association. After transformation, the feature points are much closer to the feature points to be matched, and are easily matched.

3.4 EGO-MOTION PARAMETER SOLUTION

After the feature association process, the correspondence function, ϕ_i , from Equation 5 has been solved. The solution to Equation 5 is actually the solution to the unconstrained optimization problem.

For non-linear unconstrained optimization problems [20], three methods are typically used, i.e. the quasi-Newton method, simplex search and non-linear least squares fit. This paper uses the quasi-Newton method. When using the quasi-Newton method to compute a partial derivative, the search direction is the decline direction of the function value. Through second-order Hesse matrices do not necessarily to be positive definite, the approximate Hesse matrices should be calculated, and Hesse matrices need not to be re-calculated in the iteration. Because the approximate Hesse matrices can be updated, the calculation is faster.

4 RESULTS

We constructed an experimental system with a Pioneer mobile robot and SICK 511 LiDAR. We then tested the method proposed in this paper in an indoor environment. The experimental results are shown below:

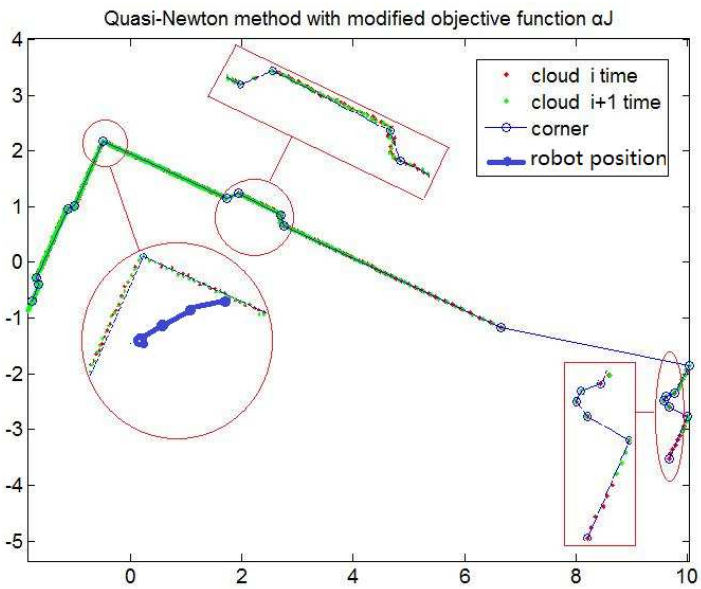


Fig. 6. matching result

It can be seen from Fig. 6 that that method our proposed method accurately calculates the robot's ego-motion. The accuracy is an improvement on the traditional ICP method.

5 CONCLUSIONS

The paper formulated a new line extraction algorithm that selects feature points from 2D LiDAR images. It solves the ego-motion parameters of an indoor mobile robot following a quasi-Newton method. This method calculates information from feature points and performs data association between frames. Experimental results show that the proposed method is superior to the commonly-used ICP algorithm, in both implementation efficiency and effect.

REFERENCES

[1] S Rusinkiewicz, Levoy M. “Efficient variants of the ICP algorithm”. *IEEE Computer Society*, 2001.

[2] M Dissanayake, P Newman, et al. “A solution to the simultaneous localisation and map building (SLAM) problem”. *IEEE Transactions on Robotics & Automation*, 17(3):229--241, 2001.

[3] P J Besl, N D Mckay. “Method for registration of 3-D shapes”. *IEEE Transactions on Pattern Analysis & Machine Intelligence*, 14(2):239-256, 1992.

[4] Z Zhang. “Iterative point matching for registration of free-form curves and surfaces”. *International Journal of Computer Vision*, 13(2):119-152, 1992.
[5] M Martin, L Achim, D Tom. “Scan Registration for Autonomous Mining Vehicles Using 3D-NDT”[J]. *Journal of Field Robotics*, 24(10):803-827, 2007.
[6] G A Borges, M J Aldon. “Line Extraction in 2D Range Images for Mobile Robotics”. *Journal of Intelligent & Robotic Systems*, 40(3):267-297, 2004.
[7] J Castellanos, J Tardos. “Laser-Based Segmentation and Localization for a Mobile Robot”. *Robotics & Manufacturing: Recent Trends in Research & Applications*. 2014:4.
[8] Einsele, Tobias. “Real-Time Self-Localization in Unknown Indoor Environments using a Panorama Laser Range Finder”. *International Conference on Intelligent Robots and Systems*. 1997:697-702 vol.2.
[9] A Siadat, S Klausmann. “An Optimized Segmentation Method For A 2d Laser-Scanner Applied To Mobile Robot Navigation”. 1999.
[10] D A Forsyth, J Ponce. *Computer Vision: A Modern Approach*. Prentice Hall Professional Technical Reference, 2002.
[11] R M Taylor, P J Probert. “Range finding and feature extraction by segmentation of images for mobile robot navigation”. *IEEE International Conference on Robotics and Automation*, 1996. Proceedings. 1996:95 - 100.
[12] J Vandorpe, H Van Brussel, H Xu. “Exact dynamic map building for a mobile robot using geometrical primitives produced by a 2D range finder”. *IEEE International Conference on Robotics and Automation*, 1996. Proceedings. 1996:901-908 vol.1.
[13] C A C Mach. “Random Sample Consensus: a paradigm for model fitting with application to image analysis and automated cartography”. 1981.
[14] P Jensfelt, H I Christensen. “Laser Based Position Acquisition and Tracking in an Indoor Environment”. *Proc.int.symp.robotics & Automation*, 1998.
[15] S T Pfister, S I Roumeliotis, Burdick J W. “Weighted line fitting algorithms for mobile robot map building and efficient data representation”. 1:1304-1311 vol.1, 2003.
[16] M De Berg, M Van Kreveld, M Overmars, et al. Computational geometry: algorithms and applications. Library Philosophy & Practice, 2008, 2011(1):333-334.
[17] C B Barber, D P Dobkin, H Huhdanpaa. “The quickhull algorithm for convex hulls”. *Acm Transactions on Mathematical Software*, 22(4):469-483, 1996.
[18] F P Preparata, S J Hong. “Convex hulls of finite sets of points in two and three dimensions”. *Communications of the Acm*, 20(2):87-93, 1977.
[19] W S Wijesoma, L D L Perera, Adams M D. “Toward multidimensional assignment data association in robot localization and mapping”. *IEEE Transactions on Robotics*, 22(2):350-365, 2006.
[20] L E Scales. *Introduction to Non-Linear Optimization*. Maemillan, 1985.

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Ecosystem Services of the World Largest Mangrove Forest Sundarban in Bangladesh

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ABSTRACT: Sundarban is the largest productive contiguous mangrove forest in the world, located in the south-western part of Bangladesh. UNESCO declared three wildlife Sanctuaries of the Sundarban as 522nd World Heritage Site in 1997. The unique and a house of diverse biodiversity of the Sundarban is not just a good to be conserved for its intrinsic value, but has a critical role in ecosystem processes that provide essential services to the country and the community living nearby. Species level traits were found to benefit a number of ecosystem services, with species abundance being particularly important for pest regulation, pollination and recreation, and species richness for timber production and freshwater fishing. It is also the hub of natural resources and beauties with several types of tourist destination which may be used as a potential tool for sustainable ecotourism promotion in future aiming one hand to protect the natural environment and cultural diversity, and on the other hand, generating a source of revenue for the local people without harming the nature. A new paradigm of management should look forward to considering climate change, ecological integrity, sustainable harvesting and ensuring continuity of the ecosystem services of the Sundarban. This paper, therefore, attempts to examine ecosystem services of the selected sites of the Sundarban in context of exploring their sustainable uses for both enhancing livelihood and promoting ecotourism.

KEYWORDS: Sundarban, Mangrove, Ecosystem, Ecosystem services, Ecotourism, World Heritage.

1 INTRODUCTION

The significance and value of ecosystem services for human well-being is well known. Among the different ecosystem in the world, mangroves ecosystems, lying along the coastlines in the tropics and subtropics, provide a number of ecosystem services such as provisioning services (e.g. typical forest products, food), cultural services (e.g. tourism, worship, educational research), regulatory services (e.g. protection from cyclones and storm surges, climate regulation, pollination) and supporting services (e.g. nursery ground of Fish, nutrient cycling, habitat of biodiversity) [1]. However, the ecosystem services concept is used to focus on management of natural assets for their values to wellbeing and the complex inter linkages of ecosystem processes for designing adaptive management strategies [2]. Likewise other Reserve Forests in the world, the world's largest mangroves, the Sundarban, covering 6000 km^2 in Bangladesh provides a variety of ecosystem services [3]. It is a unique mangrove ecosystem of considerable ecological and real contributions not only to the local and national economy but also the forest dependent livelihoods are greatly influenced by this mangrove forest. However, the Sundarban, covering about one million hectare in the delta of the rivers *Ganga*, *Brahmaputra* and *Meghna* is shared between Bangladesh (~60 %) and India (~40 %), and is the world's largest coastal wetland. The 'Sundarban Reserve Forest' (SRF) of Bangladesh part houses 300 species of flora and 425 species of fauna [4] including 291 fish species. Royal Bengal Tiger (*Panthera tigress*) is the iconic flagship species of this forest. More than 3.5 million people living around the Sundarban are directly or indirectly dependent on the ecosystem services of the forest [5]. But unfortunately, the Sundarban is to be threatened by a growing human

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population that not habitat of many rare and endangered animals especially the Royal Bengal tiger. Other species like Javan rhino, wild buffalo, hog deer, and barking deer are now extinct from the area. Large areas of the Sundarban mangroves have been converted into paddy fields over the past two centuries, and more recently into shrimp farms. But having the world's densest population, like Bangladesh, it is difficult to protect the flora and fauna unless there are economic benefits to the country as well as to the local people [6]. However, a mangrove is often considered a way to minimize losses incurred from their decline and to provide additional services to coastal communities.

There is an increasing trend to integrate ecosystem service arguments within the management plans and strategies of protected areas [7] as well as the wider landscape. However, ecosystem service-related argumentation is not undisputed [8]. Much recent works have focused on functional relationships between biodiversity and ecosystem services. In addition to a number of broader scale syntheses [9], some studies have tended to examine a small selection or individual ecosystem services [10] with few spanning multiple ecosystems [11]. Elsewhere researches showed to be useful in identifying specific links between species, ecosystem processes and ecosystem service delivery [12] [13] and can demonstrate the complexity of processes and interactions which occur in ecosystems [14] [15]. Therefore, the importance of further research is deemed essential to understand how different services interact with each other which can be critical in mediating the delivery of other services. Taking this notion, the present study explore the ecosystem services of the selected sites of the Sundarban in context of their sustainable uses in promoting wellbeing of the surrounding community, biodiversity conservation and ecotourism development. Therefore, the objectives of the study were basically in twofold; at first to identify the different ecosystem services in the selected sites of the Mangrove Forest Sundarban, and secondly to find out the major characteristics of identified ecosystem services.

2 THE SUNDARBAN

The Sundarban comprises essentially of numerous islands formed by the sediments deposited by three major rivers, the Ganga, Brahmaputra and the Meghna, and a dense network of smaller rivers, channels and creeks (Figure 1). The maximum elevation within the Sundarban is only 10 m above the mean sea level. The mangroves are the dominant geomorphic agent in the evolution of tidal shoals and their accretion to the main landmass. A new Khulna Forest Circle to preserve the forest was created in 1993 and a Conservator of Forests has been posted. The basic unit of management is the compartment. There are 55 compartments in four Forest Ranges and these are clearly demarcated mainly by natural features such as rives, canals and creeks. There are three wildlife sanctuaries established in 1977 under the Bangladesh Wildlife (Preservation) Order, 1973 (P.O. 23 of 1973):

2.1 EAST WILDLIFE SANCTUARY

Extends over an area of 31,227 ha. Freshwater and Sundri (*Heritierafomes*) dominated interspersed with Gewa (*Excoecariaagallocha*), Passur (*Xylocarpusmekongensis*) with Kankra (*Bruguieragymnorrhiza*) occurring in areas subject to more frequent flooding. There is an understory of Shingra (*Cynometraramiflora*) where soils are drier and Amur (*Amooracucullata*) in wetter areas and Goran (*Ceriopsdecandra*) in more saline places.

2.2 SOUTH WILDLIFE SANCTUARY

Extends over an area of 36,970 ha. where Gewa is the dominant woody species. It is often mixed with Sundri. It is also frequently associated with a dense understory of Goran and sometimes Passur.

2.3 WEST WILDLIFE SANCTUARY

Extends over an area of 71,502 ha. includes areas which support sparse Gewa and dense stands of Goran and discontinuous patches of Hantal palm (*Phoenix paludosa*) on drier ground and river banks and levees.

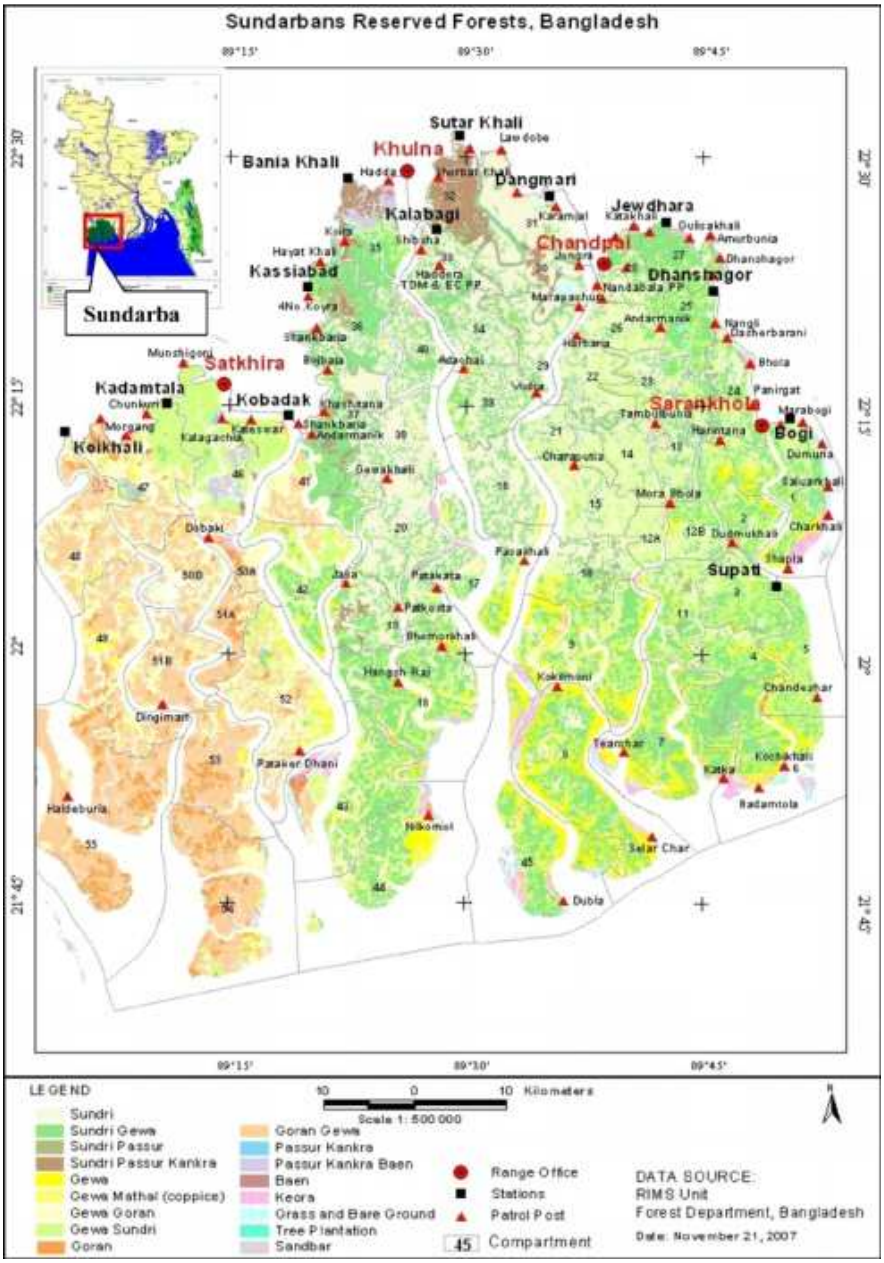

Fig 1. Location of the Sundarban Reserve Forest, Bangladesh (Source: Bangladesh Forest Department)

3 MATERIALS AND METHODS

This research employed mix method approach of both quantitative and qualitative methods and data. Ecosystem services indicators have been selected based on the study framework, data availability, measurability and current environmental concerns. A one month long field survey was conducted in three sanctuaries of the Sundarban (figure 1) in the winter period in January 2016 as this time is best for going very inside in the Sundarban. Data was collected through direct observation, photograph taking, and formal and informal discussion on the community mainly from the people whose livelihood are completely depended on different provided ecosystem services of the Sundarban. Formal discussions were also carried out with the officials of the Forest whose long experiences provided excellent insights of the raised issues of this research. Data were analyzed to prepare the list of ecosystem services along with uses and their potentiality.

4 RESULTS AND DISCUSSION

Millennium Ecosystem Assessment (2005) [16] defines ecosystem services as benefits people obtain from ecosystems. Ecosystem components include resources such as surface waters, oceans, soils, flora and fauna, etc. Ecosystem process and functions are the biological, chemical and physical interactions between ecosystem components. As stated earlier that ecosystems provide four types of potential services such as supporting services, provisioning services, regulating services, and cultural services [17], therefore, this study examined the ecosystem services on top of that classification. However, economic valuation of the provisioning services of the Sundarban has been considered for the services got by the community in general and also in exceptional cases from the forest. The observed ecosystem services found in the selected sites of the Sundarban is given in Figure 2.

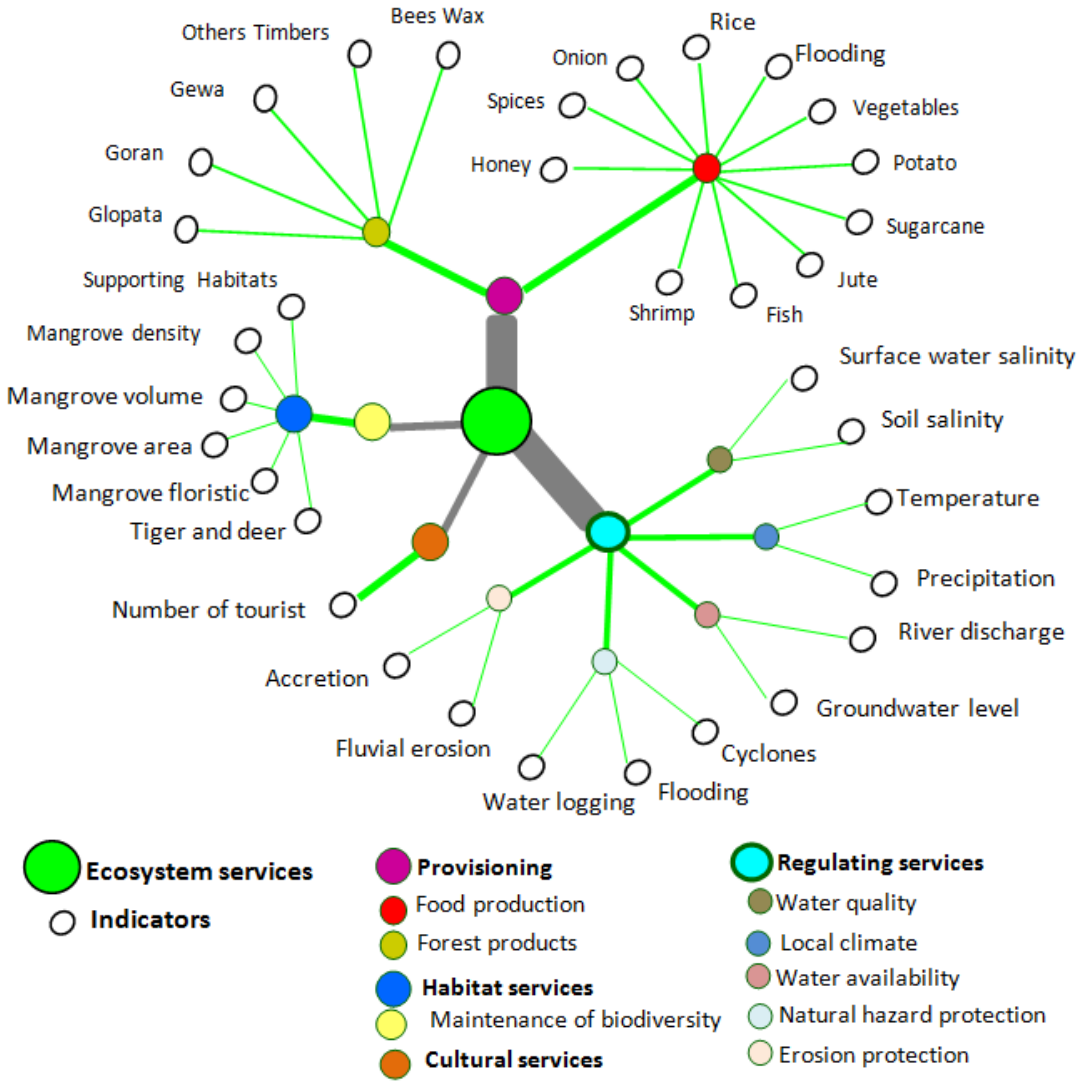

Figure 2: Ecosystem services of study area

The list of ecosystem services and their major functions and characteristics are given in Table 1. Major provisioning services of Sundarban were timber, fish, thatching materials, fuel wood, crab as well as honey and wax. Bangladesh forest department collects revenue from peoples harvesting those products. It was found from forest officials that the total revenue collection slightly decreased from Sundarban over the last few years, mostly from timber and fuel wood. However, revenue from fish, dry fish and thatching materials were increased over the period. The forest officials stated that annual extractions of thatching materials fluctuated very much in recent years and the revenue collection from thatching materials sharply increased in 2010-15. In recent years, crab collection has been increasing due to high market price. A number of crab

collectors, mainly nearby community people including women and children are involved with crab collection in the muddy areas. As a result annual revenue from crab has increased. Increasing number of crab collectors ultimately showed how the livelihoods dependent on the ecosystem services of the Sundarban. Revenue from honey and wax remained the same over the years.

Table 1. The different ecosystem services function in study area

Ecosystem Function Category	Ecosystem Service Function	Major Characteristics of Ecosystem Services in Sundarban
Provisioning Services	Food and fiber	Food products derived from plants, animals, and microbes
	Fuel	Wood and other biological materials serve as sources of energy
	Provision of Shade and Shelter	Related to vegetation those used for shade and shelter like *Golpata*
	Genetic resources	Many places are used for animal and plant breeding
	Pharmacological Resources	Natural materials used to maintain improve health
	Natural medicines	Many biocides, food additives such as alginates, and biological materials
	Ornamental resources	Animal products, such as skins and shells, and flowers are used as ornaments, although the value of these resources is often culturally determined
	Fresh water	Fresh water is another example of linkages between provisioning and regulating services
	River Transport	River is used for transporting and connecting place and people
Regulating Services	Gas Regulation	Influencing many aspects of air quality,
	Climate regulation	Ecosystems influence climate. At the global scale, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
	Water regulation	The timing and magnitude of runoff, flooding, and aquifer recharge are strongly related
	Erosion control	Vegetative cover plays an important role in soil retention
	Water purification and waste treatment	Sundarban is a source of impurities in fresh water but also can help to filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems.
	Pollination	Ecosystem changes affect the distribution, abundance, and effectiveness of pollinators
	Soil Retention	Minimizing soil loss through having adequate vegetation cover, root biomass, retaining rock and soil biota.
	Nutrient Regulation	The Sunderban is works as transportation, storage and recycling of nutrients.
	Storm protection	The presence of coastal ecosystems such as mangroves and coral reefs can dramatically reduce the damage caused by hurricanes or large waves
	Spiritual and religious values	The diversity of ecosystems is one factor influencing the tourists. Many religious and festival are now occurring here. Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem. Ecosystems influence the types of knowledge systems developed by the learners.
	Educational values	
	Aesthetic values	
	Recreation and ecotourism	
	Cultural heritage values	
Supporting Services	Supporting Habitats	Preservation of natural and semi natural ecosystems as suitable living space for wild biotic communities and individual species.
	Soil Formation	The transportation and accumulation of inorganic and organic matter in the surface through tide, litter fall etc.

Source: Field survey and Literature review

Sundarbans has vital role in protecting coastal communities. As the coastal areas of Bangladesh are very prone to natural calamities like cyclone and tidal surges, the Sundarban is reducing damage of properties and lives of coastal communities

from cyclone, tidal surges and other natural disasters. For example, the cyclone that blown over non-Sundarbans (Chittagong, Bangladesh) area on November 12, 1970 had a speed of 224 Km per hour and had a death toll of 0.5 million lives. On the other hand, another cyclone 'SIDR' had a speed of 210 to 230 Km per hour and crossed Sundarban (Khulna, Bangladesh) first and then passed over the human habitations on November 15, 2007, had a death toll of 3363 human lives. Though it is very difficult to estimate the protective value of the mangrove forests it could be easily realized its great protective services. Along with other services, cultural services of the Sundarban include tourism, education, and world heritage site, ethnic festivals, and worship by local people. All these cultural services could not be valued in monetary term. However, growing tourism in Sundarban can be the indicator of the importance of cultural services of Sundarbans. There are some special events and festivals that annually are celebrated in Sundarban and they have the potential to attract tourists. Some important attractions in Sundarban are river cruising, fishing, beach relaxation, walking, bird watching, jungle trails, wildlife watching, dolphin watching, boat trip experiences etc. Being part of the World Heritage Site as well as for unique and diversified ecosystem, Sundarbans is also attractive for international communities.

5 CONCLUSION

The Sundarban is internationally recognized as heritage site for many years could be the easy getaway for the economic development of Bangladesh. From the above discussion this paper argued that the value of diversified ecosystem services of the Sunderban is very much important for the country for its economic uplifts and environmental sustainability. However, as from the observation and also from formal and informal discussions with the community and forest officials it was found that the ecosystem services are now under threat due to anthropogenic influences and climate change impacts on natural resources, therefore, an urgent policy should be taken by the concern authority for its protection and simultaneously to take the benefits from the services these are provided by the Sundarban. As the cultural service has a great potentiality for promoting ecotourism, the country has to focus particularly on this issue in urgent context as it may be an important driving force in a socio-economic growth for the country. Finally this paper concludes that ecosystem services of the Sundarban can be a basis for sustainable development by integrating our natural resources for people and for nature with a growing population and hence an ever-increasing demand for the people.

REFERENCES

[1] Walters, B.B., Rönnbäck, P., Kovacs, J.M., Croma, B., Hussain, S.A., Badola, R., Primavera, J. H., Barbier, E., Dahdouh-Guebas, F., *Ethnobiology, socio-economics and management of mangrove forests: a review.* Aquatic Botany 89, 220–236. 2008.

[2] Hossain MS, Hein L, Rip F, Dearing J .*Integrating ecosystem services and climate change responses in coastal wetlands developments plans for Bangladesh. Mitig Adapt Strat Glob Change.*doi:10.1007/s11027-013-9489-4. 2013.

[3] Uddin MN, HaqueA ., *Salinity response in southwest coastal region of Bangladesh due to hydraulic and hydrological parameters.* Int J Sustain AgricTechnol 6(3):01–07. 2010.

[4] Biswas, S.R., Choudhury, J.K., Nishat, A., Rahman, M. *Do invasive plants threaten the Sundarbans mangrove forest of Bangladesh?* Forest Ecology and Management 245: 1-9, 2007.

[5] Giri, C., Pengra, B., Zhu, Z., Singh, A., Tieszen, L.L. *Monitoring mangrove forest dynamics of the Sundarbans in Bangladesh and India using multi-temporal satellite data from 1973 to 2000.* Estuarine, coastal and shelf science 73: 91-100. 2007.

[6] de Groot, R.S.,Wilson, M.A., Boumans, R.M.J., *A typology for the classification, description and valuation of ecosystem functions, goods and services.* Ecol. Econ. 41, 393–408, 2002.

[7] García-Mora, M.R., Montes, C., ANþ20.*El desafío de la gestión de los espaciosnaturales de Andalucía en el siglo XXI*, Consejería de MedioAmbiente, Junta de Andalucía, España., 2011.

[8] Schröter, M., van der Zanden, E.H., van Oudenhoven, A.P.E., Remme, R.P., Serna-Chavez, H.M., de Groot, R.S., Opdam, P.,.*Ecosystem services as a contested concept: a synthesis of critique and counter-arguments.* Conserv. Lett., http://dx.doi.org/10.1111/conl.12091. 2014

[9] Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., *The value of the world's ecosystem services and natural capital.* Nature 387, 253–260, 1997.

[10] Luck, G.W., Harrington,R., Harrison,P.A., Kremen,C., Berry,P.M., Bugter,R., Dawson,T.P.,deBello,F.,Dia,S., Feld,C.K., Haslett,J.R., Hering,D., Kontogianni,A., Lavorel,S., Rounsevell, M., Samways,M.J., Sandin,L., Settele,J., Sykes,M.T., VandeHove,S., Vandewalle, M., Zobel, M.*, Quantifying the contribution of organisms to the provision of ecosystem services*. BioScience 59 (3), 223–235. 2009.

[11] Bastian, O., *The role of biodiversity in supporting ecosystem services in Natura 2000 sites*. Ecol. Indic. 24, 13–22, 2013.
[12] Lavorel, S., *Plant functional effects on ecosystem services*. J. Ecol. 101 (1), 4–8. 2013.
[13] Luck, G.W., Lavorel, S., McIntyre, S., Lumb, K., *Improving the application of vertebrate trait-based frameworks to the study of ecosystem services*.J. Anim. Ecol. 81 (5), 1065–1076. 2012.
[14] Fagan, K.C., Pywell, R.F., Bullock, J.M., Marrs, R.H., *Do restored calcareous grasslands on former arable fields resemble ancient targets? The effect of time methods and environment on outcomes*.J. Appl. Ecol. 45, 1293–1303, http://dx.doi.org/10.1111/j.1365-2664.2008.01492.x., 2008.
[15] Gaston, K.J., *Global patterns in biodiversity*. Nature 405, 220–227, 2000.
[16] M A .,*Ecosystems and human well-being: a framework for assessment*. Millennium ecosystem assessment. Island Press, Washington. 2005.
[17] Fisher, B., Turner, R.K., Morling, P., *Defining and classifying ecosystem services for decision-making*. Ecological Economics 68: 643653. http://www.cserge.ac.uk/sites/default/files/edm_2007_04.pdf., 2009.

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INFLUENCE OF QUALITY MANAGEMENT PRACTICES ON SUCCESSFUL COMPLETION OF BUILDING CONTRUCTION PROJECTS IN NAKURU TOWN, KENYA

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ABSTRACT: This study aimed at examining the quality management practices of building contractors in Nakuru town and how these practices influence successful completion of projects. The study utilized the descriptive survey design where a sample of 107 building contractors was selected from the target population of 335 National Construction Authority registered building contractors in Nakuru town using the proportionate stratified sampling method. Data was collected from the selected companies using structured questionnaires, and analyzed using both descriptive and the multiple linear regression technique. Results revealed that all the four components of quality management have a statistically significant and positive relationship with successful completion of building construction projects in Nakuru town. The study recommended that building construction firm invest in quality management especially quality improvement in order to increase their rate of project completion success. Policy makers should also introduce quality management courses in the training curricular of key construction workers such as engineers and project managers so as to improve the implementation of construction projects.

KEYWORDS: National Construction Authority (NCA), Quality Management Practices (QMP), Construction.

1 INTRODUCTION

Quality management is one of the knowledge areas in project management. It is a discipline that seeks to ensure that the outcomes and benefits of projects are fit for purpose and meet requirements (Project Management Institute, 2013). Quality management has four main components: quality planning, quality assurance, quality control, and quality improvement.

The building and construction industry is one of the key pillars of the Kenyan economy. According to Macharia (2015), this industry grew by 13.1 % in 2014 fueled by steady expansion in real estate sector and the commissioning of massive infrastructure projects. This industry contributed to 4.8% of the Kenya GDP, a rate that translate to Kshs. 5.36 trillion. This growth was reflected in cement consumption trends which increased to 5,197 thousand tones in 2014 from 1,726 thousand tones in 2006 (Kenya National Bureau of Statistics, 2015). Loans and advances by commercial banks to this sector also increase from Kshs. 70.8 billion to Kshs. 80.4 billion between 2013 and 2014. The value of private building plans was in Nairobi alone was estimated Kshs. 205.4 billion while the value of completed building stood at Kshs. 59.1 billion. Workers in this sector received an average monthly wage of Kshs. 45,743.

The building construction industry in Kenya has, however, been bedeviled by various issues. A significant problem entails safety violation associated with the use of substandard building materials, failure to observe protocols, and erecting buildings in unsafe sites. This problem has been illustrated by the collapse of several buildings across the country including the sunbeam building, Nyamakima building, and most recently, the Huruma building that claimed over 40 lives (Wawira, 2016; Mathenge, 2012). The National Construction Authority (NCA) claims that it has shut down over 500 construction sites countrywide due to safety violation with 204 buildings in Nairobi set to be demolished in Nairobi (Otieno & Ogutu, 2016). Although necessary, the action taken by NCA is bound to have significant consequences to contractors and their clients including massive financial losses and potential lawsuits.

A report by Orwa (2009) stated that Nakuru soils are unstable due to fault lines and escarpments. In 2008, there was appearance of large fault line across Mai mahiu road near Longonot creating a gaping hole caused massive traffic jam on the road and also destroyed farms and houses. Due to unstable soil in Nakuru town, the town council ruled limiting construction to not more than seven floors since some area in Nakuru lie on the fault line while others lie on the escarpment. But still some developers have ignored that. There have been a few cases of buildings collapsing while still under construction, for example, Uchumi supermarket in Nakuru east sub-County collapsed while it was still under construction, a residential flat also collapsed 7 years ago, in shabaab estate when it was already occupied likely no tenant was injured. Therefore the ongoing constructions in Nakuru are seriously supervised by the county engineers, planners, health departments and the National Environment Management Agency to make sure all the laid procedures and laws are followed to the latter.

1.1 Significance of the Study

Findings of the study was expected to be beneficial at policy level as they will highlight quality management components and practices that have a significant influence on project implementation success. This knowledge will guide policy makers in establishing training programs and curriculum for engineers, project managers, technical managers, architects, and quantity surveyors. It has also provide evidence for guiding the formulation of rules and regulations for governing quality issues in the building construction industry.

Findings were also expected to be beneficial to contractors and building companies as they highlight components and practices to which they need to pay attention when it comes to the management of the quality of their projects. The study highlights best practices that the contractors need to adopt in order to improve project outcomes and avid losses. Findings were also be beneficial to researchers and academicians in the project management field as it will add knowledge regarding the relationship between quality management and project success. The study will also identify new areas for future studies.

1.2 Statement of the problem

The building construction industry is a key pillar in the Kenyan economy as it contributes 4.8% to the country's GDP and employees thousands of people. The industry also supports other sectors such as steal and cement manufacturing, catering, and banking. In addition, the building construction industry plays a critical role in meeting the housing needs of the people. However, this industry is plagued by a number of problems the most significant became gross safety violation manifested by a series of incidents of collapsed buildings across the country. It is estimated that construction industry is responsible for 27% of fatal injuries to employees, which affects the completion rate of projects. The average completion rate for government construction projects is 35.6%, which is dismal. In Nakuru, studies have shown that the soils are unstable due to fault lines and escarpments, thus making quality management practice in construction. Theories of quality management practices suggests that quality management is one of the knowledge areas that project managers need to master in order for them to implement projects successfully. Despite the significant safety problems encountered in the Kenya construction industry, no study has been conducted to examine the quality management practices of players within the industry and how these practices influence project outcomes. This study was seeking to address this knowledge gap by examining quality management practices of building contractors operating in Nakuru Town and how these practices influence the successful completion of projects.

1.3 The general objective

To examine the influence of quality management practices on successful completion of building construction projects in Nakuru Town.

1.4 Specific Objectives

- To find out the influence of quality planning practices on the successful completion of building construction projects in Nakuru Town.
- To determine the influence of quality assurance practices on the successful completion of building construction projects in Nakuru Town.
- To evaluate the influence of quality control practices on the successful completion of building construction projects in Nakuru Town.
- To examine the influence of quality improvement practices on the successful completion of building construction projects in Nakuru Town.

2 LITERATURE REVIEW

This study was guided by three theories: Juran's Theory of Quality Management, Deming's Theory of Total Quality Management, and Shenhar, Levy, and Dvir's Four Dimensions of Project Success.

2.1 EMPIRICAL REVIEW

The goal of the section was to provide a foundation for the research project, position the study within the existing body of literature, and identify research gaps.

a. INFLUENCE OF QUALITY PLANNING ON SUCCESSFUL COMPLETION OF PROJECTS

Quality management activities, like any other aspect of business, must be well thought-out and directed. Strategies and action plans for managing quality must be properly coordinated and be aligned with other initiatives within the firm. This what quality planning entails. It is a process that seeks to provide a structured sequence of activities that should be completed in order to improve and sustain quality (Senaratne & Jayarathna, 2012). It entails providing a road map on how the organization intends to realize quality goals. The quality planning process should culminate in the development of a quality plan, which is a document that describes how quality was achieved during the project.

In Kenya, Githenya and Ngugi (2014) examined the determinants if housing projects implementation. Their study revealed that quality planning was among the significant factors that influenced housing project implementation. Ong'ondo (2016), in his study that investigated preconstruction planning in the Kenya construction industry, found that the most important issues that project managers ought to pay attention to include clarity of scope statement, clarity of performance benchmarks, competency of project teams, and clarity of roles. Wambugu (2013) also found that quality planning was one of the determinants of successful completion of rural electrification projects in Kenya.

b. INFLUENCE OF QUALITY ASSURANCE ON SUCCESSFUL COMPLETION OF PROJECTS

Having an elaborate quality management plan is only a starting point of the quality management process. After a plan has been formulated, the project team has to take step of ensuring quality goals stipulated in the plan are realized. Quality assurance is one of these essential steps. Quality assurance is a proactive approach of managing quality. It entails putting in place checks that will ensure that quality is built into the project from the start (Goswami, 2015). It may encompass activities such as hiring qualified staff, selecting qualified and committed suppliers, training of staff and suppliers, improving the level of employee and supplier engagement, monitoring and inspecting inputs to ensure they meet required standards, and analyzing and approving designs (Bhonde & Shaikh, 2015). The prime objective of quality assurance is to avoid defects.

There are a number of studies that have examined quality assurance practices in the context of project management. In their study, Ruxwana, Herselman, and Pottas (2014) examined quality assurance practices in the implementation of e-health programs in five rural hospitals located in the Eastern Cape Province of South Africa. Results revealed that there were a number of weaknesses in the application of quality assurance such quality assurance being formally applied in structured manner, lack of user involvement, and the absence of independent QA evaluations. However, it was established that despite these limitations, quality assurance contributed to the success of some e-health projects. Khraiwesh (2014) found that quality assurance increased the probability for success of software engineering projects by offering adequate level of confidence that the end product will satisfy quality requirements.

c. QUALITY CONTROL AND SUCCESSFUL COMPLETION OF PROJECTS

Quality control is another important step in quality management. Quality control entails inspecting and analyzing project outputs so as to determine whether these outputs meet pre-established standards (Goswami, 2015). Where it is found that the outputs fall short of the required standard, the quality control officer is expected to initiate corrective measures. In the construction setting, corrective measures may entail reworking some parts of the building. Unlike quality assurance that focuses on preventing defects, the goal of quality control is to identify and correct defect. It is a reactive approach of managing quality. However, it is a necessary step in quality management since it may not be possible for the project team to achieve 100% defect prevention.

In their study, Githenya and Ngugi (2014) found that there was a significant relationship between project control measures and successful implementation of housing projects. The regression model showed that a unit increase in project control measures leads to 0.766 increase in the probability for successful implementation of projects. The authors recommended that project managers should focus on developing adequate control measures over every aspects of the

project including quality. Wambugu (2013) found that the supply of quality materials was a critical determinant for successful completion of rural electrification projects. It was revealed that unreliable supply of materials cause project delays and dampened the moral of workers resulting in low productivity.

d. Quality Improvement and Successful Completion of Projects

Quality improvement is also an important element in the quality management process. It entails taking deliberate actions aimed at raising the standards of quality (Huemann, 2004). Quality improvement is a popular concept in routine manufacturing and service activities. However, the concept is not so common in the project management setup because most practitioners view projects as independent and temporary undertaking. This perception is misleading especially in the context of construction project where contractors are involved in the implementation of multiple projects (Harnadez & Aspinwall, 2008). In such settings, quality lessons and improvement learnt in one project can be transferred to subsequent projects.

In different study, Pestana, Alves, and Barbosa (2014) demonstrated that it is possible to apply Lean methodology to identify and eliminate quality gaps in construction projects. The authors utilized the action research design where the used the Lean methodology to map deficiencies in the administrative processes of two construction psrojects. This processes enabled the teams managing the two projects to plan improvement efforts. Taner (2013) also provided evidence that shows successful application of Six Sigma in large-scale construction projects in Turkey. The study several factors were key to the successful application of Six Sigma including leadership and commitment of top management, linking quality initiatives to customers, and linking quality initiatives to suppliers.

e. Successful Completion of Building Construction Projects

The term project success is quite ambiguous. The point at which a construction project can be considered to have been completed successfully is not clearly defined. In most cases, the success of project is evaluated from the perspective of the project management triangle (Kylindri, Blanas, Henriksen, & Stoyan, 2012). This model suggested that a project is successful when it is completed on time, within budget estimates, and meets all predetermined specifications. However, the concept of project success has been enriched and expanded beyond the three project constraints. Prabhakar (2008) recommended the inclusion of stakeholder satisfaction as an additional measure of project success. He noted that a project may be completed on time, within budget, and meet all pre-established requirements, but fail to meet the expectations of key stakeholders such as the customer.

Stakeholders' satisfaction can be an important measure of project success in the building construction industry. Due to its technical nature, key stakeholders may not be able to articulate their expectations and preferences at the beginning of the projects. Therefore, projects managers have the responsibility of ensuring that key stakeholders are involved at every step of the project so as they can clarify their expectation on continual basis. Chan (2001) argues that a building project cannot be considered successful if the end product does not meet health and safety standards. When accidents occur, they expose the contractor and client to legal actions and financial loss.

In their study, Shenhar, Levy, and Dvir (1997) proposed four dimensions for measuring project success: project efficiency, impact on customer, business success, and preparing for the future. Project efficiency is concerned with short term measures such as projects being completed on time and within specified budgets. Impact on customer assess whether the project has deliver expected benefits to customers. This dimension measures the outcomes of the projects rather than the output (Kylindri et al., 2012). The business success dimension assesses the impact of the project on the business/ contractor in terms of profitability and market share. This dimension can only be measured after one or two years. The final dimension examines the long-term impact of the project such as improving the organization technological infrastructure and organizational learning. This dimension can only be assessed three to five years after project completion.

2.2 Research Gaps

There is a wide body of literature exploring quality management practices in construction projects. Most of these studies have highlighted quality management processes in projects and recommended best practices. Very few studies have linked these quality planning components with project success. In addition, a majority of the studies exploring quality management practices in the construction industry have been conducted outside the country. The findings may not be applicable in the Kenya context due to political, economic, social, and technological factors that usually unique in each country. There is gap in knowledge regarding the quality management practices in Kenya building constructing industry and how these practices are linked to successful completion of projects. The study was seeking to address this gap in knowledge by exploring quality

planning, control, assurance, and improvement practices on housing construction projects and how they influence the successful completion of project.

3 RESEARCH METHODOLOGY

The study utilized the descriptive survey design where a sample of 107 building contractors was selected from the target population of 335 National Construction Authority registered building contractors in Nakuru town using the proportionate stratified sampling method. Data was collected from the selected companies using structured questionnaires, and analyzed using both descriptive and inferential techniques.

4 RESEARCH FINDINGS

In this study, the inferential analysis focused on evaluating the relationship between the various quality management practices and successful completion of building construction project in Nakuru town. The multiple linear regression technique was used with the following model being tested:

$Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon,$

Where Y represents successful completion of building construction projects; X_1=quality planning practices; X_2= quality assurance practices; X_3= quality control practices, X_4= quality improvement practices, and ε = Error term. Table 4.10 present a summary of the model. As the table shows, the adjusted r-square is 0.853, which indicates that the model explain 85.3% of changes in project completion success.

Table 1: Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.927[a]	.860	.853	.42528

a. Predictors: (Constant), Quality Improvement, Quality Assurance, Quality Control, Quality Planning

According to Toole (2013), a model that yield an R square of above 0.25 is considered to be of good fit in social science research. Table 2 present the analysis of variance (ANOVA) of the model. The ANOVA test examines the significance of the relationship between the independent variable and the dependent variable by comparing the predicting power of the model with that of an intercept only model (Faraway, 2002). As the Table shows, the ANOVA test yielded a P-value of 0.00, which suggest the existence of a statistically significant relationship between project completion success, and the four quality management practices (quality planning, quality assurance, quality control, and quality improvement practices).

Table 2: ANOVA for Model I

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	82.325	4	20.581	113.792	.000[b]
1	Residual	13.384	74	.181		
	Total	95.709	78			

a. Dependent Variable: Project Completion Success
b. Predictors: (Constant), Quality Improvement, Quality Assurance, Quality Control, Quality Planning

Table 3: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.375	.091		4.121	.001
	Quality Planning	.252	.116	.235	2.163	.034
1	Quality Assurance	.310	.112	.291	2.768	.027
	Quality Control	.377	.086	.354	4.361	.000
	Quality Improvement	.366	.075	.399	4.877	.000

a. Dependent Variable: Successful Project Completion

The table 3 above yielded a P-value that is less than 0.05, and therefore, suggests that there is a statistically significant relationship between quality management practices and successful completion of building construction projects in Nakuru town at the 0.05 level of significance.

ESTIMATED REGRESSION EQUATION

Based on the Beta coefficients in Table 3, the estimated regression equation was:

Successful Completion of Projects (Y) = $0.375 + 0.252X_1 + 0.310X_2 + 0.377X_3 + 0.366X_4$. The equation shows that quality control practices have the most significant influence of successful completion of projects. The beta coefficient of 0.377 implies that, holding other factors constant, increasing quality control efforts by 1 unit would increase level of project completion success by 0.377 units. Quality planning practices have the least influence on successful completion of projects as the beta coefficient suggests that improving quality planning practices by 1 unit would increase level of project completion success by 0.252.

5 CONCLUSION AND RECOMMENDATIONS

Research findings have led to the conclusion that quality management practices have a significant influence on the successful completion of building construction projects. The study has established that all the four components of quality management (quality planning, assurance, control, and improvement) have a statistically significant and positive relationship with successful completion of building construction projects in Nakuru town.

The study has established that quality management practices have a significant influence on successful completion of projects. Consequently, building construction companies should enhance their quality management practices in order to increase their rate of project completion success. The firms should particularly invest in quality improvement activities since quality improvement was found to have the most significant influence of project success.

At the policy level, stakeholders should introduce quality management course in the training curriculums of key staff in the construction industry such as engineers and project manager in order to improve the implementation of construction projects. Training courses should incorporate all the four components of quality management (quality planning, assurance, control, and improvement). Regulatory bodies in the building construction field should also enhance the monitoring activities so as to ensure all contractors adhere to quality standards.

Future study should examine the quality implication of this informal construction system. Lastly, the current study was only able to establish whether a significant relationship exist between quality management practices and the successful completion of projects, as well as, the direction of this relationship due to its quantitative nature. A qualitative study is needed to explain why this relationship exists.

REFERENCES

[1] Bhonde, C., & Shaikh, F. (2015). Review of project quality plan. *International Journal for Research in Emerging Science and Technology, 2* (1), 26- 34.

[2] Chan, A. (2011). Framework for measuring success of construction projects. *Construction Management and Economics, 13* (3), 263- 274.

[3] Faraway, J. (2002). *Practical Regression and Anova using R.* Retrieved July 17, 2016 from https://cran.r-project.org/doc/contrib/Faraway-PRA.pdf

[4] Githenya, S., & Ngugi, K. (2014). Assessment of the determinants of implementation of housing projects in Kenya. *European Journal of Business Management, 1* (11), 1-23.

[5] Goswami, S. (2015). Role of quality management system in project completion. *Pipeline & Gas Journal, 242* (5), 101-109.

[6] Harnadez, D., & Aspinwall, E. (2008). A framework for building quality into construction projects. *Total Quality Management, 19* (10), 1013- 1028.

[7] Huemann, M. (2004). Improving quality in projects and programs, Chapter 37 in Morris P. and Pinto J., *The Wiley Guide to Managing Projects.* New York, NY: John Wiley & Sons.

[8] Kenya National Bureau of Statitics (2015). *Economic Survey 2015.* Retrieved May 30, 2016 from www.knbs.or.ke

[9] Khraiwesh, M. (2014). Process and product quality assurance measures in CMMI. *International Journal of Computer Science & Engineering Survey, 5* (3), 1-15.

[10] Kylindri, S., Blanas, G., Henriksen, L., & Stoyan, T. (2012). Measuring project outcomes: A review of success effectiveness variables. *Management of International Business and Economic Systems, 25* (2), 212- 223.
[11] Macharia, N. (2015). Overview: Kenya construction industry. *Business Review.* Retrieved May 30, 2016 from http://www.kenyanbusinessreview.com/562/construction-industry-in-kenya/
[12] Ong'ondo, C. (2016). Investigating pre-construction planning in the construction industry of Kenya: Practitioners perspectives. *International Journal of Soft Computing and Engineering, 6* (1), 38- 42.
[13] Orwa (2009). Geological structure of Nakuru District. *The people, 28(*6*),* 15-16*.*
[14] Otieno, J., & Agutu, N. (2016). NCA set to demolish 204 unsafe buildings in Nairobi. *The Star.* Retrieved May 30, 2016 from http://www.the-star.co.ke/news/2016/05/06/nca-set-to-demolish-204-unsafe-buildings-in-nairobi_c1345457
[15] Pestana, A., Alves, T., & Barbosa, A. (2014). Application of Lean construction concepts to manage the submittal process in AEC projects. *Journal of Management in Engineering, 30* (4), 101-109.
[16] Prabhakar, G. (2008). What is project success: A literature review. *International Journal of Business and Management, 3* (9), 3-10.
[17] Project Management Institute (2013). *A Guide to the Project Management Body of Knowledge.* New York, NY: Project Management Institute.
[18] Ruxwana, N., Herselman, M., & Pottas, D. (2014). A generic quality assurance model (GQAM) for successful e-health implementation in rural hospitals in South Africa. *Health Information Management Journal, 43* (1), 26- 36.
[19] Senaratne, S., & Jayarathna, T. (2012). Quality planning process of construction contractors: Case studies in Sri Lanka. *Journal of Construction in Developing Countries, 17* (1), 101- 114.
[20] Shenhar, A., Levy, O., & Dvir, D. (2001). Mapping the dimensions of project success. *Long Range Planning, 34* (2), 699-725.
[21] Taner, M. (2013). Critical success factors for Six Sigma implementation in large-scale Turkish construction companies. *International Review of Management and Marketing, 3* (4), 212- 225.
[22] Wambugu, D. (2013). Determinants of successful completion of rural electrification projects in Kenya: A case study of Rural Electrification Authority. *International Journal of Arts and Entrepreneurship, 1* (2), 1-12.
[23] Wawira, J. (2016). *African Menace: Collapse of a Building in Kenya.* Retrieved May 30, 2016 from http://recruitlink.co.za/articles/african-menace-collapse-building-kenya

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L'OPTIMISATION DE GESTION DE LA BANDE PASSANTE DANS UNE PROJECTION: CAS DE LA VIDEOSURVEILLANCE

[OPTIMISATION OF BANDWIDTH MANAGEMENT IN A PROJECTION: CASE OF A VIDEO SURVEILLANCE]

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ABSTRACT: In this reflexion, we want to manage the transmission channels of images (increase, multiply, limit or decrease the access path or transmission), describe possible methods of transmission and access to the image in order to have an idea about the amount of frames to send per second to maximize the information of highway during a projection in a video surveillance; especially when several stations negotiate live image at the same time. We tempted to outline the procedure of optimization of bandwidth. Multicast, multiple streams and video compression are three innovative methods that we have offered to users in order to optimize bandwidth management in the application of video surveillance. With software of video management of his choice, the user can maximize the function of his camera installations, to further profit a reduction of bandwidth requirements.

KEYWORDS: Optimisation, bandwidrh, projection, videosurveillance.

RESUME: Dans cette réflexion, nous voulons gérer les canaux de transmission d'images (augmenter, multiplier, limiter ou diminuer le chemin d'accès ou de transmission), décrire les méthodes possibles de transmission et d'accès à l'image afin d'avoir l'idée sur la quantité de trames à envoyer par seconde pour maximiser l'autoroute de l'information lors d'une projection en vidéosurveillance ; surtout lorsque plusieurs stations sollicitent l'image en direct et au même moment. Nous avons tenté de schématiser la procédure d'optimisation de la bande passante. La multidiffusion, les flux multiples et la compression vidéo sont trois méthodes novatrices que nous avons offertes aux utilisateurs pour optimiser la gestion de la bande passante dans les applications de vidéosurveillance. Avec un logiciel de gestion vidéo de son choix, l'utilisateur peut ainsi maximiser les fonctions de ses installations caméra, pour profiter d'avantages une réduction des exigences de bande passante.

MOTS-CLEFS: Optimisation, Bande passante, projection, Vidéosurveillance.

1 INTRODUCTION

Considérant le poids d'images qui sont transmises en ligne par seconde dans le monde de télécommunication, nous avons été curieux de savoir s'il n'y aurait pas un moyen d'optimiser le chemin de transmission de ces images pour le gain de l'opérateur (émetteur et le récepteur). C'est ainsi que nous voulons expérimenter la technologie de la vidéosurveillance IP, de par son importance de gérer efficacement la manière dont les flux vidéo sont transmis sur le réseau afin de ne pas surcharger la bande passante disponible. Même si les infrastructures technologiques informatiques sont conçues pour traiter

tous les types de données, les applications qui génèrent le trafic sur le réseau IP doivent être adéquates à l'utilisation efficace des ressources réseau en place[1].

À cette fin, nous voulons schématiser, certains mécanismes et fonctions utilisés comme mode de transmission d'images en vidéosurveillance IP pour permettre l'optimisation de la bande passante et des ressources réseau. Au cours de cette recherche, nous allons illustrés trois méthodes de transmissions qui sont :

- La méthode de Multidiffusion
- La méthode de Gestion de flux multiples
- La méthode de Compression vidéo

En fin nous allons laisser une libre expérimentation aux utilisateurs pour se choisir chacun la méthode la plus adaptée à son travail.

Partant de nos observations dans nos milieux de vie, nous avons constaté que nombreux utilisateurs et administrateur réseau envoient les images en ligne sans n'en savoir aucune stratégie sur l'optimisation du chemin de transmission. A cela il y a lieu de se poser la question suivante : Est-il raisonnable de négliger l'optimisation de la bande passante même si la capacité et la vitesse des réseaux s'avèrent considérables ?

Au regard des utilisateurs qui émettent les images sans en connaître les méthodes de gestion de transit, il y a lieu d'émettre l'hypothèse selon laquelle, même si la capacité et la vitesse des réseaux augmenteraient constamment et que les coûts connexes diminueraient, ce n'est pas une raison suffisante pour que les utilisateurs ignorent les investissements et efforts supplémentaires nécessaires pour optimiser la gestion de la bande passante.

Si la quantité de données passant par le réseau augmente toujours, les investissements en optimisation de la bande passante peuvent contribuer à une réduction du coût global, surtout par rapport aux gains d'efficacité et aux ressources maximisées. Par exemple, en vidéosurveillance, plusieurs utilisateurs finaux demandent des caméras avec une meilleure résolution et qualité d'image, optant souvent pour des caméras haute définition et à mégapixels. Ces types de caméra exigent beaucoup plus de bande passante que les caméras à définition standard[2].

En outre, des nombreuses personnes à l'intérieur comme à l'extérieur d'une organisation demandent à avoir accès à des flux vidéo connectés au réseau. Si une grande quantité d'utilisateurs tentent d'accéder à un flux vidéo spécifique simultanément, l'utilisation efficace des ressources réseau peut être nécessaire pour éviter la surcharge de la capacité et le plantage de tout le réseau.

L'objectif poursuivi dans cette recherche, est de déterminer les méthodes auxquelles l'utilisateur doit s'appuyer pour optimiser sa bande passante dans la transmission des images en ligne. Il est aussi question de démontrer que l'optimisation de la bande passante sur le réseau n'est pas nécessairement associée à d'importantes dépenses en capital; il s'agit surtout de mettre les bonnes méthodes en place et de tirer profit des capacités puissantes et uniques de ces méthodes, à partir des façons simples d'optimiser la gestion de la bande passante en vidéosurveillance IP.

A travers cette recherche, nous estimons faire comprendre aux utilisateurs, les processus normal de l'optimisation d'une bande passante, dès la phase de transmission jusqu'à la réception des trames. En plus, ce travail fournis des schémas pratiques de la bonne optimisation de la bande passante en vidéosurveillance IP.

2 APPROCHE METHODOLOGIQUE

2.1 METHODES DE TRANSMISSION DE FLUX VIDEO COURANTES

Ces méthodes nous aideront à développer trois manières théoriques de transmettre des flux vidéo sur un réseau depuis la source jusqu'à la destination. Il s'agit notamment **de la méthode de la diffusion, la diffusion unique et la multidiffusion.**

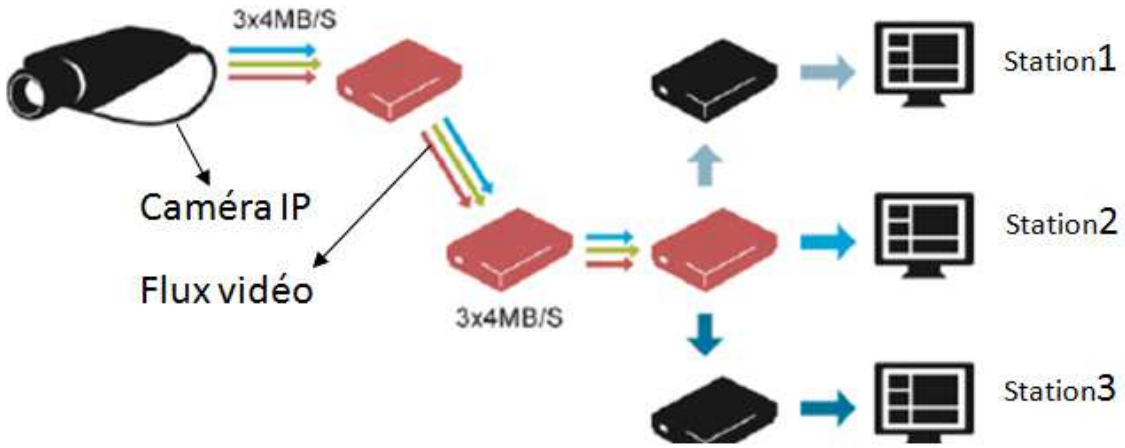
[1] *http://www.axis.com. H.264*
[2] *http://en.wikipedia.org/wiki/IGMP_snooping*

2.1.1 MÉTHODE DE DIFFUSION

La méthode de diffusion est définie comme une communication d'une source unique vers l'ensemble des destinations (CISCO ; IP multicast, 2002). En vidéosurveillance IP, la source est généralement **la caméra IP** et la destination représente **la station de surveillance du serveur d'enregistrement**. Dans cette situation, la diffusion signifie que la caméra IP transmet le flux vidéo à toutes les stations de surveillance et à tous les serveurs d'enregistrement, mais aussi à tous les dispositifs IP du réseau, même si seulement quelques destinations spécifiques ont demandé le flux. De manière générale, cette méthode de transmission n'est pas très utilisée dans les applications de vidéosurveillance, mais elle est assez courante dans l'industrie de la télédiffusion où les signaux de télévision sont commutés au niveau des destinations (http://www.sourcesecurity.com).

2.1.2 MÉTHODE DE DIFFUSION UNIQUE

La diffusion unique est définie comme communication d'une source unique vers une destination unique. Les transmissions à diffusion unique exigent une connexion directe entre la source et la destination. Dans ce cas, la caméra IP/source doit pouvoir accepter beaucoup de connexions simultanées lorsqu'un grand nombre de destinations veulent voir ou enregistrer la même vidéo en même temps. En termes de flux vidéo dans une transmission à diffusion unique, la caméra IP enverra autant de copies de la diffusion vidéo demandées par les destinations (GENETEC 2010). Dans le schéma 1 ci-dessous, trois copies du même flux vidéo sont envoyées sur le réseau; une copie pour chacune des trois (stations) destinations demandant le flux. Si chaque flux vidéo est de 4 Mbit/s, cette transmission produira 12 Mbit/s (3 x 4 Mbit/s) de données sur plusieurs segments de réseau.



Schèma1 : Transmission de signal d'image en diffusion unique

Dans le schéma ci-haut, la caméra IP envoie un flux unique de 4Mb/s mais qui est scindé en trois afin de servir trois stations sollicitant. C'est ainsi que beaucoup de destinations connectées en diffusion unique à une source vidéo peuvent donc entraîner un trafic élevé sur le réseau. Autrement dit, si nous prenons comme exemple un grand système dans lequel 300 destinations demandent le même flux vidéo, nous aurions 1200 Mbit/s (300 x 4 Mbit/s) de données voyageant sur le réseau, ce qui est impossible à gérer. Même si cette méthode de transmission est très utilisée sur Internet où la plupart des routeurs ne permettent pas la multidiffusion, dans un réseau local d'entreprise, la transmission par diffusion unique n'est pas nécessairement la meilleure méthode puisqu'elle peut faire surcharger rapidement la bande passante requise pour visualiser et enregistrer les flux vidéo.

2.1.3 LA MÉTHODE DE MULTIDIFFUSION

En transmission multidiffusion, il n'y a aucune connexion directe entre la source et les destinations. La caméra IP se connecte au flux vidéo en se joignant à un groupe multidiffusion, ce qui signifie en fait qu'elle se connecte à l'adresse IP de multidiffusion du flux vidéo. La caméra IP envoie donc une seule copie du flux vidéo à son adresse IP désignée et la destination se connecte simplement au flux disponible sur le réseau sans surcharger la source. Autrement dit, les destinations partagent le même flux vidéo. Dans le schéma 2 ci-dessous, les trois stations (destinations) qui demandent le flux vidéo ont le même impact sur le réseau qu'une destination unique demandant le flux en diffusion unique et il n'y a pas

plus de 4 Mbit/s qui voyagent sur chacun des segments du réseau. Même si 300 destinations demandaient ce flux vidéo, la même quantité de données voyagerait sur le réseau (http://Wikipedia, Multicast).

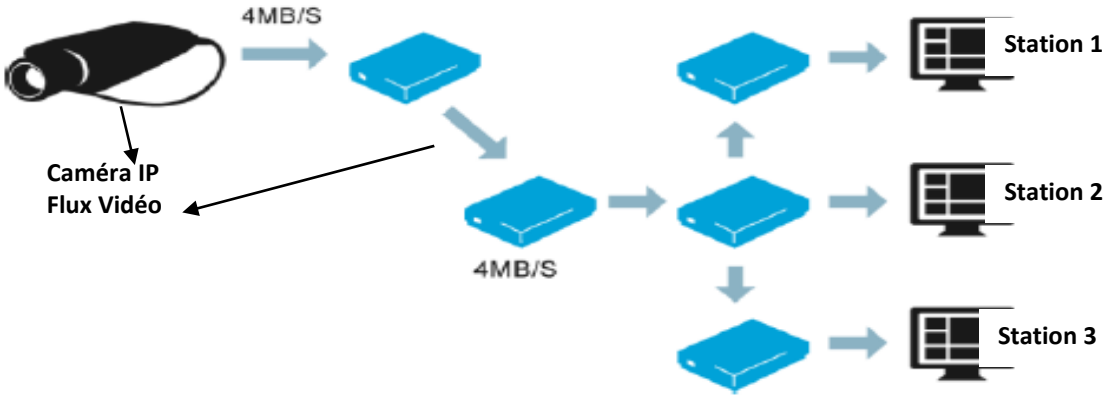


Schéma 2 : Transmission des flux vidéo en multidiffusion

Il est évident que l'utilisation de transmissions multidiffusion dans une application de vidéosurveillance IP peut permettre d'économiser beaucoup de bande passante, surtout dans les déploiements à grande échelle où la quantité de destinations peut croître très rapidement.

- **Transmissions multiples dans un seul système**

Comme certains segments d'un réseau ne permettent pas nécessairement les multidiffusions, il y a lieu de coupler les deux premières méthodes dans un système de gestion vidéo qui doit prendre en charge des méthodes de transmissions multiples et une gestion interne des diffusions unique, parce que les réseaux sont complexes et les sources vidéo IP n'utilisent pas toutes la même méthode de transmission (http://en.wikipedia.org/wiki/Multicast). Par exemple, dans un système de surveillance vidéo, certaines caméras IP peuvent être situées sur le réseau local de l'entreprise tandis que d'autres peuvent être montées à l'extérieur où elles transmettent des données sur un réseau sans fil qui ne prend pas la multidiffusion en charge. De plus, dans ce même système de vidéosurveillance, même si la plupart des stations de surveillance sont situées dans le réseau local de l'entreprise avec multidiffusion, certaines d'entre elles peuvent se connecter au système par Internet, tel qu'illustré dans le schéma 3 ci-dessous.

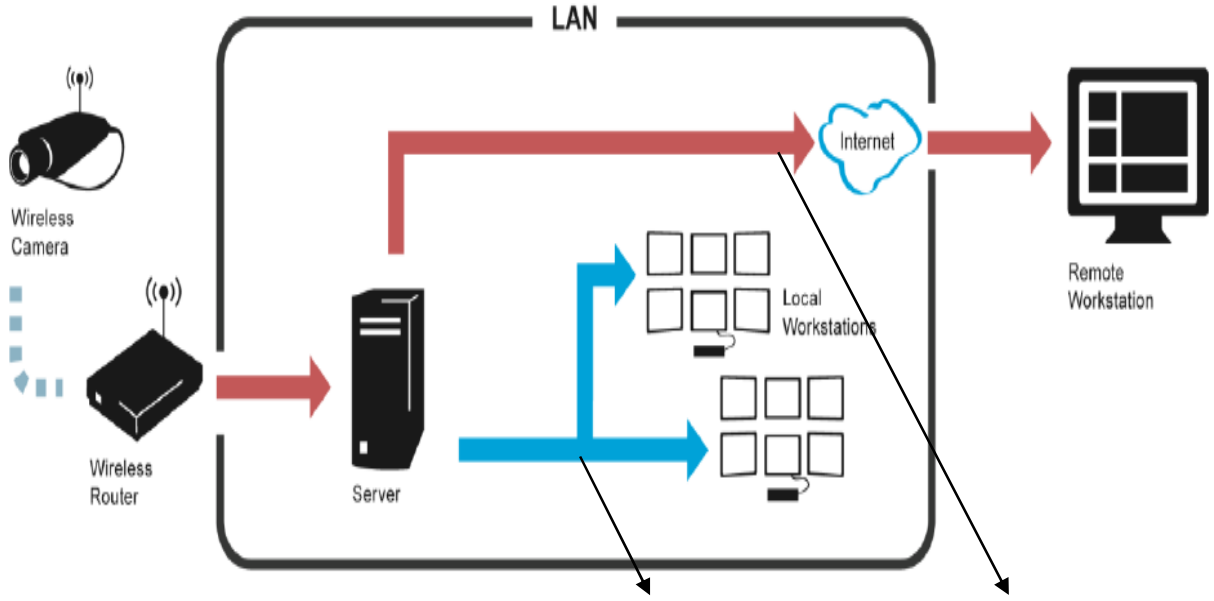


Schéma 3 : Transmission multiples dans un seul système (Multidiffusion couplée à la Diffusion Unique)

Dans ce cas, un système de gestion vidéo intelligent peut gérer les enregistrements de caméras à diffusion unique et à multidiffusion, transformer les caméras à diffusion unique en caméras à multidiffusion pour assurer une utilisation efficace de la bande passante pour les utilisateurs locaux, et fournir un flux à diffusion unique aux clients à distance, tout en utilisant un seul serveur.

Le serveur, tenant lieu de mandataire, est un autre composant très important pour la gestion efficace du trafic vidéo sur le réseau. L'idéal est que ce serveur détecte automatiquement le type de connexion de la caméra ou du client de visionnement. De cette manière, si un utilisateur se connecte quelquefois depuis le réseau local de l'entreprise et d'autres fois depuis chez lui, où la transmission vidéo multidiffusion n'est pas disponible, le serveur de gestion vidéo pourra détecter le lieu de connexion et fournir automatiquement au client de visionnement le meilleur type de flux.

De plus, la capacité de transformer une caméra à diffusion unique seulement en caméra à multidiffusion est une autre fonction importante du système de gestion vidéo. Cette fonction est importante non seulement pour les caméras qui envoient des flux sur des liaisons sans fil, mais aussi pour les caméras MJPEG. Cela est généralement effectué par le serveur de gestion vidéo capable de recevoir le flux vidéo à diffusion unique de la caméra et de créer un flux multidiffusion pour les clients.

2.2 GESTION DES FORMATS DE COMPRESSION VIDEO POUR UNE CHARGE DU RESEAU OPTIMALE

Le dernier point à aborder à propos de la gestion de la bande passante est la capacité d'un système de gestion vidéo à prendre en charge les divers formats de compression offerts par les sources vidéo IP. Les formats de compression vidéo les plus fréquents en vidéosurveillance sont les formats H.264, MPEG-4, MJPEG, MPEG-2, Wavelet et JPEG2000. Chacun de ces formats de compression a ses propres avantages et inconvénients (http://www.sourcesecurity.com). La décision de choisir un format de compression plutôt qu'un autre est basée sur plusieurs facteurs, tels que :

- La latence
- La qualité de l'image.
- Les exigences de stockage.
- Le nombre de caméras.
- L'utilisation de bande passante.

Le MPEG-4 et son successeur, le H.264, sont les formats de compression les plus efficaces sur le marché en terme d'utilisation de la bande passante. Ces formats de compression sont généralement le meilleur choix pour économiser la bande passante et l'espace de stockage sans affecter la qualité vidéo, contrairement au MJPEG qui peut offrir une grande qualité d'image mais qui utilise beaucoup de bande passante. Le MJPEG peut tout de même être un bon format de compression surtout s'il est utilisé à un débit binaire faible sur des liaisons lentes parce que chaque image est indépendante. Donc, contrairement au H.264 et au MPEG-4, si une image en MJPEG est perdue, c'est une seule image qui sera perdue plutôt qu'une séquence complète d'images.

Cependant, si nous regardons le schéma ci-dessous, avec le même niveau de qualité vidéo, nous pouvons clairement voir la différence entre différents formats de compression (H.264, MPEG-4 et MJPEG). Puisque le H.264 utilise environ six fois moins de bande passante que le MJPEG, le H.264 est assurément le meilleur choix pour l'optimisation du stockage et de la bande passante.

Comme la vidéosurveillance IP évolue de la même manière que la télédiffusion avec la télévision à haute définition, les sources vidéo IP offrent aussi des résolutions plus élevées avec des caméras à mégapixels à haut débit réseau; le H.264 deviendra donc fort probablement le format de compression standard dans l'industrie à cause de sa faible utilisation de la bande passante. C'est pourquoi il est important de rechercher un logiciel de gestion vidéo évolutif capable de prendre en charge les technologies évoluées d'aujourd'hui et de demain.

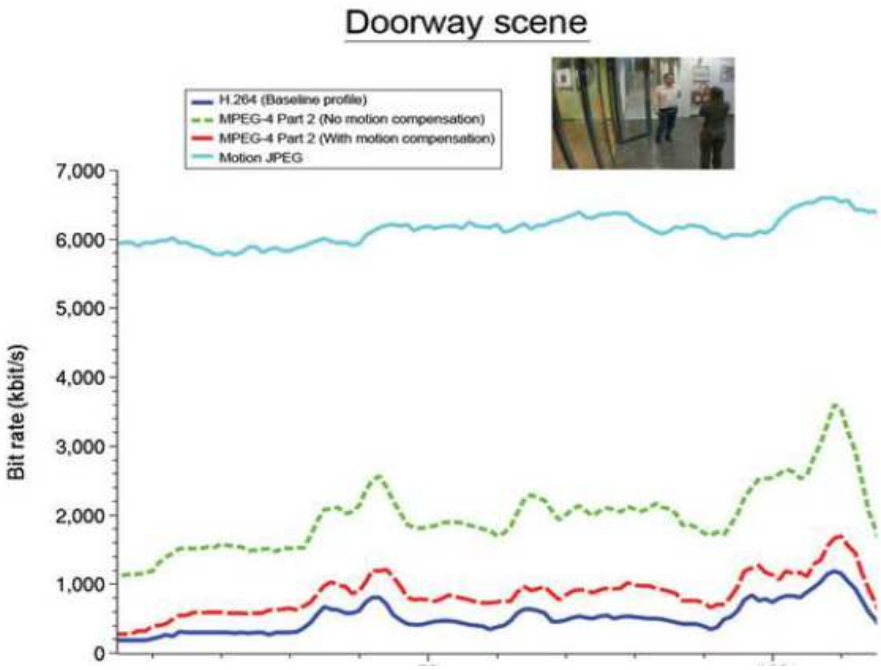


Schéma 4 : comparaison de différents formats de compression (http://www.axis.com)

2.2.1 LOGICIEL DE GESTION VIDÉO

La multidiffusion, la gestion de flux multiples et la compression vidéo sont trois des nombreuses méthodes pour optimiser l'utilisation de la bande passante dans les applications de vidéosurveillance IP. Les périphériques ou sources vidéo IP deviennent de plus en plus intelligents et offrent des fonctions jadis seulement offertes au niveau de tête par la plate-forme de vidéosurveillance. Par exemple, certaines sources vidéo IP sont capables d'effectuer des analyses vidéo directement à partir du périphérique et de transmettre la vidéo seulement en cas d'alarme. Encore mieux, certaines sources vidéo IP peuvent stocker la vidéo directement sur le périphérique et agir comme mini unités d'enregistrement.

Néanmoins, toutes ces fonctions intelligentes doivent absolument être produites par la plateforme de vidéosurveillance pour que les utilisateurs puissent profiter pleinement de tous les avantages connexes. Avec un logiciel de gestion vidéo puissant et novateur, les utilisateurs pourront profiter pleinement des dernières avancées technologiques, ce qui contribuera directement à une réduction des exigences de bande passante, à une optimisation des ressources réseau et à une diminution des besoins de stockage. Enfin, un logiciel de gestion vidéo avancé aidera les utilisateurs à économiser des sommes significatives et leur permettra de conserver l'évolutivité de leurs investissements à mesure que de nouvelles technologies émergent (Tanenbaum, Andrew S. 2003)

3 RESULTATS ET DISCUSSION

3.1 GAIN DES TRANSMISSIONS EN MULTIDIFFUSION

Après les expérimentations ci-hautes démontrées, nous remarquons que la multidiffusion est une méthode d'amélioration de la gestion de la bande passante relativement simple. Cependant, elle doit être soutenue par trois composants suivants :

- Routeurs et commutateurs à multidiffusion.
- Sources de vidéos IP prenant en charge la transmission multidiffusion.
- Système vidéo secondaire prenant en charge la gestion multidiffusion.

En termes de réseau, un commutateur à multidiffusion peut aussi être appelé commutateur prenant en charge la surveillance IGMP ou la surveillance et les requêtes IGMP. La surveillance IGMP est une fonctionnalité qui est généralement prise en charge par un commutateur de couche 2.

Les requêtes IGMP peuvent être gérées par le commutateur de couche 2 ou par un routeur multidiffusion. Cet équipement est le composant principal pour construire un réseau multidiffusion. Un commutateur prenant en charge la surveillance IGMP veille à ce que le flux multidiffusion soit seulement envoyé aux destinations qui l'ont demandé et pas aux autres destinations. En envoyant des messages tels que “IGMP join” ou “IGMP leave” sur le réseau, les destinations reçoivent ou non un flux multidiffusion. Pour assurer le bon fonctionnement de la surveillance IGMP, au moins un demandeur IGMP doit être exécuté sur le réseau. Le demandeur IGMP assure des transmissions adéquates au moyen des connexions multidiffusion.

Sans ces composants, le trafic multidiffusion n'est pas géré adéquatement sur le réseau, causant un trafic indésirable. Un commutateur sans multidiffusion interprète les paquets multidiffusion comme des paquets inconnus et les transmet à toutes les destinations. Généralement, les départements de Technique Informatique (IT) sont chargés de mettre en place un réseau multidiffusion et de s'assurer qu'il a été correctement configuré.

En termes de sources vidéo IP, la plupart des caméras et codeurs IP sur le marché prennent en charge la multidiffusion. Les sources vidéo IP en MJPEG sont des exceptions puisque les flux de ces types de sources sont pratiquement seulement transférés en diffusion unique. Cette restriction n'est pas due au format de compression, mais provient plutôt de la compression MJPEG qui est généralement couplée au protocole HTTP lors de la transmission du flux, ce qui permet d'obtenir un flux à diffusion unique seulement. Cependant, comme le protocole RTSP de contrôle du flux est en train de s'imposer, cela changera bientôt et les sources vidéo IP en MJPEG pourront être transférées en multidiffusion.

Actuellement, la présence d'un réseau multidiffusion et d'un flux d'unités vidéo multidiffusion n'est pas encore suffisamment efficace pour gérer adéquatement le trafic multidiffusion sur un réseau.

Le système de gestion vidéo utilisé doit aussi gérer adéquatement le trafic multidiffusion. D’où il faut un logiciel de gestion multidiffusion capable de fournir à l'application client de visionnement et au serveur d'enregistrement la capacité de rejoindre le groupe multidiffusion sur le réseau. Ce logiciel est une exigence minimale pour un tel système des transmissions de flux vidéo multidiffusion.

3.2 LOGICIEL DE VIDÉOSURVEILLANCE INTELLIGENT

Le logiciel de vidéosurveillance doit être beaucoup plus intelligent pour offrir un bon contrôle du trafic multidiffusion et doit donc pouvoir effectuer les tâches suivantes :

- Gérer des méthodes de transmissions multiples dans le même système.
- Offrir un service mandataire pour transformer le trafic à diffusion unique en trafic multidiffusion et vice versa.
- Pouvoir détecter automatiquement les capacités du réseau.

3.3 MAXIMISATION DES CAPACITES DE GESTION DE FLUX MULTIPLES

En vidéosurveillance IP, la gestion de flux multiples est définie comme la capacité d'une source vidéo IP à produire plusieurs flux vidéo de la même caméra en différentes qualités vidéo. Le logiciel de gestion vidéo doit aussi pouvoir contrôler ces flux.

4 CONCLUSION

Notre étude a été centrée sur ***l’optimisation de gestion de la bande passante dans une projection. Cas de la vidéosurveillance*.** Comme vous l'avez lu dans les pages précédentes, un logiciel de gestion vidéo intelligent est nécessaire pour prendre en charge les diverses méthodes à votre portée, qui contribuent à l'optimisation de la bande passante dans une application de vidéosurveillance. Un tel logiciel vous aidera à tirer profit de fonctions spécifiques telles que la multidiffusion, la gestion de flux multiples et la compression vidéo afin d'optimiser les ressources réseau, de réduire les exigences de stockage et, finalement, de réduire le coût global.

C'est pourquoi, il est important de prendre le temps de vérifier que votre logiciel de gestion vidéo est adéquat pour vraiment optimiser votre gestion de la bande passante.

Notre recherche a montré que la multidiffusion est une méthode d'amélioration de la gestion de la bande passante relativement simple. Cependant, elle doit être soutenue par les trois composants à ne pas oublier.

- Routeurs et commutateurs à multidiffusion.
- Sources de vidéos IP prenant en charge la transmission multidiffusion.
- Système vidéo secondaire prenant en charge la gestion multidiffusion.

Vu les résultats de notre expérimentation, dans le schéma 2, les trois destinations qui demandent le flux vidéo ont le même impact sur le réseau qu'une destination unique demandant le flux en diffusion unique et il n'y a pas plus de 4 Mbit/s qui voyagent sur chacun des segments du réseau. Même si 300 destinations demandaient ce flux vidéo, la même quantité de données (4Mbits) voyagerait sur le réseau.

C'est ainsi que notre question de départ selon laquelle, est-il nécessaires de négliger l'optimisation de la bande passante même si la capacité et la vitesse des réseaux augmentent ?" a été vérifiée en confirmant que :même si la capacité et la vitesse des réseaux augmentent constamment et que les coûts connexes diminuent, ce n'est pas une raison suffisante pour que les utilisateurs ignorent les investissements et efforts supplémentaires nécessaires pour optimiser la gestion de la bande passante et puisque la quantité de données passant par le réseau augmente toujours les investissements en optimisation de la bande passante peuvent contribuer à une réduction du coût global de connexion, surtout par rapport aux gains d'efficacité et aux ressources maximisées.

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REFERENCES

[1] Axis Communications. *White Paper - An Explanation of Video Compression Techniques.* [Online] Available: http://www.axis.com/files/whitepaper/wp_videocompression_33085_en_0809_lo.pdf (15 Mars 2016)

[2] Axis Communications. *White Paper - H.264 Video Compression Standard.* [Online] Available: http://www.axis.com/files/whitepaper/wp_videocompression_33085_en_0809_lo.pdf (20 Janvier 2015)

[3] CISCO. *White Paper - Overview of IP Multicast*. [Online] Available: http://www.cisco.com/en/US/tech/tk828/technologies_white_paper09186a0080092942.shtml (20 février 2016)

[4] GENETEC (2010), *gestion de la bande passante en vidéosurveillance.*

[5] Sony Professional Solutions Europe. *Video Compression Technology - H.264 Explained*. [Online] Available: http://www.sourcesecurity.com/news/articles/co-3289-ga.2806.html (05 Avril 2016)

[6] TANENBAUM, ANDREW S. (2003). Computer Networks, 4e Edition. New Jersey: Pearson Education Ltd.

[7] Wikipédia. *IGMP Snooping*. [Online] Available: http://en.wikipedia.org/wiki/IGMP_snooping (15 mars 2015)

[8] Wikipédia. *Multicast*. [Online] Available: http://en.wikipedia.org/wiki/Multicast (15 mars 2016)

[9] Wikipédia. *Streaming Media*. [Online] Available: http://en.wikipedia.org/wiki/Streaming_media (15 mars 2015)

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Facteurs d'engament entrepreneurial des étudiants de l'Université de Lomé

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ABSTRACT: Ensuring professional insertion of graduates remains a great challenge for every government. Everywhere, we witness nowadays the promotion of a new concept, the one of entrepreneurship. In Togo whether through awareness, prospectus or mass media, people are invited to turn towards the entrepreneurship like students as well.
This research is aimed at identifying the UL students' motives to turn to private venture.
To achieve this goal a questionnaire has been elaborated and administered to a 308 – student sample.
The processing of data collected allowed to consider and validate eight (8) factors or dimensions which push students to turn towards the entrepreneurship; which complies with the hypothesis put forward.

KEYWORDS: entrepreneurship, entrepreneur, commitment to entrepreneurship.

RÉSUMÉ: Assurer l'insertion professionnelle des diplômés est un grand défi pour les gouvernements. Partout ailleurs, l'on assiste ces derniers temps à la promotion d'un nouveau concept, celui de l'entrepreneuriat. Au Togo, que ce soit à travers les sensibilisations, les prospectus, les mass-médias, l'on invite la population à se tourner vers l'entrepreneuriat. Ainsi, de plus en plus, bon nombre de personnes s'orientent vers l'initiative privée à l'instar des étudiants. La présente recherche s'est donnée pour objectif d'identifier les moteurs motivationnels de l'engagement des étudiants de l'Université de Lomé à l'entrepreneuriat.
Pour atteindre cet objectif un questionnaire a été élaboré et administré à un échantillon de 308 étudiants.
Le traitement des données collectées a permis d'extraire et valider huit (8) facteurs ou dimensions qui motivent les étudiants à faire de l'entrepreneuriat ; ce qui va dans le sens de l'hypothèse émise.

MOTS-CLEFS: Entrepreneuriat, entrepreneur, engagement entrepreneurial.

1 INTRODUCTION

L'avènement de l'entrepreneuriat a été d'une remarquable importance dans le monde entier. Il est l'une des orientations stratégiques des politiques gouvernementales en matière d'emploi.

Durant ces dernières années, plusieurs pays se sont tournés vers la recherche des façons de promouvoir et faciliter une dynamique entrepreneuriale. L'augmentation des niveaux et des taux d'activités entrepreneuriales nécessite des entrepreneurs, hommes ou femmes de décisions pour créer et développer leurs entreprises (Mezghani, Belhaj, Affes, Aloulou, Ayadi, Bellaj, Choukir, Mseddi, 2008).

Pour plusieurs auteurs, l'environnement politico-économique, la culture nationale, le contexte familial, les réseaux sociaux et la personnalité sont autant de facteurs qui affectent la probabilité dans l'acte entrepreneurial (Rauch & Frese, 2000). Des auteurs comme Tocqueville (1961) et Hagen (1962) notent que certains facteurs institutionnels et socioculturels sont aussi sources d'influences du comportement entrepreneurial des jeunes.

Parallèlement, la réussite dans les formations universitaires nécessite de la part des apprenants, d'aujourd'hui, de plus en plus de ressources parmi lesquelles le facteur financier constitue l'élément de poids. Ainsi, bon nombre d'étudiants se lancent dans l'initiative privée pouvant les aider à financer leurs études.

Bien que la question de l'entrepreneuriat en milieu universitaire togolais soit d'actualité et soutenue par un large tapage médiatique, elle reste, à part la publication de Pari (2014), peu abordée par les études scientifiques chez les étudiants togolais.

Ainsi, la présente recherche a donc pour objectif d'identifier les facteurs d'engagement des étudiants togolais dans l'entrepreneuriat.

La question fondamentale que l'on se pose est de savoir quels sont les facteurs qui stimulent les étudiants à s'engager dans des activités entrepreneuriales ? La réponse provisoire qui émerge est que l'engagement entrepreneurial serait en lien avec une conjonction de facteurs, en l'occurrence les facteurs psychosociaux, économiques et environnementaux.

2 CADRE THÉORIQUE

Plusieurs chercheurs se sont intéressés à la question de l'entrepreneuriat et ont élaboré des modèles explicatifs pouvant permettre de cerner le processus de sa mise en œuvre.

Ainsi, Shapero et Sokol (1982) expliquent l'acte entrepreneurial par plusieurs catégories de facteurs qui induisent des changements considérables dans la vie d'une personne. Il s'agit notamment des perceptions de désirabilité et de faisabilité.

Ce modèle proposé par Shapero et Sokol est un modèle implicite concernant l'intention de créer une entreprise. Mais, c'est Krueger (1993), un disciple Shapero, qui, par ses investigations, a pu modéliser l'événement entrepreneurial en intégrant le concept d'intention. Selon ce modèle, les créateurs d'entreprises doivent percevoir d'abord l'action de créer comme « crédible » et ensuite être motivé à se lancer véritablement.

Pour sa part, Ajzen (1991), accorde une place centrale à l'intention de l'individu dans la genèse du comportement créatif. Selon sa théorie, l'intention prédit le comportement à travers trois variables (attitude à l'égard du comportement visé, la perception des normes sociales, le contrôle perçu).

Dans cette perspective, Bandura (1997), par sa théorie de l'auto-efficacité, estime que la perception qu'a un individu de ses capacités à exécuter une activité influence et détermine son mode de penser, son niveau de motivation et son comportement. L'auteur affirme que les individus ont tendance à éviter les situations et les activités qu'ils perçoivent comme menaçantes et s'engagent plutôt à réaliser des activités pour lesquelles ils se sentent plus aptes à accomplir. L'auto-efficacité est la croyance qu'il est possible d'atteindre l'objectif fixé et visualisé.

De leur côté, Deci et Ryan (1985) estiment plutôt que la motivation de l'individu à initier une activité entrepreneuriale a pour source la volonté de satisfaire les besoins psychologiques ou d'ordre supérieurs. Cette approche qui s'inscrit sous le chapeau de la théorie des besoins tente d'identifier les forces internes et externes qui poussent un individu à agir d'une façon motivée. Pour ces auteurs, le processus motivationnel proviendrait des facteurs dispositionnels et contextuels qui agiraient sur ces deux besoins. A travers le processus interactionnel, chaque individu, à des degrés différents, cherche à satisfaire des besoins de compétences. Pour satisfaire ce besoin, l'individu interagit d'une manière efficace dans son environnement afin d'accroitre ses capacités personnelles. Ainsi, pour Mc Clelland (1961), deux dimensions essentielles seraient à l'origine du comportement d'entrepreneur. Il s'agit du besoin d'accomplissement et le besoin de puissance.

Plusieurs facteurs expliquent donc le comportement entrepreneurial. Les chercheurs depuis les années 60 s'intéressent à la détermination et à la mise en évidence de ces facteurs. C'est aussi l'objectif de la présente étude.

3 COLLECTE ET TRAITEMENT DES DONNEES

La population cible de cette étude est constituée des étudiants de Licence et Master de l'université de Lomé exerçant déjà, pour leur propre compte, une activité génératrice de revenus ou ayant l'intention d'entreprendre une activité parallèlement à leurs études.

La population d'étude est obtenue par la technique d'échantillonnage accidentel qui met l'accent sur la disponibilité et la volonté des étudiants à participer à l'enquête.

Ainsi, le questionnaire a été administré à un effectif de 308 étudiants, dont 64,9% d'étudiants et 35,1% d'étudiantes. L'échantillon est majoritairement représenté par les étudiants de la Faculté des Sciences Economiques et de Gestion (FASEG)

avec un pourcentage de 31,5 ; suivi respectivement de la Faculté des Lettres et Sciences Humaines (FLESH), 17,2% ; de l'Institut National des Sciences de l'Éducation (INSE), 14% ; de la Faculté des Sciences (FDS), 10,7% ; de la Faculté de Droit (FDD), 10% ; du Centre Informatique et de Calcul (CIC), 2,3% ; de l'Ecole Nationale Supérieure d'Ingénieurs (ENSI), 2,3% ; de l'Ecole Supérieure de Secrétariat et de Direction (ESSD), 2,3% ; de l'École Supérieure des Techniques Biologiques et Alimentaires (ESTBA), 1,9% ; de l'École des Assistants Médicaux (EAM), 1,6% ; de l'Ecole Supérieure d'Agronomie (ESA), 1,6%. Les établissements les moins représentés sont : l'Institut des Sciences de l'Information de la Communication et des Arts (ISICA) et de l'Institut Universitaire de Technologie et de Gestion (IUT-GESTION) avec des pourcentages respectifs de 0,6 et de 1.

Les participants à l'enquête sont jeunes : 5,84% ont moins de 20 ans, 81,50% ont un âge compris entre 20 et 25 ans et 12,66% ont un âge compris entre 26 et 30 ans.

Pour la construction de l'instrument de mesure, le paradigme utilisé est celui de Churchill (1979), proposant la démarche d'élaboration d'échelles. En effet, Churchill propose, dans le tableau ci-après, la procédure de construction d'une échelle de mesure des données.

Tableau 1 : La procédure de construction d'une échelle de mesure des données

Etapes	Techniques recommandées
1. Spécifier le domaine du construit	Revue de la littérature
2. Générer un échantillon d'items	Revue de la littérature, expérience, enquête
3. Collecte des données	-
4. Purifier l'instrument de mesure	Coefficient de fiabilité, Analyse factorielle

Procédure (exploratoire) proposé pour développer de meilleures mesures (Churchill, 1979)

En suivant ce plan, 12 étudiants des deux sexes régulièrement inscrits à l'université ont été soumis à un entretien semi-dirigé enregistré et retranscrits. L'analyse de contenu des entretiens a permis d'identifier les indicateurs de l'engagement à l'entrepreneuriat et de construire un questionnaire qui a été ensuite soumis à l'appréciation de deux experts, psychologues du Travail et des Organisations. A la suite de leur correction sur la base de la proximité sémantique, 9 dimensions de facteurs ont été retenues dont chacune est composée d'items suivants :

- besoins financier (répondre au manque d'argent, mes allocations estudiantines me sont insuffisantes, financer mes études, ma famille a une situation financière défavorable, je me sens seul face à mes difficultés) ;
- besoin d'autonomie ou d'indépendance (me prendre en charge moi-même, ne pas dépendre des autres, être mon propre patron) ;
- réalisation et développement de soi (apporter une solution à ce qui freine mon évolution, découvrir mes talents, avoir d'autres expériences, dépasser mes camarades étudiants et autres amis dans les réalisations, accomplir mes autres projets, pouvoir évoluer m'incombe beaucoup) ;
- précarité de l'emploi/chômage (éviter le chômage, ne pas attendre l'état pour l'emploi, j'ai peur du chômage) ;
- nécessité d'aider autrui (avoir les moyens pour aider ma famille et mes amis, être utile aux autres, je trouve nécessaire d'aider autrui) ;
- l'envie de créer sa propre entreprise (l'entrepreneuriat est pour moi une passion, entreprendre quelque chose, initier une activité) ;
- informations sur le travail à la fonction publique (je trouve que le travail est trop contraignant à la fonction publique, on n'est pas libre quand on travaille dans le secteur public, je pense que le travail est stressant dans la fonction publique) ;
- Désir de diriger/leadership (conduire un groupe, diriger, devenir un guide pour les autres) ;
- Informations/sensibilisation à l'entrepreneuriat (la présence de la maison de l'entrepreneuriat me motive, j'ai une parfaite information et connaissance de ce dont il s'agit (entrepreneuriat), j'ai découvert l'avantage de l'entrepreneuriat grâce aux sensibilisations diverses).

Ce travail préliminaire a conduit à la construction de l'instrument de mesure basé sur le modèle de l'échelle Likert en 5 points qui part de 1 « pas du tout d'accord » à 5 « tout à fait d'accord ». L'échelle est, une fois encore, soumise aux jugements des deux experts retenus. Leurs observations et remarques ont contribué à recadrer et améliorer la compréhension de certains items.

Un pré-test d'une durée de10 à 15minuntes à été effectué sur un effectif de 30 étudiants pour nous assurer de la compréhension univoque des items.

Tableau2 : Coefficient alpha de Cronbach, indice KMO, test de sphéricité de Bartlett

	Echelle IT3E
Coefficient alpha de Cronbach	0,741
Indice KMO	0,704
Test de sphéricité de Bartlett	Khi2= 1703,745 ; (ddl)=528

La cohérence de la fiabilité interne est acceptable.

4 RÉSULTATS

La collecte des informations a permis d'aboutir aux résultats suivants :

Tableau 3 : Les facteurs d'engagement entrepreneurial des étudiants

Dimensions	Noms	Nombre d'items	Le coefficient alpha de Cronbach
F1	Besoin d'indépendance	5	0,649
F2	Besoin de domination	7	0,618
F3	Attente par rapport à l'entrepreneuriat	4	0,603
F4	Connaissance de l'entrepreneuriat	3	0,511
F5	Informations du travail à la fonction publique	2	0,500
F6	Conditions financières défavorables	2	0,591
F7	Optimisme	7	0,510
F8	Besoin de dépassement de soi	3	0,508

Ce tableau3 présente la consistance interne des huit dimensions de l'engagement entrepreneurial auxquelles nous avons abouti. Cette consistance interne est mesurée à l'aide du coefficient alpha de Cronbach. Elle varie de 0,500 à 0,649, ce qui signifie que la consistance interne est satisfaisante pour chacune des dimensions (huit) de l'engagement entrepreneurial.

5 DISCUSSION

L'objectif de la présente étude est d'arriver à identifier les dimensions à travers lesquelles se traduit la variable « engagement entrepreneurial ». Nous avons vérifié à l'aide du coefficient alpha de Cronbach la consistance entre des différentes dimensions de l'engagement entrepreneurial. Elle varie de 0,500 à 0,649, ce qui signifie que la consistance interne est satisfaisante pour chacune des dimensions de l'engagement entrepreneurial.

Les résultats auxquels nous sommes parvenus vont dans le même sens que ceux de Chigunta (2001). Selon les résultats de Chigunta ce sont les problèmes socio-économiques qui suscitent chez les sujets le besoin de s'engager dans l'entrepreneuriat. C'est un facteur qui a été identifié dans la présente étude.

Nos résultats vont également dans le même sens que ceux de Kuratko, Hornsby et Naffzigger (1997) selon lesquels ce sont les facteurs motivationnels à savoir, les récompenses extrinsèques, l'autonomie/indépendance, les récompenses intrinsèques et la sécurité, le bien être de la famille qui constituent les facteurs d'engagement entrepreneurial.

Les résultats obtenus corroborent aussi avec ceux de Pinfold (2001) ; Stevenson & Gumpert, (1985). Pour ces derniers, la poursuite d'objectifs financiers explique les décisions d'engagement. De même, Butter & Moore (1997) trouvent qu'il s'agit de la recherche de l'accomplissement de soi d'une part et d'un équilibre travail-famille (profit et croissance) d'autre part, qui seraient à l'origine des ambitions entrepreneuriales. D'autres études encore comme ceux de Cooper, Woo & Dunkelberg (1989) trouvent que la recherche de défi est un des facteurs incitatifs à la prise d'initiative.

Sur les dimensions « connaissance de soi », « besoin de dépassement », « optimisme », les étudiants estiment sans différence aucune qu'elles contribuent à la prise de décision d'engagement. Ces résultats vont dans le même sens que ceux de Naffzigger, Hornsby & Kuratk (1994) selon lesquels les caractéristiques personnelles des individus parmi lesquelles on peut

citer la connaissance de soi, l'optimisme et le besoin de dépassement sont des facteurs qui poussent les sujets à prendre la décision d'entreprendre.

La présente étude a des faiblesses relatives à la population d'étude qui s'est limitée aux étudiants de l'Université de Lomé. Il faudrait que d'autres études à caractère plus national soient entreprises pour confirmer les résultats de la présente étude sur un espace un peu plus grand.

Toutefois, ce travail a eu le mérite d'identifier les facteurs d'engagement entrepreneurial auprès des étudiants de l'Université de Lomé.

6 CONCLUSION

L'avènement de l'entrepreneuriat a bouleversé l'attitude comportementale des étudiants. De nos jours, nombreux sont les étudiants qui s'orientent et s'engagent dans l'entrepreneuriat. Ce constat a attiré notre attention sur les raisons qui suscitent leur engagement.

La présente étude a mis en exergue huit dimensions ou facteurs de l'engagement entrepreneurial des étudiants de l'Université de Lomé. Il s'agit du besoin d'indépendance, du besoin de domination, de connaissance de l'entrepreneuriat, d'information sur le travail à la fonction publique, du besoin de dépassement de soi, d'optimisme, des conditions financières défavorables et d'attente par rapport à l'entrepreneuriat.

REFERENCES

[1] Ajzen, I. (1991). The theory of planned behaviour, organizational Behavior and Human Decision Processes, vol.50, p.179-211.

[2] Bandura, A. (1997). Self-efficacy : the Exercise of Control. New York, Freeman.

[3] Buttner, E.H. & Moore, D.P. (1997). Women's Organizational Exodus to Entrepreneurship: Self-Reported Motivations and Correlates with Success, Journal of Small Business Management 35(1), 34-46.

[4] Chigunta, F. (2001). Youth Livelihoods and Enterprise Activities in Zambia. Report to IDRC, Canada.

[5] Churchill, G.A. (1979). A paradigm for developing better measures of Marketing constructs. Journal of marketing Research. 19, 4, 491-509.

[6] Cook, D. N., Scott, J.S. Brown, J. S. (1999). Bridging epistemologies: the generative dance between organizational knowledge and organizational knowing, Organization Science, 10(4).

[7] Cooper, A.C., Woo, C.Y., & Dunkelberg W.C. (1988). Entrepreneurs' Perceived Chances for Success. Journal of Business Venturing, 3, 97-108.

[8] Danjou, I. (2005). L'acte d'entreprendre ou l'émergence du « sujet », Cahier de Recherche du CDEE, ESC Lille, n. 05(01).

[9] Deci, E. L. & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenu.

[10] Dubin, R. (1956). Industrial workers' worlds: A study of the Central Life Interests of industrial workers. Social Problems. 3,131 – 142.

[11] Gasse, Y. & Guénin-Paracini, T. (2007). Le développement de l'esprit d'entrepreneuriat : analyse des activités réalisées à la commission scolaire de la capitale. CEPME, Université Laval.

[12] Krueger N.F. (1993). The impact of prior entrepreneurial exposure on perceptions of new venture feasibility and desirability, entrepreneurship Theorie & Practice (fall), pp 5-20.

[13] Kuratko, D.F., J.S. Hornsby & Naffziger, D.W. (1997). An Examination of Owner's Goals in Sustaining Entrepreneurship, Journal of Small Business Management 35(1), 24-33.

[14] Mezghani, L., Belhaj, M., Affes, H., Aloulou, W., Ayadi, F., Bellaj, B., Choukir, J., Mseddi, S. (2008). Support pédagogique: culture entrepreneuriale. Centre Universitaire d'Insertion et d'Essaimage de Sfax (CUIES), Université de sfax, version 1.2. Septembre.

[15] McClelland, D. (1961). The Achieving Society. Princeton, N.J.: Van Nostrand Company.

[16] Naffziger, D.W., Hornsby, J.S., & Kuratko, D.F. (1994). A Proposed Research Model of Entrepreneurial Motivation. Entrepreneurship Theory and Practice, 18(3), 29-41.

[17] Pari, P. (2014). Employabilité entrepreneuriale et emploie salarié: quelle orientation pour les jeunes diplômés togolais, Revue Mosaïque, N° 15, 31-43.

[18] Pinfold, G. (2001). Economic potential of sea ranching and enhancement of selected shellfish species in Canada. MS report prepared by IEC International for the Office of the Commissioner for Aquaculture Development, Ottawa, Canada. 28pp. + 8 Appen Plant.22:327—331.

[19] Rauch, A. & Frese M. (2000). Psychological approaches to entrepreneurial success: A general model and an overview of findings. International Review of Industrial and Organizational Psychology **15**,101–142.
[20] Shapero, A. & Sokol, L. (1982). The social dimension of entrepreneurship, in: The encyclopedia of entrepreneurship, in encyclopedia of entrepreneurship, Kent, C.A., D.L. Sexton K.H. Vesper (Eds.), Englewood Cliffs NJ: Prentice Hall, p. 72-90.
[21] Stevenson, H. H. & Gumpert, D. (1985). The heart of entrepreneurship, Harvard Business Review, 85, pp. 85-94.
[22] Tocqueville, A. d. (1961). De la démocratie en Amérique II. Paris: Gallimard.

ANNEXE

QUESTIONNAIRE

Dans le cadre d'une recherche sur l'entrepreneuriat en milieu universitaire nous sollicitons votre point de vu. Votre participation à cette étude nous sera très utile. Il n'y a pas de bonnes ni de mauvaises réponses. Veuillez répondre donc à ces questions avec le plus de franchise possible. Le questionnaire est anonyme. Les données collectées resteront confidentielles et ne serviront uniquement que pour notre recherche. D'avance, nous vous remercions pour votre collaboration.

INFORMATIONS SOCIO DÉMOGRAPHIQUES

Faites votre description

1. Sexe : Masculin ☐ Féminin ☐
2. Année d'entrée à l'université……
3. Année d'étude en cours…….
4. Votre faculté ……
   Parcours : Master ☐ Licence ☐ doctorat ☐
   Semestre d'étude actuel ☐
5. Niveau d'étude du père……
6. Niveau d'étude de la mère……..
7. Profession du père……
8. Profession de la mère…….....
9. Nombre de frères et sœurs……
10. Rang dans la fratrie (vous êtes le/la quelième fils/fille de vos parents) ?……
11. Age ……..
12. Veuillez compléter le tableau en indiquant les informations concernant vos parents ou tuteurs (père, mère, tante, oncle….) avec qui vous vivez.

Parents ou tuteurs	Niveau d'étude	Profession	En activité ou à la retraite ?

Les énoncés ci-après indiquent les raisons qui vous poussent ou susceptibles de vous pousser à l'engagement entrepreneurial. Veuillez lire les lire d'une manière attentive avant de choisir la réponse qui vous convient en entourant un numéro suivant l'échelle de mesure qui va de ***1 « pas du tout d'accord » à 5 « tout à fait d'accord»***.

Dans quelle mesure l'énoncé correspond-t-il à ce que vous êtes

N°	Enoncés	***Pas du tout d'accord***	***Plutôt pas d'accord***	***Ni en accord ni en désaccord***	***D'accord***	***Tout à fait d'accord***
1	Je veux être mon propre patron	1	2	3	4	5
2	Je veux entreprendre pour financer mes études	1	2	3	4	5
3	Je veux dépasser mes camarades étudiants et autres amis dans les réalisations	1	2	3	4	5
4	Je veux éviter le chômage	1	2	3	4	5
5	Etre utile aux autres est mon désir	1	2	3	4	5
6	Je veux entreprendre quelque chose	1	2	3	4	5
7	Je veux découvrir mes talents	1	2	3	4	5
8	Mon intention est de conduire un groupe	1	2	3	4	5
9	Ne pas avoir d'autres expériences fait partie de mon intention	1	2	3	4	5
10	Je ne veux rien initier	1	2	3	4	5
11	Répondre au manque d'argent	1	2	3	4	5
12	Etre dirigé est mon désir	1	2	3	4	5
13	Je veux apporter une solution à ce qui constitue un frein à mon évolution	1	2	3	4	5
14	Je veux me prendre en charge	1	2	3	4	5

15	Accomplir mes autres projets fait partie de mes préoccupations	1	2	3	4	5
16	Ne pas évoluer m'incombe peu	1	2	3	4	5
17	J'aime dépendre des autres	1	2	3	4	5
18	Grâce aux sensibilisations diverses j'ai découvert l'avantage de l'entrepreneuriat	1	2	3	4	5
19	L'entrepreneuriat est pour moi une passion	1	2	3	4	5
20	Mes allocations estudiantines me sont suffisantes	1	2	3	4	5
21	J'ignore ce qu'est l'entrepreneuriat	1	2	3	4	5
22	J'ai une parfaite information et connaissance de l'entrepreneuriat	1	2	3	4	5
23	Je trouve que le travail est trop contraignant à la fonction publique	1	2	3	4	5
24	J'aimerais devenir un guide pour les autres	1	2	3	4	5
25	La présence de la maison de l'entrepreneuriat ne me motive pas	1	2	3	4	5
26	On est libre quand on travaille dans le secteur public	1	2	3	4	5
27	Je pense que le travail est stressant dans l'administration publique	1	2	3	4	5
28	Je veux avoir les moyens pour aider ma famille et mes amis	1	2	3	4	5
29	Je n'ai pas peur de me retrouver au chômage	1	2	3	4	5
30	Ma famille a une situation financière défavorable	1	2	3	4	5
31	Je me sens seul face à mes difficultés	1	2	3	4	5
32	Je ne trouve pas nécessaire de soutenir autrui	1	2	3	4	5
33	Je peux attendre l'état pour l'emploi	1	2	3	4	5
34	J'ai suivi ou je suis des séances de formation en entrepreneuriat	1	2	3	4	5
35	J'ai rédigé ou je rédige des projets de financement entrepreneuriaux	1	2	3	4	5
36	J'ai initié ou j'initie une activité génératrice de revenu à mon propre compte parallèlement aux études	1	2	3	4	5
37	Je poursuis uniquement mes études	1	2	3	4	5

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التراث المعماري للقلاع والحصون العربية في خيبر (المملكة العربية السعودية)

[Architectural heritage of the Arab castles and forts in Khyber (Saudi Arabia)]

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ABSTRACT: Khyber is located in the northeast of the Medina, at a distance of 170 kilometers, has been a stronghold of the Jews before and during the Islamic conquest. Muslims have been able to open Khyber forts including Na'em and Al-Sa'b and Abi Alnezar then Alqmous and Aloutih and Al-Salalim.

Khyber forts erected on the Arab Planning for forts and castles, which were affected in the architecture forts and castles that have spread in Egypt, the Arabian Peninsula and the Levant, and the distinction of being held irregularly ribs on the rocky hills of high, clear idea disabilities through forts sloping (Tolos) on the way in Arabic, Which is to dusty slope which costs the attacking armies hardship ups and downs, so as not to easily reach the fort. The idea was to create a high-forts are difficult to climb vertical making them completely at the bottom and turned to the strengthening of curtain walls are so resistant to bombardment or digging tunnels underneath or earthquakes by increasing the thickness of construction and fencing that a thickness of at least at the top gradually rise and the use of ancient columns asourse in construction inside the walls

This research addresses the architectural study of the forts and castles in Khyber, as one of the tributaries of the architectural heritage of this city, which was characterized by following the Arab architectural planning of military fortifications that had prevailed in the Arabian Peninsula since ancient times. Through two axes: the descriptive study of the forts of Khyber and analytical study, which include architectural planning and architectural elements and features of urban planning for the forts.

The research aims to highlight the architectural and military importance of the forts and castles of Khyber, the study of architectural planning and architectural elements as one of the rings the evolution of Arab military fortifications.

The research also follows two approaches: descriptive and analytical study of these forts, and make a comparative study between them and contemporary forts and castles to determine the architectural planning and elements, and to emphasize that these forts and castles have been affected in architecture by the forts and castles that have spread in Egypt as well as in the Arabian Peninsula and the Levant.

KEYWORDS: forts of Khyber, Medina, fortifications.

ملخص البحث: تقع خيبر في الشمال الشرقي للمدينة المنورة، على مسافة (170) كيلو مترا، وقد كانت معقلا لليهود قبل وأثناء الفتح الإسلامي. وقد استطاع المسلمون فتح حصون خيبر ومنها حصن ناعم والصعب وأبي النزار ثم حصن القموص وحصن الوطيح وحصن السلالم.

أقيمت حصون خيبر على التخطيط العربي للحصون والقلاع، حيث تأثرت في عمارتها بالحصون والقلاع التي انتشرت في مصر وشبه الجزيرة العربية وبلاد الشام، وتميزت بأنها أقيمت غير منتظمة الأضلاع على تلال صخرية مرتفعة، وتتضح فكرة الإعاقة من خلال الحصون المنحدرة (Tolos) على الطريقة العربية والتي تتمثل في المنحدر الترابي الذي يكلف الجيوش المهاجمة مشقة الهبوط والصعود، وحتى تكون الإعاقة تامة وحتى لا تصل بسهولة إلى الحصن. وقد كانت الفكرة في إنشاء حصون عالية يصعب تسلقها بجعلها عمودية تماما عند أسفلها، واتجهوا إلى تقوية الجدران الساترة حتى تقاوم القصف أو حفر الأنفاق تحتها أو الهزات الأرضية عن طريق زيادة سماكات البناء وإقامة الأسوار التي تستدق تدريجيا بالارتفاع واستخدام الأعمدة القديمة كمداميك في داخل الجدران.

يتناول البحث دراسة معمارية للحصون والقلاع بمدينة خيبر، كأحد روافد التراث العمراني بهذه المدينة، والتي تميزت باتباع التخطيط المعماري العربي للاستحكامات الحربية الذي كان سائدا في شبه الجزيرة العربية منذ أقدم العصور. من خلال محورين الأول عن الدراسة الوصفية لحصون خيبر والثاني الدراسة التحليلية التي تشمل التخطيط المعماري والعناصر المعمارية وملامح التخطيط العمراني للحصون.

ويهدف البحث إلى إبراز الأهمية المعمارية والحربية لحصون وقلاع خيبر، ودراسة تخطيطها المعماري وعناصرها المعمارية كإحدى حلقات تطور الاستحكامات الحربية العربية. كما يتبع البحث المنهجين الوصفي والتحليلي لدراسة هذه الحصون، وإجراء الدراسة المقارنة بينها وبين الحصون والقلاع المعاصرة لتحديد أصول

التخطيط المعماري والعناصر المعمارية، وللتأكيد على أن هذه الحصون والقلاع قد تأثرت في عمارتها بالحصون والقلاع التي انتشرت في مصر وكذلك في شبه الجزيرة العربية وبلاد الشام.

كلمات دلالية: حصون خيبر، المدينة المنورة، الاستحكامات، الحصون المنحدرة.

1 مقدمة

كانت خيبر (لفظ عبراني معناه الحصن أو المعسكر) ضمن الممالك العربية (شكل 1)، ورد اسمها في كتابات الآشوريين "خبرا" كإحدى المناطق التي استولى عليها الملك البابلي نبو نيد (555-539 ق.م.)، مع جماعة من اليهود الذين استوطنوا بها، وفي بعض النواحي المجاورة في الجزيرة العربية مثل يثرب. ويرى فريق آخر أن هجرتهم إليها كان زمن نبوخذ نصر (605-563 ق.م.) الذي شردهم ودمر هيكلهم، [1]، [2]، بل أن هناك من المؤرخين من يذكر أن موجة ثانية من الزحف اليهودي على خيبر حدثت بعد دخول الرومان إلى بلاد الشام في عهد الإمبراطور الروماني هيدريان وتشتيتهم لليهود في أنحاء متفرقة ومنها بلاد الحجاز. ففي عام (138م) دخلتها ثلاث قبائل يهودية هي قريظة والنضير وقينقاع.

شكل 1. خيبر

وإن كان الرأي الأرجح عن علاقة اليهود بخيبر، وأن الديانة اليهودية كانت من الديانات التي انتشرت في الجزيرة العربية ودخلت فيهما بعض القبائل العربية واعتنقها بعض العرب، لذا يجب أن نبين أن خيبر مدينة عربية سكنتها بطون من قبائل عربية اعتنقت اليهودية وليسوا من بني إسرائيل ولا صلة لهم بأي يهود من خارج الجزيرة العربية، ولعل ما يوضح ذلك معرفة أن قبائل يمنية هاجرت إلى شمال الجزيرة وسكنت في يثرب وفدك وخيبر وهي عربية الأصل والمنشأ (اليعقوبي، 1957).

عندما استوطن اليهود، [3]، [4]، خيبر أنشأوا سلسلة من التحصينات القوية في أعالي الجبال وسط الصخور وأحاطوها بالأحجار الصلبة وأغلقوا منافذها بأبواب حديدية وخشبية، فكانت تلك الحصون أشبه بمستعمرات سكنية محصنة تحصينا منيعا، تسمح لهم بالإقامة فيها على نحو آمن. كما أصبح لها دور حربي وسياسي خطير في مقاومة الإسلام والتصدي للدولة الإسلامية، وقد ذُكر أن اليهود أقاموا هذه الحصون من منطلق عقائدي يهودي توراتي.

وكان اليهود يعتقدون أن حصونهم يستعصي غزوها أو الاقتراب منها، (الواقدي، 1965. ابن حبيب، 1942. الصالحي، 1983)، وأن حصونهم لا تقهر لمنعتها وكثرة السلاح والعدد والطعام، ("وظنوا أنهم مانعتهم حصونهم من الله فأتاهم الله من حيث لم يحتسبوا وقذف في قلوبهم الرعب" الحشر، آية 2)، كما كانوا قادرين على حشد عشرة آلاف مقاتل يتحصنون فيها وينطلقون منها لتنفيذ مشروعاتهم السياسية والحربية، وقد تعاظمت قوة حصون خيبر بفضل جهود بني النضير الذين نزلوا منطقة الحصون وقادوها للحرب ضد المسلمين، (الواقدي، 1965. ابن النجار، 1980. الحلبي، 1980). وفي العام السابع للهجرة (628م) وحال فراغ رسول الله صلى الله عليه وسلم من غزوة الأحزاب، جهز جيشا باتجاه خيبر لفتحها بعد أن استبان له تورطها، فأحاط الجيش بالحصون فسقطت حصنا بعد حصن بعد استولى اليأس على اليهود وطلبوا الصلح، واستطاع المسلمون فتح حصون خيبر وغنموا منها العديد من السلاح والمتاع، وأصبحت منذ ذلك التاريخ بلدة إسلامية خالصة.

2 الدراسة الوصفية

كانت خيبر تنقسم إلى خمس مناطق عسكرية يتبع كل منطقة منها عدد من الحصون، وكانت الحصون تتألف من عدة مجموعات رئيسية أنشأها اليهود في واحة خيبر وعلى أطرافها، (الواقدي، 1965. الهمداني، 1974. الديار بكري، 1903. ولفنسون، 1927. سعيد، 1984)، وقد سميت كل مجموعة من هذه الحصون باسم الحصن الأكبر فيها، وتحمل غالبا اسم رجل أو زعيم مهم أو عشيرة أو واد أو جبل أو اسم له مدلول عندهم. وهذه المناطق هي: (الحربي، 1969. البكري، 1949. ابن كثير، 1978. ابن الديبع، 1993. باشميل، 1979. الشهري، 1980)، منطقة النطاة وهي خط الدفاع الأول ومن أهم حصونها ناعم والصعب وقلعة الزبير ودار بني قمة، ومنطقة الشق ومن حصونها أبي وقلعة سموان (سمران)، ومنطقة الكتيبة وأهم حصونها القموص، ومنطقة الوطيح وأهم حصونها الوطيح، ومنطقة السلالم وأقوى حصونها السلالم، وكانت توجد حصون أخرى على مشارف الواحة تمثل مواقع حربية متقدمة، (ابن كثير، 1983).

ويعد حصن القموص في منطقة الكتيبة مركز الحصون ويشرف عليها جميعا، حيث منطقة الشق في الشرق على مسافة ثلاثة كيلومترات وفي الشمال الشرقي منطقة النطاة التي تصب في الشق التي بدأ بها الفتح، وإلى الجنوب نحو الغرب تقع السلالم على مسافة أربعة كيلو مترات وفي جنوب جبال الصهباء، وإلى الجنوب الغربي يقع الوطيح على مسافة حوالي كيلو مترين، (الشهري، 1980).

1. 2 حصون منطقة النطاة

وتضم ((الواقدي، 1965. ابن سعد، 2001)، حصن ناعم والصعب بن معاذ، وهناك دار بني قمة وتقع في نطاق حصن ناعم وكانت أول دار استولى عليها المسلمون تحت وطأة الحصار الذي فرض على حصن ناعم، (البكري، 1949. الحلبي، 1980. الديار بكري، 1903. ولفنسون، 1927، أما حصن الزبير (الواقدي، 1965، ابن سعد، 2001. ابن شبة، 1979. ابن حزم، 2003. البيهقي، 1985. النويري، 2004. ابن كثير، 1983. المقريزي، 1981. الصالحي، 1983. الديار بكري، 1903. الحلبي، 1980)، فهو ثالث الحصون الشهيرة (باشميل، 1979)، وخط الدفاع الأخير عن المنطقة، (المقريزي، 1981)، وكان يتمتع بمنعته لوقوعه على قمة تل صخري يصعب على الفرسان التسلق للوصول إليه لوعورة المسالك المؤدية إليه وكان له أبراج محصنة وأبواب قوية منيعة، (الواقدي، 1965. باشميل، 1979).

1. 1. 2 حصن ناعم (لوحة 1)

ويشكل خط الدفاع الأول، (الواقدي، 1965. ابن هشام، 1990. ابن سعد، 2001. ابن خياط، 1977. ابن شبة، 1979. ابن حيان، 1987. ابن حزم، 2003. السهيلي، 1970. الحموي، 1977. ابن الأثير، 1980. النويري، 2004. ابن سيد الناس، 2008. ابن كثير، 1983. ابن خلدون، 1957. الفيروز آبادي، 1969. المقريزي، 1981. الحميري، 1975. العباسي، 1916. الصالحي، 1983. الحلبي، 1980)، وكان أول الحصون التي سقطت بيد المسلمين، (الواقدي، 1965. ابن هشام، 1990. الحلبي، 1980. باشميل، 1979). ويستوعب بضعة آلاف من المقاتلين المزودين بالأسلحة، (الواقدي، 1965. المقريزي، 1981. باشميل، 1979)، وله ثلاثة أسوار تشكل مانعا قويا يعوق حركة الجنود المهاجمين، وبابان قويا يصعب على المهاجمين اقتحامهما، (الشيباني، 1971. الواقدي، 1965. البيهقي، 1985).

لوحة 1. حصن ناعم

لوحة 2. حصن النزار

ويتميز موقعه بأنه محاط بأرض رخوة مليئة بالماء والمستنقعات مما يعوق حركة المهاجمين، وقد أحاطوا الحصن بغابة من النخيل لتشكل مانعا يعرقل تقدم القوات المغيرة عليه وتكون سببا في تعذر رؤية المهاجمين لأسواره وتمنع آلات رميهم من الوصول إلى المدافعين بالأبراج وخلف الأسوار، كما كانت بمثابة مخابئ للمراقبة وللانقضاض على القوات المهاجمة عند حصار الحصن أو العسكرة أمام أسواره، (الواقدي، 1965. الصالحي، 1983. الحلبي، 1980). كما وضعوا أكواما من الحجارة كي تكون ساترا للمدافعين إذا ما اضطروا للخروج ولقذف العدو من فوق الأبراج، (ابن هشام، 1990)، هذه المكونات: الحصن المنيع المدجج بالسلاح والمقاتلين والنخيل الكثيف والأرض الرخوة يجعل من اقتحامه مستحيلا بل يمكن من محاصرة المغيرين وإبادتهم، (الصالحي، 1983). ولجأ المسلمون إلى قطع أربعمائة من النخل الذي أمام الحصن للتأثير على معنويات اليهود وإضعاف قوتهم، ومن ثم خلقوا ميدانا لقتال اليهود خارج الحصن حيث تقدم قادة اليهود الذين سقطوا صرعى وعندئذ سقط الحصن، (الواقدي، 1965. ابن هشام، 1990. الحلبي، 1980. باشميل، 1979).

2. 1. 2 حصن الصعب بن معاذ:

من الحصون القوية بوادي النطاه ويمثل ثاني أهم الحصون بعد حصن ناعم، (ولفنسون، 1927. باشميل، 1979)، ويعد خط الدفاع الثاني بهذه المنطقة، وكان مقرا لقائد جيش اليهود، (الواقدي، 1965)، حيث عقد به المجلس الخاص بوضع خطط القتال ضد المسلمين، وكان هذا الحصن منيعا ويقع على صخرة عالية، (الديار بكري، 1903. ولفنسون، 1927)، ويتميز بتعدد الأسوار، (الواقدي، 1965. المقريزي، 1981. باشميل، 1979)، ويضم مخازن السلاح التي تشمل الدبابات والمنجنيق وغيرها، (الواقدي، 1965. باشميل، 1979)، ويبلغ عدد القوات المنوط بها حمايته خمسمائة جندي، (الواقدي، 1965)، كما كان بالحصن مخازن للطعام الذي يكفي فترات الحصار الطويلة ومخابئ للنفائس وحظائر للماشية، (الواقدي، 1965. المقريزي، 1981).

2. 2 حصون منطقة الشق

وتشمل حصن أبي ويقع فوق قمة جبل يصعب تسلقه بالقرب من حصن الصعب بن معاذ إلى الغرب منه ويطل على الوادي من جهتيه الشمالية والغربية، (الواقدي، 1965. ابن سعد، 2001. البيهقي، 1985. النويري، 2004. ابن كثير، 1978. المقريزي، 1981. الصالحي، 1983. الديار بكري، 1903. الحلبي، 1980. باشميل، 1979)، وهو أول الحصون التي سقطت في يد المسلمين بهذه المنطقة وكان له أسوار متعددة وعالية محصنة وأبواب قوية منيعة، وقلعة سمران، (البيهقي، 1985. النويري، 2004. ابن كثير، 1978. الفيروز آبادي، 1969. المراغي، 1981)، وهي قلعة شديدة التحصين تقع على رأس جبل في نطاق حصن أبي وتمثل خطا دفاعيا عن هذا الحصن ومن ثم فإنها ذات موقع حصين، وحصن النزار (لوحة 2)، يقع في أدنى المنطقة المعروفة بالشق، وكان من أقوى حصون خيبر وأكبرها مساحة ويضم أقوى الفرسان، (الواقدي، 1965. المقريزي، 1981. باشميل، 1979)، ولجأ اليهود إلى وضع النساء والأطفال في هذا الحصن عند سقوط حصون النطاة وحصن أبي وسمران بيد المسلمين.

3. 2 حصون منطقة الكتيبة

وتشمل حصن القموص وحصن وُجدة ويقع في وادي خاص الذي به حصني السلالم والوطيح، (ابن شبة، 1979. الحربي، 1969. البكري، 1949. الحموي، 1977. الحميري، 1975. الجاسر، 1970).

حصن القموص: (لوحة 8:3) وهو أشهر حصونها وأقواها، (الواقدي، 1965. ابن هشام، 1990. ابن سعد، 2001. ابن خياط، 1977. الحربي، 1969. الطبري، 1977. الهمداني، 1974. ابن حزم، 2003. ابن عبد البر، 1983. البكري، 1949. السهيلي، 1970. الحموي، 1977. ابن الأثير، 1980. الكلاعي، 1968. النويري، 2004. ابن سيد الناس، 2008. ابن كثير، 1983. ابن خلدون، 1957. الفيروز آبادي، 1969. الحميري، 1975. الصالحي، 1983. الديار بكري، 1903.

الحلبي، 1980. الجاسر، 1970)، وهو أشهر الحصون في خيبر ويعرف بالحصن أو حصن مرحب وحصن خيبر الأعظم، (الحربي، 1969. البكري، 1949)، ويعود إلى الغساسنة خلال القرن الخامس الميلادي، (إدارة الآثار والمتاحف السعودية، 1975).

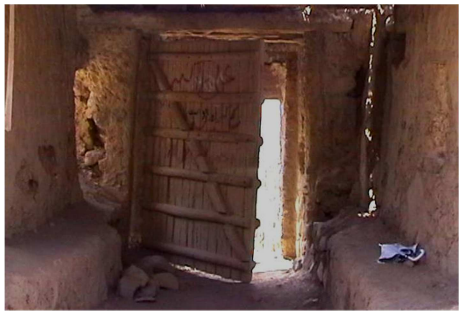
لوحة 3. حصن القموص

لوحة 4. حصن القموص

لوحة 5. حصن القموص المدخل

لوحة 6. حصن القموص التحصينات الخارجية

ويحتل قمة مرتفع تمثل صخرة عظيمة من البازلت، (جروهمان، 1933)، ويحيط بالحصن من أسفل ساتر من الحجارة وفي الجنوب منازل خيبر القديمة وفي الشمال بساتين النخيل التي تمثل حاجزا منيعا، وتؤدي إليه طرق ضيقة وملتوية إلى ممر ضيق يخترق مناطق شديدة الوعورة، (جليمور، 1982)، وهناك سلم من أحجار البازلت ينتهي ببوابة اتساعها (1.45م) يكتنفها كتفان عرض كل منهما (0.75م) وبجانب الباب بقايا برج للدفاع عن مدخل الحصن، (اليعقوبي، 1957)، ويتقدم باب الحصن بئر مطوية من أعلى الحصن إلى أسفل الوادي.



لوحة 7. أحد أبواب الحصن

لوحة 8. حصن القموص

وكانت جدرانه ملساء تعوق تسلق المهاجمين، وأمام المدخل برج للمراقبة لحمايته فضلا عن الباب الضخم، (جليمور، 1982). وقد أقيمت الأساسات من كتل حجرية بينما شيدت الجدران من الأحجار البركانية واللبن، ويلاحظ أن الجدران كانت كثيرة الفتحات لتساعد المقاتلين المحتمين بالحصن من الذود عن حصنهم وصد المهاجمين فيما يدلل ما بقي من جدرانه الخارجية على أنه كان يحتوي على عدة أبراج.

لوحة 9. معالجة عدم انتظام الكتل الصخرية

لوحة 10. استخدام أفلاق النخيل

تفضي بوابة الحصن إلى دهليز يبلغ اتساعه (2.90م) يكتنفه مصطبتان بنيتا من الحجارة السوداء والطين لجلوس المدافعين عن الحصن (لوحة 9) ويؤدي الدهليز إلى اتجاهين الأول إلى بيوت الحصن وحجراته (لوحة 10) في الطرف الشرقي وتتكون من طابقين وارتفاع الجدران (1.50م) وسمكها (1.0م) وهي من الحجارة السوداء المغطاة بملاط من الطين، ويؤدي الدهليز في الغرب إلى فناء مكشوف وفي الشمال بقايا غرفة مستطيلة تمثل مجلسا (11.0×9.35م) ويبلغ ارتفاع بقايا الجدران (1.50م)، وينقسم الفناء إلى قسمين بواسطة جدار من الحجارة السوداء ومغطى بملاط من الطين ويتوسطه باب يبلغ ارتفاع الجزء المتبقي من كتفه (1.95م) (سلام. ص40). والأسوار الخارجية مدعمة بالأبراج التي تؤدي إليها ممرات، وبالجدار الخارجي مزاغل لرمي السهام على القوات المهاجمة.

4. 2 حصون منطقة الوطيح

ويقع حصن الوطيح في وادي خاص، (الواقدي، 1965. ابن هشام، 1990. ابن سعد، 2001. ابن خياط، 1977. ابن دريد، 1987. ابن شبة، 1979. الطبري، 1977. الحربي، 1969. ابن حزم، 2003. ابن عبد البر، 1983. السهيلي، 1970. الحموي، 1977. ابن الأثير، 1980. الكلاعي، 1968. ابن سيد الناس، 2008. ابن كثير، 1983. الفيروز آبادي، 1969. الحميري، 1975. الصالحي، 1983. الديار بكري، 1903. وهو من أقوى حصون المنطقة، (الفيروز آبادي، 1969).

5. 2 حصون منطقة السُلالم

وكان حصن السُلالم الذي لم يبق منه إلا بعض الأساسات قوي التحصين، (الواقدي، 1965. ابن هشام، 1990. ابن شبة، 1979. اليعقوبي، 1957). الطبري، 1977. ابن حزم، 2003. البيهقي، 1985. ابن عبد البر، 1983. البكري، 1949. السهيلي، 1970. ابن الأثير، 1980. ابن قيم الجوزية. 3، ص325. الحميري، 1975. الصالحي، 1983. الديار بكري، 1903، شحنه اليهود بكميات هائلة من الأسلحة المكونة من الدروع والسيوف والرماح والأقواس، (البيهقي، 1985. ابن الديبع، 1993).

6. 2 حصون أخرى

تشمل حصن المريطة (المرطة)، (اليعقوبي، 1957. الحربي، 1969)، وحصن الظهار، (الحموي، 1977. الفيروز آبادي، 1969)، وحصن القصارة، (اليعقوبي، 1957).

3 الدراسة التحليلية

1. 3 التخطيط المعماري

نشأت التحصينات الحربية مع نمو التجارة وازدهارها، حيث تضمنت في ثناياها إمكان السلب والنهب اللتين أوجبتا أنشاء تحصينات دفاعية تمكن من دفع الخطر، وكانت الحصون تشرف على المدن وتقوم كخط دفاعي أول أمام العدو، كذلك أنشئت لحماية الحدود من غارات المعتدين، وفى سنة (6300 ق.م) حدث تغير رئيسي في الشرق الأدنى تمثل في بناء ثكنات للجند بالإضافة إلى القلاع والتحصينات.

وظلت الأسوار والاستحكامات من خصائص المدن عبر العصور، حيث كانت المدن منذ فجر التاريخ تحاط بسور سميك مخططه مدور أو مستطيل، وله دعامات أو أبراج بارزة تتيح للمدافعين تحته مساحة أوسع يستطيعون منها مراقبة كل من يقترب منه وتصويب سهامهم نحو من يحاول نقبه من الأعداء، وتشير المصادر إلى عناية ملوك مصر منذ مطلع عهد الأسرات بتحصين المدن والحدود. وتنقسم هذه التحصينات إلى نوعين مختلفين في الطراز والأسلوب، النوع الأول تلك الحصون التي كانت تقام في الوديان، والنوع الثاني ما كان يشيد في الجبال، ونجد أن معظم حصون الشلال قد أقيمت على صخور منحدرة فليس فيها دائما نظام إقامة السور المزدوج، وكان بكل حصن معبد ومخزن غلال، وقد تأثرت كل منطقة الشرق الأدنى تأثرا عميقا نتيجة لغزوات وهجرات شعوب البحر، (زكى، 1968. هاردنج، 1971. قدرى، 1985. شكري، 1986، [5].

وتتألف الحصون من شبكة دفاعية لم يقتصر بناؤها على الأجر بل كسوها بالحجارة، وكان للقلاع الرومانية مداخل تؤدى كل منها إلى ردهة تفتح على مدخل آخر إلى الفناء المكشوف، وتحيط الحواصل بالجدران الأربعة، (زكى، 1958). وكان البيزنطيون يشيدون القلاع والأبراج ذات الميول ويبنونها على مسافات متفاوتة من جدران القلعة، ولم تكن تلك الأبراج لحماية الأسوار بل لكي يتيسر لرماة القسي والنفط مدى طويلا لاختراق خطوط العدو المهاجمة، وكان يشيد في وسط السور برج مرتفع تخزن فيه المؤن والسلاح والعتاد وليس لكي يكون آخر ملجأ للجنود يدافعون فيه عن أنفسهم، (زكى، 1958).

والحصن من الناحية المعمارية عبارة عن بناء مربع أو مستطيل مكون في معظم الأحيان من ثلاثة أدوار وقد تزيد أو تقل، وتضم هذه الأدوار عددا من الحجرات لإقامة الجنود، وبطبيعة الحال يوجد داخل الحصن وحدات معمارية أخرى هامة كمصادر المياه ومخازن للأسلحة والحبوب وفرن صغير أو عده أفران ومراحيض وغير ذلك مما يفي بإقامة الجنود داخل الحصن لفترة طويلة خاصة أذا ما طال الحصار حوله، بالإضافة إلى برج صغير للمراقبة (الراقوبة) لمتابعة الموقف في خارج الحصن، كما يضم من الداخل أيضا ممرات ضيقة وفتحات للسهام تسمح أيضا بدخول الهواء والضوء، [6].

وتميزت الحصون التي كانت تشيد أعلى قمم الجبال بأنها أقيمت على صخور منحدرة، وتتضح فكرة الإعاقة من خلال الحصون المنحدرة (Tolos) على الطريقة العربية والتي تتمثل في المنحدر الصخري الذي يكلف الجيوش المهاجمة مشقة الهبوط والصعود حتى تكون الإعاقة تامة ولا تصل بسهولة إلى الحصن (لوحة 7:3)، وقد كانت الفكرة في إنشاء حصون عالية يصعب تسلقها بجعلها عمودية تماما عند أسفلها، فليس فيها دائما نظام إقامة السور المزدوج والمدخل يؤدى إلى ردهة تفتح على مدخل أخر إلى الفناء المكشوف، وتحيط الحواصل بالجدران الأربعة. إذن، فقد اتخذت الحصون منذ فجر التاريخ في مصر والجزيرة العربية وبلاد الشام وغيرها التخطيط المتمثل في قامتها أعلى منحدرات صخرية وإحاطة كل منها بسور سميك مزود بدعامات أو أبراج بارزة ويتألف من سورين أحدهما من داخل الآخر، والسور الخارجي أقل ارتفاعا من السور الداخلي وأقل من نصف سمكه، والأبراج ذات جدران مائلة إلى الداخل تعلوها دروة.

أقيمت حصون خيبر على التخطيط العربي، حيث تأثرت في عمارتها بالحصون والقلاع التي انتشرت في مصر وكذلك في شبه الجزيرة العربية وبلاد الشام، فتميزت بأنها أقيمت غير منتظمة الأضلاع على تلال صخرية مرتفعة، ولجأوا إلى معالجة عدم انتظام الكتل الصخرية بوضع كتل ضخمة من الخشب لخلق مساحات منتظمة لإقامة حجرات وأبراج الحصن (لوحة 11)، واتجهوا إلى تقوية الجدران الساترة حتى تقاوم القصف أو حفر الأنفاق تحتها عن طريق زيادة سماكات البناء وإقامة الأسوار التي تستدق تدريجيا بالارتفاع وإقامة الأجزاء السفلية من الجدران بكتل الحجارة الضخمة.

وكان تحقيق ذلك ببناء السور الذي بني أولا باللبن ثم بني بالحجر رغبة في زيادة متانته لمقاومة ضربات المهاجمين، وكان هذا التطوير محققا لإمكانيات أكبر في الدفاع ويزيد من إمكانية اختيار موقع مرتفع للمدينة أصلا لتحقق رؤية أفضل، كما أن السور مصمم على أن يكون أعلاه على هيئة ممر أو ممشى يمكن المدافعين من تأدية عملهم ويحقق لهم رؤية أفضل ومرمى أبعد وأوسع. وفى الوقت نفسه كانوا يزيدون من مناعة تلك الأبنية بزيادة عدد كوات الرمي فيها، وإقامة طبقات من الشرفات الدفاعية متراكبة فوق بعضها بعضا تخترقها فتحات الرمي، وقد ركزوا اهتمامهم بشكل خاص على بناء البوابات، كذلك تقويه الجدران، وإقامة الحواجز، وزيادة عدد نقاط الرمي الجانبي.

2. 3 العناصر المعمارية

يتكون الحصن من عدة أسوار تشكل مانعا قويا يعوق حركة الجنود المهاجمين، حيث كان يقف على قمة الجبل، وأقيمت الجدران الخارجية من الحجارة غير المنتظمة عليها طبقة ملساء من الملاط تعوق تسلق المهاجمين، ومزودة بالمزاغل لرمي السهام، ويتكون الحصن من دورين يمثل الدور العلوي دروة يقف خلفها المدافعون، وله بابان قويان يصعب على المهاجمين اقتحامهما، أما وسائل الإعاقة للقوات المهاجمة فتتمثل في:

1. وضع أكوام من الحجارة كي تكون ساترا للمدافعين إذا ما اضطروا للخروج.
2. أحيطت الحصون بغابات من النخيل (لوحة 3:1) لتحقيق الأغراض الدفاعية بتشكيل خط دفاعي خارجي مانع يعرقل تقدم القوات المغيرة عليه، وكان النخيل بمثابة مخابئ للمراقبة وللانقضاض على القوات المهاجمة عند حصار الحصن أو العسكرة أمام أسواره، ويكون سببا في تعذر رؤية المهاجمين لأسوار الحصن، ويمنع آلات رميهم من الوصول إلى الداخل أو المدافعين بالأبراج وخلف الأسوار.
3. الأسوار الخارجية للحصن مدعمة بالأبراج التي تؤدي إليها ممرات يصل من خلالها الجنود إلى الأبراج وفي الجدار الخارجي مزاغل لرمي السهام على القوات المهاجمة.
4. يعلو الأبراج والحجرات دروات مكشوفة كما يتقدم البرج الرئيسي بحصن القموص على حدود التل الصخري مساحة مكشوفة تحددها دروة يقف خلفها المدافعون عن الحصن لمنع أي محاولات لتسلق التل الصخري أو الوصول إلى السلم أو المنحدر الصاعد إليه (لوحة 7:1).
5. تؤدي إلى هذه الحصون ممرات ضيقة وملتوية تخترق مناطق صخرية شديدة الوعورة، وهناك سلالم من أحجار البازلت تنتهي بالبوابات الخاصة بهذه الحصون.

هذه المكونات المتمثلة في الحصن المنيع المدجج بالسلاح والمقاتلين والنخيل الكثيف والأرض الرخوة تجعل من اقتحامه مستحيلا بل تمكن من محاصرة المغيرين وإبادتهم، لذلك لجأ المسلمون إلى قطع أربعمائة من النخل الذي أمام الحصن للتأثير على معنويات اليهود وإضعاف قوتهم، ومن ثم خلق ميدان للقتال خارج الحصن وعندئذ سقط الحصن.

تؤدي الممرات والسلالم إلى المداخل التي يتكون كل منها من بوابة ضخمة وأمام مدخل حصن القموص برج للمراقبة والدفاع عنه، وتفضي بوابة الحصن إلى دهليز يكتنفه مصطبتان لجلوس المدافعين عن الحصن، ويؤدي الدهليز إلى بيوت وحجرات في الطرف الشرقي والمكونة من دورين ولها نوافذ ذات أعتاب خشبية، كما يؤدي في الغرب إلى فناء مكشوف, وكان الحصن يضم مجلسا يشرف على الفناء. وكان بكل حصن مخازن للسلاح تشمل الدروع والسيوف والرماح والأقواس والدبابات والمنجنيق وغيرها، كما كان به مخازن للطعام يكفي فترات الحصار الطويلة ومخابئ للنفائس وحظائر للماشية.

1. 2. 3 الأسوار والأبراج

كان أهم ما اعتمدت عليه الاستحكامات هو الأسوار التي تمثل خطا دفاعيا متكاملا، وحتى يستطيع هذا الخط أن يحقق مهمته بكفاءة لابد من تقوية بعض نقاطه على مسافات مختلفة بأبراج، وكان لابد من تحقيق سهولة الاتصال بين الجند المدافعين عنه وتنظيم العمل بينهم بالصورة المطلوبة، وهو أمر استدعى أن يخطط السور بمواصفات وقياسات دقيقة تفي بهذه المتطلبات، وقد انعكست هذه الأمور على عمارة وطريقة إنشاء الأسوار بما اشتملت عليه من عناصر معمارية، (عثمان، 1985، 1988).

لذلك عني المعماريون العسكريون بالأسوار كأولى الخطوات الدفاعية التي تحمى الاستحكامات، ووجدنا أنماطا من الأسوار التي ألحقت بها ممرات وأبراج متعددة الأضلاع ومربعة ودائرية ومستطيلة، وأسوار سميكة ومزدوجة ومتعددة وعالية ومزودة بوسائل دفاعية كثيرة كالسقاطات والمزاغل، وروعي ميل الجدران إلى الداخل حتى لا تتمكن القوات المهاجمة من لغمها أو نقبها. وتتضح فكرة الإعاقة من خلال موانع أساسية تكلف المهاجمين مشقة الهبوط والصعود وتسهل على المدافعين خلف الدراوي الحجرية والتي تمثل عناصر دفاعية أساسية متعددة ومتقاربة.

ثم تطور الأسلوب نتيجة التجربة والممارسة فحتى تكون الإعاقة تامة للجيوش المهاجمة وحتى لا تصل بسهولة نتيجة إمكانية تسلق الحصون المتمثلة في الأسوار الترابية كانت الفكرة في إنشاء حصون عالية يصعب تسلقها بجعلها عمودية تماما عند أسفلها، وكانت الهضاب الصخرية المستديرة والجروف غير القابلة للتسلق التي تؤمن حماية طبيعية ممتازة باستثناء رقعة صغيرة من الأرض المنبسطة هي المواقع المفضلة لتلك الحصون.

وبالتالي فقد كانت هيئتها غير منتظمة بما ينسجم مع طبوغرافية الأرض التي تقام عليها، وكانت تشاد في صفوف على طبقات متراكبة فوق المنحدرات الشديدة، (مولر، 1984)، وظهرت الأسوار المزدوجة والعالية والتي ظهرت بالحصون المصرية منذ عهد الأسرة الثانية، [5]، [7]، ويفصل السورين فناء كما كان السور الخارجي منيعا وله ممر متسع، واقتصرت الحصون المصرية والساسانية التي أنشئت على الجبال على نظام السور المزدوج. (زكي، 1968. مرابط، 1953)، وأحيطت الحصون الأخمينية بثلاثة أسوار (مرابط، 1953). وظهرت الأسوار السميكة بالحصون المصرية (زكي، 1968) والأسوار الأخمينية (مرابط، 1953)، وأسوار الإسكندرية (الفلكي، 1967)، وتميزت الأديرة السورية والمصرية بأسوارها العالية (شيحة، 1988)، التي يصعب تسلقها.

وكان تحقيق ذلك ببناء السور الذي بني أولا باللبن، ثم رغبة في زيادة متانته لمقاومة ضربات المهاجمين بني السور بالحجر، وكان هذا التطوير محققا لإمكانيات أكبر في الدفاع ويزيد من إمكانية الدفاع اختيار موقع مرتفع للحصن لتحقق رؤية أفضل، وليمكن من ركوب القوات المهاجمة. وصمم السور على أن يكون أعلاه على هيئة ممر أو ممشى يمكن الجند المدافعين من تأدية عملهم بمستو عال ويحقق للجند المشاة أو الركبان رؤية أفضل ومرمى أبعد وأوسع، (عثمان، 1985).

وقد روعي في بناء الأسوار ميل الجدران إلى الداخل وهى ظاهرة نجدها في جميع أبنية قدماء المصريين، ولعلها ترجع إلى أن مواد البناء المستعملة كانت ضعيفة فكان لابد من تقوية الحصن بجعل قاعدته سميكة ما أمكن، (زكي، 1968)، إذ هي المعرضة قبل كل جزء فيه للهجوم، وظهر ذلك من بداية الأسرات، كما أن بصور مقابر بني حسن قلاع بجدران سميكة مائلة في جزئها الأسفل مستقيمة في جزئها الأعلى. (شكري، 1986). وقد كان البيزنطيون يشيدون القلاع ذات الأسوار المائلة أيضا، (زكى، 1958)، وأن قل سمك هذه الأسوار.

وحصنت الأسوار بالأبراج والدعامات فقد تم تنفيذ دعامات أو أبراج بارزة بالأسوار الفرعونية لتتيح للمدافعين تحت الأسوار مساحة أوسع يستطيعون مراقبة كل من يقترب منه وتصويب سهامهم نحو من يحاول نقبه من الأعداء. ويعتبر حصن أمبوس (الأسرة 13) المثل الوحيد للتحصينات ذات الأبراج، التي بدأت تطويرا لفكرة الدعامات كما في حصن سيسيبى، ووجدت الأبراج المربعة في حصن سمنة وهو أول مثال واضح بالعمارة الفرعونية. (شكري، 1986. زكي، 1968).

ونجد الأبراج في أسوار سرجون (8 ق.م) وهي على مسافات مضطردة كأنها قلاع صغيرة لرد الجيش المهاجم (مرابط. 1953)، كما نجد الأبراج المستديرة والمربعة بأسوار قصر شيرين في العصر الساساني (مرابط، 1953)، والأبراج المستديرة المختلفة الأحجام في مدينة رداع باليمن (شيحة، 1987)، وكذلك بأسوار

مدينة تنيس الرومانية (لوبير، 1978). وفى أركان أسوار حصن كراكلا (الحلابات) أبراج مربعة من العصر الروماني (هاردنج، 1971)، وأقيمت بأسوار مدينة رداع أبراج للمراقبة تتخللها فتحات للسهام ومكونة من عده طوابق وحجرات وصهاريج (شيحة، 1987).

ونفذت ممرات بالأسوار وبصفة خاصة بالقلاع البيزنطية والتي كانت تتميز بأسوارها الغير سميكة (نوعا)، وكانت أبراجها بارزة بروزا ضئيلا وموزعة على مسافات معينة بين كل منها والآخر دروة غير سميكة من الحجارة، الأمر الذي كان من أجله تبنى كوابيل يعتمد عليها ممشى السور، وفي بعض الأحيان كانت تبنى لها سلسلة من العقود الداخلية. ويرجع السبب في عدم الاهتمام بسمك الأسوار البيزنطية هو الاعتماد على الخندق الكبير الذي يحيط بالقلعة، وكان يتقدمه أكمة من التراب تسمى متراسا واستحكاما ترابيا، وعلى العموم فكانت الحصون البيزنطية تعتمد على عدد من الرجال وعلى الأعمال الدفاعية الخارجية (الخندق والمتراس الترابي) ولا تعنى كثيرا بالموقع المنيع أو بمتانة الأسوار أو بترتيب منسق لاستخدام النيران الساترة. (زكي، 1969).

ونخلص من ذلك أن حصون خيبر قد استندت في أسس إقامتها على الحصون المصرية والحصون في شبة الجزيرة العربية والعراق والشام حيث سبق أن اجتمعت خصائص أسوار حصون خيبر في هذه الحصون منذ العصر الفرعوني حيث ظهرت الأسوار المحصنة بالأبراج والممرات وإنشاء الحصون العالية على الجروف الصخرية التي يصعب تسلقها وخلق موانع أساسية تكلف المهاجمين مشقة الهبوط والصعود وتسهل للمدافعين خلف الدراوي الحجرية مهمة الدفاع. ونجد كذلك الحرص على التأثر بوجود الممر أو الممشى خلف الدراوي الحجرية أعلى الأسوار والأبراج والحجرات المطلة على الواجهات، وكانت الأجزاء السفلية من الجدران حتى مستوى أعتاب الأبواب تقام بالحجر غير المنتظم، أما الأجزاء العليا فتقام بالطين المخلوط بقطع صغيرة من الحجر. وتعد ظاهرة الأسوار المتعددة بحصون خيبر تأثرا بالأسوار المصرية التي ظهرت في الأسرة الثانية وكذلك بأسوار الحصون الأخمينية المتأثرة بالحصون العراقية.

2. 2. 3 المداخل

ظهرت المداخل العالية التي يرتقى إليها بسلالم في برج من عصر الملك زوسر من بداية الأسرات وكان يرتقى إلى مدخله بسلم من حبل إلى نافذة عالية في أعلاه، (شكري، 1986)، وعرف المصريون المداخل ذات المرافق العديدة في الألف الثانية قبل الميلاد، والغرض منه تكبيد العدو المهاجم للحصن أفدح الخسائر في محاولة الانطلاق من باب الحصن ولا سيما في أثناء الظلام أو عند انسحابه عند فشل هجومه، (زكي، 1969). وهناك نوع آخر من المداخل ظهر في الحصون الأخمينية، حيث توجد بأبواب القلاع مداخل عميقة بها ممرات متتابعة لتعطيل العدو في حالة دخول القلعة، (مرابط، 1953)، وتوجد المداخل العالية بالدور الثاني بالحصون بالأديرة ويتم الوصول إليها بسلالم متحركة أو معابر متحركة ترفع بسلالم متحركة، [6].

ونخلص من ذلك أن حصون خيبر قد تأثرت في عناصرها المعمارية بالحصون المصرية والعراقية من حيث المداخل المرتفعة التي يصعب الوصول إليها وعليها أبواب ضخمة من الخشب ذات عوارض (رؤوس) مدعمة بالمسامير الحديدية المكوبجة ذات الرؤوس الكبيرة ويدور كل باب على عقب وسكرجة، ونجد على مدخل حصن القموص برج للمراقبة وللدفاع عنه، وعلى جانبي الدهليز مسطبتان لجلوس الحراس. وكان يتم وضع كتلة خشبية أعلى فتحة الباب ثم كتلة من أفلاق النخيل لتخفيف الضغط على العتب وهو ما رأيناه بعد ذلك في العقد الضحل أو عقد التخفيف.

لوحة 11. كتلة خشبية وأفلاق النخيل

لوحة 12. مزغل

ويؤدي المدخل في حصون خيبر إلى دهليز طويل عميق على جانبيه مسطبتان لجلوس جنود الحراسة (لوحة 9)، وهناك ممرات متتابعة تؤدي إلى داخل القلعة وممرات تؤدي إلى الأسوار لوصول المدافعين إلى كافة أجزاء الحصن بسرعة فائقة.

3. 2. 2. المزاغل:

استخدمت في جميع الاستحكامات الحربية عبر العصور، ووجدت في القلاع الأخمينية (مرابط، 1953)، والقلاع الرومانية والساسانية والبيزنطية والإسلامية، وكان شكل المزغل عبارة عن شق بالجدار يستطيع المدافع من خلاله استخدام وسائل الدفاع ضد العدو المهاجم من الخارج، واستخدمت المزاغل بأسوار وأبراج حصون خيبر لرمي السهام على القوات المهاجمة، وهي عبارة عن فتحات ضيقة ذات عقود منكسرة، ويلاحظ كثرة عدد المزاغل مما يعكس العدد الهائل للمدافعين عن هذه الحصون.

3. 3 ملامح التخطيط العمراني لحصون خيبر

تتكون خيبر من مركز اجتماعي منظم يستقطب جميع أركان بنية المجتمع، ومجموعة المباني والمرافق المتميزة التي أوضحت قدرة الإنسان وقللت اعتماده على الأرض وزادت سيطرته على البيئة، [8]. ونظرا لوجود المدينة في منطقة ذات مناخ صحراوي، فقد تم اللجوء إلى تطبيق معالجات بيئية عمرانية ومعمارية، تم تنفيذها وتطويرها بهدف الحفاظ على درجة الحرارة داخل المباني، وهذه المعالجات تعبر بصدق عن بعض مظاهر عمارة الصحراء [9].

ورغم أن الموقع الذي أقيمت فيه المدينة لا تتوافر به من سبل الحياة إلا عين الماء وأشجار النخيل، إلا أن المعنى الحقيقي والوظيفي للعمارة في هذا الموقع هو خلق المكان للنشاط الإنساني والديني، ومن ثم كانت طريقة إيجاد هذا المكان وكيفية تجهيزه ليفي بالاحتياجات الإنسانية هي الأكثر أهمية، وهي التي تكون الأسس النظرية لتصميم المدينة المحاطة بالحصون [10]، لتمنح قاطنيها الأمن ولتكون على صلة وثيقة بالأرض وفعالياتها، [8]، وتتمثل ملامح التخطيط العمراني فيما يلي:

1. 3. 3 الحصون هي أول أسس التخطيط

تمثل التخطيط في أنه تتوسطه وتحيط به الحصون القوية وأصبح أساس تصميم تخطيط خيبر القرب من مصادر المياه وأن يكون حصن القموص في منطقة الكتيبة مركز الحصون حيث يشرف عليها جميعا، وأقيم في بؤرة المدينة وحوله الحصون الأخرى والمنازل حوله أو قريبا منه، ثم امتد هذا التأثير على تخطيط المدينة ككل حيث تتوزع الحصون بعد ذلك، (عثمان، 1988)، مما منح أهمية له باعتباره المقصد الأول في التخطيط. كما أن عرض شوارعها وأزقتها محدودا وتتخلل الكتل

العمرانية ساحات، (سلمان، 1982). وكان من شروط إنشاء الحصون دفع المضار وجلب المنافع فيتم دفع المضار بإنشاء الأسوار حولها وكذلك جلب المنافع باختيار المواضع طيبة الهواء، ومراعاة شروط اختيار الموقع لمجابهة المناخ والظروف البيئية، (عثمان، 1988. الرفاعي، 1991).

وكانت الأسوار العالية المحيطة بمباني الحصن تعمل ككاسرات للرياح كما أن زيادة سمكها يجعلها تمثل عازلا حراريا للمباني الملتصقة بها كما في الحجرات الملاصقة للسور، والتي تمثل خطا دفاعيا على جانبي أزقة طويلة ملتوية.

2. 3. 3 تجميع المباني في مجموعات ذات كثافة عالية

اتبع في إنشاء خيبر عدد من الشروط البيئية حيث أنها كانت ذات مباني محصنة سواء كانت حصون أو منازل وشوارع رئيسية طولية وعرضية تلتقي عند المركز، مع بنائها متلاصقة بهدف تقليل مساحة الأسطح الخارجية لتحقيق العزل الحراري، وتقليل مساحة الفراغات المكشوفة، وحرص المعمار على أن يكون هناك ممرات ضيقة بينها (لوحة 13-14).

وتتميز عمارة خيبر بأن مبانيها متلاصقة مما يساعد على إيجاد تيارات هوائية تلطف من حرارة الجو بحيث تمثل كتلة معمارية واحدة لمقاومة العوامل المناخية، (الخولي، ص ص46-50)، ويرجع ذلك إلى ضيق المساحة المقام عليها المنازل ووقوعها داخل نطاق الحصون الدفاعي، ونظرا لتصميم الشوارع الضيقة وضيق المساحات الخالية، لجأ المعماري إلى إقامة الأفنية الداخلية لتوفير الهواء والإضاءة الطبيعية وتوفير الخصوصية الاجتماعية لساكني المنازل، وساعد سمك الحوائط على توفير الظلال وتقليل التعرض لأشعة الشمس، (إبراهيم، 1982).

لوحة 13. منازل خيبر

لوحة 14. منازل خيبر

3. 3. 3 توجيه المباني

وقد حرص اليهود على التوجيه المناسب للمباني بهدف تعريضها للهواء أن تكون غابات النخيل بالقسم الشمالي من المدينة وحول الحصون كما حرصوا أن يوفروا احتياجاتهم بزراعة أجزاء من الأراضي حولها، حيث تساعد على تحسين البيئة المناخية وتساعد على تلطيف الهواء وخفض درجة حرارته مع زراعة أشجار كثيفة على امتداد كساتر للمباني لحمايتها من الرياح كما أن هذه الأشجار تعمل علي خفض درجة الحرارة نتيجة ترطيبها للبيئة العمرانية.

4. 3. 3 ضيق الشوارع بين عناصر المنازل

ساعد على قلة تعرضها لأشعة الشمس المباشرة خاصة مع ارتفاع المباني والتنوع في الاتساع حيث كان لكل منها وظيفة خاصة، ويتراوح عرضها ما بين (4م) في الشوارع بين الأبواب الرئيسية والمركز، وما بين (3:2م) للشوارع الخاصة بالحركة الرئيسية داخل أقسام المدينة (حارات)، وما بين (2:1.5م) بالشوارع التي تطل عليها المنازل (أزقة).

وكان يتم توجيه الشوارع من الشمال إلى الجنوب حتى لا تتعرض واجهات المباني والطرق لأشعة الشمس وحتى لا تكون عمودية مع حركة الشمس الظاهرية، وهذا ما يجعل الشوارع تكتسب ظلالا طوال النهار واكتسابها الرياح الشمالية مع نسبة التظليل العالية في هذه الشوارع، كما تميزت الشوارع بتعرجها وانتهائها بأماكن واسعة قليلا (مجازات) تقوم بدور الفناء وتعمل على تخزين الهواء المعتدل البرودة في الليل وتمنع تسربه مع أول هبوب للرياح.

كانت الشوارع الضيقة مع الأفنية الداخلية المكشوفة أهم مظاهر التخطيط العمراني للمدينة وقد تزيد نسبة عرض الفراغات المكشوفة إلى ارتفاعها عن (5:1) وهذه الفراغات تقوم بتوفير الظلال والحماية من أشعة الشمس مما يسمح بانتقال الهواء من الشوارع الضيقة التي تمثل مناطق الضغط العالي إلى الأفنية الداخلية التي تمثل مناطق الضغط المنخفض خاصة أثناء النهار وتعرضها لأشعة الشمس.

وكان عدم جعل الشوارع والممرات مستقيمة بهدف تحويلها إلى أنفاق للرياح الشتوية الباردة أو الرياح الساخنة المحملة بالأتربة والرمال، كما أن ضيق الشوارع يمنع حدوث ذلك من خلال التعرجات والانحناءات وإتاحة مناطق مظللة أيضا، وقد اتبع المعمار وسائل لتغطية الشوارع واستخدم الساباطات وكل منها عبارة عن ممر مسقوف بين دارين أو جدارين يمثل جسرا معلقا يعلو فراغ الفناء أو الشارع بين منزلين متقابلين وتساعد الساباطات في تظليل الأفنية أو الشوارع، كما أنها تساعد على تحريك الرياح تحتها خاصة إذا كان الممر أو الشارع يفضي إلى فناء واسع في الغرب.

وساعد تظليل الشوارع إلى خفض درجة الحرارة، ولجأ المعماري في حالة عدم تظليل الشوارع إلى تنفيذ بروزات بواجهات المباني المطلة على الشوارع، (عثمان، 1988)، ويساعد بروز الطوابق بشكل متراكب لكل طابق عن الآخر على حركة الهواء وتجدده من أسفل إلى أعلى، وقد وجدت كل هذه المميزات بمنازل العلا.

5. 3. 3 ندرة الفتحات الخارجية

تتميز عمارة خيبر بجدران سميكة ونوافذ صغيرة من شبابيك وأبواب حيث أن عددها محدود ومسطحها صغير للغاية حتى أن الحوائط الخارجية للمباني تبدو كما لو كانت صماء ومصمتة، والفتحات ضيقة من الداخل واسعة من الخارج لتوسيع زاوية الرؤية، حيث تستخدم للحراسة والمراقبة، كما أن موقع كل فتحة يتم اختياره بدقة وبحكمة وكانت النوافذ الضيقة تمثل مداخل للهواء يدفع إلى داخل الغرف ليخرج من الجانب الآخر لإتمام حركة الهواء. كما تؤدي إلى ضبط مرور الضوء حيث تخفف من حدة أشعة الشمس المباشرة وغير المباشرة وتتحكم في مرور الضوء وتكون الفراغات في الجزء العلوي الذي يمثل مستوى النظر والربط بين الداخل والخارج حيث تمثل وظيفة اجتماعية حيث تحقق الخصوصية وتمكنهم من رؤية المنظر الخارجي مما يعطي إحساسا بالاطمئنان. أما الأدوار العليا فنظرا لقلة سمك جدرانها ودفء الهواء بها مساء فيتم تنفيذ فتحات نوافذ ضيقة لتزويد هذه الأدوار بالهواء البارد ليلا.

6. 3. 3 الفناء الداخلي

ويعتبر ذو أهمية معمارية ووظيفية حيث تعتبر التأثيرات البصرية بين الحصون وبيئاتها العمرانية أحد أهم محاور العلاقة بينهما من حيث تباين التشكيل البصري بين الفراغات الخارجية والفناء حيث يمثل فراغا عاما داخل الحصن، مما يعطي إحساسا غامرا بالتباين الفراغي بين الفراغات الضيقة المتعرجة المليئة بالحركة والحياة وبين الفناء المتسع المنتظم البسيط التشكيل، (صادق، 1999).

وقد يكون الفناء مغلقا عندما يحاط بالوحدات من الجوانب الأربعة أو مفتوحا عندما يحاط بالوحدات من ثلاثة جوانب، [11]، وقد كان للعوامل المناخية أثر كبير على تخطيط الحصن وتصميم عناصره الأساسية، (خير الدين، 1991)، حيث تعد المنطقة المحصورة بين الحجرات فناء داخليا وسط مسطح الحصن لإضاءة وتهوية الوحدات الداخلية حيث أنه مغلق بإحاطته بالوحدات من الجهات الشرقية والشمالية كما في حصن القموص، ونظرا لإحاطة هذا الفناء بالمباني المرتفعة لدورين فإنه تتوافر به الظلال في فصلي الصيف والشتاء، كما أن درجات الحرارة تقل عن خارج هذا الفناء ما بين أربع إلى سبع درجات، [12]، كما تتفرع منه ممرات ضيقة تجذب تيارات الهواء إلى الداخل حيث كان لهذه الممرات دور كبير في تزويد الحجرات بالضوء والهواء أيضا من خلال الشبابيك المنفذة به من أعلى. وقد تم بحصن القموص تنفيذ دخلات مسقوفة (أواوين) تشرف على الفناء.

7. 3. 3 مواد البناء

استخدمت المواد التي تساعد على حفظ الحرارة ومنع تأثير أشعة الشمس والعزل الحراري كالطين، ويعد هو المادة الأساسية للبناء بجانب الأحجار السوداء المجلوبة من الحرة والتي غالبيا ما تستخدم في بناء الأساسات والمداميك السفلى في المباني وتتكون الأسقف من جذوع النخل أو الدوم وأشجار أخرى مثل الأثل. وتم اللجوء إلى وسائل لحماية الجدران وأساساتها ببناء الأجزاء السفلية بالحجر الذي يوفر عزلا حراريا جيدا للفراغات، ويساعد على احتفاظ الفراغات الداخلية بهوائها البارد معظم ساعات النهار أثناء ارتفاع درجة حرارة الهواء بالخارج، [13].

واستخدم الطلاء المتعدد الطبقات لحماية المباني بالجص (تيبه، 1990)، وهو من المعالجات البيئية في العمارة، حيث أنه مادة رخوة هشة قابلة لامتصاص رطوبة الهواء، وانتشر استخدامه في طلاء الحوائط في المناطق ذات درجات الحرارة والرطوبة العالية حيث أن اللون الأبيض يعكس أشعة الشمس ويقلل من امتصاص الأسطح للحرارة وعند تعرضه للحرارة في الجو الجاف فإنه يفقد الرطوبة المخزونة مما يتسبب في انخفاض درجة حرارة سطح الجص والهواء الملامس لها، ويعمل الجص على عزل الجدران وحمايتها من المطر وتقويتها، ويزيد تكرار طبقات البياض الخارجي والداخلي عبر السنين علي الحوائط والأسقف من العزل الحراري.

الخاتمة ونتائج البحث

عندما استوطن اليهود خيبر أنشأوا سلسلة من التحصينات القوية أعالي الجبال وسط الصخور وأحاطوها بالأحجار الصلبة وأغلقوا منافذها بأبواب حديدية وخشبية، كما كانت تلك الحصون أشبه بمستعمرات سكنية محصنة تحصينا منيعا، تسمح لهم الإقامة فيها على نحو آمن.

تناولت الدراسة التحليلية التخطيط المعماري والعناصر المعمارية وملامح التخطيط العمراني للحصون حيث يتكون الحصن من ثلاثة أسوار تشكل مانعا قويا يعوق حركة الجنود المهاجمين، وأقيمت الجدران من الحجارة غير المنتظمة عليها طبقة ملساء من الملاط ومزودة بالمزاغل، ويتكون الحصن من دورين يمثل العلوي دروة يقف خلفها المدافعون، وله بابان قويان يصعب على المهاجمين اقتحامهما. وتميزت الأسوار الخارجية بأنها مدعمة بالأبراج التي تؤدي إليها ممرات يصل من خلالها الجنود إلى الأبراج.

تأثرت حصون خيبر في تخطيطها المعماري وعناصرها المعمارية بحصون مصر والعراق وشبه الجزيرة العربية وبلاد الشام من حيث الأسوار المتعددة والمداخل المرتفعة التي يصعب الوصول إليها وعليها أبواب ضخمة ونجد على مدخل حصن القموص برج للمراقبة والدفاع. يؤدي المدخل في حصون خيبر إلى دهليز طويل عميق، وهناك ممرات متتابعة تؤدي إلى داخل الحصن وممرات تؤدي إلى الأسوار لوصول المدافعين إلى كافة أجزاءه بسرعة فائقة.

خلصت الدراسة إلى تحديد ملامح التخطيط العمراني لحصون خيبر والتي تمثلت في أن الحصون هي أول أسس التخطيط، والأسوار العالية، وتجميع المباني في مجموعات ذات كثافة بنائية عالية خاصة في المنازل، والفناء الداخلي، وتوجيه المباني التوجيه المناسب بهدف تعريضها للهواء، وضيق الشوارع بين عناصر المنازل، وندرة الفتحات الخارجية ومواد البناء، وهي بذلك تتشابه مع منازل العلا.

المصادر العربية

- إبراهيم، عبد الباقي (1982). تأصيل القيم الحضارية في بناء المدينة الإسلامية المعاصرة، مركز الدراسات التخطيطية والمعمارية، القاهرة، ص37.
- ابن الأثير، ت 630هـ/1238م (1980). الكامل في التاريخ، ط3، دار الكتاب العربي - بيروت، 2، ص ص218-221-148.
- ابن الديبع، ت 944هـ/1537م (1993). حدائق الأنوار ومطالع الأسرار في سيرة النبي المختار وعلى آله المصطفين الأخيار، تحقيق عبد الله إبراهيم الأنصاري، مكتبة الكتبي - دمشق، 2، ص641.
- ابن النجار، ت 647هـ/1249م (1980). أخبار مدينة الرسول المعروف بالدرة الثمينة في أخبار المدينة، تحقيق صالح محمد جمال، ط3، مكة المكرمة، ص14.
- ابن حبيب، ت 245هـ/859م (1942). المخبر، تحقيق إيلزه لخش شتيتر، حيدر آباد – الدكن – الهند، ص ص248-249.
- ابن حزم، ت 456هـ/1064م (2003). جوامع السيرة، تحقيق إحسان عباس وناصر الدين الأسد، دار المعارف – القاهرة، ص ص212-213-421.
- ابن حيان، ت 354هـ/965م (1987). السيرة النبوية وأخبار الخلفاء، تحقيق السيد عزيز، ط1، دار الفكر – بيروت، ص300.
- ابن خلدون، ت 808هـ/1405م (1957). العبر وديوان المبتدأ والخبر، دار الكتاب اللبناني - بيروت، 4، ص795.
- ابن خياط، ت 240هـ/854م (1977). تاريخ خليفة بن خياط، تحقيق أكرم العمري، ط2، مؤسسة الرسالة - بيروت. ص ص82-83.
- ابن دريد، ت 321هـ/933م (1987). جمهرة اللغة، ط1، حيدر آباد - الدكن - الهند، 2، ص274.
- ابن سعد، ت 230هـ/845م (2001). الطبقات الكبرى، دار التحرير للطبع والنشر، القاهرة، 1/1، ص7، 1/2، ص77.
- ابن سيد الناس ت 734هـ/1333م، (2008). عيون الأثر في فنون المغازي والشمائل والسير، دار المعرفة – بيروت، 2، 2، ص ص132-133-134-135.
- ابن شبة، ت 262هـ/875م (1979). تاريخ المدينة المنورة، تحقيق فهيم شلتوت، دار الأصفهاني - جدة، 1، ص190-192-193.
- ابن عبد البر، ت 463هـ/1070م (1983). الدرر في اختصار المغازي والسير، تحقيق شوقي ضيف، ط2، القاهرة، ص ص197-200.
- ابن قيم الجوزية، ت 751هـ/1350م (1406هـ/1986م). زاد المعاد في هدى خير العباد، تحقيق شعيب الأرناؤوط، ط13، بيروت، 3.
- ابن كثير، ت 774هـ/1373م (1978). البداية والنهاية، دار الفكر - بيروت، 4، ص198.
- ابن كثير، ت 774هـ/1373م (1983). السيرة النبوية، تحقيق مصطفى عبد الواحد، دار المعرفة - بيروت، 3، ص ص276-363-368-375-376.
- ابن هشام، ت 218هـ/833م (1990). السيرة النبوية، تحقيق مصطفى السقا وآخرين، دار إحياء التراث العربي – بيروت، 3، ص ص344-347-348-493.

- إدارة الآثار والمتاحف السعودية - المنطقة الشمالية الغربية (1395هـ/1975م)، أرض مدين ودادان، الرياض، ص3.
- باشميل، محمد أحمد (1979). غزوة خيبر، ط5، بيروت، ص ص159-183-184-195-207-208-218-221-222.
- البكري، ت 487هـ/1094م (1949). معجم ما استعجم من أسماء البلدان والمواقع، تحقيق مصطفى السقا، القاهرة، 2، ص ص521-522-523، 3، ص745. 4، ص1380.
- البيهقي، ت 458هـ/1065م (1985). دلائل النبوة ومعرفة أحوال صاحب الشريعة، تحقيق عبد المعطي قلعجي، دار الكتب العلمية - بيروت، 4، ص ص216-224-225-226.
- تبيه، جان (1990). هندسة البناء بالطين، مجلة العواصم والمدن الإسلامية - عدد14، ص ص48-65.
- الجاسر، حمد (1970). في شمال غرب الجزيرة، ط1، بيروت، ص ص254-613.
- جروهمان، أدولف (1933). خيبر، دائرة المعارف الإسلامية، ترجمة محمد ثابت وآخرين، القاهرة، 9، ص54.
- جليمور، مايكل وآخرون (1982). تقرير مبدئي عن مسح المنطقتين الشمالية الغربية والشمالية، أطلال – حولية الآثار العربية السعودية، 6، الرياض، 6، ص19.
- الحربي، ت 285هـ/898م (1969). كتاب المناسك وأماكن طرق الحج ومعالم الجزيرة، تحقيق حمد الجاسر، منشورات اليمامة – الرياض، ص ص539-540.
- الحلبي، ت 1044هـ/1635م (1980). إنسان العيون في سيرة الأمين المأمون، المعروفة بالسيرة الحلبية، بيروت، 2، ص ص731-732-740-742-743-744-761.
- الحموي، ياقوت ت 626هـ/1228م (1977). معجم البلدان، دار صادر - بيروت، 2، ص ص398-409، 3، ص233، 4، ص63، 5، ص ص253-364. 437.
- الحميري، ت 900هـ/1495م (1975). الروض المعطار في خير الأقطار، تحقيق إحسان عباس، ط2، مكتبة لبنان – بيروت، ص ص228-490-609-571.
- الخولي، محمد بدر الدين (1977). المؤثرات المناخية والعمارة العربية، القاهرة.
- خير الدين، عمرو (1997). المعالجات البيئية في تخطيط المدن الإسلامية وتصميم مبانيها، مؤتمر انتربيلد – القاهرة، ص ص855-877.
- الديار بكري (1903). تاريخ الخميس في أحوال أنفس نفيس، بيروت، 2، ص ص44-45-47-48-53. 4، ص213.
- الرفاعي، خير الدين (1991). نحو عمارة أصيلة ومعاصرة تستمد معطياتها من القيم الإسلامية وتقنيات العصر، أبحاث منظمة العواصم والمدن الإسلامية، الحلقة الدراسية الرابعة، جدة، ص ص171-185.
- زكى، عبد الرحمن (1958). العمارة العسكرية في العصور الوسطى بين العرب والصليبيين، المجلة التاريخية، 7، ص ص109-123.
- زكى، عبد الرحمن (1968). الجيش في مصر القديمة، 1، القاهرة، ص ص47-65-66-69-70-73-74 شكل3.
- زكى، عبد الرحمن (1969). القلاع في الحروب الصليبية، المجلة التاريخية، 15، ص ص69-74-89.
- سعيد، سيف الدين (1983). الحركات العسكرية للرسول الأعظم في كفتي الميزان، ط1، بيروت، 2، ص384.
- سلام، سلام شافعي محمود (1989). حصون خيبر في الجاهلية وعصر الرسول، منشأة المعارف - الإسكندرية.
- سلمان، عيسى (1982). تخطيط المدن، حضارة العراق، 9، بغداد، ص ص7-8.
- السهيلي، ت 581هـ/1185م (1970). الروض الآنف في شرح السيرة النبوية لابن هشام، تحقيق عبد الرحمن الوكيل، القاهرة، 6، ص502-510-545.
- شكري، محمد أنور (1986). العمارة في مصر القديمة، القاهرة، ص ص67-85-86.
- الشهري، عوض (1980). مرويات غزوة خيبر، جمع وتحقيق، رسالة ماجستير، الجامعة الإسلامية - المدينة المنورة، . ص ص69-72.
- الشيباني، ت 189هـ/804م (1971). شرح كتاب السير الكبير، أملاه محمد بن أحمد السرخسي، تحقيق صلاح الدين المنجد، معهد المخطوطات بجامعة الدول العربية - القاهرة، 1، 1، ص ص72-73.
- شيحة، مصطفى (1987). رداع مدينة الآثار باليمن، مجلة المتحف العربي، 2/3، ص104.
- شيحة، مصطفى (1988). دراسات في العمارة والفنون القبطية، هيئه الآثار المصرية – القاهرة، شكل 3-4.
- صادق، محمد أحمد (1999). التشكيل الفراغي وتأثيره على علاقة المسجد بالبيئة العمرانية، ندوة عمارة المساجد، كلية العمارة والتخطيط - جامعة الملك سعود – الرياض، ص ص37-56.
- الصالحي، ت 942هـ/1535م (1983). سبل الهدى والرشاد في سيرة خير العباد، 5، تحقيق فهيم شلتوت وجوده هلال، 5، ص ص181-186-188-191-193-204-214-215-248.
- الطبري، ت310هـ/923م (1977). تاريخ الرسل والملوك، تحقيق محمد أبو الفضل إبراهيم، ط1، دار المعار - القاهرة، 3، ص ص9-10-14.
- العباسي، ت ق10هـ/16م (1916). عمدة الأخبار في مدينة المختار، تحقيق محمد الطيب الأنصاري، ط4، المكتبة العلمية - المدينة المنورة، ص314.
- عثمان، محمد عبد الستار (1985م). العمارة الحربية بين النظرية والتطبيق، مجلة كلية الملك خالد العسكرية، 7، ص ص13-138-169.
- عثمان، محمد عبد الستار (1988). المدينة الإسلامية، عالم المعرفة 28، الكويت، ص ص12-138-235-263.
- الفلكي، محمود باشا (1967). الإسكندرية القديمة، ترجمة محمود صالح الفلكي، الإسكندرية، ص63.
- مولر، فولفغانغ - فينر (1984). القلاع في الحروب الصليبية - ترجمة محمد وليد الجلاد - مراجعة سعيد طيان، 2، دار الفكر – دمشق، 2، ص31.
- الفيروز آبادي، ت 823هـ/1415م (1969). المغانم المطابة في معالم طابة، تحقيق حمد الجاسر، ط1، دار اليمامة – الرياض، ص ص134-135--186-241.
- قدرى، أحمد (1985). المؤسسة العسكرية المصرية في عصر الإمبراطورية (1570-1087ق.م.)، ترجمة مختار السويفي ومحمد العزب موسى مراجعة جمال مختار، هيئة الآثار المصرية – القاهرة، ص ص285-286.
- الكلاعي، ت634هـ/1237م (1968). الاكتفاء في مغازي رسول الله والثلاثة خلفاء، تحقيق مصطفى عبد الواحد، القاهرة، 2، ص256.
- لوبير، جراتيان (1978). دراسة عن مدينة الإسكندرية، وصف مصر، ترجمه زهير الشايب، القاهرة، 2، ص40.
- مرابط، محمود فؤاد (1953). الفنون الجميلة عند القدماء، القاهرة، ص10 ص ص90-72-272.
- المراغي، ت 816هـ/1413م (1981). تحقيق النصرة بتلخيص معالم دار الهجرة، تحقيق محمد عبد الجواد الأصمعي، ط2، المدينة المنور، ص166.
- المقريزي، ت 845هـ/1441م (1981). إمتاع الأسماع بما للرسول من البناء والأموال والحفدة والمتاع، 1، تحقيق محمد النميسي، ط1، ص ص227-237-241-242.
- النويري، ت 733هـ/1332م (2004). نهاية الإرب في فنون الأدب، المؤسسة المصرية العامة للتأليف والترجمة والطباعة والنشر - القاهرة، 17، ص ص251-255-256.

- هاردنج، لانكستر (1971). آثار الأردن، تعريب سليمان موسى، ط2، الأردن، ص ص190-191.
- الهمداني، ت 334هـ/946م (1974). صفة جزيرة العرب، تحقيق محمد بن علي الأكوع، الرياض، ص35.
- الواقدي، ت 207هـ/822م (1965). المغازي، تحقيق مارسدن جونس، عالم الكتب – بيروت، 1، ص375، 2، ص ص376-531-536-637:648-650:659-663:670-674:676-684-693-704-729.
- ولفنسون، إسرائيل (1927). تاريخ اليهود في بلاد العرب، القاهرة. ص ص116-165-167.
- اليعقوبي، ت 284هـ/896م (1957). تاريخ اليعقوبي، بيروت، 2، ص56.

REFERENCES

[1] Harper, R. F. and others, (May and June, 1900). ed. "Editorial Joseph Braslavi (Braslavski) and Leah Bornstein-Makovetsky (1972,2006), Khaybar, in Encyclopedia Judaica, via Jewish Virtual Library, Notes," The American Antiquarian and Oriental Journal. New York: Doubleday, XXII, p.207.

[2] Lamb, H. (1960). Cyrus the Great. New York: Doubleday, p.104

[3] Irfan, Shahid, Byzantium and the Arabs in the sixth century, p.322.

[4] Giorgio Levi Della Vida and Michael Bonner, Encyclopaedia of Islam, and Madelung, The Succession to Prophet Muhammad, p.74

[5] Quibell, J. E. Hierakonopolis, II, p.19, pl.V.

[6] De Villard, Monneret (1928). Deyr el Muharraqh, Milan, , pp.30-31-33.

[7] Petrie, F. The Royal Tombs, II, p.V.

[8] Lewis M. (1953). The Naeural History of Urbanzation, Univ. of Chicago press, p.383

[9] Friedmann, A. (Septamber 1980). Development of Field of Man / Enveronment Relations, The International Federation of Interior Designers Forum, (IFI), Copenhagen, p.4

[10] Al-Hussayen, M. (1995). Significant characteristics and design considerations of the planning research, Chicago.

[11] Envoldesn, C. (Septamber 1980). The form and the formulation of Theories, The International Federation of Interior Designers Forum, (IFI), Copenhagen, p.1

[12] El-Bakry, M. (1973). The Islamic houes, A study of environmental characterstics of Cairo's Islamic house, report for M. Sc. In Architecture School of Environmental studies, University college, London.

[13] Michell, G. (1978). Architecture of The Islamic World, William Marrow and company, New York, p.135.

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Patent Development of OECD Countries: A Panel Data Study

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ABSTRACT: Today, the technology has become a substantial factor that affects a country's competitiveness and economic growth. It is considered that the classical factors of production –capital, labor, land- do not provide an efficient growth in countries without the human capital accumulation and the technology. Thus far, the literature has widely examined the interaction between economic growth and the innovation level of the countries. The main contribution of this study has been to demonstrate the impact of human accumulation and the government's research and development (R&D) policies to patent development, which is a proxy for measuring the technological improvement. By exploiting the intensity of R&D researchers and R&D expenditure policy among 28 OECD countries in panel data for years 1998-2013, this paper provides the policy suggestions for governments by taking into consideration also the patent stock depreciation through years. According to our comparisons among pooled OLS, fixed and random effect models, the R&D expenditure policy and the patent stock have an obvious effect on the patent development of these 28 countries. Nevertheless, the R&D researchers and government researchers do not seem ensuring statistically significance. It would better for the governments to strengthen the human capital factor by applying more inclusive education policy to see its efficiency in the economic growth.

KEYWORDS: Research and Development, Patent, Economic Growth, OECD, Panel Data

1 INTRODUCTION

In modern world, competitiveness through technology is a major feature for countries. Not only the government but also the society itself contributes to the development of this technology which brings them much more dynamism. In this context, patents became an important measure for a country to show its competitiveness. A patent is a right granted to the owner of an invention that prevents others from making, using, importing or selling the invention without his permission. A patentable invention can be a product or a process that gives a new technical solution to a problem. It can also be a new method of doing things, the composition of a new product, or a technical improvement on how certain objects work. It is believed that the number of patents can reflect the scientific level and economic level of a country. As a consequence of this, patent development has become important to governments which try to raise the number of patents by many ways. The principal solution is increasing the R&D expenditure. Of course, there are other solutions such as rising R&D researchers. The ideas-driven model, with the assumptions made in [1], predicts that expansion in the number of researchers leads to a permanent increase in total factor productivity growth rate. In contrast, the empirical evidence suggests that most OECD economies have increased the size of their R&D workforce, while experiencing constant total factor productivity growth rates. This weak relationship between the number of researchers and this type of growth rate has led some to question the impulse of ideas-driven growth for the long run [2].

The question in this paper is that at which level the patent development can be interpreted with the indicators of R&D researchers and R&D expenditure policy. In addition to that we will use the patent counts to generate a stock of them. This stock of patents, together with the number of researchers, will allow us to evaluate the determinants of the flow of new

ideas directly. This work's results will be used in order to contribute to the limited literature about the pattern of patents in Turkey. We analyze the relationships on the country level by using the data from 28 OECD countries between the years 1998-2013. Based on the idea-based growth model, we will use the panel data model on STATA.

In the second section, we will introduce the literature review and the theoretical framework with the ideas-based growth model. In the following section, we interpret our variables and methodology on assessing the relationship between them. In the fourth section, the empirical analysis and regression tables will be presented by interpreting the results. In the conclusion part, we will point out the results obtained from the model and the policy suggestions.

2 LITERATURE REVIEW

In this section, first we will present the empirical literature concerning to the contribution of R&D related variables to innovation and growth. Secondly, after summarizing the ideas-based growth model as our theoretical framework, we will introduce our model to be estimated in the following section.

2.1 EMPIRICAL LITERATURE

In patent literature, the researches generally aim to analyze empirically the causal relations among R&D expenditures, innovation, and economic growth. As suggested in [3], a positive relationship between R&D expenditures and productivity growth, by introducing the stock of technological knowledge into the neoclassical growth model as an explanatory variable of international differences in productivity growth. In [4], it is found a positive long-term relationship between R&D expenditures and total factor productivity. By making use of aggregate level patent data, [5] made it clear that innovation is positively related to human capital in the R&D sectors and national knowledge stock, having a significant impact on total factor productivity growth. Although R&D expenditure was obviously increasing from about 1950s, no one made sure of the return rate. In 1958, [6] first estimated the social return of R&D expenditure. Then in 1964, that work was the first one to use a production function of Cobb-Douglas type, adding the education and public research expenditure variables. In 1984, [7] found the relationship of the R&D expenditure, R&D employment and the output of the patent. It is used the Poisson distribution model with the panel data from 121 firms of America in 1968 to 1975. [8] and [9] also found the relationship with the R&D expenditure and patents. [10] has made an empirical analysis and concluded that both the research and propensity to patent can lead to increase in the number of patents. Differences in innovation capacity and potential are largely responsible for persistent variations in economic performance and hence wealth among the nations in the world [11]. It is also argued that the effects of innovation on economic growth cannot be fully understood without considering the social and institutional conditions in an economy. As an illustration, [12] showed how the interaction between 3 research and social-economic and institutional conditions shapes regional innovation capacity.

2.2 THEORETICAL FRAMEWORK

Most recently, the theoretical literature can be broadly divided into two champs, i.e. the first generation models such as [1] and [13] and the second generation models such as [2] and [14]. In the neoclassical framework, the impact of innovation is treated as part of the Solow residual and hence a key contributing factor to economic progress and long-term convergence [15], [16].

Reference [1] implies that the cumulative nature of the knowledge is a really important condition. This production process is as follows:

$$Y = F(A, X)$$

where Y is the total production in the economy, A is stock of knowledge and X is the other factors. If A results as productive then,

$$F(\lambda A, \lambda X) > \lambda F(A, X)$$

then, he shows knowledge function is as follows:

$$\dot{A} = \delta H_A A$$

where H_A means the total human capital of research, A means the stock of knowledge and $\dot{A}$ means the new ideas and $\delta > 0$ is a constant. Comparing to Romer's model, [2] uses a similar model with a minor difference:

$$\dot{A} = \delta L_A^{\lambda} A^{\varphi}$$

where $\dot{A}$ represents the number of new ideas created, L_A represents the amount of human capital, or the number of researchers, devoted to innovation, A represents the stock of ideas, and $\delta > 0$ is a constant again. Actually, the only difference between the two models is the value of the parameter ϕ. In Romer's model, ϕ is constant and is equal to 1, while [2] asserts that there are other possibilities: ϕ is larger than 1 or smaller than 1. When it comes to the question which value of ϕ is closer to the reality, there is still no definitive answer.

In 1999, [18] use R&D expenditure instead of human capital, "From society's standpoint, the productivity of R&D may be varied because of the amount of R&D expenditure and the stock of ideas." Their model is as follows, where R is the R&D expenditure:

$$\dot{A} = \delta R^{\lambda} A^{\varphi}$$

[17] shows the R&D production function is a knowledge process which is determined by labor, capital and the first stock of knowledge as the function below,

$$I = f(L,K,I_0)$$

where I means the output of R&D and I_0 means the stock level. Based on that theory and the model in [2] and [18], we build the model in this paper is as follows,

$$P_{it} = \beta_0 H_{it}^{\beta 1} * R_{it}^{\beta 2} * PS_{it}^{\beta 3} \quad (1)$$

where P means the number of patents authorized during year t and in country i, H means the human capital; R means the R&D expenditure while PS means the cumulative stock of patents. The parameters $\beta 1$, $\beta 2$, $\beta 3$ measure the elasticity of human capital, R&D expenditure and the stock level to affect the output of patents. Taking the logarithm of equation (1), we get the equation (2) which we will use in order to answer our research question.

$$\ln(P_{it}) = \ln\beta_0 + \beta 1 * \ln(H_{it}) + \beta 2 * \ln(R_{it}) + \beta 3 * \ln(PS_{it}) + \varepsilon_{it} \quad (2)$$

The number of patents is a common proxy for measuring the technology and it has advantages as it is easy to quantify. Usually it is easy to measure and the data is easy to access [19]. The number of patent is also easy to compare across countries since, looking at patent applications in the US or Europe one can compare differences in innovation levels between nations or regions [20]. Of course patents are not optimal and it is important to know the limitations of a proxy. Patents measure output of innovation and are not likely to cover all that innovations should contain due to the fact that not all innovations are patented. Since innovations is only one way to measure total factor productivity and can be seen as only one component, it is important to know that there are setbacks using innovation proxies [19]. Patents can be seen as the output from another variable also frequently used as a proxy for innovation, namely research and development (R&D), in that case it is more suitable to use patents than R&D expenditure [17]. It is not only patents that are used as proxy for innovations. There are intramural and extramural R&D expenditures, operational R&D expenditure, turnover from innovation, degree of collaborators qualification etc. [21].

3 DATA & METHODOLOGY

3.1 PARTICULAR VARIABLES AND DATA SOURCES

As the purpose of this paper is comparing the data concerning to a huge group of countries, it is necessary to normalize the variables due to the fact that populations of them vary. We put account the number of patents as triadic patent families. We use the R&D expenditure as a percentage of GDP instead of absolute value of R&D expenditure. Because the purpose here is to give policy advice, we treat the R&D researchers as the human capital and the government researchers. The stock of patents, together with the number of researchers, will allow us to evaluate the determinants of the flow of patents directly.

Patent is the dependent variable in this model. When measuring innovation, it is widely accepted that the number of patents issued during a year is used. In order to get away from many limitations such as the difficulty to compare the different levels of patents all over the world, OECD has developed triadic patent families. The definition of triadic patent family is that a set of patents registered in various countries (i.e. patent offices) to protect the same invention [22]. Triadic patent families are a set of patents filed at three of these major patent offices: the European Patent Office (EPO), the Japan Patent Office (JPO) and the United States Patent and Trademark Office (USPTO). Triadic patent family counts are attributed to the country of residence of the inventor and to the date when the patent was first registered. This indicator is measured

as a number. We use the data from 1998 as the initial year, and because it is really difficult to find a general depreciation rate of the 28 countries, we will assume the depreciation rate is 5%, 10%, 15% based on [23]. The equation is as follows, where d is the depreciation rate, PS represents the patent depreciation and P is the number of triadic patent families for country i at time t+1.

$$PS_{it+1} = (1-d) * PS_{it} + P_{it+1} \quad (3)$$

R&D researchers are another variable concerned in this paper. It is defined as the professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, as well as in the management of the projects concerned [24]. This indicator is measured in per 1 000 people employed. Besides, we chose government researches as another variable. Its definition is that professionals working for government institutions engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned. This indicator is measured in per 1000 people employed and in number of researchers [25].]

Another explanatory variable of the model is the data of R&D intensity which represent gross domestic expenditure on R&D as a percentage of GDP. The source of expenditure on R&D is OECD (2014), Main Science and Technology Indicators which defines as gross domestic spending on R&D is defined as the total expenditure (current and capital) on R&D carried out by all resident companies, research institutes, university and government laboratories, etc., in a country [26]. It includes R&D funded from abroad, but excludes domestic funds for R&D performed outside the domestic economy. This indicator is measured as percentage of GDP.

3.2 Descriptive Statistics

It will be useful to check descriptive statistics in order to observe the significance and adequateness of sample group. We have 414 observations concerning to 28 countries between the years 1998-2013. Panel data used in this work is strongly balanced which defines as "A longitudinal or panel dataset is said to be strongly balanced if each panel has the same number of observations, and the observations for different panels were all made at the same times" [27]. Besides, the data provides a compact panel.

When it comes to within and between variations, our variables show an adequate within variation to use panel data. For instance within variation for the R&D expenditure as a % of GDP, is 60 per cent, for the other variables respectively R&D researchers is 44 per cent, for Government researchers is 40 per cent.

Number of patents is in a wide range in our sample as its minimum value is 1, while its maximum is 18712. The R&D expenditure as a percentage of GDP represents percentage values. The minimum expenditure is 0.01 per cent while it represents a maximum level as 4.1 per cent. The R&D researcher per 1000 employer varies between 0.08 and 17.67 whereas the government researchers are in absolute values and changing between 1.676 and 36.574.

We show in Figure1 (see Appendix), the graphs concerning to the variation of patents through time and other variables. All the variables are in logarithmic form assessed on STATA. As seen from the graphs, R&D researchers and the R&D expenditure as a percentage of GDP are related to patent development in many countries. The patent stock has a linear form as expected from its formulization.

In the following section, we will share empirical analysis of our model implemented into 3 different models, afterwards we will present a comparison table on purpose of choose the best fit model for our research question.

4 Empirical Analysis

Based on the theoretical framework presented in section 2, we use the following model to estimate in order to estimate our research question. We will show the results for pooled OLS, FE and RE Models respectively.

$$\ln(Patent_{it}) = \ln\beta_{0} + \beta 1 * \ln(RDGDP_{it}) + \beta_2 * \ln(Rp000emp_{it}) + \beta 3 * \ln(GovR_{it}) + \beta 4 * \ln(PD_{it}) + u_i + \varepsilon_{it} \quad (4)$$

4.1 Polled OLS Regression

In order to test the best model for patent development of 28 OECD countries, we pool the data first to fit the OLS regression model. The major problem with this model is that it does not distinguish between the various countries that we have. In other words, by combining 28 countries by pooling, we deny the heterogeneity or individuality that may exist among

28 countries. Assuming respectively the depreciation rates as 5 per cent, 10 per cent and 15 percent, we summarize the results below in Table 1.

The pooled OLS results suggests that by ignoring 28 different countries' heterogeneity or individuality that may occur, these explanatory variables could explain approximately 95 percent of patent development among these sample. Besides, if the patent stock depreciation rate dismissed, the power of the model in sense of the ability to explain the patent development declined to 32 per cent. R&D researcher per 1000 employer is the most efficient estimator according to t-statistics among all models both including and not including the patent stock depreciation rate, by explaining the patent development, ceteris paribus, at 1 per cent significance level. In addition to this, the power of the model increases when the patent stock depreciation rate is 15 per cent.

In the aim of analyzing the countries' heterogeneity or individuality, in the following sub sections, we will show the fixed effect (FE) and random effect (RE) regressions respectively.

Table 1. Pooled OLS Model Results

Variables	No depr	5% depr	10% depr	15% depr
Intercept	17.555***	-0.306	-0.514	- 0.646
	(1.587)	(0.611)	(0.542)	(0.480)
logRDGDP	0.528***	0.049	0.039	0.031
	(0.126)	(0.042)	(0.037)	(0.033)
logRemp	0.522***	-0.228***	-0.209***	- 0.189***
	(0.164)	(0.056)	(0.049)	(0.043)
logGovR	-1.450***	-0.051	-0.031	- 0.016
	(0.156)	(0.057)	(0.050)	(0.045)
logPD5		0.922***		
		(0.016)		
logPD10			0.942***	
			(0.014)	
logPD15				0.960***
				(0.012)
# observation	414	414	414	414
Prob > F	0.0000	0.0000	0.0000	0.0000
Adj R-squared	0.325	0.925	0.941	0.953

Notes: - ***, ** and * represent significance at the level of 1%, 5% and 10%, respectively.
- "depr" is the abbreviation of depreciation rate.

4.2 FIXED EFFECT MODEL I

In FE Model I, F statistic is significant for all 4 situations which differ according to the patent stock depreciation rate. When we check the t-statistics for each estimated variables, only the patent stock depreciation rates are significant at 1 per cent significance level.

Table 2 summarizes the results obtained by FE Model I. Another point from the results is that RDGDP and Remp are significant at 5 per cent significance level whereas GOVR provides 1 per cent significance level if the patent stock depreciation rate is excluded from the model. According to the model, an increase of 1 percent of R&D expenditure as a % of GDP, ceteris paribus, comes with an increase of 6 percent in triadic patent families. Furthermore, a rise of 1 per cent in R&D researchers causes a rise as well in patent development with a percentage approximately 13 per cent.

Besides these interpretations, it could be important to mention R-sq values. Although the patent stock excluded model seems more explicative as its coefficients are significant, its within variation is lower than included ones. We know from the literature that within variation is essential for panel- data analysis. Hence it would be better to keep the patent stock depreciation rate in the model. After giving a brief interpretation of FE Model I, now we will present RE Model results in the next sub-section.

4.3 RANDOM EFFECT MODEL

In RE Model, chi2 statistic is significant for all situations which differ according to the patent stock depreciation rate. Remp and the patent stock depreciation rates are significant at 1 per cent significance level when we check the t-statistics for each estimated variables. In Table 2, we show the results obtained from RE Model. RDGDP and Remp are significant at 5 per cent significance level whereas GOVR provides 1 per cent significance level if the patent stock depreciation rate is excluded from the model.

According to the model, an increase of 1 percent of R&D expenditure as a % of GDP, ceteris paribus, comes with an increase of 6 percent in triadic patent families. Furthermore, a rise of 1 per cent in R&D researchers causes a rise as well in patent development with a percentage approximately 13 per cent. Hence, the interpretation seems same for the previous FE Model with no patent stock depreciation rate.

R-sq values have also the same patterns. The main difference between FE and RE models is that the coefficients of variables are higher for the latter. In order to decide between two of them, we will implement a statistical hypothesis test in the next section.

Table 2. FE Model I and RE Model Results

	FE Model I				RE Model			
Variables	No depr	5% depr	10% depr	15% depr	No depr	5% depr	10% depr	15% depr
Intercept	7.001***	3.265***	2.812***	2.338***	7.113***	0.536	-0.117	-0.519
	(0.705)	(0.714)	(0.699)	(0.679)	(0.797)	(0.859)	(0.748)	(0.639)
logRDGDP	0.060**	0.032	0.030	0.027	0.064**	0.054	0.045	0.036
	(0.028)	(0.024)	(0.024)	(0.023)	(0.028)	(0.040)	(0.037)	(0.033)
logRemp	0.126**	-0.042	-0.055	-0.066	0.130**	-0.229***	-0.225***	-0.211***
	(0.053)	(0.049)	(0.048)	(0.046)	(0.054)	(0.068)	(0.060)	(0.060)
logGovR	-0.241***	0.002	0.020	0.038	-0.264***	-0.043	-0.011	0.006
	(0.071)	(0.067)	(0.065)	(0.062)	(0.071)	(0.080)	(0.070)	(0.059)
logPD5		0.262***				0.782***		
		(0.024)				(0.024)		
logPD10			0.315***				0.856***	
			(0.026)				(0.021)	
logPD15				0.375***				0.910***
				(0.028)				(0.018)
# observation	414	414	414	414	414	414	414	414
Prob > F / Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-sq within	0.070	0.280	0.320	0.366	0.070	0.278	0.318	0.364
R-sq between	0.389	0.994	0.995	0.995	0.390	0.994	0.995	0.996
R-sq overall	0.325	0.925	0.941	0.953	0.326	0.926	0.941	0.954

Notes: - ***, ** and * represent significance at the level of 1%, 5% and 10% respectively.
- "depr" is the abbreviation of depreciation rate.

4.4 COMPARISON OF MODELS AND MODEL SELECTION

In order to choose between the regressions models, we used Hausmann Test. In this test, H_0: FE model is not appropriate. H_a: FE model is appropriate. According to the results, when the patent stock depreciation rate is null, the probability value is less than 5 per cent, we can reject the null hypothesis. That means the data fails to satisfy the assumption of the Hausman test, so we keep considering the condition when the depreciation rate is 5, 10 and 15 percent respectively. The hypothesis of no systematic difference is rejected, so the FE model is preferred. In other words, the FE model is useful for the research question therefore we estimate the FE model again by cluster countries (see Table 3 for results).

In FE Model II, F statistic is significant for the patent stock depreciation rate included models. When we check the t-statistics for each estimated variables, on the contrary of FE Model I, not only the patent stock depreciation rate but also R&D researchers are statistically significant. RDGDP is significant at 5 per cent significance level for 10 per cent depreciation rate model whereas this significance level changes to 10 per cent for 5 and 15 per cent depreciation rates.

According to the model, an increase of 1 percent of R&D expenditure as a percentage of GDP, ceteris paribus, result in an increase of 3 percent in triadic patent families with different significance levels.

Table 3. FE II Model Results

Variables	No depr	5% depr	10% depr	15% depr
Intercept	7.001***	3.265**	2.812**	2.338**
	(1.259)	(1.278)	(1.219)	(1.140)
logRDGDP	0.060**	0.032*	0.030**	0.027*
	(0.026)	(0.017)	(0.017)	(0.016)
logRemp	0.126	-0.042	-0.055	-0.066
	(0.139)	(0.070)	(0.064)	(0.059)
logGovR	-0.241*	0.002	0.020	0.038
	(0.126)	(0.107)	(0.100)	(0.092)
logPD5		0.262***		
		(0.068)		
logPD10			0.315***	
			(0.071)	
logPD15				0.375***
				(0.073)
# observation	414	414	414	414
Prob > F	0.0290	0.0022	0.0007	0.0002
R-sq within	0.070	0.280	0.320	0.366
R-sq between	0.389	0.994	0.995	0.995
R-sq overall	0.325	0.925	0.941	0.953

Having revised FE model and given some interpretation, we will compare two selected model: Pooled OLS and FE model II therefore we will decide which model fits best our research question. Table 4 provides a comparison between two models: Pooled OLS and FE Model II where the former doesn't take into account the within variation as it reflects an OLS model with panel data even though F statistics shows the significance. To be able to answer our research question, we revised the FE Model allowing for arbitrary correlation over time for each individual it is used clustered standard errors. Standard errors increased but the estimated coefficient for R&D expenditure as a percentage of GDP became significant at 5 per cent for 10 per cent depreciation rate and 10 per cent for both 5 and 15 per cent depreciation rates.

We have chosen the biggest within variation in FE Model II which corresponds to the model with 15 per cent patent stock depreciation rate. An interesting interpretation is that, R&D researchers and Government Researcher are not significant in FE Model. As seen from Table 4, the coefficient of R&D patent stock is positive and significant. An increase of 1 percent of this variable, ceteris paribus, there will be an increase of 38 per cent in the number of triadic patent families at 1 per cent significance level. In addition, a rise of 1 per cent in R&D expenditures as a percentage of GDP, ceteris paribus, causes an increase of 2 per cent in triadic patent families. In summary, FE model considers within variation and F statistics is 0.0002 according to the model with 15 per cent depreciation rate of the patent stock. R&D expenditure as a percentage of GDP is also statistically significant at 10 per cent significance level.

-

Table 4. Comparison of Pooled OLS and FE II Model

	Pooled OLS Model	FE Model II
Variables	15% depr	15% depr
Intercept	- 0.646	2.338**
	(0.480)	-1.140
logRDGDP	0.031	0.027*
	(0.033)	(0.016)
logRemp	- 0.189***	-0.066
	(0.043)	(0.059)
logGovR	- 0.016	0.038
	(0.045)	(0.092)
logPD15	0.960***	0.375***
	(0.012)	(0.073)
# observation	414	414
Prob > F	0.0000	0.0002
R-sq within	-	0.366
R-sq between	-	0.995
R-sq overall	0.953	0.953

5 CONCLUSION AND POLICY SUGGESTIONS

In this paper, we tried to find if R&D expenditure policy and the count of researchers have obvious effects on the development of patents. Based on the idea-growth model, we change the model by treating R&D researchers, government researchers, R&D expenditure as a percentage of GDP and patent stock as input while treating number of patents as output. We used the panel data model to analyze 28 countries in OECD during 1998 to 2013.

In pooled OLS model, the heterogeneity or individuality has been denied that may exist among 28 countries. Even though adjusted R-square has a power to explain patent development, because of these ignored points, we implemented FE and RE models respectively and to decide which model is better, we used Hausman Test. After the test resulted as FE model is feasible, we revised FE model by clustering the standard errors which allowed for arbitrary correlation over time for each individual therefore we could decide which model fits best our research question.

After reinvestigating the FE regression model, we have compared it with Pooled OLS model and the results imply that R&D expenditure policy and the patent stock has an obvious effect on the patent development of these 28 countries. Nevertheless, the coefficient of R&D researchers and government researchers are not significant, therefore it is better for the government to strengthen education policy to have R&D researchers more qualified. In addition to this, the results show government researchers has no impact on increasing number of triadic patent families. There could be a non-productive group of researchers among the staff which should be cared about. For future work, one can study the turnover from innovation and the economic growth interaction.

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REFERENCES

[1] P.M. Romer, “Endogenous Technological Change”, *The Journal of Political Economy*, vol. 98, no. 5, pp. S71-S102, 1990.
[2] C.I. Jones, “Time Series Tests of Endogenous Growth”, *Quarterly Journal of Economics,* vol. 110, pp. 495–526, 1995.
[3] F.R. Lichtenberg, “R&D investment and international productivity differences” NBER Working Paper Series, no. 4161, 1992.
[4] D.T. Coe and E. Helpman, “International R&D spillovers”, *European Economic Review*, vol. 39, no. 5, pp. 859-887, 1995.
[5] M.E. Porter and S. Stern, “Measuring the ‘ideas’ production function: Evidence from international patent output”, NBER Working Paper, no. 7891, 2000.

[6] Z. Griliches, “Research Costs and Social Returns: Hybrid Corn and Related Innovations”, *Journal of Political Economy*, vol. 66, pp. 419-431, 1958.
[7] Z. Griliches et al., “Econometric models for count data with application to the Patents-R&D relationship”, *Econometrica*, vol. 52, no. 4, pp 909-938, 1984.
[8] H. Ernst, “Industrial research as a source of important patent”, *Research Policy*, vol. 27 no. 1, pp. 1-15, 1998.
[9] D. Popp, “Induced Innovation and Energy Price”, *American Economic Review*, vol. 92, pp. 160-180, 2002.
[10] G. Rassentosse and B. Potterie, “A policy Insight into the R&D - Patent relationship”, *Research Policy, Elsevier*, vol. 38, no. 5, pp. 779-792, 2008.
[11] Grossman and Helpman, *Innovation and Growth in the Global Economy*, Cambridge: MIT Press, 1991.
[12] P. Rodriguez et al., “Research and Development, Spillovers, Innovation Systems, and the Genesis of Regional Growth in Europe”, *Regional Studies,* vol. 42, no.1, pp. 51–67, 2008.
[13] P. Aghion, P. and P. Howitt, "A Model of Growth through Creative Destruction", *Econometrica Econometric Society*, vol. 60, no. 2, pp. 323-51, 1992.
[14] P. Segerstrom, “Endogenous Growth with Scale Effects”, *American Economic Review,* vol. 88, no.5, 1290–1310, 1998.
[15] R. Solow, “A Contribution to the Theory of Economic Growth.” *The Quarterly Journal of Economics*, vol. 70, no. 1, pp. 65-94, 1956.
[16] J. Fagerberg, “Technology and International Differences in Growth Rates”, *Journal of Economic Literature*, vol. 32, pp. 1147–1175, 1994.
[17] K.Y. Cheung and P. Lin, “Spillover effects of FDI on innovation in China: Evidence from the provincial data”, *China Economic Review*, vol. 15, pp. 25-44, 2003.
[18] C. I. Jones and J.C. Williams, "Measuring the Social Return to R&D”, *The Quarterly Journal of Economics*, vol. 113, no. 4, pp. 1119-1135, 1998.
[19] Smith, K.H., *Measuring innovation*, In: The Oxford Handbook of Innovation, Oxford University Press, New York, pp. 148-177, 2005.
[20] M. Connolly, “Technology, Trade and Growth: Some empirical Findings”, Federal Reserve Bank of New York: Research paper, vol. 9727, 1997.
[21] M.L. Manhaes, “The Challenge of Measuring innovation In Emerging Economies’ Firms: A Proposal of a new Set of Indicators on Innovation”, Working Paper, vol. 044, 2008.
[22] OECD, Triadic patent families (indicator), 2015. [Online] Available: http://www.oecd-ilibrary.org/industry-and-services/triadic-patent-families/indicator/english_6a8d10f4-en?isPartOf=/content/indicatorgroup/09614029-en (December 24, 2015)
[23] A. Pessoa, “Ideas driven growth: the OECD evidence”, The Portuguese Economic Journal, vol. 4, pp. 46-67, 2005.
[24] OECD, Researchers (indicator), 2015. [Online] Available: http://www.oecd-ilibrary.org/content/indicator/20ddfb0f-en (December 26, 2015)
[25] OECD, Government researchers (indicator), 2015. [Online] Available: http://www.oecd-ilibrary.org/content/indicator/c03b3052-en (December 26, 2015)
[26] OECD, Gross domestic spending on R&D (indicator), 2015. [Online] Available: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm (December 26, 2015)
[27] StataCorp, *Stata Longitudinal-Data/Panel-Data Reference Manual Release 12,* College Station, TX: StataCorp LP, pp.506, 2011.

APPENDIX (FOR 3.2. DESCRIPTIVE STATISTICS)

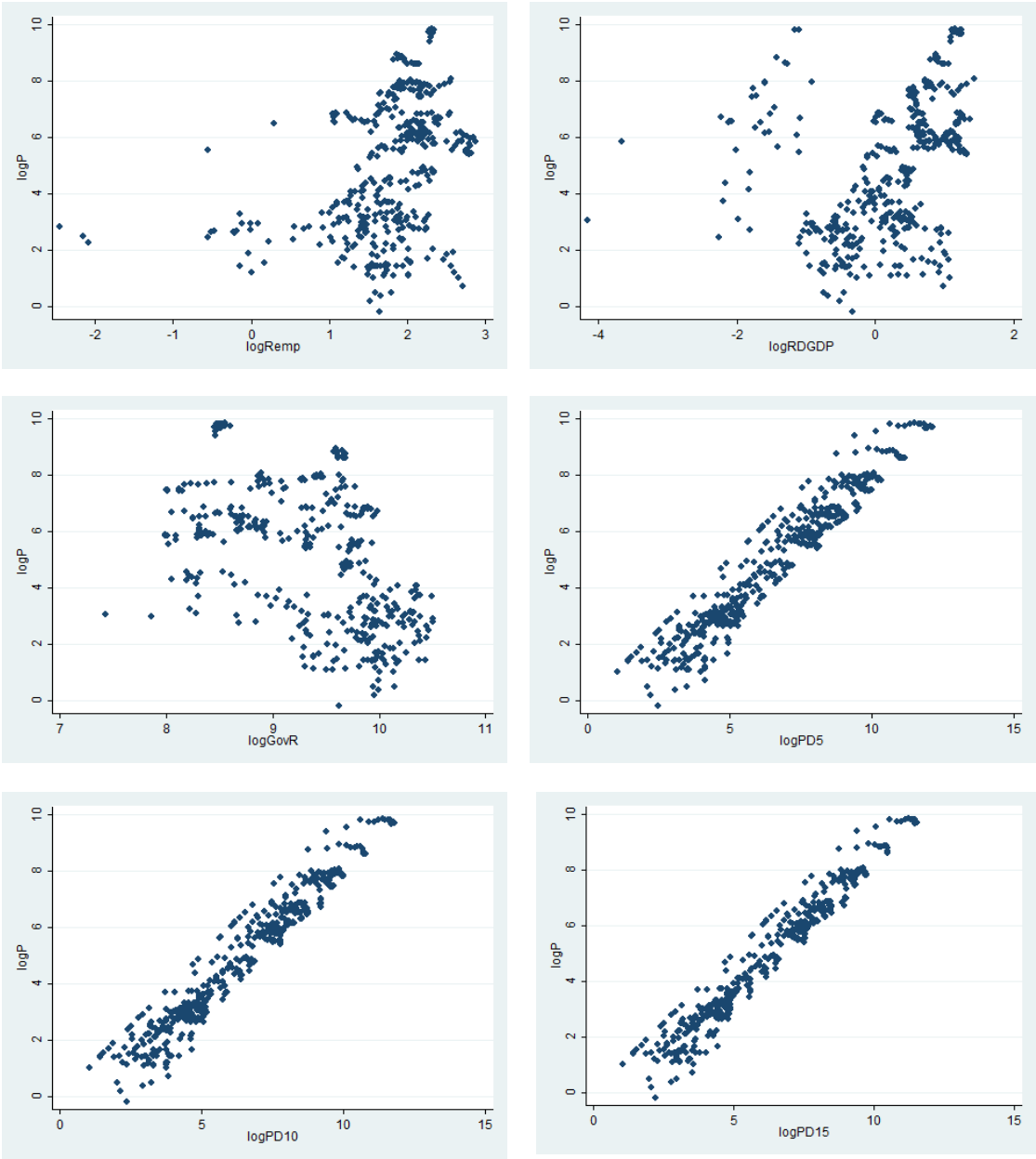

Fig. 1. The variation of triadic patent families through time and the variables for 28 OECD countries

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Stratégies d'appropriation des savoirs locaux relatifs à la prévention et à la réparation du dommage environnemental au Bénin

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ABSTRACT: Local knowledge appropriation mechanisms are operationalized in Benin for the prevention and repair of damage caused to the environment every day. Social logics underlie these strategies of appropriation. This qualitative research has analyzed the strategies of appropriation of local knowledge on the prevention and repair of environmental damage Benin to 90 surveyed through sampling technique reasoned choice.
It should be noted that the perception and practices of actors in relation to the prevention and remedying of environmental damage are lining up with social norms. Therefore, strategies to prevent and repair are based on local knowledge. Despite the advantages of these standards, they have many limitations. The participatory system of nature protection of this view needs to be strengthened.

KEYWORDS: Environmental damage, strategies, local knowledge, Benin.

RÉSUMÉ: Des mécanismes d'appropriation du savoir local sont opérationnalisés au Bénin en vue de la prévention et de la réparation du dommage quotidiennement causé à l'environnement. Des logiques sociales sous tendent ces stratégies d'appropriation. Cette recherche de nature qualitative a permis d'analyser les stratégies d'appropriation des savoirs locaux relatifs à la prévention et la réparation du dommage environnemental Bénin auprès de 90 enquêtés à travers la technique d'échantillonnage à choix raisonné.
Il est à noter que la perception et les pratiques des acteurs par rapport à la prévention et la réparation du dommage environnemental s'arriment avec les normes sociales. C'est pourquoi, les stratégies de prévention et de réparation se fondent sur les savoirs locaux. Malgré les atouts de ces normes, elles comportent bien des limites. Le dispositif participatif de protection de la nature de ce point de vue mérite d'être renforcé.

MOTS-CLEFS: Dommage environnemental, stratégies, savoir local, Bénin.

1 INTRODUCTION

Depuis un certain nombre d'années, la prévention et la réparation des dommages environnementaux sont devenues une grande préoccupation scientifique. Ils ont surtout nourri maintes réflexions juridiques au plan international et qui viennent renforcer les conventions en matière de protection de l'environnement. Dans chaque pays, dans les dispositions juridiques internes, les normes prévoient des mécanismes de protection de la nature. Le constat est que ces normes s'inspirent généralement des normes internationales. Au Bénin, par exemple, la loi cadre sur l'environnement et autres instruments juridiques ont prévu des dispositifs de protection de l'environnement. Mais toujours est-il que l'environnement continue de subir l'influence fortement destructrice de l'Homme. Le dommage écologique constitue le symptôme le plus ostensible des conséquences des excès de l'homme sur l'environnement. Il prend d'ampleur et il importe de renforcer les actions protectrices. Car force est de constater que s'il existe des lueurs d'espoir, l'environnement mondial se porte globalement très mal **(Aouba, 2010)**. Si le dommage écologique se répare pour la nature, c'est surtout pour le bien-être de l'Homme. C'est pourquoi, réparer le dommage écologique, c'est avant tout tenir compte de l'Homme et de son environnement. Mieux, le

droit de la responsabilité environnementale doit s'adapter aux défis de notre temps et des sociétés. Trouver les mécanismes de protection à partir des matériaux sociaux est un facteur d'accélération du succès **(Le Club des Juristes, 2012).** Dans cette perspective, **inforesources (2005)** nous renseigne que sur le terrain, les conventions doivent être mises en œuvre en fonction des réalités sociales. Il est donc justifié d'exiger que leur aménagement se fasse avec l'implication de la base. L'Homme en tant qu'être de culture a toujours emprunté à sa culture et à son environnement les ressources qui lui utiles pour faire face à ses besoins. De son environnement, il puise les rudiments consubstantiels à son développement. Un peuple ne peut s'engager dans un processus de développement que si celui-ci correspond à ses besoins les plus importants **(UNESCO, 1996).** C'est un peu ce que dit Larrère, valoriser quelque chose, c'est découvrir le sentiment qui nous y attache (**Larrère, 1997).**

Des solutions locales ont été souvent été conçues et opérationnalisées par les acteurs locaux pour faire face au dommage environnemental. Mais les approches locales de solution sont-elles efficaces face à l'ampleur qu'il prend aujourd'hui ?

Certes, les racines culturelles sont sources protectrices de la nature, mais au Bénin arrivent-elles à s'arrimer avec les enjeux juridiques et les conventions aussi bien nationales qu'internationales en la matière ?

La dimension sociologique est fortement présente dans le dommage environnemental. L'écologie, comme l'économie est politique au premier chef. Nos crises écologiques sont ainsi des questions d'ordre sociopolitique. C'est pourquoi l'approche social-écologique n'est pas seulement utile, elle est aujourd'hui particulièrement nécessaire. Toujours dans la logique sociologique, plusieurs approches locales existent autour du dommage écologique comme le montre **Doyon (2005)**. En effet, selon lui, le système étatique cubain, supporté par les valeurs de la révolution, a poussé la population à mettre un terme à leurs pratiques de subsistance. Toutefois, avec la crise économique des années 1990, la population a dû retrouver et réinventer un savoir local afin de pouvoir exploiter les ressources naturelles et assurer leur survie. Des mécanismes de réappropriation du savoir local existent et sont source de bonheur. Mais encore faudrait-il qu'ils existent et soient efficaces afin d'être structurés et renforcés. Pour que le dommage écologique soit réparé à bon escient, il est important que les acteurs s'y reconnaissent pour mieux s'y engager.

Quels sont les logiques sociales qui sous tendent les stratégies d'appropriation des savoirs locaux relatifs à la prévention et la reparation du dommage environnemental au Bénin ?

Cette étude vise à analyser les stratégies d'appropriation des savoirs locaux relatifs à la prévention et la reparation du dommage environnemental Bénin. Spécifiquement, elle a permis de décrire la perception et les pratiques sociales autour des savoirs locaux relatifs à la prévention et la réparation du dommage environnemental et d'apprécier les mécanismes traditionnels relatifs aux savoirs locaux par rapport à la prévention et la réparation du dommage écologique.

Après la présentation de la démarche méthodologique, les résultats sont présentés suivis d'une discussion.

2 MATÉRIELS ET MÉTHODES

C'est une démarche ethnométhodologique qui a été utilisée ici. Elle s'inspire des travaux de Garfinkel (1967). En effet, pour lui le phénomène fondamental sur lequel se focalise l'ethnométhodologie est la production locale et endogène, des choses les plus ordinaires de la vie, procédant d'un travail d'organisation, ces choses sont observables (à l'aide d'instruction) et l'on peut en rendre compte dans le langage naturel et du point de vue du sens commun. Ce sont des données qualitatives qui sont collectées dans le temps et dans l'espace. Les techniques d'entretien semi directif et d'observation ont permis de collecter les données auprès de 90 acteurs. C'est la technique d'échantillonnage à choix raisonné qui a permis d'identifier les groupes cibles ont été identifiés.

La recherche s'est déroulée dans neuf Communes du Bénin qui sont choisies en fonction des critères géographiques, historiques et de la dynamique urbaine. Dans cette perspective, les communes suivantes sont choisies : Allada, Cotonou, Klouekanmey, Abomey, Bohicon, Kétou, Parakou, Natitingou et Banikoara. L'effort est fait pour étendre l'étude à toutes les régions du Bénin.

Tableau n°1 : Les sites de la recherche

Zones d'étude	Communes	Nombre
Zone sud	Allada	10
	Cotonou	10
	Klouekanmey	10
Zone centre	Abomey	10
	Kétou	10
	Bantè	10
Zone nord	Parakou	10
	Banikoara	10
	Boukombé	10
Total		90

Source : Données de terrain, 2016.

3 RÉSULTATS

3.1 PERCEPTION ET PRATIQUES SOCIALES AUTOUR DE LA PREVENTION ET DE LA REPARATION DU DOMMAGE ENVIRONNEMENTAL AU BENIN

Le dommage écologique se présente sous la forme de la pollution de l'air, de l'eau et du sol. Il peut être occasionné directement ou indirectement par des industries et des exploitations d'activités dangereuses. Il varie en fonction de la taille et de la nature des activités humaines, de l'arène sociale, etc.

« *Les dommages écologiques affectent l'habitat des êtres vivants, la végétation à cause de plusieurs activités (l'agriculture, l'exploitation du bois, la dégradation des ressources en eau (c'est le cas de la rivière Fourninkérè, le rejet des déchets solides et ménagers, l'utilisation des pesticides et engrais qui favorisent l'eutrophisation, l'érosion des berges. Les activités économiques créent aussi de dommage écologique. Par exemple, le cours d'eau de Perma soumis aux phénomènes de pollution intense liés à l'extraction de l'or à cause de l'utilisation du mercure, il y a aussi la quête excessive du sable dans les rivières qui détruit quelques espèces naturelles (le penta desma produisant des fruits à l'intérieur beurré, afzélia africana et on note la disparition des boas et tortues.* » ***B.C. personnel d'ONG de protection de l'environnement.***

En majorité, les enquêtés savent que l'environnement connait des dommages écologiques au Bénin. Et d'ailleurs dans le discours populaire, il est perçu comme un danger. C'est pourquoi, en tant que gbɔto[1] ou Homme ce qui signifie père de la nature, géniteur, il a le devoir et à la fois le droit d'assurer la protection de la nature. La grande responsabilité sociale de l'homme dans le cadre de la protection de la nature est perçue dans le langage comme étant un acteur majeur en interaction forte avec la nature.

« *En tant que gbɔto ou Homme ce qui signifie père de la nature, géniteur, il a le devoir et à la fois le droit d'assurer sa protection* ». A.D, Sage résident dans la Commune d'Allada.

Une analyse sociolinguistique permet de se rendre compte cette compréhension de l'Homme ou du gbɔto ou en fongbé s'inscrit dans la perspective de l'idéologie de la domination de l'homme sur la nature, défendue par la philosophie kantienne ou de la philosophie cartésienne relative à la thèse du « maître possesseur ». L'Homme est donc comme détenteur de toute puissance et de toute suprématie sur l'avenir de l'environnement. C'est pourquoi, tout dommage à lui créé est considéré comme préjudiciable à l'Homme et à la vie sociale.

Compte tenu de l'importance accordée à la nature et au dommage à lui créé, plusieurs mécanismes sociaux sont conçus pour prévenir ou faire face au dommage écologique. Il s'agit notamment des savoirs transmis par l'éducation morale et civique. (dans le cercle familial, à l'école, etc.). Des actions symboliques sont aussi conçues à cet effet. La naissance de

[1] *En langue fongbé, (langue nationale la plus parlée au Bénin), cette expression signifie Homme à différencier de l'homme ou de la femme. D'un point de vue Anthropologique l'Homme a une valeur supérieure à l' homme ou à la femme et dont on a une compréhension sexuelle.*

l'enfant sera symbolisée par la plantation d'un arbre dans certaines régions du Bénin. C'est ainsi une action symbolique face aux conséquences néfastes de la déforestation et de la désertification.

En dehors de ces mécanismes cognitifs, il y a la dimension religieuse de protection de la nature et de réparation du dommage écologique. En effet, dans les localités où s'est déroulée l'étude, l'environnement est perçu comme un bien venant de Dieu. Et toute personne ayant la crainte de Dieu lui doit respect et protection.

Pour l'enquêté A. J. adepte du culte Oro, « *la forêt est un don de Dieu, celui qui contribue à sa destruction est maudit et puni. C'est cela qui explique la présence des couvents Oro et autres forêts sacrés*. » L'une des divinités de protection de la nature et très présente au sud du Bénin notamment dans le Département du Plateau au Bénin.

Comme le montrent les propos de cet enquêté, le sacré importante valeur du religieux est utilisé comme une stratégie de protection de la nature au niveau local. L'environnement et tout ce qui l'entoure est sacré. Tout est mis en œuvre pour assurer sa protection. Certains éléments constituent des éléments cosmogoniques divins. Par exemple, la divinité Sakpata est liée à la terre, la divinité Mami Wata est liée à l'eau, la divinité, la divinité Goun est liée au fer, etc. Toute action de dommage à la nature, c'est par ricochet des atteintes à ses divinités et c'est ine fine se compromettre et risquer sa vie. Et c'est l'une des missions des gardiens de la tradition. Ils veillent au grain. Tout dommage causé à la nature mérite sanction et punition parfois mortels. Ces gardiens ont une fonction régulatrice dans la réparation du dommage. Lorsque vous portez atteinte à une divinité qui se trouve dans un arbre sacré ou dans une forêt sacrée, vous risquez la mort. Celui qui ose peut poser des actes de désacralisation doit subir les conséquences. Des cérémonies sont organisées périodiquement pour conjurer le mal fait à l'environnement en vue de la réparation du dommage causée à la divinité incarnée dans un produit de l'environnement comme l'arbre, le Python, la forêt, etc.

Les mécanismes religieux jouent un rôle important dans la réparation du dommage écologique au point où ils deviennent des stratégies de protection.

« La sacralisation de certains sites et endroits sont des pratiques endogènes. Par exemple, l'amont de la rivière est moins menacé à cause des divinités présentes. Il y a des espèces de poissons rares qui ne sont pas pêchés donc sacralisées ». C.C., responsable d'un culte religieux traditionnel.

Aujourd'hui, la logique du sacré subit des mutations et l'environnement est pris d'assaut par les acteurs sociaux à la base pour satisfaire leurs besoins. Au niveau local, en dehors du sacré la participation est utilisée comme une stratégie locale de prévention du dommage écologique. Au niveau local, l'approche participative est une stratégie de prévention des dommages écologiques. C'est le cas de l'initiative de gestion intégrée de la rivière Fourninkérè. Les autorités locales prennent aussi des initiatives dans ce sens. A ce propos voici ce qu'en dit une autorité locale :

« *La Mairie a installé des plaques d'interdiction de dépôt d'ordures dans les caniveaux, les lieux et voies publics. Mais, il y a toujours des résistances malgré la présence faible d'actions et de mesures punitives. On punit les gens quand la mairie les arrête. Seulement les forfaits sont plus commis la nuit. Autre forme de résistance, les gens disent qu'ils sont chez eux de ne pas les embêter…. Les actions de sensibilisation ne portent toujours leur fruit*. » N. C., élu local.

Le législateur et les acteurs étatiques ont prévu en faveur des collectivités locales des écotaxes ou autres taxes sous le registre pollueur-payeur. En dehors de la contrainte que ces actions représentent, c'est aussi une stratégie de mobilisation de l'acteur local en vue de la protection de la nature. Les taxes constituent une motivation en de vue la participation à la prévention ou à la lutte contre le dommage écologique. Malheureusement, malgré ces initiatives locales, le dommage continue de prendre plus d'ampleur. Il importe donc de s'interroger sur l'efficacité des normes locales.

3.2 LA TRADITION LEGITIME MAIS LIMITEE FACE A L'AMPLEUR DU DOMMAGE ECOLOGIQUE

La réparation du dommage écologique signifie que le dommageur doit remettre l'environnement dans son état intact avant la survenue le dommage. Le dommage écologique prend énormément d'ampleur. Mais dans la réalité, il y a aujourd'hui comme une tolérance sociale du dommage écologique au Bénin. Face aux nombreux problèmes quotidiens auxquels les hommes sont confrontés, l'exploitation des ressources de la nature constitue une alternative facile.

« … d*ans les milieux ruraux, la déforestation tient sa source du désir des acteurs sociaux à faire face à leurs besoins sociaux vitaux* ». S.M, Spécialiste de l'environnement.

Aujourd'hui, l'ampleur des dommages dépassent les solutions de la tradition et des collectivités locales. Comme le dit l'adage « ventre affamé n'a point d'oreilles ». Pire, il existe des dommages qui vont au-delà des frontières des collectivités territoriales et des Etats.

« *Les formes actuelles que prend la pollution de l'environnement sont compliquées. Par exemple, avant nos ancêtres n'utilisaient pas les engrais chimiques pour la production agricole. Aujourd'hui, c'est la mode. Les industries polluent, les intrants agricoles entrant dans le cadre de la production du coton polluent. La pollution a pris d'ampleur et les moyens dont nous disposons pour y faire face sont très limités. Le mal de la pollution dépasse le cadre de la tradition. Le progrès est donc source du dommage causé à l'environnement*. ». S.J. Historien.

Les propos de cet enquête montrent que les mécanismes locaux de protection de la nature d'inspiration traditionnelle ont des limites. Non seulement, les dégâts créés à l'environnement sont d'une grande ampleur, mais dans la tradition, il n'existe pas encore de technologies appropriées pour faire face aux dégâts sur l'environnement qui prennent des proportions planétaires comme ce fut le cas de la marée noire aux Etats-Unis, le cas en août 2006 de ce déversement frauduleux de déchets industriels toxiques par la multinationale néerlandaise «Trafigura> (affaire Probo koala) sur onze (11) sites en Côte d'Ivoire. La marée noire de l'Erika du 12 décembre 1999 s'ajoute à cette liste d'atteintes environnementales. On pourrait s'interroger sur l'efficacité des moyens de la tradition face aux moyens colossaux déployés par des structures organisées pour détruire la forêt, l'eau et bien d'autres ressources émanant de la nature. Le droit de la responsabilité environnementale doit s'adapter aux défis de notre temps et des sociétés **(Le Club des Juristes, 2012).** Ce sont les besoins de l'Homme qui engendrent les guerres contre l'environnement. C'est donc dans leur esprit qu'il faut trouver les mécanismes de protection. Et ce point de vue, la tradition continue de jouer sa partition face aux défis écologiques. En effet, au Bénin, le dispositif juridique de protection de l'environnement est très peu connu des acteurs sociaux à la base. La comparaison entre les normes juridiques modernes et celles traditionnelles selon les informateurs confirme cette réalité. (Voir tableau II).

Tableau n°2 : Comparaison entre normes traditionnelles et modernes en matière de protection de l'environnement selon les acteurs

Quelles normes sont plus respectées en matière de protection de la nature ?	**Traditionnelles**	**Modernes**
Total	**70** %	**30**%

Selon le tableau n°2, les enquêtés pensent que 70 % des normes traditionnelles sont plus respectées en matière de protection de la nature alors que 30% ont répondu en faveur des normes modernes. Certes, dans la pratique du droit moderne, peu de dommages écologiques sont déjà réparés malgré la multitude de textes en matière de protection de la nature. Le dispositif légal est très peu connu des acteurs sociaux malgré les actions de communication que les organisations étatiques et non étatiques essaient de mettre en œuvre. C'est dire que malgré les instruments modernes de protection de la nature au Bénin, la tradition continue d'être légitime. La peur de la tradition est un facteur de respect vis-à-vis de la nature.

4 DISCUSSION

Le dispositif juridique national de protection de l'environnement est fait de quelques lois et autres textes réglementaires. Ce dispositif s'est souvent inspiré des instruments internationaux de protection de l'environnement. Or, au niveau local, il y existe atouts exploitables. Certes, aujourd'hui, au regard de l'ampleur que prend le dommage écologique, on peut s'interroger sur l'efficacité des savoirs locaux-localisés comme sus-évoquées. Mais toute chose est perçue selon les capacités de celui qui reçoit. « Le monde que nous percevons est dépendant de celui qui le perçoit. Notre cerveau construit des mondes à travers notre propre histoire » (**Windisch, 1990**). On peut retenir qu'au Bénin, une multitude de savoirs sont conçus et opérationnalisées pour réparer le dommage causé à l'environnement notamment au niveau local. Mieux, les savoirs locaux-localisés produits et diffusés relatifs au dommage écologique varient d'une arène sociale à une autre. Aussi, les acteurs sociaux arriment essentiellement leurs actions autour des normes morales endogènes même si des normes modernes sont édictées. Ces matériaux empiriques renforcent la perspective de **Halbwachs** (1970 : 182-183). Selon ce dernier, l'organisation spatiale agit sur la société par la façon dont celle-ci l'appréhende : « les formes matérielles de la société agissent sur elle non point en vertu d'une contrainte physique comme un corps agirait sur un autre corps mais par la connaissance que nous en prenons (…). Il y a là un genre de pensée ou de perception collective qu'on pourrait appeler une donnée immédiate de la conscience sociale ». Il convient de s'attacher aux représentations collectives de l'espace qui renvoient aux « sentiments communs » de la société. Dans cette perspective, **inforesources (2005)** nous renseigne que sur le terrain, les conventions doivent être mises en œuvre en fonction des réalités sociales.

5 CONCLUSION

Les mécanismes locaux en matière de protection de l'environnement ont certes des limites, mais elles peuvent être opérationnalisés et renforcer la lutte en faveur de la protection de la nature. C'est un peu ce que dit Larrère, valoriser quelque chose, c'est découvrir le sentiment qui nous y attache (**Larrère, 1997).** Malgré l'universalité du phénomène du dommage écologique et de la grande ampleur qu'il prend, il importe d'arrimer davantage les normes juridiques à celles sociales. Une lecture globale du dommage écologique intégrant les normes sociales s'imposent. Compte tenu des atouts des savoirs locaux, c'est donc le dispositif de participation des acteurs sociaux dans la réparation réelle et la valorisation des matériaux sociaux dans une perspective anticipée ou qui méritent d'être renforcés. Car, la conscience des acteurs sociaux à la protection de l'écologie doit être élevée par les mécanismes éducatifs. Hier au Bénin, comme aujourd'hui dans d'autres arènes, créer du tord à l'environnement, c'est sans doute hypothéquer l'avenir de l'Homme, le gbɔto. Cette préscience du risque élève le niveau de conscience. Et les savoirs locaux peuvent des facteurs intégrateurs à la dynamique de l'avènement ou de la réparation du dommage écologique. Le dispositif participatif de protection de la nature de ce point de vue doit être renforcé.

REFERENCES

[1] Addelmalki L., Mundler P., 1997, *Economie de l'environnement. Les fondamentaux*, Paris, Ed. Hachette Supérieur.

[2] Amakpé F., 1998, *Contribution à l'aménagement durable de la forêt classée des trois rivières : composition et dynamique des principaux groupements végétaux et besoin des populations riveraines*, FSA/UNB.

[3] Aouba S., 2010, *La réparation du dommage environnemental causé par la pollution par des déchets industriels en droit international de l'environnement,* Mémoire de Master 2 en Droit International et Comparé de l'Environnement, Faculté de Droit et de Science Economique de l'Université de Limoges.

[4] Badarou N., 2010, *Gestion des ordures ménagères à Abomey*, UAC.

[5] Bocéno L., 2012, Techernobyl ou l'expérience nouvelle d'un environnement radioactif : au sujet de quelques causes de modification de pratiques, attitudes et croyances, Paris, Harmattan.

[6] Bocéno L., 2006, *Sociopathologies : de Tchernobyl à la Hague*, Paris, Atelier National de reproduction des thèses.

[7] Bonnieux F., 2006, *Evaluation économique du préjudice écologique causé par le naufrage de l'Erika* , Rennes, INRA.

[8] Bouteloup C., 2008, Dynamiques de reconnaissance des dommages écologiques : quels apports de l'évaluation économique ?, Thèse CIFRE ENGREF/AScA.

[10] Doyon S., « Savoir environnemental local et scientifique : entre la révolution, la gouvernance nationale et le développement durable à Cuba », *VertigO - la revue électronique en sciences de l'environnement* [En ligne], Volume 6 Numéro 2 | septembre 2005, mis en ligne le 01 septembre 2005, consulté le 27 novembre 2013. URL : http://vertigo.revues.org/2742 ; DOI : 10.4000/vertigo.2742

[11] Esquissaud J. M., 1981, *Ecologie industrielle*. Hermann, éditeurs des sciences et des arts. Coll. Actualités scientifiques et industrielles.

[12] Garfinkel H., 1967, *Studies in ethnomethodology*, Paris, PUF.

[13] Gurvitch G., 1962, Dialectique et Sociologie, Flammarion.

[14] Inforesources, 2005, *Conventions globales et gouvernance environnementale,* focus n°3/05.

[15] Kpatchavi A. C., 2011, *Savoirs, maladie et thérapie en Afrique de l'Ouest : Pour une anthropologie du paludisme chez les fon et les waci du Bénin*, Cotonou, Ablodè.

[16] Larrère Raphaèl, 1997, Du bon usage de la nature. Pour une philosophie de l'environnement, Alto, Aubier, 355p.

[17] Lebel J., 2003, *La santé : une approche écosystémique*, Ottawa Canada CRDI.

[18] Le Club des Juristes, 2012, Mieux réparer le dommage environnemental, Paris.

[19] Massé R., 1995, *Culture et santé publique : les contributions de l'anthropologie à la prévention de la santé*, Paris Casablanca, Québec.

[20] Mermet, L. et al., 2005, L'analyse stratégique de la gestion environnementale : un cadre théorique pour penser l'efficacité en matière d'environnement. Natures Sciences Sociétés, 13, pp 127-137.

[21] Olivier le Fuchs, 2011, *Le dommage écologique : quelles responsabilités juridiques ?*

[22] Roussel, Marie,2007, Institutionnal failures of the global Environnemental, inédit, université d'Adélaïde.

[23] Sinsin B., Saidou A.,1998, « Impacts des feux contrôlés sur la productivité des pâturages naturels » in *Annales des Sciences Agronomiques du Bénin*.

[24] Sinsin B., Owolabi I., 2001, « Monographie Nationale de la diversité biologique » in *Rapport de synthèse*, MEHU/PNUD, Cotonou.

[25] UNESCO, 1996, « Le pouvoir de la culture » in *Rapport final de la conférence intergouvernementale sur les politiques culturelles pour le développement*, Stockholm.

[26] Tchiwanou M., 1994, *Les Fulbé éleveurs face aux nouvelles stratégies de gestion participative des ressources forestières au Bénin*.

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PHYLOGENETIC ANALYSIS OF HIV-1 ISOLATES FROM GEM SUB-COUNTY OF SIAYA COUNTY- KENYA

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ABSTRACT: As the HIV pandemic becomes increasingly complex and devastating in Africa, there is need to come up with better management strategies in terms of treatment, vaccine and better testing methods. However, this is getting hampered by the high diversity of Human Immunodeficiency Virus type 1 (HIV-1), which is brought about by high rate of replication and mutation. The occurrence of mutations leads to emergence of diverse subtypes and variants which are genetically related but distinguishable. Studies have associated the different subtypes with different clinical and public health consequences. In this study, molecular analysis of the Protease and Reverse Transcriptase gene sequences of the HIV-1 isolates from plasma samples collected from Gem sub county in western Kenya was done. Genes sequences generated were aligned with consensus sequences obtained from Los Alamos HIV Sequence database. Phylogentic analysis was then done using PAUP™ software, version 4.0. A total of 21 HIV-1 plasma isolate samples from Gem sub-county were taken for molecular analysis. The results showed several mutations in both Protease and Reverse Transcriptase gene regions. The phylogenetic analysis revealed, 16 (76.2%) of the 21 isolates analyzed to be subtype A, subtype D were 4 (19.0%), and the remaining 1 (4.8%) was circulating recombinant form, CRF_AD. Since this study revealed three different HIV-1 subtypes in Gem, it would be necessary to conduct a future study to find out the effect of these subtypes on the transmission, pathogenicity and the rate of HIV-1 disease progression in Gem sub-county, western Kenya.

KEYWORDS: Mutation, Diversity, HIV Subtype, Antiretroviral, Protease, Reverse Transcriptase, Recombinant form.

1 BACKGROUND

Human Immunodeficiency virus (HIV) is a kind of virus that belongs to a group of viruses called retroviruses. It is believed that HIV originated in sub Saharan Africa during the twentieth century. [1] and it is now a pandemic, with an estimated 38.6 million people currently living with the HIV worldwide.[2] It has its genome in form of ribonucleic acid (RNA), and inside it are the three enzymes necessary for replication. These are surrounded by a coat of glycoprotein. This virus, like other pathogens needs a host cell to complete its life cycle. It starts its life cycle by first attaching to the host cell, usually the CD-4 T-lymphocyte cell, which is a cell of the immune system. After this attachment, it empties its content into the cell and with the help of its reverse transcriptase, it changes its genome, usually RNA into DNA and with the help of its intergrase enzyme, it integrates its genome into the host cell DNA. Once integrated, it is called a provirus.

When the host cell undergoes transcription it produces the viral messenger RNA (mRNA) which eventually get translated to viral protein which then gets chipped into sizes by protease enzymes into new viral particles which eventually burst the host cell. This process leads to killing of many of immune system cells thereby weakening the immune system, leading to a condition referred to as Acquired Immunodeficiency Syndrome (AIDS).[3]Once immune system is weakened, one remains

prone to opportunistic infections and tumors. Currently, there is no known vaccine or medicine that cures HIV/AIDS, save for the antiretroviral drugs that inhibit action of viral enzymes that are necessary for viral replication. Vaccine development has been hampered by the high rate of viral mutations that occurs naturally, enabling HIV to exist in an individual as a complex mixture of genetically related but distinguishable variants. [4] If mutations occur in the gene region encoding molecular antiretroviral drug target, then this may cause ARV drug resistance. [5]

In African continent, HIV prevalence varies. For instance, in southern African countries, more than one in every five pregnant women is HIV infected. [6] In a few sub Saharan African countries, HIV prevalence in prenatal clinics in 2003 exceeded 10%, while in urban settings in southern Africa, antenatal sero-prevalence reached 40%.[6] In West Africa, HIV prevalence in pregnant women remain generally stable at low levels, though in some urban areas it exceeds 10 percent, while in rural areas the rates are generally low.[6]

In East Africa and parts of Central Africa, prevalence has fallen, for instance, in Addis Ababa, among 15-24 years old pregnant women, the prevalence fall to 11% in 2003 from 24% in 1995. Previous studies reveal that Asia is experiencing rapidly growing epidemics. [7] Likewise, Eastern Europe is also experiencing rapid increase in prevalence, which is being attributed to rise in mother to child transmission. [8].The risk of mother to child infection increases if a breast feeding mother is newly infected, owing to the initially high level of virus. [9]. It is therefore important that more attention should be directed to HIV/AIDS prevention and treatment.

HIV infection is most commonly due to unprotected sex with infected partner, but can also occur from receiving contaminated blood during transfusion or exposure to non sterile instrument or medical procedure.[10] Most infected children under 15 years have contracted the virus by transmission from their mothers, an indication of the prevalence of infection in women of child bearing age. Mother to child transmission of HIV can occur before, during or after delivery, but only in rare cases does it occur during early stages of pregnancy. [11] In Europe and America, the estimated rate of mother to child HIV transmission ranges from 14-25% while in developing countries, it ranges from 13- 42%.[12]In developed countries, antiretroviral therapy, elective caesarean section, and refraining from breastfeeding have been used to reduce the rate of mother to child transmission with some success.[13] In developing countries, peripartum antiretroviral prophylaxis with one drug alone can reduce the rate of infection in breastfed infants assessed at 2 or 3 month of ARV administration to around 10 percent[14] [15], and with two or more drugs to about 7 percent at 6 weeks.[16] Prolonged breastfeeding has been reported to expose infants more to the risk of HIV transmission. [17] [18] The risk of the mother to child transmission has been associated with the maternal viral load in plasma. [19] A study also indicated the risk of mother to child transmission to depend on the subtype the mother harbors, where subtype D is easily transmitted than subtype A and C. [20]

The current approach to prevention of mother to child transmission targets the late intrauterine and intrapartum periods, because this period is a relatively short interval of relatively high risk.[21] An estimated 40 percent of overall transmission occurs in late pregnancy and during labour pain and delivery.[22] Peripartum antiretroviral prophylaxis reduces transmission risk in the period of and around delivery.[23] Studies have shown that antiretroviral therapy can reduce overall risk of HIV infection even in breastfeeding populations.[17]Transmission through breastfeeding has been well documented with the initial reports indicating the possibility of transmission through breast milk in breastfed infants being of women who had been infected postnatally through blood transfusion or through heterosexual exposure.[24][25] Another study conducted revealed infant infection through wet nursing [26]

There are two types of HIV responsible for infection, namely, HIV-1 and HIV-2. A major proportion worldwide is caused by HIV-1 virus which was first identified in 1983. [27] The HIV type 2 was first detected in West Africa and is significantly present in this region since the beginning of AIDS epidemics two decades ago. [28] HIV-1 has evolved significantly varying from one geographical region to another.[29] HIV-1 is the most diverse and has evolved into three major groups, mainly, group O (Outlier), N (non M) and M (major)[29] M group is the most divergent group and has evolved into nine different subtypes, subtype A, B, C, D, F, G, H, J and K.[30]

All the subtypes originated from central Africa.[30] In addition, strains of HIV-1 recombinants forms have been identified to be in circulation. [30] Other forms which have been recognized are, A to H with subtypes A and B being the most prevalent.[31][32][33] A study conducted in South Africa indicated that the virus diversity influences transmission and pathogenicity, and it associated subtypes B with male homosexual transmission and C with heterosexual transmission.[34] Other studies also associate subtype A and G with longer AIDS free survival period, which is opposed to other non B subtypes.[35] All groups of HIV-1 are found in Africa; while group M is found all over the continent, group N and O are restricted to Central Africa.[36][37][38][39] Subtypes A, and D are prevalent in East Africa subtype A in West Africa, and C in South Africa, while recombinant subtypes viruses are found in Central and West Africa.[30] In West and Central Europe, America and Australia, subtype B is the most prevalent form.[40] Globally, subtype C is the predominant form causing much of heterosexual

infections worldwide.[41] Unlike HIV-1, HIV-2 does not vary so much in geographical distribution, and almost all types of HIV-2 are found in West Africa and majority of HIV-2 characterized belong to the group A reported in West Africa region. [31][32][33]

HIV genetic diversity has significant clinical and public health consequences; HIV mutagenic potential and diverse assortment of antigenic epitope has hampered HIV vaccine development effort. Many vaccine development attempts have concentrated on subtype B which is the dominant in the developed world which fund such vaccine development initiatives, raising the concern whether they will be effective in Africa where none subtype B dominate. [42] The high genetic diversity also poses threat to testing and diagnosis of HIV. Most HIV tests detect the HIV antibodies, and originally, these tests relied on subtype B epitopes. For instance, when type O emerged in 1990s, it tested negative with kit manufactured based on subtype B model. [43] Therefore, HIV diversity data is a very important tool in HIV and AIDS management and yet there is still relatively little information on the viral diversity in rural western Kenya, and the few studies on diversity in Kenya have been tilted to either antenatal clinic attendee or commercial sex workers in the urban centres thereby leaving out the general rural population. So it was necessary to carry out a study to determine the HIV subtypes circulating in Gem District, western Kenya. The findings of this study will be useful for better management of HIV/AIDS in Gem western Kenya, and other parts of the country.

2 MATERIALS AND METHODS

2.1 STUDY AREA

This study was conducted in Gem District, western Kenya, within Nyanza province. It is an area of approximately 403.1 km^2, and about 42 kilometers northwest of Kisumu town. Gem lies between latitude 0° 26' to 0° 12' north of Equator and longitude 33° 58' east and 34° 05'west of Prime meridian. It is an area were cultural practices, which fuel HIV transmission, such as wife inheritance and polygamy are common. It lies along the Kenya - Uganda highway, with trading centres along the highway.

2.2 STUDY POPULATION AND SAMPLING SCHEME

Study Population and Sampling Scheme According to 2007 Kenya AIDS Indicator Survey (KAIS), 7.1% adult (aged 18 years and above) Kenyans (representing 1,417,000) were HIV infected; Nyanza province in which Gem, western Kenya falls under had an average of 14.9% adult infection. Gem population was estimated at approximately 75,000[44], so working with 14.9% which was the average adult HIV prevalence in Nyanza province[45], an estimated 11,175 adults were HIV infected in Gem, western Kenya, from which the study sample of 45 was drawn. The study sample of 45 tested HIV positive by Unigold™ Using the software Power and Sample Size program, 45 HIV positive adults were randomly selected to be able to reject the null hypothesis with a power of 0.95, given a standard deviation of 1.96 and type I error probability of 0.05.

2.3 INCLUSION CRETERIA

To be included in the study, one had to be an adult aged 18 years and above and tested HIV positive with Unigold™, and also,must have been resident of Gem for the last 6 months and willing to participate in the study.

2.4 EXCLUSION CRITERIA

Any persons below 18 years of age, and/or testing HIV negative with Unigold™ was excluded from the study. All persons not having been living in Gem in the previous 6 months, regardless of age and/or HIV status, were also excluded from the study.

2.5 ETHICAL CONSIDERATIONS

Informed consent was obtained from those individuals meeting inclusion criteria. Approval for this study was obtained from the ethical review committee at Kenya Medical Research Institute (KEMRI) and Human Investigational Review Board (HIRB) at Centre for Disease Control and Prevention (CDC), Atlanta, Georgia, USA. Since the process of drawing blood samples exposed the participants to some risk of pain, the process was carried out professionally and in a sterile manner to minimize the risk of infections.

2.6 SAMPLE COLLECTION AND PROCESSING

All the prospective study participants were requested to give 5 mililitres of blood and this was taken through venipuncture, put into anticoagulant tubes (EDTA tubes) and then put in cooler box and transported to the main KEMRI/CDC-HIV research laboratory for plasma separation. The amount chosen was sufficient for an extra aliquot to be stored as back-up during the experiments. The samples were centrifuged to separate plasma from whole blood and the plasma aliquoted in two 1.5 mililitres tubes (an extra tube as a back-up) and kept in a - 80^{0}C freezer awaiting RNA extraction and nucleic acid analysis.

2.6.1 QIAGEN™ RNA EXTRACTION

During extraction, one tube of plasma of each sample was drawn from the freezer and thawed in ice (4^{0}C) in the biosafety cabinet. An aliquot of 500 microlitres was made into another 1.5mililitre tube. This was then centrifuged for one hour at 16400 revolutions per minute at 4^{0}C in a refrigerated centrifuge (microcentrifuge, Eppendorf, USA). After spinning, 360 microlitres of the supernatant was pippeted out leaving 140 microlitre as the pellet. Then 560 microlitres of lysis buffer (in the Qiagen^{TM} RNA extraction kit) was added to the pellet, mixed by pulse vortexing and then briefly centrifuged. This was then incubated at room temperature for 1 hour to allow for maximum lysis of viral particles to occur. This was then followed by brief spinning and pulse votexing. Exactly 560 microlitres of absolute ethanol was added and mixed by pulse vortexing followed by brief spinning to coagulate the viral nucleic acid. Then 630 microlitres of this sample was then added to the spin column, put in a 2-millilitres collection tube, and then span for 1 minute at 8000 revolutions per minute and at 25^{0}C and the filtrate discarded. (The membrane in the spin column is meant to trap the viral nucleic acid as the filtrate passes.) This step was repeated with the remaining sample. Then 500 microlitres of wash buffer-1 in the kit, was added to the spin column to wash the already membrane trapped RNA. Same procedure was repeated with wash buffer-2 in the kit, and spinning at 8000 revolutions per minute done for 3 minutes at 25^{0}C. Elution of the membrane trapped RNA was finally done with 60 microlitres of diethylpyrocarbonate (DEPC-treated) water in a separate 1.5 mililitres sterile RNase free tube. In cases where the RT-PCR reaction was not to be set immediately, the RNA extract was stored at -80^{0}C.

2.6.2 RT-PCR

The protease and the RT regions from each patient sample were first amplified using RT-PCR. During this reaction, 10 microlitres of the RNA extract was added to the PCR reaction mix containing 1µl of supper script III one step enzyme (Gibco Chemicals, USA), 2 microlitres of 10 milimolar dNTP (Applied Biosystems USA), 10microlitres of 5X PCR buffer (Applied Biosystems, USA.), 0.5 microlitres of RNase inhibitor (Applied Biosystems, USA), 23.5 microlitres of DEPC treated water (Sigma Chemicals, USA) and a set of the following 1.5 microlitres of 8 micromolar of each primers: RT gen 4R, 5´-TAATTTTTTAGGGAAGATCTGGCCTCC-3´ bp2082-2108 and pro-out 5´-CTGTTAGTGCTTTGGTTCCTCT-3´ bp 3399-3420 (CDC, HIVR Laboratory, Atlanta, Geogia, USA). The reaction was performed under the following conditions: initial denaturation and subsequent reverse transcription at 65^{0}C for 10 minutes, and 50^{0}C for 45 minutes, respectively; denaturation of cDNA at 94^{0}C for 2 minutes, 40 cycles at 94^{0}C for 15 seconds, 55^{0}C for 20 seconds, and 72^{0}C for 2 minutes, and final extension of 72^{0}C for 10 minutes. Deionized water was used as negative control for the reaction.

2.6.3 NESTED PCR

Since RT-PCR ended up with a little bit larger fragments, it was therefore necessary to do nested PCR to narrow the amplification to the specific fragment of interest. This second round of amplification was carried out in a 50 microlitres reaction mixture comprising of 10 microlitres of the RT-PCR product, 1 microlitres of 2.5 units of Taq polymerase (Applied Biosystems, USA), 2 microlitres of 10 milimolar dNTP (Applied Biosystems, USA), 10 microlitres of 5x PCR buffer (Applied Biosystems USA) and 24.5 microlitres of DEPC treated water (Sigma Chemical, USA) and a set of the following 1.5 microlitres of 8 micromolar of each primer: 215/219, 5´ TCAGAGCAGACCAGAGCCAACAGCCCC-3´ bp 2136-2163 and PAF-4 5´CCTTACTAACTTCTGTATGTCATTGACAAGTCCAGCT 3´ bp 3300-3334 (CDC, HIVR Laboratory, Atlanta, Georgia, USA), and the reaction performed with the cycling parameters of 94^{0}C for 4 minutes followed 40 cycles at 94^{0}C for 15 seconds, 55^{0}C for 20 seconds, and 72^{0}C for 2 minutes with a final extension step at 72^{0}C for 10 minutes. Deionized water was used as negative control for the reaction.

2.6.4 GEL ELECTROPHORESIS

Gel electrophoresis was done by mixing 5 microlitres of the nested PCR product with 2 microlitres of the loading dye and loaded onto a 1% ethidium bromide stained agarose gel. This was followed with electrophoresis at 130V for 20 minutes. The loaded well that did not show any band as shown in Figure 2.0 were considered negative for HIV-1. Those that did show band as shown in Figure 2.0 at position 1200 basepairs as indicated by mass ladder control, were considered to be positive for HIV-1, and so were taken for purification prior to sequencing. At this stage, out of the 45 samples initially taken for amplification, only 30 samples amplified.

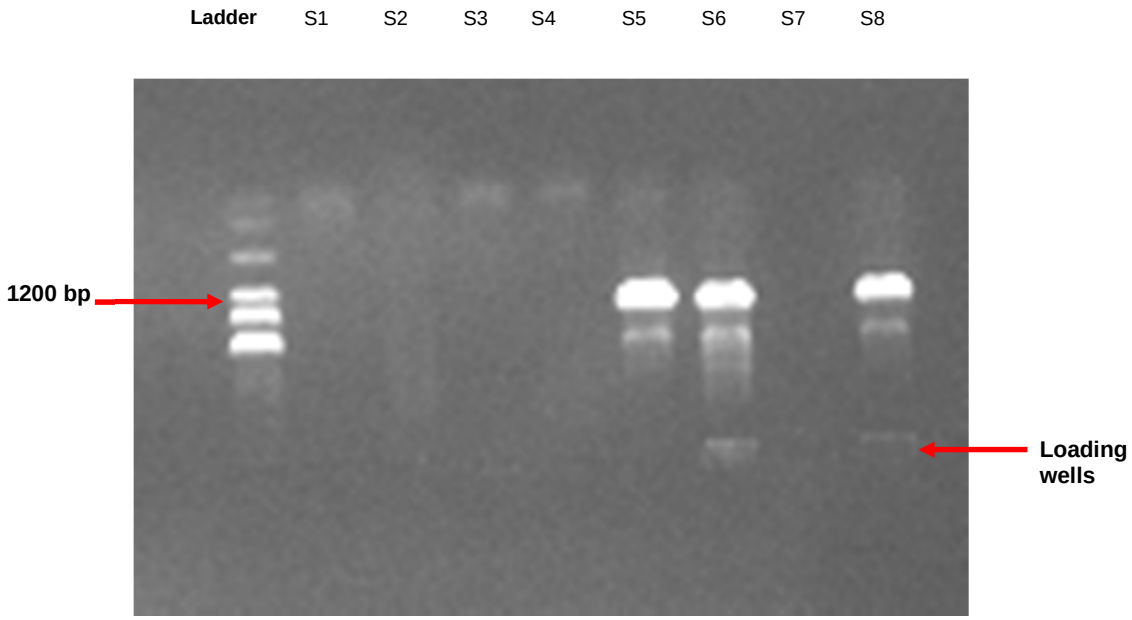

Figure 1.0: Picture of a gel showing positive and negative samples

A picture of a gel taken after electrophoresis of nested PCR product to identify the samples where gene amplification occurred. Each sample marked as S1-S8 was loaded into its well and electric current applied at a voltage of 130v for 20 minutes. Since the region amplified was 1200 basepairs in size, the samples in which gene amplification occurred; S5, S6 and S8 had bands corresponding to a 1200 basepair band in the ladder (control) as shown.

2.6.5 QIAQUICK PURIFICATION OF PCR PRODUCT

Due to the presence of nonspecific bands on some samples, the PCR products were purified with the QIAquick gel extraction kit (Qiagen, USA) as per the manufacturer's instructions.

2.6.6 DILUTION OF PCR PRODUCTS

For the samples that showed bigger bands, which meant high concentration of PCR product, dilution with DEPC-treated water was done either 1 in 4 or 1 in 10 depending on the size of the band (the bigger the band the more the DNA in the sample and therefore the higher the dilution). Dilution of the PCR product was done so as to have a less concentrated product recommended for sequencing reaction as this would give more distinct peaks during genetic analysis.

2.6.7 SEQUENCING REACTION

PCR products were sequenced using overlapping oligonucleotide primers. Sequencing reactions were performed using the Big Dye Terminator Cycle Sequencing Ready Reaction sequencing kit (Applied Biosystems, USA) according to the manufacturer's instructions.

2.6.8 PURIFICATION OF THE SEQUENCED PRODUCT

This step was carried out to get rid of excess dDNTPs from the sequenced product and the purification at this step was done using Centri-sep Columns™ (Applied Biosystems, USA). The Centri-sep Column™ was first prepared by tapping it for the gel in it to settle at the bottom, the top was then removed. 0.8 ml of distilled or deionized water was added to the column and the top taken back, and this was allowed to settle for 1 hour at room temperature so as to fully wet the gel in the Centri-sep Column™. The column was then gently tilted on one side and tapped to remove any air bubble that could be trapped in the gel. Then, the top of the column was removed followed by the bottom seal and the column put in collection tube to collect the filtrate while spinning for 2 minutes at 300rpm. After this the filtrate was discarded and columns put in sterile 1.5ml tubes and the sample i.e the sequenced product, added by gently pipetting from the top of the gel in the column and then briefly spinning to get out the purified sample as the filtrate.

2.6.9 SPEED VAC DRYING OF THE SEQUENCED PRODUCT

The samples were then arranged in the Speed Vac™ (Applied biosystems, USA) for drying, and drying manually done at medium speed for 30 minutes.

2.6.10 DENATURATION

The dried samples were then resuspended in the 20 microlitres of formamide and pulse vortexed and left to settle for 30 minutes after which the samples were put back to the optical tubes and loaded to the thermocycler set at 94°C for 2 minutes for the denaturation before sequence analysis.

2.7 SEQUENCE ANALYSIS

The sequencing products were run on ABI 3100™ (Applied Biosystems) Genetic Analyzer and then assembled by Sequencher™ software (Gene Code, Ann Arbor MI). The PRO and RT gene sequences generated were then aligned with consensus sequences obtained from Los Alamos HIV Sequence database (htt//hiv_web.lanl.gov) representing HIV-1 subtypes including A1, A2, B, C, D, G, F1, F2, K, H, J, and the circulating recombinant forms. Phylogenetic analysis was performed using PAUP™, Version 4.0, and maximum likelihood tree constructed and confidence of analysis tested using bootstrap values. The gene sequences were further analyzed by Similarity analysis using SimPlot™ to determine whether they were pure subtypes or recombinant forms. Similarity plot using SimPlot™ version 2.5 Software (S.Ray, htt://www.med.jhu.edu/deptmed/sray) determined the percent similarity between Gem sequence and a selected group of reference sequences by moving a window of 400 basepairs fragment with 20 basepairs increment along the alignment. Similarity values were plotted at the midpoint of 400 basepairs fragment and similarity curve generated.

2.8 LIMITATIONS OF THE STUDY

The study used in-house PCR method, which had just been developed by CDC/KEMRI HIVR Laboratory, Kisumu-Kenya, so was still not yet well refined and therefore could affect the PCR result. (It could amplify only up to 2000 viral copies per milliliters of plasma). The study was carried out under very strict management conditions that at times did not allow for repeat of certain assays that failed, like when some primers failed to anneal during sequencing reaction leading to failure of some samples to sequence.

3 RESULTS

3.1 PHYLOGENETIC ANALYSIS

Phylogenetic analysis was done sing PAUP™ software and phylogenetic tree constructed as shown in Figure 2.0 Many of the sequences marked 'Gem' clustered next to subtype A reference sequences, confirming them as subtype A sequences. Some clustered next to subtype D reference sequences confirming them as of subtype D, while ones sequence, Gem.3001670 was next to subtype A, but with a very short branch as compared to other subtype A. Other analysis (similarity analysis) revealed it as a recombinant form (CRF_AD). The phylogenetic analysis result was extracted from the tree and tabulated as shown in Table 1.0, so as to show the subtype of each individual sequence analyzed phylogenetically. Out of 21 samples analyzed, 16 (76.2)% were subtype A, subtype D were 4 (19.0%), while circulating recombinant form (CRF_AD) was 1 (4.8%), as summarized in Table 2.

Figure 2.0: phylogenetic tree

The tree estimates the evolutionary past based on gene sequences. It consists of branches and nodes. The tree consists of both internal and terminal nodes as shown. The internal node corresponds to hypothetical last common ancestor of gene sequences arising from it, while the terminal node corresponds to the sequences from which the tree was derived. The length of the branches corresponds to amount of evolution (percent sequence difference) between the two nodes they connect. Thus the longer the branch, the more divergent the sequences attached to it. In Figure 3, the sequences analyzed are marked in the tree as 'Gem' in the branches, and amongst them are other sequences that act as reference sequences in the tree.

Table 1: Distribution of HIV-1 subtypes for individual Gem sequences

Sample codes	Subtypes
Gem. 007 (control sample)	A
Gem.2000260	A
Gem.3002680	A
Gem. 2005360	A
Gem.2005470	A
Gem.3000040	A
Gem.300080	A
Gem.3000780	D
Gem.3001060	A
Gem. 3001150	A
Gem. 3001230	A
Gem. 3001670	CRF_AD
Gem. 3001990	D
Gem 3002400	A
Gem.3002500	A
Gem. 3003360	A
Gem. 3003780	. A
Gem. 3004000	A
Gem. 3004030	A
Gem.3004740	A
Gem. 3005280	D
Gem.3005690	D

Table 2: Summary of HIV-1 subtypes circulating in Gem, western Kenya.

Subtype A	Subtype D	CRF_AD
16 (76.2%)	4 (19.0%)	1 (4.8%)

3.2 RECOMBINATION ANALYSIS

Recombination analysis was done as a confirmatory test on the subtypes and the similarity curves plotted as shown Similarity curve showing sequence Gem 2000260 as subtype A is shown in Figure 4, while Figure 5 shows a similarity curve for sequence, Gem 3005280, which was a representative of subtype D. Figure 6 shows similarity curve for sequence, Gem 3001670, which was found to be a recombinant form (CRF_AD). So the similarity analysis which was meant to confirm recombination among the subtypes showed only one sequence, Gem 3001670 (Figure 5) as the only recombinant form.

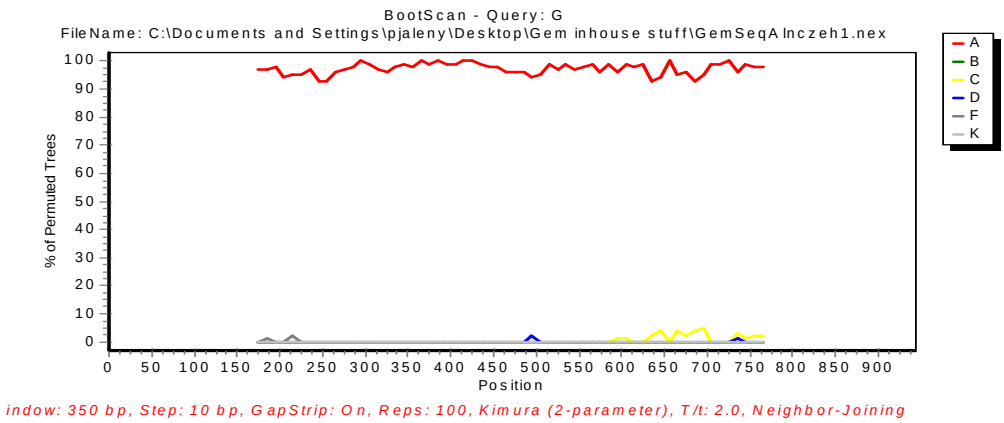

Figure 3.0: Similarity curve for sequence Gem 2000260 (subtype A)

Similarity plot to determine percentage similarity between sequence, **Gem 2000260** and a group of selected reference sequences for subtype A, B, C, D, F, and K by moving a window of 350 basepairs fragments with steps of 10 basepairs increments along the alignment and similarity values plotted at the midpoint of 350 basepairs fragment.

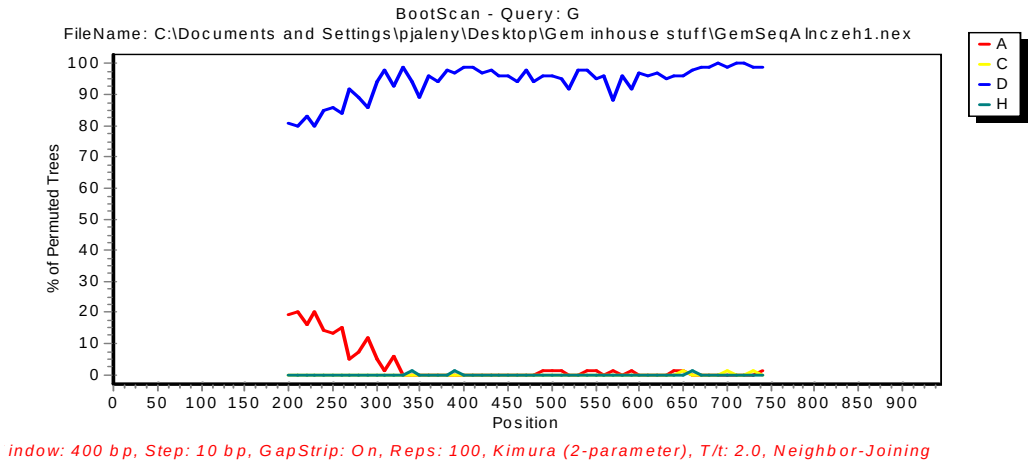

Figure 4.0: Similarity curve for sequence Gem 3005280 (subtype D)

Similarity plot to determine percentage similarity between sequence, **Gem 3005280** and a group of selected reference sequences for subtype A, C, D, and H, by moving a window of 400 basepairs fragments with steps of 10 basepairs increments along the alignment and similarity values plotted at the midpoint of 400 basepairs fragment.

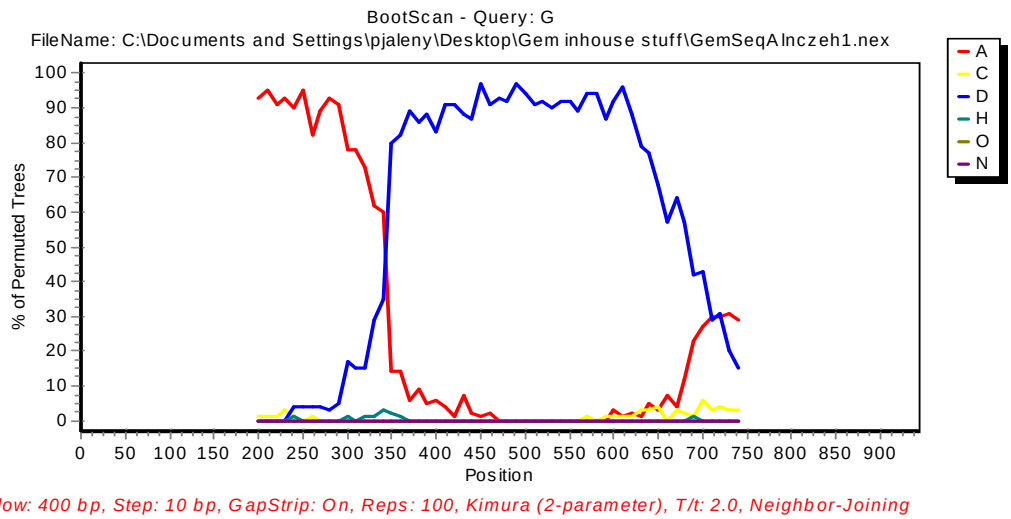

Figure 5.0: Similarity curve for sequence Gem 3001670 (recombinant CRF_AD)

Similarity plot to determine percentage similarity between sequence, **Gem 3001670** and a group of selected reference sequences for subtype A, C, D,H, O, and N by moving a window of 400 basepairs fragments with steps of 10 basepairs increment along the the alignment and similarity values plotted at the midpoint of 400 basepairs fragment.

4 DISCUSSION

Phylogenetic analysis revealed that HIV epidemics in Gem sub-county is driven by subtype A, which was 76.2%, followed by subtype D which was 19.0%. There was also a small percentage of recombinant form (CRF_AD), 4.8%. The subtypes found in this study were similar to those found in another study in Kenya, except that it did not find subtype C and G which were

found in the previous study.[46] The finding of this study were also in line with another HIV-1 diversity study conducted in Kenya which found HIV-1 subtype A to be the dominant followed by subtype D.[47] Other similarity analysis studies in Kenya have shown that most of the HIV-1 recombinant forms in Kenya have a portion of HIV-1 subtype A[46] ,so the recombinant form found in this study too was a combination of subtype A and subtype D. In this study some of the subtypes A in the phylogenetic tree were clustered around Ugandan subtype A strains which is an evident of the social interaction between the people of Gem subcounty and Uganda. The existence of HIV recombinant form in Gem confirms a possibility of co-infection.[48] the exixtant of recombinant form of subtype A and D in this study therefore reveals coinfection by these two subtypes in this region. It may even involve other subtypes though not revealed by the study.

5 CONCLUSIONS

The study revealed that in Gem sub county, HIV-1 diversity is constituted by two subtype A and subtype D, with subtype A being the dominant. The result also showed that recombinant form (CRF_AD) also exists in small proportion. The findings of this study are in consistence with other studies that are so far conducted in Kenya except for the slight variations which may be attributed to sample origin.[48][46]

Other studies conducted in other regions in Africa have shown that HIV diversity has influence on the transmission, rate of disease progression and pathogenicity. [34][49] It is therefore advisable to carry out a future study to determine the effect of subtypes found in this study on the transmission, rate of HIV disease progression, and pathogenicity in Gem, western Kenya.

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REFERENCES

[1] Gao F., Bailes E., Robertson D.L., Chen Y., Roderburg C.M., Michael S.F., Cummins L.B., Arthur L.O., Peeters M., Shaw G.M., Sharp P.M., Hahn B.H. (1999). Origin of HIV-1 in the Chimpanzee Pan troglodytes troglodytes. *Nature.* 397: 436-441.

[2] UNAIDS, Geneva. (2008). Report on the global HIV/AIDS Epidemics. *UNAIDS*. 13-14.

[3] Marx J.L. (1982). New disease baffles medical community. *Science.* 217: 618-621.

[4] Najera I., Holguin M.E., Quinones-Mateu M.A., Monuz-Fernandez R., Najera C., Lopez G., Domingo E. (1995). Pol gene quasispecies of human immunodeficiency virus: mutations associated with drug resistance in virus from patients undergoing no therapy. *J Virol*. 69: 23-31.

[5] Yahi N., Tamalet C., Toures C., Tivoli N., Ariasi F., Volot F., Gastaut J., Gallais H., Moreau J., Fantini J. (1999). Mutation patterns of the reverse transcriptase and protease genes in HIV-1 infected patients undergoing combination therapy: Survey of 787 sequences. *J Clin Microbiol.* 37: 4099-4106.

[6] UNAIDS, Geneva. (2002). Report on the global HIV/AIDS Epidemics. *UNAIDS.* 8-9.

[7] UNAIDS/WHO, Geneva. (2002). Epidemiological Fact sheet update.*UNAIDS/WHO* 12-13.

[8] UNAIDS/WHO, Geneva. (2005). Epidemiological Fact sheet update. *UNAIDS/WHO* 10-11.

[9] Quinn T.C., Wawer M.J., Sewankambo N., Serwadda D., Li C., Wabwire M.F., Meehan M.O., Lutalo T., Grey R.H. (2000). Viral load and heterosexual transmission of HIV-1 virus type one. *Engl J Med.* 342: 921-929.

[10] Buve A., Bishikwabo-Nsarhaza K., Muagadura G. (2002). The spread and effect of HIV-1 infection in sub Saharan Africa. *Lancet.* 359: 2011-2017.

[11] Senise J.F., Palacious R., Tanno Z.N., Lunardi L., Castelo A. (2003). Viral load exposure during pregnancy and mother to child transmission. *Antimicrob Chemother.* 48: 14-17.

[12] Msalleti P., Newell M. L., Dabis F. (1995). Rate of mother to child transmission of HIV-1 in Africa, America and Europe: Results from 13 perinatal studies. *J Acquir Immune Defic Syndr.* 8: 506-510.

[13] Dorenbaum A., Cunningham C.K., Gelber R.D., Culnane M., Mofenson L., Britto P., Rekacewicz C., Newell M.L., Delfraissy J.F., Schrader B.C., Mirochnick M., Sullivan J.L. (2002). Two dose intrapartum/newborn nevirapine and standard antiretroviral therapy to reduce to reduce perinatal transmission: a randomized trial. *JAMA.* 288: 189-198.

[14] The Petra study team. (2002). Efficacy of short course regimen of Zidovudine and Lamovudine in preventing early and late transmission of HIV-1 in mother to child in Tanzania, South Africa and Uganda. (Petra study): a randomized double blind, placebo controlled trial. *Lancet*. 359: 1178-1186.

[15] Guay L.A., Musoke P., Fleming T., Bagenda D., Allen M., Nakabitto C., Sherman J., Bakati P., Ducar C., Deseyve M., Emel L., Mirochnick M., Fowler M.G., Mofenson L., Miotti P., Dransfield K., Bray D., Mmiro F., Jackson J.P. (1999). Intrapertum and neonatal single dose nevirapine compared with zidovudine for prevention of mother to child transmission of HIV-1 in Kampala , Uganda : *HIVNET* 0012 randomized trial. *Lancet.* 354: 795-802.

[16] Dabis F., Benquet L., Ekouevi D.K., Viho I., Rouet F., Horo A., Sakarovitch C.,Bequet R., Fassionou P., Dequae L.M., Welffens E.C., Rouzioux C., Lorey V. (2005). Field efficacy of zidovudine, lumivudine and single dose nevirapine to prevent peripertum HIV transmission. *AIDS.* 19: 309-318.

[17] Lorey V., Karon J.M., Alioum A., Ekpini E.R., Meda N., Greenberge A.E., Msellati P., Hudgens M., Dadis F., Wiktor S.Z. (2002). Twenty four months efficacy of maternal short corse zidovudine regimen to prevent mother to child transmission of HIV-1 in West Africa. *AIDS.* 16: 631-641.

[18] Lorey V., Karon J.M., Alioum A., Ekpini E.R., Van de Perre P., Greenberge A.E., Msellati P., Hudgens M., Dabis F., Wiktor S.Z. (2003). Postnatal transmission of HIV-1V after a short maternal short course of Zidovudine peripartum regimen in West Africa. A pooled analysis of two randomized clinical trials. *AIDS.* 17: 1493-1501.

[19] Mayaux M.J., Dussaix E., Isopet J., Rekacewicz C., MandelbrotL., Ciraru-Vigneron N., Allemon M.C., Cambrin V. (1997). Maternal load during pregnancy and mother to child transmission of HIV-1: the French perinatal cohort study. *J Infect Dis.* 175: 172-175.

[20] Yang C., Li C., Newman R.D., Shi Y.P., Ayisi J.,Van Eijk A.M., Otieno J., Misore A.O., Steketee R.W., Nahlen B.L., Lal R.D. (2003). Genetic diversity of HIV-1 in western Kenya: subtypes specific differences in mother to child transmission. *AIDS.* 17: 1667-1674.

[21] Hofemeryr G.J. and Mclntyre J. (1997). Preventing HIV perinatal infections. *Br Me* J. 315: 199-200.

[22] Oxtoby M. J. (1990). Perinatally acquired HIV infection. *Pediatr Infect Dis J.* 199: 609-619.

[23] Dabis F., Msellati P., Meda N., Welffens E.C., You B., Manigart O., Lorey V., Simonon A., Cartaoux M., Combe P., Ouangre A., Ramon R., Ky-zerbo O., Montcho C., Salamon R., Rouzioux C., Van de Perre P., Mandelbrot L. (1999). Six months efficacy; tolerance and acceptability of short regimen of oral zidovudine to reduce vertical transmission of HIV in breastfeeding Cote d' Ivoire and Burkina Faso: A double blind placebo controlled multicentre trial. *Lancet.* 353: 786-792.

[24] Palasanthira P., Ziegler J.B., Stewart G. J., Stuckey M., Armstrong J.A., Cooper D. A., Penny R., Gold J. (1993). Breastfeeding during primary HIV infection and risk of transmission from mother to infant. *Infec Dis.* 169: 441- 444

[25] Van de Perre P., Simonon A., Msellati P., Hitimana G.D., Vaira D., Bazubagira A., VanGoethem C., Stevens M.A., Karitu E., Sondag-Thu I. (1991). Postnatal transmission of Human immunodeficiency virus type 1 from mother to infant .A prospective cohort study in Kigali, Rwanda. *New Engl J Med.* 325: 593-598.

[26] Nduati R., John G., Kreiss J. (1994). Postnatal transmission of HIV-1 through pooled breast milk. *Lancet.* 344: 1432-1439.

[27] Gallo R.C., Sarin P., Gelmann E.P. (1983). Isolation of human T cell leukemia virus in Acquired Immunodeficiency Syndrome (AIDS). *Science.* 220: 865-867.

[28] Larsen O., Da Silva Z., Sandstrom A., Andersen P. K., Poulsen A.G., Melbye M., Dias F., Naucler A., Aaby P. (1998). Declining HIV-2 prevelence and incidence among men in a community study from Guinea-Bissau. *AIDS.* 12:1707-1714.

[29] Spiral S., Weiberg M.A., Leomba H., Turner D., Brenner B.G. (2003). Impact of clade diversity on HIV-1 virulence, antiretroviral drug sensitivity and resistance. *J Antimicrob Chemother.* 51: 229-240.

[30] Thomson M.M., Perez-Alvarez L., Najera R. (2002). Molecular epidemiology of HIV-1 Genetic forms and its significance for vaccine development and Therapy. *Lancet.* 2: 461-471.

[31] Xiang Z., Wilkins A., Dias F., Wittle H., Breuer J. (1997). HIV type 2 pathogenicity is not related to subtype in rural Guinea Bissau. *AIDS Res Hum Retro.* 13: 501-505.

[32] Heredia A., Vallej O., Soriano V., Silva A., Mansinho K., Fevereiro L. (1998). Phylogenetic analysis if HIV-2 strains from Portugal. *AIDS Res Hum Retro.* 14: 717-723.

[33] Sarr A.D., Sankale J., Guaye-Ndiaye A., Essex M., Mbuop S., Kanki P.J. (2000). Genetic analysis of HIV type 2 in monotypic and dual HIV infections. *AIDS Res Hum Retro.* 16: 295-298.

[34] Van J.H., Woods R., Lambrick M., Rybicki E.P., Williamson A.L., Williamson C. (1997). An association between HIV-1 subtype and mode of transmission in Cape town, South Africa. *AIDS.* 11: 81-87.

[35] Mehendale S.M., Bollinger R.C., Kulkarni S.S., Stallings R.Y., Brookmeyer R.S., Kulkarni S.V. (2002). Rapid disease progression in HIV-1 infected Seroconverters in India. *AIDS Res Hum Retro.* 18: 1175-1179.

[36] Tatt I.D., Barlow K., Nicoll A., Clewley J. P. (2003). The public health significance of HIV-1 sibtypes. *AIDS.* 15: 59-71.

[37] Simon F., Mauclere P., Roques P., Laussert-Ajaka I., Miller-Trustwin M.C., Sargosti S. (1998). Identification of new Human Immunodeficiency Virus type 1 distinct from group M and group O. *Nat Med.* 4: 1032-1037.

[38] Vidal N., Peeters M., Mulunga-Kabeya C., Nzilambi N., Robertson D., Hunga W. (2003). Unprecedented degree of human immunodeficiency virus type 1 group M genetic diversity in the Democratic republic of Congo suggests that the HIV-1 pandemic originated in Central Africa. *J Virol.* 74: 498-507.

[39] Yamaguchi J., Bodella P., Kaptue L., Zekeng L., Gurtler L.G., Devare S.G. (2003). Near full length genome of 15 HIV type 1 group O isolates. *AIDS Res Hum Retro.* 19: 979-988.

[40] Osmanov S., Pattou C., Walker N.B., Schwardlander B. (2000). Estimated global distribution and regional spread of HIV-1 genetic sub types in the year 2000. *J Acquir Immune Defic Syndr.* 29: 184-190.

[41] Walter B.L., Armitage A.E., Graham S.C., De Oliveria T., Skinhoj P.J., Yvonne E., Stuart D.T., David T., McMichael A.J., Chesebro B., Ivasen A.K.N. (2009). Functional characteristics of HIV-1 subtype C compatible with increased heterosexual transmissibility. *AIDS.* 23: 1047-1057.

[42] Butler I.F., Pandrea I., Markx P.A., Apetriel C. (2007). HIV genetic diversity: Biological and Public health consequences. *Curr HIV Res*. 5: 23-45.

[43] Gashen B., Taylor J., Yusin K., Foley B., Gao F., Lang D., Novitsky V., Heynes B., Hahn B.H., Battachryk T., Kirber B. (2002). Diversity consideration in HIV-1 Vaccine selection. *Science*. 296: 2354-2360.

[44] Eijk, A.M., Lindblade K.A., Odhiambo F., Peterson, E., Sikuku E., Ayisi J.G., Ouma P., Rosen D.H., Slutsker L. (2008). Reproductive health issues in rural western Kenya. *Repr Health.* 5: 123-128.

[45] National AIDS/ STI Control Programme (NASCOP), Kenya. (2009). 2007 Kenya AIDS Indicator Survey: Financial Report.Nairobi. *NASCOP.* 15-16

[46] Yang C., Li C., Shi Y.P., Winter J.,Van Eijjk M.A. Ayisi J., Hu DJ., Steketee R.W., Nahlen B.L., Lal R.B. (2004). Genetic diversity and high proportion of recombinant among HIV type 1 infected pregnanat women in Kisusmu, western Kenya. *AIDS Res Hum Retro.* 20: 565-574.

[47] Lihana R.W., Khamadi S.A., Lwembe R.M., Kinyua J. G., Muriuki J.K., Lagat D., Okoth F.A., Makokha E.P., Songok E.M. (2009). HIV-1 subtypes and viral tropism determination for evaluating antiretroviral therapy options: an analysis of archived Kenya blood samples. *BMC Infect Dis*. 9: 215-223

[48] Cornelissen M., Van Den B., Zorgdrager F., Vladimir L., Goudsmit J. (1997). POL gene diversity of five HIV types 1 subtypes: Evidence for naturally occurring mutations that contributes to drug resistance, limited recombination pattern and common ancestry for subtypes B and D. *J Virol.* 71: 6348-6358.

[49] Kanki J.P., Hamel D. J., Sankalé J. L.,(1999). Human immunodeficiency virus type 1 subtypes differ in disease progression. *J. Infect. Dis*, 179: 68–73.

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Caractérisation de la minéralisation de la nappe des gneiss côtiers éburnéens par modélisation géochimique (Sud-Est de la Côte d'Ivoire)

[Characterization of groundwater mineralization in the eburnean coastal gneiss by geochemical modeling (South East Ivory Coast)]

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ABSTRACT: Fractured aquifers of gneiss are the main drinking water sources for population living in the north area of Alépé. Neglecting geochemical monitoring of such groundwater is able to deliver water consumers taking unacceptable risks. The quality of water from bedrock in terms of taste can lead people to drink surface water whose chemical quality is lower in comparison with the reference quality. The aim of this study is to estimate the major cations concentration of gneiss groundwater in which mineralization was almost due to silicate hydrolysis. To achieve the aim in view, a study of main mineral of the gneiss aquifer was carried out and a geochemical simulation through inverse modeling by PHREEQCI code was applied on water rock process. The study showed that the main silicate minerals of gneiss that contained major cations were albite, K feldspar, plagioclases and amphibole. The dissolution mean rates of minerals able to increase groundwater mineralization by hydrolysis were 1.3 x 10^{-5} mol L^{-1} for K-feldspar, 3.8 x 10^{-4} mol L^{-1} and 1.0 x 10^{-4} mol L^{-1} for oligoclase and amphibole (ferro-tshermakite), respectively. Through these results, it shown that oligoclase would be the mineral more favourable for hydrolysis among feldspars studied in the gneiss. In gneiss groundwater, sodium was mainly supplied by oligoclase, potassium was supplied by K-feldspar and ferro-tshermakite, magnesium was supplied by ferro-tshermakite only and calcium was supplied by oligoclase and ferro-tshermakite.

KEYWORDS: Aquifer, gneiss, silicate, groundwater, modeling

RESUME: Les aquifères fracturés du gneiss sont les principales sources d'eau potable de la région nord d'Alépé. Négliger le suivi géochimique de telles nappes revient à livrer les consommateurs des eaux de la région à des prises de risques énormes. La qualité de goût incomprise, peut amener certaines populations à se tourner vers les eaux de surface dont la qualité chimique est au plus niveau de l'échelle de référence. L'objectif de l'étude est de cibler la source des cations majeurs et d'estimer leurs concentrations dans la nappe de gneiss dont la minéralisation se fait quasiment suivant le processus

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d'hydrolyse. Pour atteindre cet objectif, une étude des principaux minéraux constitutifs de l'aquifère est faite et une simulation géochimique au moyen de modèle inverse par le code PHREEQCI est appliquée sur les interactions entre les minéraux et l'eau. Les résultats montrent que les principaux minéraux du gneiss susceptibles de minéraliser la nappe sont l'albite, le K-feldspath, les plagioclases et les amphiboles. Les taux moyens de dissolution des minéraux favorables à l'hydrolyse sont de 1,3 x 10^{-5} mol.L^{-1} pour le K-feldspath, de 3,8 x 10^{-4} mol.L^{-1} et de 1,0 x 10^{-4} mol.L^{-1} respectivement pour l'oligoclase et l'amphibole (ferro-tshermakite). L'étude montre que dans l'aquifère du gneiss, l'oligoclase serait plus favorable à la dissolution par rapport aux autres feldspaths de la roche. Le sodium provient majoritairement de l'oligoclase, le potassium provient à la fois du K-feldspath et du ferro-tshermakite, le magnésium provient exclusivement du ferro-tshermakite et la source du calcium est à la fois l'oligoclase et le ferro-tshermakite.

MOTS-CLEFS: Aquifère, gneiss, silicates, eaux souterraines, modélisation.

1 INTRODUCTION

En Côte d'Ivoire, la nappe de fractures est très sollicitée car elle constitue parmi les sources d'eaux exploitables, la principale source d'eau potable qui alimente environ deux tiers soit une quinzaine de million de la population ivoirienne. La qualité des eaux de fractures dépend de la lithologie de l'aquifère. La minéralisation des nappes se fait par altération ou hydrolyse des minéraux au contact de l'eau. Dans la zone d'étude, la nature du socle est constituée en grande partie de gneiss mais on y rencontre également des métamonzogranites, des métagranites à muscovite et des métamonzonites à biotite [4]. Ces roches métamorphisées sont beaucoup fracturées [1] et les débits enregistrés sont parfois considérables ; ils sont de l'ordre de 3m^3/h dans les roches granito-gneissiques d'après les conclusions d'une étude réalisée en Côte d'Ivoire [5] et de 2,9m^3/h dans les granites [19] de Côte d'Ivoire. La nappe de fractures des gneiss de la région située au Nord de Alépé est très éprouvée car elle sert de source d'approvisionnement d'eau potable aux populations rurales qui s'y trouvent. Les eaux souterraines de cet aquifère sont de bonne qualité et méritent un suivi en ciblant et les différentes sources d'approvisionnement et en estimant les taux de dissolution, des cations majeurs dans l'eau par hydrolyse au dépens de la roche. Plusieurs travaux ont été menés dans plusieurs localités et montrent que l'activité des microorganismes participe à la dissolution de l'albite et des amphiboles [14], [8]. En milieu anoxique à pH 6,86 à 25°C et en 65 jours, de tel processus bactérien se produit amenant une dissolution de la biotite et la phlogopite à des taux respectifs de ~10^{-5} mol.L^{-1} pour le K^+ et ~10^{-6} mol.L^{-1} pour le Mg^{2+} et le Si^{4+} [6]. [17] ont également montré que le taux de dissolution des minéraux augmente en milieu acide.

L'objectif de cette étude est d'utiliser la modélisation inverse par le code PHREEQCI pour simuler la dissolution des principaux minéraux de l'aquifère fracturé du gneiss au Sud-Est de la Côte d'Ivoire. Il s'agit plus spécifiquement d'étudier premièrement les principaux minéraux du gneiss par microscopie optique et par la microsonde électronique et secondairement d'étudier les interactions eau-roche. Le processus d'hydrolyse entre l'eau et la roche est couramment simulé en géochimie [12], [16].La simulation oppose deux types d'eau : (1) une solution 1 qui représente les eaux d'infiltration, acides et moins minéralisées et (2) une solution 2, moins acide et relativement plus minéralisée qui présente les caractéristiques de l'eau de la nappe au moment du prélèvement.

2 GENERALITES SUR LE GNEISS DE LA ZONE D'ETUDE

Les travaux de [4] ont montré que le gneiss regroupe un faciès fin à biotite et un autre faciès amphibolitique sont des faciès paradérivés qui présentent des recristallisations métamorphiques plus élevées. Ces faciès sont localisés autour des métamonzogranites et des métamonzonites à biotite (Figure 1). Ces gneiss sont facturés [1] et mézosonaux. Ils sont très hétérogènes et leur répartition reste très circonscrite à la périphérie des grands massifs monzogranitiques à monzosonitiques [4].

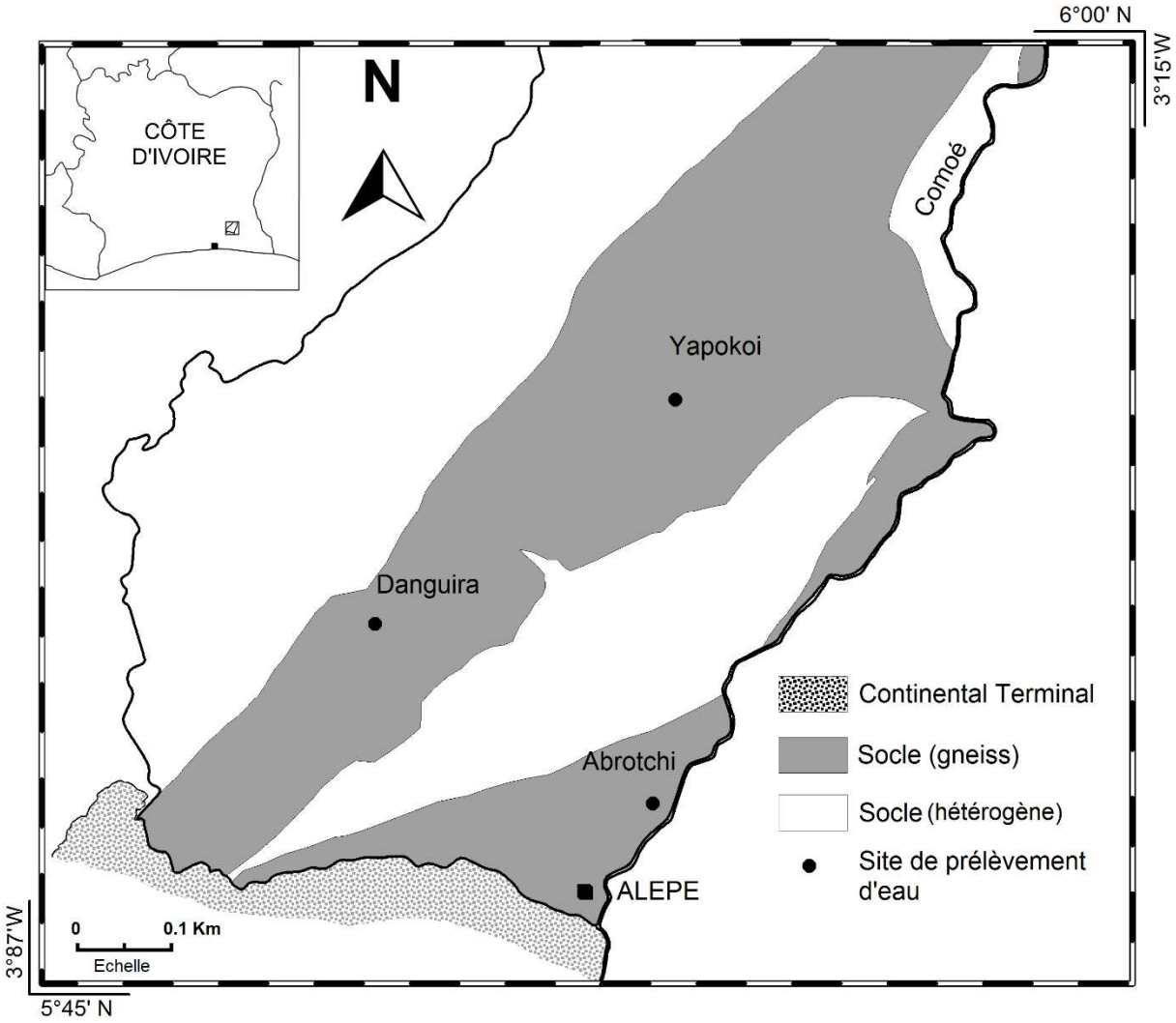

Figure 1 : Situation de la zone d'étude

3 MATERIEL ET METHODES

3.1 ECHANTILLONNAGE D'EAU ET DE ROCHE

Trois échantillons d'eau ont été prélevés dans l'aquifère du gneiss précisément à YAPOKOI, à DANGUIRA et à ABROTCHI. Le matériel d'échantillonnage est composé d'un pHmètre et d'un conductimètre pour la mesure de pH et de la conductivité électrique (CE). Le pHmètre a également servi à faire la mesure *in situ* de l'alcalinité des eaux souterraines. Ces eaux ont été conservées dans des flacons en Nalgène de différentes capacités : 500 ml pour les cations et 125 ml pour les anions.

Deux échantillons de roche ont été prélevés dans la partie saine du gneiss à différents points et non loin des forages qui ont servi à prélever les échantillons d'eau.

3.2 ETUDE EN LABORATOIRE

L'analyse des échantillons d'eau a été faite à l'UMR GEOPS (Géosciences Paris-Sud). Les cations et anions majeurs ont été mesurés respectivement sur un ICP-AES emission spectrometer Varian-liberty 200 et une chromatographie ionique-Dionex. L'incertitude sur la mesure des ions par chromatographie ionique est fonction du nombre d'échantillon analysé entre deux calibrations et est estimée à 4 % dans cette étude tandis que l'incertitude maximale acceptée sur l'ICP est de 5 %.

Les échantillons de gneiss ont servi à confectionner des lames minces à l'UMR GEOPS. Ces lames minces portent sur les niveaux sombres de la foliation pour avoir un ensemble représentatif des minéraux. L'étude minéralogique du gneiss s'est faite en plusieurs étapes : d'abord au microscope optique en lumière transmise à GEOPS (Figure 2) puis à la microsonde électronique CAMECA SX100 l'Université Pierre et Marie Curie.

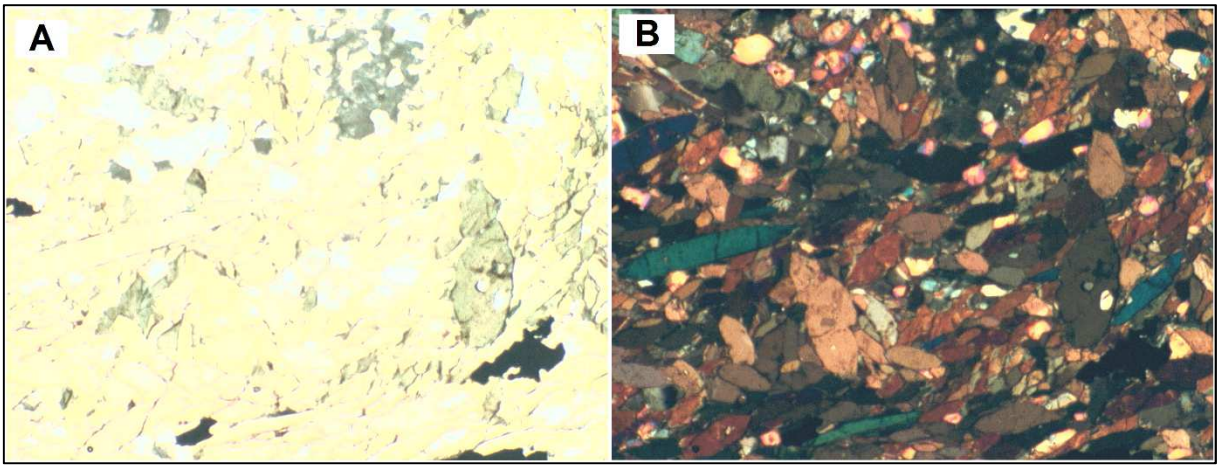

Figure 2 : Minéralogie du gneiss (A : Lumière Naturelle ; B : Lumière Polarisée)

3.3 MODELISATION GEOCHIMIQUE

La modélisation géochimique inverse simule les interactions eau-roche dans l'aquifère du gneiss en impliquant la connaissance d'une part de la chimie des eaux de recharge et celle de l'échantillon d'eau prélevée et d'autre part de la minéralogie de l'aquifère rocheux. L'eau de recharge qui est la solution 1 est acide et moins minéralisée tandis que l'eau de la nappe échantillonnée représentant celle qui a interagi avec l'aquifère est la solution 2 est moins acide et relativement plus minéralisée [3]. La température de simulation est de 25°C. Les interactions eau-roche montrant la minéralisation de la nappe en cations majeurs, ont été simulées à partir du code USGS (PHREEQCI). Ce programme de modélisation est couramment utilisé pour expliquer et interpréter les processus géochimiques [7], [9], [18]. Les données d'entrée du modèle se présentent suivant la Figure 3. Les minéraux silicatés servant de données d'entrée de modèle ne concernent que les principaux minéraux dont la dissolution est susceptible de minéraliser la nappe souterraine [3]. Les minéraux comme le quartz ne possédant pas de cations majeurs dans leurs formules structurales ne sont pas pris en compte.

```
TITLE Inverse modelling of South ivorian Gneiss Groundwater
SOLUTION_SPREAD
    -units    mmol/l
 Number       pH      Si          Ca          Mg          Na           K       Alkalinity   S(6)          Cl
      1      6.1   0.020       0.290       0.005       0.035       0.010            0.200  0.017       0.218
      2      7.3   0.771       0.491       0.242       0.622       0.044            1.995  0.003       0.188
INVERSE_MODELING 1
    -solutions      1        2
    -uncertainty    0.265    0.265
    -phases
        Albite            dis
        K-Feldspar        dis
        Plagioclase       dis
        Amphibole         dis
        Kaolinite         pre
        Halite
        Gypsum
        Fe(OH)3(a)
        CO2(g)
        CH4(g)
    -range             1000
    -tolerance         1e-010
    -mineral_water     true
PHASES
Albite
    Na0.96Al0.96Si3.04O8 + 8H2O = 0.96Al(OH)4- + 3.04H4SiO4 + 0.96Na+
    log_k     0
K-Feldspar
    K1.63Al1.63Si2.37O8 + 8H2O = 1.63Al(OH)4- + 2.37H4SiO4 + 1.63K+
    log_k     0
Plagioclase
    Na0.86Ca0.21Al1.2Si2.78O8 + 4.88H+ + 3.12H2O = 1.2Al+3 + 0.21Ca+2 + 2.78H4SiO4 + 0.86Na+
    log_k     0
Amphibole
    Ca2.81Na0.45K0.13Mg1.71Fe1.18Al2.94Si6.30O22(OH)2 + 20.8H+ + 1.2H2O = 2.94Al+3 + 2.81Ca+2 + 1.18Fe+2 +
6.30H4SiO4 + 0.13K+ + 1.71Mg+2 + 0.45Na+
    log_k     0
END
```

Figure 3 : Données d'entrée du modèle

L'équation générale de bilan de masse prise en compte dans la simulation s'écrit :

$$\Delta m_{T,k} = m_{T,k(final)} - m_{T,k(initial)} = \sum_{p=1}^{p} \alpha_p b_{p,k} \qquad (1)$$

Où ; $\Delta m_{T,k}$ est la différence de concentration de l'élément k entre l'eau finale et l'eau initiale ; *p* est le nombre de phases ; α_p est le transfert de masse de la phase *p* et $b_{p,k}$ est le coefficient stœchiométrique de l'élément *k* dans la phase *p* [3].

4 RESULTATS

4.1 COMPOSITION CHIMIQUE DES SOLUTIONS ET COMPOSITION MINERALOGIQUE

La composition chimique moyenne de la nappe de fractures (solution 2) est présentée dans le Tableau 1. Celle de la solution 1, représentative des eaux de recharge de la région est donnée par [3] (Tableau 1).

Les résultats de l'étude minéralogique du gneiss révèlent d'une part, un assemblage de minéraux essentiels que sont : le quartz, les amphiboles, les plagioclases et le feldspath potassique et d'autre part, un seul minéral accessoire qu'est l'épidote. La Figure 4 montre que les amphiboles contenues dans cette roche sont des ferro-stshermakites selon la classification de [2]. Les plagioclases sont constitués de l'albite et de l'oligoclase et le feldspath potassique est l'orthose.

Tableau 1 : Composition chimique moyenne des solutions 1 et 2

N° Solution	pH	Si^{4+}	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	alcalinité	S(6)	Cl^{-}
1	6,1	0,020	0,290	0,005	0,035	0,010	0,200	0,017	0,218
2	7,3	0,771	0,491	0,242	0,622	0,044	1,995	0,003	0,188

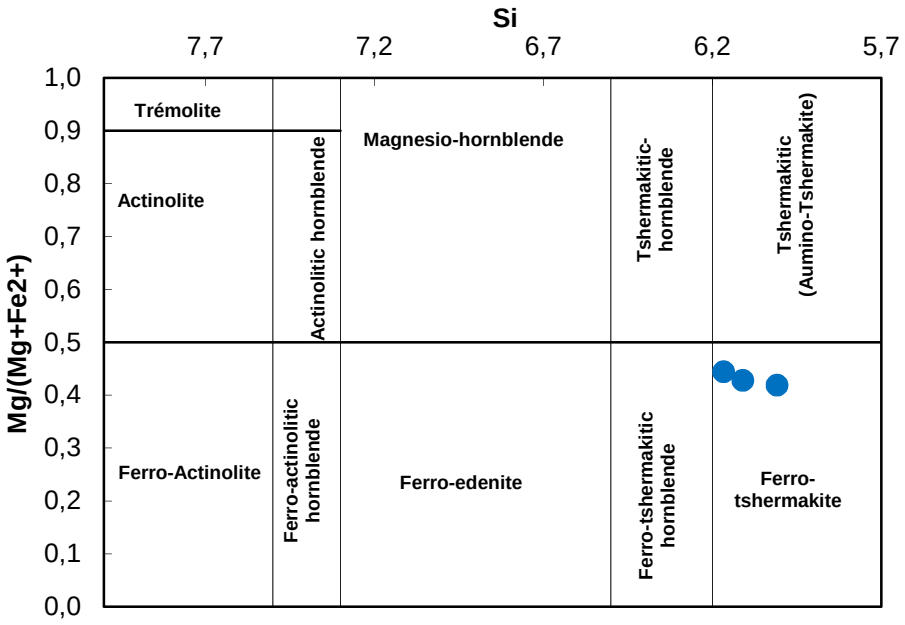

Figure 4 : Classification des amphiboles [2]

Les formules structurales des minéraux essentiels (Tableau 2) utilisés comme données d'entrée du modèle, abondants dans la roches et contenant des cations majeurs sont :

Amphiboles

- Ferro-tshermakite : $Ca_{2,81}Na_{0,45}K_{0,13}Mg_{1,71}Fe_{1,18}Al_{2,94}Si_{6,30}O_{22}(OH)_2$

Plagioclases

- Albite : $Na_{0,96}Al_{0,96}Si_{3,04}O_8$
- Oligoclase : $Na_{0,86}Ca_{0,21}Al_{1,20}Si_{2,78}O_8$

Feldspath potassique (orthose) : $K_{1,63}Al_{1,63}Si_{2,37}O_8$

Tableau 2 : Proportion des cations dans les principaux minéraux silicatés

Principaux minéraux	Si^{4+}	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Al^{3+}	Fe^{2+}
Albite	3,04	–	–	0,96	–	0,96	–
Oligoclase	2,78	0,21	–	0,86	–	1,25	–
K-feldspath	2,37	–	–	–	1,63	1,63	–
Amphibole	6,30	2,81	1,71	0,45	0,13	2,94	1,18

4.2 MODELE INVERSE DE LA MINERALISATION

Le modèle inverse est appliqué dans cette étude comme dans plusieurs travaux [11], [13] en vue d'expliquer la minéralisation de la nappe de gneiss. De l'équation (1) générale de bilan de masse, découlent les équations (2) à (6) par le calcul du taux de dissolution de chaque espèce minérale, en tenant compte à la fois de la concentration et de la proportion de chaque cation majeur respectivement dans la nappe et dans les minéraux contenus dans le gneiss:

$$\Delta m_{T,Na} = 0{,}622 - 0{,}035 = 0{,}96\alpha_{albite} + 0{,}86\alpha_{oligoclase} + 0{,}45\alpha_{amphibole} \quad (2)$$

$$\Delta m_{T,K} = 0{,}044 - 0{,}010 = 1{,}63\alpha_{K-feldspath} + 0{,}13\alpha_{amphibole} \quad (3)$$

$$\Delta m_{T,Ca} = 0{,}491 - 0{,}290 = 0{,}21\alpha_{oligoclase} + 2{,}81\alpha_{amphibole} \quad (4)$$

$$\Delta m_{T,Mg} = 0{,}242 - 0{,}005 = 1{,}71\alpha_{amphibole} \quad (5)$$

$$\Delta m_{T,Si} = 0{,}771 - 0{,}020 = 3{,}04\alpha_{albite} + 2{,}37\alpha_{K-feldspath} + 2{,}78\alpha_{oligoclase} + 6{,}30\alpha_{amphibole} \quad (6)$$

4.3 TAUX DE DISSOLUTION DES MINERAUX

Une seule possibilité de simulation de dissolution partielle des minéraux primaires a été proposée à travers le modèle dont les résultats sont présentés dans le Tableau 3.

Tableau 3 : Résultats de la simulation de la minéralisation des eaux de fractures des gneiss

Phase solide (minéraux)		Taux de dissolution des minéraux		
		modèle		
		minimum	maximum	moyenne
Oligoclase	$Na_{0,86}Ca_{0,21}Al_{1,20}Si_{2,78}O_8$	3,65E-04	3,93E-04	3,84E-04
K-feldspath	$K_{1,63}Al_{1,63}Si_{2,37}O_8$	3,29E-06	2,16E-05	1,28E-05
Ferro-tshermakite	$Ca_{2,81}Na_{0,45}K_{0,13}Mg_{1,71}Fe_{1,18}Al_{2,94}Si_{6,30}O_{22}(OH)_2$	1,00E-04	1,13E-04	1,01E-04
Kaolinite	$Al_2Si_2O_5(OH)_4$	-3,97E -04	-3,78E -04	-3,89E-04
CO_{2g}	CO_2	9,39E -04	2,40E -03	1,67E-03

La combinaison proposée par le modèle présente l'oligoclase comme la principale source de sodium. Le taux moyen de dissolution du feldspath potassique est de 1,3 x 10^{-5} mol.L^{-1}. Ceux de l'oligoclase et de l'amphibole (ferro-tshermakite) sont respectivement de 3,8 x 10^{-4} mol.L^{-1} et de 1,0 x 10^{-4} mol.L^{-1}. Les taux de dissolution pour la phase solide et de production pour la phase gazeuse sont de signe positif alors que ceux de précipitation de phase solide sont affectés d'un signe négatif.

5 DISCUSSION

5.1 ORIGINE DES CATIONS MAJEURS

Les différentes sources majeures des cations dans les eaux souterraines de fractures sont les minéraux de l'aquifère, au contact avec l'eau. L'influence des eaux de pluie se situe au niveau du sodium dont la concentration milli molaire de ces eaux avant infiltration dans le sol est de 0,23 ; la concentration du reste des cations majeurs est inférieure à 3 x 10^{-5} mol.L^{-1} [3]. Pour corriger cet effet, les données d'entrée du modèle intègrent la concentration du sodium des eaux de pluie (*cf.* Figure 3). En ce qui concerne les alcalins, la seule source de sodium obtenue dans la simulation est l'oligoclase qui est le plagioclase calcosodique proche de l'albite. La concentration de 8,6 x 10^{-4} mol.L^{-1} de sodium dans l'oligoclase implique un taux de dissolution de 3,8 x 10^{-4} mol.L^{-1} de ce minéral au profit de la minéralisation de la nappe du gneiss. Cela implique que la dissolution de l'albite ne semble pas contrôler la minéralisation en sodium de la nappe de gneiss. L'étude révèle quant au potassium dans la nappe de gneiss, les sources de feldspaths potassiques et de ferro-tshermakite (amphibole). Dans l'aquifère du gneiss, les différentes concentrations de potassium dans le K-feldspath et dans le ferro-tshermakite respectivement de 1,6 x 10^{-3} mol.L^{-1} et 1,3 x 10^{-4} mol.L^{-1} favorisent un taux de dissolution de K-feldspath et de ferro-tshermakite respectivement de 1,3 x 10^{-5} mol.L^{-1} et de 1,0 x 10^{-4} mol.L^{-1}. En ce qui concerne les alcalinoterreux, le calcium provient à la fois de l'oligoclase et du ferro-tshermakite. Mais la source privilégiée du calcium est l'oligoclase qui a une vitesse de dissolution supérieure à celle de l'amphibole [15]. Les concentrations en calcium de 2,1 x 10^{-4} mol.L^{-1} et de 2,8 x 10^{-3} mol.L^{-1} respectivement dans l'oligoclase et dans le ferro-tshermakite d'une part, et d'autre part, la concentration en magnésium de 1,71 x 10^{-3} mol.L^{-1} dans le ferro-tshermakite, favorisent également les mêmes taux de dissolution (1,3 x 10^{-5} mol.L^{-1} et de 1,0 x 10^{-4}) de ces minéraux dans l'aquifère. Les taux négatifs du Tableau 3 de la kaolinite renseignent sur la

précipitation de ce minéral au cours du processus de minéralisation de la nappe au dépens des principaux minéraux de l'aquifère. Le taux positif du CO_2 dans le Tableau 3 indique que ce gaz dissous dans l'eau au moment de l'échantillonnage est en début de consommation dans le processus d'alcalinisation comme indique le pH 7,3 de l'eau.

5.2 CARACTERISTIQUES DE LA NAPPE DE FRACTURES DES GNEISS

Le processus de dissolution d'amphibole de l'aquifère du gneiss est relativement dynamique. Le taux d'amphibole est 10 fois plus grand (10^{-4} mol.L^{-1} contre 10^{-5} mol.L^{-1}) que celui se produisant par exemple dans les granodiorites d'Aboisso plus à l'Est [20]. Le taux de dissolution des plagioclases est encore plus important (4 fois plus grand) que celui de l'amphibole dans l'aquifère du gneiss. Le taux de précipitation de kaolinite dans cet aquifère (3,89 x 10^{-4} mol.L^{-1}) révèle que l'eau de la nappe était sursaturée vis-à-vis de ce minéral. Ce qui est en parfait accord avec les conclusions de [10] qui montrent que la majeure partie du socle cristallin est recouverte d'altérites essentiellement constitués d'altération kaolinique surmontée de cuirasses ferrugineuses dont l'aspect diffère selon la position topographique qu'elles occupent. Il a nécessité un taux de production de dioxyde de carbone (CO_2) de 1,67 x 10^{-3} mol.L^{-1} pour produire ces différents taux de dissolution des minéraux primaires silicatés et essentiels dans la nappe de gneiss. Il faut beaucoup plus de CO_2 dans cet aquifère de gneiss que n'en trouvent [20] dans les aquifères des granodiorites dans la même région soumise au même climat.

6 CONCLUSION

La minéralisation des eaux de l'aquifère de gneiss du Sud-Est de la Côte d'Ivoire est modeste. L'étude révèle que les principaux minéraux : les plagioclases (oligoclase), les feldspaths potassiques et les amphiboles (ferro-tshermakite) minéralisent la nappe respectivement à des taux de dissolution de 0,38 mmol.L^{-1} ; 0,013 mmol.L^{-1} et de 0,10 mmol.L^{-1}. Des plagioclases aux amphiboles en passant par les feldspaths potassiques, le taux de dissolution décroit montrant ainsi une minéralisation orientée et gouvernée par les feldspaths. Les ions sodium dans la nappe proviennent majoritairement de l'oligoclase tandis que les ions potassium proviennent majoritairement des feldspaths potassiques. Les alcalino-terreux à savoir le calcium et le magnésium tirent majoritairement et respectivement leurs origines de l'oligoclase et du ferro-tshermakite. Le ferro-tshermakite est la seule source d'approvisionnement de la nappe en magnésium.

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REFERENCES

[1] B. Adiaffi, *Apport de la Géochimie isotopique, de l'Hydrochimie et de la Télédétection à la connaissance des aquifères de la zone de contact "Socle-Bassin sédimentaire" du Sud-est de la Côte d'Ivoire*, Thèse, Université de Paris-Sud, Orsay, France, pp. 230, 2008.

[2] B. E. Lake, "Nomenclature of amphiboles", *American Mineralogist*, vol. 63, pp. 1023-1053, 1978.

[3] C. A. J. Appelo et D. Postma, *Geochemistry, groundwater and pollution*, 2nd adition, 2005.

[4] C. Delor, I. Diaby, J-P. Tastet, B. Yao, Y. Simeon, M. Viadal, A. Dommanget, *Notice explicative de la carte géologique à 1/200 000, feuille de Grand Bassam et d'Abidjan*, 1992.

[5] DGE, Etude de faisabilité des forages manuels, identification des zones potentiellement favorables, 2009. [En ligne] Disponible : http://www.pseau.org/outils/biblio/resume.php?d=2111

[6] H. Sugimori, T. Yokoyama, T. Murakami, "Kinetics of biotite dissolution and Fe behavior under low O2 conditions and their implications for Precambrian weathering", *Geochimica et Cosmochimica Acta,* vol. 73, pp. 3767-3781, 2009.

[7] H. W. T. Mapoma, X. Xie, L. Zhang, M. T. Nyirenda, A. Maliro, D. Chimutu, "Hydrochemical characteristics of rural community groundwater supply in Blantyre, southern Malawi", *Journal of African Earth Sciences*, vol. 114, pp. 192-202, 2016.

[8] J. Hopf, F. Langenhorst, K. Pollok, D. Merten, E. Kothe, "Influence of microorganisms on biotite dissolution: An experimental approach", *Chemie der Erde-Geochemistry*, Vol. 59, pp. 45-56, 2009.

[9] J. Moran-Ramirez, R. Ledesma-Ruiz, J. Mahlknecht, J. A. Ramos-Leal, "Rockewater interactions and pollution processes in the volcanic aquifer system of Guadalajara, Mexico, using inverse geochemical modeling", *Applied Geochemistry*, vol. 68, pp. 79-94, 2016.

[10] J-P. Tastet, *Environnements sédimentaires et structuraux Quaternaires du littoral du golfe de Guinée (Côte d'Ivoire, Togo, Bénin)*, Thèse, Université de Bordeaux I, France, 1979.

[11] K. L. Lecomte, A. I. Pasquini, P. J. Depetris, "Mineral Weathering in a Semiarid Mountain River: Its assessment through PHREEQC inverse modeling", *Aquatic Geochemistry*, vol. 11, pp. 173-194, 2005.

[12] K. L. Locsey, M. Grigorescu, M. E. Cox, "Water–Rock Interactions: An Investigation of the Relationships Between Mineralogy and Groundwater Composition and Flow in a Subtropical Basalt Aquifer", *Aquatic Geochemistry*, vol. 18, pp. 45-75, 2012.

[13] L. Belbhiri, A. Boudoukha, L. Mouni, T. Baouz, "Application of multivariate statistical methods and inverse geochemical modeling for characterization of groundwater — A case study: Ain Azel plain (Algeria) ", *Geoderma,* vol 159, pp. 390-398, 2010.

[14] L. Frankel, "Microorganism induced weathering of biotite and hornblende grains in estuarine sands", *Journal of Sedimentary Research*, vol. 47, pp. 849-854, 1977.

[15] M-H. Derron, *Interaction eau-roche de basse température : géochimie des métaux dans l'altération météorique des roches mafiques alpines*, Sciences de la Terre, Université de Lausanne, 209pp, 1999.

[16] M. Tallini, R. A. Falcone, V. Carucci, A. Falgiani, B. Parisse, M. Petitta, "Isotope hydrology and geochemical modeling: new insights into the recharge processes and water–rock interactions of a fissured carbonate aquifer (Gran Sasso, central Italy) ", *Environmental Earth Sciences*, vol. 72, pp. 4957-4971, 2014.

[17] P. Frogner and P. Schweda, "Hornblende dissolution kinetics at 25°C", *Chemical Geology*, Vol. 151, no. (1-4), pp. 169-179, 1998.

[18] P. Rodriguez-Escales, A. Floch, G. Vidal-Gavilan, B. M. van Breukelen, "Modeling biogeochemical processes and isotope fractionation of enhanced in situ biodenitrification in a fractured aquifer", *Chemical Geology*, vol. 425, pp. 52-64, 2016.

[19] Y. A. N'Go, D. L. Goné, I. Savané, M. M. Goblé, "Potentialités en eaux souterraines des aquifères fissurés de la région d'Agboville (Sud-Ouest de la Côte d'Ivoire) : Caractérisation hydroclimatique et physique", *Afrique Science*, vol. 1 no. 1, pp. 127-144, 2005.

[20] Y. M-S. Oga, B. Adiaffi, F. M. Gnamba, C. Marlin, D. Baka, E. M. E. Amani, J. Biémi, "Application du modèle inverse aux interactions eau-roche dans les eaux souterraines des métagranodiorites, Sud-Est Côte d'Ivoire", *European Scientific Journal,* vol. 11, no. 3, pp. 57-67, 2015.

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Les effets à court terme de la restauration de l'environnement sur la diversité et l'abondance des carabes dans trois écosystèmes de bas-fonds au Burkina Faso

[Short-term effects of environmental restoration on diversity and abundance of Carabids in three lowland ecosystems in Burkina Faso]

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ABSTRACT: Many human activities affect arthropod diversity and may threaten environmental health. Some insects may act as biological indicators based on their presence or absence in an ecosystem.
The present study was conducted from 2006 to 2009 to evaluate changes in the diversity and abundance of ground Carabids following restoration activities conducted in three lowlands ecosystems that had previously experienced high levels of human pressure in Burkina Faso. Three micro-catchments were identified in the regions of Soum, Sanmatenga, and Kompienga, using a hydrographic chart of Burkina Faso.
The diversity and abundance of carabids collected in pitfall traps at the beginning and end of the rainy season were compared using 2006 as a sampling reference year with restoration activities (abandonment of farming, forestation and scarification) occurring in 2007. Post-treatment surveys were conducted in the same seasons of 2008 and 2009.
Forty-nine species of Carabids have been identified based on monitoring of 1800 pitfall traps. The number of species generally increased in 2008 and 2009, from 9 to 41 species in the three micro-catchments. Species richness and insect abundance definitely increased where human pressure decreased and restoration measures were successfully conducted. However, Carabid diversity increased only in Soum micro-catchment; this site seemed to be more affected by restoration.
Carabids are likely to be good indicator species; reports can be prepared relatively quickly.
The results are discussed in relation to the goal of developing ecologically sound tools based on bio-indicator insects that can be used for environmental management.

KEYWORDS: Carabidae, Biological indicator, Environment Management, Human Activities.

RESUME: De nombreuses activités humaines affectent la diversité des arthropodes et peuvent menacer la santé de l'environnement. Certains insectes peuvent agir comme indicateurs biologiques en fonction de leur présence ou absence dans un écosystème.
La présente étude a été menée de 2006 à 2009 pour évaluer les changements dans la diversité et l'abondance des carabes suite à des activités de restauration menées dans trois écosystèmes des plaines qui avaient connu des niveaux élevés de pression humaine au Burkina Faso. Trois micro-bassins ont été identifiés dans les régions du Soum, Sanmatenga et Kompienga, en utilisant une carte hydrographique du Burkina Faso.
La diversité et l'abondance des carabes recueillis dans des pièges à fosse au début et à la fin de la saison des pluies ont été comparées en utilisant 2006 comme année de référence d'échantillonnage avec des activités de restauration (abandon de l'agriculture, reboisement et scarification) effectuées en 2007. Des enquêtes post-traitement ont été menées dans les mêmes saisons en 2008 et 2009.

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Quarante-neuf espèces de carabes ont été identifiées sur la base de la surveillance de 1800 pièges à fosse. Le nombre d'espèces a généralement augmenté en 2008 et 2009, de 9 à 41 espèces dans les trois micro-bassins versants. La richesse en espèces et l'abondance des insectes a certainement augmenté où la pression humaine a diminué et les mesures de restauration ont été menées avec succès. Cependant, la diversité des carabes a augmenté seulement dans le micro-bassin versant du Soum; ce site semblait être plus touché par la restauration.

MOTS-CLEFS: Carabidae, indicateur biologique, gestion environnement, activités humaines.

1 INTRODUCTION

The United Nations Conference on Environment and Development, also known as the Rio Earth Summit, highlighted biodiversity conservation; at the summit several authors pointed out the urgency and need to maintain environment quality (Dunn, 2005 [1]). The direct and indirect effects of human activities on ecosystems often cause a loss of biodiversity, specifically through the transformation and fragmentation of natural habitats (Groombridge and Jenkins, 2002 [2]). Burkina Faso, a tropical country, is an illustrative example of this situation in that anthropogenic pressure on biodiversity is a major concern (Augusseau *et al.*, 2003 [3]). The country's exponential human population growth coupled with declining rainfall has led to the migration of young people and farmers to marginal virgin lands. These marginal lands have previously been colonized by humans; however, the lowlands and south Sudanese humid zones are particularly preferred by agricultural migrants. Therefore, anthropogenic landscapes have rapidly replaced natural areas (around 60% of the country in 2000) regardless of their historic ecological balance and level of biodiversity (Augusseau *et al.*, 2000 [4]). An effective management strategy for ecosystem resources requires an efficient and frequent evaluation of the effects of human activities and other interventions on these areas. One method used to measure the anthropogenic effect on the environment is based on the monitoring of bio-indicator insects (Hilty and Merenlenden, 2000 [5]). Beetles of the Order Coleoptera, the largest group of ground-dwelling arthropods, are an important part of total biodiversity (Ohsawa, 2010 [6]) for many regions of the world and represent more than a quarter of the currently known animal species worldwide. Ground beetles (i.e. Carabidae) are well documented as bio-indicators (Rainio and Niemelä, 2003 [7]) because they are sensitive to habitat change (Roughley *et al.*, 2006 [8]) as well as to variations in humidity and temperature (Ilboudo-Tapsoba *et al.*, 2011 [9]). Moreover, Carabids have previously been used to measure changes induced by land exploitation (Cole *et al.*, 2005 [10]).

The present study aims to determine the effects of restoration on the diversity of the Carabidae family in three lowland ecosystems that have previously experienced intense human pressure. The effectiveness of restoration measures should lead to an increase in taxonomic diversity—or at least an increase in abundance—of this insect group that is highly sensitive to changes in their habitats. The results are expected to show whether the Carabidae family can serve as an effective indicator group which can be used for environmental assessment in lowland ecosystems.

2 MATERIAL AND METHODS

2.1 DESCRIPTION OF THE LOWLAND ECOSYSTEMS MONITORED

Three lowland ecosystems were identified in three micro-catchments (MCs) geographically located in the Soum, Sanmatenga, and Kompienga regions of Burkina Faso. The Soum, Sanmatenga and Kompienga MCs are located in the sub-Sahelian, North-Sudanian, and South-Sudanian phytogeographical sectors, respectively, according to the classification provided by a phytogeographic chart (Figure 1) of Burkina Faso (Fontès and Guinko 1993 [11]) describes the physical characteristics and socioeconomic activities of each micro-catchment. According to data from the General Directorate of Meteorology of Burkina Faso on the climate of the three MCs, the Kompienga MC was less hot and wetter than the Sanmatenga and Soum MCs (Table 1).

2.2 DATA COLLECTION

The study area was identified along the northeast transect in Burkina Faso and the main MCs were selected by reviewing a hydrographic chart and phytogeographical areas (Figure 1) of Burkina Faso. Carabid beetles were collected in each lowland ecosystem and at selected sites within each MC. The collections began in 2006, which is used as a reference year, prior to the implementation of some environmental restoration activities (abandonment of farming and reforestation of lowlands) that were conducted in 2007 (Table 2). Then in 2008 and 2009, insects were collected again to determine whether the restoration

activities affected the insect populations, especially Carabid abundance and diversity. For insect collection, three transects have been laid out perpendicular to a stream in each MC; on each transect, at least two 20 × 50 m plots were demarcated on both sides of the stream, starting at the stream edge on a 20 m side of a plot. In each plot the ground-dwelling Carabid beetles were sampled using a Barber trap at the beginning (June–July) and end of the rainy season (September–October). The Barber trap is known as the most efficient method to sample ground-dwelling arthropods, and particularly beetles of the Carabidae family (Cook and Holt, 2006 [12]). Each plot contained five traps set at each of the four plot corners with the fifth in the middle of the plot (Figure 2). Traps were filled with 40% alcohol up to the lower third of the trap to capture in the insects that fell inside. The traps were checked 24 hours after being set. Carabid specimens were sorted and packaged in jars containing 70% alcohol and were then transferred to the laboratory where they were identified taxonomically.

2.3 Specimen Identification And Parameters Calculation

All the collected Carabidae were identified to at least the genus level by comparing the collected specimens with reference collections available in the following museums: National Museum of Natural History in Burkina Faso, Museum of the International Institute of Tropical Agriculture (IITA) in Cotonou (Benin), and the Museum of the Institut Français d'Afrique Noire at Cheick Anta Diop University in Dakar (Senegal); several taxonomic keys (Delobel and Tran, 1993 [13]; Delvare and Aberlenc, 1999 [14]) were also used (Table 3).

Data collected gave a first insight into the variation of insect numbers in relation to ecosystem conditions and sampling period. These data were also used to calculate classical ecological indices that allow an analysis of insect diversity. The calculated indices were:

The specific richness (RS) was determined by the total number of species listed in one site for a given period (Magurran, 2004 [15]);

The Shannon diversity index (Dray, 2003 [16]; Magurran, 2004 [15]) estimates population diversity and is determined by the following formula: $H' = - \Sigma ((q_i/Q) \log_2 (q_i/Q))$ where Q_i is the number of species of the ith taxon and Q is the total number of individuals in the population.

The diversity reaches a maximum when all the observed taxa have the same abundance.

H' max = $\log^2 S$ where S is the total number of taxa in the population.

2.4 Data Analysis

All data were initially transformed using the formula $\log_{10} (x–1)$ and analyzed with SPSS16.0 software. After verifying that the transformed data did not assume a Gaussian distribution using a Shapiro-Wilk test, the non-parametric Friedman analysis of variance was used to compare calculated parameters between independent groups. All differences were considered significant at $P < 0.05$.

3 Results

3.1 Overall Results

In the present study, a total number of 1800 traps were set in the three monitored MCs; 32 genera and 49 species of Carabidae were collected. The genus with the most species (10) was *Chlaenius*; this was also the most frequently encountered genus. Meanwhile, the genus *Lonchochinus* had many individuals but only one species. Species richness varied depending on the MC considered. The Soum MC exhibited the richest Carabid fauna with 43 species compared with 40 and 28 species for Kompienga and Sanmatenga MCs, respectively (table 3). Several species only appeared after the completion of restoration activities, and taxa present varied by the MC considered. The most abundant species was *Chlaenius* (*Chlaenites*) *columbinus.* The total number of collected insects significantly differed among the three MC studied ($\chi^2 = 10.39$; $P<0.005$).

3.2 Effects Of Environmental Restoration On The Carabid Populations

3.2.1 Species Richness

Restoration activities allowed species richness to increase significantly from 29 to 41 in the Soum MC (Table 4; $\chi^2 = 13.03$; $P = 0.01$). The species richness increased from 20 to 23 and from 32 to 39 in Sanmatenga and Kompienga MC, respectively, but the observed variations were not significant ($P > 0.05$).

3.2.2 RELATIVE ABUNDANCE

The number of individuals collected per trap increased from 2006 to 2009 in all of the three MCs (Figure 3). Restoration activities significantly increased the abundance of Carabidae in the Soum (χ^2 =20.4; $P < 0.0001$); Sanmatenga (χ^2 = 11.8; $P < 0.001$) and Kompienga (χ^2 = 18.7; $P < 0.0001$) MCs.

3.2.3 INSECT DIVERSITY

Spatial and temporal variations were noticed in Shannon diversity indices in the three MC monitored (Figure 4). However, the observed diversity was lower than the theoretical diversity calculated for the three MCs, indicating a heterogeneous representation of the species in the Carabid population. Friedman analysis of variance was applied to the matrix of Shannon diversity indices per year and per MC. They showed no significant differences in the diversity of Carabids between the reference year (2006) and the end of the study in 2009 ($P > 0.05$).

4 DISCUSSION

From this study, the Carabidae family appears to be a useful and significant taxonomic group that can be used in the characterization of the condition of lowland ecosystems in Burkina Faso. The overall number of species identified in the three MC monitored (i.e. 49 species) in the present study were comparatively low when considering the total number of known Carabid species throughout the world. However, the present study enabled the expansion of the list of Carabidae known to occur in Burkina Faso from 33 species in 1996 (Sanon, 2010 [17]) to 75 species currently, including, 42 new county-record species for Burkina Faso of the 49 Carabidae species identified. Some variations were noted on other ecological parameters in relation with environmental restoration activities in each MC. Specifically, habitat restoration seems to have allowed a significant increase in species richness and abundance in all three of the MCs whereas insect diversity significantly increased in only the Soum MC. Previous data demonstrated that environmental conditions and habitat structures affect Carabid beetle assemblages (Garcia-Tejero *et al.*, 2013 [18]). However, as far as we know (Ulyshen *et al.*, 2006 [19]; Jahnova *et al.*, 2015 [20]) this is the first time an increase in the species richness and/or abundance of Carabids was noted after environmental restoration in the lowland ecosystems of sub-Saharan Africa. Among the ecological variables assessed during this study, the Shannon diversity index was the least affected considering the fact that this index increased significantly in only one MC (Soum). Therefore, one can assume that Carabid density depends on the quality of the environment and the level of human impact. The restoration has probably created a more favorable environment for the survival and expansion of Carabidae species mainly in Soum and Kompienga. Indeed, more humid conditions, milder temperatures and a favorable microclimate are believed to cause an increase in the diversity of Carabidae (Ilboudo-Tapsoba *et al.*, 2011 [9]).

After two years, the effects of restoration can be observed only for species richness and abundance. Diversity, a more synthetic parameter that considers both species richness and their equitability seems to be more difficult to achieve, specifically where the environment has previously been disturbed by human activities. A longer time (more than two years) after restoration is needed in this type of an environment for the restoration to significantly affect Carabid diversity. Our results can be correlated with the ecological requirements of Carabids and also with the effects/changes induced by restoration activities versus the effects of human activities in each MC.

Several factors influence the diversity of Carabids. Habitat selection and thus the spatial structure of local communities of Carabids are determined by local factors that are not only biotic (species interactions) and abiotic (micro climate conditions) but also include regional factors (pool of species, landscape composition (Michels *et al.*, 2010 [21]). The activities of humans are well known to induce changes to insect habitats. For example, deforestation causes changes in abiotic conditions on the ground (sunshine, light, temperature, soil moisture, air currents) and in the atmosphere (Bornn and Schroeder, 2001 [22]). All of the three MCs considered in this study previously experienced high levels of human pressure through deforestation and farming activities.

The main restoration activities conducted in all of the three MCs included abandonment of farming and reforestation. Clearly, waiting 2 years after reforestation is not long enough for the vegetation to fully recover to the point there is significant variation in Carabid diversity. Therefore, the differences noted among the three MCs monitored could be related to the specific ecology of each MC including soil chemical composition and related soil characteristics (Katherine *et al.*, 2012 [23]), Temperature variation (Katherine *et al.*, 2012 [23]). We hypothesized that the Soum MC meets the requirements needed for Carabid diversification better than the other MCs during or after the restoration period for reasons that remain have yet to be more precisely determined.

Table 1: Location, climate, vegetation, soil and socio-economic activities of the study area

	Soum (MC of Béli)	Sanmatenga (MC of Korsimoro)	Kompienga (MC of Kompienga)
Location	Northern part of Burkina Faso, between the 13°51'10,8'' and 14°40'40,8''paralels of northern latitude and between the 1°16'30'' and 2°03'39,6''meridians of western longitude.	Coordinates: 01°04' of western longitude and 12°49'of northern latitude. Its total surface is 107 949 ha.	Eastern region of Burkina Faso, between the 0°30'and 0°40' eastern longitude and between 11°and 11°20' northern latitude. It covers an area of 93001.3ha.
Climate	Sahelian climate characterized by a rainy season from June to September, with some annual average rainfall below 600 mm. Monthly average temperature ranges between 20 ° C and 35 ° C with relative humidity of 10% to 40 %.	Northern Sudan climatic zone characterized by a rainy season from June to September. Annual average rainfall is 600-800 mm. Monthly average temperature ranges between 25 ° C and 35 ° C with relative humidity of 10% to 60 %.	Average annual rainfall of 900-1000 mm, a rainy season of 4-5 months from May to October. Monthly average temperature ranges between 20 ° C and 30 ° C with relative humidity of 15% to 65 %.
Vegetation	The vegetation described by (Fontès and Guinko 1995), is now highly degraded It is characterized by an herb layer, whose main plant species of the Poaceae family are *Cenchrus biflorus* and *Aristida mutabilis* in the lowlands. The herb layer is associated to a low and clear shrub layer whose dominating species are some *Combretum glutinosum* (Combretaceae), *Guiera senegalensis* (Combretaceae) and *Acacia senegal* (Leguminosae-Mimosaideae).	Shrub savannah dominated by the *Combretun micranthum*, *combretum nigricans*(Combretaceae), an open wooded savannah dominated by *Balanites aegyptiaca* (Mimosaceae), *Lannea microcarpa* (Anacardiaceae), a forest gallery along the water course dominated by some M*itragyna inermis* (Rubiaceae), *Anogeissus leiocarpa* and *Combretum micranthum* (Combretaceae).	The vegetation of the Micro catchment is within the Northern Sudanian phytogeographical sector according to the sectioning of Fontès and Guinko (1995) [24]. It is however much influenced by some recent man-made pressure. The vegetation shows some clear shrub savannah dominated by some *Combretum ghazalense* (Combretaceae), *Balanites aegyptiaca* (Balanitaceae), a wooded savannah dominated by *Terminalia avicennioïdes* (Combretaceae), *Diospyros mespiliformis* (Ebenaceae)
Soil	*T*he most representative land is the less bleached out ones. They have a great proportion of sand and a low proportion of clay and loam.	The lands are generally poor in organic matter with big proportion of clay and loam and low proportions of sand.	The soils are deeply bleached out Tropical ferruginous varying with some vertisols and Hydromorphic Gley and pseudo Gley soils.
Socio-economic activities	Agriculture and livestock farming.	Agriculture and cut down of trees for sale.	agriculture and livestock farming

Table 2: Restoration activities conducted in each zone of the surveys in 2007

	Soum	Sanmatenga	Kompienga
Abandonment of farming	X	X	X
Reforestation	X	X	X
Soil scarification		X	

Table 3: List and classification of the Carabid species identified in three micro-catchments from 2006 to 2009

	Soum			Sanmatenga			Kompienga		
Scientific Name	2006	2008	2009	2006	2008	2009	2006	2008	2009
**Myriochile dorsata* (Brullé)	x	x	x	x	x	x		x	x
Myriochile melancolica (Fabricius)	x	x	x				x	x	
Cicindela neglecta (Dejean)	x	x	x	x		x	x		
Cicindela plurinotata (Audouin et Brullé)	x	x	x	x	x	x	x	x	x
**Megacephala megacephala* (Olivier)	x	x	x						
**Megacephala quadrisignata* (Dejean)	x	x	x					x	x
Ctenosta senegalense (Dejean)	x	x	x				x		
Lissauchenius caecus (Dejean)	x	x	x					x	x
Lissauchenius sp	x	x	x				x	x	x
Chlaeniostenus denticulatus (Erichson)	x	x	x	x	x	x	x	x	x
Hyparpalus holosericeus (Dejean)	x	x	x					x	x
Systolocranius sp	x	x	x				x	x	x
**Paussus armartus* (Westwood)				x	x	x	x	x	x
**Siagona senagalensis* (Dejean)		x	x	x	x	x	x	x	x
Chlaenius (Chlaenites) morosus (Laferte-Senectere)	x	x	x	x		x	x		x
Chlaenius(Chlaenites) lucidicollis		x	x	x	x	x		x	x
Chlaenius (Chlaenites) senegalensis (Dejean)	x	x	x	x	x	x	x	x	x
Chlaenius (Chlaenites) sp1	x	x	x	x		x	x	x	x
Chlaenius (Chlaenites) sp2	x	x	x	x	x	x	x	x	x
**Chlaenius (Chlaenites) dusaultii* (Dufour)		x	x			x	x	x	x
Chlaenius (Chlaenites) rufomarginatus		x	x	x	x	x	x	x	x
Chlaenius (Chlaenites) columbinus (Dejean)	x	x	x				x		x
Chlaenius (Spilochlaenius) Crutiatus (Dejean)	x	x	x	x	x				
Chlaenius (Spilochlaenius) boisduvali (Dejean)	x	x	x			x		x	x
Dichaetochilus nigricus (Dejean)			x				x		
Xenodochus exaratus (Dejean)	x	x	x	x		x		x	x
Nototachys senegalensis (Alluaud)									
Cyclosomus sp			x						
Anoplogenius velox (Linné)		x						x	x
Styphlomerus spI							x	x	x
Styphlomerus spII			x				x	x	x
Cymindoidae bisignata (Dejean)				x	x	x	x		x
Pachydinodes conformis (Dejean)	x		x		x			x	x
Systocranius senegalensis (Gemminger et Harold)				x	x	x	x	x	x
Galeritola africana (Dejean)		x	x		x		x	x	x
Lonchosternus sp	x	x					x		
**Calosoma senegalensis* (Dejean)		x	x	x	x	x		x	x
Tomochilus carbonatus (Chaudoir)	x	x	x		x	x	x	x	x
Neochryopus savage (Hope)	x	x	x	x	x	x	x		x
Tetragonoderus quadrum (Fabricius)	x	x	x	x		x	x	x	x
Abacetus crenulatus (Dejean)	x	x	x		x	x	x		x
Graphiterus obsoletus (Olivier)		x	x		x			x	x
Brachinus sp1	x	x	x		x		x		x
Brachinus sp2	x	x	x				x		
Aploa nobilis (Dejean)			x						
Drypta ruficollis (Dejean)				x	x	x	x	x	x
Epomis protensus (Chaudoir)			x					x	x
Epomis croesus (Fabricus)	x	x	x				x	x	x
Paracallistoides notula (Fabricus)			x				x	x	x
Overall/MC		**43**			**28**			**40**	

** Species already listed in Burkina Faso before our study*

Table 4: Temporal variation of species richness in three micro-catchments from 2006 to 2009

	Soum			Sanmatenga			Kompienga		
	2006	2008	2009	2006	2008	2009	2006	2008	2009
Specific richness	29	36	41	20	21	23	32	32	37
Friedman Test		13.03			1			1,13	
P		*0.001*			*0.6*			*0.5*	

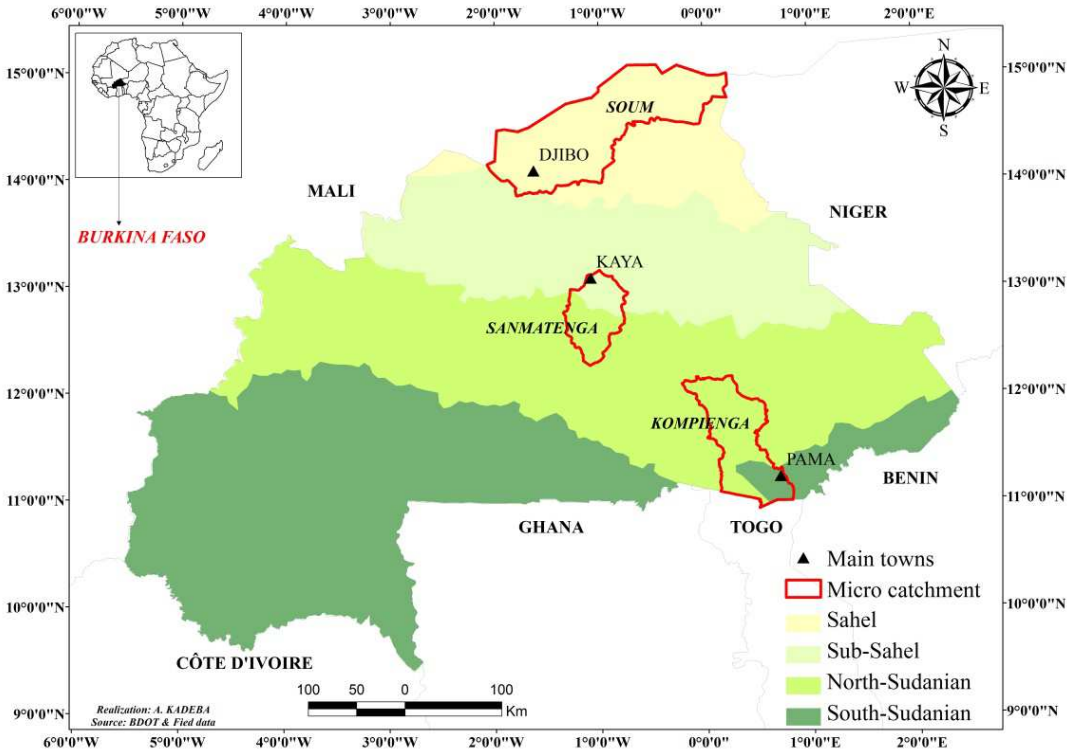

Figure 1: Micro catchment location and phytogeographical areas of Burkina Faso

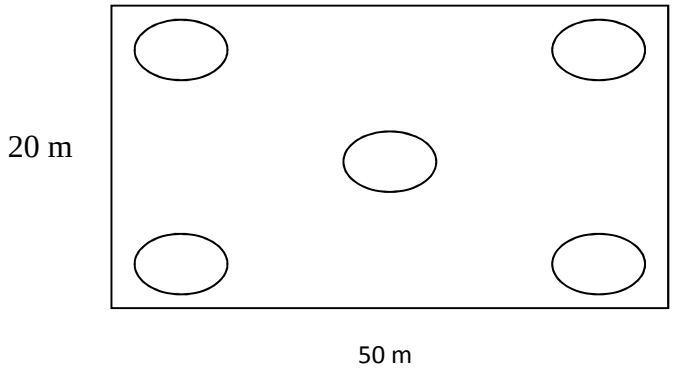

Figure 2: Design of the 20 × 50 m experimental plots containing five pitfall traps

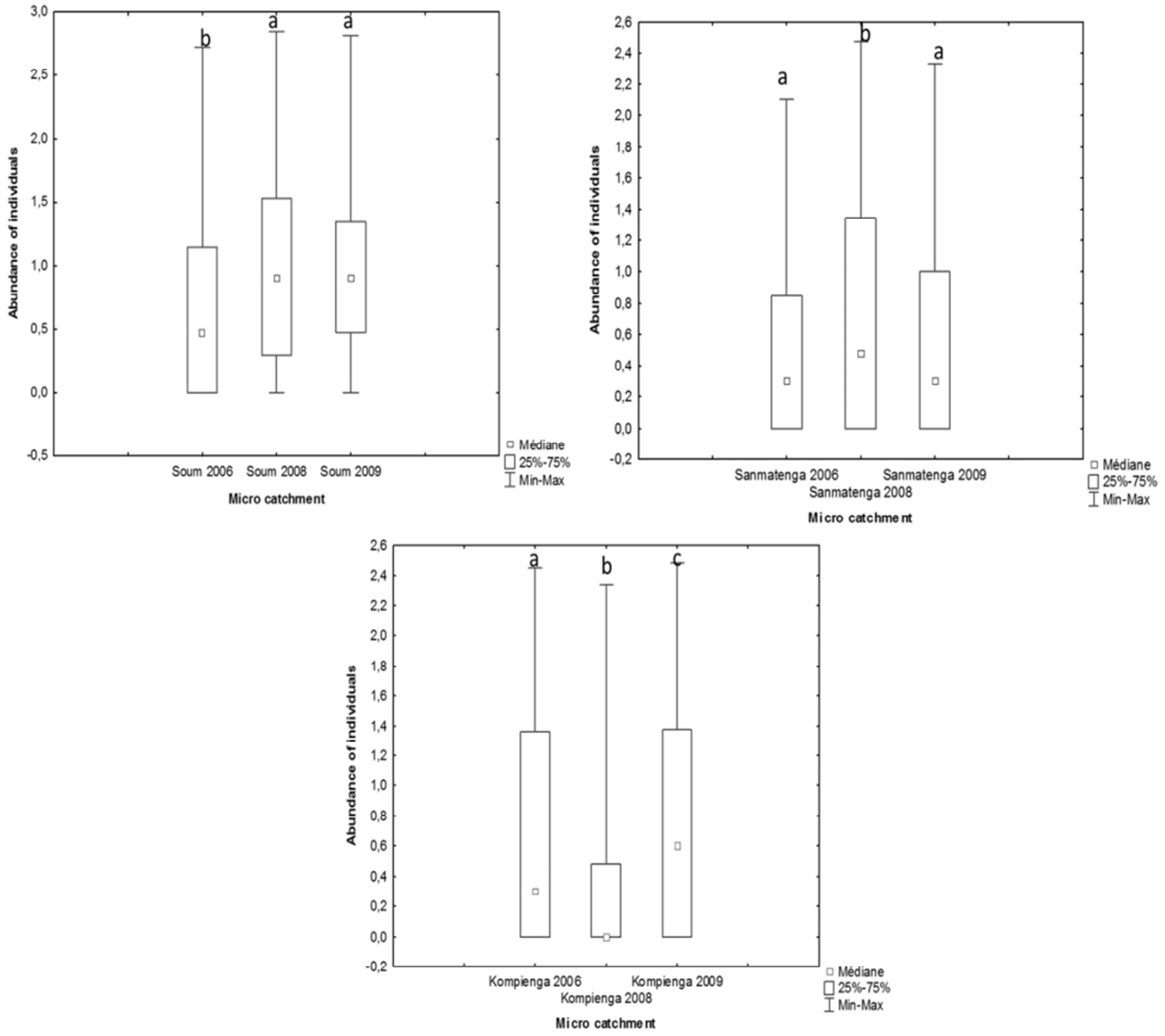

Figure 3: Variation of the Carabidae abundance by micro-catchments from 2006 to 2009

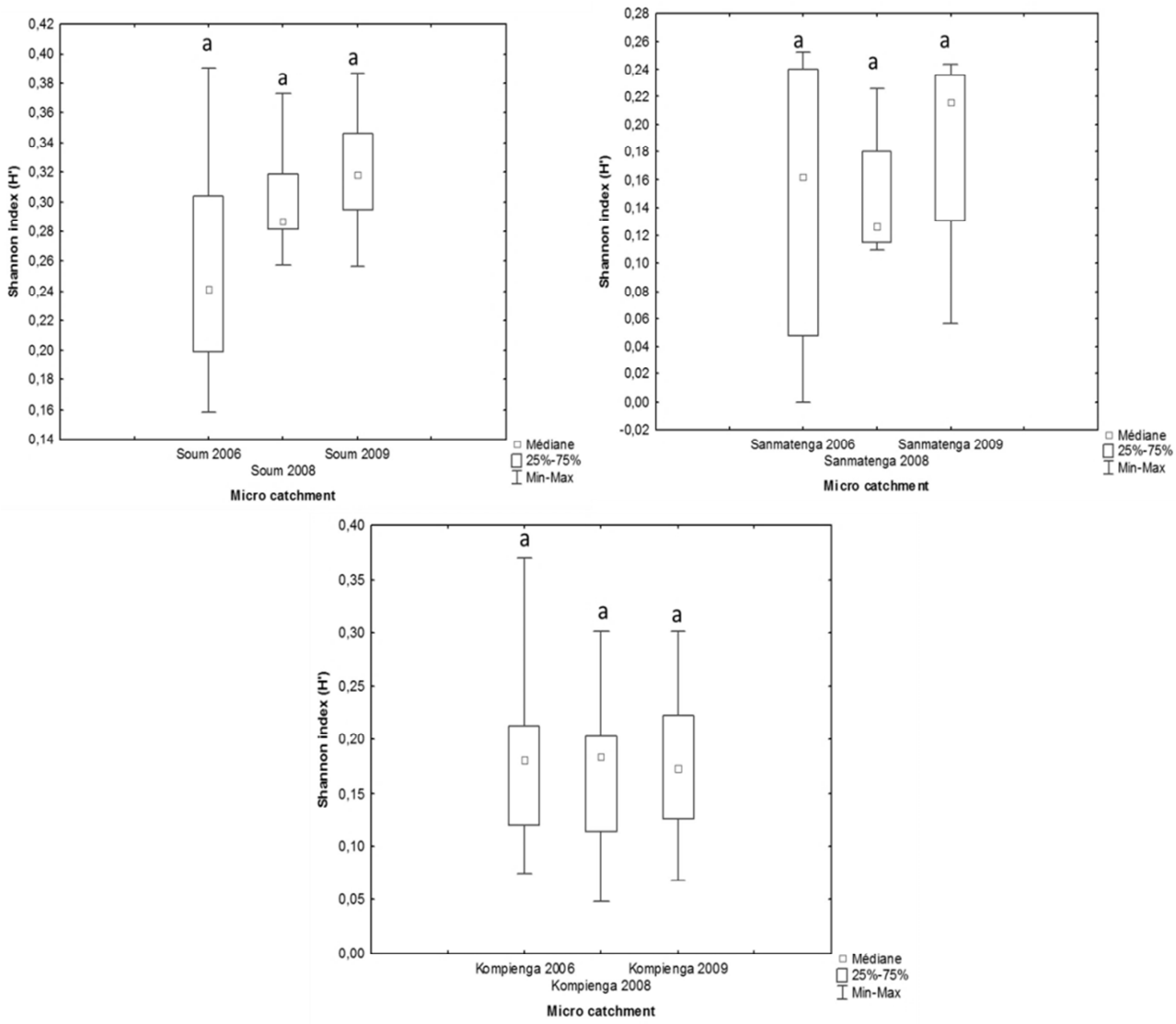

Figure 4: Variation of the Shannon index (H') by micro-catchments from 2006 to 2009

5 CONCLUSION

These results also suggest the dominant species have an important value ecologically and their presence is related to environmental management. Determining the nature of the association of species of Carabidae with particular types and structures of vegetation and also with soil physicochemical parameters will be important steps towards achieving ecologically sound management.

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REFERENCES

[1] R.R. Dunn, Modern insect extinctions, the neglected majority. *Conservation Biology journal*, vol.19, pp. 1030–1036, 2005.

[2] B. Groombridge, M.D. Jenkinms, World Atlas of biodiversity. Earth's Living Resources in the 21St Century. California, 2002.

[3] X. Augusseau, E. Liehoun, J.P. Cheylan, Dynamiques sociales et transformation des espaces : le cas d'un village burkinabé en pleine recomposition. Organisation spatiale et gestion des ressources et des territoires ruraux. Actes du colloque international, 25-27 février 2003, Montpellier, France. Umr Sagert, Cnearc, 2003.

[4] X. Augusseau, E. Liehoun, A. Kara, Evolution de l'organisation agraire dans deux terroirs d'accueil de migrants du Sud-ouest du Burkina Faso: un même processus dans l'actuel front pionnier ? In Centre national pour la recherche scientifique et technique (CNRST), éd. Forum national de la recherche scientifique et des innovations technologiques. Ouagadougou: CNRST, 2000.

[5] J. Hilty, A. Merenlender, Faunal indicator taxa selection for monitoring ecosystem health. *Biological conservation*, Vol.92, pp. 185-197, 2000.

[6] M. Ohsawa, Beetle families as indicators of Coleopteran diversity in forests:a study using Malaise traps in the central mountainous region of Japan. *Journal of Insect Conservation*, vol. 14, pp. 479–484, 2010.

[7] J. Rainio, J. Niemelä, Ground beetles (Coleoptera: Carabidae) as bioindicators. *Biodiversity & Conservation*, vol. 12, pp. 487-506, 2003.

[8] R.E. Roughley, D.A. Pollock, D.J. Wade, Biodiversity of ground beetles (Coleoptera: Carabidae) and spiders (Araneae) across a tallgrass prairie – aspen forest ecotone in southern Manitoba. *Canadian Entomologist journal*, vol.138, pp. 545-567, 2006.

[9] E. Ilboudo-Tapsoba, H. Tankoano, M. Ouedraogo, I. O. Dicko and A. Sanon, Diversité des Insectes actifs au sol dans quatre écosystèmes de bas-fonds du Burkina Faso : importance pour la détermination de bio-indicateurs caractérisant ces milieux. *Int. J. Biol. Chem. Sci*. vol. 5, n°2, pp. 724-738, 2011.

[10] L. Cole, D. Mc. Cracken, I. Downie, P. Dennis, G. Foster, T. Waterhouse, K. Murphy, A. Griffin, and M. Kennedy, Comparing effects of farming practices on ground beetle (Coleoptera: Carabidae) and spider (Araneae), assemblages of Scottish farmland. *Biodiversity & Conservation journal*, vol. 14, pp. 441-460, 2005.

[11] J. Fontès, S. Guinko, Inventaire cartographique des ressources végétales et de l'occupation du sol au Burkina Faso. Rapport scientifique; projet Campus 88 313 101, Ministère de la Coopération française, Ronéo, 1993.

[12] W.M. Cook, R.D. Holt, Fire frequency and mosaic burning effects on a tallgrass prairie ground beetle assemblage. *Biodiversity & Conservation journal,* vol. 15, pp. 2301-2323, 2006.

[13] A. Delobel, M. Tran, Les coléoptères des denrées alimentaires entreposées dans les régions chaudes. ORSTOM, CTA, Paris, France, 1993.

[14] G. Delvare, H. Aberlenc, Les insectes d'Afrique et d'Amérique tropicale. Clés pour la recommandation des familles. Imprimerie caballery-58500 Clamecy, France.302p, 1999.

[15] A.E. Magurran, *Measuring Biological diversity*. Blackwell Publishing, Malden, Oxford and Victoria, 2004.

[16] S. Dray, Eléments d'interface entre analyses multivariées, systèmes d'information géographique et observations écologiques. Thèse de doctorat, Université Claude Bernard Lyon1, 2003.

[17] A. Sanon, La diversité des insectes In Atlas de la Biodiversité de l'Afrique de l'Ouest, Tome II : Burkina Faso. Ouagadougou et Frankfurt/Main, 2010.

[18] S. Garcia-Tejero, A. Taboada, R. Tarrega, J.M. Salgado, Land use changes and ground dwelling beetle conservation in extensive grazing dehesa systems of north-west Spain. *Biological Conservation,* vol. 161, pp. 58–66, 2013.

[19] M.D. Ulyshen, J.L. Hanula, S. Horn, J.C. Kilgo, and C.E. Moorman, The response of ground beetles (Coleoptera: Carabidae) to selection cutting in a South Carolina bottomland hardwood forest. *Biodiversity and Conservation*, vol. 15, pp. 261–274, 2006.

[20] Z. Jahnova, M. Knapp, J. Boha, and M. Tulachova, The role of various meadow margin types in shaping carabid and staphylinid beetle assemblages (Coleoptera: Carabidae, Staphylinidae) in meadow dominated landscapes. *J Insect Conserv*., vol. 20, pp. 59-69, 2016.

[21] G.J. Michels, V.A. Carney, E.N. Jones, and Pollock, D.A., Monitoring ecosystem health. *Biological conservation*, *vol.* 92, pp.185-197, 2010.

[22] A. Bornn, B. Schröder, Habitat models and their transfer for single and multi-species groups: a case study of carabids in an alluvial forest. *Ecography*, vol. 24, pp. 483-496, 2001.

[23] H. Katherine, R. Cameron Simon, and Leather, Heathland management effects on carabid beetle communities: The relationship between bare ground patch size and carabid biodiversity. *Journal of Insect Conservation*, vol. 16, pp. 523-535, 2012.

[24] J. Fontès, S. Guinko, Carte de la végétation et de l'occupation des sols du Burkina Faso. Notice explicative, Ministère de la coopération française, Projet Campus, Toulouse, 1995.

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إشكالية حماية الممتلكات الثقافية والتراث في فترات النزاع المسلح

[Problematic of protection of cultural property and heritage in times of armed conflicts]

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ABSTRACT: Heritage and cultural property in all its forms, represents people's Assembly, which passed from generation to generation, where blend the features of national character and national characteristics distinct memory. Monuments constitute an episode of cultural and civilizational evolution, and confirms that the loss of any impact, represents a great loss for all of humanity. In these circumstances, it is not surprising to find that the war took a pose on the monuments and their value, as destroying monuments and cultural property and heritage of many countries, under the pretext of military necessity.

If the media play a national and a national responsibility, especially in the countries and communities in which they locked in a comprehensive counter neo-colonialism and regional and international instruments, as is happening today in many of the Arab world countries, the media transformed by necessity into high-impact strength, and be one of the priorities of its duties is not pumping breaking news field or the immediate prosecution of media hostile lies and refutes it by video and audio and documents, but also to defend the national patriotic memory components, particularly the inherited cultural and civilizational heritage, and thus defend the threatened destruction, mutilation identity.

Instead of the media system's active role in the definition of heritage and civilization, and to contribute to influencing the preservation of identity and the consolidation of its components in society, it ignore little by little these components, although the deliberate destruction of Antiquities and places of worship and works of art is a manifestation of slipping into the abyss of the overall cultural war.

This research deals with the role of media in protecting the heritage and cultural property, and aims to highlight: the dire consequences and the risks to the wealth of civilization and culture in the Arab countries, including Iraq (for example), which took the forms in a systematic destruction of historical monuments and religious sites.

Controlled by the western media and western agencies bias against the Arab countries, and the control of news sources pictured on the Arab news, and the role of media outreach, in the face of the impact of satellite television and hostile Internet and social networks, and other media dominant, which has become a large part of which poses a threat to national identity.

It follows a descriptive approach through the extrapolation of the definition of cultural property, treaties and conventions organized to protect them in situations of armed conflict, and to monitor the destruction of Iraqi cultural property solution, as follows analytical method to determine the role of new media in the protection of cultural properties.

KEYWORDS: the role of media, protection of heritage, cultural properties.

ملخص البحث: يمثل التراث والممتلكات الثقافية بكافة أشكالها ذاكرة الشعوب الجمعية التي تنتقل من جيل إلى جيل, فتمتزج بملامح الشخصية الوطنية وسماتها القومية المتميزة. كما أن الآثار تشكل حلقة من حلقات التطور الثقافي والحضاري، وما يؤكد ذلك أن ضياع أي أثر أو فقدانه، يمثل خسارة كبرى لا للدولة صاحبة الأثر فحسب بل للإنسانية جمعاء. وفي هذه الظروف فإنه ليس من الغريب أن نجد أن الحروب أخذت تشكل خطراً على الآثار وقيمتها، إذ تدمر الآثار والممتلكات الثقافية والتراث لدول كثيرة، بحجة الضرورات العسكرية.

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وإذا كان الإعلام يضطلع بمسؤولية وطنية وقومية، ولا سيما في البلدان والمجتمعات التي تخوض صراعاً شاملاً لمواجهة الاستعمار الجديد وأدواته الإقليمية والدولية, كما يحدث اليوم في العديد من بلدان الوطن العربي, فإن الإعلام يتحول بحكم الضرورة إلى قوة شديدة التأثير, وتكون من أولويات مهماته ليس ضخ الأخبار العاجلة الميدانية أو الملاحقة الفورية للأضاليل الإعلامية المعادية ودحضها بالصوت والصورة والوثائق وحسب, وإنما بالدفاع عن مكونات الذاكرة الوطنية القومية وفي مقدمتها الموروث والتراث الثقافي والحضاري, وبالتالي الدفاع عن الهوية المهددة بالتدمير والتشويه. وبدلاً من قيام المنظومة الإعلامية بدور فعال في التعريف بالتراث الحضاري, والمساهمة في الحفاظ على الهوية وترسيخ مكوناتها في المجتمع, فإنها تتجاهل شيئاً فشيئاً هذه المكونات, رغم أن التدمير المتعمد للآثار وأماكن العبادة والأعمال الفنية هو مظهر من مظاهر الانزلاق إلى هاوية الحرب الثقافية الشاملة.
يتناول البحث دور الإعلام في حماية التراث والممتلكات الثقافية، ويهدف إلى إبراز التداعيات الوخيمة والمخاطر التي تحيط بالثروة الحضارية والثقافية الموجودة في الدول العربية, والذي اتخذ أشكالاً ممنهجة في تدمير الآثار التاريخية والمواقع الدينية. وسيطرة الإعلام الغربي وتحيز الوكالات الغربية ضد الدول العربية، وسيطرة المصادر الإخبارية المصورة على الأخبار العربية. ودور التوعية الإعلامية في مواجهة تأثير الفضائيات وشبكة الانترنت وشبكات التواصل الاجتماعي, وغيرها من الوسائط الإعلامية المهيمنة, والتي أصبح جزء كبير منها يشكل خطراً على الهوية الوطنية.
يتبع البحث المنهج الوصفي من خلال استقراء تعريف الممتلكات الثقافية، والمعاهدات والاتفاقيات المنظمة لحمايتها في حالات النزاع المسلح، ورصد التدمير الذي حل بالممتلكات الثقافية العراقية، كما يتبع المنهج التحليلي لتحديد دور الإعلام الجديد في حماية الممتلكات الثقافية.

كلمات دلالية: دور الإعلام، حماية التراث، الممتلكات الثقافية، الآثار.

1 تعريف الممتلكات الثقافية

يعد مصطلح الممتلكات الثقافية (Cultural Properties) من المصطلحات الحديثة، (شحاتة، 1977. بدر الدين، 1999. مخاط والشدود، 2001. عتلم، 2005. سمير، 2006. علي، 2011)، [1]، الذي لم تحمل بعض الاتفاقيات الدولية مفهوما واضحا له، فنجد المادة الأولى من العهد الأمريكي المبرم في عام (1935) والذي يعرف بميثاق رويرخ للدول الأمريكية عرفت التراث الثقافي بأنه، (ابن منظور. قاسم، 1980. اليونسكو، 1985-2003. خورشيد، 1992. خشبة، 1997. الجبلي، 2002. تيزيني، 2008): الأشياء والأماكن والأعمال الفنية التي تحوز قيمة ثقافية، وهي تضم مجموع الفنون (ميثاق رويرخ، 1935)، [3]،[2]، والآثار التاريخية التي تمثل الجانب المادي من التراث، (أنيس، 1973. أمين، 1998. الدباغ، 1981. قاسم، 1996. أوجي، 1998. شعث، ٢٠٠٤. الحذيفي، 2007). أما بالنسبة لاتفاقية جنيف لعام (1949) فإنها اقتصرت على ذكر بعض الممتلكات الثقافية وذلك في المادة (53) من البرتوكول الأول الملحق بها لعام (1977)، والتي نصت على حظر أي من الأعمال العدائية الموجهة ضد الآثار التاريخية أو الأعمال الفنية أو أماكن العبادة التي تشكل التراث الثقافي أو الروحي للشعوب.

وورد تعريف الممتلكات الثقافية في اتفاقية لاهاي بتاريخ 14 مايو 1954، وتعد أول اتفاقية تضمنت بيان المقصود بالممتلكات الثقافية بشكل عام وتفصيلي، كون التعريف الذي جاءت به الاتفاقيات الدولية والإقليمية التي سبقت هذه الاتفاقية، كانت أغلبها مقتصرة على بيان عدد من الممتلكات الثقافية دون الكل، أو كان التحديد وفق تلك التعريفات غير شامل لجميع الممتلكات الثقافية، وقد ورد في المادة الأولى، بأنها: الممتلكات المنقولة أو الثابتة ذات الأهمية الكبرى لتراث الشعوب الثقافي كالمباني المعمارية أو الفنية منها أو التاريخية الديني منها أو الدنيوي والأماكن الأثرية ومجموعات المباني التي تكتسب بتجمعها قيمة تاريخية أو فنية والتحف الفنية والمخطوطات والكتب والأشياء الأخرى ذات القيمة الفنية والتاريخية والأثرية وكذلك المجموعات العلمية ومجموعات الكتب الهامة والمحفوظات ومنسوخات الممتلكات السابق ذكرها، والمباني المخصصة بصفة رئيسة وفعلية لحماية وعرض الممتلكات الثقافية المنقولة والمبينة في الفقرة (أ) كالمتاحف ودور الكتب الكبرى ومخازن المحفوظات، وكذلك المخابئ المعدة لوقاية الممتلكات الثقافية المنقولة المبينة في الفقرة (أ) في حالة نزاع مسلح، وغيرها ذات العلاقة التي تتطلب بموجب الاتفاقيات الوقاية والاحترام والحماية المتواصلة وقت السلم ووقت الحرب، وعدم تعريضها للتلف والتدمير وتحريم سرقتها ونهبها أو تبديدها، (اتفاقية حماية التراث العالمي الثقافي والطبيعي، 1972. السيد، 1984)، [4] ،[5]، والمراكز التي تحتوي مجموعة كبيرة من الممتلكات الثقافية والتي يطلق عليها اسم (مراكز الأبنية التذكارية)، (معاهدة لاهاي، 1954).

أما اتفاقية حماية التراث العالمي الثقافي والطبيعي (1972) التي أقرها المؤتمر العام لمنظمة اليونسكو في دورته السابعة عشرة بباريس في 16 تشرين الثاني 1972، وتعنى بحماية التراث العالمي الثقافي والطبيعي، والاتفاقية الدولية (اليونيدروا) الخاصة بإعادة الممتلكات الثقافية المسروقة والمصدرة بطرق غير مشروعة لعام (1995)، [6]، [7]، التي أوردت تعريفا للممتلكات الثقافية في المادة (1) على أن الآثار: هي الأعمال المعمارية وأعمال النحت والتصوير على المباني والعناصر أو التكوينات ذات الصفة الأثرية والنقوش والكهوف ومجموعة المعالم التي لها جميعاً قيمة عالمية استثنائية من وجهة نظر التاريخ أو الفن أو العلم، والمجمعات وهي مجموعة المباني المنعزلة أو المتصلة، التي لها بسبب عمارتها أو تناسقها أو اندماجها في منظر طبيعي، قيمة عالمية استثنائية من وجهة نظر التاريخ أو الفن أو العلم، والمواقع وهي أعمال الإنسان، أو الأعمال المشتركة بين الإنسان والطبيعة، وكذلك المناطق بما فيها المواقع الأثرية التي لها قيمة عالمية استثنائية من وجهة النظر التاريخية أو الجمالية أو الإنثولوجية أو الأنثروبولوجية، وبهذا فإن الاتفاقية أعلاه تؤكد أن كل دولة عليها اتخاذ سياسة عامة تستهدف جعل الممتلكات الثقافية تؤدي وظيفة في حياة الجماعة والعمل على تأسيس دائرة لحمايتها والمحافظة عليها فضلاً عن تنمية الدراسات والأبحاث العلمية.

كما أشار النظام الأساسي للمحكمة الجنائية الدولية الذي أقر في مؤتمر روما (1998) إلى عبارة (الآثار التاريخية) لغرض التعبير عن الممتلكات الثقافية المشمولة بالحماية أثناء النزاع المسلح والتي يعد الاعتداء عليها جريمة حرب، (عطية، 1999. عمرو، 2010. المدور، 2009)، وجاء البرتوكول الثاني الملحق باتفاقية لاهاي (1999) ليؤكد على التعريف الوارد في المادة الأولى من اتفاقية (1954) (اسكيرول، 2003. مينيتي، 2004. علي، 2011)، في تحديد الممتلكات الثقافية المشمولة بالحماية القانونية في زمن النزاع المسلح وفي زمن الاحتلال تحديدا، وذلك في المادة الأولى الفقرة (ب) منها.

وقد دفع ذلك الأمم كافة إلى الاهتمام بالتراث وحمايته بوضع الخطط والاستراتيجيات، وسن التشريعات والقوانين الخاصة بحماية هذا التراث من عوامل التدمير المختلفة. (سالمان، ٢٠٠٧. الآلوسي, 2007)، ويعتبر التراث المعماري العربي في واقعه التاريخي بمثابة الإنجاز الحضاري الذي يبلور إلى حد كبير ملامح الشخصية الحضارية العربية في عصورها الزاهرة. كما يعتبر أحد أبرز أسس الوحدة الثقافية العربية والحفاظ على الهوية القومية، لكن هذا التراث الغني والمتنوع يواجه أخطارا جسيمة بفعل عوامل تدمير طبيعية وبشرية أدت إلى تخريب وضياع جزء مهم من تراث الأمة الحضاري، (إبراهيم، ١٩٦٨. سيد، ٢٠٠٩).

وهناك اتجاه بعدم تمتع أي ممتلك ثقافي بالقيمة الفنية أو التاريخية، ما لم يكن هنالك اتفاق عام على المستوى الدولي باعتباره متمتعاً بهذه القيمة، ويقدم أنصار هذا الاتجاه أمثلة على هذا النوع من الممتلكات (سعود، 2011). أما الاتجاه الثاني فقد تبنى المفهوم الواسع للممتلكات الثقافية المشمولة بالحماية بموجب أحكام القانون الدولي، إذ ذهب أنصار هذا الاتجاه إلى امتداد نطاق هذه الحماية إلى كل الممتلكات الثقافية على النحو الذي تحدده الدول الأطراف في الاتفاقية الواقع على أراضيها هذه الممتلكات، طبقاً للمعايير والقواعد الوطنية الخاصة بها، ومن هنا فإن جميع الممتلكات الثقافية تتمتع بالحماية، (مخاط، 2001). وقد تعددت المعايير التي يتم الاستناد إليها لتحديد ما إذا كان الممتلك الثقافي ذو أهمية لتراث شعب من الشعوب أم لا، وهذه المعايير هي: معيار الربط بالأعيان المدنية حيث يعد عينا مدنيا كل

الأهداف التي ليست أهدافاً عسكرية، (عطية، 1998. سعود، 2011)، ومعيار الأهمية لتراث الشعوب الثقافي، (عبد القادر، 2010)، ولاشك في أن هذا المعيار يوسع من نطاق الحماية المقررة للممتلكات الثقافية، (الطائي، 2012).

1. وبهذا يشتمل مصطلح الممتلكات الثقافية على مجموعة متنوعة من المصطلحات المتداخلة تارة والمستقلة تارة أخرى، ومن أهم هذه المصطلحات التراث والثقافة والحضارة والآثار، أما الثقافة فهي سلوك يرجع إلى قيم إنسانية متجذرة في المجتمع وهي قابلة في طبيعتها للتعديل والتغيير وفقاً لظروف متغيرة، وتشكل نماذج للعيش ضمن اطر مجتمعية واقتصادية وسلوكية منوعة ومتعددة (مدكور، 1975). وأما الحضارة فهي تمثل قيما إنشائية مبتدعة أي أنها تشير إلى انجازات علمية مرتبطة بنماذج الحياة المادية، ويجدها البعض شكلا من أشكال الثقافة عندما يكون لها جانب متميز من الرقي مع الاتسام بخصائص مميزة عن الثقافات الأخرى، وعلى هذا المنوال فإن الممتلكات الثقافية هي خليط من أشياء منقولة أو ثابتة ذات محتوى مادي ومعنوي لها مضامين تراثية وثقافية وحضارية وتاريخية. وتكمن أهمية الحفاظ على التراث الثقافي في الأهداف التي يمثلها هذا التراث وهي حفظه لذاكرة وهوية الإنسان والمجتمع؛ وإن فقدان التراث الثقافي يعني فقدان الذاكرة، ويعني افتقارا اقتصاديا مهما في التنمية المحلية لمناطق هذا التراث، (عوض، 1983. الجابري، 1993. حسين، 2001).

في الآونة الأخيرة تصاعد الاهتمام العلمي الأكاديمي والسوسيو ثقافي بقضية التراث عامة على أساس أنه تراث عالمي، (معتوق، 2004)، حيث بات هذا المصطلح ونعني به التراث العالمي يستعمل على الصعيد الدولي، ويقصد به التراث ذو القيمة العالمية الاستثنائية من التراث الثقافي أو الطبيعي والمدرج ضمن قائمة اليونسكو للتراث العالمي، (أل مالك)، [8]، وتشترك الآثار والتراث في صياغة هوية الجماعة، (الحذيفي، 2007)، لذلك وجدنا أن قسما من التشريعات المختصة بالآثار سواء الوطنية منها أو الدولية، استخدم مصطلح التراث للدلالة على الآثار، أو كمصطلح رديف للآثار، أو شاملاً لها باعتبار أن الآثار تدخل ضمناً في نطاق التراث، (أوجي، 1998).

2 حماية الممتلكات الثقافية في فترات النزاع المسلح

تعد الحروب من أخطر ما يلحقه الإنسان بالتراث الثقافي حيث يتم تدمير الممتلكات الثقافية. وهناك عدة أسباب لدمار وتلف الممتلكات الثقافية أولها الأسباب البشرية بما تحمله من عوامل الإتلاف والتدمير الأشد خطرا ويشتمل هذا العامل على مجموعة من العناصر ومنها الحرائق وأعمال الهدم والتخريب والسرقة، والترميم الخاطئ والمنشآت وحركة المواصلات وقلة الوعي لدى المواطنين بأهمية التراث. (اتفاقية حماية التراث العالمي الثقافي والطبيعي، ١٩٧٢. حمو، ١٩٨٠. سعد، ١٩٨٤. عبد الوهاب، 1985. المجالس القومية المتخصصة، ١٩٩٠. عطية، 2003. أصلان، ٢٠٠٤. علي، (د. ت). ومن ثم تعتبر الحماية الخاصة للممتلكات الثقافية في فترات النزاع المسلح إحدى صور الحماية التي يوفرها القانون الدولي للتراث الثقافي العالمي (شعث، ٢٠٠٦)، نظراً لارتباطه بالإنسان ومعبراً عن ذاتيته الوطنية وحضارته الثقافية. وتعكس هذه الحماية التوسع الذي لحق بنطاق القانون الدولي الإنساني حيث لم يعد قاصراً على حماية ضحايا الحروب من الإفراد وتخفيف معاناتهم، بل امتد نطاقه ليكفل الحماية الخاصة للممتلكات الثقافية، وقد جاء هذا التوسع في نطاقه ليشمل - كنتيجة طبيعية لما خلفته الحروب - الدمار والسلب والنهب للممتلكات بمختلف أنواعها ومنها الثقافية، فضلاً عن صعوبة تعويض ما يتم نهبه أو إصلاح ما يتم تدميره من تلك الممتلكات. وكان القانون الدولي الإنساني أول من كفل إجراءات الحماية للممتلكات الثقافية، حيث وضع العديد من الأحكام المتعلقة بحماية الأهداف المدنية والممتلكات الثقافية، وقرر أيضا حماية الأماكن التاريخية والدينية والفنية والعلمية، لما لها من أهمية تاريخية وروحية للأمم وللشعوب.

إن بيان مفهوم الحماية الخاصة للممتلكات الثقافية وبيان أحكامها، يوجب الإشارة إلى أن هناك عدة أنواع من الحماية أولها أن جميع الممتلكات الثقافية تتمتع بشكل تلقائي للحماية العامة، حيث يلتزم أطراف النزاع المسلح باتخاذ كافة الإجراءات الممكنة بعدم استخدام الممتلكات الثقافية لأي غرض عسكري ونقلها بعيداً عن الأهداف العسكرية أو عدم إقامة أهداف عسكرية بالقرب منها, ويجب على الطرف الآخر في النزاع المسلح الامتناع عن سلب الممتلكات الثقافية أو نهبها أو تبديدها ووقايتها من هذه الأعمال, ومنع أي عمل عدائي يهدف إلى تخريب هذه الممتلكات أو اتخاذ تدابير انتقامية ضدها, ولا يجوز التخلي عن هذا الالتزام إلا إذا استلزمت ذلك الضرورة العسكرية القهرية، ويقصد بذلك الحماية الخاصة، والحماية الممنوحة بموجب البروتوكول الثاني لاتفاقية لاهاي وهي حماية معززة تكمن في حصانة الممتلكات الثقافية من الهجوم وحظر استخدامها أو المناطق المجاورة لها مباشرة في العمل العسكري, ولا تعتمد الحماية على تحديد نوعية الهدف هل هو مدني أم عسكري, وإنما يقصد بالحماية المعززة أنه حتى إذا ما شكلت الممتلكات الثقافية هدفاً عسكرياً فلا يجوز اتخاذه هدفا للهجوم, إلا إذا كان الهجوم هو الوسيلة الوحيدة لإنهاء استخدام هذه الممتلكات الثقافية لأغراض عسكرية أو إذا اتخذت جميع الاحتياطات في اختيار وسائل الهجوم وأساليبه, بهدف إنهاء ذلك الاستخدام أو في حالة الدفاع عن النفس.

وقد أوصت معاهدة لاهاي على اتخاذ كافة التدابير الدولية والوطنية لحماية المواقع الأثرية والممتلكات الثقافية للدول باعتبارها تراثا ثقافيا إنسانيا، ففي عام (1970) تبنى المؤتمر السادس عشر لليونسكو التدابير الواجب اتخاذها لحظر موضوع استيراد وتصدير ونقل الممتلكات الثقافية بطرق غير مشروعة. كما صدر أيضا العديد من الاتفاقيات الدولية الخاصة بحماية الممتلكات الثقافية مثل اتفاقية حماية التراث الثقافي والطبيعي (1972). كما أوصى المعهد الدولي لتوحيد القانون الخاص (1995) برد القطع الثقافية المسروقة أو المصدرة بطرق غير مشروعة.

ومما لاشك فيه أن اتفاقية لاهاي أجازت وضع عدد محدود من المخابئ المخصصة لحماية الممتلكات الثقافية المنقولة ومراكز الأبنية التذكارية والممتلكات الثقافية الثابتة الأخرى ذات الأهمية الكبرى تحت نظام الحماية الخاصة المادة (1/8/أ)، بمعنى أن الحماية الخاصة نظام قررته اتفاقية لاهاي لطائفة محدودة من الممتلكات الثقافية، في ظروف خاصة وشروط محددة والتي حددتها الاتفاقية في مادتها الثامنة حيث اشترطت لتمتع الممتلك الثقافي بالحماية الخاصة تحقق شرطيين موضوعيين:

الشرط الأول: يتمثل في عدم استعمال هذا الممتلك الثقافي لأغراض حربية يعني أنه لا يمكن أن يتمتع الممتلك الثقافي بالحماية الخاصة إذا استخدم لدعم المجهود الحربي وذلك باعتباره هدفاً عسكري, (العناني، 2010)، هذا وإن الحراس المسلحين الذين وضعوا خصيصاً لحماية وحراسة الممتلكات الثقافية لا يعتبر وجودهم استعمالاً لأغراض عسكرية، (أبو الوفا، 2006).

الشرط الثاني: أن يكون الممتلك الثقافي واقعا على مسافة كافية من أي مركز صناعي كبير أو هدف عسكري هام يعتبر نقطة حيوية، بالرغم من أهمية هذا الشرط إلا أنه يثير كثيراً من الإشكاليات وتكمن معضلته بجواز وضع مخابئ للممتلكات الثقافية تحت نظام الحماية الخاصة، مهما كان موقعها إذ تم بناءها بشكل يجعلها في مأمن من أن تمسه القنابل، وكما يجوز وضع الممتلكات الثقافية بجوار الأهداف العسكرية بشرط أن تتعهد الدول الأطراف بعدم استعمال الهدف المذكور في حالة نشوب نزاع مسلح. (اتفاقية جنيف، 1949. البرتوكول الأول لعام 1977 الملحق بها).

ويؤخذ على هذه الاتفاقية في وضعها لهذا الشرط في أنها لم تحدد ما المقصود بعبارة مسافة كافية إذا كان من الأفضل تحديد تلك المسافة لكي لا تفسر وتتضارب الآراء حولها من قبل الأطراف المتنازعة كل حسب ما تقضيه مصلحته، (علي، 2011)، وبالرغم من المحاولات لتخفيف من حده هذا الشرط وما ورد عليه من استثناءات لكنه لا يخلو من النقد، ذلك أن ظروف النزاع المسلح قد تجبر الدولة المتعهدة بعدم استخدام الهدف العسكري الواقع بالقرب من الممتلك الثقافي، أضف إلى ذلك أن الدول في حالة نشوب النزاع المسلح قد لا تبقى على تعهداتها التي التزمت بها قبل حدوث النزاع، كما وإن تطور تقنية الحروب واستخدام الأسلحة الحديثة مثل الصواريخ العابرة للقارات وأسلحة الدمار الشامل لا تدع مجالا للادعاء بأنه لن يمس الممتلك الثقافي ضرر من جراء استخدام الأسلحة، حتى وان كان محصنناً بشكل قوي وخير مثال على ذلك ما أوردناه في المثال السابق ذكره وهو خير دليل لتطبيق هذه الانتقادات.

ولا تتمتع الممتلكات الثقافية بشكل تلقائي بالحماية بمجرد توافر الشروط السالفة الذكر، بل اشترطت اتفاقية لاهاي على ضرورة قيد الممتلك الذي ترغب الدولة الطرف في الاتفاقية توفير الحماية الخاصة لها في السجل الدولي للممتلكات الثقافية الموضوعة تحت نظام الحماية الخاصة المادة (12) تحت إشراف منظمة اليونسكو، (اتفاقية لاهاي، 1954. اللائحة التنفيذية. حماد، 1997. سبيكر، 2000. علي، 2011)، ويعد هذا الشرط شكليا، أي أن الاتفاقية قررت إنشاء هذا السجل وتولت اللائحة التنفيذية للاتفاقية بيان نظامه (المواد 12-16)، ويتبين إن الفائدة العملية من تسجيل الممتلك الثقافي تتمثل في أن هذا الموقع يكتسب عند قيده في السجل وضعاً خاصاً في حالة وقوع نزاع مسلح، وذلك لكي تحاط الدول الأخرى علماً، ومن ثم لا يمكن لها اتخاذ الإعمال العسكرية ضد تلك الممتلكات الثقافية.

ويتبين أن تدمير الممتلكات الثقافية وأماكن العبادة لا تعكس ضرورة عسكرية، بقدر ما يقصد بها القضاء على هوية الخصم وتاريخه وثقافته بغية محو كل أثر لوجوده، (عبد القادر، 2010)، وتكون ضرورة سياسية لتحطيم معنويات الطرف الأخر ورموزه والروحية، كون هذا التراث يمثل هوية الدولة، فلم يكن ضرب مرقدي الإمامين (الحسن العسكري وعلي الهادي) في (2006/2/22) بسامراء بالعراق لضرورة عسكرية، بل كان لضرورة سياسية لزرع التفرقة والطائفية بين أبناء شعبنا العراقي، إذ يجب حماية الأماكن المقدسة وعدم استهدافها أياً كانت الحجة المقدمة.

وتجدر الإشارة أن اتفاقية لاهاي لم تقرر حماية خاصة لاماكن ودور العبادة بخلاف المادة (53) من البرتوكول الأول (1977) الملحق باتفاقيات جنيف الأربع لعام (1949) التي جاءت شاملة لتلك الحماية الخاصة لكل من الأعيان الثقافية وأماكن العبادة، وأقرت الحماية نفسها في المادة (6) في البرتوكول الثاني لاتفاقيات جنيف الأربع.

3 الإعلام الجديد والممتلكات الثقافية في ظل للعولمة

جاءت وسائل الإعلام الجديد (New Media) لتحل سيطرة مركزية لوسائل الإعلام التقليدية المركزية، وأصبح بإمكان الأفراد والمؤسسات مخاطبة الجميع مباشرة وبتكلفة معقولة، (بيت المال، 2011)، فالإعلام الجديد أو الإعلام الرقمي (Digital Media) هو مصطلح يضم كافة تقنيات الاتصال والمعلومات الرقمية التي جعلت من الممكن إنتاج ونشر واستهلاك وتبادل المعلومات من خلال الأجهزة الالكترونية (الوسائط) المتصلة أو غير المتصلة بالإنترنت، والتفاعل مع المستخدمين الآخرين.

وهناك تعريفات أخرى مختلفة منها أنه يمثل أشكال التواصل في العالم الرقمي والتي تضمن النشر على الأقراص المدمجة وأقراص الدي في دي وبشكل أكثر أهمية على شبكة الإنترنت. وأنه مصطلح يضم أشكال التواصل الإلكتروني المختلفة والتي أصبحت ممكنة من خلال استخدام تقنيات الحاسب الآلي. وبالنظر إلى علاقة هذا المصطلح بوسائل الإعلام القديم مثل الصحف المطبوعة والمجلات والتي تتسم بسكون نصوصها ورسوماتها، فإن وسائل الإعلام الجديد تشتمل على: المواقع على الشبكة العنكبوتية والنقل المتدفق للصوت والفيديو وغرف الدردشة والبريد الإلكتروني ومجتمعات الإنترنت وإعلانات الإنترنت وأقراص السي دي والدي في دي والواقع الافتراضي ودمج البيانات الرقمية مع الهاتف والكاميرات الرقمية والهواتف الجوالة.

إن قوة وسائل الإعلام الجديد لا تقتصر على خاصية التفاعل التي تتيحها والتي تسمح بتبادل أدوار العملية الاتصالية، ولكن تلك الوسائل أحدثت ثورة نوعية في المحتوى الاتصالي متعدد الوسائط والذي يشتمل على النصوص والصور وملفات الصوت ولقطات الفيديو. هذه الخصائص وسواها دفعت الجميع إلى القفز على تلك الوسائل الجديدة التي استطاعت خلال فترة زمنية قصيرة إحداث الكثير من التأثيرات المذهلة على المستويات السياسية والتجارية والاجتماعية والتقنية، حيث برزت شبكات التواصل الاجتماعي، مثل فيسبوك وتويتر ويوتيوب والمدونات إضافة إلى انتشار أجهزة الهواتف الذكية المزودة بالكاميرات الرقمية والقدرة على الارتباط بالإنترنت من أي مكان مثل الآي فون وبلاك بيري وكذلك الأجهزة اللوحية مثل الآي باد وجالكسي تاب، والتي أدت إلى رفع سقف حرية التعبير والحصول على المعلومة والقدرة على الاتصال بشكل غير مسبوق والتي كان لها تأثيرات كبيرة لا يمكن تجاهلها.

إن التغيرات الحالية التي تعيشها تكنولوجيا الإعلام هي التغيرات الرئيسية الرابعة من نوعها في العصر الحديث، وذلك عقب اختراع الطابعة وبشكل رئيسي الطابعة البخارية السريعة والتي جعلت توزيع الصحف والمجلات والكتب للعموم حقيقة واقعة (1833) ومن بعدها اختراع الراديو (1920) ثم التليفزيون (1939)، والتغير الذي نشهده اليوم يعتمد على استخدام الكمبيوتر في إنتاج وتخزين وتوزيع المعلومات والتسلية، هذه الخاصية وهي عملية توفير مصادر المعلومات والتسلية لعموم الناس بشكل ميسر وبأسعار منخفضة هي في الواقع خاصية مشتركة بين الإعلاميين القديم والجديد، الفرق هو أن الإعلام الجديد قادر على إضافة خاصية جديدة لا يوفرها الإعلام القديم وهي التفاعل (Interactivity) وما بعد التفاعل.

والتفاعل هو قدرة وسيلة الاتصال الجديدة على الاستجابة لحديث المستخدم تماماً كما يحدث في عملية المحادثة بين شخصين. هذه الخاصية أضافت بعداً جديداً هاماً لأنماط وسائل الإعلام الجماهيري الحالية والتي تتكون في العادة من منتجات ذات اتجاه واحد يتم إرسالها من مصدر مركزي مثل الصحيفة أو قناة التلفزيون أو الراديو إلى المستهلك مع إمكانية اختيار مصادر المعلومات والتسلية التي يريدها متى أرادها وبالشكل الذي يريده.

في السابق كانت قدرة المستخدمين على التفاعل تقتصر على دائرة رجع الصدى للمحتوى المنشور على المواقع الإلكترونية عبر إضافة التعليقات وتدوين الملاحظات على سجلات الزوار مثلا. ثم انتقلت بعد ذلك العلاقة إلى التحرر نسبياً مع وجود المنتديات ومجموعات الأخبار والقوائم البريدية، غير أنها لم تتح للجمهور حرية الممارسة الإعلامية المطلقة والتي لم تتوفر لهم إلا بعد ظهور المدونات وما تبعها بعد ذلك من ظهور لشبكات التواصل الاجتماعي ومواقع الفيديو التشاركية كاليوتيوب والموسوعات الحرة مثل ويكيبيديا، وهذه المواقع تمثل عناصر الانتقال إلى مرحلة ما بعد التفاعلية.

وتعتبر هذه المرحلة انقلاباً على نموذج الاتصال التقليدي، حيث أصبح بمقدور الفرد العادي إيصال رسالته إلى من يريد في الوقت الذي يريد بطريقة متعددة الاتجاهات وليس من أعلى إلى أسفل فقط، وفق النموذج الاتصالي القديم. بالإضافة إلى ذلك فإن الإعلام الجديد يتميز بالخصائص التالية:

1. تغيير أنماط السلوك الخاصة بوسائل الاتصال من حيث تطلبها لدرجة عالية من الانتباه فالمستخدم يجب أن يقوم بعمل فاعل (active) يختار فيه المحتوى الذي يريد الحصول عليه.
2. اندماج وسائل الإعلام المختلفة والتي كانت في الماضي وسائل مستقلة لا علاقة لكل منها بالأخرى بشكل ألغيت معه تلك الحدود الفاصلة بين تلك الوسائل.
3. جعل من حرية الإعلام حقيقة لا مفر منها، فالشبكة العنكبوتية العالمية مثلا جعلت بإمكان أي شخص لديه ارتباط بالإنترنت أن يصبح ناشراً وأن يوصل رسالته إلى جميع أنحاء العالم بتكلفة لا تذكر، هناك أيضاً على الإنترنت عشرات الآلاف من مجموعات الأخبار التي يمكن لمستخدميها مناقشة أي موضوع يخطر على بالهم مع عدد غير محدود من المستخدمين الآخرين في أنحاء متفرقة من العالم.
4. تعدد الوسائط حيث أحدث ثورة نوعية في المحتوى الاتصالي الذي يتضمن مزيجا من النصوص والصور وملفات الصوت ولقطات الفيديو.
5. تفتيت الجماهير (media fragmentation) ويقصد بذلك زيادة وتعدد الخيارات أمام مستهلكي وسائل الإعلام والذين أصبح وقتهم موزعاً بين العديد من الوسائل مثل المواقع الإلكترونية وشبكات التواصل الاجتماعية والهواتف الذكية وألعاب الفيديو الالكترونية بجانب الوسائل التقليدية من صحف وإذاعة وتلفزيون.
6. غياب التزامنية ويقصد به عدم الحاجة لوجود المرسل والمتلقي في نفس الوقت، فالمتلقي بإمكانه الحصول على المحتوى في أي وقت يريده.

7. الانتشار وعالمية الوصول: ويقصد بالانتشار شيوعه ووصوله إلى جميع شرائح المجتمع تقريبا، إضافة إلى عالميته وقدرته على تجاوز الحدود الجغرافية.
8. قابلية التواصل بصرف النظر عن مواصفات ومقاييس المنشئ للمحتوى.

إن العولمة (Globalization)، (الأسد، 1997. باسيل، 1997. الجابري، 1998. أحمد، 2000. ملي، 2007)، التي تعني إكساب الشيء طابع العالمية، (المطيري، 1999)، هي مشروع حضاري غربي متكامل، (التويجري، 2000)، يتمثل في سيطرة وغلبة ثقافة من الثقافات على جميع الثقافات في العالم، (الجابري، 1999. السادة، 2000)، حيث أن الغرب حقق أهدافاً عالية في مجال التكنولوجيا والكمبيوتر، فتطور خلال السنوات الأخيرة تطوراً هائلاً في حقل الاتصالات والمعلومات والإنترنت، (أبو زعرور، 1998). ويجمع المنظور الأمريكي للعولمة بين أمور التكنولوجيا والاقتصاد والسياسة والسلوك والقيم والأخلاق، أي لا يريد أن يسيطر على الجوانب المادية فحسب، إنما يتعدى ذلك إلى القيم الاجتماعية للشعوب، (شلبي، 1999). وفي سياق التطور السياسي للإنسانية لا ينبغي تعميم العولمة على المستقبل، فإن العولمة تأخذ دورها كأحد حلقات ذلك التطور. وهي تمثل الهيمنة الغربية الأمريكية في مجال الاتصالات والمنجزات العلمية الهائلة, وهي عبارة عن تنازل الدولة الوطنية أو حملها على التنازل عن حقوق لها لفائدة المتحكمين في العالم (الجابري , 1997)، ومن ثم تتعدد أشكال العولمة وصيغها، وتتفاوت تطبيقاتها، وتتشعب تفسيراتها وأبعادها، (أبو زعرور، 1998. التويجري)، [9].

ومقصود العولمة الذي يطفو إلى السطح، (عن إيجابيات العولمة، (أولاخ، 2000. الشرعبي، 2006، [10]، وعن سلبياتها، الميلاد، 1998. أمين، 1998. زقزوق، 2001)، هو إزالة الحواجز والحدود بين الثقافات وحركة الاقتصاد والمجتمع وإتاحتها للجميع على طول العالم وعرضه، (حجازي، 1998). وهذا أمر مقبول من حيث النظرة العامة. لكن في الواقع، إن العولمة هي الآلة التي يريد بها الغرب طمس قسمات الشعوب وتشكيلها حسب رؤيته، ويريد أن يسير العالم وفق مفاهيمه (جارودي، 1998)، بالسيطرة على التكنولوجيا والمعلوماتية والاتصالات وأجهزة الاستعلام اللازمة حتماً للاستمرار في الهيمنة رغم أن لكل أمة مفاهيم ورؤى واتجاهات تقيس عليها تلك القضايا، (الزعبي, 2001).

ومن هنا تجد وسائل الاتصال العربية والقنوات الفضائية على وجه الخصوص نفسها أمام تحد كبير، وهو تأثير تيارات العولمة التي لا تعترف - في الواقع - بأي ثقافة غير الثقافة الغربية، وأن بعض الكتاب الأمريكيين يحاولون الإيحاء بأن ثقافات البلاد الأخرى هي ثقافات تقليدية غير ملائمة، (ثابت، 1999). ومن ثم لم تعد العولمة نظاما اقتصاديا وإنما نشأت مرتبطة بوسائل الاتصالات الحديثة, وهذه الوسائل تنشر ثقافة الاختراق، حيث يعمل مروجو العولمة بوسائلهم الضخمة على تدمير التراث الأصيل الذي ابتدعته الإنسانية في مسيرتها الطويلة.

نتطرق هنا باختصار إلى البعد الثقافي للعولمة، وذلك لارتباطه بالبعد الاتصالي والإعلامي، إذ أن أبعاد العولمة تتخذ من الإعلام الجديد والاتصالات الحديثة وسيلة أساسية لتجد طريقها إلى التغلغل والتطبيق. ومن أهداف العولمة في المجال الثقافي أن يسير البشر على النمط الغربي ووفق تقليده وسلوكه، وتغليب معايير الثقافة الغربية. فالإعلام في حد ذاته يعد بعداً للعولمة، كما يعتبر أيضاً آلية من الآليات التي لا يمكن الاستغناء عنها في تنفيذ الأبعاد الأخرى للعولمة، وإن عالمية الاتصالات التي تترتب على تطور تقنيات الأقمار الصناعية (يسري، 1999)، من القوى الرئيسة التي تعتمد عليها العولمة ومن هنا يبرز دور الإعلام الجديد بصفةٍ خاصة في ترسيخ العولمة.

فعلى مدى عصور طويلة مضت، كانت وسائل الإعلام التقليدية من صحف ومجلات وإذاعة وتلفزيون هي محور الوسائل الاتصالية والإعلامية المجتمعية التي يتم استخدامها للوصول إلى الجماهير وإيصال الرسائل المختلفة إليهم سواء كانت تلك الرسائل تحمل طابعا سياسيا أو اجتماعيا أو تجاريا أو غير ذلك. وبالرغم من أهمية الدور الذي كانت تقوم به تلك الوسائل، إلا أن وسائل الإعلام الجديد أعادت تشكيل خارطة العمل الاتصالي والإعلامي في المجتمعات المعاصرة بما تحمله من خصائص كعالمية الانتشار وسرعة الوصول والتفاعل وقلة التكلفة، (وثيقة برنامج عمل المؤتمر الدولي للسكان والتنمية. مارتن، 1998. هنتنجتون، 1999. المنير، 2000. الردادي، 2001. المسيري، 2001. محمد، 2001. خريسان، 2001). التميمي، 2001). ومما لا شك فيه أن الاستعمار الغربي استخدم كل الوسائل التي تمكنه من إخضاع البلدان المستضعفة لها ومن تلك الوسائل الإعلام الموجه، (المخزومي , 1965. الجابري, 2000).

وإذا كانت الدول الخاضعة للهيمنة تدرك بطيئاً أهمية عامل الاتصالات الثقافية في نضالها، تحقيقا لوجود واستقلال لهما دلالتهما، فإن المهيمنين ليسوا أقل تنبهاً لمغزى هذا العامل، وقد يكون وعيهم في الحقيقة متفوقاً على وعي ضحاياهم، ومن ثم فإن الفترة القادمة سوف تشهد بوجه اليقين تعاظم الصراع على الصعيدين الوطني والدولي بين أولئك الذين ينشدون الهيمنة الثقافية وبين أولئك الذين يسعون إلى الإبقاء عليها، وتحتل وسائل الإعلام العام مركز الصدارة في المشروعات العاملة التي تستخدم في عملية التغلغل، ومن أجل تحقيق ذلك، لابد من أن تستحوذ القوة المهيمنة المتغلغلة على وسائل الإعلام ذاتها، ويتم ذلك بقدر كبير عن طريق إضفاء الطابع التجاري على الإذاعة والتلفزيون والصحافة، (شيلر, 2007).

إن أزمة التراث العربي هي نتيجة لوسائل المعرفة المصدرة عبر وسائل الاتصال الحديثة، أو سياسة العولمة الأمريكية التي تبغي إزالة ثوابت الأمم المختلفة, وإن أصحاب هذه التقنية ليسوا أمما تمتلك عقائد وتراث بل لها معتقدات وقيم مخالفة, فالمعرفة أصبحت في ظل الوسائل الحديثة تقتحم كل القيود الموروثة والمكتسبة, فالدول الكبرى صاحبة القرار في العالم تصر على انتزاع الأفراد من مجتمعهم وعقائدهم وتدفعهم إلى تفعيل الهجرة إلى غير تراثهم، (شمال، 1999).

ومما لا شك فيه أن للعولمة أثرا كبيرا وواضحا في الهوية الثقافية، (عزت، 1985. أحمد، 2000). حسن، 2002. القاسم، 2003)، والحضارية، (نعمان، 1995. الجابري، 1998. الحمد، 1999. وطفة، 2010). حيث تشير العولمة الثقافية إلى وضع شعوب العالم في قوالب فكرية موحدة وذلك لإبعادها عن ثقافتها وموروثها الحضاري ومن ثم إفراغ الهوية الجماعية للأمة من أي محتوى، (الجابري، 1998). فالبث الثقافي المُصدر لنا من العولمة الأمريكية له أثر سلبي على التراث والعقل العربي وبالتالي على الهوية، فالعلاقة بين العولمة ومسألة الهوية ليست إذن علاقة وحيدة الاتجاه, وهي لا تطرح مشكلة واحدة يمكن حلها بل هي تنسج إشكالية لا يمكن حلها إلا بتجاوزها. وعملية التجاوز تتطلب مقاومة هذه الإشكالية بـأقوى أسلحتها، أقصد تعميم المعرفة العلمية. وأن التغلب على مساوئ العولمة يتم بالرفع من مستوى الهوية إلى الدرجة التي تستطيع بها الصمود الإيجابي المملوء بالثقة بالنفس. وأن الوسائل التقنية التي توفرها العولمة على مستوى الاتصال خاصة هي خير مساعد على نشر المعرفة العلمية وتعميم الروح النقدية، (الجابري, 2006).

وفي ظل طموح الدول الغربية عامةً والولايات المتحدة الأمريكية على وجه الخصوص، ورغبتها في بث ثقافتها وأيديولوجيتها ومراميها الاقتصادية، وفي ظل امتلاكها للآلة الإعلامية الحديثة، وتقنياتها المساعدة المتمثلة في الأقمار الاصطناعية وغيرها، فإن كل هذه المعطيات جعلت المعلومات تسير في اتجاهٍ واحد، من الشمال إلى الجنوب ومن الغرب إلى الشرق، أي من الدول الغنية تجاه الدول النامية. ومن ثم فإن إعلان حرية تدفق المعلومات قد صار آحادي الاتجاه، (العشاوي، 1996).

وتتعرض الدول العربية كغيرها من دول العالم الثالث إلى ذلك التدفق أحادي الاتجاه، خاصةً وأن للدول الغنية طموحات في منطقة الشرق الأوسط وأفريقيا والجزيرة العربية تملي عليها أن يسير هذا التدفق صوب المنطقة على وجه الخصوص. وهناك اختلال كمي بين الدول النامية في المواد الإعلامية، كالاختلال بين الأنباء السياسية من جهة والأنباء الاجتماعية والثقافية والاقتصادية من جهةٍ أخرى، حيث يظهر طغيان الأنباء السياسية على غيرها. كما أن هناك اختلال نوعي بين ما يطلق عليه الأنباء السارة والأنباء السيئة، إذ تغطي أنباء الدول الغنية الإنجازات والابتكارات ومظاهر التطور والتقدم، بينما تظهر أنباء الدول النامية من بوابة الأزمات، أو ما يسمى بأخبار الأزمات (Crisis News)، كالحروب والانقلابات والمجاعات والفيضانات والزلازل. الخ.

أما عن تدفق المعلومات على نطاق الدول العربية، فهناك إمكانية لتدفق المعلومات بينها بشكلٍ متوازن، فمن المفترض أن يشكل انتشار القنوات الفضائية فيها أرضاً خصبة تحول دون أن يكون ذلك التدفق مخلاً، لأن القرب الجغرافي بين هذه الدول والصلات الثقافية والدينية بينها واللغة وحجم السكان كلها عوامل تؤهل لعدم الاختلال في تدفق المعلومات. لكن عدم الاستقرار السياسي والتبعية الإعلامية والسياسية والثقافية والاقتصادية للغرب في معظم الدول العربية تجعل ذلك التوازن أمراً صعب المنال. وتوفر القنوات التلفزيونية التي تبث عبر الأقمار الاصطناعية الكثير من المعلومات التي تخدم التنمية وتسهم في ترقية المجتمعات وتفتح للإنسان آفاق المعرفة والتطور في شتى مناحي الحياة، ولا ريب في أن أي دولة نامية بحاجة إلى المعلومات التي تساعدها على التخطيط لبرامجها التنموية، واكتشاف ما تحويه أرضها من إمكانات اقتصادية.

لكن هذه المعلومات تبقى حكراً لدى الدول الغنية، حيث تتعامل معها كسلعة لا يمكن إتاحتها إلا للشركات التابعة لتلك الدول، والتي تقوم بدورها للبحث عن استثمارات في الدول النامية بناءً على تلك المعلومات، التي ربما تريد الدولة المتعلقة بها كتمانها لظروفها الخاصة، أو ربما لا تكون على علمٍ بها أصلا، (الجمال، 1989). ولقد أصبح تعبير (العلم السري) تعبيراً عادياً في قاموس الدول الغربية، يستخدم ليبرر استثناء بعض مجالات البحث العلمي من قانون حرية المعلومات باعتبار أن البوح به قد يضر بالمصالح الأمنية والاقتصادية، (باشا، 1999).

ولم يقتصر احتكار المعلومات على تلك المعلومات التي يُبرر احتكارها على أنها تتعلق بالمصالح الأمنية والاقتصادية فحسب، بل انعكس ذلك على الأخبار وغيرها من المعلومات. خاصة وأن وكالات الأنباء العالمية تسيطر على (80%) من المعلومات المتداولة دوليا، (عبد الرحمن، 1984)، و (90%) من كمية الأخبار المتداولة على مسرح الأحداث العالمية، (مندوب، 1982). وذلك رغم انتشار العديد من وكالات الأنباء الوطنية حول العالم. والمأمول من القنوات الفضائية العربية العمل في ظل هذا التدفق الكثيف للنهوض بشعوب الدول العربية من خلال برامج تنموية وثقافية.

لكن هناك العديد من المظاهر الأخرى التي كرست سيطرة الإعلام الغربي على هذه الدول، ومن تلك المظاهر: تحكم عدد من وكالات الأنباء في النظام الإعلامي الدولي ومن ثم فإن الدول العربية تعتمد في استقاء أنبائها بشكل أساسي على هذه الوكالات، في الوقت الذي أثبتت فيه الأبحاث العلمية تحيز هذه الوكالات ضد الدول العربية ودول العالم الثالث عموماً، (رشتي، 1985)، وسيطرة المصادر الإخبارية المصورة على الأخبار العربية: حيث أن للأخبار المصورة أسلوبها الدقيق في التعبير، لذلك تميزت بقيمة إعلامية ربما تفوق الكلمة أحياناً.

ولما كانت الدول العربية مثار اهتمام الغرب، فقد سعت الدول الغربية لبسط نفوذها الإعلامي على المنطقة، ومن ثم وجهت الكثير من هذه الدول شبكات وقنوات كبرى لتحكم سيطرتها على الأخبار المصورة في وسائل الإعلام العربية والأقمار الاصطناعية التي استخدمتها الدول الغربية في بث المواد الإعلامية إلى المنطقة العربية، ولما دخلت الدول العربية هذا المجال كان هذا الاستخدام لاستقبال الأخبار من الخارج وليس للتبادل الإخباري، ومن أمثلة ذلك ما قامت به فرنسا، حيث استخدمت تلك الأقمار في التبادل البرامجي مع الأردن لأول مرة على نطاق الدول العربية، وبموجب ذلك أصبحت تصل الأردن حقيبة إخبارية منتظمة من هيئة الإذاعة الفرنسية، كما اتفقت دول الخليج والتلفزيون الفرنسي على بث يومي عبر قمر المحيط الهندي.

ويأتي دور التوعية الإعلامية التي تتلخص في تعريف المواطن على أهمية الآثار الثقافية والاقتصادية له ولغيره وانتهاز الفرص لإثارة اهتمامه بالتراث الحضاري وإشعاره بالمسئولية، وإشراك المواطنين في تحمل مسؤولية حماية التراث الحضاري الأثري والتراثي، ومن الضروري إحداث مؤسسات حكومية أو أهلية تساعد على توعية المواطنين وشاغلي الأبنية الأثرية والتراثية، والاتصال بالجهات الفاعلة في هذا المجال لشرح أبعاد قضية التراث وفائدتها للشعب والهوية وبالتالي مطالبتها بتخصيص الأموال اللازمة لصيانة تلك المباني وترشيد استخداماتها وإصدار التشريعات الناظمة لذلك.

إن تدمير التراث الثقافي والحضاري لأي شعب أو أمة أو مجتمع, يمكن أن يتم عبر عدد من الخطوات والأعمال, منها: تدمير المواقع والآثار التاريخية والأماكن التراثية، وتدمير الرموز والمواقع الدينية والروحية، وتدمير المتاحف وسرقة محتوياتها، وتدمير المكتبات وسرقة وإتلاف وحرق محتوياتها، وتدمير مواقع الأرشفة والتوثيق وسرقة وتحطيم محتوياتها، وتدمير التراث الحضاري والاجتماعي والفني ومنع تطويره وانتشاره، وتحطيم التماثيل والرموز التي تخلد انجازات وشخصيات العلماء المتميزين والمفكرين والمبدعين في الأمة والوطن.

وفي معمعة الحرب الشاملة التي تتعرض لها دول الوطن العربي اليوم, وفي موازاة ومؤازرة الأعمال الحربية العدوانية الإرهابية, تتعرض الدول العربية لأشرس حرب إعلامية عرفتها منطقتنا بل العالم كله, تقوم بها عشرات وكالات الأنباء والفضائيات العالمية والإقليمية, التي تستخدم أحدث تقنيات العمل الإعلامي ووسائل الاتصال عالية السرعة والتطور والأداء, بهدف كسب العقول والقلوب والرأي العام العالمي والإقليمي والمحلي, عبر التلاعب المحترف والذي يقوده خبراء متخصصون في علم الإعلام الحديث والاتصالات والعلاقات العامة ومناهج التواصل الاجتماعي والحرب النفسية، حيث يجري مزج بعض الحقائق والوقائع الحاصلة بنسبة كبيرة جداً من الأضاليل والمعطيات الزائفة الملفقة, لزعزعة ثقة الناس بالدولة أولاً, وببعضهم بعضاً, لجعلهم يعتقدون بأن المشكلة ليست في المستعمرين الجدد والكيان الصهيوني والفكر التكفيري, وإنما بالخلافات الطائفية والمذهبية والفروق الدينية والإثنية والقبلية. أي أن الهدف الأساسي من هذه الحرب الإعلامية يتمثل بإعادة توجيه الرأي العام, وتدمير مرتكزات وأسس التلاحم الوطني والتضامن المجتمعي المشترك, وتغيير الأولويات ونسف الثوابت الفكرية والنفسية والعاطفية للمواطن, بحيث يوجه نحو مسارات أو متاهات ومنزلقات ثقافية وسياسية وإيديولوجية مضادة لأسس ومرتكزات الوعي الوطني والتضامن المجتمعي والانفتاح المتبادل القائم على احترام الاختلافات الثقافية والدينية والطائفية والإثنية وغيرها.

ولمواجهة هذه الحرب التي أشرنا لبعض تجلياتها ولاسيما في مجال محاولة تدمير التراث الثقافي الحضاري ونسف مرتكزات الهوية الوطنية, فإننا نخلص إلى أن وسائل إعلامنا الوطنية كلها وبجميع أشكالها وأدواتها ومسمياتها مطالبة بالتفاعل الإيجابي مع معركة الوجود الأصيل والتفاعل الفوري مع مشكلات الاعتداءات المنظمة على التراث الحضاري ونهب الآثار وتدميرها, والعمل على تسليط الضوء على مكونات الهوية الحضارية الوطنية في كل بقاع الوطن بكل التزام ووعي ومعرفة ومسؤولية, كما أن وسائل الإعلام مسئولة عن حماية الهوية الوطنية وتسجيل جميع عناصرها, وتزويد الرأي العام بها ثقافيا, وبذلك يتم تحصينه سياسياً واجتماعياً, حتى يكون قادراً على التمييز بين ما يخدم الهوية الوطنية وما يصب في صالح الفكر الطائفي أو المذهبي أو الإثني المضاد للفكر العقلاني العلماني التعددي المنفتح.

فمن غير المنطقي أن يجهل الشباب قيمة التراث الحضاري وهو أول أسس تكوين الهوية الوطنية، أو لا يدركون أسس ومقومات الشخصية العربية وتاريخ أمتهم الحضاري. وإذا كنا نخشى عليه من تأثير الفضائيات المعادية وشبكة الانترنت وشبكات التواصل الاجتماعي, وغيرها من الوسائط الإعلامية المهيمنة, والتي أصبح جزء كبير منها يشكل خطراً على الهوية الوطنية, فإن الحل الوحيد والأساسي يكمن في صنع البديل الجاذب واستنفار روح الوطنية لدى الشباب.

إن سبيل حماية التراث يكون من خلال توعية الأجيال الحالية والقادمة بالتأكيد على أهمية ومميزات التراث الحضاري العربي, وشرح دور هذا التراث وأثره الكبير والفعال على حضارات العالم, ومن ثم مجابهة تيار العولمة على الحضارة العربية بكل إمكانيات التقنية الحديثة المتوفرة في إيصال المعلومة إلى جميع أنحاء العالم عبر الانترنت والبث التلفزيوني عبر الأقمار الصناعية، ونشر ذلك بكل الوسائل الإعلامية المتاحة المرئية والمقروءة والمسموعة, وتوحيد الجهود العربية الداعية إلى توثيق التراث العربي والحضارة العربية بالعمل على إصدار كتب وأفلام ونشرات ووثائق عربية موحدة كالموسوعات العربية الكبيرة حول الفنون والعلوم والآداب العربية الأصيلة المرتبطة بالإنسان العربي وبالأرض العربية, وتشجيع ودعم مراكز التوثيق العربية والمتاحف ودور الآثار المعنية بذلك, ودعم ورعاية دور

النشر العامة والخاصة في الوطن العربي وفي العالم التي تتبنى فكرة إبراز أهمية أصالة التراث العربي والهوية الوطنية والقومية للشعوب ونشره والتعريف به وتعميمه كجزء من الحضارة العربية والعالمية وميزاتها في الفلسفة واللغة والعمارة والنحت والتصوير والآداب والعلوم والفنون عبر التاريخ المشرف للأمة العربية.

ونؤكد هنا على تقديم البديل والاستثمار في الصناعات الإعلامية والثقافية. فالجمهور بحاجة إلى بديل مقنع وواقعي وإلى أخبار دقيقة وليس إلى آراء في الأخبار أو أخبار على هامش الآراء, والجمهور بحاجة إلى برامج ومواد ثقافية محلية تعكس شخصيته وهويته واهتماماته وانشغالاته, لكن إذا انعدمت المادة الجيدة والجادة والأسلوب الجذاب للتقديم وخلت من الصور والحركة, فإن هذا الجمهور ينصرف عنها إلى فضائيات أخرى, ولابد أنه سيجد ضالته أو شيئاً منها في بعض تلك الفضائيات, بغض النظر عن توجهاتها الثقافية والسياسية والإيديولوجية والقيمية. فالأمر أكبر وأخطر من تحطيم بعض التماثيل أو إزالة بعض القبور والمقامات, فهو يتعلق بمخطط استراتيجي, يهدف إلى تدمير كيان المجتمع ووجوده وتاريخه وحاضره ومستقبله. ولهذا يتوجب على الدول ومنظمات المجتمع المدني بها وجميع القوى الحية في العالم أن تواجه هذه الحرب الهمجية بقوة وصلابة وخطة شمولية متكاملة مضادة.

ولا يحتاج المراقب المتخصص إلى جهد كبير لكي يكتشف طبيعة الإعلام الغربي، وتعامله مع الدول الحاضنة للممتلكات الثقافية، ولا يبذل المتابع والمهتم كثيرا من العناء في هذا المجال، حتى يصل إلى الإستراتيجية الإعلامية التي استخدمها الغرب مع الشعوب والمجتمعات ذات الإرث الحضاري، ومن الغرابة بمكان، أن الغرب يتكلم كثيرا عن الحضارة الإنسانية وأهمية ووجوب الحفاظ على الإرث الإنساني عبر التاريخ، لأنه لا يمثل أمة أو دولة بعينها، إنما هو إرث إنساني للجميع، ويستطيع المتخصص أن يرى ويحدد التناقضات الواضحة بين أقوال الغرب وأفعاله، لاسيما في تعامله الإعلامي مع العراق مثلا، وهي دولة تضم أهم المواقع الأثرية التي تعود لحضارات الإنسان الأولى والراقية في الوقت نفسه.

التساؤل الذي يتناقله المعنيون وغيرهم عن سر التعامل الإعلامي الغريب مع العراق، حيث يشعر الغرب بالحسد إزاء هذا التاريخ الحضاري، كما يتضح ذلك من سلوك وأهداف وسائلة الإعلامية المختلفة، كما نلاحظ أن الداعمين للغرب إعلاميا يلتقون معه في الأهداف والصفات نفسها، ويظهر أن الدول التي لا تمتلك تاريخا حضاريا عميقا، تلتقي فيما بينها في الأهداف وإثارة الفتن، ضد الدول والشعوب التي تشكل حواضن تاريخية مشرقة للآثار والحضارات التي أسهمت بدفع البشرية خطوات إلى الأمام دائما وأبدا في طريق التقدم والتحضر في الفكر والسلوك.

لهذا عندما نأتي لتشريح ومعرفة قواعد الإعلام الغربي وأساسياته، وطرق وأساليب تعامله مع العراق، فإننا لا شك سنلاحظ أن هذا الإعلام قائم على إثارة الفتن والاحتراب ونشر البغضاء بين مكونات وإثنيات وأعراق الشعب العراقي أيضا، لذلك يركز هذا الإعلام (المغرض) على الاضطرابات الأمنية والسياسية القاسمة منذ سنوات في العراق، ويحاول بل يستميت من أجل أن يظهر للجميع بأن أسبابها ودوافعها طائفية وعرقية وإثنية وما شابه.

لذلك، فإننا مطالبون بأن نسمي الفتن وحالات الاحتراب التي يدعمها الإعلام الغربي ويسعى دائما لتأجيجها، بأنها سياسات إعلامية مغرضة ومخطط لها مسبقا، ولسنا نغالي إذا قلنا أن الغرب ينظر بعين الحسد للعراق، كونه يمتلك إرثا حضاريا يشار له بالبنان على المستوى الإنساني، خاصة أن أمريكا والغرب الأوربي التي تتحكم اليوم بالعالم سياسيا واقتصاديا وثقافيا وتسعى لعولمة غربية شاملة من خلال سعيها الواضح لجعل القرن الراهن، قرنا بهوية غربية خالصة لا تمتلك عمقا تاريخيا، ولا إرثا حضاريا يغوص في أعماق الزمن، الأمر الذي شكل ولا يزال لها نقطة ضعف تدفعها للتخطيط الدائم، إعلاميا وسياسيا واقتصاديا وثقافيا للنيل من الدول والشعوب ذات الإرث الحضاري، وهذا يستدعي إثارة الفتن في هذه المناطق لتدمير الآثار.

وهذا بالضبط ما يفتقد له الأوروبيون كونهم على المستوى الحضاري التاريخي لا يتمتعون بحضور واضح، حيث ينظر الغرب بحساسية مفرطة، للحواضن الحضارية عبر التاريخ. وهنا لابد أن نتساءل من يقف وراء تدمير الآثار في عدد كبير من المدن الأثرية والمتاحف العراقية، وهل الحرب الطائفية هي السبب وراء هذا التدمير، أم أن هناك من يخطط بصورة فعلية من وراء الستار لكي يتم تدمير الآثار والحضارة العراقية، والتي تنفذها عصابات ترتبط بقوى عالمية. لذلك فهي حملة إعلامية (إرهابية) مخطط لها مسبقا، ومن الواضح أن هناك دولا وقوى وجماعات تتمحور حولها، وتجمعها مع بعضها أهداف متقاربة، جعلتها تلجأ إلى استخدام ماكينة إعلامية غربية مدعومة من بعض الدول، يقوم عملها الإعلامي على تزييف الحقائق وتصوير الوقائع بغير صورتها الحقيقية، الأمر الذي يستدعي منا مواجهة هذه الحرب الإعلامية بأساليب مكافئة لها، والوقوف بالضد منها تماما، لتبصير الحكومات والساسة والمجتمعات المعنية كافة، بهذه الأهداف الخبيثة التي ترتكز على إثارة الفتن وقلب الحقائق، كون هذه الحملة الإعلامية والنهج الإعلامي الغربي، يُظهر غير ما يُبطن للملأ في معظم نشاطاته الإعلامية المشبوهة.

ومن ثم يقع على كاهل المجتمع الدولي مسؤوليات قانونية وأخلاقية في مساعدة العراق في جهوده الرامية إلى استعادة ما فقده من ممتلكات ثقافية لا تقدر بثمن. وحيث أن تشريعات الدول المستوردة في الغرب تتساهل مع الاتجار في الممتلكات الثقافية المسروقة. لذلك يجب تغيير تلك القوانين لصالح حماية الموروث الثقافي لتلك البلدان التي تعاني كثيرا من الاتجار غير الشرعي لثروتها الثقافية والحفريات غير القانونية لمواقعها الأثرية القديمة. ويجب تعديل المواثيق الدولية الخاصة بالموروث الثقافي بطريقة يُمكن استخدامها بشكل مؤثر في استرداد المواد الثقافية المسروقة. وتدلل تجربة العراق المريرة على أن التعاون والتنسيق الدولي يجب أن يستند في المقام الأول إلى قاعدة إقليمية، لكون الدول الإقليمية تُشكل الممر الأول لخروج الممتلكات الثقافية بشكل غير قانوني بغية وصولها إلى مقاصدها النهائية في بلدان الغرب.

وللإعلام بمختلف أدواته وأشكاله ومسمياته دور أساسي في العمل على منع إلغاء الذاكرة الجمعية العربية, عبر تدوين كل أجزائها ومكوناتها في كل دولة, وإذا كنا نتفق على أن الإعلام هو المنظومة التي من شأنها أن تحفظ إلى جانب التربية والتعليم والمؤسسات الثقافية ودوائر الثقافة الشعبية والتراث الشعبي والآثار والمتاحف التراث الحضاري والهوية الوطنية, فإننا نعتقد أن العبء الأكبر يقع على الإعلام لأنه الأكثر تأثيرا في وعي الناس وتشكيل اتجاهات الرأي العام.

إن مخرجات الإعلام تخدم بدون أدنى شك هذه الهوية وتعمل على صيانتها وتقويتها في إطار الحركة التي يعيشها المجتمع ضمن التحولات والتطورات التي تشهدها منطقتنا العربية حالياً. أما إذا كانت المنظومة الإعلامية مهزومة وغير منتجة وغير متفاعلة مع الحراك المجتمعي وغير مواكبة ثقافياً لما يجري في المجتمع, فإنها بدلا من المساهمة في التعريف بالتراث الحضاري للوطن والحفاظ على الهوية الوطنية وزرع مكوناتها في العقل المجتمعي, فإنها تتجاهل هذه المكونات وتساهم من حيث تدري أولا تدري بخلق فراغات ستملأ بقيم وأفكار ومعتقدات واتجاهات وسلوكيات تتنافى وتتناقض وتتنافر مع كل ما هو وطني وقومي وإنساني.

أما عن مسؤوليات الإعلام تجاه تراثنا الحضاري وهويتنا الوطنية فتقع على عاتق الإعلام الوطني مسؤوليات جسيمة ليس في التصدي للحرب الإعلامية الهائلة, التي تشن على البلدان العربية ورموز السيادة والاستقلال الوطني, وإنما لتوظيف جهود أكبر وأكثر فاعلية وتأثيراً في التعريف بتراثنا الحضاري وتوثيقه من جهة, والدفاع عن هويتنا الثقافية وعناصرها الحضارية المتعددة والمتكاملة التي تعبر بصورة رائعة عن مختلف مكونات المجتمع من جهة أخرى.

ويظهر جليا الترابط بين الأحداث السياسية وبين نهب وتدمير التراث الحضاري في البلدان التي أُشعلت فيها الفوضى التدميرية غير الخلاقة حيث أن هناك تماثلاً أو مسارا متوازيا بين ما يجري من تحطيم لتلك الدول وتدمير للتاريخ العربي والذاكرة الجماعية والتراث الحضاري فيها, وكأن المخططات لا تكتفي بتفكيك الدول العربية وتمزيقها, بل أنها ترمي إلى إفراغها عمداً من مخزونها التاريخي العريق وتحويلها من عقول فكرية وعلمية وإبداعية, إلى هياكل فارغة المضمون والمحتوى.

إن وسائل الإعلام العربية بحاجة للوقوف أمام نفسها بوضوح وصراحة لتحديد إستراتيجيتها وهويتها ومدى قدرتها على البقاء. وإن موضوع التراث وحمايته هو عملية شمولية، ولابد لوسائل الإعلام العربية من خطة تهدف للتعريف بالتراث وما يتعرض له من مخاطر، وكما كان الإعلام سببا في المساعدة على الأرشفة والحفاظ

على التراث والتعريف به وتقديمه للجمهور كان السبب في أن الأجيال الجديدة تنمو جاهلة للمخزون الثقافي التاريخي والأثري. ولعل الإعلام هو أهم الوسائل التي يمكن أن تخدم موضوع تأصيل وحماية التراث بإيجاد إعلام فعال وموجه يتعاون مع المتخصصين من العاملين في الحقل التراثي والفني الأصيل.

وعلى وسائل الإعلام الجديد الدعوة إلى اتباع سياسة صارمة لحماية التراث والممتلكات الثقافية، وتتبع هذه السياسة عدة نقاط رئيسية نجملها في: الدعوة إلى حفظ الذاكرة الإجمالية لتراث العالم العربي، وتشجيع الرقمنة والتوسع في استخدام تكنولوجيا المعلومات في توثيق التراث، وتجميع واستثمار المبادرات العربية المتاحة في مجال توثيق التراث، والإسهام في زيادة المحتوى الإلكتروني للعالم العربي على شبكة الإنترنت، وإبراز إسهامات العرب في الحضارة البشرية، وتعزيز وجود خدمات عامة عالية الكفاءة في المجالات المرتبطة بالتراث، وخلق بيئة تشجع على الإنتاج المستدام للمحتوى العربي الرقمي المتاح مباشرة على شبكة الإنترنت، وتطوير برامج تدريب للمشروعات الصغيرة والمتوسطة من داخل العالم العربي في توثيق وحفظ التراث، وتدريب المشاركين على أعمال التوثيق الاليكتروني، والمساعدة في تحديد ووضع المعايير في تطبيق تكنولوجيا معلومات التراث بتوفير إرشادات معيارية، وقواعد بيانات متكاملة ذات إتاحة عالية لمتطلبات تكنولوجيا معلومات التراث، ولقواعد بيانات متاحة شاملة، وإعداد ونشر بوابة الكترونية على شبكة الانترنت تعرض ما تم توثيقه من كافة الدول والمؤسسات المشاركة مع إمكانية التحديث المستمر لها.

كما ينبغي الدعوة إلى إبراز كل من الثراء والتكامل التاريخي للتراث العربي بهدف توثيق العصور والحقبات التاريخية التي مرت بتاريخ كل دولة أو إقليم، وتوثيق المدن التاريخية على مستوى الوطن العربي، توثيق الأحداث والشخصيات والآثار والقطع الأثرية المهمة في تاريخ الوطن العربي، وتوضيح العلاقات التفاعلية بين الأحداث والآثار والشخصيات المختلفة، وتحقيق الربط بين محاور مشروع ذاكرة العالم العربي، وإعداد خط زمني متكامل لتاريخ الوطن العربي.

وفي مجال العمارة والتراث العمراني العربي: حفظ وتوثيق تراث العمارة والعمران إلكترونياً لتأصيل معرفة الأجيال القادمة بتراثها، والإسهام في زيادة المحتوى العربي الخاص بالتراث المعماري، وإبراز تنوع الإنتاج المعماري والعمراني في المدن العربية، فضلاً عن إسهامات الحضارات القديمة، وتأثيرها على الحركة العمرانية، والمساعدة في تحديد ووضع معايير التوثيق الخاصة بتراث العمارة والعمران في العصر الرقمي، والإتاحة الرقمية والتقليدية لكل جوانب تراث العمارة والعمران للجمهور العام والباحثين والخبراء المتخصصين على أوسع نطاق، وعرض العمارة الشعبية وسمات المجتمع الذي تنتمي إليه، ومدى تأثير الثقافات الخارجية عليه، وإبراز الطرز المعمارية المتنوعة السائدة في كل فترة تاريخية وأهم ملامحها.

وفي مجال المخطوطات العربية: حفظ وتوثيق تراث المخطوطات العربية إلكترونياً، والإسهام في زيادة المحتوى العربي الخاص بها، وإبراز إسهامات الحضارة العربية والإسلامية على الحضارة العالمية بوجه عام، وفي تطور المعرفة العلمية بشكل خاص، والمساعدة في تحديد وضع معايير التوثيق الخاصة بتراث المخطوطات العربية في العصر الرقمي، والإتاحة الرقمية والتقليدية لكل جوانب التراث المخطوط للجمهور العام والباحثين والخبراء المتخصصين على أوسع نطاق.

وفي مجال تكنولوجيا المعلومات: تشجيع أعمال الرقمنة في الدول العربية وزيادة استخدام تكنولوجيا المعلومات، واستخدام تقنيات الاتصالات والمعلومات في توثيق التراث العربي مما يسهل حفظه واسترجاعه، ونشر التراث العربي على شبكة الانترنت عن طريق إنشاء بوابة الكترونية عن تراث العالم العربي للحفاظ على الذاكرة التراثية الإجمالية لشعوب العالم العربي، والمساعدة في تحديد ووضع المعايير في تطبيق تكنولوجيا معلومات التراث بتوفير إرشادات معيارية وقواعد بيانات متكاملة ذات إتاحة عالية لمتطلبات تكنولوجيا المعلومات، وتعريف العالم بالإسهامات العربية في تشكيل حضارة العالم بشكل تفاعلي، وتكوين مصدراً موثوقاً للمعلومات عن التراث العربي، وزيادة المحتوي العربي على شبكة الإنترنت.

4. الخاتمة ونتائج البحث

تناول البحث دور الإعلام في حماية التراث والممتلكات الثقافية التي تشكل حلقة من حلقات التطور الثقافي والحضاري وتمثل ذاكرة الشعوب التي تنتقل من جيل إلى جيل من خلال أربعة محاور: الأول عن تعريف الممتلكات الثقافية، والثاني عن حماية الممتلكات الثقافية في فترات النزاع المسلح، والثالث عن تدمير الممتلكات الثقافية العربية (العراق نموذجا)، والرابع عن دور الإعلام في حماية التراث والممتلكات الثقافية في ظل للعولمة

تصدى البحث لمخططات تدمير الآثار والممتلكات الثقافية بحجة الضرورات العسكرية.

أكد البحث على دور الإعلام في البلدان والمجتمعات العربية التي تخوض صراعاً شاملاً لمواجهة الاستعمار الجديد وأدواته الإقليمية والدولية.

يؤكد البحث أن الإعلام يتحول بحكم الضرورة إلى قوة شديدة التأثير وتكون من أولويات مهماته الدفاع عن مكونات الذاكرة الوطنية القومية والهوية المهددة بالتدمير والتشويه وفي مقدمتها الموروث والتراث الثقافي والحضاري.

أكد البحث التداعيات الوخيمة والمخاطر التي تحيط بالثروة الحضارية والثقافية الموجودة في الدول العربية, والذي اتخذ أشكالاً ممنهجة في تدمير الآثار التاريخية والمواقع الدينية، وسيطرة الإعلام الغربي وتحيز الوكالات الغربية ضد الدول العربية، وسيطرة المصادر الإخبارية المصورة على الأخبار العربية.

ركز البحث على دور التوعية الإعلامية التي تتلخص في تعريف المواطنين على أهمية الممتلكات الثقافية وانتهاز الفرص لإثارة اهتمامهم بالتراث الحضاري وإشراكهم في تحمل مسؤولية حماية التراث الحضاري الأثري والتراثي.

تناول البحث البعد الثقافي للعولمة وارتباطه بالبعد الاتصالي والإعلامي، ومن هنا يبرز دور القنوات الفضائية التلفزيونية بصفةٍ خاصة في ترسيخ العولمة.

تقع على عاتق الإعلام الوطني مسؤوليات جسيمة تجاه التراث الحضاري والهوية الوطنية ليس في التصدي للحرب الإعلامية الهائلة التي تشن على البلدان العربية فحسب, وإنما لتوظيف جهود أكبر وأكثر فاعلية وتأثيراً في التعريف بالتراث الحضاري وتوثيقه من جهة, والدفاع عن الهوية الثقافية وعناصرها الحضارية المتعددة والمتكاملة التي تعبر بصورة رائعة عن مختلف مكونات المجتمع من جهة أخرى.

المصادر العربية

- إبراهيم، عبد الباقي (١٩٦٨). التراث الحضاري في المدينة العربية المعاصرة، ط1، مركز الدراسات التخطيطية والمعمارية، القاهرة ، ص12.
- ابن منظور، محمد بن مكرم بن منظور الإفريقي المصري. لسان العرب، 2، ط1، دار صادر - بيروت - لبنان، ص ص200-201.
- أبو الوفا، أحمد (2006). النظرية العامة للقانون الدولي الإنساني وفي الشريعة الإسلامية، ط1، دار النهضة العربية - القاهرة ، ص102
- أبو زعرور، محمد سعيد (1998). العولمة، دار البيارق - عمان، الأردن، ط1، ص ص13-14.
- اتفاقية جنيف، 1949. البرتوكول الأول لعام 1977 الملحق بها، المادة 2/52، المادة 14/ف7.

- اتفاقية حماية التراث العالمي الثقافي والطبيعي أقرها المؤتمر العام لمؤتمر اليونسكو المنعقد في باريس في 17 أكتوبر إلى 21 نوفمبر 1972 في دورته السابعة عشر المنعقدة في باريس اعتمدها في 16 نوفمبر 1972، منظمة الأمم المتحدة للتربية والعلم والثقافة (يونسكو) باريس، ص82، مجلة التراث الثقافي للإنسانية، العدد 1982/18، الملحق 1، ص30.
- اتفاقية لاهاي، (1954). اللائحة التنفيذية، المواد1-2/12-4/14.
- أحمد، عزت السيد (2000). انهيار مزاعم العولمة، اتحاد الكتاب، دمشق، ص12.
- أحمد، كنعان (2000). العولمة والبحث العلمي واقعا وطموحا، ندوة العولمة والتعليم العالي والبحث العلمي في الوطن العربي، جامعة العلوم والتقنيات والطب، بالتعاون مع اتحاد الجامعات العربية 2000/11/23، تونس، ص11.
- الأسد، ناصر الدين (1997). الهوية والعولمة، ندوة العولمة والهوية أكاديمية المملكة المغربية - الرباط، ص63.
- اسكيرول، برنل ودانتين كلمنت (2003). منع التجارة الغير مشروعة في الممتلكات الثقافية، دليل أساسي لتطبيق اليونسكو لسنة 1970، دائرة المكتبة الوطنية، ط1، ص3.
- أصلان، طارق وآخرون (٢٠٠٤). أسباب تلف أحجار البناء في المباني الأثرية القديمة وبعض طرق الترميم، مجلة جامعة تشرين للدراسات والبحوث العلمية، سلسلة العلوم الهندسية المجلد ٢٦، العدد ١، جامعة تشرين – اللاذقية.
- أل مالك، سعيد بن عبد الله بن محمد. التراث العالمي، المفهوم والأهمية.
- الآلوسي, حسام محيي الدين (2007). العقل العربي والإبداع, دار الخلود للتراث - القاهرة, ص ص7-8.
- أمين، أحمد حلمي. حماية الآثار والأعمال الفنية، دار النشر والتدريب الأمين، الرياض - المملكة العربية السعودية، ص ص126-138.
- أمين، جلال (1998). العولمة والدولة، مركز دراسات الوحدة العربية، مركز دراسات الوحدة العربية - بيروت، ط1، ص156.
- أنيس، إبراهيم وآخرون (1973). المعجم الوسيط، 1، ط2، دار المعارف - القاهرة، ص5.
- أوجي، فراس ياوز عبد القادر (1998). الحماية الجنائية للآثار، رسالة ماجستير، كلية القانون - جامعة بغداد، ص ص ص19-54-55.
- أولاخ، بريت ومايكل شيشتر (2000). إعادة التفكير في العولمة (العولمات)، ط1، لندن، ص233.
- باسيل، يوسف (3 تموز 1997). حقوق الإنسان من العالمية الإنسانية والعولمة السياسية، مجلة الموقف الثقافي، 10، دار الشؤون الثقافية - بغداد، ص17.
- باشا، أحمد فؤاد (يوليو 1999). التقدم العلمي في ظل العولمة والنموذج الإسلامي لتفاعل الحضارات، مجلة الموقف، 141، ص43.
- بدر الدين، صالح محمد (1999). حماية التراث الثقافي والطبيعي في المعاهدات الدولية، دار النهضة العربية، القاهرة، ص15.
- بيت المال، حمزة أحمد أمين (2011)، أهمية التخطيط الاتصالي والإعلامي لتوظيف وسائل الإعلام الجديد في التوعية بخطورة المخدرات، مؤتمر: نحو إستراتيجية فعالة للتوعية بأخطار المخدرات وأضرارها، مركز النشر العلمي - جامعة الملك عبد العزيز، ص3.
- التميمي، محمد بن سعد (2001). العولمة وقضية الهوية الثقافية في ظل الثقافة العربية المعاصرة، ط1، ص ص111-274-275.
- التويجري، أحمد عثمان (فبراير 2000). الدين والعولمة، المجلة العربية، 273، ص38.
- التويجري، عبد العزيز بن عثمان. العولمة والحياة الثقافية في العالم الإسلامي، المنظمة الإسلامية للتربية والعلوم والثقافة (إيسيسكو) الرياض، موقع إيسيسكو على شبكة المعلومات الدولية.
- تيزيني، طيب (أبريل - مايو 2008). مفهوم التراث العالمي، مدخل باتجاه التأسيس، مجلة عالم الفكر، 4.
- ثابت، أحمد (أكتوبر 1999). العولمة والخيارات المستقلة، مجلة المستقبل العربي، 248، ص19.
- الجابري, علي حسين (2006). الموجة الثالثة من الحداثة إلى العولمة, مجلة الحكمة, 42, بيت الحكمة - بغداد, ص162.
- الجابري , محمد عابد (1997). قضايا في الفكر المعاصر, ط 1, مركز دراسات الوحدة العربية - بيروت, ص135.
- ----- (2000). المشروع النهضوي العربي, ط 2, مركز دراسات الوحدة العربية – بيروت، ص22.
- ----- (1993). نحن والتراث، المركز الثقافي العربي، بيروت، ط6، ص22.
- ----- (1998). العرب والعولمة، مركز دراسات الوحدة العربية، بيروت، ص135.
- ----- (1998). العولمة والهوية الثقافية، مجلة المستقبل العربي، 228، ص ص14-15-19.
- جارودي، روجيه (1998). العولمة المزعومة – الواقع – الجذور – البدائل، تعريب محمد السبيطلي، دار الشوكاني للنشر والتوزيع - صنعاء - اليمن، ص17.
- الجبلي، أحمد (2002). العولمة والهوية في اليمن، ندوة الأبحاث لوحدة والعولمة، مركز الدراسات والبحوث اليمن صنعاء، ص27.
- الجمال راسم (1989). مقدمة في وسائل الاتصال، الأقمار الصناعية ووظائفها الاتصالية، مكتبة مصباح - جدة، ط1، ص173.
- حجازي، أحمد مجدي (مايو 1998). العولمة وآليات التهميش في الثقافة العربية، المؤتمر العلمي الرابع (الثقافة العربية في القرن القادم بين العولمة والخصوصية)، جامعة فيلادلفيا - الأردن، ص3.
- الحذيفي، أمين أحمد (2007). الحماية الجنائية للآثار، دراسة مقارنة، دار النهضة العربية – القاهرة، ص ص94-98-151.
- حسن، سمير إبراهيم (2002). الثورة المعلوماتية عواقبها وآفاقها، مجلة دمشق للآداب والعلوم الإنسانية، جامعة الآداب والعلوم الإنسانية، 18/1، دمشق، ص212.
- حسين، إسماعيل (2001/09/11). موروثنا الشعبي، الهوية الضائعة، صحيفة الجزيرة السعودية، 10575.
- حماد، كمال (1997). النزاع المسلح والقانون الدولي العام، ط1، مؤسسة مجد الجامعية للدراسات للنشر، ص126.
- الحمد، تركي (1999). الثقافة العربية في عصر العولمة، دار الساقي، ط1، بيروت، لبنان، ص20.
- حمو، نعمت بديل (١٩٨٠). استعمال الطرق الجيوفيزيائية للكشف عن الآثار، مجلة سومر، المجلد السادس والثلاثون، ٢/١، و زارة الثقافة والإعلام - بغداد، ص٢٦٣.
- خريسان، باسم علي (2001). العولمة والتحدي الثقافي، دار الفكر العربي - بيروت، ط1، ص132.
- خشبة, سامي (1997). مصطلحات فكرية, مطابع الهيئة المصرية العامة - القاهرة، ص ص66-67.
- خورشيد، فاروق (1992). الموروث الشعبي، دار الشروق – بيروت، ط1، ص12.
- الدباغ، تقي (1981). مقدمة في علم الآثار، الموسوعة الصغيرة، 88، منشورات دار الحافظ – بغداد، ص 88.
- الردادي، عائض (محرم 1421هـ/2001). ضياع الهوية في الفضائيات العربية، المجلة العربية، 37، ص7.
- رشتي، جيهان أحمد (1985). الإعلام الدولي بالراديو والتلفزيون، دار الفكر العربي - القاهرة، ص376.
- الزعبي, موسى (2001). دراسات في الفكر الاستراتيجي والسياسي, من منشورات اتحاد الكتاب العرب - دمشق, ص9.

- زقزوق، محمود حمدي (2001م). الإسلام في عصر العولمة، مكتبة الشروق - القاهرة، ط1، ص ص16-18-19.
- السادة، بربر علوي (2000). العولمة طريق الهيمنة، مجلة الوعي الإسلامي، 409، ص6.
- سالمان، سلامة سالم (٢٠٠٧). دور المصادر التراثية في تحقيق التنمية المستدامة مع بيان دور المنظمات غير الحكومية في إدارة المصادر التراثية، ندوة الاتجاهات الحديثة في إدارة المصادر التراثية، تونس.
- سبيكر، هايك (2000). حماية الأعيان المدنية وفقا للقانون المعاهدات الدولية، دراسات في القانون الدولي الإنساني، ط1، دار المستقبل العربي - القاهرة، ص ص210-211.
- سعد، كواكب (١٩٨٤). منبر المسجد الأقصى، دراسات في تاريخ وآثار فلسطين، جامعة حلب، المجلد الأول، ص ص١٠١-١١٨.
- سعود، يحيى ياسين (2011). الممتلكات الثقافية ووسائل حمايتها واستردادها دوليا، مجلة الحقوق - الجامعة المستنصرية، السنة السادسة، 15/4، ص ص114-107-116.
- سمير، رحال (2006). حماية الأموال والممتلكات إثناء النزاعات المسلحة، رسالة ماجستير، كلية العلوم القانونية - جامعة سعد دحلب بالبليدة، ص4.
- سيد، أشرف صالح محمد (٢٠٠٩). التراث الحضاري في الوطن العربي، أسباب الدمار والتلف وطرق الحفاظ، مؤسسة النور للثقافة والإعلام، ص ص5-15.
- السيد، رشاد عارف (1984). دراسة لاتفاقية لاهاي لسنة 1954، المجلة المصرية للقانون الدولي، 40، القاهرة، ص63
- شحاتة، مصطفى كامل الإمام (1977). الاحتلال الحربي وقواعد القانون الدولي المعاصرة، مع دراسة تطبيقية عن الاحتلال الإسرائيلي للأقاليم العربية، رسالة دكتوراه، كلية الحقوق - جامعة القاهرة، ص257.
- الشرعبي، راضية (2006/2/24). الإعلام العربي وتحديات العولمة الثقافية، مركز العهد الثقافي.
- شعث، شوقي (٢٠٠٦). المعالم التاريخية في الوطن العربي، وسائل حمايتها وصيانتها وترميمها، مجلة التراث العربي، العدد ١٠٤، اتحاد الكتاب العرب – دمشق، ص٣٠٢.
- شلبي، أحمد (مايو 1999). العولمة، مجلة المنهل، 557، ص46.
- شمال، محمود (1999). سيكولوجية الخطاب في برامج البث الوافد من الفضاء مجلة الحكمة, بيت الحكمة - بغداد , 9, السنة الثانية, ص ص94-100.
- شيلر, هربرت (2007). الاتصال والهيمنة الثقافية, ترجمة وجيه سمعان عبد المسيح ومختار محمد التهامي, مكتبة الأسرة - الهيئة المصرية العامة للكتاب - القاهرة, ص ص16-18-23-26.
- الطائي، حيدر أدهم (2012). سرقة الممتلكات الثقافية العراقية في ضوء قواعد القانون الدولي، مجلة الحقوق - الجامعة المستنصرية، 4/16-17، ص ص45-48.
- عبد الرحمن، عواطف (يونيو 1984). قضايا التبعية الإعلامية والثقافية في العالم الثالث، سلسلة دار المعرفة 78، دار الرسالة - الكويت، ص74.
- عبد القادر، ناريمان (2010). القانون الدولي الإنساني واتفاقية لاهاي لعام 1954 وبروتوكولها لحماية الممتلكات الثقافية في زمن النزاع المسلح، القانون الدولي الإنساني، أفاق وتحديات، 2، ط10، منشورات الحلبي الحقوقية - بيروت، ص ص73-85-86.
- عبد الوهاب، محمد فهمي (1985). دراسات نظرية وعلمية في حقل الفنون الأثرية وطرق ومواد الترميم الحديثة، القاهرة.
- عتلم، شريف (2005). محاضرات في القانون الدولي الإنساني، منشورات اللجنة الدولية للصليب الأحمر، القاهرة، ص10.
- عزت، حجازي (1985). الشباب العربي ومشكلاته، موسوعة عالم المعرفة، ط1، المجلس الوطني للثقافة والفنون والآداب - الكويت، ص2.
- العشاوي، هدى (أغسطس / سبتمبر 1996). جناية القنوات الفضائية على القراءة عند الأطفال، المجلة العربية، 231، ص58.
- عطية، أبو الخير أحمد (1998). حماية السكان المدنيين والأعيان المدنية إبان النزاعات المسلحة، دراسة مقارنة بالشريعة الإسلامية، ط1، دار النهضة العربية - القاهرة، ص80.
- ----- (1999). المحكمة الجنائية الدولية الدائمة، دراسة للنظام الأساسي والجرائم التي تختص بالنظر إليها، دار النهضة العربية - القاهرة، ص44.
- عطية، أحمد إبراهيم (2003). حماية وصيانة التراث الأثري، دار الفجر للنشر والتوزيع – القاهرة.
- علي، أحمد سي (2011). حماية الأعيان المدنية في القانون الدولي الإنساني، ط1، دار الأكاديمية - الجزائر، ص ص12-38-39.
- علي، حيدر كاظم عبد وعمار مراد غركان (د. ت). الحماية الخاصة للممتلكات الثقافية أثناء النزاعات المسلحة، كلية القانون - جامعة بابل.
- علي، محمود عبد (2011). النظام القانوني لحماية الأعيان الثقافية وتطبيقاته في العراق، مجلة الحقوق - الجامعة المستنصرية، السنة السادسة، 15/4، ص ص282-283.
- عمرو، محمد سامح (2010). أحكام حماية الممتلكات الثقافية في فترات النزاع المسلح والاحتلال، القانون الدولي الإنساني (أفاق وتحديات)، منشورات الحلبي الحقوقية – بيروت، ص244.
- العناني، إبراهيم محمد (2010). الحماية القانونية للتراث الإنساني والبيئة وقت النزاعات المسلحة، القانون الدولي الإنساني (آفاق وتحديات)، مجموعة باحثين، ط2، منشورات الحلبي الحقوقية - بيروت، ص38.
- عوض، لويس (1983). ثقافتنا في مفترق الطرق، الطبعة الثانية، دار الآداب - بيروت، ص57.
- القاسم، خالد بن عبد الله (2003). العولمة الثقافية وأثرها على الهوية، ندوة العولمة وأولويات التربية، كلية التربية – جامعة الملك سعود، 20-2003/4/22، منشورة على الشبكة الدولية للمعلومات.
- قاسم، عون الشريف (1980). معركة التراث، دار القلم - بيروت، ص67.
- قاسم، محمد أحمد (1996). الإعلام الأثري، الندوة العلمية للآثار اليمنية، صنعاء، ص1.
- مارتن، هانس بيتر وهارالد شومان (1998). فخ العولمة، ترجمة عدنان عباس علي، سلسلة عالم المعرفة - الكويت، ص253.
- المجالس القومية المتخصصة (١٩٩٠). حماية التراث التاريخي والأثري، ضمن موسوعة المجالس القومية المتخصصة ١٩٧٤-١٩٩٠، المجلد الحادي عشر، القاهرة، ص ص٢١٢-٢١٩.
- محمد، إسماعيل علي (2001). العولمة الثقافية وموقف الإسلام منها، دار الكلمة للنشر والتوزيع - القاهرة، ط1، ص27.
- مخاط، محمد ثامر وعدنان محمد الشدود (2001). الحماية الدولية للممتلكات الثقافية، دراسة تطبيقية على الممتلكات الثقافية في محافظة ذي قار، مجلة الحقوق، الجامعة المستنصرية، 15/4، ص ص3-34 -35
- المخزومي , محمد (1965). خاطرات جمال الدين الأفغاني, دار الفكر الحديث - بيروت, ص293.
- مدكور، إبراهيم (1975). معجم العلوم الاجتماعية، الهيئة المصرية العامة للكتاب - القاهرة، ص139.
- المدور، هبة عبد العزيز (2009). الحماية من التعذيب في إطار الاتفاقيات الدولية والإقليمية، ط1، منشورات الحلبي الحقوقية - بيروت، ص126.
- المسيري، عبد الوهاب (فبراير 2001). العالم من منظور غربي، منشورات دار الهلال - القاهرة، ص ص127-129-220.

- المطيري، منصور زويد (1999). العولمة في بعدها الثقافي، مجلة كلية الملك خالد العسكرية، 58، ص33.
- معتوق، فريدريك (2004). مدخل إلى سوسيولوجيا التراث، ط 1، دار الحداثة - بيروت.
- ملي، أسعد (2007). العولمة بين التكيف والممانعة، مجلة جامعة دمشق للآداب والعلوم الإنسانية - سورية، مجلد 23 العدد 2، ص119.
- مندوب، مظفر (1982). جهاز تلفزيون الخليج ودوره في الحد من ظاهرة التدفق الإعلامي من الخارج، مجلة التوثيق الإعلامي، 1/4، ص74.
- المنير، محمود سمير (2000). العولمة وعالم بلا هوية، دار الكلمة للنشر والتوزيع، المنصورة - مصر، ط1، ص ص130-131.
- ميثاق رويرخ، المادة الأولى من العهد الأمريكي المبرم عام 1935.
- الميلاد، زكي (1998). الفكر الإسلامي وقضايا العصر، الكلمة، 20، السنة الخامسة.
- مينيتي، فيتوريو (2004). آفاق جديدة لحماية الممتلكات الثقافية في حالة نزاع مسلح: دخول البروتوكول الثاني المحلق باتفاقية لاهاي 1954 حيز التنفيذ، مجلة اللجنة الدولية للصليب الأحمر، منشورات اللجنة الدولية للصليب الأحمر، القاهرة، ص228.
- نعمان، أحمد (1995). الهوية الوطنية – الحقائق والمغالطات، دار الأمة للطباعة والترجمة والنشر و التوزيع - الجزائر، ص 23.
- هنتنجتون، صامويل (1999). صدام الحضارات، إعادة صنع النظام العالمي، ترجمة طلعت الشايب، ط1، ص103.
- وثيقة برنامج عمل المؤتمر الدولي للسكان والتنمية المنعقد بالقاهرة 5-1994/9/15، الترجمة العربية الرسمية، الفصل الثامن، الفقرات 31-35.
- وطفة، علي (2010). تصدعات الهوية وهزائمها، موقع اتحاد الكتاب العرب.
- يسري، عبد الرحمن (يوليو 1999). نحو سياسة اقتصادية موحدة للعالم الإسلامي في مواجهة العولمة، مجلة الاقتصاد الإسلامي، 217، ص56.
- اليونسكو (1985). بحوث ومناقشات ندوة تكنولوجيا تنمية المجتمع العربي في ضوء الهوية والتراث، المركز الإقليمي العربي للبحوث والتوثيق في العلوم الاجتماعية، دار نافع للطباعة والناشر - القاهرة، ص ص29-46.
- اليونسكو (2003). تعريف الشباب بحماية وإدارة مواقع التراث، ص13

REFERENCES

[1] Unesco (1984). *The potation of movable cultural property*, Paris, p.219.
[2] Nahlik. S. E. (1967). *La protection internationale des biens culturels en cas de conflit arme*, Deiahay, 1, p.121.
[3] www.iccrom.org
[4] Pierre, Laurent frier (1997). *Droit du patrimoineculturel*, Paris, p.14.
[5] http://whc.unesco.org/fr
[6] The UNESCO regional office in the Arab states of the Gulf 5, July 2002. *Convention on stolen or illegally exported cultural objects.* http://www.unesco.org/doha/
[7] Unesco (1984). *The protedion of movable cultural property*, Paris.
[8] *www.alburath.com*
[9] *www.isesco.org.ma/arabic*
[10] *www.alahd.com*

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On Misconceptions of Ecological Concepts among Public Senior Secondary Schools Students in Benin City, Nigeria

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ABSTRACT: This study was motivated by the poor performance of students in science (biology) in WAEC and NECO examinations. Research showed that conflicts exist between science and students perceptions of science which results in students developing misconceptions in science, eventually leading to low performance of students in external examinations. As a result, the need to study ecological misconceptions as a major topic in biology syllabus became paramount. The focus of this was to find out the misconceptions held by students in ecology, to determine if sex, cultural background and school type have influence on students conception on ecological concepts. Based on this, four schools were chosen from urban centre and two schools were chosen from the rural location. A total of 246 students participated and two-tier diagnostic questionnaire with 20 items was used as the research instrument. Hypotheses were tested using t-test with 0.05 level of significance. Analysis was done using SPSS and the results showed that students holt much much misconceptions in the tested concepts, and that these misconceptions were not different by sex, but are significantly different by cultural backgrounds and school types with a higher misconceptions existing amongst students in rural and public secondary schools. In sum, improving teaching techniques could ameliorate the challenges inherent with understanding of scientific phenomenon.

KEYWORDS: Misconception, Ecology, Biology, Science.

BACKGROUND

Society and culture are the primary agents of socialization of a child that pass information or ideas into the child even before the child's formal education. This information or idea may conform to what is generally accepted or held by experts in the field or it may be at variance with the acceptable meaning (misconception). Today, it is said that students brings to the classroom, alternative conceptions which can be different from the acceptable views. These views influence what students learn during science lessons. [1], in her study in 1983, posited that more than 50 percent of the respondents to a questionnaires on the cultural implication on science education, were found to adhere to or share in certain superstitious beliefs, and these interferes with their understanding of science concepts. [2], also stressed that no child comes to classroom completely blank, they emphasized that students make meaning of what you teach by comparing it to what they already know or believe. According to them, what the students know may be misconceptions about the topic the teacher is teaching. These misconceptions interfere with learning and that these misconceptions are held strongly and hence are resistant to change.

[3] said that in Africa, various conception of knowledge are strongly tied to the culture and traditions of the people. Explanations of natural phenomena (scientific knowledge), often conflict with the accepted knowledge in science. Much of these preconceived or erroneous explanation and views, have their roots in family's held believes of the African world".

[4], stated that the African child is practically operating in a three ways of life (scientific, native, and religion). As a result, an African child embarking upon the acquisition of scientific concepts in his tricontextual setting (native, religious and scientific), has always been under constant confusion. [1] described misconception as one of the major factors which leads to poor performance of students in ecology. According to her, more than 50 percent of students who sat for ecology, failed in the year 1995, 1997, and 2000. Same also apply to the performance of students at the National Examination Council (NECO) 2011 such that of 97,595 students who sat for ecology, only 29.52 percent passed and 70.48 percent failed.

The West Africa Examination Certificates chief examiners reports (2004), also reveals misconception as one of the major weakness manifested by candidates in ecology. In a position paper reported by the Science Teachers Association of Nigeria (STAN), [4] further confirmed that cultural beliefs are actually among some of the major causes of poor performance in science, technology and mathematics education in Nigeria. Similarly, [5], stated that the kinds of conceptions students brings to school were largely invisible to pedagogies and even more unknown to those who set educational policy. Only a pre – established harmony between the students mind and the school curriculum, would justify the prediction that the school as constitute could succeed in their ambitious and over expanding mission.

SOME BASIC CLAIMS ABOUT MISCONCEPTIONS

[6] stated that:

1. Students come to school instruction with diverse misconceptions concerning natural object and events.
2. The misconception that students bring to school instruction goes beyond age, ability, gender and cultural boundaries.
3. Misconceptions are tenacious and resistance to extinction by conventional teaching strategies.
4. Misconception often parallel explanation of natural phenomena offered by previous generation of scientists and philosophers.
5. Misconceptions have their origin in diverse set of personal experiences including direct observation and perception, peer, culture and language as well as in teachers' explanation and instructional materials.
6 Students prior knowledge interact with the knowledge presented in the formal instruction resulting in a diverse set of unintended learning outcome.
7. Instructional approaches that facilitate conceptual change can be effective classroom tools.

STATEMENT OF THE PROBLEM

The perception of science by an average Nigerian student is that of seeing science as something foreign to him or her and therefore difficult. This is as a result of the conflicts between science and the students' preconception. This results in low performance of students in science. Efforts have been made to improve science education in Nigeria, despite this; the performance of science students in external examinations is on the decline and alarming. The problem of the study therefore is: what are the misconceptions held by students in ecology? What is the influence of misconceptions held by students on academic performance in ecology?

1) Does the sex of the students have a role to play in acquiring misconception in ecology?
2) How has cultural location (urban and rural) promoted misconception of concepts in ecology?
3) Does the type of school attended by the students promote or eliminate misconceptions in students?

HYPOTHESES OF THE STUDY

This problem was tested with the following hypotheses. They are stated in null form and was tested at a significance level of 0.05.

NULL HYPOTHESES

1) The misconceptions held by students in ecology are not significantly different by se
2) The misconceptions held by students in ecology are not significantly different by culture.
3) Students who hold the wrong and right conceptions in ecology is not significantly different by school type

SIGNIFICANCE OF THE STUDY

The significance of this study in the Nigerian society where science enrolment and achievement are on the decline cannot be over emphasized. If Nigeria has to accomplish the aim and objectives of education, issues which hinder the effective learning of science cannot be ignored. The factors underlying the differential participation and achievement of boys and girls in school ecology are needed to be examined. The results and conclusions will provide information to help teachers take students understanding of ecological concepts thereby improving ecology instruction in Nigeria. It is also expected that the results of this of this study will give textbook authors information about the misconception existing amongst student into consideration thereby enhancing the quality of Nigerian ecology textbooks. This will help in developing meaningful conceptual knowledge about ecology and its real world application. The result of this study enables the teachers and curriculum developers to identify factors which may have influenced on male and female students negative attitude towards ecology. The study will have important implications for treating understanding of ecological concepts and giving more attention to improve education equity for both boys and girls.

REVIEW OF RELATED LITERATURES

MISCONCEPTIONS IN ECOLOGY

There are many science education research that emphasized the importance of understanding students' misconceptions on ecological terms, such as food chain, food web, energy pyramid and decomposers [7]. [8] listed 50 most important ecological concepts by surveying the members of the British Ecological Society. Twenty important concepts from the Cherrett's list would be recognized and endorsed as essential to environmental literacy by some of the environmental educators [9]. Munson listed these 20 most important concepts: the ecosystem, succession, energy flow, conservation of resources, competition, niche, materials cycling, the community, life history strategies, ecosystem fragility, food web, ecological adaptation, environmental heterogeneity, species diversity, density dependent regulation, limiting factors, carrying capacity, maximum sustainable yield, population cycles, and predator-prey interaction. As seen in the list, ecosystem, energy flow, food chain, food web and prey-predator interaction are among the most important 20 concepts.

Ecological concepts are prominent aspect of science syllabuses. While science teachers identified ecological concepts as important and believed them easy for students to understand. There are many studies that revealed certain misconceptions particularly about environment, population, community, habitat and decomposers [10]. For example, working with junior high students. [11] developed a unit that they hoped would change preexisting misconceptions and prevent the formation of new ones by ignoring details and avoiding information overload. They focused on the role of plants in moving materials (like carbon, hydrogen, and oxygen) cyclically through the ecosystem. They found that students have misconception that plants are dependent on people, not vice versa. Other misconception about producer is that green plants are only producers of carbohydrates in ecosystems. In addition, some students believed that plants take food from the outside environment, or plants get their food from the soil via roots [12], [13]. [14] found several misconceptions about consumers; for example, the number of producers is high to satisfy consumers and there are more herbivores because people keep and breed them and humans provide food for other organism.

[3] studied Nigerian students' misconceptions about ecology. After instruction, 26 students aged from 13 to 15 at elementary school were assessed by the essay test and clinical interview. Results of the essay test and interview revealed that students failed to define ecosystem, habitat, community, population, and many students confused ecosystem with habitat and population. They also stated community is the same as population. He found that students remembered the everyday language meaning when population was asked. Thus, students thought population as human population. Also, he reported that there are more herbivores than carnivores because plants eaters produce more young ones at one time and people breed more plant eaters than meat eaters. he stated students described carnivores as big or ferocious and herbivores as passive or smaller. Students also thought that bacteria are the source of energy in ecosystem because heat and gases are produced by decomposing dead plants and animals. Student ordered food chain in aquatic environment as small fish was eaten by large fish that was eaten by crocodile and lastly it was decomposed by bacteria. Students thought that plants do not live in water so they could not understand food relationship in aquatic environment. [3] found that students believed that the base (producer level) of the energy pyramid is wider than apex (consumer level) since the number of producers is higher than the herbivores to provide enough food for herbivores. Also, he indicated that students thought that energy decreases from producer level to consumer level since herbivores use some energy for digesting or herbivores may be hungry at time of eating or energy evaporates into the atmosphere during respiration so carnivores get little energy from herbivores. On the other hand, some students in his study considered that available energy increases from the base to the apex of the energy

pyramid so carnivores are the most powerful because energy accumulates up; thus, carnivores get their energy from both producers and herbivores. Moreover, students assumed that decomposers located at the top of the energy pyramid and they said that bacteria are the source of energy. Moreover,

[15] reported that decomposers release some energy that is cycled back to plants. The study conducted by [9] related to ecology indicated that some students do not perceive organism exist within a system of interacting biotic and abiotic factors. Students also believed that varying the population of an organism might not affect an ecosystem because some organisms in the ecosystem are not important. Furthermore, he found that students do not have clear explanation about species, population and community in their minds and students do not understand that each species has unique needs, and therefore each species has a unique effect on an ecosystem. On the other hand, some students believed that the needs of a species are general and typical of similar species that carry out the same role within the ecosystem. Munson reported that students interpreted food webs as simple food chains. He stated that populations higher on a food web increase in number because they deplete those lower in the web. Similarly, [16] revealed that students described ecosystem that are not an organized whole, but a collection of organisms. In another study, [14] investigated students' ideas about ecology and found that most pupils aged 5 and 16 are inconsistent in the form of explanation used in different contexts; for example, they may explain relative population size in different communities in different ways.

[17] studied seventh grade Turkish students' misconceptions related to ecological concepts. They conducted an interview and by using results of the interview and literature, they developed two-tier diagnostic test. Eighteen misconceptions were identified by means of this test related to the concepts of environment, ecosystem, decomposer, and population, energy resources in ecosystem and food chain and food web. They reported that students defined food chain as a kind of feeding relation including different food materials such as proteins and vitamins. Also, students had difficulty in identification of first consumer, second consumer or producer; for example, they maintained carnivores are the first consumer as they are wild and strong. On the other hand, several students claimed that humans are the first consumer because they consume everything. Moreover, they found that ecosystem is the interaction among living things and population is the number of people in a certain area; such as, population of city. Furthermore, they reported three misconceptions about decomposers such as decomposers eat dead plants and animals to keep environment, decomposers are not important because they are found on dead animals and they have no effect on ecosystems because they are too small to be seen by naked eye. They found several misconceptions about energy flow and energy pyramid. They reported that the strongest one has more energy; for example, when asked to which one has the greatest energy among grass, sheep and man, students believed that man has the greatest amount of energy since he is stronger so he has more energy. However, other students responded the reason of this question as man gets his energy from both grass and ship. On the other hand, students believed that energy flows from the stronger one to weaker one; for example, student stated in a food chain including plant, chicken and man, energy flows through man to plant because man has the greatest energy while some students thought that energy does not pass from one organism to other organism. Also, other students in her study believed that there is no relationship between plants and animals since plants and animals have own energy. Moreover, students claimed that plants get their energy from soil because they grow in soil and their food of mineral and water are present in soil.

[18] investigated tenth grade students' misconceptions related to food web that a hierarchy leading to the ability to determine how a change in the size of one population can affect another population in the same web but not on the same chain, and identification of specific misconceptions held by subjects concerning food web. Data were collected from 200 students. In their study, they found five misconceptions about food web. These are:

1. Interpretation of food web dynamics in terms of a food chain.
2. In a food web, a change in one population will only affect another population if two populations are directly related as predator and prey.
3. A population located higher on a given food chain within a food web is a predator of all populations located below it in the chain.
4. A change in the size of a prey population has no effect on its predator population
5. If the size of one population in a food web is altered, all other populations in the web will be altered in the same way.

[19] studied changes in students' ideas of a food chain and they looked for underlying ontological belief that may explain students' ideas. Data were collected by observing 28 ninth grade students during 24 instructional sessions on ecology in Israel. Results of the study showed that there are several factors that affect students' consideration in identifying a food chain such as eating event, size hierarchy and total elimination; for instance, students thought that a big fish fed on smaller fish fed on a smaller one. Furthermore, they reported that students considered if the organism is eliminated when consumed, it is assumed as an element in a food chain otherwise, it could not constitute food chain. The study conducted by [7] indicated that students considered bacteria as the microscopic-sized bacteria to diseases when asked whether bacteria in

the human body constitute a food chain. Some of the student defined food chain as cyclic that white blood cell swallows the bacteria that feed on the human body. On the other hand, most of students thought bacteria as decomposers but they stated that decomposers feed only on the last element of the chain. Furthermore, he reported that most of the students did not consider nectar as the first link of the feeding relations because it is not contained the green parts of plants. They thought that only a green component of plants is the part of a food chain since it contains photosynthesis products to pass on the subsequent consumers. In addition, students in this study believed that humans in feeding relations are always at the top of the pyramid and that larger organisms always feed on smaller ones.

[10] investigated common misconceptions about photosynthesis, respiration, food webs, evolution and ecosystems to help improve college ecology instruction, ecology faculty and researchers who study learning should collaborate to design research about ecology teaching and ecological thinking. He reported that students believed that energy is not lost in trophic transfer since diagrams of energy pyramids that indicate decreases in energy, without indicating that energy is given off as heat, can reinforce students' misconception that energy is not conserved.

METHODOLOGY

STUDY DESIGN AND POPULATION

The study design adopted was the cross-sectional study. The target population of this study consists of S.S 2 and S.S 3 students in Egor local government area of Edo state. Since it is not feasible to cover the entire population, it becomes important to define an accessible/representative sample from the population from which the result of this study was generalized. The desired sample size is 246 students. Simple random sampling was used to obtain the representative sample. The schools in this district were obtained from the catalogue of public and private secondary schools. Average of 40- 60 students per school participated in this study.

RESEARCH INSTRUMENT

Questionnaire was the major data instrument in this research. In it two-tier diagnostic instruments for assessing students' conceptions was used for data collection. The instrument consisted of multiple choice items with the diagnostic part which is the reason part. If a student gave the correct answer and correct reason a student is said to have right conception. Correct answer but wrong reason or wrong answer but correct reason for any of the items is said to be a misconception or alternative conception on that item. Section A of the test item sought for piece of information like class of participants, age, and sex type of school and settlement which was rural or urban. The second part contains the questions which the students responded to.

TEST ADMINISTRATION

A total of 250 questionnaires were administered to students of the selected secondary schools in Edo state. The questionnaires were self-administered. The administration were done after due permission by the principal and class teachers of the various schools. In the course of administration, the items not understood by the respondents in the questionnaires explained by the researcher. The questionnaires were filled and collected instantly.

METHOD OF DATA ANALYSIS

The statistical analysis was done by using the SPSS version 22. The significance level was set at 0.05. To test the hypothesis, frequency table, descriptive and cross tabulations which include person product correlation coefficient and the t-test were used to see the effect of sex, school type and school location (urban and rural) on students' misconceptions in ecology.

ASSUMPTIONS

1. Test was administered under standard conditions.
2. Students answer test questions seriously and time was assumed sufficient for answering all questions in each instrument
3. Students did not interact during the test.

RESULT

Summary statistics of students with respect age, gender, school type and school location. The descriptive statistics of participants like minimum age, maximum age, range, mean, standard error of the mean, standard deviation and variance of students. The results obtained from the participants who were of the senior secondary schools SSS II and SSSIII respectively gave a minimum age of the students to be 10 years old and a maximum age of the students (participants) to be 21 years old. The mean age was obtained to be 16. 39, std. Error = 0.1std. Deviation = 1.535, variance = 2. 357. Using the mean and std. deviation for the interval of the age of SSSII and SSSIII students; 16. 39 ± 1.535 = 14.855 years $\leq$ x $\leq$ 17. 925 year. This is approximately 15 years $\leq$ x $\leq$18 years old, as the age interval of students in the classes surveyed.

Table 1: Misconceptions held by students in the selected ecological concepts

S/N	Question	Frequency of misconception	Percentage (%) of misconception
1	Plants are found on land but absent in water? True/False	190	77.2
2	In the energy pyramid, which of the following trophic level is the widest?	143	58.1
3	As you move across the trophic levels in a food chain, energy ……	137	55.7
4	……. is the source of energy in a food chain?	190	77.2
5	In the pyramid of number, organisms at the higher trophic levels are …. in number.	227	92.3
6	The following is the first link of feeding relation in a food chain except?	139	56.5
7	In feeding relation, which of trophic level is occupied by man?	175	71.1
8	Ecosystem can be defined as ……..	113	45.9
9	One of these is not a biotic component of an environment	225	91.5
10	One of these does not influence population density.	85	34.6
11	Which of the following groups of organisms feed directly on green plants	182	74
12	All of these can be used in the measurement of common ecological factors except ?	108	43.9
13	One of these is not a major terrestrial biome of the world	192	78
14	Breathing roots are characteristic structures of plants growing on?	239	97.2
15	Puddles, ponds, rivers, lakes, seas, and oceans are grouped together as?	157	63.8
16	Fewer number of trees is characteristic of the savannah zones of Nigeria True/False	204	83
17	The adaptation for water conservation in organisms include the following except?	137	55.7
18	The relationship between a herbivore and the bacteria which live in the caecum is known as commensalism. True/False?	97	39.4
19	When large numbers of organisms share limited space and resources the result is :	178	72.4
20	Succession can best be defined as?	180	73.2

Table 2 presents descriptive statistics of participants according to gender, school type and school location in ecological concepts: Male (urban school); Mean score = 19.80, std. deviation = 14.683. Female (urban schools); mean = 23.49, std. deviation = 11.048. Male (private schools); mean score = 55.39, std. deviation = 14.537, Female (Private schools); mean score = 52.00, std deviation = 11.536. Male (rural schools); mean score = 27.73, std. deviation = 18.712. Female (rural schools); mean score = 28.33, std deviation = 16.061. From the results above, the male (private schools) had the highest mean score of 55.39 which means this group had the lowest misconceptions from the selected concepts on ecological terms. This group was closely followed by their female counter part still from private schools with the mean score of 52.00 which had no significant difference from that of their male group. The results showed that the male of the public urban schools had a mean score of 19.80, which means that they had the highest misconceptions of ecological terms. They were also followed by their female counter part which had 23. 49, similarly, no significant difference was observed between them. The male and female of the rural schools was observed to also held a high level of misconceptions from the results obtained.

Table 2: Descriptive statistics for the scores according to students' gender, school type and school location.

Variable	Mean	Std. Deviation	N
Male (urban schools)	19.80	14.683	49
Female (urban schools)	23.49	11.048	43
Male (private schools)	55.39	14.537	38
Female (private schools)	52.00	11.536	40
Male (rural schools)	27.73	18.712	33
Female (rural schools)	28.33	16.061	45

From table 3, we have that the students of urban public schools had a mean score = 21. 52, the urban private schools had a mean score = 53.65 and the rurals schools had a mean score = 28.08. The students of the urban public schools and rural schools are observed to hold a high level of misconceptions in ecological terms whereas the private schools have a lower level of misconceptions.

Table 3: Descriptive Statistics of the urban public schools, private schools and Rural schools

Variable	Mean	Std. Deviation	N
Urban Public Schools	21.52	13.171	92
Urban Private Schools	53.65	13.110	78
Rural Schools	28.08	17.117	78

From table 4, the t-test table above shows the comparison between the male and female of each school type. The rural schools had a mean score of 27.73 for male and 28.33 for female. The p-value = 0.878 which indicates that there is no significant difference between the performance of males and females in the schools. Urban private schools had 55.39 for males and 52.00 for females, p-value = 0.256 which shows no significant difference between the males and females. The urban public schools had a means of 19. 80 for males and 23.49 for females, P-value = 0.181. This outcome did not give sufficient evidence that there is significant difference between the means of the males and females.

Table 4: Inferential statistics t – test result

School type	Gender	Means	Std dev.	P-Volue	Decision
Rural Schools	Male	27.73	3.257	0.878	Not Significant
	Female	28.33	2.394		
Urban Private School	Male	55.39	2.358	0.256	Not Significant
	Female	52.00	1.824		
Urban Public School	Male	19.80	2.098	0.181	Not Significant
	Female	23.49	1.685		

INFERENTIAL STATISTICS

HYPOTHESIS I:

H_o: The misconception held by students in ecology is not significantly different by sex.

From table 5, the male students have a mean score of 33. 25, n = 120 standard error = 2,013 while the female students have a mean score of 34.10 n = 128 and standard error = 1.585. The p – value = 0.738 which shows that there is no significant difference between the means.

H_o is therefore not rejected. This may be because both the male and female student are made to use the same curriculum, taught by the same quality teachers and learn under the same environment with the same instructional materials and so possess the same misconception in ecology.

Table 5: t- test for comparison by sex

Sex	n	Mean	Std.dev	P-value	Inference
Male	120	33.25	2.013	0.738	Not significant
Female	180	34.10	1.585		

Hypothesis 2: The misconception held by students in ecology is not significantly different by culture (urban and rural).

From table 6 above, the urban schools have mean score = 36.26, n=17 std dev. = 1.590 while the rural schools have mean score = 28.08, n=78, std dev. = 1.938. The P-value of the means between urban schools and rural schools, P-value = 0.003, which shows that there is a significant difference between the means. From the results, we have that misconceptions is higher in rural schools with the lower mean = 28.08. The urban schools have less misconception when compared to the rural schools. From this result, **H_o** is therefore rejected and **H_1** is accepted which says that the misconceptions held by students in ecology is significantly different by culture (urban and rural).

Table 6: t-test statistics for culture (urban & rural)

Variable	N	Mean	Std.dev	P-value	Inference
Urban schools	170	36.26	1.590	0.003	Significant
Rural schools	78	28.08	1.938		

Hypothesis 3: Students who hold the wrong and right conceptions in ecology is not significantly different by school type.

Comparing public schools with private schools, we have mean score = 24.53, std.dev = 1.182 n= 170 for the public schools. The private schools have mean score = 53.65, std.dev = 1.484, n = 78; when the means were compared, we have $p<0.001$. This shows a significant difference between the schools. The misconception is higher in public schools and less in private schools. From this result, **H_o** is therefore rejected; **H_1** is accepted which says that: "Students who hold the wrong and right conceptions in ecology is significantly different by school type.

Table 7: t-test statistics for location (urban & rural)

Variable	N	Mean	Std.dev	P-value	Inference
Public schools	170	24.53	1.182	<0.001	Significant
Private schools	78	53.65	1.484		

OVERVIEW OF THE STUDY

The main purpose of the study was to investigate students' understandings of ecological concepts and the effect of gender and reasoning ability on senior secondary schools students' understanding ecological terms. In this study, Test of Ecology Concepts (TEC), was used to measure misconceptions related to ecological concepts two-tier tests, was developed based on the previous studies and administered in order to asses students' misconceptions related to ecological concepts. Statistical analyses were presented in chapter 4.

DISCUSSION AND CONCLUSIONS

The results of this study indicated that students have many misconceptions about basic ecological terms, food chain, food web, energy flow and source of energy according to results of TEC and interviews. Most of the students have misconception about food web since students thought food web as a simple food chain. [6] reported that students aged 15-17 have difficulty in progressing from food chain to food web and had many misconception about food web than first year university students since food chain is thought as a simple set of isolated organisms so students have difficulty to understand food web. Another most common misconception about food web in this study is that a change in one population will only affect another population if the two populations are directly related as predator and prey. [3], [18] revealed the similar result and

claimed that students overcome this difficulty in food web concept if food chains are thought as interactive population embedded in an ecological context. Moreover, students could not differentiate first consumer from second or third consumer. Results of TEC and interview also showed that students have many misconceptions about food chain; for instance, during interview students stated ''strong animals eat weak animals'', ''food chain is a kind of germination of seed'' and they drew food chain as a cyclic or linear. They considered part of plant like flower, leaves is not producer and producer must be green.

Moreover, a bacterium inside the herbivore is a part of food chain because a bacterium eats other organisms but other students said that a bacterium inside the herbivore is not a part of food chain since it decomposes organic materials into inorganic materials in the ecosystem. Students considered bacteria as the microscopic-sized bacteria to diseases when asked whether bacteria in the herbivore constitute a food chain as indicated by [7]. He concluded that students' prior knowledge affects further learning as seen in the function of bacteria.

Findings of this study showed that students have difficulty to understand energy pyramid and energy source; for instance, most of the students believed that the source of energy for plants is soil since plant grow in soil. [3], [13] were reported the similar findings.

More so, students thought that the number of plants is very high so the base of the energy pyramid is larger than the top of the energy pyramid. Moreover, they believed that number of producers is higher than the consumers. On the other hand, [14] found that the number of producers is high to satisfy consumers and there are more herbivores because people keep and breed them and humans provide food for other organisms.

These results suggest that students brought their misconceptions to the class and most of the students only memorize scientific facts. They do not try to understand facts with reasons. Therefore, teachers ought to realize and identify students' misconceptions. Also, they should design their lesson to remediate these misconceptions. Result of this study showed that there was not statistically significant gender difference with respect to understanding ecological concepts

IMPLICATIONS OF THE STUDY

There are several important implications according to results of this study and findings of the previous studies:

1. Results of the previous studies and this study showed that students have misconceptions and these misconceptions are obstacles for students to learn new concepts. Teacher should pay attention to students' misconceptions that was found in this study or previous studies while planning their learning activities and learning materials.
2. By means of two-tier diagnostic test, complete understanding and lack of knowledge can be differentiated from misconception so two-tier diagnostic test ought to be used to identify misconception.
3. Students' reasoning ability is important for understanding of ecological concepts that are abstract. It is very difficult for students to understand abstract ecological concepts like energy flow or notion of energy. In order to increase understanding, teachers should use more concrete materials like models, diagrams, simulations to make abstract concepts understandable to students.
4. Teachers should determine whether they introduce gender bias during instruction or interaction with their students. In addition, textbooks and curriculum materials ought to be examined to identify whether they reflect gender difference or not.

RECOMMENDATIONS FOR FURTHER RESEARCH

There are several recommendations for the further studies. They can be listed as the followings:

1. The other ecology topics can be investigated by using a three-tier test to identify students' misconceptions.
2. The sample can be chosen from different city and sample size can be increased to get more accurate results for further studies.
3. Senior secondary school students' misconception concerning some ecological concept was investigated in this study. Similar research studies can be conducted for different classes.
4. The effect of reasoning ability and gender on students' understanding and attitude regarding other ecology topics or other subject areas such as physics, chemistry can be investigated.

REFERENCES

[1] Omoifo C.N. (2012) Dance of the Limits Reversing the Trend in Science Education in Nigeria. Inaugural Lecture Series 124, University of Benin, Pg 13-36.

[2] National Teachers' Institute Kaduna (2007), Manual for Retraining of Primary School Teachers, 11-14

[3] Adeniyi, E.O. (1985). Misconceptions of selected ecological concepts held by some Nigerian students. *Journal of Ecological Education* 19 (4), 311-316.

[4] Wasagu M.A. (1999), The Relationship between Science Students' Cultural Beliefs and their Academic Achievement at the Secondary School Level in Sokoto State. Journal of the Science Teachers' Association in Nigeria, 34,1$2, 27-32

[5] Howard G. (2011), The Unschooled Mind , Misconceptions in the Sciences, 155-180

[6] Wandersee, J.H. (1994). *Making high-tech micrographs meaningful to the ecology student*. The content of science. London: The Falmer Press, 161-176.

[7] Eilam, R., (2002). Strata comprehending ecology: Looking through the prism of feeding relations. *Science Education*, 86(5), 645-671.

[8] Cherrett, J. M., (1989). *Key concepts: The results of a survey of our members' opinions.* Oxford: Blackwell Scientific Publications.

[9] Munson, B. H., (1994). Ecological misconceptions. *Journal of Environmental Education*, 25(4), 30-34.

[10] D'Avanzo, C. (2003). Application of research on learning to college teaching: ecological examples. *Bioscience*, 53, 1121-1128.

[11] Eisen, Y., Stavy, R. (1992). Material cycles in nature: a new approach to teaching photosynthesis in junior high school. *The American Ecology Teacher*, 54, 339-342.

[12] Bell, B., (1985). Students' ideas about plant nutrition: what are they? *Journal of Ecological Education,* 19, 213-218.

[13] Smith, E.L., Anderson, C.W. (1984). Plants as producers: A case study of elementary science teaching. *Journal of Research in Science Teaching*, 21(7), 685-698.

[14] Leach, J., Driver, R., Scott, P., Wood-Robinson, C., (1996). Children's ideas about ecology 3: ideas found in children aged 5-16 about the interdependency of organisms. *International Journal of Science Education*, 18, 129-141.

[15] Lavoie, D.R. (1997). *Using a modified concept mapping strategy to identify students' alternative scientific understandings of ecology*. Paper presentation at National Association for Research in Science Teaching, Annual meeting at Chicago, IL, March 21-24.

[16] Brehm, S., Anderson, C. W., & DuBay, J., (1986). Ecology: A teaching module. Occasional Paper No. 94. East Lansing, MI: Institute for Research on Teaching, Michigan State University.

[17] Özkan, Ö., (2001). *Remediation of seventh grade students' misconception related to the ecological concepts through conceptual change approach*. Unpublished Master Thesis, The Middle East Technical University, Ankara.

[18] Griffiths, A.K., & Grant B. A. C., (1985). High school students' understanding of food webs: Identification of a learning hierarchy and related misconceptions. *Journal of Research in Science Teaching*, 22(5), 421-436.

[19] Reiner, M., & Eilam, B., (2001). Conceptual classroom environment—a system view of learning. *International Journal of Science Education*, 23(6), 551- 568.

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Utilisation des images satellitaires du Landsat dans l'étude de la dégradation des berges des oueds : exemple des berges des oueds Rdat, Zat et Tensift lors de la crue de Novembre 2014 (Marrakech, Maroc)

[Use of Landsat satellite images in the study of the degradation of the riversides of wadis: example of the riversides of wadis Rdat, Zat and Tensift during the flood of November, 2014 (Marrakech, Morocco)]

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ABSTRACT: The evolution of the riversides of wadis, Rdat, Zat and Tensift, depends, principally, on the intensity of floods and inundations generated by torrential rains slaughtered at the level of north mountainside of High - Atlas of Marrakech. The climatic conditions makes of the valleys of the wadis studied favorable zones to floods and to the degradation of the soil.
From 21 to 23 November 2014, violent torrential storms, attaining 250 mm in few hours, beat down on the very high peaks of High - Atlas of Marrakech. They have resulted in impressive floods of different wadis that originate in high altitudes. Hurtling down the slopes up to the plains of the Haouz, the Muddy Waters, at high load solid, have carted the soils, trees, crops, houses and road infrastructure.The riversides of the wadis have not escaped this destruction. This degradation of soils, orchards and olive groves can be observed and analyzed by the satellite images and the field studies.
As well, we proceeded to a treatment of images with the GIS tools using satellite images of Google Earth at high resolution and the Landsat images(missions of October and December 2014) with a resolution of 30m and 15m (panchromatic band). To highlight the vegetative cover of alluvial plains and its evolution in bare soil during the flood, we have represented the bands the ratios 6/7, 6/5 and 4/2 respectively in red, green and blue using the software ENVI.
The analysis of the risk linked to the degradation of the banks of wadis in the study area, revealed three main processes of degradation; the erosion due to the current under the effect of the water, the landslide in mass after a quick drop in the water level and the collapse.
The results obtained are very interesting and can be very useful for the understanding and the good management of water hazards and more specifically to the phenomenon of soil degradation.

KEYWORDS: floods, Landsat images, degradation, wadis, riversides, vegetation cover, bare soil, Marrakech, Morocco.

RESUME: L'évolution des berges des oueds, Rdat, Zat et Tensift, dépend, essentiellement, de l'intensité des crues et des inondations générées par des averses abattus au niveau de versant nord du Haut-Atlas de Marrakech. Les conditions climatiques dans la région font des vallées des oueds étudiées des zones favorables aux crues et à la dégradation du sol.
Du 21 au 23 novembre 2014, de violents orages diluviens, atteignant 250 mm en quelques heures, se sont abattus sur les très hauts sommets du Haut-Atlas de Marrakech. Ils ont entraîné des inondations et d'impressionnantes crues des différents oueds qui prennent naissance dans les hautes altitudes. Dévalant les pentes jusqu'aux plaines du Haouz, les eaux boueuses, à forte charge solide, ont charrié les sols, les arbres, les cultures, les maisons et les infrastructures routières. Les berges des

oueds n'ont pas échappé à cette destruction. Cette dégradation des sols, des vergers et d'oliveraies peut être observée et analysée par les images satellitaires et les études de terrain.
Ainsi, nous avons procédé à un traitement des images à l'aide d'outils de SIG en utilisant des images satellitaires, à haute résolution et des images Landsat avec une résolution de 30m (missions d'octobre 2014 et de décembre 2014). Pour mettre en évidence le couvert végétal des plaines alluviales et son évolution en sol nu lors de la crue, nous avons représenté les bands ratios 6/7, 6/5 et 4/2 respectivement en rouge, vert et bleu à l'aide du logiciel ENVI.
L'analyse du risque lié à de la dégradation des berges dans la région d'étude, a révélé trois principaux processus de dégradation ; l'érosion due au courant sous l'action de l'eau, le glissement en masse après une décrue rapide et l'éboulement ou l'effondrement par sapement.
Les résultats obtenus sont très intéressants et peuvent être d'une très grande utilité pour la compréhension et la bonne gestion des risques hydriques et plus précisément le phénomène de dégradation des sols.

MOTS-CLEFS: crues, inondations, images Landsat, dégradations, oueds, berges, Zat, Rdat, Tensift, Marrakech.

1 INTRODUCTION

Par définition, la rive et la berge souvent confondues ont deux différents sens. La berge est le talus incliné plus ou moins vertical qui sépare le lit mineur, qui est l'espace occupé par l'écoulement pour des crues courantes y compris les bancs non fixés par la végétation et le lit majeur qui représente toute la plaine inondable limité par les hautes eaux (crues extrêmes). Cette dernière est le produit géomorphologique de l'action à long terme des processus fluviaux **[1].** Cependant, la plaine alluviale fonctionnelle est la zone actuellement exposée à l'action des inondations **[2].** La hauteur d'une berge est très irrégulières, elle peut aller de moins de 1 m jusqu'à plusieurs mètres. La rive quant à elle est le milieu géographique qui sépare le milieu aquatique et terrestre, cette dernière commence dès le sommet de la berge et constitue une partie plus ou moins étendue qui reste sous l'influence du milieu aquatique **[3].**

Les ressources en terres cultivables au niveau des rivières (le lit majeur) jouent un rôle majeur dans la productivité agricole et dans le développement durable, notamment, pour les habitants installés tout au long des Oueds, elles constituent ainsi leurs principales sources de nourriture. Toutefois, ce patrimoine agricole est souvent menacé par le problème de la dégradation des berges dues aux phénomènes hydrologique extrêmes (crues). Une étude approfondie s'avère nécessaire pour comprendre le danger lié à la dégradation des berges, d'où l'objectif fondamental du présent article.

Partout dans le monde, les inondations et les crues sont des catastrophes dommageables, notamment, sur les milieux naturels. Durant ces dernières années, ces phénomènes ont pris de l'ampleur à cause du changement climatique que connaît notre planète. Au Maroc, le Haut Atlas du Marrakech par son climat semi-aride est l'une des régions les plus touchées par ces risques naturels néfastes et répétitifs.

Les bassins versants de l'oued R'dat et de Zat (région d'étude) sont parmi les sous bassins de Tensift caractérisés par un climat aride à semi-aride en aval et un climat subhumide en haute montagne. Les précipitations et les débits sont caractérisés par une grande variabilité **[4].** Les conditions climatiques font des vallées des oueds des zones favorables aux crues et à la dégradation du sol (bien évidement des terres cultivables). Ainsi, l'abondance des ressources en eau superficielle dans les bassins étudiés est directement liée à la morphologie de ces bassins **[5].** Provoqué par les styles tectoniques dans le Haut Atlas de Marrakech **[6].**

Du 21 au 23 novembre 2014 et entre le 4 et 5 mai 2016, de violents orages diluviens, atteignant 250 mm en quelques heures, se sont abattus sur la zone axiale du Haut-Atlas de Marrakech. Ils ont entraîné des inondations et d'impressionnantes crues des différents oueds qui prennent naissance dans ces altitudes. Dévalant les pentes jusqu'aux plaines du Haouz, d'Ouarzazate et de Souss-Massa, les eaux boueuses, à forte charge solide, ont charrié les sols, les arbres, les cultures, les maisons et les infrastructures routières (photos 1, 2, 3 et 4). Les berges des oueds n'ont pas échappé à cette destruction. Cette dégradation des sols, des vergers et d'oliveraies peut être observée et analysée par les images satellitaires et les études de terrain.

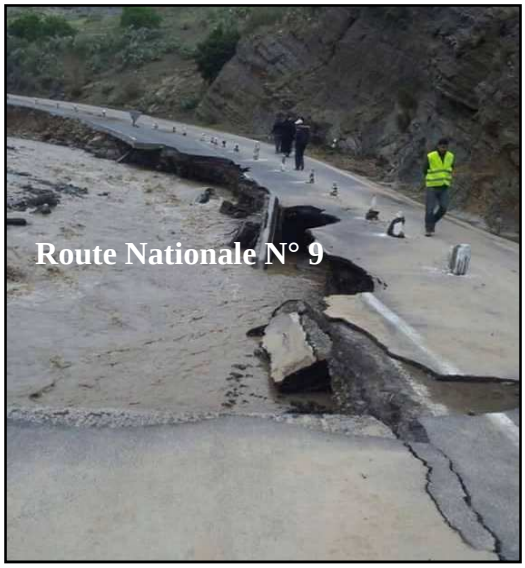


Photo 1 : destruction de l'infrastructure routière

Photo 2 : dégradation des berges de l'oued

Photo 3 : Pont détruit

photo 4 : Maison détruite

2 MATÉRIELS ET MÉTHODES

Pour mettre en évidence et étudier la destruction des berges, nous avons utilisé des images satellitaires, de Google Earth, à haute résolution et des images Landsat (missions d'octobre 2014 et de décembre 2014). Pour mettre en évidence le sol nu, la limite des eaux et le couvert végétal, nous avons procédé à un traitement des images à l'aide d'outils de SIG.

Avec le logiciel ENVI, nous avons représenté les bands ratios 6/7,6/5 et 4/2 respectivement en rouge, vert et bleu, ainsi, le couvert végétal (champs et polycultures) dans les plaines fluviatiles, apparaît en rouge, le sol nu alluvial en bleu clair et le cours d'eau en bleu foncé.

Pour distinguer la dégradation dans les zones non couvertes par les images de Google Earth, nous avons utilisé la bande 8 panchromatique pour sa haute résolution (15m).

De nombreux missions de terrains ont été, également, effectués dont l'objectif est de visualiser et d'analyser le problème de la dégradation des berges des Oueds sur le terrain.

3 SITUATION GEOGRAPHIQUES ET CONTEXTE GEOMORPHOLOGIQUE

Situé au centre Ouest du Maroc, Le bassin du Tensift auquel appartient la zone d'étude s'étend sur une superficie de 18.210 Km2 couvrant totalement la wilaya de Marrakech, et partiellement les provinces d'Essaouira, d'El Kelaâ des Sraghna et de Safi. Il est limité au sud par la ligne de crête du Haut Atlas, au nord par le massif précambrien des Jbilet, à l'est par le bassin du Tassaout et à l'ouest par l'océan Atlantique où se situe son embouchure (Souiria).

Le bassin du Tensift est composé, généralement, de cinq sous bassins bien individualisées. Ces derniers sont étant de l'Ouest à l'Est ; les bassins versants du N'Fis, de Gheraya, d'Ourika, de Zat et de Rdat. Ces deux derniers ont constitués l'objet de la présente étude **(Figure. 1).**

La morphologie du bassin versant de l'Oued R'dat (521 km^2) est le résultat d'une évolution géomorphologique très longue comme montré par Sabatier en 1982. La région d'étude est constituée, essentiellement, par des terrains imperméable (30%) et semi-perméable **[7].**

Le bassin versant de l'Oued Zat (545 km^2) est représentée, principalement par la formation permo-triasique. Elle est constituée, d'une part, par des basaltes altérés, sombres ou verdâtres, d'autre part, par un complexe rouge, grés marnes ou argiles salifères. Tandis que, le bassin du Zat, où on rencontre les sommets les plus hauts du Haut Atlas, est constitué de roches éruptives et métamorphiques précambriennes : les granites, diorites, et dolérites **[8].**

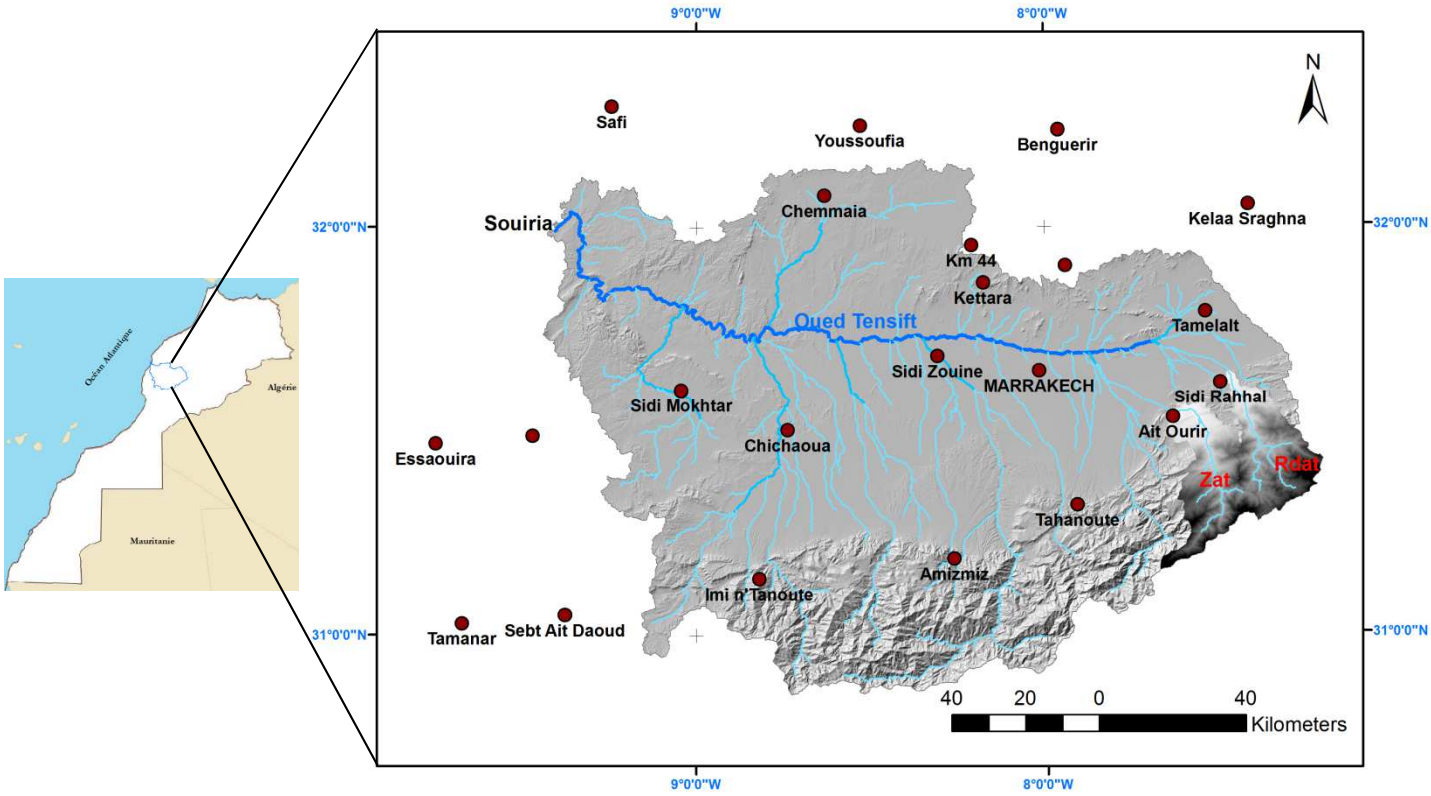


Figure. 1: Localisation de la zone d'étude

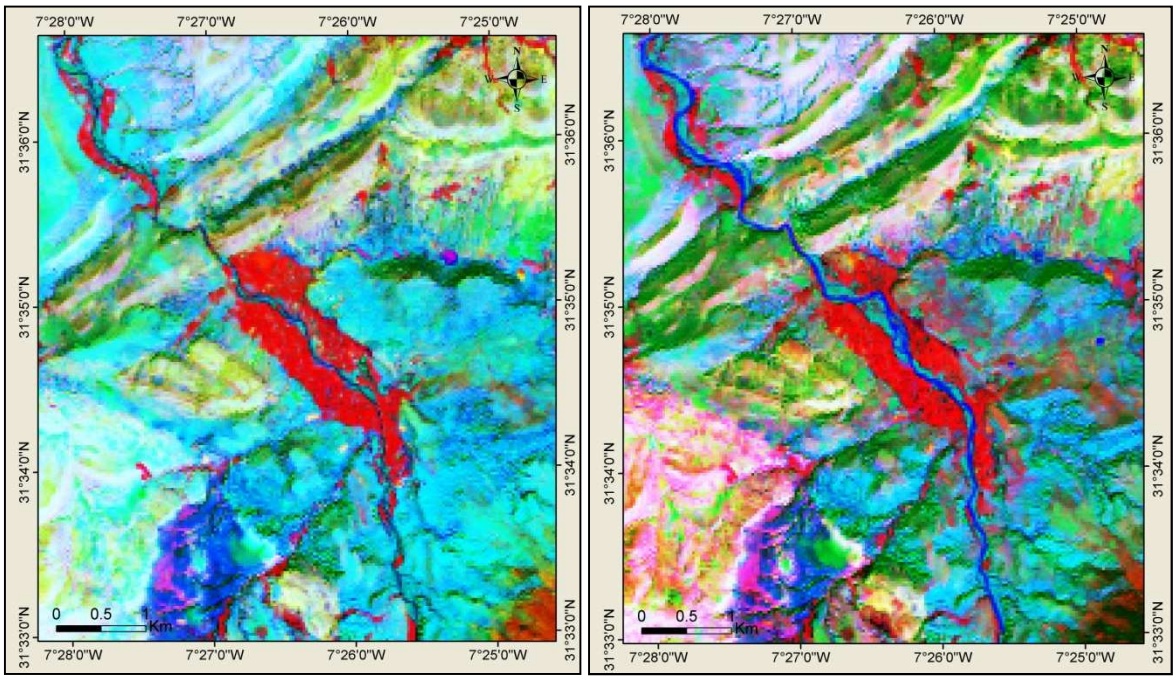
4 RÉSULTATS ET DISCUTIONS

L'érosion hydrique, l'une des conséquences les plus remarquables de crues, est un sérieux problème de point de vue, aussi bien économique qu'environnemental, à l'échelle mondial ainsi qu'à l'échelle du Maroc. Toutefois, ce phénomène est très accentué au niveau des berges des oueds R'dat, Zat et Tensift, dont on assiste, généralement, à des terres agricoles, ces derniers sont facilement érodées, notamment, pendant les moments des crues et des inondations (crues du mois novembre 2014).

L'analyse de l'état du couvert végétal, présenté en rouge, au niveau des berges des Oueds en question, avant et après les crues de l'automne 2014 **(Figure 2, 3 et 4),** a montré une destruction remarquable du couvert végétal après la décrue du Novembre 2014. Cette destruction est due, d'une part, à l'intensité des crues et des inondations générées par les averses dans la région, et d'autre part, à la nature des matériaux constitutifs de la berge.

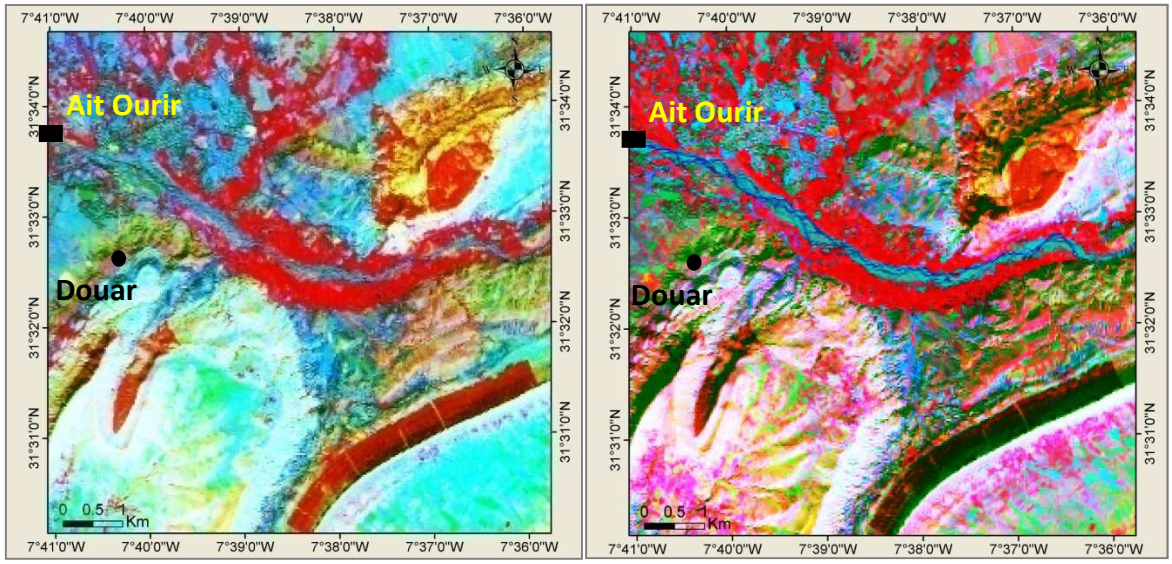
D'après les résultats obtenus de l'analyse des figures 2, 3 et 4. Nous sommes convaincus que la destruction du couvert végétal au niveau des oueds Rdat, Zat et Tensift, se traduit, essentiellement, par la dégradation des berges de ces derniers, en augmentant la surface de sol nu alluvial lors des impressionnantes crues.

Les superficies érodées (sol nu alluvial) sous l'effet érosif des crues dans les oueds étudiés, peuvent aller de quelques m^2 jusqu'à plusieurs dizaine de mètres carrés dans certains endroits, notamment, dans les parties avales des bassins versants.



Landsat_ Octobre _2014 Landsat_ Décembre _2014

Figure.2 : Observation de la destruction du couvert végétal après les crues du mois novembre 2014 au niveau de l'Oued R'dat à Sidi Rehal (à droite)



Landsat_ Octobre _2014 Landsat_ Décembre _2014

Figure.3 : Observation de la destruction du couvert végétal après les crues du mois novembre 2014 au niveau de l'Oued Zat à Ait Ourir (à droite)

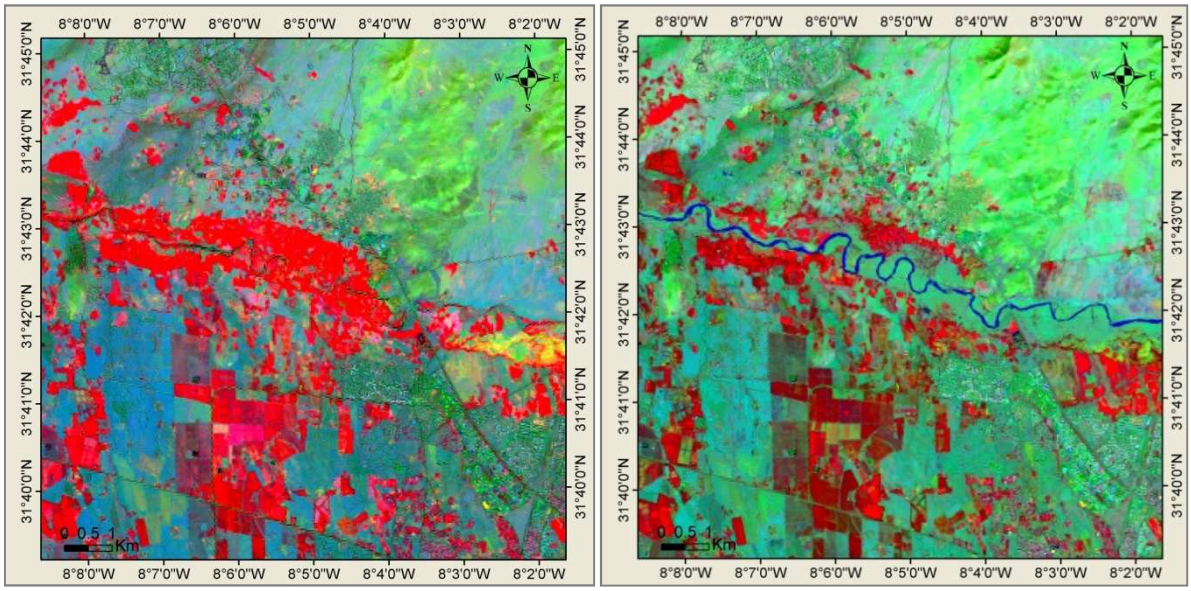


Figure.4: Observation de la destruction du couvert végétal après les crues du mois novembre 2014 au niveau de l'Oued Tensift (à droite)

L'observation de la destruction du couvert végétale par les images Landsat a été validée par les images satellitaires de Google Earth et par la bande panchromatique du Landsat (la bande 8) pour les zones non couvertes par les images du Google Earth **(Figure, 5, 6 et 7)**.

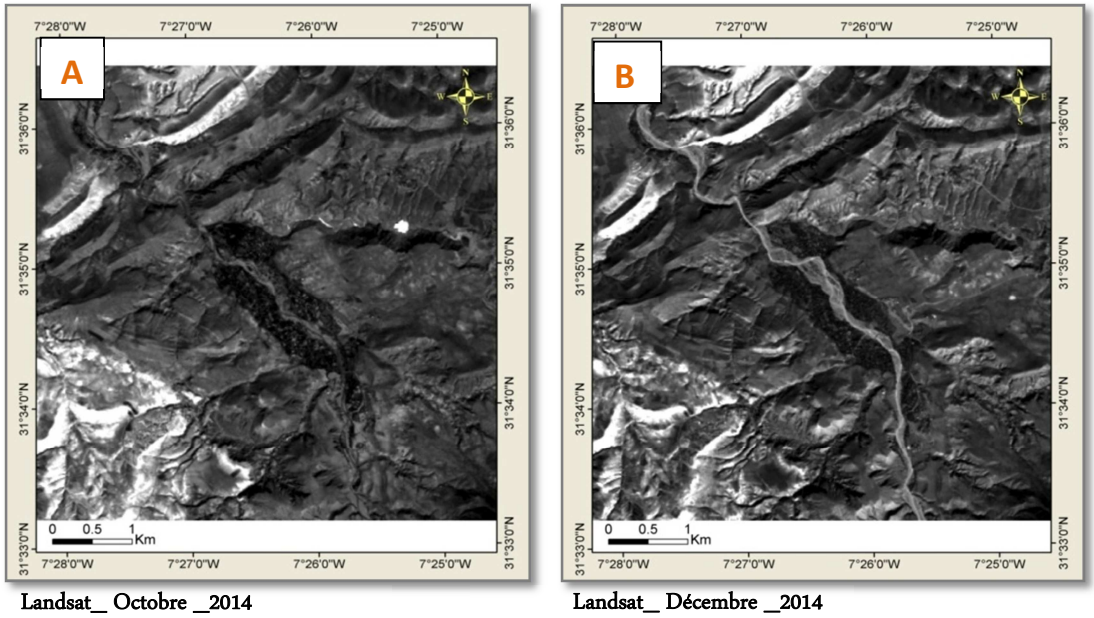


Figure.5: Observation de la destruction du couvert végétal par la bande 8 panchromatique du Landsat avant (A) et après (B) les crues du mois novembre 2014 au niveau de l'Oued R'dat à Sidi Rehal

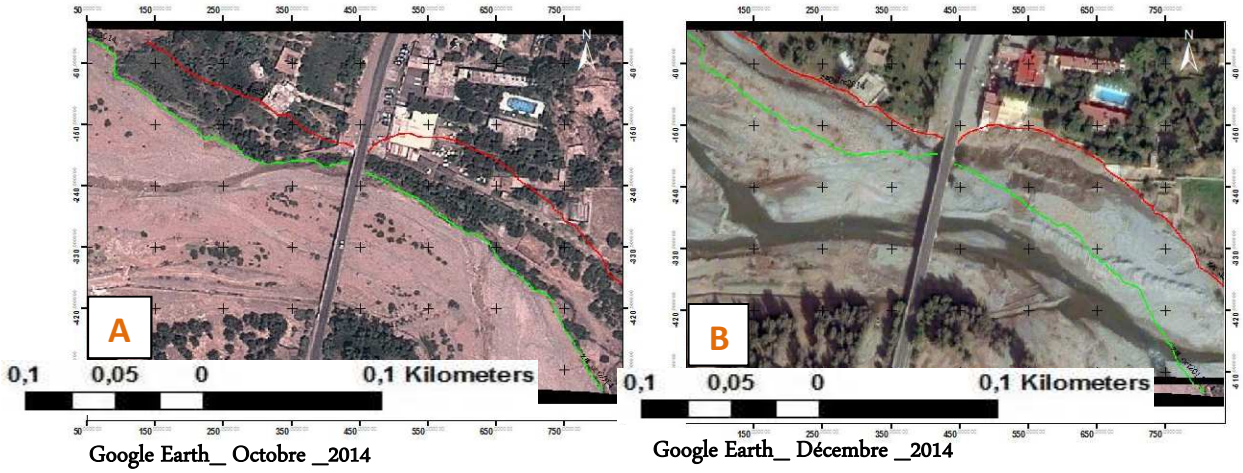


Figure.6: Observation de la destruction du couvert végétal et les infrastructures par les images de Google Earth avant (A) et après (B) les crues du mois novembre 2014 au niveau de l'Oued Zat

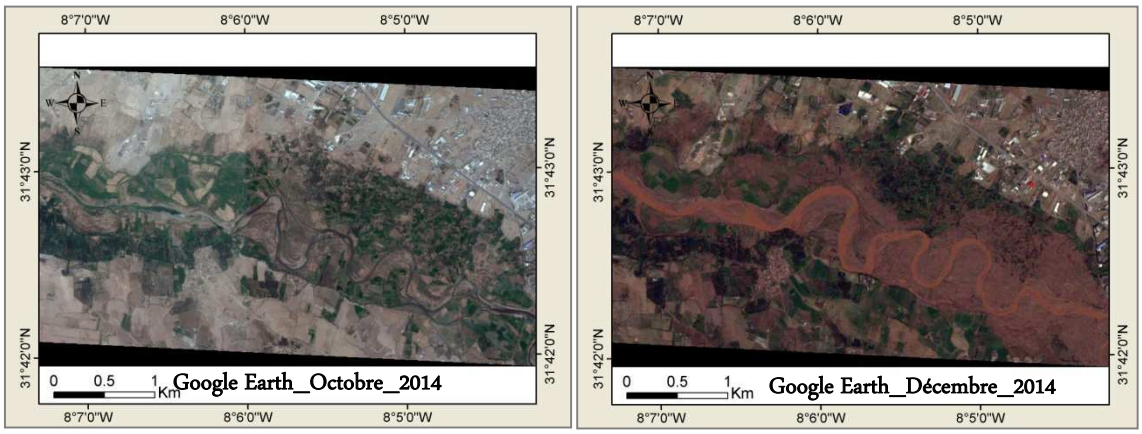


Figure.7: Observation de la destruction du couvert végétal par les images de Google Earth avant (Octobre 2014) et après (Décembre 2014) les crues du mois novembre 2014 au niveau de l'Oued Tensift

5 ETUDES DE TERRAIN

Après avoir observé, par les images satellitaires, le problème de la dégradation des berges, nous avons réalisés des études de terrain dont l'objectif était de visualiser et d'analyser les effets des crues et des inondations sur les berges des Oueds. D'après les études, nous avons constaté que, d'une manière générale, les berges d'une rivière peuvent se dégrader selon trois principaux mécanismes suivant :

- Erosion par la vitesse du courant ;
- Glissement en masse ;
- Eboulement / effondrement.

5.1 ÉROSION DUE À LA VITESSE DU COURANT

L'érosion d'une berge se produit lorsque des grains de matériaux constitutifs de la berge sont arrachés par l'eau de la rivière. Cet enlèvement des particules peut avoir lieu lorsque la vitesse du courant et sa turbulence sont capables de vaincre le poids des particules et éventuellement leurs cohésions **[3].** Dans la région d'étude ces conditions sont toujours satisfaites lors des crues qui caractérisent la région par leurs agressivités. Le processus d'érosion se produit aussi bien au niveau de la partie visible de la berge qu'à son pied sous l'eau (sapement ou affouillement). Ce dernier est un cas particulier d'érosion et due à la turbulence de l'eau à la base d'une berge. L'affouillement ou sapement d'une berge est une vraie menace des arbres **(Photo 6)** et des ouvrages (ponts).

Lorsque le courant fait un angle avec la berge, l'érosion atteint son taux maximal. C'est le cas d'une berge concave **(Photo 5)**. La présence d'un obstacle (arbre abattu, gros bloc, …) au niveau du cours d'eau, perturbe les filets liquides du courant, conduit à l'érosion des berges en produisant un courant réfléchi **(Photo 7)**.

Photo 5 : Berge concave au niveau de l'Oued Rdat : A en aval à Sidi Rehal et B en amont à Iswal.

Photo 6 : Sapement des berges sous l'enracinement des arbres.

Photo 7 : Un arbre qui a tendance de tomber et un bloc rocheux (obstacles), au niveau de l'Oued Rdat.

5.2 GLISSEMENT EN MASSE

Le glissement lorsqu'une masse de terres constitutives de la berge se déplace en bloc (en masse) avec une ligne de cisaillement qui sépare la zone déplacée et la zone qui reste en place **(photo 8).** Ce dernier est analogue à une faille normale. Le glissement se produit très souvent au moment de la décrue. Cette dernière constitue la condition la plus défavorable pour les berges. An niveau de ces derniers on peut rencontrer, également, des ouvertures plus au moins parallèles au sommet des berges **(photo 9)** et qui sont considérés comme des témoignages du phénomène de glissement.

Photo 8 : Le phénomène de glissement en masse an niveau des berges de l'Oued Rdat

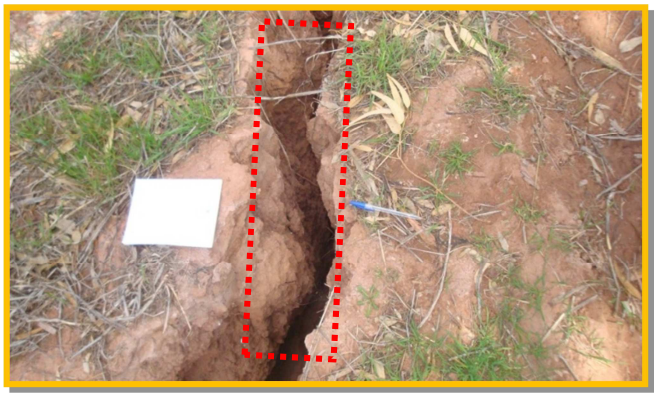


Photo 9 : Ouverture témoignant du phénomène de glissement

5.3 EBOULEMENT / EFFONDREMENT

Le mécanisme de sapement, érosion par le courant à la base des berges qui sont plus au moins cohérentes, conduit à la création des zones en surplomb **(photo 10)**. L'éboulement/effondrement **(photo 10)** se produit par la chute brutale de ces zones sous l'effet de la gravité (leurs propres poids) ou, éventuellement, par d'autres facteurs (le passage d'une charge/force au-dessus, …).

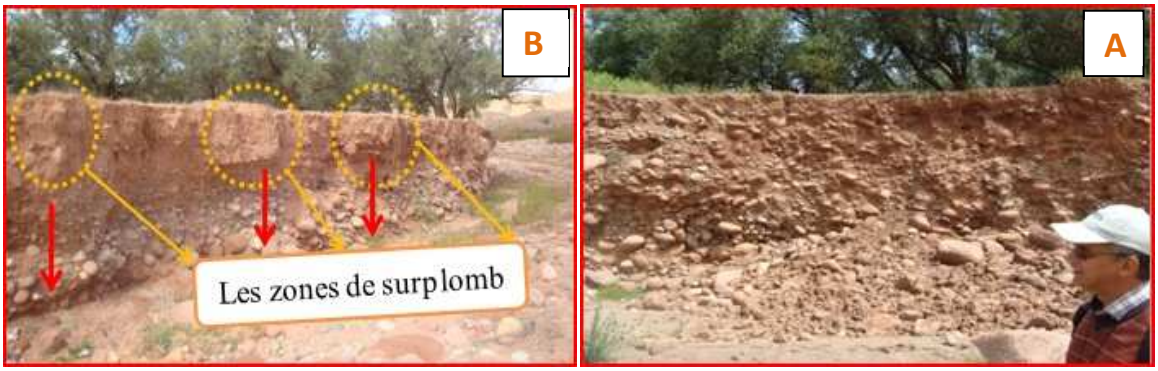


Photo 10 : Effondrement des berges (A) suite à la création des zones en surplomb(B) au niveau de l'Oued Rdat.

Les phénomènes et les formes de dégradation les plus fréquemment observés dans la région d'étude sont l'érosion et l'effondrement. Les berges constituées de matériaux limo-argileux et sableux, sont particulièrement sensibles au phénomène de la dégradation **[9].** L'effondrement est une conséquence directe de l'érosion au pied des berges, il se produit au moment des crues comme il peut avoir lieu lorsque le plan d'eau atteint le toit des zones en surplomb lors des prochaines crues.

Le mécanisme d'éboulement est relativement similaire à celui du glissement. Dans les deux cas, c'est une masse de terres constitutives des berges qui se déplace en bloc. Cependant, le glissement est un processus plus lent et il se produit le plus souvent au moment de la décrue contrairement à l'éboulement.

Les crues de 21 au 23 novembre 2014, qui ont causées nombreux dégât (humains, agricoles, infrastructures, …) dans les secteurs de Guelmim, Agadir, Ourzazate Et Marrakech, peuvent être comparées à celles de l'Ourika. Parmi ces dernières on cite les crues de 17 out 1995 et de 28 octobre 1999 qui sont les plus destructives **(photos 11 et 12)** de l'histoire moderne du Maroc avec les débits de point respectivement de 1030 m^3/s et 762 m^3/s. Les crues de l'Ourika sont très fréquentes. Elles surviennent, généralement, en tout saison. Pendant une période de 34 ans d'observation, chaque mois d'une année hydrologique a connu au moins une crue, à l'exception le mois de Décembre **[10].**

Photo 11 : Maison détruite par la crue du 17 Aout 1995 (source : [10]. saidi at al, 2010)

Photo 12 : Mur de soutènement de l'Ourika détruit par la crue du 28 octobre 1999 (source : [10]. saidi at al, 2010)

6 CONCLUSION

La présente étude a pour objectif de détecter le changement de la superficie du couvert végétale dans les plaines fluviatiles, au niveau des Oueds Rdat, Zat et Tensift pendant les crues du Novembre 2014 en utilisant les images satellites provenant du capteur de Landsat (missions d'octobre et de décembre). Les résultats obtenus permettent de dégager un recul de la superficie couverte par la végétation et l'augmentation de la surface du sol nu alluvial après la décrue témoignant de la dégradation des berges Oueds étudie.

Les bassins versants des différents affluents de Tensift sont propices aux phénomènes d'érosion hydrique et notamment la destruction des berges alluviales. Lors des dernières crues de l'automne 2014 (de 21 au 23 novembre 2014), des pertes importantes en terres cultivables, suite à la dégradation des berges des Oueds, ont été transporté par les écoulements boueux.

L'analyse du risque lié à de la dégradation des berges dans la région d'étude, a révélé trois principaux processus de dégradation : l'érosion due au courant sous l'action de l'eau, le glissement en masse après une décrue rapide et l'éboulement ou l'effondrement par sapement au pied des berges.

Les impacts des crues dans la région d'étude sont considérables et directement visibles au niveau des infrastructures routières (ponts, routes nationaux, …), les habitations, les terrains agricoles (notamment au niveau des plaines fluviatiles) et une forte charge solide au niveau des eaux. D'où la nécessité d'une attention particulière envers ce phénomène.

Ces immenses dégâts sont visibles grâce aux images satellitaires, couplées à une série des études du terrain, dont le traitement et l'étude peut s'avérer d'une très grande utilité, aussi bien, pour comprendre le phénomène de dégradation ainsi que pour la réflexion à une bonne gestion de ce risque naturel.

RÉFÉRENCES

[1] Nanson, G.C., CROKE, J.C. (1992).A genetic classification of floodplains. *Geomorphology*, vol. 4, n° 6, p. 459-486.

[2] Demers, Silvio., Olsen, Taylor., Buffin-Bélanger, Thomas., Marchand, Jean-Philippe., M. Biron, Pascale., Morneau, François., (2014). L'hydro-géomorphologie appliquée à la gestion de l'aléa d'inondation en climat tempéré froid : l'exemple de la rivière Matane (Québec), *Physio-Géo* [En ligne], Volume 8 ; DOI : 10.4000/physio-geo.3813.

[3] Degoutte, Gérard., (2012). Diagnostic, aménagement et gestion des rivières (2° Éd.) : Hydraulique et morphologie f luviales appliquées, Tec et Doc - Lavoisier.

[4] Saidi, M.E.M., Boukrim, S., Fniguire F., Ramromi, A., (2012). Les écoulements superficiels sur le Haut Atlas de Marrakech cas des débits extrêmes. larhyss journal, issn 1112-3680, n° 10, mars, pp. 75-90.

[5] Saidi, M.E.M., AGOUSSINE, M'Bark., DAOUDI, Lahcen., (2006). Effet de la morphologie et de l'exposition sur les ressources en eau superficielle de part et d'autre du Haut Atlas (Maroc) ; exemple des bassins versants de l'Ourika et du Marghène. Bulletin de l'Institut Scientifique, Rabat, section Sciences de la Terre, 2006, n°28, 41-49.

[6] Missenard, Yves.,Taki, Zouhair., Frizon de Lamotte, Dominique., Benammi, Mohamed., Hafid, Mohamad., Leturmy, Pascale., Se´brier, Michel., (2007). Tectonic styles in the Marrakesh High Atlas (Morocco): The role of heritage and mechanical stratigraphy. Journal of AfricanEarth Sciences 48 (2007) 247–266

[7] Pacson, P., (1977), Le Haouz de Marrakech, Thèse de Doctorat d'Etat, 2 tomes, 693p, Rabat.

[8] Duclaux, A., (2005). Modélisation hydrologique de 5 Bassins Versants du Haut-Atlas Marocain avec SWAT (Soil and Water Assessment Tool). Mémoire du diplôme d'Ingénieur Agronome de l'Institut National Agronomique de Paris-Grignon. 53 p.

[9] Saint-Laurent, D., Guimont, P., (1999). « Dynamique fluviale et évolution des berges du cours inférieur des rivières Nottaway, Broadback et de Rupert, en Jamésie (Québec) ».Géography physique et Quaternaire, vol. 53, n° 3, p. 389-399.

[10] Saidi, M.E.M., DAOUDI, Lahcen., Aresmouk, Mohamed El Hassane., Fniguire, Fatima., Boukrim, Siham., 2010. Les crues de l'oued Ourika (Haut Atlas, Maroc): Événements extrêmes en contexte montagnard semi-aride, Comunicações Geológicas, 2010, t. 97, pp. 113-128.

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Diagnostic de la communication interne au sein d'une organisation marocaine

[Diagnosis of internal communication within a Moroccan organization]

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ABSTRACT: Today and especially in large companies, internal communication emerges as an important strategic asset. Internal communication is a management assistance tool. It cannot be designed or performed independently. It evolves with the organization and through it.
It seems essential to give importance to men because it is they who make the company and not the reverse. This importance is manifest as listening and optimal internal communication that passes through the achievement of many goals for the business.
Hence the interest of this article summarizes a study in a Moroccan organization. This investigation concerns the internal communication within an organization operating in the field of insurance. This is achieved diagnosis to identify some strengths and weaknesses in order to propose ways forward in internal communication system.
The objective is to make an inventory of the existing while analyzing communication needs. The methodology to carry out this study is as follows: first a pre investigation comprised interviews and a questionnaire 1. The goal was to test the waters to collect the interviewees felt about the internal communication. This step is fundamental because it is a transitional phase to the second experimental stage, which is structured around two in the first steps that the TGN (The nominal group technique) to be followed by a questionnaire 2.
The three investigative tools used in this study will be a return of the collected data will be opened, analyzed and interpreted in terms of impact and delete on the internal communication process.

KEYWORDS: Internal communication, process, impact, obstacles, improvement.

RÉSUMÉ: Aujourd'hui et plus particulièrement dans les grandes entreprises, la communication interne apparaît comme un atout stratégique non négligeable. La communication interne est un outil d'aide au management. Elle ne peut être ni conçue, ni pratiquée de manière indépendante. Elle évolue avec l'organisation et à travers elle.
Il semble primordial d'accorder de l'importance aux Hommes car ce sont eux qui font l'entreprise et non pas l'inverse. Cette importance doit se manifester par une écoute et une communication interne optimale qui passe par la réalisation de nombreux objectifs pour l'entreprise.
D'où l'intérêt de cet article qui résume une étude réalisée au sein d'une organisation marocaine. Cette investigation porte sur la communication interne au sein d'un organisme opérant dans le domaine de l'assurance. Il s'agit de réaliser un diagnostic afin de dégager certains points forts et points faibles dans le but de proposer des voies de progrès au système communication interne.
L'objectif étant de réaliser un inventaire de l'existant tout en analysant les besoins en matière de communication. La démarche méthodologique pour mener à bien notre étude se présente comme suit : tout d'abord une pré enquête composée des entretiens et d'un questionnaire 1. L'objectif était de tâter le terrain pour recueillir le ressenti des interviewés quant à la communication interne. Cette étape est fondamentale, car elle constituera une phase de transition à la 2ème étape

expérimentale qui est structurée autour de deux sous étapes la première qui la TGN (*La technique du groupe nominal)* qui sera suivi d'un questionnaire 2.
Les trois outils d'investigation utilisés lors de cette étude feront l'objet d'une restitution des données collectées qui seront dépouillées, analysées et interprétées en termes d'impact et de suppression sur le processus communication interne.

MOTS-CLEFS: Communication interne, processus, impact, entraves, amélioration.

1 INTRODUCTION

La communication en général et la communication interne en particulier est une fonction importante au sein d'une entreprise quelle qu'elle soit. Cette fonction est toujours en évolution, en mutation avec la société. La communication impulse et sans elle aucune ou peu d'entreprises sont viables sur le long terme.

Partant de ce constat, et laissons de côté la communication externe, il nous a semblé important de trouver une thématique qui soit à la fois passionnante d'une part, mais aussi et surtout intéressante et captivante pour les organismes ciblés par la communication d'autre part.

Ainsi, nous remarquons partout et quotidiennement des affiches et des spots publicitaires, une entreprise qui essaie de vendre sa marque au consommateur. Mais qui est derrière ces produits, à la base de leur réalisation, sinon des Hommes. En effet, si la compagnie de l'assurance, fait des efforts énormes pour se vendre et pour avoir une image de marque auprès du public externe, que fait-il en revanche auprès de ses salariés pour vendre son image? Le fait-il déjà? Si oui, comment et par quels moyens? Quelles sont les entraves à la communication interne au sein dudit organisme? Grosso modo, Comment se porte la communication interne au sein de la compagnie de l'assurance?

L'objectif de cette étude de recherche est de faire un diagnostic de la communication interne au sein de la compagnie d'assurance[i]. Il s'agit là, d'un inventaire de l'existant, d'une analyse des besoins en matière de communication, dans le seul but, est celui de contribuer dans le domaine de la recherche appliquée en matière de la communication interne en milieu professionnel.

Pour mieux atteindre l'objectif général de cette étude, nous avons décliné cet objectif en plusieurs sous objectifs qui se présentent comme suit :

- Déterminer et classer par ordre d'importance les entraves à la communication interne au sein de la compagnie d'assurance.
- Connaître, saisir et hiérarchiser les éléments (moyens et outils) susceptibles d'améliorer voire optimiser la communication interne au sein de la compagnie d'assurance.
- Connaître l'image perçue par le personnel de la compagnie d'assurance vis à vis de la communication interne.

Ceci nous permettra de déceler à la fois les points forts et les points faibles de la communication interne. Afin de présenter des propositions et des solutions pour une communication optimale.

2 REVUE DE LITTÉRATURE

Nous allons tout d'abord essayer de définir brièvement la communication en général avant d'étudier la communication interne et dire qu'elle fait partie intégrante de la communication d'entreprise.

Plusieurs auteurs définissent la communication. Nous avons choisi certains parmi eux à titre d'exemple :

Pour DEVITO : « il y a communication lorsqu'on émet ou reçoit des messages et lorsqu'on donne une signification aux signaux d'une autre personne. Toujours, la communication humaine est déformée par les parasites, se produit dans un contexte, a un certain effet et comporte une possibilité de rétroaction »[ii].

[i] Nous n'avons pas eu l'autorisation de citer le nom de la compagnie dans laquelle cette étude a été menée.
[ii] J. A., DEVITO, « *Les fondements de la communication humaine*», Gaëtan Morin, 1993.

Pour CATCHART : « la communication est le mot désignant le processus de transfert de significations d'un individu à l'autre »[iii].

Dans une entreprise « La communication peut être définie comme la production d'informations sur le milieu interne et externe et comme la création d'interfaces, (…), c'est la coordination d'éléments indépendants en vue de favoriser la réalisation de la stratégie de l'organisation» [iv].

D'usage professionnel et personnel, la communication fait partie des pratiques quotidiennes et naturelles sur lesquelles on s'interroge rarement. Pourtant, la communication est un art difficile et dur à définir, situé à la croisée de disciplines aussi diverses selon M. De Miribel[v] que l'anthropologie, la sociologie ou la psycholinguistique. Le terme "communication" est utilisé par différentes disciplines et chacune d'entre elles l'emploie sous une acception propre.

D'après les définitions que nous allons voir ci-dessous, il apparait que la communication interne est au cœur des préoccupations managériales de l'entreprise et constitue une dimension essentielle de la stratégie des organisations.

Prétendre délimiter les différentes définitions de la communication interne est une tâche quasi impossible, surtout si l'on sait qu'il y a autant de définitions que d'angles de vision.

Sur ce, nous allons essayer de citer quelque unes, notamment celles qui nous ont éveillé et captivé notre esprit.

La communication interne ainsi peut être définie comme étant celle « qui englobe des actes de communication qui se produisent à l'intérieur de l'entreprise» [vi]. Elle remplit de multiples fonctions : exposer des résultats, transmettre des informations, expliquer une nouvelle orientation…

La communication interne engage l'entreprise en tant que système d'information et de décision dans son milieu. Elle organise et gère les flux d'informations qui circulent à l'intérieur de l'organisation.

D'autres auteurs définissent la communication comme étant « l'ensemble des actions entreprises pour mettre les personnes en relation les unes avec les autres dans la réalisation d'un projet commun. Elle permet à chacun d'être connu dans sa personne et reconnu dans sa mission. Facilitant ainsi le plein épanouissement des hommes. La communication fait passer de l'organigramme à l'organisme et assure de même coup la vitalité, l'efficacité et l'adaptabilité de l'entreprise» [vii].

Egalement, « La communication interne est un ensemble de principes, d'actions et de pratiques visant à donner du sens pour favoriser l'appropriation, à donner de l'âme pour favoriser la cohésion et à inciter chacun à mieux communiquer pour favoriser le travail en commun » [viii].

Nous allons donc essayer de donner une définition de la communication interne après nous être inspiré de nos lectures :

La communication interne est une discipline de la communication. Autrement dit, la communication interne fait partie intégrante de la communication d'entreprise. Par opposition à la communication externe, elle n'intervient qu'à l'intérieur de l'entreprise, en particulier sur l'ensemble des comportements des salariés, leur permettant ainsi de s'exprimer afin de s'épanouir et produire en cohésion.

3 MÉTHODOLOGIE DE L'ENQUÊTE

Pour mener à bien notre étude, nous avons opté à la fois pour une approche qualitative et quantitative.

Premièrement, nous avons commencé par une **pré enquête** qui consistait à observer directement le personnel et à réaliser des entretiens informels avec quelques personnes. Cela nous a permis de déceler une certaine insatisfaction du

[iii] CATCHART, R., Small Group Communication, A. Reader, Dubuque, IA: Brow
[iv] Nicole D'ALMEIDA & Thierry LIBAERT, « *La communication interne de l'entreprise* », 3e édition, Dunod, Paris, 2002, p. 9
[v] Marielle DE MIRIBEL, Contribution à la reconnaissance de la fonction communication en bibliothèque : approche théorique et historique: la communication écrite en direction des lecteurs. Thèse de doctorat. Sciences de la communication et de l'information. Université Paris 10-Nanterre, 1999
[vi] Marie-hélène WESTPHALEN, *Op. cit*. ,p.77.
[vii] Philippe DETRIE et Catherine MESLIN-BROYEZ, « *La Communication interne au service du Management »*, les Editions LIAISONS, 1995, p.32
[viii] Philippe DETRIE et Catherine MESLIN-BROYEZ, *op. cit*. p.38.

personnel de la compagnie d'assurance vis- à- vis de la communication interne. Néanmoins pour s'assurer de l'intérêt de notre étude nous avons procédé à une deuxième série d'entretiens. Cette fois ci nos entrevues (avec cinq personnes) étaient formelles. Aidé par un mini guide d'entretien, des questions préméditées et ciblées, un objectif clair et précis, celui de s'assurer du bon choix du thème, c'est-à-dire l'existence réelle d'un véritable besoin au niveau du système communication interne.

Deuxièmement, nous avons diagnostiqué l'état des lieux et cela par le biais d'une enquête qualitative basée sur la Technique du Groupe Nominal (TGN) d'une part. Et d'autre part, par l'administration à l'ensemble du personnel d'un questionnaire résultant de la TGN. En plus du questionnaire de pré enquête, nous avons administré les résultats de la TGN sous forme de deux questionnaires différents à tout le personnel de la compagnie d'assurance, pour plus de sens et d'objectivité. Notre but n'étant bien sûr que de confirmer ou infirmer ce qui a été avancé par les participants lors de la TGN.

Pourquoi la TGN ?

La TGN (technique de groupe nominal) qui est une approche structurée d'interaction des membres d'un groupe, elle permet entre autre de générer des idées/réponses concernant une question appelée « question nominale ».

Nous avons décidé de recourir à cette technique, à la fois pour délimiter et classer par ordre d'importance le nombre de facteurs qui nuisent au bon fonctionnement du processus communication interne. Prioriser un certain nombre d'entraves en vue de les éradiquer si possible, mais également découvrir, grâce à la créativité des intervenants les moyens et les outils qui peuvent améliorer voire optimiser le système communication interne au sein de la compagnie d'assurance.

Plus de deux semaines ont séparé la distribution du questionnaire et sa collecte. Sur les (160) questionnaires distribués, nous avons pu récupérer (109), (13) questionnaires étaient inexploitables.

4 ANALYSE ET INTERPRÉTATION DES RÉSULTATS

4.1 ETAPE 1 : PRÉ ENQUÊTE : ENTRETIENS ET QUESTIONNAIRE 1 (GUIDE D'ENTRETIEN)

1ÈRE PHASE : ENTRETIENS

Comme mentionné plus haut, nous nous sommes entretenus au tout début de notre expérimentation avec cinq employés (Responsables, cadres et agent) de la compagnie d'assurance.

Ci-dessous un tableau qui résume les réponses de nos interviewés :

Tableau 1 : Récapitulatif des réponses du guide d'entretien

Questions	Réponses			Commentaire de certains interviewés
	Oui	Non		
A votre avis la communication interne au sein de votre compagnie d'assurance est-elle efficace ?	**1 personne**	**4 personnes**	**Pourquoi ?**	- Absence service CI[ix]. - Absence responsable CI. - La même information émane de plusieurs personnes…
Etant un membre de la compagnie d'assurance, sentez- vous un changement quant à la communication interne ?	**4 Personnes**	**1 personne**	**Comment ?**	- Prise de conscience de l'importance accordée à la CI. - Des innovations commencent à voir le jour quant à la CI. - La volonté d'être un leader sur le marché de l'assurance…
Quels sont les éléments que vous espériez améliorer concernant la communication interne au sein de la compagnie d'assurance ?				- Disposer d'un service CI. - Avoir un responsable CI. - Organiser plus de réunions. - Communiquer l'information au bon moment. - Plus de transparence au niveau de l'information…

[ix] Communication Interne

A traves nos trois questions posées lors des entretiens, l'objectif était spécialement de tâter le terrain pour recueillir le ressenti des interviewés quant à la communication interne.

2ÈME PHASE : QUESTIONNAIRE N°1

Nous commencerons cette partie par dépouiller et interpréter les résultats une à une des neuf questionnaires que nous avons administrés. Signalons à juste titre que ce premier questionnaire constitue une rallonge de la phase exploratoire que nous avons débuté par les cinq entretiens précédemment analysés.

Analysés de manières séparés mais également croisés, les entretiens et le questionnaire 1 nous servirons de support pour clôturer cette partie par une interprétation générale. Celle-ci constituera certainement une transition vers la suite des étapes de notre expérimentation.

Maintenant, passons en revue les six questions posées et les résultats que nous avons dépouillés et interprétés.

« **Quelle importance accordez-vous au fait d'être informé par votre compagnie d'assurance dans les domaines suivants ? »**

Tableau 2 : Dépouillement des résultats de la question 1 (questionnaire 1)

	Nombre de Réponses			
Domaines	Primordial		Secondaire	
La stratégie poursuivie par votre organisme	8	88,89%	1	11,11%
L'actualité ressources humaines	7	77,78%	2	22,22%
Les actions en faveur du développement durable et de l'éthique	6	66,67%	3	33,33%
Les nominations	8	88,89%	1	11,11%
Les arrivées de nouveaux collaborateurs	9	100,00%	0	0,00%
Les départs	7	77,78%	2	22,22%

« Comment jugez-vous l'information que diffuse votre compagnie d'assurance dans les domaines suivants ? »

Tableau 3 : Dépouillement des résultats de la question 2 (questionnaire 1)

	Nombre de Réponses				
Domaines	Insuffisante		Suffisante		Omniprésente
La stratégie poursuivie par votre organisme	5	56%	4	44%	0%
L'actualité ressources humaines	4	44%	5	56%	0%
Les actions en faveur du développement durable et de l'éthique	4	44%	5	56%	0%
Les nominations	2	22%	7	78%	0%
Les arrivées de nouveaux collaborateurs	3	33%	6	67%	0%
Les départs	3	33%	6	67%	0%

« Vous identifiez-vous aux « valeurs » que revendique votre compagnie d'assurance ? Cochez une seule réponse »

Tableau 4 : Dépouillement des résultats de la question 3 (questionnaire 1)

Propositions	Nombre de réponses
Oui	2
Non	0
En partie	7

« Pensez-vous qu'une bonne communication interne contribue à renforcer la motivation des salariés ? »

Tableau 5 : Dépouillement des résultats de la question 4 (questionnaire 1)

Propositions	Nombre de réponses
Oui	9
Non	0

« Comment qualifieriez-vous la communication interne dans votre compagnie d'assurance ? » Cochez une seule réponse.

Tableau 6 : Dépouillement des résultats de la question 5 (questionnaire 1)

Propositions	Nombre de personnes
Elle contribue à insuffler un esprit d'organisme qui est source de motivation	2
C'est juste un canal de diffusion d'informations	6
C'est surtout un outil de propagande	0
Elle est inexistante	1

« Au global, comment considérez-vous la communication faite par votre compagnie d'assurance en direction de ses salaries ? »

Tableau 7 : Dépouillement des résultats de la question 6 (questionnaire 1)

Propositions	Nombre de personnes
Bonne	0
Moyenne	9
Mauvaise	0

Selon le pré diagnostic, nous relevons que le contexte au sein de la compagnie d'assurance change en continue et rapidement. Ainsi, la communication interne change constamment son rôle, d'une machine à faire circuler l'information à une fonction clé qui développe le sens collectif. Considérée comme essentielle par le personnel de compagnie d'assurance, la communication interne fait l'objet de nombreuses critiques de leur part. Par le biais d'une pré enquête qualitative (mini entretien et questionne 1), nous avons essayé de palper notre terrain d'investigation pour un avoir avant-goût.

L'analyse des réponses recueillies fait ressortir les conclusions suivantes :

- Les attentes du personnel de la compagnie d'assurance sont nombreuses et exigeantes car la communication interne est très sévèrement jugée,
- L'existence d'une véritable prise de conscience en matière de communication interne de la part de la société,
- Seulement (2/9) des répondants trouvent que la communication interne faite par l'organisme contribue à insuffler un esprit d'organisme qui est source de motivation,
- La totalité des participants jugent la communication de la compagnie d'assurance comme étant moyenne,
- La majorité des participants attestent qu'incontestablement la communication interne peut contribuer de prés à instaurer un esprit de groupe qui sera source de motivation. N'oublions pas que la motivation est un facteur essentiel à l'épanouissement du personnel, il faut qu'il se sente informé, écouté et qu'il baigne dans un climat social propice,

Les interviewés ont aussi proposés des recommandations à savoir :

- La communication interne doit se vendre
- Tout doit être impliqué, responsable et personnel
- Il faut donner des informations fraîches et de qualité
- Faire un suivi à travers des diagnostics réguliers

4.2 ETAPE 2 : EXPERIMENTATION : TGN ET QUESTIONNAIRE 2

La deuxième étape dite expérimentale sera articulée autour d'une TGN et d'un questionnaire

1ÈRE PHASE : LA TGN

La TGN a été réalisée auprès de sept personnes et animée par deux animateurs, deux personnes se sont excusées. Le déroulement de la TGN s'est fait dans de bonne condition dont la mesure où l'ensemble du matériel a été mis à la disposition des participants ainsi que des animateurs.

Tout d'abord, une présentation des participants et des animateurs suivi d'une explication des objectifs de la TGN et d'un bref exposé sur ce que c'est la TGN pour en conclure avec la question nominale qui fut formulée comme suit : **« Selon vous, quelles sont les entraves à la communication interne au sein de votre organisme ? Et/ou les éléments (moyens et outils) qui peuvent l'améliorer, voire l'optimiser ? »**

Une fois la phase réflexion et rédaction individuelle des réponses est terminée, les participants ont commencé à les énoncer à tour de rôle et une réponse à la fois. Nous tenons à signaler que nous avons obtenus deux listes différentes celle des entraves et celle des moyens et outils d'amélioration.

L'épuisement des réponses a enclenché l'étape suivante qui consistait à discuter une après une celle-ci pour en unifier le sens, dissiper les confusions, si confusion il y a, et réajuster la formulation si le besoin se fait imposer.

Ensuite, nous avons abordé l'opération de vote qui allait nous permettre de classer les différentes réponses selon leurs scores, leurs fréquences et leurs moyennes. Il a fallu bien réexpliquer tout le processus de vote pour une meilleure appréhension.

En matière de vote, la fiche utilisée et la suivante :

Tableau 8 : Prototype de la fiche de vote utilisée lors de la TGN

N	Score	Fréquence	Total	rang

- 1ére colonne : le numéro de chaque énoncé à mesure qu'il est noté.
- 2ème colonne : les points donnés à l'énoncé sur les fiches.
- 3ème colonne : le nombre de fois que l'énoncé a été choisi
- 4ème colonne : le total des points donnés à l'énoncé en additionnant les chiffres de la deuxième colonne.
- 5ème colonne : le rang occupé par chaque énoncé en fonction des points qui lui ont été données.

Les résultats exposés par les participants sont les suivants :

Tableau 9 : Résultat brut des entraves (réponses non classées par le vote)

N°	ÉNONCÉS
1	Absence d'une structure chargée de la communication interne
2	Circulation de l'information de façon non structurée (communication informelle, rumeurs…)
3	Absence de plan de communication interne
4	Retard dans la transmission de l'information
5	Absence d'une personne chargée de la communication interne
6	Outlook reste insuffisant
7	L'indisponibilité des personnes (pas le temps pour lire les messages)
8	Existence de plusieurs interlocuteurs
9	Monopole de l'information par les responsables (rétention de l'information par les responsables)
10	Absence d'une politique de communication interne
11	Non utilisation des moyens et outils de communication interne (Outlook reste insuffisant)
12	Trop de communication descendante (dans le sens informationnel)

Tableau 10: Résultat brut des moyens et outils d'améliorations (réponses non classées par le vote)

N°	ÉNONCÉS
1	Création d'une unité ou d'un service spécialisé en matière de communication
2	Elaborer une politique de communication interne
3	Alerte sur Outlook pour informer de l'arrivée d'un nouveau message sur l'intranet de l'organisme
4	L'existence d'un seul interlocuteur pour transmettre et communiquer l'information
5	Organiser des réunions générales périodiques
6	Mettre en place des panneaux d'affichages aux endroits les plus visités par les employés (restaurants…)
7	Elaborer un plan de communication interne
8	Essayer d'émettre l'information au bon moment
9	Diversifier les outils de communication interne
10	Equilibrer entre les trois types de communication (ascendante, descendante, transversale)
11	Homogénéiser les divers canaux de communication

Après avoir procédé pendant la phase pré-vote à l'élimination des réponses redondantes et à celles qui prêtaient à confusion, nous nous sommes retrouvés à la fin avec une liste de 23 réponses sur (28). Le vote et le traitement des résultats de celui-ci selon trois critères; le score, la fréquence et la moyenne, nous ont permis de dégager les 15 items (7 entraves et 8 moyens et outils d'amélioration). Nous allons nous contenter de traiter que les entraves qui meubleront le second questionnaire que nous avons distribué à 160 employés de la compagnie d'assurance.

Tableau 11 : Enoncés des entraves retenues après le vote final pour la phase suivante de l'expérimentation

N°	ÉNONCÉS
1	Absence d'une structure chargée de la communication interne
2	Absence d'une politique de communication interne
3	Trop de communication descendante (dans le sens informationnel)
4	Retard dans la transmission de l'information
5	Monopole de l'information par les responsables (rétention de l'information par les responsables)
6	Absence de plan de communication interne
7	Absence d'une personne chargée de la communication interne

Tableau 12 : Enoncés des moyens et outils d'amélioration retenues après le vote finale pour la phase suivante de l'expérimentation

N°	ÉNONCÉS
1	Création d'une unité ou d'un service spécialisé en matière de communication
2	Elaborer un plan de communication interne
3	Elaborer une politique de communication interne
4	Organiser des réunions générales périodiques
5	Equilibrer entre les trois types de communication (ascendante, descendante, transversale)
6	Essayer d'émettre l'information au bon moment
7	L'existence d'un seul interlocuteur pour transmettre et communiquer l'information
8	Mettre en place des panneaux d'affichages aux endroits les plus visités par les employés (restaurants…)

2ÈME PHASE : QUESTIONNAIRE 2

Nous tenons à rappeler que le questionnaire qui a été distribué à l'ensemble du personnel est le résultat de la TGN que nous avons organisé et est destiné au classement des 7 plus importantes entraves nuisibles à une communication interne optimale au sein de la compagnie d'assurance. Le classement est double parce qu'il sera produit selon deux critères :

1. **Le degré d'impact** de chaque entrave sur le bon fonctionnement du système communication interne, et
2. **Le degré de priorité** quant à la suppression de chaque entrave.

Pour ce faire, le questionnaire présente aux répondants les échelles suivantes :

Situation actuelle					Situation désirée				
1	2	3	4	5	1	2	3	4	5

La « situation actuelle » correspond au (degré d'impact) alors que la «situation désirée» renvoie au (degré de surpression). L'échelle proposée s'étale de 1 à 5 avec les valeurs suivantes :

Concernant la **« situation actuelle »** :

1 = **influence nulle** sur le bon fonctionnement du processus communication interne
2 = **influence faible** sur le bon fonctionnement du processus communication interne
3 = **influence moyenne** sur ……
4 = **forte influence** sur……..
5 = **Facteur déterminant, très forte influence** ……..

Concernant le degré de suppression désirée **« situation désirée »** :

5 = il faut **supprimer complètement** cette entrave **(100 %)**
4 = il faut **supprimer fortement** cette entrave **(75 %)**
3 = il faut **moyennement supprimer** cette entrave **(50 %)**
2 = il faut **supprimer faiblement** cette entrave **(25 %)**
1 = **pas la peine de supprimer** cette entrave **(0 %)**

A propos du degré d'impact, nous avons obtenus les résultats ci-dessous que nous avons jugé opportun de les rassembler dans un seul tableau récapitulatif qui contient les 7 entraves ainsi que les différents degrés d'influence cités pour chacune d'elle :

Tableau 13 : Récapitulatif des réponses sur la première tranche I du questionnaire 2 (degré d'influence)

Entrave	Influence (nombre de citation)					TOTAL
	Nulle	Faible	Moyenne	Forte	Très forte (Déterminante)	
1	0	0	9	29	58	96
2	0	8	22	31	35	96
3	0	2	53	36	5	96
4	0	9	39	47	1	96
5	0	0	45	48	3	96
6	0	8	6	47	35	96
7	5	6	11	26	48	96
TOTAL	5	33	185	264	185	672

Nous nous apercevons d'après ce tableau récapitulatif que le degré d'influence « 4 » qui renvoi à « la forte influence » de l'entrave fut le plus cité avec un total de 264 fois. Suivi en deuxième et au même rang par les deux degrés « moyenne » et « très forte influence » cités 185 fois chacun. Ces deux catégories d'influence totalisent 370 citations. Nous remarquons clairement que les trois blocs d'influence « moyenne », « forte » et « très forte » se détachent des deux autres catégories « influence faible » et « nulle » qui sont venues respectivement en quatrième position (33 citations) et cinquième position (5 citations), signant ainsi une dernière position très en recul par rapport aux autres.

Pour classer les entraves selon leur degré d'influence sur le bon fonctionnement du processus communication interne au sein de la compagnie d'assurance, nous avons opté de procéder à une opération d'attribution de points selon l'échelle suivante :

- Chaque citation du degré (**influence nulle**) vaut 1 point ;
- Chaque citation du degré (**influence faible**) vaut 2 point;
- Chaque citation du degré (**influence moyenne**) vaut 3 point;
- Chaque citation du degré (**influence forte**) vaut 4 point;
- Chaque citation du degré (**influence déterminante**) vaut 5 point.

Ce qui nous donne les valeurs consignées sur le tableau suivant :

Tableau 14 : Score général des sept entraves selon leur nombre total de citation (degré d'influence)

Entrave	Influence (nombre de citation)					Total des points	Rang
	Nulle	Faible	Moyenne	Forte	Très forte (Déterminante)		
1	0	0	9	29	58	433	1
2	0	8	22	31	35	381	4
3	0	2	53	36	5	332	6
4	0	9	39	47	1	328	7
5	0	0	45	48	3	342	5
6	0	8	6	47	35	397	2
7	5	6	11	26	48	394	3

Le classement final ressort comme indique le tableau suivant :

Tableau 15 : Classement final des sept entraves selon leur degré d'influence

N° de l'entrave	Énoncé de l'entrave	Rang
1	Absence de structure chargée de la communication interne	1
6	Absence de plan de communication interne	2
7	Absence d'une personne chargée de la communication interne	3
2	Absence d'une politique de communication interne	4
5	Monopole de l'information par les responsables (rétention de l'information par les responsables)	5
3	Trop de communication descendante (dans le sens informationnel)	6
4	Retard dans la transmission de l'information	7

Nous constatons un changement entre le classement livré par la TGN et celui dégagé au terme du dépouillement des résultats du questionnaire 2. L'ensemble des cinq entraves ont connu un chamboulement à l'exception de l'entrave N°1 et N°5 qui ont gardées leur classement. Compte tenu de l'effectif (96) qui a participé au questionnaire qui est plus important que celui qui a pris part à la TGN (7), nous allons retenir comme résultat final le classement du questionnaire 2.

En plus du classement des entraves selon leur degré d'influence, nous avons sollicité les répondants pour exprimer leur opinion concernant le degré de suppression que doit subir chaque entrave, et cela afin d'améliorer voir optimiser le système communication interne. Autrement dit, les répondants se sont prononcés, via le même questionnaire, sur les priorités de traitement des entraves. Ils ont ainsi reclassé les 7 entraves selon un autre critère, celui du degré de suppression.

Les résultats obtenus sont consignés au niveau du tableau ci-dessous. Mais avant tous nous tenons à rappeler que l'échelle proposée est :

5 = il faut **supprimer complètement** cette entrave **(100 %)**
4 = il faut **supprimer fortement** cette entrave **(75 %)**
3 = il faut **moyennement supprimer** cette entrave **(50 %)**
2 = il faut **supprimer faiblement** cette entrave **(25 %)**
1 = **pas la peine de supprimer** cette entrave pour améliorer le processus communication interne **(0 %).**

Tableau 16 : Récapitulatif des réponses sur la seconde tranche du questionnaire 2

Entrave	Suppression suggéré (nombre de citation)					Total
	Nulle 0 %	Faible 25 %	Moyenne 50 %	Forte 75%	Complète 100%	
1	0	0	0	14	82	96
2	0	0	10	26	60	96
3	0	2	27	56	11	96
4	0	0	19	61	16	96
5	0	0	24	51	21	96
6	0	0	2	37	57	96
7	0	0	0	37	59	96
Total	0 (0.00%)	2 (0,30%)	82 (12,20%)	282 (41,96%)	306 (45,54%)	672

La première remarque que dégage ce tableau récapitulatif c'est la concentration de la couleur (bordeaux) sur les deux colonnes «suppression 100%» et «suppression 75%» ce qui veut dire que les 96 répondants ont massivement suggérés la suppression complète de la moitié des entraves. Toujours d'après le même tableau, le degré de suppression «5» qui renvoi à la «suppression complète» de l'entrave fut le plus citée avec un total de 306 fois, suivi du degré de suppression «4» qui renvoi à la «forte suppression» de l'entrave avec 282 citations.

Nous poursuivrons le même itinéraire de dépouillement et d'analyse que la section précédente (degré d'impact des entraves). Le classement se fera toujours en transformant l'échelle proposée pour les réponses en échelle de points :

- 5 points pour le « 5 », traduisant une « priorité absolue », c'est à dire une (**suppression complète**).
- 4 points pour le « 4 », traduisant une « forte priorité » (**suppression à 75%**).
- 3 points pour le « 3 », traduisant une « moyenne priorité » (**suppression à 50%**).
- 2 points pour le « 2 », traduisant une « faible priorité » (**suppression à 25%**).
- 1 points pour le « 1 », traduisant la « **non priorité** », la suppression de l'entrave n'influence ni positivement ni négativement le système communication interne.

Le classement des cinq marches de l'échelle proposées aux répondants fait ressortir la configuration suivante :

Tableau 17 : Score et classement générale des 7 entraves selon leur nombre de citation (degré de suppression)

Entrave	Suppression suggérée (nombre de citation)					Total	Rang
	Nulle 0%	Faible 25%	Moyenne 50 %	Forte 75%	Complète 100%		
1	0	0	0	14	82	466	1
2	0	0	10	26	60	434	4
3	0	2	27	56	11	364	6
4	0	0	19	61	16	381	7
5	0	0	24	51	21	381	5
6	0	0	2	37	57	439	2
7	0	0	0	37	59	443	3
Total	0	2	82	282	306	672	

Le classement des 7 entraves selon le degré de suppression exprimé pour chacune d'entre elles par les 96 répondants ressort comme suit :

Tableau 18 : Classement général des entraves selon leur degré de suppression

N° de l'entrave	Enoncé de l'entrave	Rang
1	Absence de structure chargée de la communication interne	1
7	Absence d'une personne chargée de la communication interne	2
6	Absence de plan de communication interne	3
2	Absence d'une politique de communication interne	4
5	Monopole de l'information par les responsables (rétention de l'information par les responsables)	5
4	Retard dans la transmission de l'information	6
3	Trop de communication descendante (dans le sens informationnel)	7

Si le dépouillement et l'interprétation de la première partie du questionnaire 2 nous a permis de classer les 7 entraves en fonctionnement de leur degré d'influence sur le bon déroulement du processus communication interne au sein de la compagnie d'assurance, le traitement des résultats de la seconde partie a accouché du classement relaté dans le tableau « suppression». Il s'agit là de livrer aux responsables de la compagnie d'assurance les plus importantes entraves classées selon le degré d'urgence et qui requiert éventuellement un traitement d'urgence.

5 LIMITES DE LA RECHERCHE

Notre recherche s'articule autour de la réalisation d'un diagnostic de la communication interne au sein de la compagnie d'assurance et étant donné que ledit organisme ne dispose pas d'une structure ou d'un responsable chargé de la communication interne et que le personnel n'a pas de connaissances précises relatives à ce sujet, il était vraiment difficile de collecter les informations traitant de la communication interne dans un tel environnement. Ce qui a constitué en lui-même un obstacle majeur et de taille de cette étude.

Egalement, lors de la réalisation des entretiens, certains interviewés étaient amenés à reporter les entrevues suite à des charges de travail urgentes qui apparaissent à la dernière minute d'une part. D'autre part, l'interruption lors des entretiens par des collaborateurs nuisait réellement à la fiabilité et la qualité des informations collectées.

Une autre limite, liée cette fois ci à l'organisation de la TGN. Une difficulté insurmontable consistait en le fait de trouver le jour et le lieu qui convient à l'ensemble des participants, vu que chacun d'entre eux avait des engagements propres à lui.

6 CONCLUSION

En guise de conclusion, nous rappelons que notre recherche s'est inscrite dans le cadre de l'étude de la communication en milieu professionnel. Notre objectif consistait en la réalisation d'un diagnostic, en vue d'identifier les forces et les faiblesses de la communication interne en tant qu'outil d'aide au progrès dans un quelconque organisme.

Le diagnostic nous a permis de dégager les points forts et les points faibles de la communication interne au sein de la compagnie d'assurance et de faire des recommandations à même de l'améliorer.

Ainsi, nous avons traité dans un premier temps, du cadre théorique et conceptuel. Ce cadre nous a permis de mieux cerner les concepts clés de notre recherche, notamment, celui de la communication en général et de la communication interne en particulier.

Dans un deuxième temps, nous avons présenté les outils d'investigation, notre méthodologie de recherche, ainsi que les résultats de la recherche, leur analyse et interprétation. Nous avons alors pu identifier les forces et les faiblesses de la communication interne et en proposer quelques recommandations.

Au niveau méthodologique, nous avons mené notre étude moyennant trois principaux outils, en l'occurrence : l'observation directe, l'enquête qualitative et l'enquête quantitative.

L'observation directe a consisté à prendre contact avec les personnes ressources d'une part et à consulter la documentation disponible en la matière d'autre part. L'enquête qualitative s'est concrétisée par une TGN qui a réuni autour d'une question nominale sept employés de la compagnie d'assurance.

L'enquête quantitative a été assurée via l'administration directe d'un questionnaire auprès de 160 personnes avec un taux de réponse de 60%, soit 96 questionnaires exploitables.

Suite à l'analyse des données collectées, nous avons pu dégager les entraves à la communication interne, afin de les étudier en termes de degré d'impact et de degré de suppression. En général, nous avons remarqué l'inexistence d'une structure clairement définie et chargé de la communication interne. Cette fonction est considérée comme étant du ressort de la Division Ressources Humaines, sans être pour autant clairement définie, ce qui favorise les relations verticales descendantes, au détriment des autres.

REFERENCES

[1] J. A., DEVITO, « Les fondements de la communication humaine», Gaëtan Morin, 1993.
[2] CATCHART, R., Small Group Communication, A. Reader, Dubuque, IA: Brow
[3] Nicole D'ALMEIDA & Thierry LIBAERT, « La communication interne de l'entreprise », 3e édition, Dunod, Paris, 2002, p. 9
[4] Marielle DE MIRIBEL, Contribution à la reconnaissance de la fonction communication en bibliothèque approche théorique et historique : la communication écrite en direction des lecteurs. Thèse de doctorat. Sciences de la communication et de l'information. Université Paris 10-Nanterre, 1999
[5] Marie-hélène WESTPHALEN, Op. cit. ,p.77.
[6] Philippe DETRIE et Catherine MESLIN-BROYEZ, « La Communication interne au service du Management », les Editions LIAISONS, 1995, p.32
[7] Philippe DETRIE et Catherine MESLIN-BROYEZ, *op. cit*. p.38.

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Impact de la fertilisation organique sur quelques caractéristiques du sol et les paramètres de croissance de l'hévéa (*Hevea brasiliensis* Müll Arg.) en phase d'installation à Bonoua, dans le Sud de la Côte d'Ivoire

[Impact of organic fertilization on some soil characteristics and rubber tree growth parameters (*Hevea brasiliensis* Müll Arg.) during the installation phase in Bonoua in the south of Côte d'Ivoire]

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ABSTRACT: An Agronomic test of a period of eighteen month, was conducted in the town of Bonoua, to study the effect of organic fertilizer on the vegetative growth of immature plants of rubber trees (Hevea brasiliensis Müll Arg.), and the effect on chemical soil characteristics. A randomized complete block (BCR) of eight treatments and three repetitions, using two sources of organic manure with three levels of doses each, has been set up. The data on the growth unit (CPU), the diameter of the scion (DS) and the height (H) of plants, were observed every six months, starting from the implementation of the tests. Soil samples were also collected, with the same frequencies for analysis. The results showed that, on chemical soil characteristics, some differences relative to control without fertilizers, thus indicating some improved effects of the two types of compost on the studied soil, concerning pH, organic matter content and the cation exchange capacity. Unlike the cow manure-based compost, the increasing of the dose of compost made from chicken droppings resulted lesser effects on soil pH. Vegetative growth in plant height and diameter of the scion were also improved respectively with 24.45% and 15.60%, compared to the control (without fertilizer), through the used of 1.2 t ha-1 of compost of chicken manure. So, under the conditions of this study, this manure, at this level, can be recommended on immature rubber plants.

KEYWORDS: chicken droppings, cow dung, vegetative growth, chemical soil characteristics, Ivory Coast.

RESUME: Un essai agronomique d'une durée de dix-huit mois a été conduit dans la localité de Bonoua en vue d'étudier l'effet de la fumure organique sur la croissance végétative des plants immatures d'hévéas (*Hevea brasiliensis* Müll Arg.) et sur les

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caractéristiques chimiques du sol. Un dispositif en blocs complets randomisés à 8 traitements et 3 blocs utilisant deux sources de fumure organique avec 3 niveaux de doses chacune, a été mis en place. Des données sur l'unité de croissance, le diamètre du scion et la hauteur des plants ont été relevées tous les 6 mois à partir de la mise en place des essais. Des échantillons de sol ont également été prélevés selon les mêmes fréquences, pour des analyses. Les résultats ont montré, au niveau des caractéristiques chimiques du sol étudié, des différences relatives par rapport au témoin sans fertilisant, indiquant ainsi, quelques effets améliorants des deux types de compost sur le sol, notamment sur le pH, la teneur en matière organique et la capacité d'échange cationique. Contrairement au compost à base de bouse de vache, l'augmentation de la dose de compost à base de fiente de poulet a entrainé des effets moindres sur le pH du sol. La croissance végétative en hauteur des plants et le diamètre du scion ont été également améliorés respectivement de 24,45 et de 15,60 % par rapport au témoin (sans fertilisant), par l'apport de 1,2 $t.ha^{-1}$ de compost à base de fiente de poulet, qui peut être, dans les conditions de la présente étude, la dose et le types de compost conseillés sur des plants d'hévéa immatures.

MOTS-CLEFS: fiente de poulet, bouse de vache, croissance végétative, caractéristiques chimique du sol, Côte d'Ivoire.

1 INTRODUCTION

Avant les années 1990, grâce à la disponibilité d'une importante réserve forestière, aux conditions climatiques favorables et à la stratégie de diversification des cultures, la Côte d'Ivoire a assuré de manière continue et satisfaisante l'extension de l'hévéaculture sur l'espace forestier. Ce qui lui a permis d'occuper le 7ème rang mondial et le 1er rang africain des pays producteurs de caoutchouc naturel. Cet essor remarquable a été, possible grâce à l'appui de la recherche, à travers la sélection clonale et l'amélioration des technologies de récolte du latex des clones. L'appui de la recherche a ainsi contribué à l'amélioration de productivité de l'hévéa sans toutefois mettre l'accent sur la gestion durable de la fertilité des sols [1], [2], [3], [4]. Au cours de ces dernières décennies, face aux changements climatiques [5], [6], [7], et la baisse de la fertilité des sols due essentiellement à la faible utilisation d'engrais et à la forte pression foncière [8], il importe de recourir aux bonnes pratiques culturales par la gestion rationnelle de la fertilité des sols en valorisant les sources de matières organiques locale. Cette gestion durable du sol signifie que les éléments nutritifs exportés dans la production ou mobiliser par les plantes soient compensés par les apports, de telle sorte que l'équilibre entre éléments minéraux soit maintenu [9]. Diverses méthodes concourent à cette gestion durable des sols, entre autre, l'utilisation des fertilisants organiques. Plusieurs études menées sur la fertilisation organique des sols ont montré l'important rôle des fertilisants organiques sur les propriétés physiques, chimiques et biologiques du sol et également sur le développement et le rendement des cultures [10], [11], [12], [13], [14]. Aussi, l'on assiste-t-il, de plus en plus, à l'utilisation de la fumure organique en hévéaculture, notamment, en pépinière, alors que, très peu d'études ont été consacrées à l'évaluation de l'effet de cette fumure sur les vergers d'hévéa. Cette insuffisance rend difficile toute recommandation à l'attention des paysans, quant aux systèmes de fertilisation organique en culture de l'hévéa. La présente étude se propose de rationaliser l'utilisation de la fumure organique en hévéaculture. Cet objectif général se décline en deux objectifs spécifiques, à savoir, évaluer les effets de la fumure organique sur quelques caractéristiques chimiques du sol et apprécier les effets de cette fumure sur les paramètres de croissance des hévéas immatures.

2 MATERIEL ET METHODES

2.1 SITE DE L'ÉTUDE

L'essai, a été conduit en milieu paysan, dans la localité de Bonoua au Sud-Est de la Côte d'Ivoire, zone de forte production de caoutchouc naturel (figure 1). Le climat de cette région est de type subtropical humide, avec un régime bimodal [15]. La pluviométrie moyenne annuelle est de l'ordre de 1700 mm [16]. Le sol est de type ferrallitique fortement désaturé selon la classification française CPCS [17]. Ces sols ont des propriétés physiques très variables et une richesse chimique toujours faible et voire très faible. L'horizon humifère (3-6 % MO) peu épais est souvent fortement désaturé avec un pH inférieur à 5,5 [18].

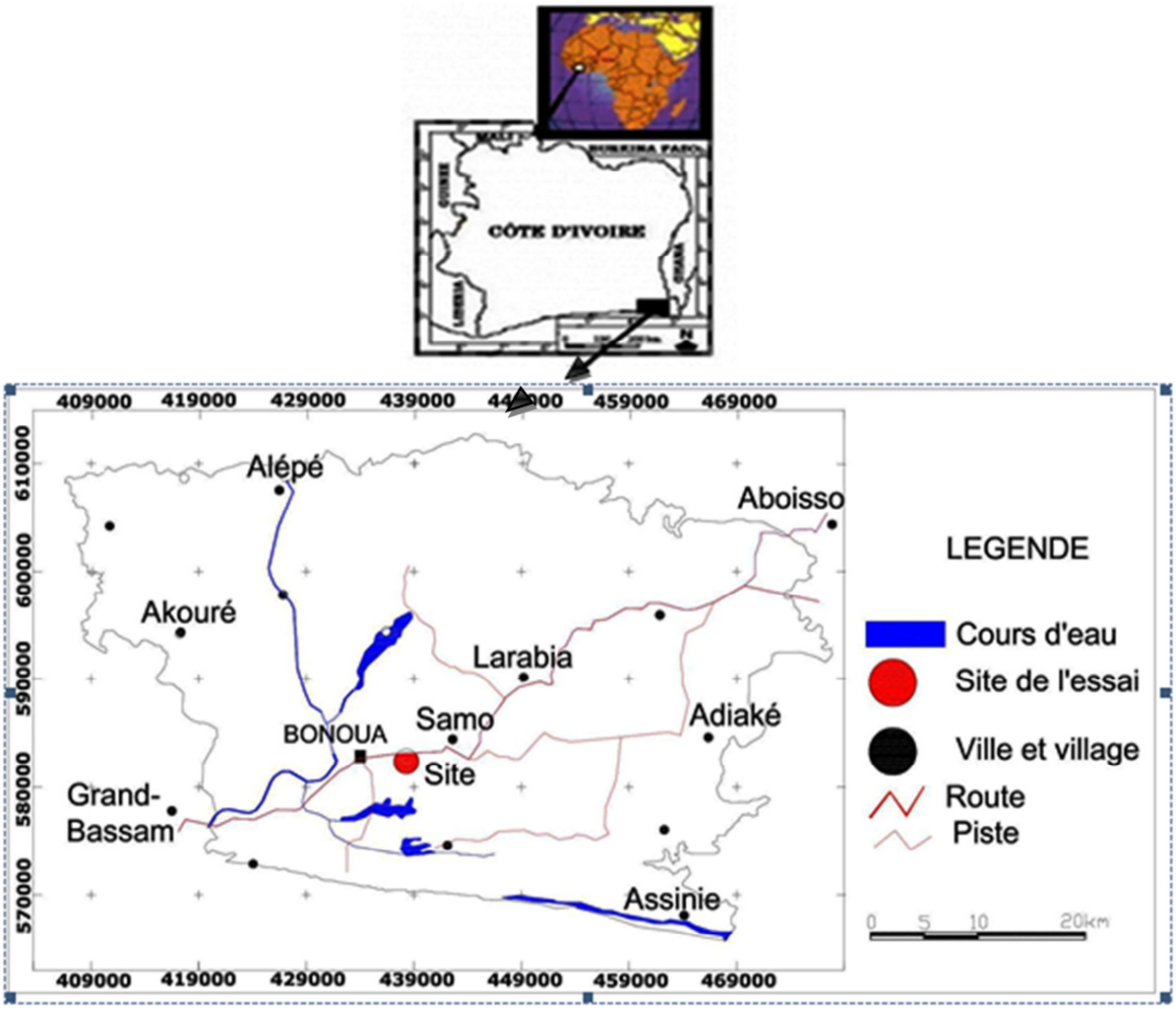

Figure 1. Carte de localisation de la zone d'étude (Source : [16], modifié)

2.2 MATÉRIEL VÉGÉTAL

Le matériel végétal est constitué de plants de la variété IRCA 41 à 3 étages foliaires. Ce clone est haut producteur et adapté aux conditions pédoclimatiques de la Côte d'Ivoire. Il est fortement présent dans le verger ivoirien.

2.3 FUMURES

La fumure organique est constituée de deux types de compost fait à base de fiente de poulet et de bouse de vache. Le compostage a été réalisé selon la méthode "Indore" durant 6 mois dans des fosses de 3 m de longueur, 2 m de largeur et 1 m de profondeur, soit un volume de 6 m^3. Des échantillons des deux types de compost ont été prélevés puis analysés au laboratoire de végétaux et de sols de l'Ecole Supérieure d'Agronomie de Yamoussoukro, selon les méthodes usuelles.

Une fumure minérale, telle que recommandée en hévéaculture en Côte d'Ivoire, a été utilisée comme un témoin relatif.

Elle comprend : l'Urée ([CO(NH2)2]), titrant à 46 % d'azote (N) ; le Phosphate tricalcique (Ca3(PO4)2) titrant à 33 % de phosphore (P2O5) et le Chlorure de Potassium (KCl) titrant à 60 % de potasse (K2O).

2.4 DISPOSITIF EXPERIMENTAL, TRAITEMENTS ET EPANDAGE DU MATERIEL FERTILISANT

L'essai a été conduit selon un dispositif en Bloc Complet Randomisé (BCR) utilisant 8 traitements et 3 blocs. Chaque traitement a été identifié par un code consigné dans le tableau 1. Le nombre de plants par traitement est de 45. Les arbres

sont plantés à la densité de 555 pieds à l'hectare, soit 6 m × 3 m (6 m entre les lignes et 3 m entre les plants). Les différents blocs du dispositif ont été séparés par 2 lignes d'hévéas appelées "lignes de bordures", et les différents traitements, par 2 plants.

Le premier apport d'engrais s'est effectué au planting (mai - juin) dans le trou de plantation. Le second s'est fait au cours de la petite saison pluvieuse (octobre-novembre), puis, le troisième, en avril de l'année suivante. Les apports d'engrais furent effectués par épandage au pied de l'arbre, dans une cuvette sarclée, de rayon variant entre 30 et 60 cm (Figure 2).

La parcelle expérimentale occupe majoritairement le sommet d'une toposéquence.

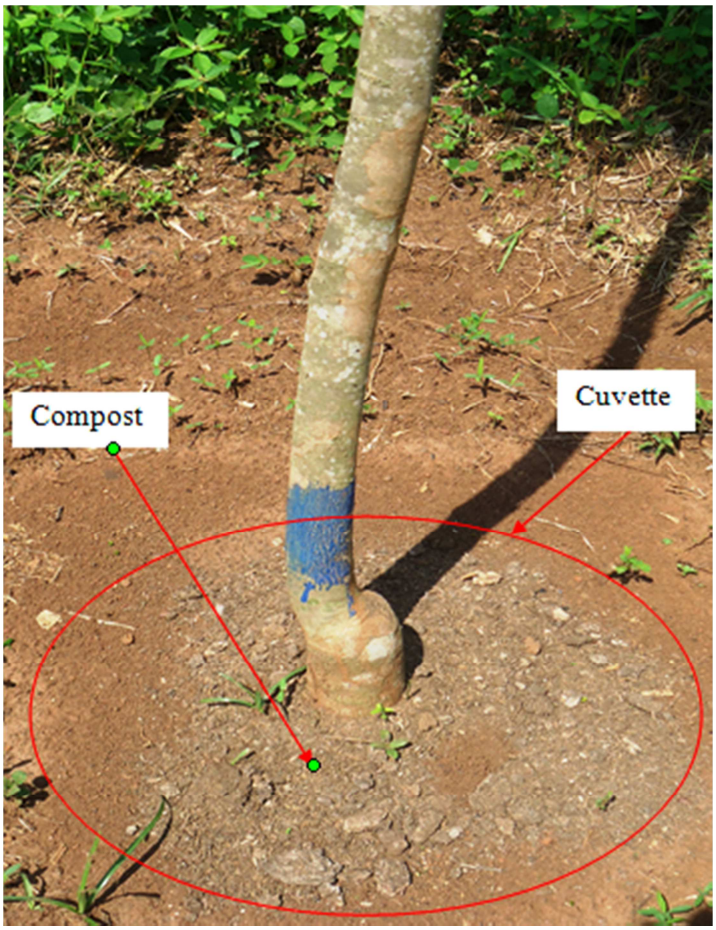

Figure 2: Apport de compost sur un pied d'hévéa

2.5 ETUDE DU SOL

Trois échantillons de sol ont été prélevés à la tarière, dans l'horizon superficiel (0 – 20 cm), sur chaque parcelle élémentaire. Le mélange de ces trois échantillons de sol a permis de constituer un échantillon composite de sol pour chaque parcelle élémentaire.

Cette opération, réalisée, 18 mois après planting a donné au total 24 échantillons composites. Ils ont été analysé en laboratoire pour déterminer les teneurs en carbone organique (C-org), azote total (N-total), phosphore assimilable (P-ass.), capacité d'échange cationique (CEC), ainsi que le pH. Le taux de matière organique (MO) a été calculé, selon la formule : MO (%) = C (%) × 1,72

Ces analyses ont été également réalisées au laboratoire de végétaux et de sols de l'Ecole Supérieure d'Agronomie de Yamoussoukro (Côte d'Ivoire).

2.6 COLLECTE DES DONNÉES AGRONOMIQUES

La mesure des paramètres agronomiques a été effectuée sur des plants d'hévéa, au moment de la mise en place puis tous les 6 mois jusqu'au 18ème mois de l'essai. Ainsi, la hauteur des plants (H) a été mesurée à l'aide d'une règle graduée, le diamètre au scion (DS) à l'aide d'un pied à coulisse électronique. Les unités de croissance (UC) ou étage foliaire des plants et le taux de mortalité, ont été également déterminés aux mêmes périodes. Mais les résultats ont porté sur les données du 18e mois après planting.

2.7 ANALYSE STATISTIQUE DES DONNÉES

Les données collectées ont été soumises à une analyse de variance (ANOVA un facteur) à l'aide du logiciel STATISTICA 7.1. La comparaison multiple des moyennes a été faite selon le test de Student-Newman-Keuls au seuil de 5 %.

Tableau 1. Quantité d'éléments apportés par la fertilisation

Traitements			Engrais organique (t.ha^{-1})			Phosphate tricalcique $Ca_3(PO_4)_2$ (kg.ha^{-1})			Chlorure de potassium KCl (kg.ha^{-1})			Urée (kg.ha^{-1})		
Code		Na	App 1	App 2	App 3	App 1	App 2	App 3	App 1	App 2	App 3	App 1	App 2	App 3
T1	**Témoin absolu**	45	0	0	0	0	0	0	0	0	0	0	0	0
T2	**Engrais minéral**	45	0	0	0	41,6	0	83,2	47,2	0	47,2	0	30,6	0
T3	**Com1 (½ D)**	45	0,6	0,6	0,6	0	0	0	0	0	0	0	0	0
T4	**Com1 (1 D)**	45	1,2	1,2	1,2	0	0	0	0	0	0	0	0	0
T5	**Com1 (2 D)**	45	2,4	2,4	2,4	0	0	0	0	0	0	0	0	0
T6	**Com2 (½ D)**	45	0,6	0,6	0,6	0	0	0	0	0	0	0	0	0
T7	**Com2 (1 D)**	45	1,2	1,2	1,2	0	0	0	0	0	0	0	0	0
T8	**Com2 (2 D)**	45	2,4	2,4	2,4	0	0	0	0	0	0	0	0	0

Com1 *: Compost à base de bouse de vache ;*
Com2 *: Compost à base de fiente de poulet;*
¼ D: *quart de dose* ***;***
½ D*: demi dose;*
1 D*: dose normale;*
2 D *: double dose ;*
App 1*: 1ere Application (au planting) ;*
App 2 *: 2e Application (6 mois après planting) ;*
App 3: *3e Application (12 mois après planting);*
Na : *Nombre d'arbres par traitement*

3 RESULTATS

3.1 TENEUR EN ELEMENTS FERTILISANTS DES DIFFERENTS TYPES DE COMPOST

L'examen des résultats de l'analyse de la teneur en éléments fertilisants des deux types de composts (Tableau 2) indique que le compost fait à base de fiente de poulet, est plus riche en carbone organique (C), en phosphore (P) et en bases échangeables, notamment, en calcium (Ca^{2+}) et en magnésium (Mg^{2+}) que le compost fait à base de bouse de vache. Seule la teneur en azote (N) a une tendance contraire, avec 34.89 g.kg^{-1} de N pour la bouse de vache contre 27,28 g.kg^{-1} de N pour la fiente de poulet.

Les deux types de compost ont des teneurs identiques potassium (K), soit 0,91% de matière sèche. Cette valeur est faible comparativement à celles des teneurs en magnésium et calcium, respectivement de 3,31 et 18,43 % de matière sèche, dans la fiente de poulet.

Au niveau de la bouse de vache, c'est le magnésium qui présente la plus faible valeur avec 0,74 % de mati-re sèche..

Aussi, la comparaison des deux types de compost montre-il que celui à base de fiente de poulet a un rapport C/N plus élevé (18,7) que celui à base de bouse de vache (11,4).

Tableau 2. Teneur en éléments minéraux des deux types de composts

Eléments fertilisants	Fiente de poulet	Bouse de vache
C ($g.kg^{-1}$)	50,89	39,88
N ($g.kg^{-1}$)	27,28	34,89
P ($mg.kg^{-1}$)	13,69	1,74
K (% de matière sèche)	0,91	0,91
Mg (%de matière sèche)	3,31	0,74
Ca (%de matière sèche)	18,43	1,49
MO ($g.kg^{-1}$)	87,53	68,59
C/N	18,7	11,4

3.2 EFFETS DE LA FUMURE ORGANIQUE SUR LA MATIERE ORGANIQUE ET LA CAPACITE D'ECHANGE CATIONIQUE DU SOL

L'analyse de variance des paramètres chimiques à 18 mois après plantation ne montre aucune différence significative entre les différents traitements (tableau 3) au seuil de probabilité de 5%. Cependant, certains paramètres chimiques de la fertilité du sol, tels que la matière organique (MO) et la capacité d'échange cationique (CEC), ont été légèrement améliorés avec l'apport de la fumure organique par rapport au traitement sans fertilisant (témoin absolu). Cet effet améliorant est plus perceptible à travers, les valeurs moyennes de ces deux paramètres, enregistrées pour les traitements T6, T7 et T8 du compost fait à base de fiente de poulet.

En effet, les teneurs moyennes du sol en matière organique, ont été respectivement de 3,98 ± 1,03 ; 4,07 ± 0,40 et 4,14 ± 0,24 $g.kg^{-1}$ pour les traitements T6, T7 et T8. Avec ces même traitements, les valeurs de la CEC ont été respectivement de 11,23 ± 6,91 ; 11,41 ± 3,63 à 12,81 ± 9,88 $cmol.kg^{-1}$.

L'apport de la matière organique sous forme de compost de bouse de vache et de fiente de poulet a également conduit à des valeurs moyennes de pH et d'azote, plus élevées, à l'exception de la double dose de compost à base de fiente de poulet, par rapport au témoin sans fertilisant. Contrairement, aux données de la matière organique et de la CEC, c'est le compost à base de bouse de vache qui a donnée des valeurs de pH légèrement plus élevées.

3.3 EVOLUTION DU PH DU SOL EN FONCTION DES DOSES CROISSANTE DE COMPOST

Aussi, l'évolution du pH en fonction des doses croissante des deux types de compost montre-il des tendances d'évolutions contraires. En effet, l'augmentation de la dose de compost à base bouse de vache, de la demi dose aux double de la dose recommandée, provoque une légère élévation du pH du sol, passant de 5,02 à 5,32, alors que le compost à base de la fiente de poulet, utilisé dans les mêmes conditions conduit à une légère baisse allant de 5,30 à 4,93 (figure 3).

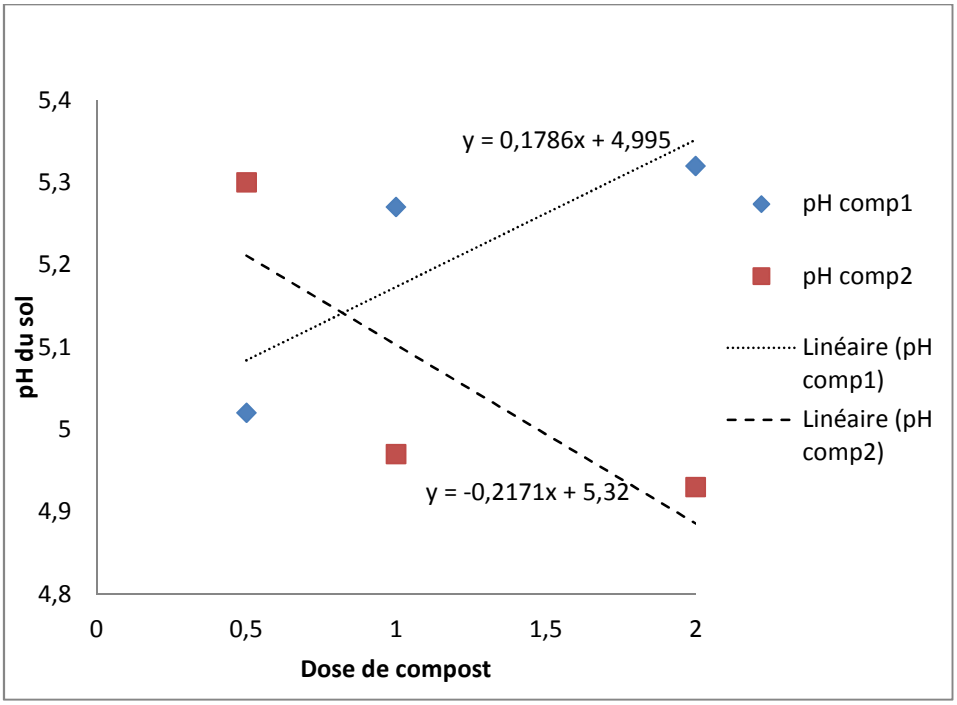

Figure 3. Evolution du pH du sol en fonction des fractions de la dose recommandée

Tableau 3. Caractéristiques chimiques du sol du site de l'étude

Traitements	pH eau	MO (g.kg^{-1})	N-total (g.kg^{-1})	C/N	P-ass (mg.kg^{-1})	CEC (cmol.kg^{-1})
T1	4,96 ± 0,27^{a}	3,22 ± 0,27^{a}	0,18 ± 0,02^{a}	11,99 ± 2,09^{a}	88,19 ± 16,84^{a}	7,01 ± 0,23^{a}
T2	5,06 ± 0,34^{a}	3,31 ± 0,60^{a}	0,20 ± 0,03^{a}	09,85 ± 2,66^{a}	67,36 ± 9,62^{a}	7,49 ± 0,51^{a}
T3	5,02 ± 0,38^{a}	3,62 ± 0,88^{a}	0,21 ± 0,04^{a}	11,00 ± 0,35^{a}	86,81 ± 24,06^{a}	8,21 ± 2,01^{a}
T4	5,27 ± 0,18^{a}	3,67 ± 0,67^{a}	0,19 ± 0,02^{a}	11,18 ± 0,74^{a}	88,19 ± 56,72^{a}	8,03 ± 1,09^{a}
T5	5,32 ± 0,29^{a}	3,73 ± 1,59^{a}	0,21 ± 0,07^{a}	11,33 ± 0,60^{a}	67,36 ± 10,49^{a}	7,25 ± 0,54^{a}
T6	5,30 ± 0,28^{a}	3,98 ± 1,03^{a}	0,21 ± 0,06^{a}	11,13 ± 0,69^{a}	74,39 ± 17,49^{a}	11,41 ± 3,63^{a}
T7	4,97 ± 0,22^{a}	4,07 ± 0,40^{a}	0,19 ± 0,03^{a}	11,11 ± 0,54^{a}	99,31 ± 21,38^{a}	11,23 ± 6,91^{a}
T8	4,93 ± 0,30^{a}	4,14 ± 0,24^{a}	0,17 ± 0,02^{a}	11,03 ± 0,40^{a}	78,47 ± 06,36^{a}	12,81 ± 9,88^{a}
Dl	7	7	7	7	7	7
MG	5,11 ± 0,29	3,72 ± 0,76	0,20 ± 0,04	11,08 ± 1,22	81,26 ± 23,64	9,18 ± 4,36
Pr < F	0,486*	0,822*	0,857*	0,735*	0,745*	0,636*

Les valeurs moyennes suivies de la même lettre dans la même colonne ne sont pas significativement différentes au seuil de 5 % (Test de SNK)
Dl : *Degré de liberté ;*
MG *: Moyenne générale ;*
* *: Non significatif*

3.4 EFFETS DE LA FUMURE ORGANIQUE SUR LES PARAMETRES DE CROISSANCE DES PLANTS IMMATURES

Le tableau 4 met en évidence les effets de la fumure organique sur les paramètres de croissance des plants âgés de 18 mois.

3.4.1 HAUTEUR DES PLANTS IMMATURES

Les hauteurs moyennes des plants ont varié de 222,23 cm (T3) à 310,17 cm (T7). L'analyse de variance a montré une différence entre les différents traitements au seuil de probabilité de 5%. Toutefois, les traitements T5, T6, T7 et T8 ont

favorisé une meilleure croissance en hauteur des plants par rapport aux témoins absolu et relatif. Les gains de croissance en hauteur ont été de 2,4 ; 2,5 ; 7,17 et 24,45 % respectivement pour les traitements T6, T5, T7 et T8 par rapport au traitement témoin absolu (T1) et de 12,64 ; 12,75 ; 17,88 et 36,89 % par rapport au traitement témoin relatif (T2).

3.4.2 DIAMÈTRE DU SCION

Au niveau des diamètres du scion, les résultats de l'analyse de variance n'ont montré aucune différence significative selon les traitements. Les valeurs moyennes ont varié de 19,54 à 24,30 mm de diamètre. Cependant, la variation moyenne la plus élevée a été obtenue avec le traitement T7 (Dose normale de compost fait à base de fiente de poulet).

3.4.3 UNITÉ DE CROISSANCE

L'analyse de variance de la variation moyenne des unités de croissance n'a pas montré de différence significative selon les traitements au seuil de probabilité de 5%. La variation la plus faible est observée au niveau du traitement T6 (Demi-dose de compost fait à base de fiente de poulet).

Tableau 4. Variations des hauteurs moyennes, des diamètres moyens du scion et des unités de croissances moyennes des plants immatures d'hévéa du clone IRCA 41

Traitements	H (cm)	DS (mm)	UC
T1	249,22 ± 69^{b}	21,02 ± 5^{a}	3,34 ± 1^{a}
T2	226,58 ± 66^{b}	21,11 ± 6^{a}	3,60 ± 1^{a}
T3	222,23 ± 86^{b}	19,54 ± 7^{a}	3,52 ± 2^{a}
T4	237,11 ± 96^{b}	20,17 ± 6^{a}	3,18 ± 2^{a}
T5	255,49 ± 88^{ab}	21,56 ± 8^{a}	3,29 ± 2^{a}
T6	255,22 ± 87^{ab}	20,60 ± 6^{a}	3,12 ± 2^{a}
T7	310,17 ± 17^{a}	24,30 ± 7^{a}	4,12 ± 2^{a}
T8	267,09 ± 76^{ab}	20,04 ± 5^{a}	3,50 ± 1^{a}
Dl	7	7	7
MG	252,89 ± 91	21,04 ± 7	3,34 ± 2
Pr < F	**0,002****	0,085*	0,213*

Les valeurs moyennes suivies de la même lettre dans la même colonne ne sont pas significativement différentes au seuil de 5 % (Test de SNK)
***Dl:** Degré de liberté, **MG:** Moyenne générale, * : non significatif **;** ** : significatif*
***H:** Variation des hauteurs, **DS:** variation des diamètres du scion,*
***UC:** Variation des unités de croissance*

3.5 TAUX DE MORTALITE DES PLANTS

La figure 4 présente le taux moyen de mortalité des plants par traitement. Les plus forts taux ont été observés au niveau des traitements T2 (témoin relatif avec engrais minéral) et T3 (demi-dose de compost à base de bouse de vache), avec des valeurs respectives de 11,43% et 8,33 %. Les plus faibles taux de mortalité (1%) ont été observés avec les traitements T7 (dose normale de compost fait à base de fiente de poulet) et T4 (dose normale de compost fait à base de bouse de vache).

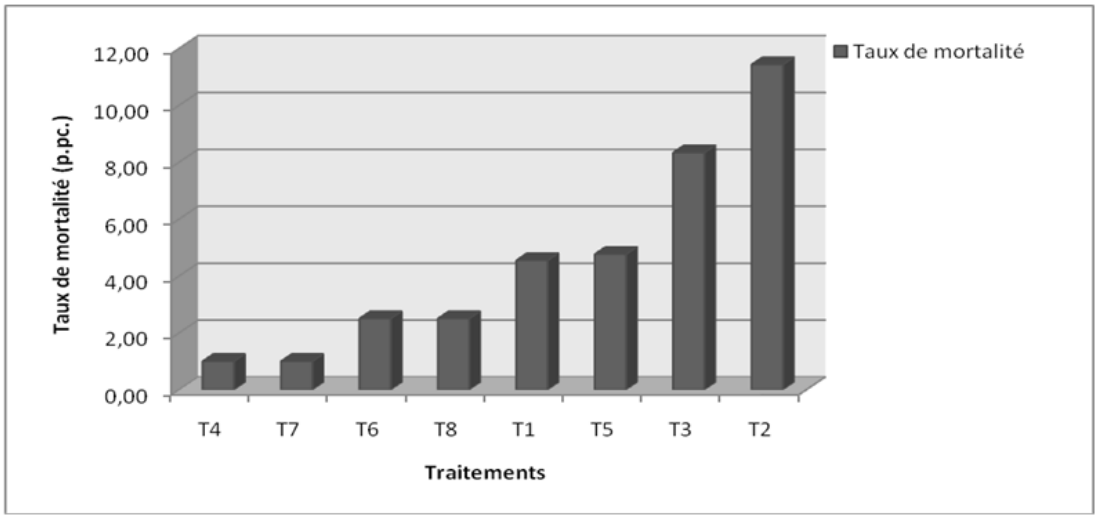

Figure 4. Taux moyen de mortalité par traitement

4 DISCUSSION

4.1 COMPOSITION DES COMPOSTS A BASE DE BOUSE DE VACHE ET DE FIENTES DE POULET

Bien que, 6 kg d'urée ait été ajouté à la bouse de vache et à la fiente de poulet, pendant la phase de compostage, pour éviter la faim d'azote [19] , la forte teneur en azote indiquée par les résultats d'analyse chimique sur les compost à base de bouse de vache et de fiente de volaille, serait une qualité intrinsèque à ces source de matière organique [20].

La plus forte teneur en azote observée pour le compost à base de bouse de vache comparativement au compost à base de fiente de poulet est contraire aux observations faite par [21]. Mais cela est à relativiser, car la concentration des éléments minéraux dans les déjections d'animaux est fonction de l'alimentation de ces derniers [22].

4.2 EFFETS DE LA FUMURE SUR LES CARACTERISTIQUES CHIMIQUES DU SOL

Les applications de fumure réalisées au cours de cette étude n'ont pas eu d'effet significatif sur les paramètres chimiques du sol, qui a bénéficié, si l'on considère la dose apportée au planting, de trois apports de compost en 12 mois. Cette fréquence d'apport, est supérieure à celle proposé par d'autres auteurs, pour ce type de fertilisant, à savoir une à deux applications par an [23]. Ces apports combinés à la durée de l'expérimentation (18 mois), n'ont certainement pas permis d'établir des différences significatives, dans la fourniture des éléments minéraux au sol.

Toutefois, la supériorité relative des valeurs obtenues après l'apport des différents types de composts, comparés aux deux témoins, a été également constatée par d'autres auteurs [24], relevant que les composts à base de fientes de volailles et de bouse de vache pourrait faire augmenter le pH du auquel, ils sont appliqués.

La valeur élevée du rapport C/N du compost à base de fiente de poulet comparativement à celui de la bouse de vache, montre que le compost à base de bouse de vache est plus stable que le compost à base de fiente de poulet. Les réactions chimiques conduisant à une matière organique stable, pourraient continuer au niveau du compost à base de fiente de poulet, si les conditions sont réunies. Ces réactions conduisent à la libération de divers composés, entre autres, des acides carboniques [25]. Ces acides seraient responsables de la baisse du pH en fonction des doses de croissantes de compost à base de fiente de poulet.

Quant au compost à base de bouse de vache, l'augmentation du pH en fonction des doses croissantes de compost montre que, ce fertilisant, à ce stade, joue le rôle d'amendement tel que rapporté par [26].

Les résultats montrent que la matière organique et la capacité d'échange cationique du sol ont été légèrement améliorées par les composts, avec un plus grand effet pour le compost fait à base de fiente de poulet. Cette légère différence observée serait due à la teneur en matière organique de la fiente de poulet qui est 1,28 fois supérieure à celle de la bouse de vache. En effet, la teneur en matière organique serait un facteur déterminant de la valeur de la capacité d'échange

cationique [27]. Par ailleurs, la fréquence et la quantité des apports de compost fait à base de fiente de poulet serait également des éléments explicatifs l'amélioration de la teneur en matière organique et capacité d'échange cationique, comme cela a été relevé par certains auteurs après l'étude des effets synergiques des engrais minéraux et de la fumure de volaille dans l'amélioration de la fertilité d'un sol ferrallitique (ferralsol) de l'Ouest de la Côte d'Ivoire [28]. La référence [29], lors de l'étude de la fertilisation organo-minérale du manioc (*Manihot esculenta* Crantz) et diagnostic des carences du sol, ont également fait des observations similaires.

4.3 EFFETS DE LA FUMURE SUR LES PARAMETRES AGRONOMIQUES DES HEVEAS IMMATURES

Après dix-huit mois d'essai, les résultats ont montré un effet significatif de l'application de la fumure organique sur la croissance végétative des plants immatures d'hévéa. L'effet positif de l'application du compost observé, a déjà été signalé dans plusieurs travaux, dont les études de l'influence de la fumure organique, du NPK et du mélange des deux fertilisants sur la croissance de Moringa Oleifera L. [30], des effets des amendements locaux sur les rendements, les indices de nutrition et les bilans culturaux dans un système de rotation coton-maïs dans l'ouest du Burkina Faso [31], de même que l'étude de la fertilisation organo-minérale du manioc [28]. Comparativement aux deux témoins (absolu et engrais minéral seul), les apports de composts ont amélioré la croissance en hauteur des hévéas immatures, notamment, le compost fait à base de fiente de poulet, et c'est le traitement T7 (dose normale de compost fait à base de fiente de poulet) qui a donné le meilleur résultat. Des résultats similaires ont été obtenus au Nigéria, relativement à la croissance du théier [32] et en Côte d'Ivoire, sur la croissance et le développement du cocotier en pépinière [14]. Cette croissance végétative induite par l'application de la fiente de poulet serait donc meilleure, comparée à celle induite par la fumure minérale ou même le compost fait à base de bouse de vache. En effet, l'application de compost fait à base de fiente de poulet, de par sa structure spongieuse et poreuse, mais aussi, de ses caractéristiques chimiques intéressantes pour l'amélioration de la structure du sol, serait responsable de cette croissance végétative. Cependant, le retard de croissance observé sur la micro parcelle ayant reçu l'engrais minéral serait dû au fort taux de mortalité observé, qui probablement pourrait s'expliquer par l'apport élevé de chlorure de potassium (47,2 $kg.ha^{-1}$) lors du planting.

4.4 EFFET DE LA FUMURE ORGANIQUE SUR LE TAUX DE MORTALITE DES PLANTS D'HEVEA IMMATURES

Les plus faibles taux de mortalité observés avec la dose complète des composts à base de fiente de poulet et de bouse de vache, par rapport aux témoins absolu et relatif, montre que la fumure organique pourrait réduire la mortalité des plants d'hévéa, en phase d'installation. Cela pourrait s'expliquer par l'amélioration du milieu trophique de la plante. Toutefois, l'augmentation des doses de fumure organique pourrait accroitre le taux de mortalité, rendant ces doses néfastes aux plants [33]. Cela est observé avec les doubles doses des fumures organiques (T5 et T8). Cette tendance est plus forte avec le compost à base de bouse de vache et se justifierait par la forte teneur en azote de ce compost [33]. Cependant, la supériorité du taux de mortalité obtenue avec la demi-dose du compost à base de bouse de vache, par rapport à la double dose de ce compost et au témoin absolu, montre la mortalité des plants serait la résultante de plusieurs facteurs.

5 CONCLUSION

Les résultats des travaux effectués au cours de cette étude, ont montré que, l'application de fumure organique, bien que n'ayant pas eu d'effets statistiquement significatifs sur les paramètres chimiques du sol à court terme, a néanmoins conduit à des différences relatives au niveau du pH, de la matière organique et de la capacité d'échange cationique.

Toutefois, sur les paramètres de croissance végétative des plants, des effets positifs préliminaires sont notés. La dose fractionnée de 1,2 $t.ha^{-1}$ de compost, fait à base de fiente de poulet, au regard des paramètres de croissance, du faible taux de mortalité et de certaines caractéristiques du sol, telle que le phosphore assimilable, serait le meilleur traitement.

Par ailleurs, les résultats témoignent de la nécessité de conduire les essais de fertilisation organique à base de compost, sur une période plus longue, afin de mieux apprécier les gains, tant au niveau du sol que des cultures pérennes.

REFERENCES

[1] J.M. Eschbach et M. Tonnelier, "Influence de la méthode de la stimulation, de la concentration du stimulant et de la fréquence de son application sur la production du clone GT 1 en Côte d'Ivoire", In : C.R. Coll. Expl. Physiol. Amél. Hévéa, IRCA-CIRAD, ed., Montpellier, France, 295-306, 1984.

[2] J.C. Prévôt, J.N.L. Jacob, R. Lacrotte, A. Vidal, E. Serrès, J.M. Eschbach and J. Gigault, "Physiological parameters of latex from Hevea brasiliensis. Their use in the study of the laticiferous system. Typology of functioning production mechanisms. Effects of stimulation", In : IRRDB physiology and Récolte de latex Meeting, Hainan, 1986, Pan Yanqing and Lhao Canwen Eds, South China Academy of Tropical Crops of functioning (Hainan), 136-157, 1986.

[3] R. Lacrotte, "Etude des relations entre la teneur en sucres du latex et la production. Approche des mécanismes du chargement en saccharose des laticifères *d'Hevea brasiliensis* Muell. Arg", Thèse de Doctorat d'Université, Université des Sciences et Techniques du Languedoc, Montpellier II, 266 p, 1991.

[4] S. Obouayeba, "Contribution à la détermination de la maturité physiologique de l'écorce pour la mise en saignée d'*Hevea brasiliensis* Muel. Arg. (Euphorbiacées) : Normes d'ouverture". Thèse de Doctorat Unique. Université de Cocody, Abidjan, Côte d'Ivoire, 225 p., 2005.

[5] Y.T. Brou, F. Akindès, et S. Bigot, La variabilité climatique en Côte d'ivoire : entre perceptions sociales et réponses agricoles, Cahiers Agricultures vol. 14, n°6, novembre-décembre 2005, pp. 533 -540, 2005.

[6] A.M. Kouassi, K.F. Kouamé, B.T.A. Goula, T. Lasm, J. Paturel, J. Biemi, "Influence de la variabilité climatique et de la modification de l'occupation du sol sur la relation pluie-débit à partir d'une modélisation globale du bassin versant du N'zi (Bandama) en Côte d'ivoire". Rev., Ivoir., Sci., Technol., 11 (2008) 207-229., 2008

[7] T. Brou, 2010. "Variabilité climatique, déforestation et dynamique agrodémographique en Côte d'Ivoire", Sécheresse, Vol. 21, n°4, pp. 327 -329, 2010

[8] Y.S. Affou, et K. Tano, "Situation foncière et émigration dans la boucle du cacao (Côte d'ivoire) ", Agronomie africaine Volume III (1) : 35 – 43, 1991.

[9] R. Manlay, "Dynamique de la matière organique à l'échelle d'un terroir agropastoral de la savane –ouest africaine (Sud-Sénégal) ". Thèse Doctorat ès Sciences de l'environnement. Ecole Nationale du Génie rural, des Eaux et Forêts. Université de Montpellier, 246 p., 2000.

[10] A. Gros, "Engrais – Guide pratique de la fertilisation". 6ème édition Revue et complétée. La maison Rustique, 436 p., 1974.

[11] C. Piéri, "Fertilité des terres de savanes. Bilan de trente ans de recherche et de développement agricole au sud du Sahara". Ministère de la Coopération et du développement, Centre de coopération International en Recherche Agronomique pour le Développement (CIRAD), Paris, France, 444 p., 1989.

[12] D. Soltner, "Les bases de la production végétales". Tome I : le sol et son amélioration, 23è eds. Poitiers (France) : Sciences et Techniques Agricoles, 472 p., 2003.

[13] D.M. Djéké, T.K.P. Angui, et Y.J. Kouadio, "Décomposition des broyats de coques de cacao dans les sols ferrallitiques de la zone d'Oumé, centre-ouest de la Côte d'Ivoire : Effets sur les caractéristiques chimiques des sols", Biotechnol. Agron. Soc. Environ., Vol. 15 (2011) n°1: pp. 109-117., 2011.

[14] M. Zadi, "Effet de deux types d'engrais organiques sur la croissance et le développement du cocotier (*Cocos nucifera* L.) Hybride PB 113+ en pépinières". Mémoire de DEA. Abidjan (Côte d'Ivoire) : Université d'Abobo – Adjamé, UFR des Sciences de la nature ; 60 p., 2013.

[15] M. Eldin, Le climat. In Le milieu naturel de Côte d'Ivoire. ORSTOM Paris, pp. 73-108., 1971.

[16] Aké G. E., Kouadio B. H., Adja M. G., Ettien J-B., Effebi K. R., et Biémi J., "Application des méthodes DRASTIC et SI pour l'étude de la vulnérabilité à la pollution par les nitrates (NO3-) de la nappe de Bonoua (Sud-Est de la Côte d'Ivoire) ", Int. J. Biol. Chem. Sci. 4(5) : pp. 1676 – 1692., 2010.

[17] AFES, "Classification des sols, travaux CPCS 1963 – 1967", édition 1967, 100 p., 2011.

[18] Perraud A., "La matière organique des sols forestiers de la Côte d'Ivoire". Thèse, Nancy, 134 p., 1971.

[19] CFPPA du Morvan, "Broyage, paillage et compostage – Le guide pratique, tout savoir sur la valorisation de nos déchets verts après broyage", Conseil Général de la Nièvre, 8 p., 2012.

[20] B. Leclerc, "Guide des matières organiques". Tome 1, Deuxième édition, ITAB pp. 115-119, 2001.

[21] D. Ziegler et M. Héduit, "Engrais de ferme, valeur fertilisante, gestion et environnement", ITCF, ITP, ITEB, France, 35 p, 1991.

[22] E. Lorinquer, P. Ponchant et P. Levasseur, "Composim : le calculateur de la quantité et de la composition des effluents porcs, bovins et volailles, Notice d'emploi et guide méthodologique", IFIP, IDELE, ITAVI, 36 p., 2014.

[23] E. Bouvier, G. Gazeau et D. Jammes, Adapter les apports organiques au sol, Les sols vivants, Matières organiques, Fiche n°3, 8 p., 2012.

[24] S. Dragon et C. Icard, "Effet d'apport de différents amendements organiques sur les propriétés du sol - Bilan de 15 années d'essai en culture légumière à la SERAIL", Echo-MO n° 81, 5 p., 2010.

[25] I.E.A. Znaïdi, "Etude et évaluation du compostage de différents types de matières organiques et des effets des jus de composts biologiques sur les maladies des plantes", Mémoire de Master, C.I.H.A.M. Méditerranien Agronomic Institute of Bari, 91 p., 2002.

[26] A. Weill et J. Duval, "Les amendement organiques : fumiers et composts, Module 7 : Amendement et fertilisation, In : Guide de gestion globale de la ferme maraichère biologique et diversifiée", Equiterre, 19 p., 2009.

[27] G. Huber et C. Schaub, "La fertilité des sols : L'importance de la matière organique", Agricultures et Territoires, 42 p., 2011.

[28] Akanza K., P. et Yoro G., "Effets synergiques des engrais minéraux et de la fumure de volaille dans l'amélioration de la fertilité d'un sol ferrallitique de l'Ouest de Côte d'ivoire, Agronomie Africaine, Vol. 15 (3). pp. 135 – 144., 2003.

[29] Akanza K. P. et Yao-Kouamé A., "Fertilisation organo-minérale du manioc (*Manihot esculenta* Crantz) et diagnostic des carences du sol", J. Appl. Biosc. 46 : pp. 3163 – 3172., 2011.

[30] Pamo E.T., Boukila B., Tonfack L.B., Momo M.C.S., Kana J.R. et Tendonkeng F., "Influence de la fumure organique, du NPK et du mélange des deux fertilisants sur la croissance de *Moringa oleifera* LAM. Dans l'Ouest Cameroun". LRRD News 3 : pp. 53 – 62., 2005.

[31] Koulibaly B., Traoré O., Dakuo D., Zombré P.N., "Effets des amendements locaux sur les rendements, les indices de nutrition et les bilans culturaux dans un système de rotation coton-maïs dans l'ouest du Burkina Faso", *Biotechnol. Agron. Soc. Environ*. 2009 13(1), 103-111, 2009.

[32] Ipinmoroti R.R., Iremiren G.O., Olubamiwa O., Fademi A.O., and Ipinmoroti, R R., Adeoye G.O. and Makinde E.A., "Effects of urea-enriched organic manures on soil fertility, tea seedling growth and pruned yield nutrient uptake in Ibadan, Nigeria", Bulg. J. Agric.Sci.,14: pp. 592 – 597, 2008.

[33] V.I. Tchabi, D. Azocli et G.D. Biaou, "Effet de différentes doses de bouse de vache sur le rendement de la laitue (Lactuca sativa L.) à Tchatchou au Bénin", Int. J. Biol. Chem. Sci. 6(6): 5078-5084, 2012.

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ICT integration & the role of school leadership: perceptions of head teachers of secondary schools in Quetta Pakistan

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ABSTRACT: The study figure outs perceptions of secondary school head teachers about ICT integration in teaching and learning in schools in Pakistan with focus on Balochistan Province. This was a qualitative study with having eight head teachers as research participants while interviews, informal talks and focused group discussion were used as data collection tools. It is observed from the findings that most of the head teachers had positive perceptions about integration of ICTs into day to day teaching and learning practices. In addition the head teachers although revealed many hindrances in the way of integration of ICT into teaching and learning practices but there existed a significant optimistic approach, at the end of schools' head teachers, for having considered many enablers for promoting ICT integration in teaching and learning. Their effective leadership role was found to be the man enabler in this regard.

KEYWORDS: ICT, Head teacher, Perceptions, ICT integration.

1 INTRODUCTION

The changing times make the job of the educational institutions very much crucial as the 21st century generation demands much more from the schools and the teachers [18]. Since the revolutions in ICT the role of teachers and institutions needs to be redefined [4] and ICT integration therefore earns serious and considerable recognition worldwide and is widely explored [31],[13],[29],[35],[10],[21]. Schools in Pakistan, however, confront with and struggle to face challenges hindering ICT integration. Research studies, in the context of Pakistan, [25] underpin certain challenges hindering the integration of ICT in teaching and learning. These studies highlight lack of teacher's skills, of using ICT in teaching and learning, non availability of ICT facilities and non ICT supportive environment at schools as some key hindrances in the way of its integration at schools.

Despite all these challenges the studies of [11] and [16] for example, also observe a significant improvement in teachers' skills of ICT integration once their capacity is enhanced while [25] finds major development in students' learning outcomes due to ICT being used in teaching and learning by the teachers. This informs that despite the challenges ICT integration bears fruits when measure, like teachers' capacity building and provision of ICT resources, is made. Though teachers' engagement in capacity building programs enhances teachers' skills of ICT integration but theory and practice according to [8] are strongly linked and therefore teachers must be provided regular on the job support. In this regard research study [11] considers support from the school management one of the key enabler for ICT integration. While research in other part of the world do inform that head teachers possess a key role in ICT integration in the process of teaching and learning [15],[27],[2]. Head teachers as educational leader and manager posses a fundamental role in schools in Pakistan [28],[24],[19],[20] and hence could enable ICT integration in schools [11].

Though research informs about head teachers' role being very much fundamental in ICT integration but it becomes imperative to get aware of how do they perceive their role in this regard. This research explores about the perceptions of the head teachers of eight secondary schools, of Quetta Pakistan, to have insight about their perceptions in ICT integration in the process of teaching and learning.

2 CONTEXT & BACKGROUND

Eighteenth Constitutional Amendment, in the constitution of Islamic Republic of Pakistan 1973, has introduced a number of changes that have profound impacts on the existing institutional as well as legal framework of education in Pakistan. Certain major changes such as insertion of article 25-A and omission of concurrent list have occurred. The amendment has resulted in delegation of number of subjects to the legislative and executive jurisdiction of the federating units, the four provinces namely Punjab, Khyber Pukhtunkhwa, Sindh and Balochistan. These subjects, before the amendment, remained in the jurisdiction of the federal government. In context of education these include curriculum, syllabus, planning, policy, centres of excellence, standard of education and Islamic education.

The education department, Government of Balochistan, has further devolved powers to the districts and schools. In addition to devising a Balochistan Education Sector Plan (BESP), District Education Plans (DEPs) have also been developed, through consultative process at districts, for all the thirty two districts of the province. Furthermore targets of the district plans will be reflected in the school development plans being devised by the schools. There are 810 secondary schools in the province [6] and each one has been declared as a hub for the neighboring schools while this forms a cluster where the secondary school functions as nucleus in terms of implementing educational interventions and reforms. The head teachers of the hub schools have been empowered with regard to monitor and assess the performance of his/her own school and of the neighboring ones. S/he has also been authorized, via providing annual budget, to purchase furniture and other reading and writing material for his/her and the neighboring schools as per needs.

Owning to and on the face of Pakistan's Medium-Term Development Framework 2005–2010, Vision 2030 and National ICT strategy and the achievement of their goals and the ultimate aim of a knowledge-based economy[4], in the post 18th amendment scenario ICT, in the face of all the interventions remains a cross cutting theme. For example, Education Management Information System [6] has been transformed through a robust and effective use of ICT while real time school monitoring is being carried out through digital devices. Specific interventions with regard to ICT integration in the process of teaching and learning has also been made through certain initiatives. Chief Minister's ICT program has just been initiated where ICT resources are being provided to all the secondary schools of Quetta. While another key intervention regarding ICT integration is the proposed provision of ICT resources to 100 secondary schools of the province. In addition to ICT resources electricity back up support is also being provided to the selected schools due frequent to electric power shut downs occurring in Pakistan [16] A resource center is planned to be established at Quetta where subject experts will devise ICT based teaching and learning material and the same will be provided to the schools for ICT integration in the process of teaching and learning.

All these factors lead to form a different context of education where clarity of roles and responsibilities have been defined at provincial, district and school level in particular the context of schools has become scale of success for any interventions and the head teachers remain the key change agent [7]. ICT being focused and intervened at schools and the head teachers being empowered needs to have clarity and through understanding of the integration of ICT in teaching and learning practice, as they have a leading role in educational intervention [28] and in particular in the exiting educational scenario in Balochistan their role becomes more central. This therefore, becomes pivotal to have the insights of how these head teachers perceive ICT integration in the learning process as their perceptions and attitude matter a lot in playing their leadership role effectively [34]

3 OBJECTIVES OF THE STUDY

The key objective of the study was to identify perceptions of head teachers of secondary schools in Quetta Balochistan abut ICT integration in the process of teaching and learning.

4 RESEARCH QUESTION

What are the perceptions of the head teachers, of government secondary schools in Quetta Balochistan, about ICT integration in the process of teaching and learning?

5 LITERATURE REVIEW

ICT in education has been in debate since its revolution and its adoption for creating knowledge economies and education has not remained a part as the very purpose of ICT in education, according to [37] is to facilitate better learning. Research informs that the organizations that do not fit in the use of new technologies provided by ICTs cannot significantly claim to prepare their students for life in the 21st century [18]. Their study suggests that the use of ICT in teaching and learning process enables students via engaging them in problem based learning and make them impendent and critical thinkers. They further argue that the use of different approaches offered by ICTs enhance teaching and learning by transforming the environment into the one that is learner cantered.

The term learner cantered here refers to a complete paradigm shift from teacher cornered and student cantered but rather to one where both are equally involved in the process of learning. So, leaner cantered understandably means that not only students but also the teachers are engaged in the learning process and there prevails a learning environment where they learn in collaboration and learning becomes a collaborative process. ICT according to [11] seems to be concerned with achieving the goals of creating and transforming learning environment. For solving the varied problems of education it is understood that educational technology, as previously discussed, promotes suitable child learning processes. In developing countries, as [36] explores, it has to be mastered and utilized by educationists if they are to keep pace with each other and catch up with the developed nations.

Pakistan as a developing country do face huge demand from society to force schools to give appropriate response to this technical innovation [16],[11]. Schools face a huge challenge to meet the expectation of society's demand of ICT integration. The same becomes more challenging when research [11] explores lack of trained teachers and their low level of motivation, towards opting ICT as a tool of teaching and learning, as one of the key hindering factors in integration of ICT in teaching and learning. They emphasis upon developing teachers professionally to meet the purpose ICT integration. In the presence of ICT skilled teachers major differences in the learning of students and teaching approaches are observed [14]. Schools in the western world invested a lot for ICT infrastructures and teachers capacity enhancement over the last 20 years, and students use computers more often and for a much larger range of applications [37].

Research in the context of Pakistan, finds that most of the teachers are willing to integrate ICT in the process of teaching and learning [11]. A research study [16] carried out in the context of Khyber Pakhtoonkhwa and Punjab provinces of Pakistan on the impacts of teachers course on ICT integration finds a strong correlation between capacitating teachers and its delivery at the classroom level. Study [25] finds higher students learning outcomes in the result of ICT integration in the process of teaching and learning while another study [1] recommends focusing on enhancing the skills of the teachers to meet the purpose of ICT integration. This refers to a strong desire and competency at the end of teachers and a better future prospect with regard to ICT integration in teaching and learning in schools in Pakistan.

Theory and practice are strongly linked [8] while teacher working context is very vital in enhancing their skills of ICT integration [31]. It is fundamental that, in addition to enhancing teachers' capacity, they are to be provided enough on the job support. Such support could only be provided via offering opportunities to the teachers for their growth in ICT at their schools as [12] considers the same to be possible through effective educational leadership. School leadership according to him possesses a key role in this regard as their involvement in the academic process encourages teachers to take part in their ongoing professional growth. He suggests the need to develop a collaborative learning environment at work place and such environment is considered as a process "… in which the teachers in a institute and its administrators continuously seek and share learning, and act on their learning. The goal of their actions is to enhance their effectiveness as professionals for students' benefits…" (p.1).

A study [5] suggests that head teachers themselves have to become authentic learners and integral players in the learning environment they endeavor to create. They are usually perceived to be the role models for teachers and initiatives taker [22]. When they change their own practices and involve in or facilitate teacher learning, the teachers are more encouraged to help each other to grow professionally [5],[7],[9] So, it is quite evident that enhancing the ICT skills of the teachers head teachers need to improve their own capacity with regard to ICT integration. Otherwise their insufficient knowledge and negative perceptions of ICT in teaching and learning will hamper ICT integration in schools [15]. In addition to their understanding of ICT integration their heartening behavior towards teachers, for integrating ICT, inspires them to have a sincere commitment to their own as well as to the learning of students [30]. The head teacher therefore, has to be supportive rather than directive and should guide rather than dictate and must lead from the heart.

A research study on ICT integration [23], in Tanzania, finds the role of head teachers very central while [11] in the context of Pakistan, also proposes the administrative support very much important for the integration of ICT. In Kuwait a research study [2] finds strong co-relation between support from the head teachers and the ICT integration in schools. His study also

reveals that the supportive policies strengthen the role of head teachers to a greater extent. His study informs that the role of head teachers become more effective if the policies provide room for practicing their powers and the influence. Head teacher role associated with influence, power and accountability and finds it pivotal [26]. In the prevailing policy, of power devolution in Balochistan, the head teachers accommodates what [2] recommends and expands their horizon of influences for playing a central role towards the integration of ICT in teaching and learning practices. In addition when the ICT infrastructure, at schools, is also strengthened by the education department, then there emerge ideal conditions for the head teachers to play their role in this regard. This is informed that although teachers remain central in accommodating ICTs into classrooms but the spotlight has shifted to head teachers as key change agent for sustained ICT integration at schools [27]. The head teachers are therefore, very much effective in ICT integration and [15] recommends exploring the same further.

Research in Pakistan though explores about the issues or factors that hinder ICT integration but it meanwhile also suggests to exploring about factors that can make ICT integration possible in schools [11]. The role of head teachers being more considered and found central in ICT integration [27] need to be explored to find how they could make ICT integration possible in schools in Pakistan. The role of head teachers in the context of Pakistan has already been recognized very much fundamental in the overall educational reforms and initiatives [24]; [19]; [20] however, in the prevailing newly emerging educational context after power devolution and the establishment of schools clusters their role becomes much more critical. It is recommended that principals, in Pakistan, need to utilize their leadership capabilities towards integrating technologies [24].

This study, in the foresight of all the available literature and at the face of policies that empowers school leaders as key change agents and schools as a real implementation ground for gauging success of educational reforms, finds it pivotal to investigate about how the head teachers perceive the integration of ICT at schools. This is assumed to help in surfacing their perceptions for ICT integration at schools that afterwards lays a foundation for exploring avenues for ICT integration in schools in the context of Balochistan province of Pakistan as head teachers' perceptions and attitude matter a lot in playing their leadership role effectively [34].

6 METHODOLOGY

The qualitative research paradigm was used to generate data from the participants' perspectives in the natural setting, which [3] considers one of the basic characteristics of the qualitative research. It is argued that "Qualitative researchers are interested in understanding people's experience in the context. The natural setting is the place where the researcher is most likely to discover or uncover what is to be known about the phenomenon of interest" [17]. It was important to interact with the principles in real setting to gather healthy and reliable information.

Purposive sample of eight schools with equal participation of boys and girls schools was maintained. The research sites were selected on the basis of availability of ICT infrastructure and ICT teachers. The study had eight head teachers as research participants. A proper prior consent, of the participants, was earned. Semi structured interviews, informal talks and focused group discussions were used as data collection tools. A simultaneous data analysis was done to focus and shape the study as it proceeded. All the categories of the collected data were compared and connected for a more comprehensive meaning making. The reflective memos, field notes and interview transcripts provided substantial support in analyzing and interpreting the data.

7 FINDINGS AND ANALYSIS

In relation to head teachers' perception of ICT integration in teaching and learning at their schools few of the head teachers were found so hesitant about thinking of ICT integration to be merely impossible in initial interviews while in later seating they were with totally changed perceptions. It shows that being not in the discourse of ICT integration they did not feel the intensity of the ICT integration at schools and most importantly in teaching and learning practices. A head teacher in the initial interview shared that they, their school, did not need ICT as they could hardly teach through chalk and blackboard and according to him it was better to effectively manage the same. While in the second interview he shared:

> *"Don't take my first interview seriously as my views are now changed after I discussed it [ICT integration in teaching and learning] with my ICT graduate daughter. She shared how she is thought through ICT at her university. It is very effective and now I feel why children are afraid of coming schools as they are fed up with the same chalk and blackboard approach. They are the kids of their new world while we teach them with the way we were taught….. Since [after having discussed with his daughter] than I think if the teachers of the university can use ICT in teaching than why not we [schools]…. Though it seems difficult but merely doable… you come next time and you will not see my computers [including other ICT resources] that dead but completely utilized"*

The views of the head teacher underpin a very important aspect of lack of awareness of some head teachers about ICT integration. The same reflects as causing their lack of interest and intentions in this regard. It also reveals that head teacher's less conceptual understanding of their role as [34] also finds have less room left for creativity and change. On the other hand six of the eight head teachers had enough understanding of ICT and its integration in teaching and learnig. They could simply exemplify about how ICT could enhance teaching and learning practices. A head teacher for example shared that if he sees ICT being hugely become part of daily affairs then why not in schools. If shopkeepers for example, manage their business through ICT like CCT cameras and accounting software then why not the schools and the head teachers, according to them, in particular, should help schools to get enable in this regard. Most of them were of the view that ICT can be integrated in teaching and learning practices but may not be to the extent that the developed world opts to.

A principle upon responding to a question of how their perception could be exemplified said that he himself has used certain ICT applications in the classroom. He added that in addition to download different material, such as activity sheets, from the internet and used them in the class. Another head teacher shared that i have been using MS word and in particular Excel in my school planning and budgeting and I think teachers can use the same for enhancing students' skills of organizing and analysing the data. Such understanding of head teachers surfaces an encouraging aspect of their perception for ICT integration in teaching and learning. Another head teacher with having good examples for ICT integration added that ICT integration could be possible, that in addition to provision of ICT equipments, teachers' capacity is enhanced and supportive environment is created at schools by the head teachers so teachers practices newly learnt skills and approaches. He considered head teachers' role very imperative being having powers in schools and in particular after being empowered by the education department. He was confident to have opened the door of ICT integration. In addition to creating opportunities for teachers professional development for ICT integration a head teacher stated that their own skills need to be enhanced first, prior to engage teachers in teaching through ICT. She said:

> *"We always force others to do things for us and the same perceptions may exist with regard to ICT integration. I have always tried to lead with examples and this convince teachers better than what I intend to convince them through debates and conversations. I strongly support ICT integration in the teaching and learning process as I consider it very much fundamental in this modern world. I have learnt about ICT and its integration into teaching and learning with the help of our ICT teacher"*

This head teacher perceives herself as role model and the same reflects in the integration of ICT. To bring about change head teachers, according to her, must lead from the front, via setting examples, in order to inspire and motivate teachers to adopt that change.

She further added that they need to learn from one another at schools as according to her at schools there exist very skilled human resource and according to her she usually go to her teachers for her own learning because she felt that it was not important that a head teacher must ask teachers to meat at her/his office. The perceptions of the head teachers considers the integration of ICT through developing a collaborative cultures at schools as the literature perceive and propose the existence of learning communities or learning organizations where each one seek and learn without fear and authority from one another [32].

In response to what means could they perceive as fundamental elements for ICT integration they mostly pointed out strong desire and motivation of head teachers and teachers for laying the bases for ICT integration at schools. A head teacher pointed that availability of ICT resources are fundamental for ICT integration but according to her they do have equipments that they could proceed with and pointing out the scarcity of resources some time could not be justified as a hindrance in the way of ICT integration but rather an excuse at our part. Another head teacher also shared that there were enough ICT resources in their schools and enough to introduce ICT in teaching practices. Adding further she shared that the need for further resources would definitely emerge as they continued with ICT integration and could put the demands for further resources. Such perceptions of the head teachers reveal a fundamental phenomenon of the process of change being inevitable and beginning from where the change is possible [7]. Probing further, surfaces another important aspect that in parallel to demanding for more ICT resources they need equally skilled and qualified teachers. So, although resources do matter but trained teachers and having a supportive environment available for teachers' professional development, at school, need to earn more focus as ICT integration will need on the job support for the teachers, she added.

Two of the female head teachers perceived ICT very much helpful in managing schools as they were of the opinion that ICT had contributed into many aspects of the schools ranging from devising student assessment tools, exam results, announcing results, maintaining updated record of the school. Though the same doesn't show to have direct link with ICT into teaching and learning but definitely lead to generate cross cutting value of ICT and could definitely trigger its use in each aspect of the schooling. Teachers when see the head teachers using ICT in their professional domain will definitely think of the same in their teaching and will look for exploring further in this regard.

Head teachers perceived the provision of technical and moral support to the teachers with regard to ICT integration very pivotal. In response to exemplifying the support most of them revealed the recognition of incentives in form of awards, encouraging teachers on occasion and during the school assembly. Two of the head teachers were of the opinion that in addition to such support they needed to support teachers via providing technical inputs either by them or having such human resource arranged for them. They considered ensuring the required material such as varied software, internet connectivity and other necessary ICT tools available for the teacher. This refers to head teachers' understanding of the support on their part as [29] finds in his study that the school leadership in Bahrain is limited to recognition and appreciation of teachers efforts and propose school leadership to go beyond appreciation and recognition of teachers efforts via providing technical support and becoming a role model in this regard.

Two of the head teachers pointed out shortage of time a key factor that hinders ICT integration. According to them the teachers have to cover a lengthy syllabus which makes it difficult for them to engage teachers in extra sessions for enhancing their skills of ICT integrations. Four of the teachers on the other hand did consider the same as a key hindrance but were of the view that they needed to think out of the box and could create opportunities for teachers' engagement in sessions being organized for improving their skills of ICT integration. They proposed certain strategies as a head teacher elaborated:

> *"Why do we think we need to have eight periods a day and each period of 30 minutes… this is not a universal rule … we can manage time by many ways such as teaching four subjects in one week and four in other and maximize the period timings so, we can cover syllabus and have sessions, at least a week for teachers to help them enhance their skills".*

Another head teacher came up with more suggestion as she shared that they would co-teach with the teachers to help them during what they actually do in the classroom. She said… it will help mange time effectively and facilitate the teacher in real working environment and develop good working relationships with the teachers and even involve the students in the process. Such opinions leads to evolve head teachers role to more a mentor and coach rather merely a school administrator.

The head teachers, all of them, were of the opinion that ICT integration remains possible once they are themselves capable of integrating ICT into teaching and learning practices. A strong desire and optimistic opinion were found at their end with regard to ICT integration as they perceived ICT as facilitating teachers and students in their learning. According to them it depended mostly on the head teachers that how they come up and play their leadership role effectively towards making teachers enable to integrate ICT in their teaching practices.

8 DISCUSSION

The findings inform about the head teachers perceptions to be very positive towards ICT integration. They consider schools equally responsible to respond to the changes and demands that ICT has. In addition they were also able to inform about how they perceive their leadership role towards facilitating the ICT integration. This reveals the idea of ICT integration being well realized yet the same is new to them. The important point is that these head teachers were open to learning. A head teacher, for example, not considering the ICT in teaching and learning was very much convinced when he was oriented by his daughter about the due role of ICT in education and he had very different and positive perceptions in the next session of interview. This implies that enhancing head teacher' skills remain prerequisite in order to improve their leadership role with regard to ICT integration or other educational initiative and reform. [20] In the same way found that if the head teacehrs are aware of the scope and value of ICT in the due process of learning then it will make them more inclined to and effective in playing their role towards ICT integration.

The head teachers have considered a collaborative learning culture and supporting working conditions as a vehicle for professional growth with regard to ICT integration. The same process was perceived by the head teachers to be very much important for their own and the learning of the teachers. This is similar to the findings of other studies [2],[15]. In this study there were certain facets ranging from regular interaction and discussions, organization of session and co-teaching perceived to be vital for ICT integration. Above all the head teachers perceived their own involvement a corner stone in this regard. The same is refers to pedagogical leaders that becomes integral part of the teaching and learning practices [32] rather than behaving as boss and focus more on directing others. Such perceptions, of the head teachers, are found to be more of enabling others and in particular very helpful towards ICT integration at schools [27].

In addition to their own involvement in the due process of ICT integration in teaching and learning practices the head teachers perceived their out of box thinking as a major shift from a more traditional style of leadership and management, that is limited to accomplishment of more administrative tasks, to initiating the process of change [22]. The head teachers for example considered the work load of teachers and shortage of time, as mostly the head teachers in Pakistan are faced with [28] as a key hindrance in ICT integration and proposed to deal with these issue more tactically rather than blaming the issue

and having their hands up. A head teacher for example provided an insight about how she could minimize the issue via bringing about change in the length of period as according to her a thirty minute period and eight periods in a day was not a universal truth. She could maximize period duration to an hour and have four to five periods a day via putting alternate subjects a week. Such approach of the head teachers reveal them to be more focused about eliminating the hindrances via realizing their due role. This refers to improved leadership skills and strong level of empowerment and of the paradigm of practicing powers and empowering and heartening other [30].

Another key aspects revealed by the head teachers was scaling up the ICT integration gradually rather than waiting for the environment to become ideal in terms of availability of sophisticated ICT resources and intervene with full scale reforms agenda of ICT integration. They were more focused on ICT integration not as only about availability of the required resources but about influencing and empowering teachers in the ongoing engagement in their learning. The same perceptions of the head teachers emerge as one of the key enablers towards ICT integration in teaching and learning. They deem to have good understanding of their context in terms of the available ICT resources, the human capital and above all the level and scope of ICT integration in teaching and learning.

9 Implications Of The Study

Being a small scale qualitative research, the findings might not be applicable for all educational contexts but they provide head teachers of the province, or of the similar contexts, deeper insights about framing future strategies with regard to ICT integration in day to day teaching and learning practices.

The research for example [19] consider the role of the head teacher very significant in the context of developing countries and in the context of Pakistan in particular, where the teachers have fewer opportunities for professional development and the head teachers are more concerned about administrative affairs rather than the academic ones. However, it is now time for the head teachers to think of their roles seriously in terms of ICT integration at schools in order to meet the challenges of modern era that revolution of ICT has imposed on schools. This study will help and provoke the desire of head teachers for ICT integration as they will think seriously about ICT integration as a dire need and an imperative to be opted by them towards transforming schools into real learning places.

The findings earn more value in the educational scenario of power devolution to the clusters and the head teachers of the cluster schools having the horizon of influence more broadened. The findings can help them about how to integrate ICT at their own schools and at the neighboring ones coming into their cluster jurisdiction.

The study was conducted in public schools, in Balochistan which were similar, in terms of physical resources especially with regard to ICT infrastructure and ICT skilled human resource, to the rest of the schools in Pakistan and particularly in Balochistan. By sharing the similarities do not mean that the head teachers in other public schools can or should necessarily perceive ICT integration in the same way, but they may add value via perceiving ICT integration beyond the perceptions of head teachers in this study and hence may establish effective ICT integration at their schools.

10 Recommendations

The study surfaces new dimension of head teachers' role, as they despite many hindrances in the way of ICT integration, is found very much optimistic. At instances some head teachers had very practical ideas and strategies for ICT integration in schools and it therefore, would be very much fundamental if future research focuses on the role of these head teachers in ICT integration at schools and in particular enabling teachers towards its use in the process of teaching and learning. The study at instances finds the female head teachers being more optimistic and serious about ICT integration in teaching and learning practices so, exploring the same from gender perspective would also be very much interesting and productive.

Most of the head teachers, in the study, were found more aware of their due role in the process of educational change with respect to ICT integration but at instances few lacked deeper understanding about ICT in education. The same establishes a fundamental need for enhancing their understanding in this regard. This aspect calls for serious consideration, of the education department, policy makers and educationist, about how they strengthen their understanding of ICT in education.

One of the major recommendations would be to look into how empowering the head teachers leads to effective educational reforms or serve the overall school improvement agenda. This study finds the empowerment of the head teachers' as one of the significant dimensions in terms of enabling them thinking out of the box, challenging the laid down traditional principals and the statuesque and bringing about change. This aspect does need some consideration in terms of looking at it from the perspective of a correlation between empowerment and accountability.

In the context of the developing countries, particularly in Pakistan, where opportunities for teachers' professional development are very limited, studies need to be conducted to explore appropriate ways that help teachers grow professionally in the area of ICT by providing opportunities at the school level. So, studies conducted in this regard in the context of Pakistan but in particular in Balochistan, where head teachers become more influential in terms of possessing more authority and influence after being empowered through cluster based power devolution, would be a valuable contribution towards integration of ICT in teaching and learning at schools.

Another important feature, as this study explores, could be to look into ICT from the perspective of its use in helping out the head teachers in effectively managing schools. The same if explored further would provide deeper insight to them in this regard.

11 CONCLUSION

The head teachers, in this study, were found to be very much inspired with the use of ICT in education and perceived the same to be greatly applicable at the school level. They considered bringing about change with regard to ICT integration a slow and gradual process that according to them would bear fruits once schools proceed with ICT integration from the level that they deem possible rather than waiting and intending to start with a full scale ICT utilization. Such perception according to them itself hinders the ICT integration at schools. Head teachers perceived their role very much effective to improve the use of ICT in teaching and learning at their respective schools. They considered their role to be very effective with regard to enhance teachers' skills of ICT integration via realizing the concept of ICT in education to them, encouraging them to regularly use the available ICT resources in the process of teaching and enabling them through role modeling with regard to understanding and utilization of ICTs in the due process of teaching and learning. They perceived their strong will and commitment and more importantly thinking out of the box as key factors that enable schools and teachers to best utilize ICT in the process of teaching and learning.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

REFERENCES

[1] Adil, A. , Masood, A. M., & Ahmed, M, "Age and Gender's Association with Information & Communication Technology (ICT) Usage into Educational Institutions of Pakistan", *Sociology Mind vol.*3, no.4, pp.325-332, 2013.

[2] Alsharija, M, *Leadership Practices of Kuwait Secondary School Head Teachers for Embedding Technology, 2012. [Online] Available*: http://eprints.qut.edu.au/53276/1/Mohammed_Al-Sharija_Thesis.pdf

[3] Bogdan, C.R., & Biklen, K.S. Jr, *Qualitative research for education.* Boston: Allyn & Bacon, 1998

[4] Baron, J.,& Maier, H, *The challenging of maintaining the momentum, 2005.* [Online] Available: http://www.ascilite.org.au/conferences/brisbane05/blogs/proceedings/07_Baron.pdf (Dec, 3, 2015)

[5] Drago-Severson, E, *Helping teachers learn: Head Teacher leadership for adult growth and development,* California: Corwin Press, 2004.

[6] EMIS, 2015. [Online] Available: http://emis.gob.pk/Views/Gis/SchoolSearchgraph.aspx (Nov 5, 2015)

[7] Fullan, M, *The Moral imperative of School Leadership,* Cilifornia: Crown Press, 2003.

[8] Gronow, M, *ICT leadership in school education, 2007.* [Online] Available: http://www.acu.edu.au/__data/assets/pdf_file/0012/89895/ICT_Leadership_in_School_Education.pdf (Dec 22, 2015)

[9] Hargreaves, A, *Changing teachers, changing times.* London: Palmer Press, 1994.

[10] Harris, J.B., & Hofer, M.J, "Technological Pedagogical Content Knowledge (TPACK) in Action", *Journal of Research on Technology in Education,*vol.43, no.3, pp. 211-229, 2011.

[11] Hassan, T., & Sajid, A. R, "ICTs in Learning: Problems faced by Pakistan", *Journal of Research and Reflections in Education,* vol.7, no.1, pp.52-64, 2013.

[12] Hord, S. M, *Professional learning communities: Communities of continuous inquiry and improvement:* Austin: Southwest Education Development Laboratory, 1997. [Online] Available: http://www.sedl.org/pubs/change34/plc-cha34.pdf (Jan 2, 2016)

[13] Horzum, M.B, "An investigation of the technological pedagogical content knowledge of pre-service teachers", *Technology, Pedagogy and Education,* vol.22, no.3, pp. 303-317, 2013.

[14] Ivanic, R., & Tseng, M.I.L, Understanding the relationships between learning and teaching: an analysis of the contribution of applied linguistics, 2005. [Online] Available: http://dera.ioe.ac.uk/22329/1/doc_641.pdf (Feb 12, 2016)

[15] Kisirkoi, F. D, "Integration of ICT in Education in a Secondary School in Kenya: A Case Study", *Literacy Information and Computer Education Journal (LICEJ),* vol.6, no.2, pp.1904-1909, 2015.
[16] Majoka, M, I, Fazal, S., & Khan, M.S, "Implementation of Information and Communication Technologies (ICTs) in Education Course: A Case from Teacher Education Institutions in Pakistan", *Bulletin of Education and research,* vol.35, no.2, pp.37-53, 2013.
[17] Maykut, R., & Morehouse, R, *Beginning qualitative research: a philosophical practical guide.* London: The Falmer Press, 1994
[18] Mbodila, M , Jones,T., & Muhandji, K, "Integration of ICT in Education: Key Challenges", *International Journal of Emerging Technology and Advanced Engineering,* vol.3, no.11, pp.515-520, 2013.
[19] Memon, M.& Bana, Z, Pedagogical leadership in Pakistan: Two head teachers from the Northern Areas. In: J. Retallick & I. Farrah (Eds.). *Transforming Schools in Pakistan: Towards the Learning Community:* Karachi, Oxford University Press, pp.162-181, 2005.
[20] Memon, M, Ali, R. N, Simkins, T., & Garrett, V, "Understanding the head teacher role in Pakistan: emerging role demands, constraints and choices", *International Studies in Education Administration,* vol.28, no.2, pp.48-46, 2000.
[21] Mishra, P., & Koehler, M. J, "Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge", *Teachers College Record* vol.108, no.6, pp.1017-1054, 2006.
[22] Moos, L, "Comparing Educational Leadership Research", *Leadership and Policy in Schools, vol.12*, no3, pp. 282-299, 2013.
[23] Mwalongo, A, "Teachers' perceptions about ICT for teaching, professional development, administration and personal use", *International Journal of Education and Development using Information and Communication Technology,* vol.7, no.3, pp. 36-49, 2011.
[24] Niazi, S, "School Leadership and Educational Practices in Pakistan", *Academic Research International.* vol.3, no.2, pp.311-319, 2012.
[25] Nisar, M.W, Munir. E., & Shad, S.A, "Usage and Impact of ICT in Education Sector; A Study of Pakistan", *Australian Journal of Basic and Applied Sciences,* vol.5, no.12, pp. 578-583, 2011.
[26] Niekerk, M.P, *Head Teachers influence on teacher professional development for the integration of information and communication technology in schools*, 2009. [Online] Available: http://repository.up.ac.za/xmlui/bitstream/handle/2263/24285/00front.pdf?sequence=1&isAllowed=y (Jan 2, 2016)
[27] Niekerk M.V., & Blignaut, S, "A framework for Information and Communication Technology integration in schools through teacher professional development", *Africa Education Review,* vol. 11, no.2, pp. 236-253, 2014.
[28] Qutoshi, S.B., & Khaki. J, "The Role of a Principal / Head teacher in School Improvement: A Case Study of a Community-Based School in Karachi, Pakistan". *Journal of Research and Reflections in Education,* vol. 8, no. 2, pp. 86-96, 2014.
[29] Razzak, N.A, "Challenges facing school leadership in promoting ICT integration in instruction in the public schools of Bahrain", *Educ Inf Technol* vol.20, pp.303–318, 2013.
[30] Robbins, S. P, DeCenzo, D. A.,& Wolter, R, *Supervisions today* (6th ed.). Pearson, New Delhi, India, (2012).
[31] Rosenberg,J.M.,& Koehler, M.J, "Context and Technological Pedagogical Content Knowledge (TPACK): A Systematic Review", *Journal of Research on Technology in Education,* vol. 47, no.3, pp. 186-210, 2015.
[32] Sergiovanni,T.J, "Leadership as pedagogy, capital development and school effectiveness", *Int. j. leadership in education,* vol.1, no.1, pp.37-4 6, 1998.
[33] Shaikh,Z.A., & Khoja,S.A, "Role of ICT in shaping the future of Pakistani Higher Education System", *The Turkish Online Journal of Educational Technology,* vol.10, no.1, pp.1303 – 6521, 2011.
[34] Sidiqui,S, "Educational Leadership: Change through Self Understanding", *Bulletin of Education and Research,* vol. 33, no.1,pp. 21-29, 2011.
[35] Swan, K., & Hofer, M, "In Search of Technological Pedagogical Content Knowledge", *Journal of Research on Technology in Education,* Vol. 44, no.1, pp.75-98, 2011.
[36] Umme, K, *Information Communication Technology in Education.* HP Bhargave Book Agra, 2008.
[37] Volman, M, "Variety of roles for a new type of teacher. Educational technology and teacher profession", *Teacher and Teacher Education, vol. 21*, pp.15-31, 2005.

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Study on efficacy of agricultural trainings in respect of improving the livelihood of disaster affected farmers

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ABSTRACT: This research paper investigates the extent of training effectiveness as perceived by the participant farmers of Nobojibon Program, a rehabilitation program for the disaster affected people of Bangladesh. The specific objectives of the study were to determine and describe the extent of effectiveness of Trainings as perceived by the participant farmers of Nobojibon Program and to explore the relationship between each of the selected characteristics of the trainees/farmers and effectiveness of training programs. Data for the study were collected by personal interviewing from 120 randomly selected farmers of six Unions of Kalapara Upazila of Patuakhali district during the period of March 01, 2015 to April 15, 2015. Here 60 male and 60 female farmers were purposively taken. Pearson's product moment correlation co-efficient were computed to examine the relationship between the concerned variables. The effectiveness of training scores of the respondents ranged from 83 to 244 with an average being 163.66 and standard deviation 35.05. It was found that more than fifty percent (50.83) of the farmers had medium level of effectiveness of training compared to 27.5 percent of them having less effectiveness and 21.67 percent, high effectiveness. Out of ten independent variables, six of them, that is years of farm size, communication exposure, innovativeness, cosmopoliteness, economic motivation and commercialization had significant positive relationships with their effectiveness of training. Four independent variables *i.e.* age, education, annual family income and organizational participation had no significant relationship with their effectiveness of training.

KEYWORDS: Living standard, SIDR, Knowledge, Skill, Technology, Salinity, Descriptive survey.

1 INTRODUCTION

Agriculture is the mainstay of growth and poverty reduction in Asia and life-blood of Bangladesh economy. The landscape of Bangladesh is an intricate design of small fields, where the green and gold of rice dominate. The scientific means to make most productive use of the resources are now available and are being developed. Farmers have also been searching for better ways to grow their crops to bring changes in their existing pattern of cultivation. For dissemination of agricultural technologies, there generally exists a communicative chain to reach the farmers. Usually, the connection is made through government and non-government extension agents or change agents as well as the input suppliers. Generally, GO-NGOs are using several communication tools to connect the farmers with modern or new technologies, such as Farmers Field Day (FFD), Participatory Rural Appraisal (PRA), Training, Method Demonstration, Result Demonstration, Simulations, Video

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Programs, Exposure Visit, Workshop Participatory Action Research (PAR), Regular Household Visit, Leaflet Distribution, Festoon & Postering, input support etc. Among all the tools "Training" is the most commonly used by GO's & NGO's development programs or projects. Village women & girls are now getting training from the well- trained extension agents at suitable time by several development programs. Some training is to develop individual's working skill and some training is related to social awareness.

Training is a term which covers a wide range of activities. Its length can vary from short term training activities, such as one day demonstration to longer- term professional courses that may last several months. Trainers are also diverse. Generally, FAO considers four main audiences: primary producers, technical specialists, professionals and students receiving technical education [1]. The development training selected as a focus of this study refers to such trainings of farmers and extension staff undertaken in conventional and or participatory models. Thus in the system, where the role of extension and communication- intervention was looked on as transferring and disseminating readymade knowledge from research to farmers, or from 'early adopters' to other farmers which is often referred to as the transfer of technology model of extension [2], [3]. A systematic approach to training consists of logically structuring and sequencing the disparate types of activities, which make up a training program. This is achieved by the concept of the training cycle/ process which delineates these activities into defined and inter-related stages ranging from initial conception and formulation of training to its final delivery and evaluation [4]. Evaluation is about assessing the effectiveness of the various aspects of training. It is an interactive process in which various stages of training are appraised from the viewpoint of their adequacy and contribution to achieving the training objectives. Evaluation can also play an important role in the re-orientation and modification of these objectives and the formulation, and launch of new training programs. Evaluation can take place at any point in time in a training program. It is a decision making tool. Providing answers to questions relevant to training. The kind of information required has to be relevant to the question and should be systematically identified [5]. In general, evaluation serves four purposes [6] appraisal of the achievement of the individual, diagnosis of the learning difficulties of the individual trainees or a group of trainees, appraisal of the effectiveness of a training program, curriculum, training materials, procedures, and organizational arrangements and assessment of the progress to help understand training problems and develop sound policy, [5]. Therefore, training programs and projects are evaluated from different angles and viewpoints trainers and their institutions, trainees (their learning, reactions, post training job performance and contribution) [4]. The term effectiveness is relative. Typically, effectiveness is determined with respect to the achievements of a goal or set of goals. Human resource development effectiveness must be determined with respect to the goals of the program being examined [1]. Murshed-E-Jahan and Pemsl [7] on their study on Bangladeshi small farmers concluded that building the capacity of farmers through training is more valuable than the provision of financial support in terms of raising production and income. Similarly, a study by Tripp et al. [8] confirms the importance of training can contribute to enhancement of farmers'skills in farming works. Studies on the effectiveness of training for farmers showed that not all programmers meet success as most failures of programmes in the developing countries were attributed to the tendency of excessively concentrating on a particular technology transfer rather than a broader spectrum of farmer empowerment including knowledge disseminations [9], [10].

The present investigation was mainly concerned to study farmer's opinion regarding effectiveness of the agricultural trainings provided by Nobo Jibon Program. "Nobo Jibon" is a five-year (2010-2015) program funded by USAID's Multi Year Assistance Program (MYAP) and designed to reduce food insecurity and vulnerability for over 190,000 households or 1 million individual beneficiaries . The project covers nine of the most food-insecure Upazilas in Barisal Division. The primary objective of Nobo Jibon is to help households increase production and income, with improved access to food and market opportunities. The indirect benefits of the program will spill over throughout Barisal Division as a result of broader activities in disaster preparedness, early warning and response capacity. This study tried to explain and explore the relationship of some selected characteristics of the farmers such as age, education, farm size, annual income, organizational participation, communication exposure, innovativeness, economic motivation, cosmopoliteness and commercialization with their opinions toward effectiveness of agricultural trainings. The effectiveness would be high if he extent to which the trainers and the trainees both attributed it high performance level. Many things impair the effectiveness of the communication process as well as the training programs. Some associated with the source of message, some are associated with the receiver or trainees and some are common to both, while others are associated with the channel of communication. The following specific objectives were formulated to give proper direction to the study:

- determination and description the extent of effectiveness of Trainings as perceived by the participant farmers of Nobojibon Program
- exploration the relationship between each of the selected characteristics of the respondents and effectiveness of training programs
- identification the constraints confronted by the farmers that might be reduce the effectiveness of the training

2 METHODOLOGY

Kalapara Upazilla of Patuakhli District was selected as the study area. The land area under this Upazilla is 49210.20 ha. Total cultivated land is 40940 hectares out of which single cropped area is 17685 hectares, doubled cropped area is 16800 hectares and tripled cropped area is 6045 hectares. The cropping intensity is 199.35 percent. The main crops cultivated in this Upazilla are Rice, Vegetables, and Watermelon etc. The villages were selected from four Unions namely Nilganj, Mithaganj, Baliatoli, Dhulasar, Latachapli and Lalua. The design of the study was a descriptive survey research. It was designed to describe the relationship between selected characteristics of the farmers and effectiveness of agricultural training of Nobojibon Project. Efforts also were also made to identify the barriers or problems of participants to make the training effective. Data were collected by an interview schedule with selected sample respondents rather than the whole population. All the farmers who received agricultural training from Nobojibon Project of Kalapara Upazilla constituted the population of this study. To make a representative sample, 15 percent of the farmer was selected through random sampling technique. Thus, one hundred and twenty farmers were selected as sample from a total of 800 farmers. For the study, data were collected by means of interview with the sample farmers. Data were collected during the period from 01 March' 2015 to 15 April' 2015. All possible efforts were made to explain the purpose of the study to respondents in order to get valid and pertinent information from them. In this study selected individual characteristics of the farmers were considered as independent variables; which are, Age, Education, Farm size, Annual family income, Organizational participation, Communication/Media exposure, Innovativeness, Economic Motivation, Cosmopoliteness and Commercialization. Effectiveness of the agricultural training of Nobojibon Project was considered as dependent variables of this study. After the collection of data, all information contained in the interview schedule was edited. Data were transferred to coding sheet with numerical scores given to each question. Simple statistics like frequency, percentage, mean, range, standard deviation and rank order were used to interpret the descriptive data. The SPSS20 computer programs were used to perform the data analysis. Correlation of coefficient test was used to determine the relationship between the selected characteristics of the farmers and the effectiveness of agricultural trainings.

3 RESULTS AND DISCUSSION

3.1 SELECTED CHARACTERISTICS OF THE FARMERS

The findings of the selected characteristics of farmers (namely, age, level of education, farm size, annual family income, organizational participation, communication exposure, innovativeness, economic motivation, cosmopoliteness and commercialization) on use effectiveness of agricultural training are presented below.

Age: The observed age of the farmers ranged from 19 to 70 years. The mean age was 38.47 years with standard deviation of 10.96. The farmers are classified into three categories and distribution of the respondents is shown in Table 1. Analysis of data indicate that the highest portion (49.17 percent) of the respondents fell in the young category while 38.33 percent and 12.5 percent respondents fell in middle and old age category respectively. Thus 87.5 percent of the respondents fell in the young to middle age category. Noor and Dola [11] also observed bigger chunk of the farmers representing a total of 190 or 58.8% young adult's farmers to be of 40 years and below. Therefore, it is expected that effectiveness of training would be reflected more in the young to middle age group compared to old age group.

Table 1. Distribution of respondents by their age scores

Categories (years)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Young (< 35)	59	49.17	38.47	10.96
Middle-aged (36-50)	46	38.33		
Old (>50)	15	12.5		
Total	**120**	**100**		

Education: The year of schooling of the farmers ranged from 0 to 12 and the mean was 5.84 with standard deviation of 2.77. On the basis of scores obtained, the respondents were grouped according to national standard of classification. The categories and distribution of the respondents with their number, percent, mean and standard deviation are shown in Table 2.

Table 2. Distribution of respondents by their years of schooling scores

Categories (years)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
No Education	02	1.67	5.84	2.77
Primary (1-5)	71	59.17		
Secondary (6-10)	43	35.83		
Higher secondary (11-12)	4	3.33		
Total	**120**	**100**		

Analysis of data indicate that highest portion (59.17 percent) of the respondents had primary education, while 35.83 percent had secondary level of education and only 3.33 percent had higher secondary level of education. The majority of the farmers were found literate (from primary level to above secondary level). Education helps an individual to get useful information for solving their various problems by reading newspaper, books, leaflets and observing through various media like demonstration, film show, exhibition etc. Now-a-days there is a great scope of being benefited from different kinds of printed materials which can reach easily to the educated farmers.

Farm size: The farm size of the farmers in the study area varied from 0.006 to 1.27 hectares. The average farm size was 0.21 with standard deviation 0.19. Based on their farm size scores, the farmers were classified into three categories and shown in Table 3 with number, percent, mean and standard deviation. Data computed in the Table 3 show that the highest proportion (66.67 percent) of the respondents had small farm as compared to 31.67 percent medium sized farm and 1.66 percent of the respondents fell in large farm category. Only 1.66 percent of the farmers had big farm. Thus, almost all the farmers possessed medium and small farm. Noor and Dola [11] also found majority of small farmers during their case study. This finding also has the similarity with findings of Islam [12]. In Bangladesh small farmers live on a subsistence level and this may be one of the vital reasons for their low motivation towards adoption of improved farming practices in their farm.

Table 3. Distribution of respondents by their farm size scores

Categories (ha)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Marginal (0.02-0.19)	22	18.33	0.21	0.19
Small (0.02-1.00)	58	48.33		
Medium (1.01-3)	38	31.67		
Large (>3)	02	1.67		
Total	**120**	**100**		

Annual family income: Annual family income of the respondent was measured in 'thousand Taka' per year. It was ranged from 65 to 695 with an average of 234.91 and standard deviation of 136.97. The distribution of the farmers in different categories on the basis of their annual income has been shown in Table 4 with number, percent, mean and standard deviation. It is observed that the highest proportion (75 percent) of the respondents had low income while 18.33 percent, 6.67 percent had medium and high income respectively. Since the greater proportion (75 percent) of the farmers had low annual family income, it is logical to assume that they might have very low access to modern high cost technologies. This is so because income is associated with purchasing power of an individual. This may lead to the farmers not to use more modern cultural practices and ultimately training will be less effective by them. The gross annual income of a farmer is an important indicator of how much he can invest in his farming. Naturally, the person with more annual income can invest more in his farming and as a result he may adopt more modern technologies. Farmers with low annual income generally invest less in their farms. It is therefore, a considerable portion of the farmers face difficulty in following standard recommendation due to less economic ability of the farmers.

Table 4. Distribution of respondents by their annual family income scores

Categories (Taka '000')	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Low (≤275)	90	75	234.91	136.97
Medium (276-485)	22	18.33		
High (>485)	8	6.67		
Total	**69**	**100.0**		

Organizational participation: The organizational participation scores of the respondents ranged from 4 to24, the mean and standard deviation were 9.09 and 6.94 respectively. The respondents were classified into three categories. The categories and distribution of the respondents are shown in Table 5 with their number, percent, mean and standard deviation.

Table 5. Distribution of respondents by their organizational participation scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Poor Participation (≤11)	88	73.33	9.09	6.94
Medium Participation (12-20)	27	22.5		
High Participation (≥20)	5	4.17		
Total	**120**	**100**		

Analysis of data indicate that the highest proportion (73.33 percent) of the respondents fell in the poor participation category while 22.5 percent and 4.17 percent respondents fell in medium and high organizational participation category respectively. Organization participation of a farmer was quantified by membership in different organization for a particular period of time. A great majority of the farmers in the study area were found to have poor participation. Participation in different organizations brings an individual to come in contact with persons of different occupational and social status. This may broaden his outlook and vision. Organizational participation helps in identifying the problems and find out their solution. Informal exchange of ideas in organizational participation helps in decision making on various issues including farming. Knowledge, skills, leadership capacities etc of a farmer might be improved as a result of organizational participation.

Communication Exposure: The communication exposure of the respondents in the study area ranged from 8 to 42 and the mean was 21.18 with standard deviation of 8.04. The distribution of the respondents in different categories on the basis of their media exposure has been shown in Table 6 with number, percent, mean and standard deviation. The highest proportion (49.17 percent) of the respondents had medium communication exposure as compared to 36.66 percent low and 14.17 percent low communication exposure. Communication exposure is important for receiving up to date farm information. Overwhelming portion (85.83%) of the respondents had low to medium communication exposure. The poor communication exposure to various sources of information is likely to be the root cause of inadequate knowledge. Noor and Dola [11] also reported increasing of farmers in networking (27% of the respondents) after the training.

Table 6. Distribution of respondents by their communication exposure scores

Categories (years)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Low (<17)	44	36.66	21.18	8.04
Medium (18-29)	59	49.17		
High (>29)	17	14.17		
Total	**69**	**100**		

Innovativeness*:* The innovativeness of the respondents in the study area ranged from 3 to 18 and the mean was 9.84 with standard deviation of 3.47. The distribution of the respondents in different categories on the basis of their innovativeness has been shown in Table 7 with number, percent, mean and standard deviation. Analysis of data indicate that the highest

proportion (50 percent) of the respondents fell in the moderately innovative category while 37.5 percent fell in less innovative and 12.5 percent in the highly innovative category respectively.

Table 7. Distribution of respondents by their innovativeness scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Less Innovative (≤8)	45	37.5	9.48	3.47
Moderately Innovative (09-13)	60	50		
Highly Innovative (>13)	15	12.5		
Total	**120**	**100**		

Economic Motivation: The economic motivation of the respondents in the study area ranged from 15 to 31 and the mean was 22.79 with standard deviation of 3.27. The distribution of the respondents in different categories on the basis of their economic motivation has been shown in Table 8 with number, percent, mean and standard deviation. Analysis of data indicate that the highest proportion (66.67 percent) of the respondents fell in the moderately motivated category while 30 percent fell in highly motivated and 3.33 percent in the less motivated category respectively. Thus more than three-fourth (96.67 percent) of the farmers had medium to high economic motivation. This means, farmers at large keenly interested to maximize economic gain from farming. The economic motivation helps farmers to make decisions to adopt and continue practicing improved technology for making economic gain from farming. The economic motivation is a positive force towards change and more particularly for farming. Although majority of the farmers was economically motivated to maximize profit from their farming activities. The economic motivation of the farmers creates an atmosphere of communication and information in the farming communities. For getting economic benefit from farming the farmers try to increase their knowledge, skill and improved adoption behavior. Hence it is expected that economic motivation of the farmers might increase the knowledge, skill and practice of technology appropriately and ultimately training will be more effective.

Table 8. Distribution of respondents by their economic motivation scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Less Motivated (≤16)	4	3.33	22.79	3.27
Moderately Motivated (17-24)	80	66.67		
Highly Motivate (≥25)	36	30		
Total	**120**	**100**		

Cosmopoliteness: The Cosmopoliteness of the respondents in the study area ranged from 02 to 12 and the mean was 6.19 with standard deviation of 2.63. The distribution of the respondents in different categories on the basis of their Cosmopoliteness has been shown in Table 9 with number, percent, mean and standard deviation.

Table 9. Distribution of respondents by their Cosmopoliteness scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Less Cosmopolite (≤6)	65	54.17	6.19	2.63
Moderately Cosmopolite (7-10)	50	41.67		
Highly Cosmopolite (>10)	5	4.16		
Total	**120**	**100**		

Analysis of data indicate that the highest proportion (54.17 percent) of the respondents fell in the less cosmopolite category while 41.67 percent fell in moderately cosmopolite and 4.16 percent in the highly cosmopolite category respectively. Thus more than three-fourth (95.84 percent) of the farmers had low to moderate cosmopoliteness. Cosmopoliteness has favorable effect on knowledge, skill and practice of recommended technology which is ultimate training effectiveness. Through visiting different locations one can see others using several technologies which will encourage him to

do so. Visiting several locations broaden one's outlook. Thus cosmopoliteness might be a strong factor for training effectiveness.

Commercialization: The score for commercialization of the respondents in the study area ranged from 00 to 96 and the mean was 53.81 with standard deviation of 28.14. The distribution of the respondents in different categories on the basis of their commercialization has been shown in Table 10 with number, percent, mean and standard deviation. Analysis of data indicate that the highest proportion (45 percent) of the respondents fell in the highly commercial category while 31.67 percent fell in moderately commercial and 23.33 percent in the "no" to "less commercial" category respectively. Thus about three-fourth (76.67 percent) of the farmers had medium to high commercialization. The farmers having more commercial tendency have more urged to use latest technologies**.** So, commercialization has favorable effect on knowledge gaining**,** skill developing and practice of recommended technology which is ultimate training effectiveness.

Table 10. Distribution of respondents by their commercialization scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
No Commercialization (0)	11	9.16	53.81	28.14
Less Commercial (≤32)	17	14.17		
Moderately Commercial (33-66)	38	31.67		
Highly Commercial (>66)	54	45		
Total	**120**	**100**		

3.2 Relationships between Independent and Dependent Variables

The selected independent variables included age, years of schooling, farm size, annual family income, organizational participation, communication exposure, innovtiveness, economic motivation, cosmopoliteness and commercialization. The dependent variable was effectiveness of agricultural trainings. Pearson's product moment co-efficient of correlation 'r' was used to test the null hypothesis concerning the relationships between two variables. Five percent level of probability (0.05) was used as the basis for rejection of null hypothesis. The results of the test of co-efficient of correlation between the independent and dependent variables have been shown in Table 11. However, the relationships have been presented in the following sub-sections dealing with one of the characteristics of the farmers with their effectiveness of agricultural trainings.

Table 11. Correlation between independent and dependent variables

Dependent variable	Independent variables	Computed 'r' values
Effectiveness of Agricultural Training as Perceived by Participant Farmers	Age	-0.025^{NS}
	Level of Education	0.103^{NS}
	Farm size	0.277**
	Annual Income	0.141^{NS}
	Organizational participation	0.113^{NS}
	Communication Exposure	0.376**
	Innovativeness	0.283**
	Economic Motivation	0.254**
	Cosmopoliteness	0.238**
	Commercialization	0.344**

**Significant at 5 percent level of probability*
*** Significant at 1 percent level of probability*
NS: Not Significant

Age and Effectiveness of Training: The relationship between age of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between age of the farmer and their effectiveness of training." The computed value of the coefficient of co-relation between the concerned variables was found to be -0.025 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=-0.025) found to be smaller than the tabulated value with 118 degrees of freedom at 0.05 level of probability.
b) The null hypothesis was accepted.
c) The trend of relationship between the concerned variables was negative.
d) The relationship between the two variables was not significant.

Based on above findings it may be concluded that the age of the farmers had no significant relation with effectiveness. This finding indicated that with the increased age of the farmers, there was a corresponding decrease in their training effectiveness. Sharif [13] also found no significant relationship between age of the respondents and training effectiveness in his respective study. Thus the present findings show consistency with findings of previous studies.

Education and Effectiveness of Training: The relationship between educational qualification of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between educational qualification of the farmer and their effectiveness of training." The computed value of the coefficient of co-relation between the concerned variables was found to be 0.103 as shown in the table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.103) found to be smaller than the tabulated value with 118 degrees of freedom at 0.05 level of probability.
b) The null hypothesis was accepted.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was not significant.

Based on above findings it may be concluded that the educational qualification of the farmers had no significant relation with effectiveness. This finding also indicated that with the increased educational qualification of the farmers, there was a corresponding increase in their training effectiveness. Sharif [13] also found no significant relationship between age of the respondents and training effectiveness in his respective studies. Thus the present findings show consistency with findings of previous studies.

Farm Size and Effectiveness of Training: The relationship between farm size of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between farm size of the farmer and their effectiveness of training." The computed value of the coefficient of co-relation between the concerned variables was found to be 0.277 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.277) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the farm size of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmer having large farm were more likely to perceive training effectively. Akter [14] also found significant relationship between farm size of the respondents and training effectiveness in her respective studies. Sharif [13] also found significant relationship between farm size of the respondents and training effectiveness in his respective studies. Thus the present findings show consistency with findings of previous studies.

Annual Income and Effectiveness of Training: The relationship between annual family income of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between annual family income of the farmer and their effectiveness of training." The computed value of the coefficient of co-relation between the concerned variables was found to be 0.141 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.141) found to be smaller than the tabulated value with 118 degrees of freedom at 0.05 level of probability.
b) The null hypothesis was accepted.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was not significant.

Based on above findings it may be concluded that the annual family income of the farmers had no significant relation with effectiveness. This finding also indicated that with the increased annual family income of the farmers, there was a

corresponding increase in their training effectiveness. Sharif [13] also found no significant relationship between annual family income of the respondents and training effectiveness in his respective studies.

Organizational Participation and Effectiveness of Training: The relationship between organizational participation of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between organizational participation of the farmer and their effectiveness of training." The computed value of the coefficient of co-relation between the concerned variables was found to be 0.113as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.113) found to be smaller than the tabulated value with 118 degrees of freedom at 0.05 level of probability.
b) The null hypothesis was accepted.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was not significant.

Based on above findings it may be concluded that the organizational participation of the farmers had no significant relation with effectiveness. This finding also indicated that with the increased organizational participation of the farmers, there was a corresponding increase in their training effectiveness. Sharif [13] also found no significant relationship between organizational participation of the respondents and training effectiveness in his respective studies.

Communication exposure and Effectiveness of Training: The relationship between communication exposure of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between communication exposure of the farmer and their effectiveness of training. The computed value of the coefficient of co-relation between the concerned variables was found to be 0.376 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.376) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the communication exposure of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmer having more communication exposure were more likely to perceive training effectively. A farmer may get required information from various communication sources such as mass media, individual contact, poster, papers, group discussion, training, farmers' field days etc. the farmers having more frequent contact with several types of information sources are getting more scopes to gain knowledge on different technologies. So it can be said the higher the communication exposure, the higher would be the perception of effective training. Sharif [13] also found significant relationship between communication exposure of the respondents and training effectiveness in his respective studies. Thus the present findings show consistency with findings of previous studies. Fardous [15] found that media exposure of the farmers had significant positive relationships with training effectiveness in their respective studies. Akter [14] found that media exposure of the farmers had significant positive relationships with training effectiveness their respective studies.

Innovativeness and Effectiveness of Training: The relationship between innovativeness of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between innovativeness of the farmer and their effectiveness of training. The computed value of the coefficient of co-relation between the concerned variables was found to be 0.283 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.283) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the innovativeness of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmer having more innovativeness were more likely to perceive training effectively. Innovative farmers have a fertile mind to receive any message very fast. They have curiosity to test anything firstly than others. They are always seeking something newer, something better than present, and something more effective

than they have. That's why innovative farmers make the training effective by adopting most of all technologies rapidly. Akter [14] found that innovativeness of the farmers had significant positive relationships with training effectiveness in her respective study.

Economic Motivation and Effectiveness of Training: The relationship between economic motivation of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between economic motivation of the farmer and their effectiveness of training. The computed value of the coefficient of co-relation between the concerned variables was found to be 0.254 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.254) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the economic motivation of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmers were more economically motivated were more likely to perceive training effectively. Economic motivation attaches greater importance to profit maximization on immediate or long run basis. Modern varieties along with recommended improved cultural practices deserve huge scope of profit maximization. Economic motivation of a famer is one of the pre-requisite conditions for improving farming behavior such as knowledge, skill, attitude and adoption of technologies. Economically motivated farmers have more intention to search new improved technologies always. To get economic benefit such farmers increase their contacts with different information sources for searching new technologies. They provide more attention to any new message and try out them accordingly. Hence it is expected that the economic motivation of the farmers might increase the effectiveness of training. Sharif [13] also found significant relationship between economic motivation of the respondents and training effectiveness in his respective studies. Thus the present findings show consistency with findings of previous studies.

Cosmopoliteness and Effectiveness of Training: The relationship between cosmopoliteness of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between cosmopoliteness of the farmer and their effectiveness of training. The computed value of the coefficient of co-relation between the concerned variables was found to be 0.238 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.238) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the cosmopoliteness of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmers were more cosmopolite was more likely to perceive training effectively. Cosmopoliteness has favorable effect on knowledge, skill and practice of recommended technology which is ultimate training effectiveness. Through visiting different locations one can see others using several technologies which will encourage him to do so. Visiting several locations broaden one's outlook. Thus cosmopoliteness might be a strong factor for training effectiveness.

Commercialization and Effectiveness of Training: The relationship between commercialization of the farmers and their effectiveness of training was determined by the hypothesis "there is no relationship between commercialization status of the farmer and their effectiveness of training. The computed value of the coefficient of co-relation between the concerned variables was found to be 0.344 as shown in the Table 11 and following observations were made regarding the relationship between two variables.

a) The computed value of "r"(r=0.344) found to be larger than the tabulated value with 118 degrees of freedom at 0.01 level of probability.
b) The null hypothesis was rejected.
c) The trend of relationship between the concerned variables was positive.
d) The relationship between the two variables was significant.

Based on above findings it may be concluded that the commercialization status of the farmers had significant & positive relationship with effectiveness of training. It indicates that farmers were more commercial were more likely to perceive training effectively. Commercialization increases the urge for more production as well as more implementation of modern technologies. Generally a farmer, who produces crops in a commercial scale, will take care more to produce more with minimum production cost. These types of farmers are more potential farmer to receive any training effectively.

3.3 Relationships between Independent and Dependent Variables

The score for Effectiveness of Training of the respondents in the study area ranged from 83 to 244 and the mean was 163.66 with standard deviation of 35.05. The distribution of the respondents in different categories on the basis of their commercialization has been shown in Table 12 with number, percent, mean and standard deviation.

Table 12. istribution of respondents by their training effectiveness scores

Categories (score)	Farmers		Mean	Sd. dev.
	Frequency	Percent		
Less Effective (≤137)	33	27.5	163.66	35.05
Moderately Effective (138-191)	61	50.83		
Highly Effective (>192)	26	21.67		
Total	**120**	**100**		

Analysis of data contained in Table 12 indicate that the highest proportion (50.83 percent) of the respondents fell in the Moderately Effective category while 27.5 percent fell in Less Effective and 21.67 percent in the Highly Effective category respectively. Thus more than three-fourth (72.50 percent) of the farmers had medium to high effectiveness of training. On the other hand less than one fourth of the respondent fell in less effective category.

3.4 Problems Faced by Farmers

Through interview schedule researcher enlisted and ranked five main problems which were faced by the participant farmers and which might be the hindrance to make the training effective.

Table 13. Distribution of Problems faced farmers in a rank order

SL	Problem	Rank
01	Salinity of soil and water.	1
02	Scarcity of sweet water about six month of a year.	2
03	Small scale farming.	3
04	Unstable weather of coastal area.	4
05	Regular high tide inundates the vegetables field.	5

4 Conclusion

In Bangladesh, almost all of the ongoing development programs are Training based. They are spending a greater portion of their budget for farmers training. Since the study tries to address the problems related to inadequacies of the process at all levels, especially at grass root levels, and as no study was undertaken in the region concerning the issue, it is hoped that this study will be relevant and will make significant contribution. Size of the farm is an important factor for increasing effectiveness of training. When in a training small farmer and large farmers sit together, that training definitely will not effective for any one side. So training should be for homogeneous farmers regarding farm size and training contents also must be farmers specific. Farmers shared that at Kalapara saline water is the main obstacle for agricultural activities. Fresh water is unavailable about 7-9 months of a year. So authority should launch several projects for conserving fresh water. If the farmers get fresh water over the year round the cropping intensity will be increase at a remarkable stage. Kalapara Upazilla is one of the most disaster prone areas in southern Bangladehs. So farmers need appropriate adaptive technologies against natural disasters. The farmers who are more economically motivated stated the training as effective. There was a significant relationship between economic motivation and effectiveness of training. So authority should emphasize to increase

economic motivation of the farmers. This can be done during training by lecture and in training follow up through household visit by change agents. In this study only twenty technologies were considered while conducting such studies in the future, the other aspects might be included. To make training effective the trainer or change agent attributes are the crucial factors which were not included in this study. In future it should be considered. This study considered only 10 characteristics of the farmers. There might be other characteristics which might have relationship with effectiveness of training of the farmers. Further studies may be conducted with variables other than these 10 characteristics. The study was conducted at Kalapara Upazilla of Patuakhali district. Similar studies might be carried out in other areas of Bangladesh.

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REFERENCES

[1] FAO, Planning for Effective Training: A Guide to Curriculum Development, Rome, 2002.
[2] Chambers, R., Pacey, A. and Thrupp, L-A., Farmer-first: farmer innovation and agricultural research, Intermediate Technology Publications, London, UK, 1989.
[3] Hagman, J., Chuma, E., Murwira, K., and Connolly, M., Learning Together through Participatory Extension, Harare, Zimbabwe, 2000.
[4] Hassen Hakimian and Amdisa Teshome, Trainers Guide: Concepts, Principles, and Methods of Training, With Special Reference to Agricultural Development, FAO, Rome, 1993.
[5] FAO, Performance Evaluation Guide: Assessing Competency Based Training in Agriculture, Rome, 1995.
[6] Ahmann, J.S. and Glock, M., Evaluating student progress: principles of tests and Measurements, 6th ed. Allyn and Bacon, Inc., Boston, 1981.
[7] K. Murshed-E-Jahan and D. E. Pemsl, “The impact of integrated aquaculture–agriculture on small- scale farm sustainability and farmers‘livelihoods: Experience from Bangladesh”, Agricultural Systems, Vol. 104(5), pp. 392-402, 2011.
[8] R. Tripp, M. Wijeratne and V. Hiroshini, “What Should We Expect from Farmer Field Schools? A Sri Lanka Case Study”, World Development, Vol. 33(10), pp. 1705–1720, 2005.
[9] S. Oreszczyn, A. Lane, and S. Carr, “The role of networks of practice and webs of influencers on farmers‘ engagement with and learning about agricultural innovations”, Journal of Rural Studies Vol. 26, pp404-417, 2010.
[10] P. Yang, W. Liu, X. Shan, P. Li, J. Zhou, J. Lu and Y. Li, “Effects of training on acquisition of pest management knowledge and skills by small vegetable farmers”, Crop Protection, Vol. 27, pp. 1504–1510, 2008.
[11] K. B. M. Noor and K. Dola, “Investigating Training Impact on Farmers’ Perception and Performance”, International Journal of Humanities and Social Science, Vol. 1(6), pp. 145- 152, 2011.
[12] Islam, S., Farmers' perception of the harmful effects of using agrochemicals, in crop production with regard to environmental population, Ph.D. Thesis, unpublished, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, 2000.
[13] Sharif, M.N., Effectiveness of crop management training as perceived by farmers, M.S (Agril. Ext. Ed.) Thesis, Unpublished, Department of Agricultural Extension & Rural Development, Patuakhali Science & Technology University, Bangladesh, 2013.
[14] Akter, S., Farmers’ Perception of Environmental Degradation due to use of Pesticides, M.S (Environmental Sicence) Thesis, Unpublished, Department of Environmental Science, Bangladesh Agricultural University, Mymensingh, 2012.
[15] Fardous, M. T., Farmers’ Perception of Village and Farm Forestry Programme towards Sustainable Forestry Development, M.S. (Ag. Ext. Ed.) Thesis, Unpublished, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh, 2002.

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Epidemiology, Treatment and Outcome of Muscle invasive bladder cancer in north Tunisia

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ABSTRACT: *Introduction:* There have been only few data published reporting the clinical or pathological features of bladder cancer in Tunisia. Muscle invasive bladder is characterized by poor outcome despite systemic therapy. We aim to report the epidemiological, clinicopathological features and treatment of invasive bladder cancer in a Tunisian population. Materials and methods: A total of 141 patients diagnosed with invasive bladder cancer were included in the analysis. Data were collected and correlated with overall survival (OS). Kaplan Meier survival analysis was used to evaluate the median survival time and survivals were compared by the log-rank test. *Results:* Median age at diagnosis was 63 years old. Sex ratio was 14.6. Median follow-up duration was 22 months. Smoking was the most important risk factor in our series (81.6%) of cases followed by occupational exposure. Hematuria was the most common symptom reported in 93.6% of cases. Urothelial bladder carcinoma was the most common histologic subtype representing 93.5% of cases. Only 61 patients underwent curative surgery, followed by adjuvant gemcitabine-based chemotherapy in 32 cases. TNM staging was the most significant prognostic factor in our population ($p<0.001$). Median overall survival of the organ confined group was 60 months, in the locally advanced group was 36 months and in the metastatic group was 12 months ($p<0.001$). *Conclusions:* The increasing incidence of bladder cancer is due to ongoing high prevalence of smoking, which represents the main risk factor. Therefore primary prevention is crucial. Bladder cancer remains diagnosed in Tunisia at locally advanced and/or metastatic stages impairing the prognosis

KEYWORDS: bladder cancer; epidemiology; treatment; prognosis, outcome.

1 INTRODUCTION

Invasive bladder cancer is the most common urological cancer in Tunisia accounting for 347 new cases per year [1]. The incidence of bladder cancer is increasing; it varies by sex, about three times higher in men. Smoking, occupational exposure and certain genetic susceptibility are the main risk factors for this cancer. About 25% of newly diagnosed bladder cancers present with muscle invasion and need either radical surgery or radiotherapy but often still have poor outcome despite systemic therapy [2].

To our knowledge, there have been only few data published reporting the clinical or pathological features of bladder cancer in Tunisia. Therefore, we sought to study invasive bladder cancer cases seen over a five years period in order to help draw the epidemiological and clinicopathological features of this cancer in Tunisia along with its risk factors.

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2 MATERIAL AND METHODS

This is a retrospective study including all cases of invasive bladder cancer in north Tunisia. Patients were firstly diagnosed by urologists then only those who needed chemotherapy were transferred to Salah Azaiez Cancer Institute between the years 2009 and 2013. The medical records of these patients were reviewed and included in the present study. Clinicopathological data (size, site, morphology, multiplicity, stage, grade of tumor, etc.), epidemiological data (age, sex, occupation and smoking habit), investigations and treatment and follow-up data from the case notes were entered on a standard data collection sheet.

STATISTICAL ANALYSIS

Data were analyzed using SPSS software version 20 (IBM SPSS Statistics; IBM Corp, Armonk, NY, USA) and chi-square test was used to compare the variables. A p-value of 0.05 was taken as significant. Kaplan Meier survival analysis was used to determine the median overall survival (OS) and survivals were compared by the log-rank test.

3 RESULTS

3.1 PATIENT'S CHARACTERISTICS

A total of 141 patients were treated at the Salah Azaiez Cancer Institute in the period of the study. The distribution was quite homogeneous with an average of 28.2 cases per year (Range: 27 to 31) (figure1).

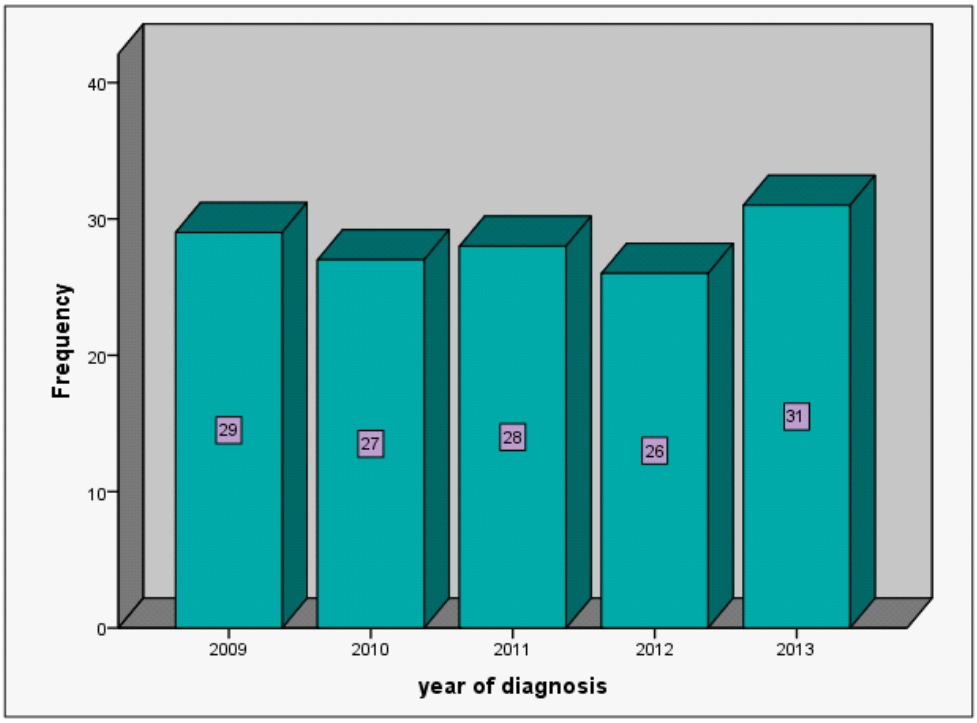

Fig. 1. Distribution of muscle invasive bladder cancer cases per year

Median age at diagnosis was 63 years old (Range: 38 to 85years). Sex ratio was 14.6. Risk factors in our population are shown in table I.

Table 1. Risk factors of invasive bladder cancer

	Male(132)	Female(9)	X2
Tobacco smoking	114(86.4%)	1(11.1%)	***P<0,001***
Familal History of bladder cancer	3(2.3%)	0(0%)	P=0.868
polycyclic aromatic hydrocarbons	22(16.6%)	1(11.1%)	P=0.55
Bilharzia	1(0.8%)	0(0%)	P=0.936

Smoking was the most important risk factor reported in 81.6% of cases. Hookah smoking was noticed in 20% of cases, snuff tobacco in only 3% of patients and the main form of smoking consisted of cigarettes (77%). Smoking was followed by the second most important reported risk factor for bladder cancer which is occupational exposure. In our series, 23 patients were exposed to polycyclic aromatic hydrocarbons and 7 were farmers. Our male patients were more exposed to this carcinogen compared to female patients (16.6% vs 11.1%). Only three male patients had a family history of bladder cancer and only one patient was subject to a parasitic infection and suffered from Bilharzia.

Mean time to diagnosis was 6.45 months (from 1 to 48 months). The most common symptom was hematuria in 132 patients (93.6%). Kidney failure was noticed in 9.9% of cases. All patients had a prior trans-urethral resection for diagnosis. Urothelial bladder carcinoma was the most common histologic subtype (93.5%) followed by non-urothelial carcinoma (adenocarcinoma in 5.1% and squamous cell carcinoma in 1.4%. Urothelial carcinoma was mostly found in a pure form (88.4%). Whereas divergent differentiation were found in the other cases (squamous differentiation 8.5%, glandular differentiation 1.6% and sarcomatoid differentiation 1.6%) (Figure 2).

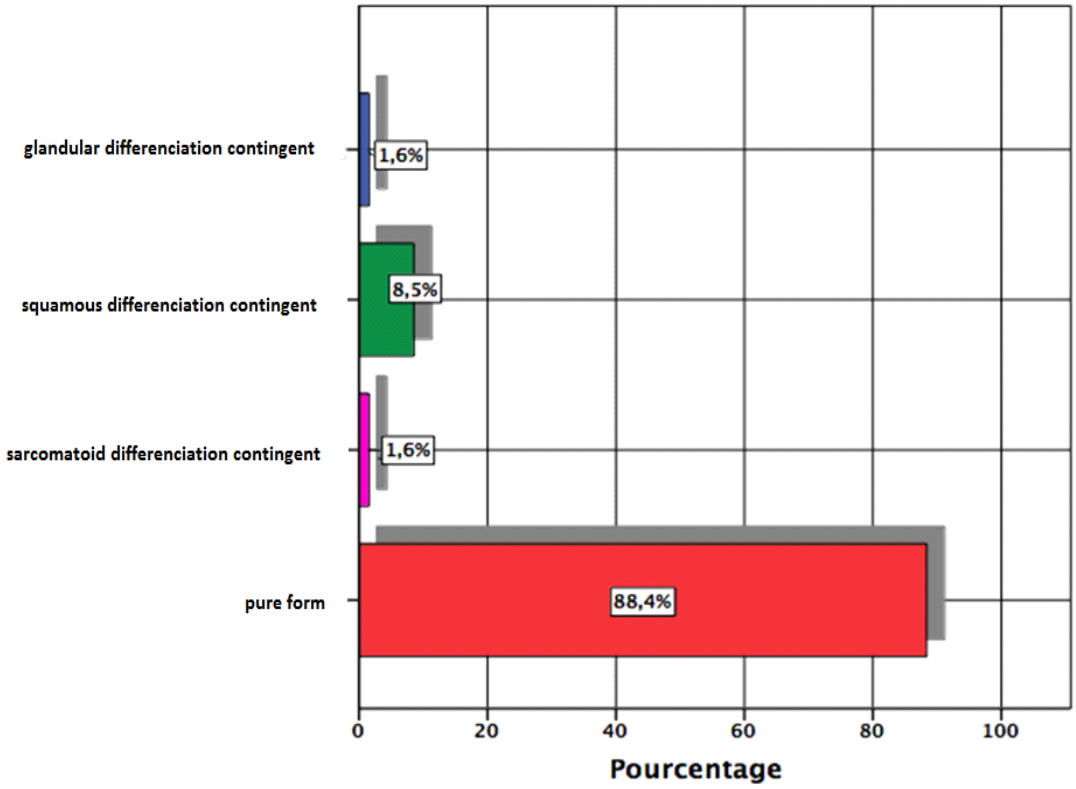

Fig. 2. Tumoral contingents

All patients had a body CT scan but only 42.6% had a bone scan. Organ-confined tumors (T2 N0) were present in 15 patients (11.1%). Non-organ-confined tumors (>T2 and/or N+) were found in 126 patients (88.9%), T3 in 65(48.1%) and T4 in 49 (36.3%) patients.

Fifty eight (41.1%) patients were metastatic at the time of diagnosis. The most frequent sites of metastasis at the diagnosis are lungs in 22 patients (40.7%) and bone in 14 patients (14.9%) (Figure 3).

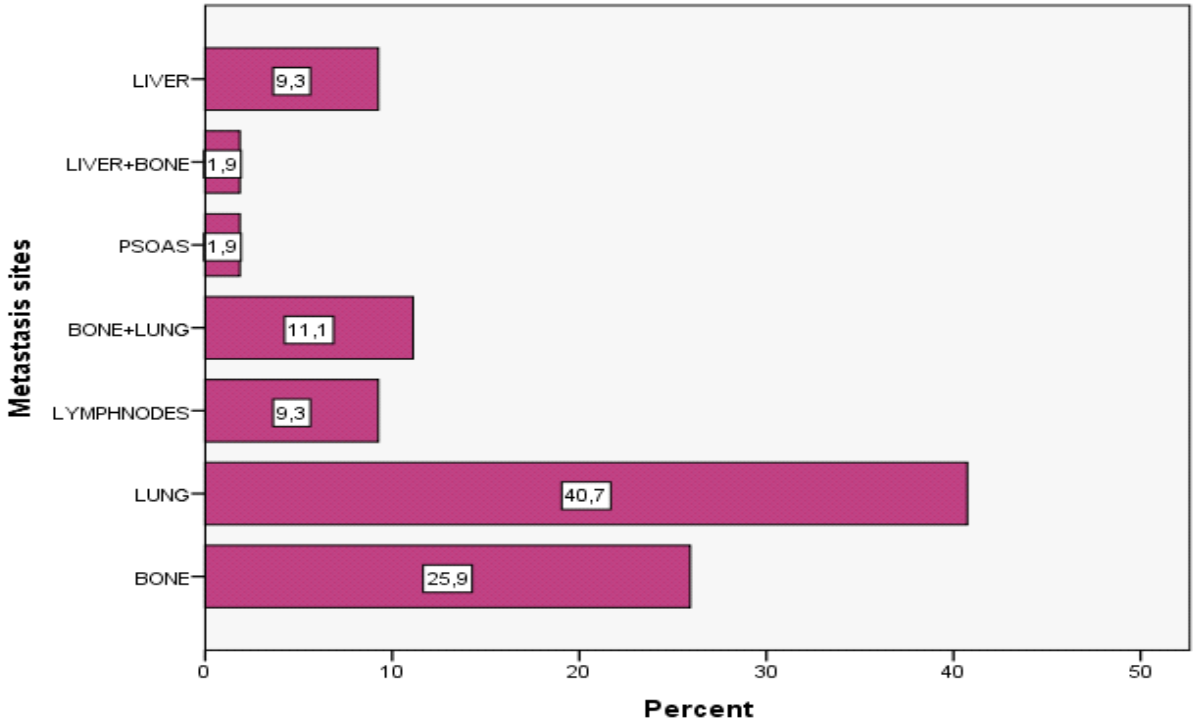

Fig. 3. Metastasis sites

3.2 TREATMENT

Among the eighty-three non metastatic patients only seventeen (20.48%) received gemcitabine-based neoadjuvant chemotherapy. Sixty-one patients had surgery consisted of a radical cystectomy with lymph-node dissection. Operated patients characteristics are show in Table II.

Table 2. Clinicopathological Characteristics of operated Patients

	AC After RC	RC Alone
No. of Patients	32	29
Male/Female	29/3	27/2
Age, Median	59	61
Acute Renal Failure	0	1
Performance Status		
<1	31	28
2	1	1
pT Stage		
<pT2	1	4
pT2	2	5
pT3	17	10
pT4	12	10
pN		
pN0	17	20
pN1	6	4
pN2	9	5
pN3	0	0
Nuclear Grade		
High	27	1
Low	5	28
Cisplatin-Based AC		
MVAC	0	
GC	32	
Median AC cycles	4(1-7)	
Form of Urinary Diversion		
Ileal conduit	30	28
Ileal neobladder	2	1
Open surgery	32	29

Abbreviations: AC=adjuvant chemotherapy; GC=gemcitabine and cisplatin; MVAC=methotrexate, vinblastine, doxorubicin, and cisplatin; RC = radical cystectomy

Three patients had a neobladder reconstruction and fifty eight had Briker urinary derivation. Thirty two patients had gemcitabine based adjuvant chemotherapy.

Forty four metastatic patients received palliative chemotherapy consisted of gemcitabine-based regimen (gemcitabine and cisplatin or carboplatin) in 43 cases, MVAC (methotrexate, vinblastine, doxorubicin and cisplatin) in 1 case. Fourteen patients didn't receive chemotherapy due to a poor PS (3/4).

3.3 SURVIVAL

Statistical analysis showed that patients younger than 65 years had a better outcome than those aged more than 65 years but this difference wasn't statistically significant (P=0.094). Distant metastasis (p=0.02) and T3/T4 stage (p=0.02) were associated with reduced OS. However lymph node involvement didn't impair the OS. TNM staging was the most significant prognostic factor in our population (p<0.001). Median overall survival of the organ confined group was 60 months, in the locally advanced group 36 months and in the metastatic group was 12 months (p<0.001) (figure4).

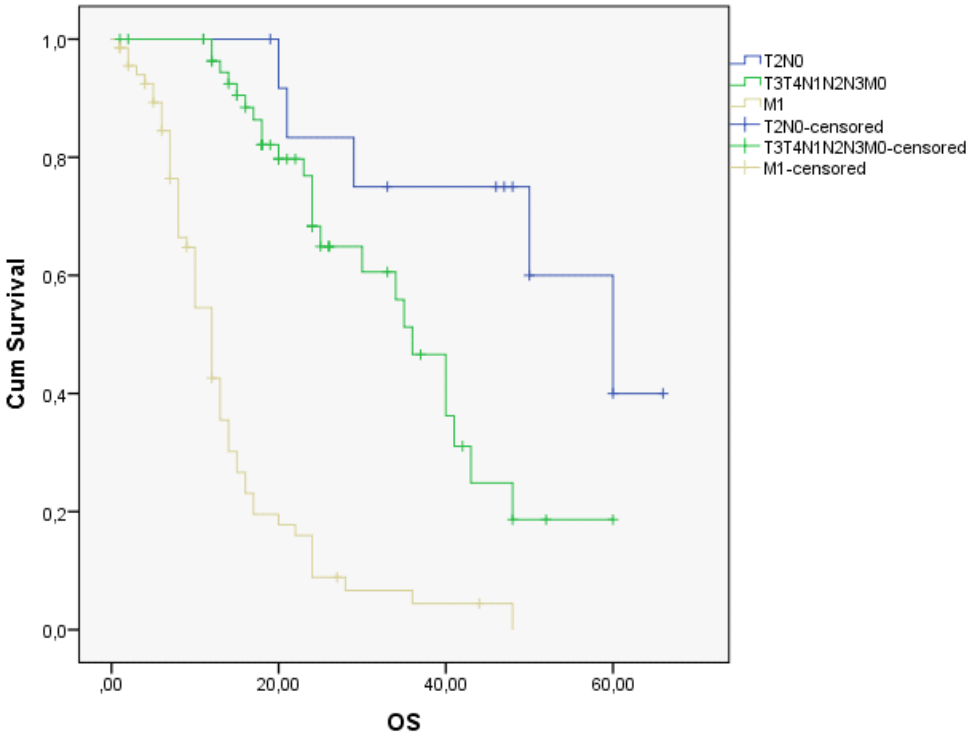

Fig. 4. Kaplan-Meier survival curves in muscle invasive bladder cancer according to TNM stage

Whereas for Disease free survival (DFS), the organ confined group presented better DFS (18 months) than the locally advanced patients (11 months) but this difference wasn't statistically significant p=0.355.

In the operated group, patients who had adjuvant chemotherapy seemed to have better overall survival (60 months) than patients who did not received chemotherapy (40 months) p=0.406 (figure 5).

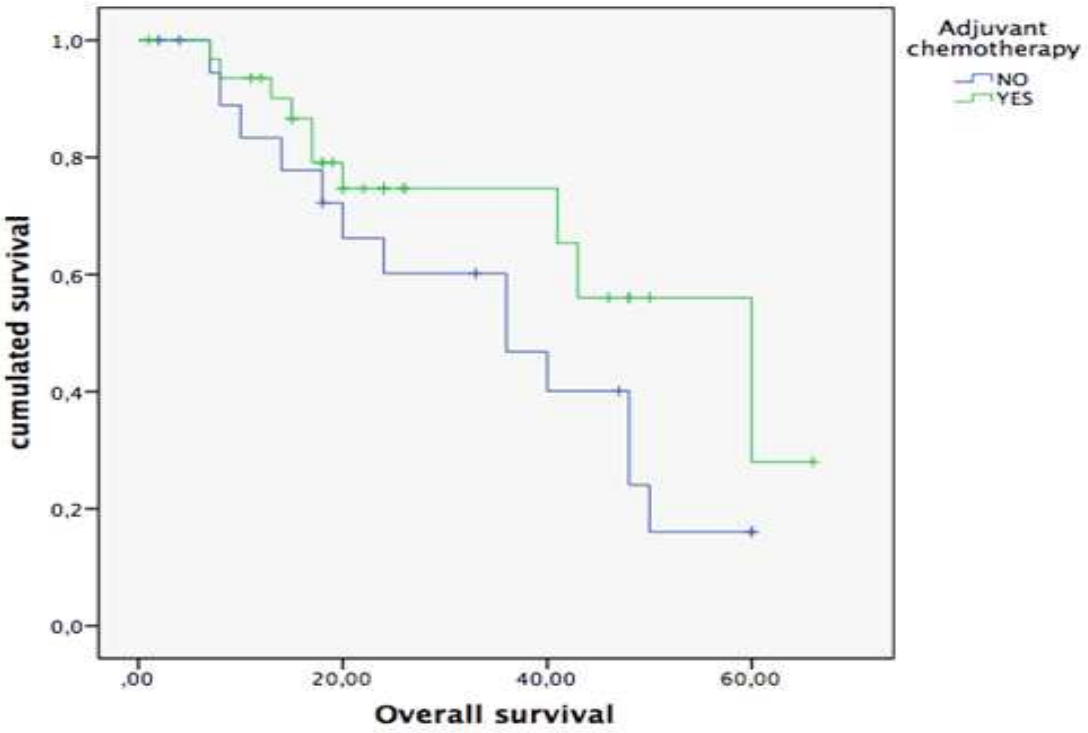

Fig. 5. Kaplan-Meier survival curves in muscle invasive bladder cancer according to adjuvant chemotherapy.

On the other hand, metastatic patients who received chemotherapy seemed to have a better overall survival (12 months) than patients who did not receive chemotherapy (8 months) p=0.318.

4 DISCUSSION

Bladder cancer is the 9th cancer worldwide [3], it is more common in men than females, ranked 7th when compared to all male cancers while its ranked 17th in women cancers [4, 5]. About 25% of newly diagnosed bladder cancer present with muscle invasion.2 Median age at diagnosis worldwide is 67 years.6 Unlike, in our population median age was 63 years. The incidence and prevalence of bladder cancer are seen in the sixth decade of life, with a peak in the seventh and eighth decade. Thus, is it mainly an elderly disease [6].

In Tunisia, the incidence of bladder cancer in men is among the highest incidences in the world; 15.6 / 100 000. According to the north Tunisia cancer register (RCNT 1999-2003 within 10 Governorates) published in 2007, the sex ratio of this pathology remains very high (close to 10) [1].

There are multiple possible reasons for the observed preponderance of bladder cancer in males. In fact, men are more exposed to industrial carcinogens and to exogenous estrogen than females which explains the low incidence of bladder cancer in females [7]. Additionally, smoking is more common in males compared to females, which is a well-established and important risk factor for bladder cancer [8].

Bladder cancer is a multifactorial disease. Nowadays, several risk factors are known and well established namely, Cigarette smoking and occupational exposure to aromatic amines which represents the most important ones [9].

Smoking is the main risk factor for bladder cancer; it is present in 50% of male cases, 35% of female cases and 65% of invasive bladder cancer [10]. Moreover, the risk of developing bladder cancer is 2-4 times higher in smokers compared to nonsmokers and this risk is directly proportional to the intensity and/or duration of smoking [11]. At the cessation of exposure, the risk decreases by more than 30% after 1 to 4 years and more than 60% after 25 years but it doesn't reach that of nonsmokers [12]. In our series, 81.6% of patients were exposed to tobacco. Following smoking and as seen in our study, occupational exposure to carcinogens is viewed as the second most important risk factor for bladder cancer. Roughly 20% of all bladder cancers have been suggested to be related to such exposure, mainly in industrial areas processing paint, dye,

metal, and petroleum products [13]. Moreover association between specific pesticides exposures and bladder cancer risk has been observed among agricultural populations [14]. Two studies have shown a link between farming and bladder cancer among non-smokers, which highlights the difficulty of trying to study the effect of other exposures on smoking-related cancers [15], [16] .The risk of death from bladder cancer appears to be elevated for more than 30 years after cessation of exposure to occupational carcinogens [17].

Haematuria is the most common symptom of bladder cancer [18], representing 93.6% in our series. The most frequent pathologic subtype in our series was urothelial carcinoma (93,5%) like most north African countries and worldwide except for Egypt where the endemic infestation of shistosomiasis explain why squamous cell carcinoma is the most frequent histological subtype[19, 20, 21]. Other types of bladder cancer, i.e. squamous cell carcinoma and adenocarcinoma have much lower relative frequency. These findings are in line with our study results. In all "Cancer Incidence in Five Continents" (2016) registries, squamous cell carcinoma accounts for 1.1% and 2.8% of all bladder cancers in men and women respectively. Adenocarcinoma of the bladder constitutes respectively 1.5% and 1.9% of all bladder tumors worldwide (2016) [20].

Controversy regarding surgery has emerged concerning the best surgical approach (open versus robotic), and the optimal extent of lymph-node dissection. Robotic surgery is the new tendency in radical cystectomy even if there is no evidence in better outcome or complication rate in the robotic radical cystectomy group [22]. There are many options of adjuvant treatment for bladder cancer. Adjuvant chemotherapy (AC) after radical cystectomy in the treatment of muscle-invasive bladder cancer is controversial. There are ten main randomized trials that evaluated the role of AC. The most recent trial is the EORTC30994, who recruited only 284 of the planned 660 patients in locally advanced muscle invasive bladder cancer. Immediate AC was compared to deferred therapy upon relapse. Median overall survival was prolonged with AC (6.75 vs 4.6 years). However, results did not reach statistical significance for OS (HR 0.78, 95% CI 0.56e1.08, p = 0.13) [23] .

Furthermore, Kanatani et al suggested that postoperative cisplatin-based AC gives patients a survival advantage in locally advanced or node positive bladder cancer, especially in node-positive cases as reported in our study [24]. The most recent meta-analysis of nine trials showed overall survival benefit of adjuvant chemotherapy (pooled HR 0.77, 95% CI 0.59e0.99, p = 0.049). This meta-analysis did not include the last EORTC trial. Moreover, this meta-analysis is not reliable because it included unpowered trials with insufficient cohorts and heterogeneous populations [25]. In our series, AC seems to improve overall survival, although the non-receiving chemotherapy group had more organ-confined tumors, less metastatic nodes and a lower histological grade. Whereas, other options than chemotherapy are being discussed in adjuvant setting such as radiotherapy or chemoradiation. Recently, Zaghloul M published an abstract in ASCO GU 2016 comparing these three options. The trial demonstrated no difference in outcome but a better local control with protocols using radiotherapy. Furthermore, this trial had a larger proportion of squamous cell histotype explaining why the radiotherapy is so efficient [26]. All patients with locally advanced or metastatic disease received gemcitabine-cisplatin (GC) regimen. GC was compared with MVAC in two major randomized trials comparing locally advanced and metastatic patients, shown no outcome difference with a better risk/benefice ratio with GC , additionally, this regimen was better tolerated [27], [28]. These findings support our use to the GC regimen in the palliative settings.

5 CONCLUSIONS

To our knowledge, our study is the largest series published in Tunisia. Most available data are based on retrospective analysis. Bladder cancer remains diagnosed in Tunisia at locally advanced and/or metastatic stages impairing the prognosis. Moreover, the increasing incidence of bladder cancer is due to ongoing high prevalence of smoking, which represents the main risk factor. Therefore primary prevention is crucial, and smoking cessation programs should be encouraged and supported.

Besides Quitting tobacco smoking, avoiding occupational exposure to aromatic amines and other related chemicals are some of the ways to avoid increasing the risk of developing bladder cancer. On the other hand, pesticide exposure may be an overlooked risk factor in bladder cancer. More efforts must be done by public authorities regarding prevention and particularly reducing tobacco consumption. Despite the results of randomized trials and expert recommendations regarding neoadjuvant chemotherapy almost all patients in Tunisia receive only adjuvant chemotherapy. Further clinical trials exploring new treatment modalities such as robotic radical cystectomy and adjuvant radiotherapy are warranted.

CONFLICTS OF INTEREST

None

REFERENCES

[1] Registre des Cancers du Nord de la Tunisie 1999-2003 : 101–104, 2007.

[2] Stenzl A, Cowan NC, De Santis M, Kuczyk MA, Merseburger AS, Ribal MJ, Sherif A and Witjes JA: Treatment of muscle invasive and metastatic bladder cancer: update of the EAU guidelines. Eur Urol 59:1009-1018, 2011.

[3] Murta-Nascimento C, Schmitz-Dräger BJ, Zeegers MP, Steineck G, Kogevinas M, Real FX and Malats N: Epidemiology of urinary bladder cancer: from tumor development to patient's death. World J Urol 25: 285–295, 2007.

[4] Van Rhijn BW, Burger M, Lotan Y, Solsona E, Stief CG, Sylvester RJ, Witjes JA and Zlotta AR: Recurrence and Progression of Disease in Non–Muscle-Invasive Bladder Cancer: From Epidemiology to Treatment Strategy. Eur Urol 56: 430-442, 2009.

[5] Ferlay J, Bray F, Pisani P and Parkin DM: GLOBOCAN 2002: cancer incidence, mortality and prevalence worldwide. IARC Cancer Base No. 5, version 1.0. International Agency for Research on Cancer Web site. http://www-dep.iarc.fr. Accessed June 26, 2009

[6] Ferlay J, Soerjomataram I and Ervik M: GLOBOCAN 2012 v1.0, cancer incidence and mortality worldwide: IARC CancerBase No. 11 [Internet]. Lyon (France): International Agency for Research on Cancer; 2013. Available at: http://globocan.iarc.fr. Accessed October 13, 2014.

[7] Wolpert BJ, Amr S, Ezzat S, Saleh D, Gouda I, Loay I, Hifnawy T, Mikhail NN, Abdel-Hamid M, Zhan M, Zheng YL, Squibb K, Abdel-Aziz MA, Zaghloul M, Khaled H and Loffredo CA: Estrogen exposure and bladder cancer risk in Egyptian women. Maturitas 67: 353–357, 2010.

[8] Gupta P, Jain M, Kapoor R, Muruganandham K, Srivastava A and Mandhani A: Impact of age and gender on the clinicopathological characteristics of bladder cancer. Indian J Urol 25: 207-210, 2009.

[9] Negri E and La Vecchia C: Epidemiology and prevention of bladder cancer. Eur J Cancer Prev 10: 7-14, 2010.

[10] Pelucchi C1, La Vecchia C, Negri E, Dal Maso L and Franceschi S : Smoking and Other Risk Factors for Bladder Cancer in Women. Preventive Medicine 35:114 –120, 2002.

[11] Kirkali Z, Chan T, Manoharan M, Algaba F, Busch C, Cheng L, Kiemeney L, Kriegmair M, Montironi R, Murphy WM, Sesterhenn IA, Tachibana M and Weider J: Bladder cancer: epidemiology, staging and grading, and diagnosis. Urology 66:4 –34, 2005.

[12] Brennan P, Bogillot O, Cordier S, Greiser E, Schill W, Vineis P, Lopez-Abente G, Tzonou A, Chang-Claude J, Bolm-Audorff U, Jöckel KH, Donato F, Serra C, Wahrendorf J, Hours M, T'Mannetje A, Kogevinas M and Boffetta P: Cigarette smoking and bladder cancer in men: a pooled analysis of 11 case-control studies. Int J Cancer 86:289-294, 2000.

[13] Burger M, Catto JW, Dalbagni G, Grossman HB, Herr H, Karakiewicz P, Kassouf W, Kiemeney LA, La Vecchia C, Shariat S and Lotan Y: Epidemiology and Risk Factors of Urothelial Bladder Cancer. European Urology 63:234-241, 2013.

[14] Koutros S, Silverman DT, Alavanja MC, Andreotti G, Lerro CC, Heltshe S, Lynch CF, Sandler DP, Blair A and Beane Freeman LE: Occupational exposure to pesticides and bladder cancer risk. International Journal of Epidemiology 0:1–14, 2015.

[15] Kabat GC, Dieck GS and Wynder EL. Bladder cancer in nonsmokers. *Cancer* 57:362–367, 1986.

[16] Amr S, Dawson R, Saleh DA, Magder LS, Mikhail NN, St George DM, Squibb K, Khaled H and Loffredo CA: Agricultural workers and urinary bladder cancer risk in Egypt. Arch Environ Occup Health 69:3-10, 2014.

[17] Pira E, Piolatto G, Negri E, Romano C, Boffetta P, Lipworth L, McLaughlin JK and La Vecchia C: Bladder cancer mortality of workers exposed to aromatic amines: a 58-year follow-up. J Natl Cancer Inst 102: 1096-1099, 2010.J Natl Cancer Inst 102: 1096-1099, 2010.

[18] Yazbek-Hanna M, Whelan P and Jain S: Bladder cancer. Medicine 44: 52-55, 2016.

[19] R. Salah, N. Harir , S. Zeggai, F. Sellam, N. M. Merabent, S. Moullessehoul and M. Bedjaoui : Cancers urologiques en Algérie : profil histoépidémiologique à propos de 348 cas. J. Afr. Cancer 7 : 126-131, 2014.

[20] Eble JN SG, Epstein JI and Sesterhenn IA: World Health Organization Classification of Tumors. 2004. Lyon, France.

[21] Zheng YL, Amr S, Saleh DA, Dash C, Ezzat S, Mikhail NN, Gouda I, Loay I, Hifnawy T, Abdel-Hamid M, Khaled H, Wolpert B, Abdel-Aziz MA and Loffredo CA: Urinary Bladder Cancer Risk Factors in Egypt: A Multicenter Case–Control Study, Cancer Epidemiol Biomarkers Prev 21: 537-546, 2012.

[22] R Scarpato K, K Morgans A and A Moses K: Optimal management of muscle-invasive bladder cancer – a review. Research and Reports in Urology 7:143- 151, 2015.

[23] Sternberg CN, Skoneczna I, Kerst JM, Albers P, Fossa SD, Agerbaek M, Dumez H, de Santis M, Théodore C, Leahy MG, Chester JD, Verbaeys A, Daugaard G, Wood L, Witjes JA, de Wit R, Geoffrois L, Sengelov L, Thalmann G, Charpentier D, Rolland F, Mignot L, Sundar S, Symonds P, Graham J, Joly F, Marreaud S, Collette L and Sylvester R : Immediate versus deferred chemotherapy after radical cystectomy in patients with pT3-pT4 or Nþ M0 urothelial carcinoma of the bladder (EORTC 30994): an intergroup, open-label, randomised phase 3 trial. Lancet Oncol 16: 76-86, 2015.

[24] Kanatani A, Nakagawa T, Kawai T, Naito A, Sato Y, Yoshida K, Nozaki K, Nagata M, Yamada Y, Azuma T, Suzuki M, Fujimura T, Fukuhara H, Nishimatsu H, Kume H, Igawa Y and Homma Y: Adjuvant chemotherapy is possibly beneficial for locally advanced or node-positive bladder cancer. Clin Genitourin Cancer 13: 107-112, 2015.

[25] Leow JJ, Martin-Doyle W, Rajagopal PS, Patel CG, Anderson EM, Rothman AT, Cote RJ, Urun Y, Chang SL, Choueiri TK and Bellmunt J: Adjuvant chemotherapy for invasive bladder cancer: a 2013 updated systematic review and meta-analysis of randomized trials. Eur Urol 66: 42-54, 2014.

[26] Zaghloul MS, Christodouleas JP, Smith A, Abdalla A, William H, Khaled HM, Hwang WT and Baumann BC: A randomized clinical trial comparing adjuvant radiation versus chemo-RT versus chemotherapy alone after radical cystectomy for locally advanced bladder cancer. J Clin Oncol : (suppl 2S; abstr 356), 2016.

[27] Von der Maase H, Hansen SW, Roberts JT, Dogliotti L, Oliver T, Moore MJ, Bodrogi I, Albers P, Knuth A, Lippert CM, Kerbrat P, Sanchez Rovira P, Wersall P, Cleall SP, Roychowdhury DF, Tomlin I, Visseren-Grul CM and Conte PF: Gemcitabine and cisplatin versus methotrexate, vinblastine, doxorubicin, and cisplatin in advanced or metastatic bladder cancer: results of a large, randomized, multinational, multicenter, phase III study. J Clin Oncol 18: 3068-3077, 2000.

[28] Von der Maase H, Sengelov L, Roberts JT, Ricci S, Dogliotti L, Oliver T, Moore MJ, Zimmermann A and Arning M: Long-term survival results of a randomized trial comparing gemcitabine plus cisplatin, with methotrexate, vinblastine, doxorubicin, plus cisplatin in patients with bladder cancer. J Clin Oncol 23:4602-4608, 2005.

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Eating habits among the people of Abora traditional area

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ABSTRACT: This paper discusses eating habits among the people of Abora Traditional Area in the Abura Asebu Kwamankese, Central Region of Ghana. The discussion focuses on Cultural etiquettes or values and examines how the people of the Abora Traditional Area consider eating as a social phenomenon; norms associated with eating, who to eat with, at what place, when to eat, what to eat by some categories of people and so on. The paper also touches on some beliefs the people have on eating. How people should conduct themselves when eating will also receive attention in the discussion. Through observations, discussions and interviews among selected villages and elderly folks in the area, the author Some specific situation(s) will be highlighted to unveils how the people of Abora Traditional area recognises eating as a perfect social behaivour.

KEYWORDS: eating habits, Abora Traditional Area, habit, social behavior villages.

THEORETICAL FRAMEWORK

As a native of the area and a traditional leader, I based my discussions on my experience and training of young ones. That is to say, intuitive knowledge will be applied in the discussion. Also, I analysed what some scholars have written on the phenomenon.

INTRODUCTION

This paper is structured in five sections. The first section introduces broadly the paper, followed by the second which discusses issues pertaining to euphemisms, and dilates on forms of indirection. In the third section the papers examines Sociolinguistics variables in eating habits while the forth section speaks to good and bad habits in eating. The fifth section addresses issues pertaining to some prohibits in eating to precede the last section, the conclusion.

The concept of eating is practiced everywhere around the globe. It is an act whereby food is put into the mouth to chew/and to swallow with the aim of satisfying' one's hunger. At times, the kind of food to be eaten is of one's own choice. At other times, the situation will determine the kind of food to be eaten or it will depend on the food available. The Fantes say, *Kuntunn biara yɛ ɔmee* (whatever fills the stomach means satisfaction).

Among the people of Abora Traditional Area, like any other community around the globe, the act of eating is considered a very important aspect of human life and as such it must be done properly and at the appropriate place by the various categories of people in the community. It must be noted here that eating habits are not static - they change. This is due to the period of eating, what is being eaten, circumstances surrounding the eating event, the place of eating and so on. For example, if somebody is eating alone at his farm, he will not behave as eating with others at home.

It is worth mentioning here that, the people of Abora Traditional Area metaphorically view drinking of wine as form of eating.

There are some categories of people in the area under review (eg. Chiefs, Heads of clans, Leaders of Asafo companies etc.), people should not see them eating at public places. This is because the people attach much importance to eating; and for that matter, their important personalities must not eat anyhow at anywhere. Another reason to this effect is that, they believe that some people possess evil spirits and juju so if any of these important personalities is seen eating publicly, those with bad spirits will use their spirits and juju to destroy them. Also, eating at the appropriate place by these important personalities is a form of *Face Saving mechanism*. Again, may be the kind of food that the person might be eating does not befit his position; so when many people see him eating such food, they may look down upon him.

EUPHEMISMS

Because the people consider eating as a very important and sacred act, they often use euphemism when they want to talk about the act. It is known euphemisms are used as forms of indirection, i.e. to tune peoples' minds out of the real act under discussion. Also, it is used to cover up the unpleasantness of something. For example, when food is ready and children are sent to call their fathers or elderly relatives from the streets or at any public place: the children only inform the elders that they are needed at the house or some visitors are waiting for them. Children who inform their elders at public places that food is ready are rebuked or in most cases punished. It is culturally unacceptable in the Abora Traditional Area, for somebody to announce eating time publicly - hence the use of euphemisms for eating. Some of the euphemistic expressions are: *Morokɔbɔ*

m'ano twɛr I am going to knock at my mouth, *Yɛrokɔto hɛn nsa nsu mu* - we are going to dip our hands into water, *Mirikeyi me nsa* - I am going to take my hand out, *Yerekɛka hɛn ano* -We are going to touch our mouth, and so on. We see from the above statements that all the expressions have some kind of relations to eating. Whenever we are eating, the hand is raised to the mouth and as the hand touches the mouth, there is a kind of knock. Again we wash our hands before eating. So at eating we always dip or put our hands into water; and also, during eating, we put the hand in the bowl and take it out several times.

SOCIOLINGUISTIC VARIABLES

Every society is made up of different categories of people. That is to say that, not all members of any given society are of the same rank; some hold higher positions while others are at the grassroots. Some have economic power whereas others are at the receiving end and so on. The Akan community, like any other society in the world is made up of different categories of people occupying different positions on the social ladder and political hierarchy.

To look at eating habits among the Abora people very closely, I have considered the participants or the various categories of people who engage in the act. In order to have this achieved, I will consider the social classes in the community in line with the acronymn 'GRAPD' - where we have 'G' as *gender*, 'R' as *rank*, 'A' as *age*, 'P' as *power* and 'D' as *distance* (Agyekum, 2002)

In a traditional Fante home, there are two parts of the same household - *Pramado* or *Mbanyin mu* - the part of the house where the adult males stay and *Gyaadze* or *Mbasiafo mu* - where females and children stay. This division in the various households has some kind of effect on the eating habits of the Akans.

Gender, as used in this work differentiates males from females in terms of eating. In this regard males and females do not eat together.

Gender, in terms of eating talks about the particular places in the household where males are expected to eat. It even extends to how the males' eating table is set, the kind of dish from which they eat as against their female counterparts.

At dinner, the food of the males in a household are put into nice enamels known as *komitsi* and sent to the *pramado* where the males have their supper; whereas that of the females who prepared the meals are put into *yabaa* or *apɔtɔyewa* (earthen ware) and eaten at the *gyaadze* or the kitchen. The eating table of the males is nicely set whereas the females often put their bowls on the ground or on top of basket or at times it is put in the mortar. It is not accepted for husbands or grown-up males to eat at the kitchen. Men are also not expected to eat with women especially from the same bowl. When any grown-up and responsible man is seen eating with a woman at the kitchen or from a cooking pot or cooking utensil, he is mocked at by his friends and relatives and even at times he is rebuked or he is nicknamed *Okotobonku* (a man who associates himself closely with women). This is because just after eating, many issues pertaining to the various gender groups are discussed; for example issues pertaining to war (in the olden days) are discussed by men.

So far as eating is concerned, pregnant women in the Akan community are restricted. In support of this Minta (1996:44) posits that, there are foods that a pregnant woman should eat at specific times of the pregnancy period and there are others, which she should not be eaten by them. The reason for this restriction is to ensure good health of the pregnant woman and the unborn child. Also, pregnant women are not allowed to eat in public because it is believed that if they do so, people with evil spirits will destroy their unborn babies through the eating.

Rank and Power as used in this work refer to one's status in the society. The people of Abora hold people in authority in high esteem. Thus, people in authority are highly respected. These people include the Chief, Head of a Clan, *Asafohen*[1], *Asafo Supi*[2] *Akɔmfo*[3], members of the council of elders, some royals, the rich and others.

Each of these people is expected by members of the Akan community not to eat anyhow and at any place. They are expected to eat indoors. They (especially chiefs) have to eat at where many people will not see them - not even at the compound of their various household.

According to Akuffo (1976:80) only the *Sodohene* and few members from his outfit are allowed to be at the dinning place of the Paramount Chief (the ɔmanhen). They are allowed there just to serve the king. It is expressed in the Fante community that *ɔhen (Opanyin) nndzidzi bagua mu* meaning the chief (elderly) does not eat in public. When any of those mentioned above is found to be eating at unapproved place, he is scorned, mocked at, rebuked or even fined by the appropriate authorities. Women in their menstrual periods are not allowed to cook for some people like Chiefs, Heads of clans, *Asafo Supi* and so on.

At funerals and other gatherings, when it is time for the chief and his elders to take their drinks, they ask permission and go to the palace to enjoy the drinks. This is what the ɔkyeame tells the people: *'Nananom reserɛ kwan akɔhwɛ ahɔho wɔ ahemfie.* Meaning, the Chief and his elders are going to attend to some visitors at the palace. As stated ealier, the Fantes do not announce 'eating' in public.

In terms of age, the people of Abora Traditional area distinguish children from adults. Children from the same household eat together, in most cases from the same bowl; and adults too eat together, according to sex as mentioned under gender. This act of eating together encourages unity among members of each household. Children are not supposed to eat with adults. However, on few occasions, some well-behaved and clean children are allowed to eat with adults, especially with their fathers. The people have this to say, *Sɛ abofra hu ne nsa ho hohor a, ɔnye mpanyimfo dzidzi* (If a child is able to wash his hand well, he eats with adults).

Also, age affects what one wants to eat in the Abora society. Here, it is only adults (those having the purchasing power) who eat what they wish to take at a particular time. Children take whatever is available. Again, well-behaved and serviceable children at times get what they wish to eat. Because the people under review want their children to behave well, the latter are motivated by giving them what they like to eat. The expression, *Abofra a ɔyɛ somakɔ no, odzi n'abodweedze* (A serviceable child eats what pleases him) confirms this act. After eating, children in the household wash all the bowls from which they ate (including that of the adults) as well as the cooking utensils.

Distance, as used in this work refers to intimacy - i.e. how close is someone to a chief or an elderly person. Here, how one relates with another especially those in high positions and the rich influence his eating. We have already mentioned chiefs and other high ranking personalities and how and where they are supposed to eat. In the Abora Traditional area, some chiefs or high-ranking personalities at times invite some lower ranking individuals (privately) to join them either to drink or eat. This happens when the invitees are very 'close' and 'faithful' to those in power or the rich. When a high ranking personality in any of the community in the area under review invites lower ranking personality to a 'table', we often expressed it as *"Akokɔba a ɔbɛn ne nã no dzi abɛbɛw ne serɛ".* (to wit., a chick which is close to its mother eats the thigh of a grasshopper).

SOME GOOD OR ACCEPTED EATING HABITS

Opoku (1964: 16) is of the view that, the Akans, among whom are the people of Abora Traditional area, normally eat twice (morning and evening) a day. That is to say that one needs strength for the day's work so between 9.00 and 10.00 in

[1] *Leader of Asafo company*
[2] *Leader of Asafo company*
[3] *the traditional priests and priestesses*

the morning, the Akans take their first meal for the day and between 5.00 and 6.00 in the evening when they have returned from their farms, they take their second meal. Meanwhile, one has the right to eat some fruits like oranges, bananas etc. between the two major meals. It is not accepted for somebody to eat between meals. Some elders make sure that children adhere to eating twice a day. This is to train the children to be able to cope with every situation especially in case of famine.

It is the belief of the people that, no matter how sweet or palatable a food may taste, one does not eat with both hands. It is accepted amongst the Akans that it is only the right hand, which must be used for eating. When a child begins to learn how to eat, the adults make sure that he/she eats with the right hand only.

One must sit straight on a stool when eating. The adults enforce this on children during eating times. Even where there are only few stools for the adults, children are made to sit on rags; and they must sit straight. It is scientifically true that if one does not sit properly when eating, he/she may develop some abdominal problems. When a child or any member of the community under review puts the left hand on the ground while eating, thus not sitting straight, he/she is rebuked by the elders in the house.

The amount or size of a morsel into the mouth must not be too big. It must be such that chewing and (or) swallowing will not be a problem. We say that, *Abofra tsi fufu a ɔbɔkɔ n'anomu-* (a child picks a morsel that can go into the mouth).

SOME PROHIBITIONS IN EATING

One must not lick the finger frequently when eating: We have already mentioned that, the people of Abora encourage group eating to ensure togetherness in their various households. As two or more people eat from the same bowl, it is not accepted for any of them to lick the fingers too often. When any member of the household is found to be frequently licking the fingers, he/she is rebuked or scorned. The licking of the hands is avoided to protect people from being infected by any communicable disease.

When people are eating together, it is against the cultural etiquette of the people for any of them to open his or her mouth wide. It is the belief that some fluid from the mouth (saliva) may drop into the food - thus contaminating or polluting the food in case the one is sick. Also it is not hygienic; so one must not open the mouth too wide when eating.

When one is talking or singing, it is likely that some bits of spits come out of the mouth. So eating and talking or singing at the same time will mean polluting the food (which others are also enjoying) with spits. Also, talking or singing while eating will cause some kind of disorder in the throat and may cause serious ailment or even death. The Fantes say "*Obi mmfa edzidzi mmfa kasa so"*. to wit., one cannot talk while eating. The adults tell the children that when one talks/sings while eating, that person's mother will die. So this act is considered a taboo.

- According to the Akan cultural etiquette, when one begins to eat, he/she needs not to go anywhere until eating is over. This is because if one of the members moves away, by the time s/he comes back, the rest might have consumed all the food. Also if one stops eating to listen to a call, s/he might be told some bad news (death of a relative) which may bring the eating to an abrupt end. In order to encourage smooth and uninterrupted eating habits among the people, children are discouraged from moving from place to place when they are eating.

Finally, putting the left hand on the ground while eating is not encouraged by the people of Abora traditional area - thus, it is also a taboo. The act of putting the left hand on the ground while eating does not ensure good sitting posture in eating. As this may cause some disorder in the body if it continues, the people discourage children from this act. Any child who continues to do that during eating is punished. These prohibitions as we have seen them must not be encouraged so as to instill good eating habits amongst the members of the Abora Traditional Area.

CONCLUSION

The Akans consider the act of eating as a very important aspect of human life. Because of this, eating is not done anyhow and at anywhere. Special people in the community under review are restricted in various ways so far as eating is concerned. They are not allowed to eat at anywhere, to eat anything and even it is not anybody who must cook for a chief or any other traditional leader.

Children are trained on what to do before, during and after eating. Both adults and children are rebuked if they do not comport themselves well during eating processes. Those who flout good eating habits are scorned.

In the nutshell, the people of Abora Traditional Area try to encourage good eating habits among themselves, especially the young ones.

REFERENCES

[1] Agyekum, K. (2000): The socio-cultural concept of face in the akan Community.
[2] Akuffo, B. S. (1976): Ahemfie adesua; Ghana Publishing Corporation Tema.
[3] Minta, J. K. (1996): Akan Amambra mu bi. Bureau of Ghana Languages; Accra.
[4] Opoku, A. A. (1964); Abayɛn ne afitra. Bureau of Ghana Languages; Accra.

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Une dermatose factice révélant un état dépressif

[Artefacta dermatitis revealing depression]

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ABSTRACT: We report the case of a 27-year-old lady with psychiatric history, presented to dermatological consultation with 6 years, ambiguous history of recurrent skin ulcerations on her members, abdomen, chest and face, the cause of which she could not explain. Examination revealed different age lesions: erosive lesions of one to two centimeters, with net borders coexisting with crusted lesions and scarring hyper pigmented lesions situated on accessible parts of the body. No general signs accompanied these lesions and laboratory testing was normal. The diagnosis of dermatitis artefacta was raised, motivating a deepening interrogation that revealed psychosocial and interpersonal difficulties. Abandoned by her husband, who had married a second wife for six years (date of appearance of lesions). She was also accused to be responsible of repeated miscarriages of the second wife, and then repudiated without her 3 children who are abused by the second wife.
Her psychiatric evaluation revealed a severe depression without psychotic symptoms. The recommended psychiatric treatment (psychotherapy and antidepressant medication) could not be conducted because she had broken up the medical following.

KEYWORDS: dermatitis artefacta, self-inflicted injury, cutaneous artifactual disease, psychocutaneous, depression, psychomsomatic.

RESUME: Nous rapportons l'observation d'une jeune dame âgée de 27 ans, sans antécédent psychiatrique connu, ayant consulté en dermatologie pour des exulcérations cutanées évoluant depuis 6 ans dont l'histoire de la maladie ambiguë, imprécise était émaillé d'une errance diagnostic et thérapeutique. L'examen dermatologique notait des lésions d'âges différents : lésions exulcérées, érosives ovalaires variant de un à deux centimètres de grand axe, bien limitées, aux bordures nettes coexistant avec les lésions exulcero-croûteuses et des lésions cicatricielles hyperpigmentées siégeant sur les parties accessibles du corps : les membres supérieures, les membres inférieures, l'abdomen, le haut de la poitrine ainsi que le visage. Ces lésions n'étaient accompagnées d'aucun signe général et les examens paracliniques étaient normaux. Le diagnostic d'une pathomimie cutanée a été évoqué, motivant un approfondissement de l'interrogatoire. Celui-ci révéla des difficultés psychosociales et interpersonnelles. Elle était délaissée, par son mari, qui avait épousé une seconde femme depuis six ans (date d'apparition des lésions). Elle serait en outre accusée, d'être à l'origine des fausses couches répétées de sa co-épouse, puis répudiée sans ses enfants qui seraient maltraités par celle-ci.

L'évaluation psychiatrique de la patiente a conclu à une dépression sévère sans symptômes psychotiques. La prise en charge psychiatrique préconisée (psychothérapie et traitement antidépresseur) n'a pu être menée, la patiente ayant rompu le suivi médical.

MOTS-CLEFS: pathomimie cutanée, automutilation, dermatose factice, psychocutané, dépression, psychosomatique.

INTRODUCTION

La pathomimie, trouble factice entièrement provoqué par le sujet lui-même sur son propre corps dans un état de conscience claire, est l'expression somatique d'une souffrance psychique [1], [2].

La peau étant d'accès facile, les pathomimies cutanées ou dermatose factice sont les plus fréquentes, le patient crée alors des lésions sur son revêtement cutanéo-muqueux ou ses phanères pour combler un besoin psychologique dont il ou elle n'a pas conscience [1] .Nous rapportons un cas de pathomimie cutanée révélant un état dépressif chez une jeune femme de 27 ans.

OBSERVATION

Une jeune femme de 27 ans, couturière vivant à Ouagadougou, sans antécédents psychiatriques personnel ou familial, ni d'antécédents de consommation de substances illicites connus, consultait au service de dermatologie de l'Hôpital Saint Camille de Ouagadougou (HOSCO) pour des exulcérations cutanées évoluant depuis six ans. Ces lésions avaient déjà fait l'objet de multiples consultations et traitements auprès de plusieurs agents de santé dont un dermatologue, sans succès.

L'interrogatoire était flou et énigmatique, la patiente n'arrivant pas à préciser le mode de survenue des lésions. Les ulcérations succéderaient tantôt à des bulles, tantôt à des papules, tantôt à un prurit.

L'examen clinique notait un bon état général et de conscience, une tenue vestimentaire correcte et adaptée. L'examen dermatologique notait des lésions d'âges différents : lésions exulcérées, érosives ovalaires variant de un à deux centimètres de grand axe, bien limitées, aux bordures nettes coexistant avec les lésions exulcero-croûteuses et des lésions cicatricielles hyperpigmentées siégeant sur les membres supérieures (figure1), les membres inférieures figure1 et 2), l'abdomen, le haut de la poitrine (figure 3) ainsi que le visage. Ces lésions n'étaient accompagnées d'aucun signe général.

Fig. 1. Lésions siegeant sur les zones accessibles des membres supérieures et inférieures

Fig. 2. Lésions siegeant sur les zones accessibles des membres supérieures et inférieures

Fig. 3. Lésions siegeant sur la poitrine

L'examen neurologique ne révélait pas de troubles de la sensibilité superficielle ni profonde, les réflexes étaient conservés. Les explorations complémentaires (une sérologie rétrovirale, une glycémie à jeun, une numération formule sanguine, une créatininémie, les transaminases sériques, biopsie cutanée) ne révélaient aucune anomalie. Le diagnostic de prurigo avait été évoqué devant la notion de prurit, la localisation sur les parties découvertes de lésions érosives et exulcéro

crouteuses. Un traitement fait d'un antiseptique local, un antibiotique local et un antihistaminique prescrit. Après trois mois de suivi fait d'une succession de poussées des lésions sur les mêmes sites, le diagnostic d'une pathomimie cutanée a été évoqué, motivant un approfondissement de l'interrogatoire. Celui-ci révéla des difficultés psychosociales, interpersonnelles. La patiente serait mariée dans un foyer polygame dont elle serait la première épouse, mère de trois enfants. Elle serait délaissée par son mari, qui aurait épousé une seconde femme depuis six ans (date d'apparition des lésions). Sa vie sexuelle serait inexistante. Elle serait en outre accusée par son époux, sa belle-famille et sa coépouse d'être à l'origine des fausses couches répétées de cette dernière. Elle aurait récemment été répudiée par son époux, sa coépouse étant à nouveau enceinte, afin de l'empêcher de nuire à cette nième grossesse. Ses enfants restés avec leur père seraient maltraités par la seconde femme.

L'évaluation psychiatrique de la patiente a conclu au diagnostic de dépression sévère sans symptômes psychotiques. . La prise en charge psychiatrique préconisée (psychothérapie et traitement antidépresseur) n'a pu être menée, la patiente ayant rompu le suivi.

DISCUSSION

La pathomimie cutanée ou dermatose factice est l'un des problèmes les plus complexes pour le dermatologue, qui n'y pense pas toujours [1].

Notre patiente est une illustration de cette complexité. Le diagnostic était enfin évoqué sur la base d'un faisceau d'arguments :

- Le sexe féminin, les pathomimies étant plus fréquemment rencontrées chez les femmes que chez les hommes [1].
- L'histoire de la maladie faite d'une errance de six ans, avec des consultations multiples, une discordance entre la clinique et les examens complémentaires.
- L'interrogatoire qui notait une histoire de la maladie ambiguë,
- Un début brutal mais une grande tolérance pour les lésions affichantes [1].
- l'aspect clinique fait de lésions d'érosions, exulcérations (représentants 60% des lésions rencontrées dans les pathomimies), de formes géographiques bien limitées, d'âge différents, siégeant sur des zones accessibles ne correspondant pas à un mécanisme physiopathologique bien définie[3].
- Leur apparition du jour au lendemain sans aucun symptôme ni prodrome associé [4].
- les explorations paracliniques strictement normales [5].
- Une absence de toute preuve de motifs extérieurs au comportement (elle n'avait rien à gagner sur le plan économique, ni de récompenses externe) écartant la simulation [6], [7].

La pathomimie touche habituellement, les femmes (dans l'adolescence ou l'âge adulte) qui ont tendance à être émotionnellement fragiles et survient généralement dans un contexte de difficultés psychosociales ou interpersonnelles [4].

Plusieurs théories expliquant l'origine des troubles factices sont émises. Les motivations du pathomime sont souvent difficiles à comprendre. S'adapter à une souffrance psychique sévère et jouer le rôle de malade sans avantages tangibles ni immédiats en serait une [7].

Elle traduirait ainsi un appel à l'aide lorsque des contraintes émotionnelles deviennent trop grandes à supporter. [1]: la quête d'un regain d'attention de l'entourage, de l'être aimé, ou la recherche d'une relation fixe et sécurisante avec un médecin faisant écho au sentiment d'insécurité de la vie personnelle [7] .

La théorie d'un état dissociatif dans la survenue des troubles factices a été plus récemment développée [9]. La notion de trouble dissociatif couvre un spectre allant des mécanismes de défense à l'altération de l'état de conscience. Etre dans un état dissociatif consisterait à avoir des trous de mémoire concernant une expérience personnelle, qui ne serait pas dus à un oubli ordinaire, à des expériences extra corporelles, ni à d'autres distorsions perceptives [9]. Il s'agirait du résultat de la répression de pensées ou de souhaits inacceptables pour l'individu [9]. Ainsi, les symptômes dissociatifs surviendraient au cours de périodes de difficultés relationnelles ou interpersonnelles [9].

Pour ce qui concerne notre patiente, le contexte social a créé une dépression profonde, et la pathomimie cutanée constitue un appel au secours lancé par la patiente. L'arrivée de la seconde épouse, la confiscation de l'être aimé par cette dernière ainsi que les accusions à son égard constitueraient une réalité insupportable pour la patiente, le comportement factice pourrait être considéré comme un mécanisme de défense psychique face à la réalité de trahison, d'abandon et d'accusation (9). Des facteurs de stress aigu sur un fond d'histoires traumatisantes de la vie seraient à l'origine de cet état dépressif.

Les différents procédés de production des lésions cutanées sont variés (usage des ongles, scarifications, entailles par des objets tranchant tel couteaux, morceaux de verre, brûlure par cigarette, pièce chaude, tasse de thé) et dépendent du niveau d'instruction et de connaissance du pathomime. Cependant, de nombreuses fois, les patients ne révèlent généralement pas comment ils produisent la lésion comme c'est le cas chez notre patiente [10].

La prise en charge des troubles factices en dermatologie n'est pas codifiée, cependant elle doit relever d'une prise en charge pluridisciplinaire. La recherche abrupte de la vérité, ainsi que la révélation du diagnostic au patient seraient à proscrire [1], [8], [9]. Le fait de tenir secret et ne pas dévoiler l'implication du pathomime dans la survenue des lésions, ne doit jamais être perdu de vue [9]. Certains auteurs plaident en faveur de la prise en charge des pathomimies cutanées en dermatologie, avec la participation du psychiatre et non son transfert en psychiatrie. [8]. Cela pourrait être ressentie par le pathomime comme une trahison, un abandon et aboutir au déplacement de sa demande de soins vers d'autres prestataires, comme cela a été le cas chez notre patiente qui a interrompu le suivi medical dès son transfert en psychiatrie [9]. L'établissement d'une relation médecin-malade basée sur la confiance, l'empathie pour le malade est nécessaire à la réussite de cette prise en charge. L'explication de l'état psychiatrique associé à l'origine de la pathologie factice pourrait déculpabiliser le malade et l'aider à adhérer à la thérapie pour la résolution de ce désordre [9].

CONCLUSION

Le diagnostic et la prise en charge d'une dermatose factice restent un challenge pour le dermatologue. En effet, la dermatose factice confronte le clinicien à deux ordres de problèmes : celle d'é1iminer une authentique dermatose, et celle de reconnaître le trouble psychique puis le prendre en charge. Il faut savoir y penser devant toute dermatose dont l'interrogatoire note une histoire ambiguë, des lésions cutanées ne répondant à aucun mécanisme physiopathologique connu, des examens complémentaires normaux. La prise en charge multidisciplinaire requiert une relation médecin-malade de confiance et une empathie pour le patient afin de faciliter l'acceptation de la thérapie par le patient.

REFERENCES

[1] L. Misery, "les pathomimies cutanées", Annales Medico-psychologiques, no168, pp. 297-300, 2010.
[2] I Sneddon, "Self inflicted injury: A follow up of 43 patients" British Medical Journal;no1,pp. 527-530, 1975.
[3] F Busato, A Castex, A Godel, D Adoue," Analyse des résultats d'un registre des pathomimies cutanées," Revue Medecine Interne, no 24 Suppl 1, 2003.
[4] A Abelhauser," Pathologies factices et vérités subjectives". L'Evolution Psychiatrique,no 64,pp. 113-133, 1999
[5] S Verraes-Derancourt, C Derancourt, F Poot, M Heenen, P Bernard. " Pathomimie : étude rétrospective de 31 malades", Annales de Dermatologie et Venereologie " no 133, pp. 235-238, 2006.
[6] CI. Labram," Les maladies factices et le syndrome de Munchausen", Revue de Medecine Interne, Tome IV, no 4 : pp. 343-351, 1983.
[7] L. Krahn, H. Li, M. O. Connor,"Patients who strive to be ill :factitious disorder with physical symptom" American Journal of Psychiatry;no160, pp. 1163- 1168, 2003.
[8] Y. Scrivener," Pathomimies cutanées, Plaidoyer pour une prise en charge en milieu dermatologique sans confrontation directe". Annales de Dermatologie Venereologie,no 132,pp.109-110, 2005.
[9] F. Fekih- Romdhane, W. Homri, R. Labbane, "Troubles factices en dermatologie : intérêt du concept d'état dissociative", Annales de Dermatologie Venereologie, no143,pp. 210-214,2016.
[10] S., Nayak , B. Acharjya , B.Debi , SP. Swain, " Dermatitis artefacta". Indian Journal of Psychiatry; no55: 189-91, 2013.

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Retrospective Study Evaluating Efficacy and Toxicity of Concurrent Chemoradiotherapy in Head and Neck Cancer Patients

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ABSTRACT: Head and neck cancer is the most common cancer in developing countries. The concurrent chemoradiotherapy (CCRT) was a standard care for patients with locally advanced squamous cell carcinoma. So, the aim of the present retrospective study was to assess the efficacy and toxicity of the radical concurrent chemo-radiotherapy in head and neck cancer patients and to identify the prognostic and therapeutic factors affecting the outcome. This current study included 102 patients receiving radical radiotherapy concurrently with chemotherapy (Cisplatin, paclitaxel, and Docetaxel plus Cisplatin). These data were collected from the databases at South Egypt Cancer Institute and Assuit University Hospital.
In these patients, the sites of tumor were in the following descending order: larynx (65.7%), the oral cavity (16.7%), the hypopharynx (14.7%) and oropharynx (2.9%). The tumor stage IV was recorded in 83 patients (81.4%).
The loco-regional control after the treatment was 74.5%. The median follow up was 12 months. The 2-year overall survival (OS) and progression free survival (PFS) were 26.7% and 23% respectively. The prognostic factors that were significantly associated with the tumor response were the tumor stage, the histopathologic grade, the radiation dose and radiation treatment time. The primary tumor site was the only significant independent prognostic factor affecting both OS and PFS and the radiation technique significantly affected OS but not PFS. The hazard ratio was considered in the significant prognostic factors to determine the importance of factor levels. The most common treatment toxicities recorded were for mucositis (29.4%), dysphagia (28.4%) and skin reaction (21.6%).

KEYWORDS: Head and Neck, Cancer, Chemoradiotherapy, Retrospectives, Cisplatin, Cox regression.

1 INTRODUCTION

Head and neck cancer (HNC) is the most common cancer in developing countries and is responsible for many deaths worldwide [1]. Head and neck cancer is the sixth type of cancer [2],[3], representing about 6% of all cases and accounting for an estimated 650,000 new cancer cases and 350,000 cancer deaths worldwide every year [4].

Concurrent chemoradiotherapy (CCRT) is the current standard of care for patients with locally advanced squamous cell carcinoma of the head and neck [5],[6]**.** CCRT provides organ preservation that can affect the psychological status, performance status and quality of life of patients. [7].

Treatments used in the management of head and neck tumors may induce more mutilations and malfunctions, worsening the quality of life. Consequently, optimizing outcomes in terms of survival, tumor control, function, and quality of life is a challenge [2],[8].

Most randomized clinical trials exhibit the superiority of combined radiotherapy (RT) and chemotherapy to RT alone for the treatment of locally advanced, non-metastatic squamous carcinoma of the head and neck (HNC) [5],[6]. In Meta-Analysis

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of Chemotherapy on Head and Neck Cancer (MACH-NC), concurrent chemoradiotherapy was found to be the most effective approach with an absolute benefit of 6.5% in 5 years [9].

Chemotherapy is being combined with radiotherapy for improvement of locoregional control and organ preservation and to reduce the formation of distant metastasis [10],[11]. Medina [10] and NCCN [12] also stated that neoadjuvant therapy has yet to be conclusively proven to be beneficial.

The overall survival rate for this cancer depends on the primary site and disease stage with variability [13]. In the case of oral cavity cancer, the overall survival rate is 50% over five years [3]. For other sites (pharynx and larynx), the rate is greater than 50% for early stage disease and generally less than 50% at advanced stages [14].

Toxicity from concurrent chemoradiotherapy was tolerated in most of the patients [15],[16]. Acharya et al. [17] reported that the most common toxic effects of the CRT are oral mucositis, skin reactions and hematological toxicities. Acharya et al. [17] stated also that despite acute toxicities, most of the patient completed the intended treatment; this was facilitated by administration of aggressive supportive care.

According to the previous findings, the current study aimed at the evaluation of the efficacy and toxicity of the radical concurrent chemoradiotherapy in locally advanced head and neck cancer patients of the South Egypt Cancer Institute and Assiut University Hospital and the identification of the prognostic and therapeutic factors affecting the corresponding outcome.

2 PATIENTS AND METHODS

2.1 ELIGIBILITY AND EXCLUSION CRITERIA

The medical records of all patients with head and neck squamous cell carcinoma (HNSCC) treated with radical CRT in South Egypt cancer Institute (SECI) and Assiut University Hospital (AUH), Clinical oncology Department, Assiut, Egypt between 2008 and 2012 were reviewed and assessed retrospectively. The current study included patients with loco-regionally advanced American Joint Committee on Cancer (AJCC) Stage III & IV HNSCC excluding nasopharyngeal cancers which were histologically diagnosed and planned for definitive CCRT. Patients treated with induction chemotherapy prior to the CCRT were included. Patients who had distant metastatic disease or fatal co-morbidity at treatment initiation were excluded.

2.2 RADIOTHERAPY

All patients were irradiated with megavoltage beams either on a telecobalt or a Linear Accelerator, with conventional fractionation (200 cGy per fraction, one fraction per day, 5 days per week) using 2D (Fig. 1), conventional technique or 3D (Fig. 2), conformal radiotherapy with shrinking field technique. Most patients were treated with bilateral opposing portals to the face and neck as per the institutional policy. Three-field technique (bilateral opposing for primary and upper neck matched onto a low anterior neck field) was used sparingly at the discretion of the treating oncologist. The radiation portals were dictated by primary site and disease stage. Beam modifiers and posterior neck boosts with appropriate electron energy were used as and when indicated. Spinal cord shielding was applied after 46 Gy in 23 fractions.

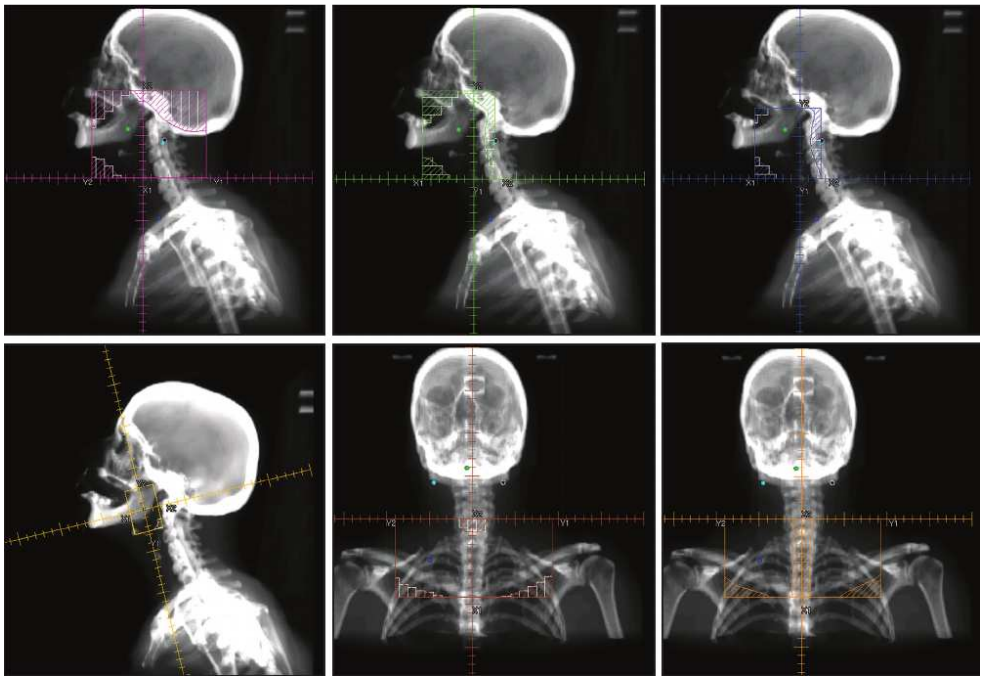


Fig. 1. A typical example of the conventional three-field technique. (A) The beam's eye view (BEV) of one of the bilateral fields for the initial 21 fractions. (B) The BEV of one of the off-cord lateral fields for the subsequent 6 fractions. (C) The BEV of the first cone-down to the primary tumor and the high-risk clinical tumor region for the next 6 fractions. (D) The BEV of the second cone-down for 3 more fractions. (E) The BEV of the anterior supraclavicular field for 22 fractions with a larynx block in the middle. (F) The BEV of the anterior field with the spinal cord block for additional 3 fractions [18]

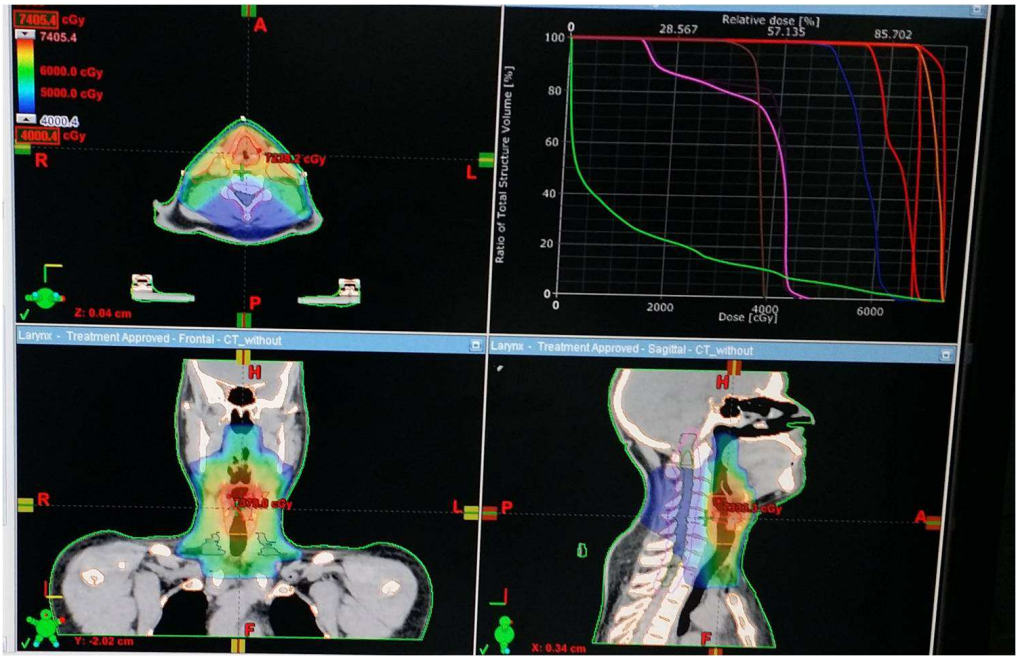


Fig. 2. Example of the 3D conformal radiotherapy planning technique showing dose distribution for axial, coronal and sagittal views and dose volume histogram

2.3 CHEMOTHERAPY

Three regimen of concurrent chemotherapy were included in the present study; weekly cisplatin 30-40 mg/m2, weekly paclitaxel 40 mg/m2 and weekly docetaxel 20-25mg/m2 plus cisplatin 20-25 mg/m2. Two or three cycles of induction chemotherapy that includes docetaxel, cisplatin, and 5-fluorouracil (TPF) were given prior to the CCRT. TPF regimen given in

21-day cycles (Docetaxel, 75 mg/m2, Intravenous (I.V.) on day 1; Cisplatin, 75 mg/m2, I.V. on day 1; 5-fluorouracil, 1000 mg/m2/day by continous I.V. infusion over 24 hours on days 1 through 4).

2.4 FOLLOW UP

All patients were monitored closely weekly during the course of CCRT for assessing the toxicity of therapy. Toxicity grading was done according to the Radiation Therapy Oncology Group (RTOG) [19],[20] and Common Toxicity Criteria (CTC) grading systems [21] for radiation-related and chemotherapy-related toxicities respectively. The patients were followed up at 4–6 weeks from completion of therapy to assess response, toxicity and disease status. Post treatment evaluations included physical examination, fiberopticnasolaryngoscopy and contrast-enhanced neck Computerized Tomography (CT) scan. Subsequent follow-up visits were scheduled at 3–6 monthly intervals for the first 2 years and annually thereafter. Patients who dropped out or did not complete planned course of treatment were included as events for all the outcome measures. The disease status of patients who had completed the planned course of therapy, but not actively following-up was updated by telephonic contact. Non-responding patients were considered lost to follow-up and censored for statistical consideration.

2.5 STATISTICAL ANALYSIS

The survival is defined as the time for registration to death regardless of the cause. The overall survival (OS) and progression free survival (PFS) were calculated using the method of Kaplan-Meier. All estimates were calculated from the date of diagnosis till the defined event if any or until last contact or death. The data was compared using the log-rank test and Cox regression model for multivariate analyses. The statistical analysis for comparing the percentages in different groups was performed using Chi-square test. All analysis was done by IBM SPSS statistical package version 20 [22]. Descriptive statistics were estimated in terms of mean, number (No), and percentages (%).The hazard ratio (HR) was considered in the significant prognostic factors to determine the importance of factor levels.

3 RESULTS

A total of 102 patients with AJCC Stage III and IV HNSCC (excluding nasopharynx) who were treated with definitive concurrent CRT at a period from 2008 to 2012 at SECI and AUH, Clinical Oncology Department were included in the dataset. Patients with progressive disease or dropouts after a few fractions of RT without completing the planned radical course either due to toxicity or socio-personal reasons were also included in the analysis.

3.1 PATIENTS' CHARACTERISTICS (TABLE 1)

The median age of the patients was 59 years (range 28–87 years). The males were 82 patients (80.4%) while the females were 20 patients (19.6%) with sex ratio 4.1:1 in favor of males. The most common tumor site was larynx in 67 patients (65.7%) followed by the oral cavity in 17 patients (16.7%) then the hypopharynx and oropharynx in 15 patients (14.7%) and 3 patients(2.9%) respectively. According to TNM staging system, stage III was recorded in 19 patients (18.6%) while stage IV was represented by 83 patients (81.4%). The histopathology was identified to be squamous cell carcinoma in all patients, with grades I (GI), II (GII) and III (GIII) represented by 26 (25.5%), 48 (47%) and 28 (27.5%) patients respectively. Smokers were 37 patients (36.3%) and non-smokers were 65 patients (63.7%); all females in the current study were non-smokers.

3.2 TREATMENT CHARACTERISTICS (TABLE 1)

All 102 patients received radical concurrent chemoradiotherapy (CCRT) and 20 patients (19.6%) of them received induction chemotherapy followed by the CCRT. The patients received three different types of concurrent chemotherapy including; weekly cisplatin in 81 patients (79.4%), weekly paclitaxel in 12 patients (11.8%), and weekly docetaxel plus cisplatin in 9 patients (8.8%). The median total dose of radiation for the entire study was 60Gy. Most of the patients received 66-70 Gy. The median radiation treatment time (RTT) was 50 days. The radiation planning technique used 2D, conventional technique in 81 patients (76.4%) and 3D, conformal radiotherapy in 21 patients(20.6%).

Table 1. Patients and treatment characteristics

Variable	No.(n=102)	%
Age		
≤59	51	50
>59	51	50
Sex		
Male	82	80.4
Female	20	19.6
Tumor site		
Larynx	67	65.7
Oral cavity	17	16.7
Hypopharynx	15	14.7
Oropharynx	3	2.9
Stage		
III	19	18.6
IV	83	81.4
Pathologic grade		
GI	26	25.5
G II	48	47
G III	28	27.5
Smoking		
-	65	63.7
+	37	36.3
Treatment modalities		
Radical CRT	82	80.4
Induction CT+ radical CRT	20	19.6
Chemotherapy type		
Cisplatin	81	79.4
Paclitaxel	12	11.8
Docetaxel + Cisplatin	9	8.8
Radiation dose (Gy)		
<60	20	19.6
≥60	82	80.4
Radiation technique		
2D	81	76.4
3D	21	20.6
Radiation treatment time	52	51
≤50	50	49
>50		

3.3 EFFICACY ANALYSIS

3.3.1 LOCAL CONTROL AND TREATMENT RESPONSE:

Local control after the treatment occurred in 74.5% of the patients. Tumor response was evaluated 4-6 weeks after completion of the treatment. Complete response (CR), partial response (PR), Stable disease (SD) and progression of disease were recorded in 20 (19.6%), 44 (43.1%), 12 (11.8%) and 7 (6.9%) patients respectively. 19 patients (18.6%) did not complete the planned radiation regimen due to toxicity or socio-personal reasons (Fig. 3). Most of the patients with PR, SD or progressed disease continued their treatment with chemotherapy or salvage surgery.

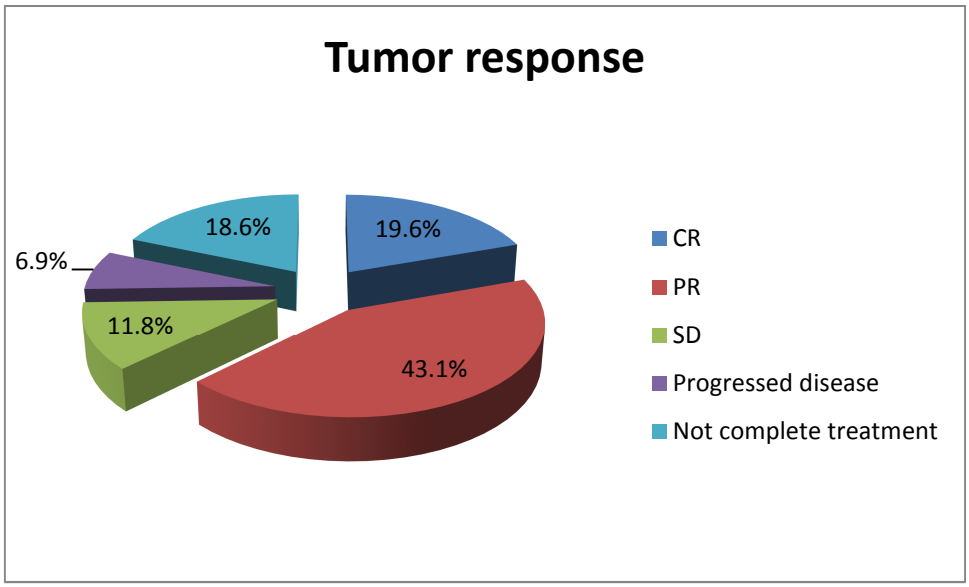


Fig. 3. Tumor response to the treatment

The influence of age, sex, tumor site, stage, histopathologic grade, smoking, treatment modalities, chemotherapy type, radiation dose, RTT and planning technique were studied by Chi-square test in association with tumor response. The prognostic factors that significantly affected the tumor response (P< 0.05) were the tumor stage, the histopathologic grade, radiation dose and RTT.

3.3.2 THE SURVIVAL

With a mean follow-up of 12 months (range 0–92 months) for all patients, the 2-year overall survival and PFS were 26.7% and 23% respectively (Figs. 4 & 5). Three patients (2.9%) developed distant metastases, three patients (2.9%) developed local recurrence after CR and four patients (3.9%) showed progression of their disease was detected on follow up.

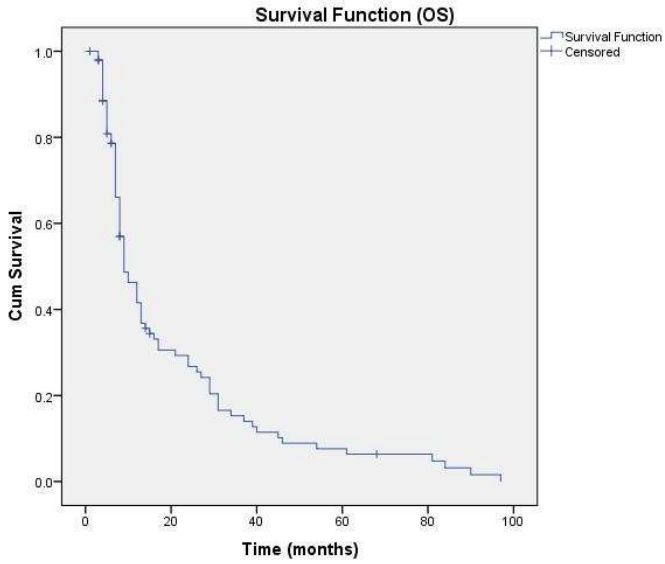


Fig. 4. Kaplan-Meier plots of overall survival (OS) for all patients

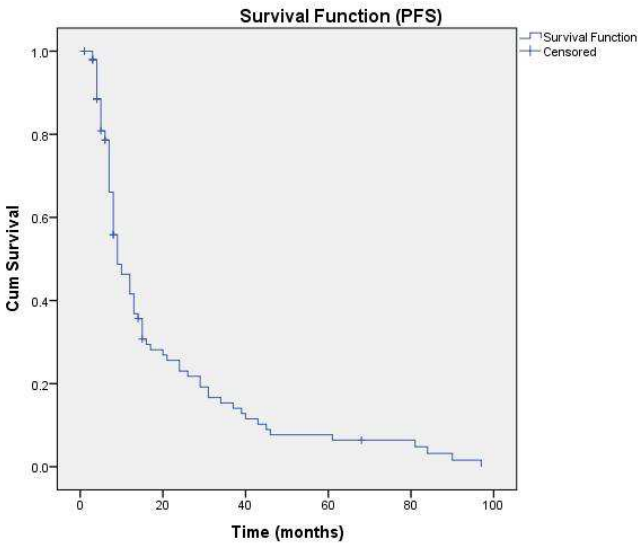
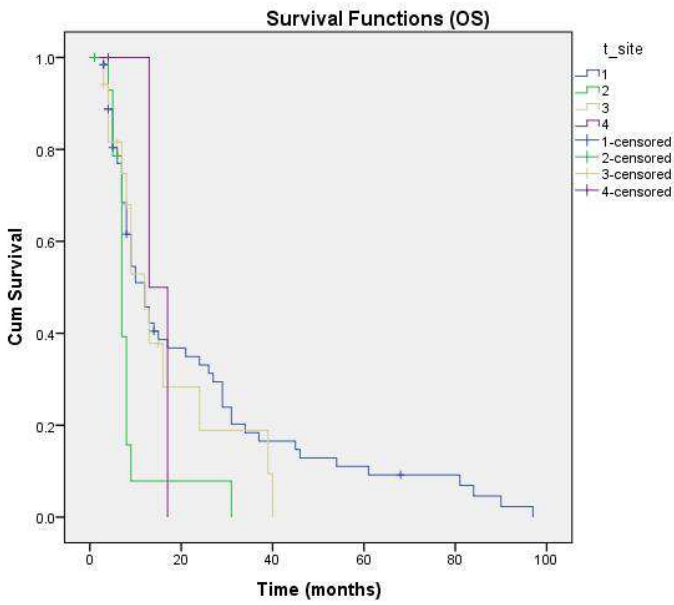
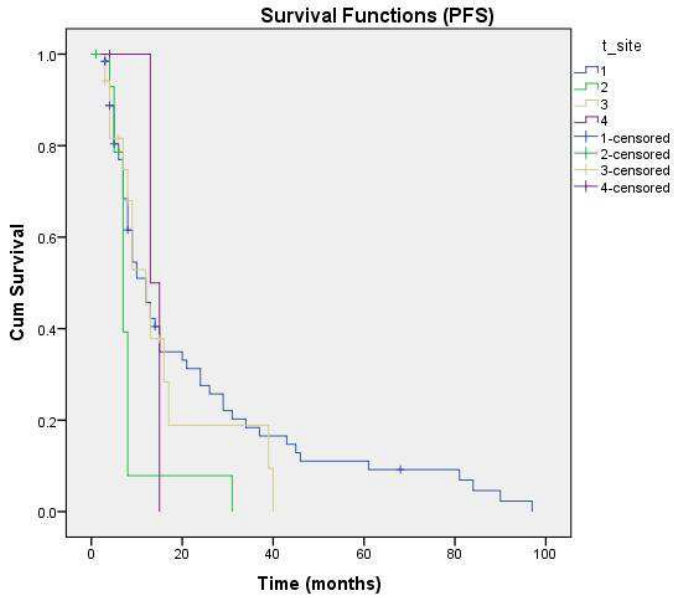


Fig. 5. Kaplan-Meier plots of progression free survival (PFS) for all patients

The impact of different prognostic factors on OS and PFS was studied (Table 2). The primary tumor site was highly significant for both OS and PFS (P= 0.04 for both) (Fig. 6). Patients with oropharyngeal cancer showed the worst outcome, with a 2-year OS and PFS of 0% for each may be due to less number of the patients enrolled in the study. In contrast patients with laryngeal and oral cavity cancers had the best 2-year outcomes. Their 2-year OS and PFS was 33.1% & 27.6% and 18.9% & 15.9% respectively. Hypopharyngeal cancer fared intermediately with 2-year outcomes of 2.5% and 2.4% for OS and progression free survival respectively.



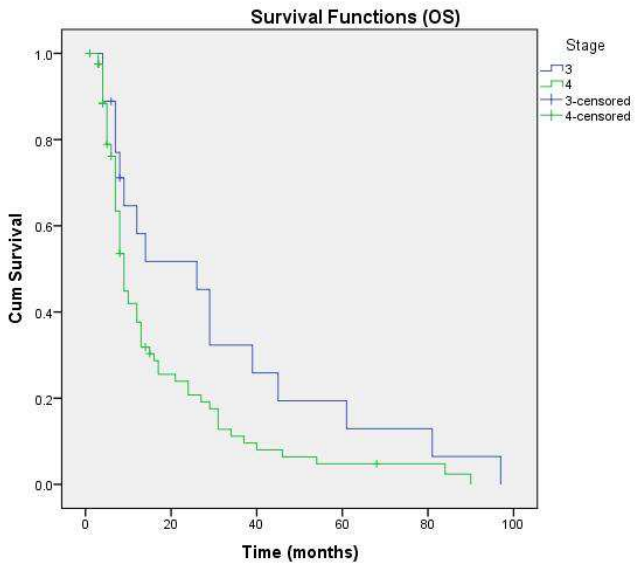
(a)



(b)

Fig. 6. Kaplan-Meier plots of overall survival (a) and progression free survival (b) for the primary tumor site

The AJCC stage grouping was highly significant for both OS and PFS (Fig. 7). The 2-year OS and PFS was 46.4% and 41% respectively for stage III disease as compared to 20.8%and 17.7% for stage IV with significant p-values (p =0.05).



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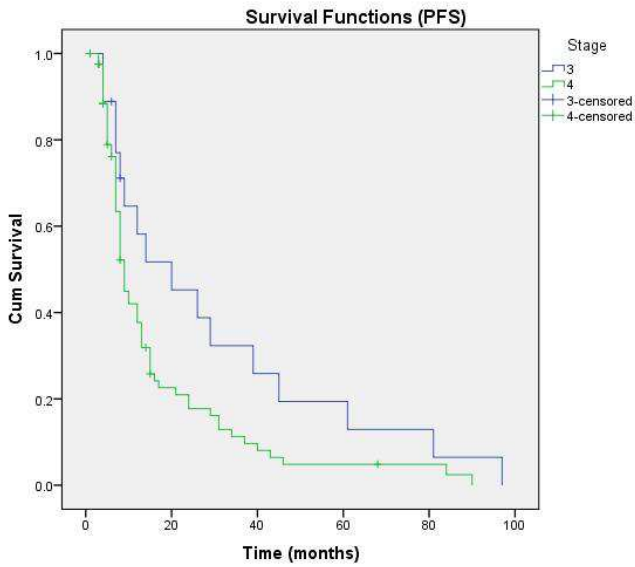
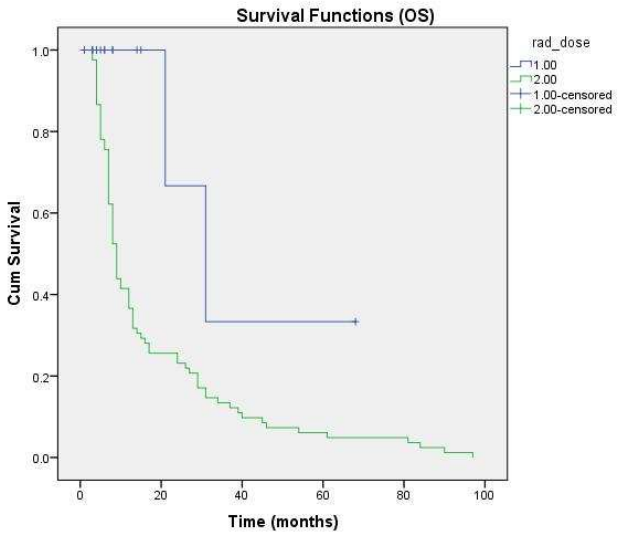


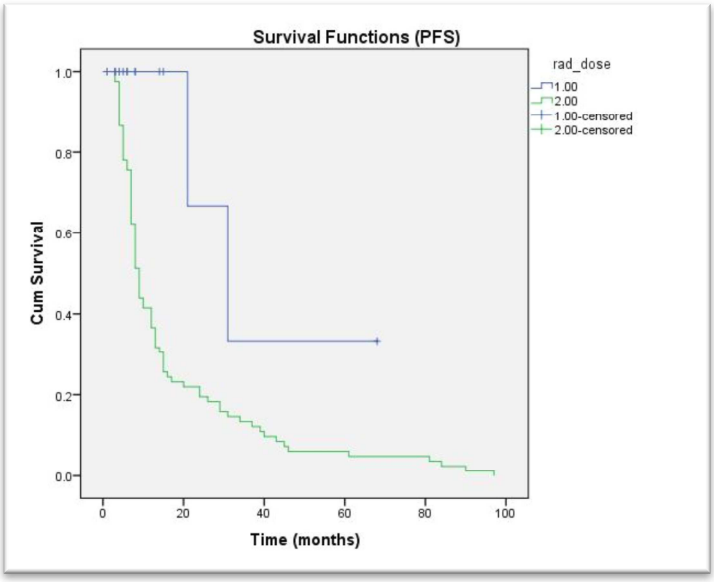
(b)

Fig. 7. Kaplan-Meier plots of overall survival (a) and progression free survival (b) according to the tumor stage

The intensity of treatment affected all the outcome measures significantly. On the basis of total dose of RT delivered, the patients were categorized into two dose groups, <60 Gy; and ≥60 Gy. The 2-year OS in patients receiving <60 Gy was 23.2% as compared to 56.7% in patients receiving ≥60 Gy (p = <0.001). Similarly patients receiving higher total doses had better 2-year PFS (19.5% vs 56.7%, p = <0.001) (Fig. 8).



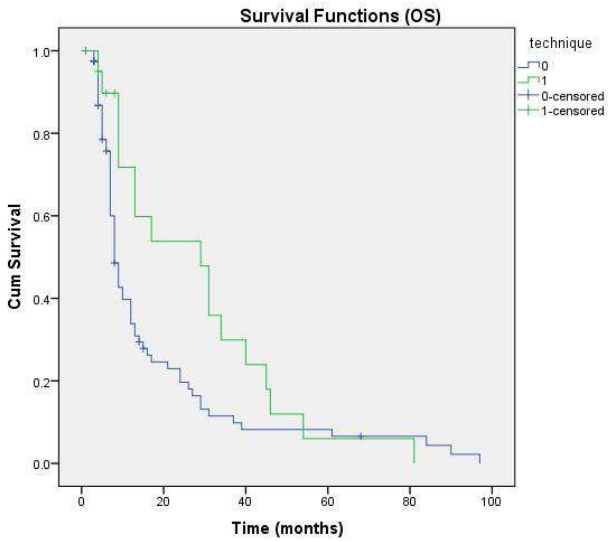
(a)



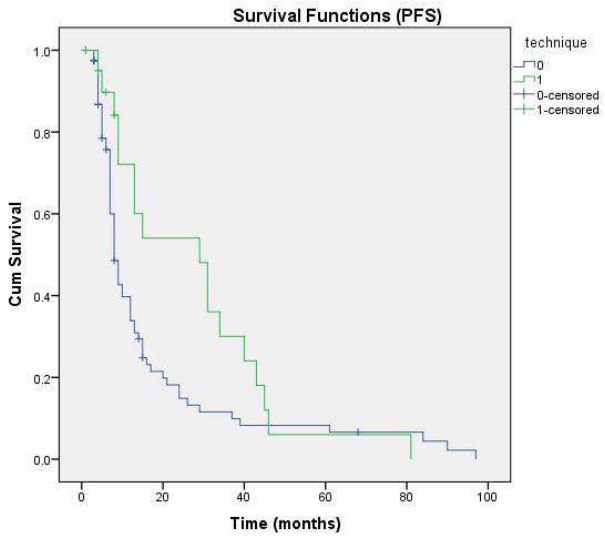
(b)

Fig. 8. Kaplan-Meier plots of overall survival (a) and progression free survival (b) according to the radiation dose (rad_dose)

In the current study, radiation technique was a significant predictor of outcome with patients treated with 3D planning showing better survival than patients treated with 2D. The 2-year OS and 2-year PFS were 50.4% vs 19.7% (P= 0.05) and 50.3% vs 14.9% (P= 0.05) for 3D and 2D respectively emphasizing on the more efficacy of 3D planning in comparison with 2D planning (Fig. 9).



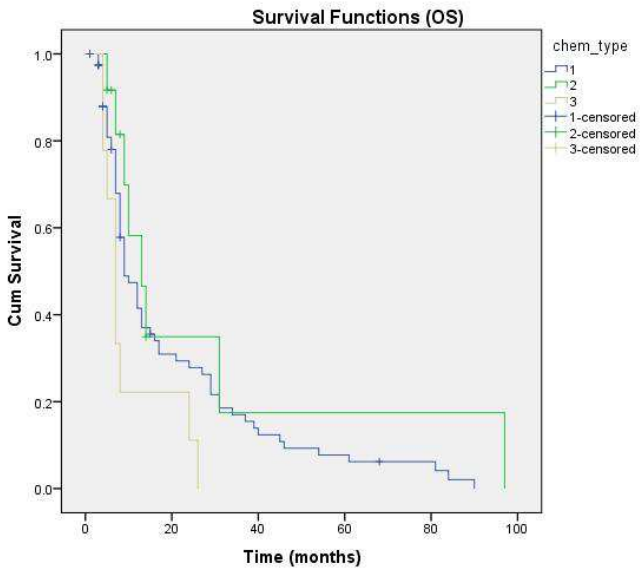
(a)



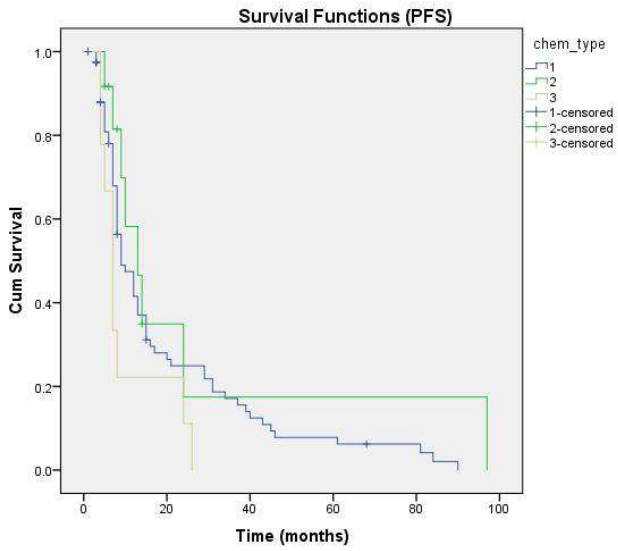
(b)

Fig. 9. Kaplan-Meier plots of overall survival (a) and progression free survival (b) according to the radiation technique

The type of chemotherapy used concurrently with radiotherapy affected significantly the OS but not the PFS. The 2-year OS for cisplatin, paclitaxel and docetaxel plus cisplatin were 27.8%, 24.7% and 11.1% (P=0.05) whereas, the 2-year PFS were 23.7%, 17.5% and 11.1% respectively (P=0.07) (Fig. 10).



(a)



(b)

Fig. 10. Kaplan-Meier plots of overall survival (a) and progression free survival (b) according to the chemotherapy type (chem_type)

Younger age as a prognostic factor did show a trend towards improved outcome which did not reach statistical significance. It is well-accepted that older patients tend to have worse outcomes with aggressive schedules due to lower compliance and higher toxicity rates. Histological grade, sex and smoking were not found to affect outcome significantly (P>0.05). The therapeutic factors as the treatment modalities and radiation treatment time also were not significantly affect the OS and PFS.

All the significant prognostic factors recorded by the Kaplan-meire univariate analysis were subjected for further multivariate analysis. Multivariate analysis using Cox proportional hazards model confirmed the importance of the primary tumor site as significant and independent prognostic factors for both OS and PFS (P=0.04) and the importance of radiation technique as a significant prognostic factor for OS (P=0.04) but not for PFS (P=0.06). The value of hazard ratio (HR) for tumor site showing that the affection on OS for hypopharynx, oral cavity and oropharynx is 2.0 times, 1.2 times, and 1.7 times respectively higher compared to the larynx whereas the affection on PFS is 2.1 times, 1.2 times and 1.6 times respectively

higher compared to the larynx. The 2D technique reflects a risk of 2.1 times over that of 3 D technique on the OS (Tables 3 & Figs. 11-13).

Table 2. Prognostic factors affecting both the overall (OS) and progression-free (PFS) survivals (Kaplan-Meire analysis- log rank test)

Prognostic factor	2-year OS		2-year PFS	
	%	P value	%	P value
Age				
≤59	34.7	0.90	29.8	0.86
>59	18.4		15.6	
Sex				
Male	28.9	0.08	24.2	0.08
Female	18.2		15.1	
Tumor site				
Larynx	33.1		27.6	
Oral cavity	18.9	0.04	15.9	0.04
Hypopharynx	2.5		2.4	
Oropharynx	0		0	
Stage				
III	46.4	0.05	41	0.05
IV	20.8		17.7	
Pathologic grade				
GI	30.4		25.6	
G II	26.7	0.96	21	0.96
G III	21.2		17.3	
Smoking				
-	26.5	0.66	20.1	0.60
+	27.4		27.4	
Treatment modalities				
Radical CRT	28.9		24.3	
Induction CT+ radical CRT	18.1	0.13	18.1	0.17
Chemotherapy type				
Cisplatin	27.8		23.7	
Paclitaxel	24.7	0.04	17.5	0.07
Docetaxel + Cisplatin	11.1		11.1	
Radiation dose(Gy)				
<60	23.2	<0.001	19.5	<0.001
≥60	56.7		56.7	
Radiation technique				
2D	19.7	0.05	14.9	0.05
3D	50.4		50.3	
Radiation treatment time				
≤50				
>50	25.4	0.84	25.9	0.84
	26		20	
Tumor response				
CR	45.8		45	
PR	15.9	<0.001	11.4	<0.001
SD	13.6		13.6	
Progressed disease	0		0	
Not complete treat.	-		-	

Table 3. Significant factors in multivariate analysis (Cox-regression) for overall survival (OS) and profression free survival (PFS)-based outcome measures (Hazard ratio, HR and 95% confidence limits, CL)

Multivariate Cox-regression results					
		OS		PFS	
Variable	No.	HR (95%CL)	P-value	HR (95%CL)	P-value
Tumor response					
Not complete treatment	19	(reference, ref)		(reference, ref)	
CR	20	4.2 (0.2-76.3)	0.33	3.8 (0.2-70.2)	0.36
PR	44	4.4 (0.2-80.6)	0.32	4.3 (0.2-78.6)	0.32
SD	12	6.3 (0.4-102.6)	0.19	5.7 (0.4-94.2)	0.22
Progression	7	6.8 (0.3-136.8)	0.20	6.6 (0.3-131.2)	0.21
Chemotherapy type					
Cisplatin	81	(ref)		(ref)	
Paclitaxel	12	0.7 (0.3-1.8)	0.48	0.8 (0.3-1.9)	0.60
Docetaxel +Cisplatin	9	1.5 (0.7-3.3)	0.29	1.4 (0.7-3.0)	0.38
Radiation dose					
<60	20	(ref)		(ref)	
≥60	82	2.0 (0.2-16.0)	0.52	2.1 (0.3-17.4)	0.47
Tumor site					
Larynx	67	(ref)		(ref)	
Hypopharynx	15	2.0 (1.0-4.1)	0.04	2.1 (1.0-4.1)	0.04
Oral cavity	17	1.2 (0.6-2.3)	0.53	1.2 (0.6-2.3)	0.56
Oropharynx	3	1.7 (0.4-8.8)	0.49	1.6 (0.3-8.1)	0.55
Radiation technique					
3D	21	(ref)		(ref)	
2D	81	2.1 (1.0-4.4)	0.04	2.0 (0.9-4.1)	0.06
Stage					
III	19	(ref)		(ref)	
IV	83	1.7 (0.9-3.2)	0.11	1.7 (0.9-3.2)	0.11

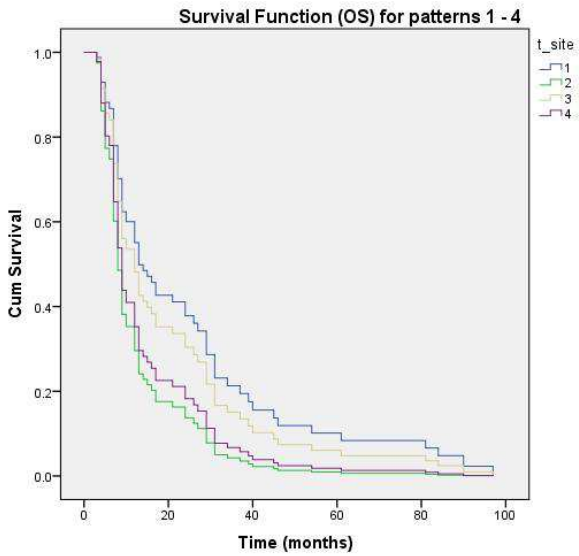


Fig. 11. The cumulative overall survival according to tumor site (t_site) patterns

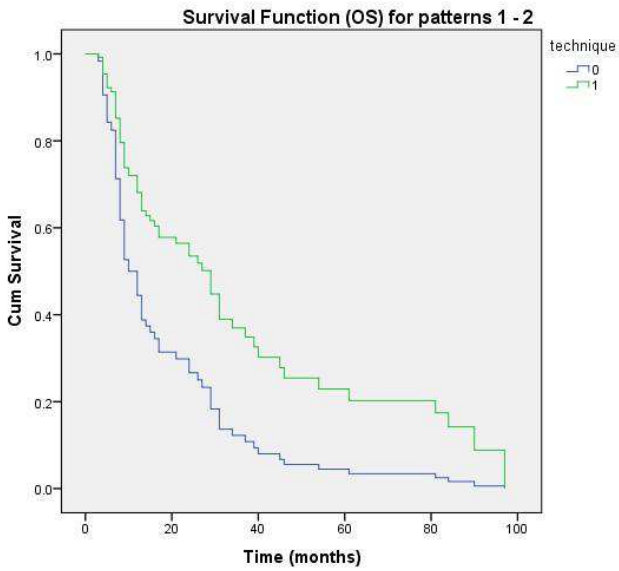


Fig. 12. The cumulative overall survival according to radiation technique patterns

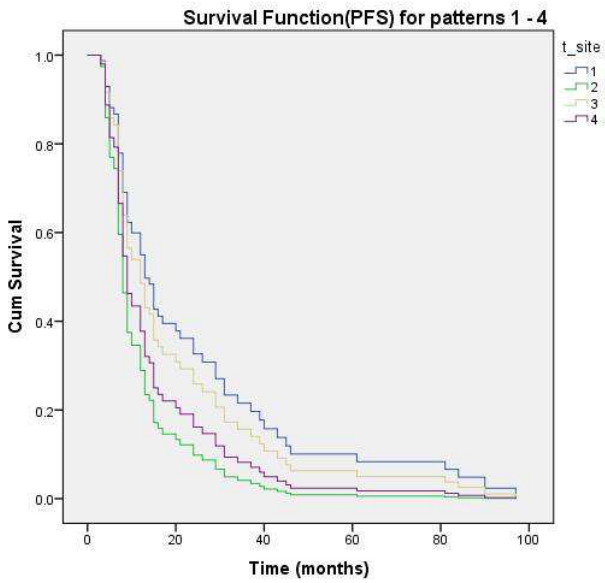


Fig. 13. The cumulative progression free survival according to tumor site (t_site) patterns.

3.4 TOXICITY ANALYSIS

Toxicity from concurrent chemoradiotherapy was tolerated in most of the patients considered. The present results (Fig. 14) exhibited that mucositis was the most common toxicities occurring in 30 patients (29.4%) followed by dysphagia occurring in 29 patients (28.4%) whereas the skin reaction was represented by 22 patients (21.6%). The RTOG acute grade III toxicity included mucositis, dysphagia and dermatitis occurring in 6 (5.9%), 5 (4.9%) and 9 (8.8%) patients respectively. Such grade of toxicity was recorded in most of the time in patients receiving more intense treatment i.e. doses ≥66 Gy and planning with 2D radiation technique.

In other toxicities recorded, only one patient developed grade III laryngeal edema and this patient underwent urgent tracheostomy. Grade I and III xerostomia occurred in 7 patients (6.9%) and 5 patients (4.9%) respectively. Grade I/II nausea and vomiting occurred in 7 (6.9%) patients. Acute hematologic toxicity in the form of neutropenia occurred in 4 (3.9%) patients. The incidence of CTC grade III neutropenia was 1.9% and no episodes of febrile neutropenia were recorded. There was minimal acute kidney dysfunction recorded in 3 (2.9%) patients. One patient developed ototoxicity and one patient

developed cardiac toxicity. Other radiation-enhanced complications were reported such as infection flaring by accumulation of pus behind the ear recorded in one patient and development of trachea-esophageal fistula in two other patients who did not complete their treatment and salvage surgery done.

Toxicity of the treatment may lead to patient interruption in receiving the planned dose of radiotherapy. This situation was recorded in 19 (18.6%) patients who dropped out of treatment and did not complete RT. The overall treatment regimen was well tolerated with acceptable acute toxicity. An analysis of late effects of the regimen was not attempted due to the lack of proper documentation of late toxicity.

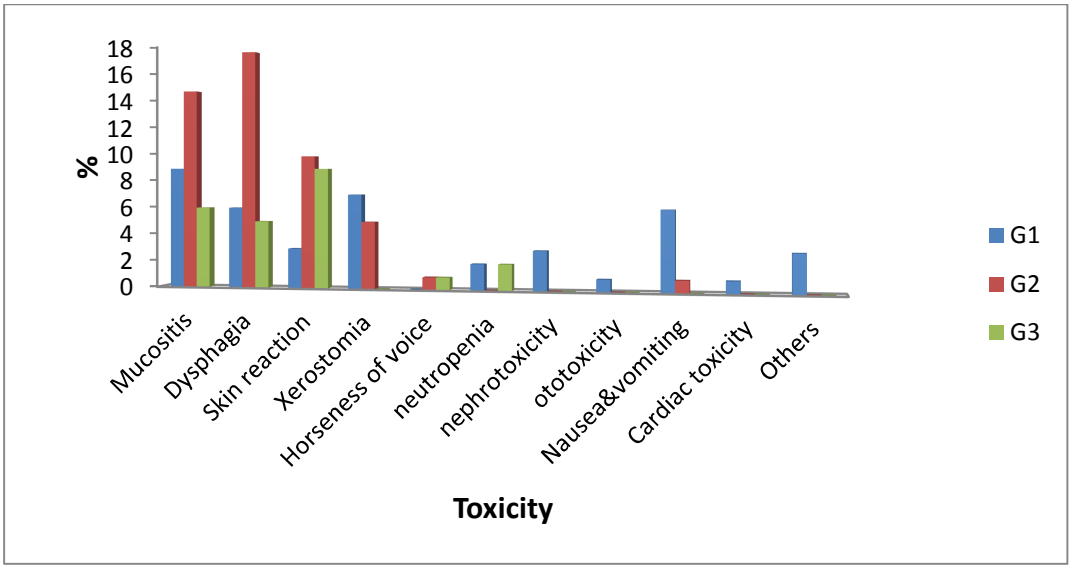


Fig. 14. Distribution of treatment-related toxicities according to the RTOG and CTC grading systems

4 DISCUSSION

Concurrent chemoradiotherapy is considered the standard treatment for locally advanced head and neck cancer patients [1],[5],[6],[11]. These authors referred to the efficacy of this regimen in improving the outcomes. However, the concurrent chemoradiotherapy was found to be associated with some types of toxicities [5],[11],[17],[23]. So, the present work assessed the efficacy and the toxicity of such treatment.

The efficacy of any curative approach is measured by its ability to achieve locoregional control and improve the survival [24],[25],[26]. In present work, the tumor response (locoregional control) after the treatment, OS, and PFS were considered as measures of efficacy.

As regards the patient response to the treatment, only 19.6% of the patients achieved CR. Mesía, et al. [25] concluded that 24% of their patients had complete response (CR). However, Adelstein, et al. [24] reported that 40.2% of their patients had CR. Such higher percentage may be due to inclusion of all the patients in their study with treatment of a total radiation dose of 70 Gy given in single, daily, 2 Gy fractions but the patients in current study were treated with different radiation dose with median dose of 60 Gy. In addition, the other prognostic factors considered in the present work could affect adversely the tumor response.

The present study revealed that the most significant factor affect the tumor response after treatment were the stage, the tumor grade, the total radiation dose and radiation treatment time (RTT) ($P < 0.05$). This was partially in agreement with Gupta, et al. [27] who stated that the stage grouping, primary site and intensity of treatment were significant predictor of the treatment outcome. As regarding the histological grading, van Weert, et al. [28] concluded in their study that histopathological grade proved to be an independent prognosticator. A situation emphasized by de Visscher, et al. [29] who reported the correlation of aggressive invasion pattern with poor local-regional control. Cannon, et al. [30] concluded that prolonged radiation treatment time is associated with inferior outcome and compromise tumor control in patients with head and neck cancer.

The current study reveals that 2-year OS and 2-year PFS were 26.7% and 23% respectively. This was comparable with the results of Peddi, et al. [31] revealed that the patients received concurrent cisplatin with RT showed the 2-year overall survival and progression free survival of 70% and 67% respectively. This difference may be due to receiving only single agent, concurrent chemotherapy, cisplatin for all patients included in their study since the cisplatin showed higher survival benefit. The findings of Forastiere, et al. [32] revealed better 2-year overall survival of 74%. Such higher value may be due to that all patients included in their study has only one tumor site, laryngeal carcinoma receiving total dose of 70 Gy with concurrent cisplatin. However, the current study included different tumor sites, different radiation doses and chemotherapy regimens that affected the outcome.

Statistical analysis of different prognostic factor in the present study showed that the tumor site independent significantly affect both OS and PFS (P=0.04) but the radiation technique significantly affect OS (P=0.04) but not for PFS (P=0.06). This result is in agreement with Gupta, et al. [27] who reported that the primary site was one of the significant and independent predictors of the outcomes. Moreover, Overgaard, et al. [33] referred to tumor site as a good prognostic value.

As regarding the radiation technique, Billan, et al. [34] concluded in their study that 3DCRT in head and neck cancer permits good coverage of the PTV than 2DRT. Clavel, et al. [35] reported superior outcomes (OS, DFS, and LRC) for IMRT patients compared to those treated with conventional radiation therapy techniques for locally advanced oropharyngeal cancer. However, Kouloulias, et al. [36] stated that there are no significant differences in terms of locoreginal control and overall survival between IMRT and 2-3D RT. These authors also mentioned that there are significant variations in tumor control and survival outcomes due to differences in patient sample, tumor stage, and follow up among several studies. In the current work, 2D technique reflects a risk of 2.1 times over that of 3D techniques on the overall survival in terms of hazard ratio (2.1, 95% CL of 1.0-4.4).

The current study included patients treated with concurrent chemoradiotherapy only who were 82 patients (80.4%) with 2-year OS and PFS of 28.9% and 24.3% respectively. The remaining 20 patients (19.6%) received induction chemotherapy followed by concurrent chemoradiotherapy with 2-year OS and PFS (18.1% for each). This result is different from the results reported by Lorch, et al. [37] and Wang, et al. [11] for phase III trial in which the induction chemotherapy lead to moderate benefit in clinical response and survival rate. However, NCCN [12] stated that an improvement in OS with incorporation of induction chemotherapy has not been established compared to receiving directly concurrent chemotherapy.

Among the three different regimens of chemotherapy concurrently used with radiotherapy in the present work, the first regimen; single agent cisplatin exhibited the highest survival benefits. In general, all types of chemotherapy have significant effects on OS (P=0.04). Similarly, Rades, et al. [38] reported that cisplatin alone was significantly associated with improved OS. Many other studies preferred cisplatin as a concurrent chemotherapy with radiotherapy [5],[9],[24],[39].

Most of the patients in the present study were treated up to doses of 66-70 Gy (median dose of 60 Gy) on a median radiation treatment time of 50 days (7 weeks). The patients received higher total dose with shorter treatment time showed better outcome. NCCN [12] reported that when using conventional definitive fractionation, the primary tumor and involved lymph nodes generally require a total of 66 Gy (2.2 Gy/ fraction) to 70 Gy (2.0 Gy/ fraction).

Trotti [40] stated that the addition of chemotherapy has introduced systemic toxicity as well as exacerbating local tissue reactions when used concurrent with radiotherapy. Tobias, et al. [23] mentioned mucositis to be the most common toxicity during treatment. In addition, Acharya, et al. [17] reported that the most common toxic effects of the CRT were mucositis, skin reactions and hematological toxicities. Among different CCRT-associated toxicities recorded in the current work, mucositis, dysphagia and skin reaction were the most common toxicities. So, it is recommended that the treatment of toxicities should be managed aggressively to limit treatment interruptions that lead to prolongation of the overall treatment time and affect the efficacy and treatment outcome.

5 CONCLUSION

In conclusion, induction chemotherapy followed by the radical chemoradiotherapy shows no improvement in the treatment outcome. The types Concurrent chemotherapy plays a significant role in the variation of the outcome and cisplatin as a mono-chemotherapy showed superior survival. It is concluded that the assessment of prognostic factors such as the tumor stage, the histopathologic grade, the radiation dose, radiation techniques, tumor site and radiation treatment time is a cornerstone in these therapies. Treatment toxicity was tolerable and was highly recorded in patients with high radiation dose and 2DRT.

REFERENCES

[1] L. Zhang, N. Jiang, Y. Shi, S. Li, P. Wang, Y. Zhao. Induction chemotherapy with concurrent chemoradiotherapy versus concurrent chemoradiotherapy for locally advanced squamous cell carcinoma of head and neck: a meta-analysis. Scientific Reports, vol. 5, pp. 10798, 2015

[2] L. Rigoni, R.F. Bruhnb, R.D. Cicco, J.L. Kanda, L.L. Matos. Quality of life impairment in patients with head andneck cancer and their caregivers: a comparative study. Brazilian Journal of Otorrhinolaryngology, vol., pp., 2016

[3] D.M. Walker, G. Boey, L.A. McDonald. The pathology of oral cancer. Pathology, vol. 35, no.5, pp. 376-83, 2003

[4] D.M. Parkin, F. Bray, J. Ferlay, P. Pisani. Global cancer statistics, 2002. CA: A Cancer Journal for Clinicians, vol. 55, no.2, pp. 74-108, 2005

[5] M.-J. Ahn, A. D'Cruz, J.B. Vermorken, J.-P. Chen, I. Chitapanarux, H.Q.T. Dang, A. Guminski, D. Kannarunimit, T. Lin, W.T. Ng, K. Park, A. Chan, T. C. Clinical recommendations for defining platinum unsuitable head and neck cancer patient populations on chemoradiotherapy: A literature review. Oral Oncology, vol. 53, pp. 10-16, 2016

[6] S. Mallick, R. Benson, P. Julka, G. Rath. Altered fractionation radiotherapy in head and neck squamous cell carcinoma. Journal of the Egyptian National Cancer Institute, vol. 28, no.2, pp. 73-80, 2016

[7] A. Munshi. Head and neck cancers: Safely preserving the talk. South Asian journal of cancer, vol. 3, no.3, pp. 143-4, 2014

[8] L.L. Gunderson, J.E. Tepper. Clinical radiation oncology, Head and neck cancer (ed 3rd). Saunders, an imprint of Elsevier Inc., 2012

[9] J. Pignon, A. le Maître, E. Maillard, J. Bourhis, M.-N.C. Group. Meta-analysis of chemotherapy in head and neck cancer (MACH-NC): an update on 93 randomised trials and 17,346 patients. Radiotherapy and Oncology, vol. 92, no.1, pp. 4-14, 2009

[10] P.J. Medina. The role of chemotherapy and other modalities in head and neck cancer. University of Tennessee Advanced Studies in Pharmacy, vol. 3, no.1, pp. 12-20, 2006

[11] H.M. Wang, C.Y. Lin, C.H. Hsieh, C.L. Hsu, K.H. Fan, J.T.C. Chang, S.F. Huang, C.J. Kang, C.T. Liao, S.H. Ng, T.C. Yen. Induction chemotherapy with dose-modified docetaxel, cisplatin, and 5-fluorouracil in Asian patients with borderline resectable or unresectable head and neck cancer. Journal of the Formosan Medical Association, vol., pp., 2016

[12] NCCN. National compehensive cancer network Clinical (NCCN) Practice Guidelines in Oncology: Head and neck cancers, NCCN-Web site, 2015, pp

[13] M.J.C. Ruback, A.L. Galbiatti, L.M.R.B. Arantes, G.H. Marucci, A. Russo, M.T. Ruiz-Cintra, L.S. Raposo, J.V. Maniglia, É.C. Pavarino, E.M. Goloni-Bertollo. Clinical and epidemiological characteristics of patients in the head and neck surgery department of a university hospital. Sao Paulo Medical Journal, vol. 130, no.5, pp. 307-13, 2012

[14] S. Marur, A.A. Forastiere. Head and neck cancer: changing epidemiology, diagnosis, and treatment. Mayo Clinic Proceedings, vol. 83, no.4, pp. 489-501, 2008

[15] M. Buglione, R. Cavagnini, F.D. Rosario, L. Sottocornola, M. Maddalo, L. Vassalli, S. Grisanti, S. Salgarello, E. Orlandi, C. Paganelli, A. Majorana, G. Gastaldi, P. Bossi, A. Berruti, G. Pavanato, P. Nicolai, R. Maroldi, A. Barasch, E.G. Russi, J. Raber-Durlacher, B. Murphy, S.M. Magrini. Oral toxicity management in head and neck cancer patients treated with chemotherapy and radiation: Dental pathologies and osteoradionecrosis (Part 1) literature review and consensus statement. Critical Reviews in Oncology/Hematology, vol., pp., 2015

[16] M. Buglione, R. Cavagnini, F.D. Rosario, L. Sottocornola, M. Maddalo, L. Vassalli, S. Grisanti, S. Salgarello, E. Orlandi, C. Paganelli, A. Majorana, G. Gastaldi, P. Bossi, A. Berruti, G. Pavanato, P. Nicolai, R. Maroldi, A. Barasch, E.G. Russi, J. Raber-Durlacher, B. Murphy, S.M. Magrini. Oral toxicity management in head and neck cancer patients treated with chemotherapy and radiation: Xerostomia and trismus (Part 2). Literature review and consensus statement. Critical Reviews in Oncology/Hematology, vol. 102, pp. 47-54, 2016

[17] B. Acharya, T. Manandhar, A.K. Jha. Effect of Concurrent Chemoradiation in patients with locally advanced head and neck cancer. Post Graduate Medical Journal of National Academy of Medical Sciences, vol. 8, no.1, pp. 1-7, 2008

[18] Q. Shang, Z.L. Shen, M.C. Ward, N.P. Joshi, S.A. Koyfman, P. Xia. Evolution of treatment planning techniques in external-beam radiation therapy for head and neck. Applied Radiation Oncology, vol. 4, no.3, pp. 18-25, 2015

[19] J.D. Cox, J. Stetz, T.F. Pajak. Toxicity criteria of the Radiation Therapy Oncology Group (RTOG) and the European Organization for Research and Treatment of Cancer (EORTC). International Journal of Radiation Oncology, Biology, Physics, vol. 31, no.5, pp. 1341-6, 1995

[20] Wikibooks-Contributors. Radiation Oncology/Toxicity grading/RTOG. (2014, January 21). Wikibooks, The Free Textbook Project. Retrieved 20:38, July 14, 2016.
from https://en.wikibooks.org/w/index.php?title=Radiation_Oncology/Toxicity_grading/RTOG&oldid=2602526, 2016

[21] NCI. Common Terminology Criteria for Adverse Events: (CTCAE), U.S. Department of Health and Human Services, National Cancer Institute (NCI), http://evs.nci.nih.gov/ftp1/CTCAE/CTCAE_4.03_2010-06-14_QuickReference_5x7.pdf, 2010, pp

[22] IBM-SPSS. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY, IBM Corp., 2011, pp

[23] J.S. Tobias, K. Monson, N. Gupta, H. Macdougall, J. Glaholm, I. Hutchison, L. Kadalayil, A. Hackshaw, U.K. Head, G. Neck Cancer Trialists. Chemoradiotherapy for locally advanced head and neck cancer: 10-year follow-up of the UK Head and Neck (UKHAN1) trial. The Lancet Oncology, vol. 11, no.1, pp. 66-74, 2010

[24] D.J. Adelstein, Y. Li, G.L. Adams, H. Wagner, J.A. Kish, J.F. Ensley, D.E. Schuller, A.A. Forastiere. An intergroup phase III comparison of standard radiation therapy and two schedules of concurrent chemoradiotherapy in patients with unresectable squamous cell head and neck cancer. Journal of Clinical Oncology, vol. 21, no.1, pp. 92-8, 2003

[25] R. Mesía, S. Vázquez, J.J. Grau, J.A. García-Sáenz, A. Lozano, C. García, J. Carles, A. Irigoyen, M. Mañós, B. García-Paredes, E. del Barco, M. Taberna, Y. Escobar, J.J. Cruz. A Phase 2 Open Label, Single-Arm Trial to Evaluate the Combination of Cetuximab Plus Taxotere, Cisplatin, and 5-Flurouracil as an Induction Regimen in Patients With Unresectable Squamous Cell Carcinoma of the Head and Neck. International Journal of Radiation Oncology, Biology, Physics, vol. 94, no.2, pp. 289-296, 2016

[26] S.I. Pai, W.H. Westra. Molecular pathology of head and neck cancer: implications for diagnosis, prognosis, and treatment. Annual Review of Pathology, vol. 4, pp. 49-70, 2009

[27] T. Gupta, J.P. Agarwal, S. Ghosh-Laskar, P.M. Parikh, A.K. D'Cruz, K.A. Dinshaw. Radical radiotherapy with concurrent weekly cisplatin in loco-regionally advanced squamous cell carcinoma of the head and neck: a single-institution experience. Head and Neck Oncology, vol. 1, pp. 17, 2009

[28] S. van Weert, I. van der Waal, B.I. Witte, C. René Leemans, E. Bloemena. Histopathological grading of adenoid cystic carcinoma of the head and neck: Analysis of currently used grading systems and proposal for a simplified grading scheme. Oral Oncology, vol. 51, no.1, pp. 71-76, 2015

[29] J.G. de Visscher, K. van den Elsaker, A.J. Grond, J.E. van der Wal, I. van der Waal. Surgical treatment of squamous cell carcinoma of the lower lip: evaluation of long-term results and prognostic factors--a retrospective analysis of 184 patients. Journal of Oral and Maxillofacial Surgery, vol. 56, no.7, pp. 814-20; discussion 820, 1998

[30] D.M. Cannon, H.M. Geye, G.K. Hartig, A.M. Traynor, T. Hoang, T.M. McCulloch, P.A. Wiederholt, R.J. Chappell, P.M. Harari. Increased local failure risk with prolonged radiation treatment time in head and neck cancer treated with concurrent chemotherapy. Head and Neck, vol. 36, no.8, pp. 1120-5, 2014

[31] P. Peddi, R. Shi, B. Nair, F. Ampil, G.M. Mills, S.H. Jafri. Cisplatin, cetuximab, and radiation in locally advanced head and neck squamous cell cancer: a retrospective review. Clinical Medicine Insights, Oncology, vol. 9, pp. 1-7, 2015

[32] A.A. Forastiere, H. Goepfert, M. Maor, T.F. Pajak, R. Weber, W. Morrison, B. Glisson, A. Trotti, J.A. Ridge, C. Chao, G. Peters, D.-J. Lee, A. Leaf, J. Ensley, J. Cooper. Concurrent chemotherapy and radiotherapy for organ preservation in advanced laryngeal cancer. The New England journal of medicine, vol. 349, no.22, pp. 2091-8, 2003

[33] J. Overgaard, H.S. Hansen, L. Specht. Five compared with six fractions per week of conventional radiotherapy of squamous cell carcinoma of head and neck: DAHANCA 6 & 7 randomized controlled trial. Lancet, vol. 362, no.9388, pp. 933-940, 2003

[34] S.G. Billan, V. Bakouche, A. Nevelsky, R. Abdah-Bortnyak, R. Uziel, F. Rawashdeh, E. Gez, R. Epelbaum, A. Kuten. Moving from 2D to 3D conformal radiotherapy (3DCRT) in locally advanced head and neck cancer: A dosimetric comparison. Journal of Clinical Oncology, vol. 25, pp., 2007

[35] S. Clavel, D.H.A. Nguyen, B. Fortin, P. Després, N. Khaouam, D. Donath, D. Soulières, L. Guertin, P.F. Nguyen-Tan. Simultaneous integrated boost using intensity-modulated radiotherapy compared with conventional radiotherapy in patients treated with concurrent carboplatin and 5-fluorouracil for locally advanced oropharyngeal carcinoma. International Journal of Radiation Oncology, Biology, Physics, vol. 82, no.2, pp. 582-9, 2012

[36] V. Kouloulias, S. Thalassinou, K. Platoni, A. Zygogianni, J. Kouvaris, C. Antypas, E. Efstathopoulos, K. Nikolaos. The treatment outcome and radiation-induced toxicity for patients with head and neck carcinoma in the IMRT era: a systematic review with dosimetric and clinical parameters. Biomedical Research International, vol. 2013 (2013), Article ID 401261, 12 pages, pp., 2013

[37] J.H. Lorch, O. Goloubeva, R.I. Haddad, K. Cullen, N. Sarlis, R. Tishler, M. Tan, J. Fasciano, D.E. Sammartino, M.R. Posner. Induction chemotherapy with cisplatin and fluorouracil alone or in combination with docetaxel in locally advanced squamous-cell cancer of the head and neck: long-term results of the TAX 324 randomised phase 3 trial. The Lancet Oncology, vol. 12, no.2, pp. 153-9, 2011

[38] D. Rades, D. Seidl, S. Janssen, A. Bajrovic, S.G. Hakim, B. Wollenberg, S.E. Schild. Do we need 5-FU in addition to cisplatin for chemoradiation of locally advanced head-and-neck cancer? Oral Oncology, vol. 57, pp. 40-5, 2016.

[39] A.A. Forastiere, Q. Zhang, R.S. Weber, M.H. Maor, H. Goepfert, T.F. Pajak, W. Morrison, B. Glisson, A. Trotti, J.A. Ridge, W. Thorstad, H. Wagner, J.F. Ensley, J.S. Cooper. Long-Term Results of RTOG 91-11: A Comparison of Three Nonsurgical Treatment Strategies to Preserve the Larynx in Patients With Locally Advanced Larynx Cancer. Journal of Clinical Oncology, vol. 31, no.7, pp. 845–852, 2013

[40] A. Trotti. Toxicity in head and neck cancer: a review of trends and issues. "International Journal of Radiation Oncology, Biology, & Physics", vol. 47, no.1, pp. 1-12, 2000.

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Trig-Disc: An innovative device for determination of values of trigonometric functions with single measurement

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ABSTRACT: Angles and lengths of a triangle engaged the mathematicians from historical time. The branch of mathematics that resulted from these studies is now known as Trigonometry. The discovery that lengths of a right angled triangle and the angles between them have a definite relationship led to the invention of trigonometric functions. The determination of values of various trigonometric functions like sine, cosine, tangent, cotangent, cosecant and secant for various angles in four quarters of a circle was a challenging task. Various methods and tables were generated for determining these values. Efforts were made to invent various devices for these measurements. There exist various U.S. patents [1-7] based on devices developed to visualize, teach and calculate values of various trigonometric functions. In the present paper, we are reporting a very accurate, economic, simple, and portable device designed for measuring the values of Trigonometric functions. The patent application number for the reported device is 1068/DEL/2015. The device consists of (i) a unit radius circular disc (with 360° angle scale indication on its circumference of 1° accuracy, X- and Y-linear scales markings with accuracy of 0.01 unit and marking of four quadrants of the circle), (ii) a corresponding linear scale with positive marking, (iii) a corresponding linear scale with negative marking and (iv) a blank transparent strip. The device can directly measure all the six trigonometric identities (sine, cosine, tangent, cotangent, cosecant and secant) for any value of angle up to the accuracy of 0.01 units just by measurement of only one parameter on one of the provided scale by appropriately placing it on Trig Disc along with blank linear strip in respective quadrants. Single measurement on a linear scale and no division or calculations of values is main feature of the device.

KEYWORDS: Trigonometry, trigonometric functions, trigonometric function values, Trigonometric devices, trigonometric identities

1 INTRODUCTION

Angles and lengths of a triangle engaged the mathematicians from historical time. The branch of mathematics that resulted from these studies is now known as Trigonometry. The discovery that lengths of a right angled triangle and the angles between them have a definite relationship led to the invention of trigonometric functions. The concept of unit circle (a circle of 1 unit radius) is commonly used to determine values of all trigonometric functions. A unit circle is shown below in Figure 1:

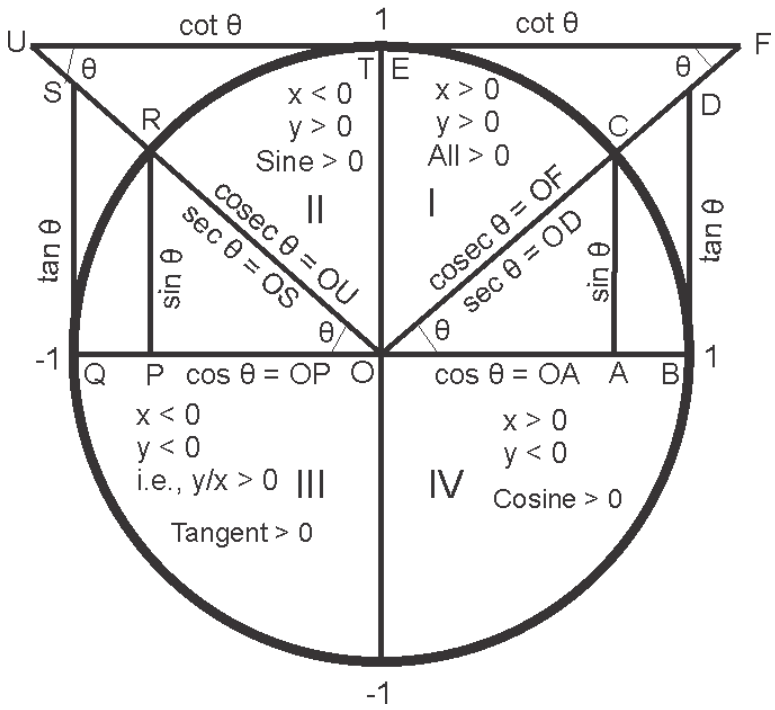

Figure 1: A Unit Circle concept to express all trigonometric functions.

Here, the trigonometric functions sine and cosine are defined in terms of the coordinates of points lying on the unit circle $x^2 + y^2=1$.

- Cosine of the angle θ is defined to be the horizontal coordinate x.
- Sine of the angle θ is defined to be the vertical coordinate y.
- The values of all six trigonometric functions can be represented as the lengths of various sides of triangles associated with the unit circle definition of cosine and sine.
- From Layout (in I Quadrant), see that OB, OE and OC all have length 1.
- ∠ COA = ∠ DOB = ∠ OFE = θ, and ∠ OAC = ∠ OBD = ∠ FEO (all three are right angles).
- By definition the point C has coordinates (cos θ, sin θ). This means cos θ = OA and sin θ = AC.
- Triangles OAC and OBD are similar. (since, ∠COA = ∠DOB = θ, and ∠OAC = ∠OBD). Hence, the ratios of corresponding sides are therefore equal.
- AC/OA = BD/OB, that is, sin θ/cos θ = BD/1. This means that tan θ = BD.
- Also, OC/OA = OD/OB, that is, 1/cos θ = OD/1. This means that sec θ = OD.
- Triangles OBD and FEO are similar. Therefore OB/BD = EF/OE, that is, 1/tanθ = EF/1. This means that cot θ = EF.
- Finally, using the similar triangles OAC and FEO, we get OC/AC = OF/OE, that is, 1/sin θ = OF/1, and so this means that cosec θ = OF.
- Hence, we get
  - Cos θ = OA Sin θ = AC Tan θ = BD
  - Sec θ = OD Cot θ = EF Cosec θ = OF

2 EXISTING DEVICES FOR MEASURING VALUES OF TRIGONOMETRIC FUNCTIONS

Since values of trigonometric functions are used in wide variety of applications in navigation, engineering, and physics, it is necessary to have some simple devices for determining these values. For use on demand basis, trigonometric tables were developed long ago in seventeenth century (such as Bernegger tables) to have easy access to the values for trigonometric functions. In modern days, calculators and computers are easiest ways to know these values. However, this has not hindered people to innovate and design tools for calculating values for trigonometric functions. To meet this requirement various visual teaching aids for measuring trigonometry identities have come into being.

U.S. patent no. 4435162, for example, discloses a trigometric visualizer which comprises of a pair of circular discs which are connected at their centers for their relative coaxial rotation on one another. The upper disc comprises of a larger circle

while lower disc has a circle, which is one half of that of upper circle. It uses two circles and measures two functions i.e. sine and cosine only as compared to the present invention which uses only one unit circle to measure all six identities [1].

U.S. patent no. 4655714, discloses a visual aid for teaching trigonometric functions, which comprises of a device wherein two planar membranes are pivotally collected. The relative rotational movement of said two members aids the measurement of angles. One said member features rectilinear scales for secants and cosecants, which are mutually perpendicular, calibrated and collinear with the pivot point. While in present invention all the six identities are measured using single unit circle [2].

U.S. patent no. 20140215840, discloses a device which has a tangent calculator that enables the user to read positive and negative tangent values in the configuration described. A sine/cosine calculator has enabled the user to do positive and negative sine and cosine readings, as well as per unit ratios of triangle sides. An angle tracking device tracks angles and can do tangent readings. It is mentioned in the patent that since the tangent of 90° equals to plus infinity, and the tangent of -90° equals to minus infinity, the Tangent Calculator was restricted to readings between −1.7 and +1.7, corresponding to angles between -60° and $+60^o$ However, in comparison, using the present invention values of tangent up to 75° (in first quadrant) can easily be measured and for values for angles more than 75°, combination of more than one linear scale can be used [3].

U.S. patent 3556397, discloses a trigonometric calculator with a scale member having circular degree scale and a cursor member mounted to pivot on it at the center of the degree scale. Coordinate axes at the center of the scale lengthen one unit in each positive and negative direction and are calibrated from zero to one. The sine and cosine functions may be directly read from the coordinate axes for any angle indicated by the cursor member on the degree scale. In comparison the present invention provides a simpler method of directly measuring the values of all the six trigonometric functions (sin, cos, tan, cot, sec, cosec) based on measurement of only one length on the provided scale along with blank linear strip. [4]

There are many other devices developed for determining trigonometric functions, which were patented [5-7].

3 PRESENT INVENTION

3.1 TRIG DISC: A DEVICE FOR DETERMINATION OF VALUES OF TRIGONOMETRIC FUNCTIONS WITH SINGLE MEASUREMENT

In most of the above-mentioned devices [1-7], there are methods, which are slightly complicated or need some calculations for determining the values of trigonometric functions. Also, the compilation of all the values of trigonometric angles from 0° to 360° forms a very bulky booklet to carry and to use. Hence it is felt that there is a need for an invention, which obviates the drawbacks mentioned above. This motivated us to do the reported work.

3.2 DEVICE DESIGNING

Based on the concept of unit circle we have designed a small handy innovative plastic device consisting of a plastic unit radius circular disc, (with 360° angle scale indication on its circumference of 1° accuracy, X- and Y- linear scales markings with accuracy of 0.01 unit, marking of four quadrants of the circle and markings of Sin θ and Cos θ), a linear scales of positive markings with accuracy of 0.01 unit, a linear scale of negative marking with accuracy of 0.01 unit and a blank linear transparent strip without any markings. The device is shown in the Figure 2.

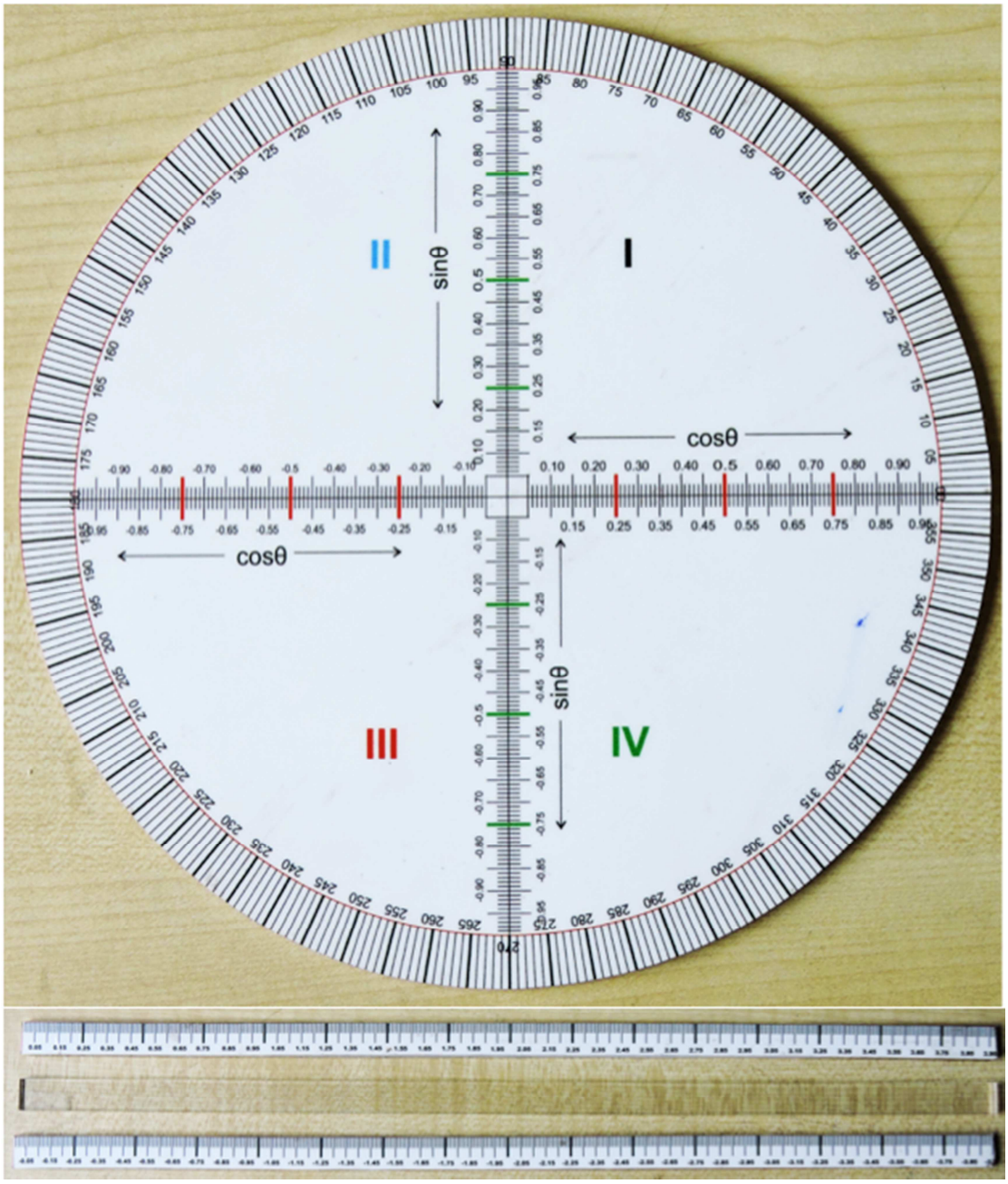

Figure 2: Trig Disc consisting of (i) a plastic unit radius circular disc, (ii) a linear scales with positive markings (iii) a linear scale with negative markings and (iv) a transparent strip.

The device can be used to easily find (directly measure) the values of all the six trigonometric functions (sine, cosine, tangent, cot, secant, cosec) just by measurement of only one length on one of the provided scales (positive or negative) by appropriately placing it on Trig Disc along with blank linear transparent strip in respective quadrants (first, second, third and fourth quadrants) for any angle. The device and scales are designed in Corel draw. Using this instrument, the value of trigonometric functions can be determined up to an accuracy of 0.01 units.

3.3 MEASUREMENTS OF TRIGONOMETRIC VALUES USING TRIG DISC

(i) Sine: To find the value of sine of an angle in first quadrant place blank linear strip parallel to x-axis at the angle on the circumference of Trig Disc whose value need to be measured. Look at the intersection of blank linear strip on y-axis. This gives the value of Sine of the angle as shown in Figure 3. For example, Sin 30° = 0.5. The value of all sine angles from 0 to 90° in first quadrant thus can be measured.

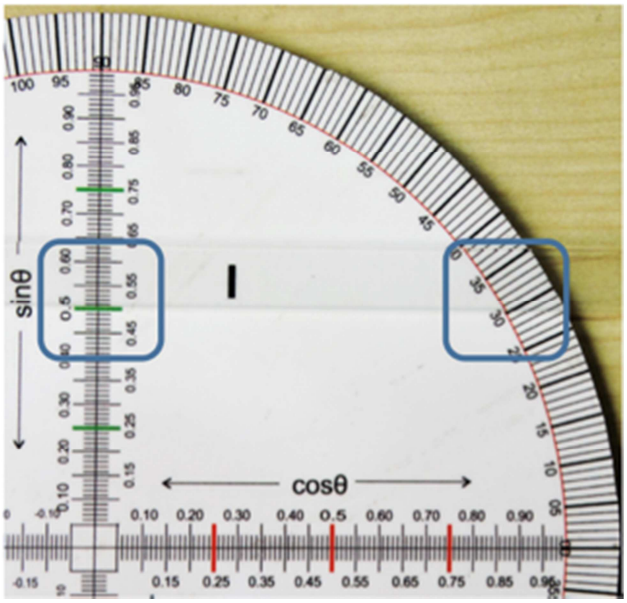

Figure 3: Measurement of Sine values

(ii) Cosine: To find the value of cosine of an angle in first quadrant place blank linear strip parallel to y-axis at the angle on the circumference of Trig Disc whose value need to be measured. Look at the intersection of blank linear strip on x-axis. This gives the value of Cosine of the angle as shown in Figure 4. e.g. Cos 75° = 0.26. The value of all cosine angles from 0 to 90° in first quadrant can thus be measured.

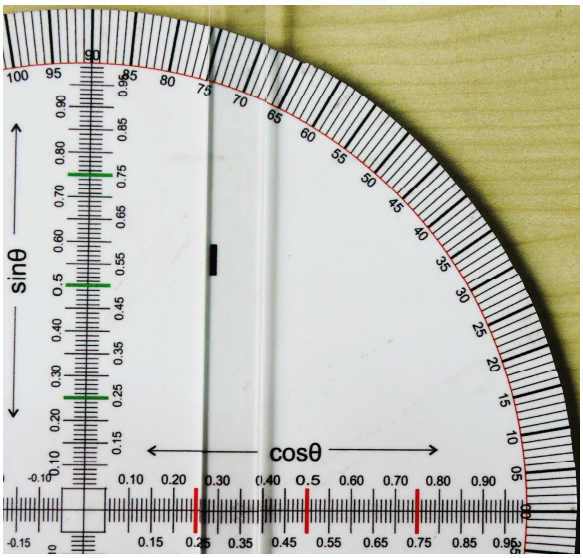

Figure 4: Measurement of Cosine values

(iii) Tangent: To find the value of tangent of an angle in first quadrant place positive marking linear scale perpendicular to x-axis at its unit value and blank linear strip along the line from center and the angle on the circumference of Trig Disc whose value need to be measured. Look at the intersection of positive marking linear scale and blank linear strip. This gives the value of tangent of the angle as shown in Figure 5. e.g. Tan 30° = 0.58 It shall be noted that for measuring values of tangent of angles more than 75°, larger scales shall be used.

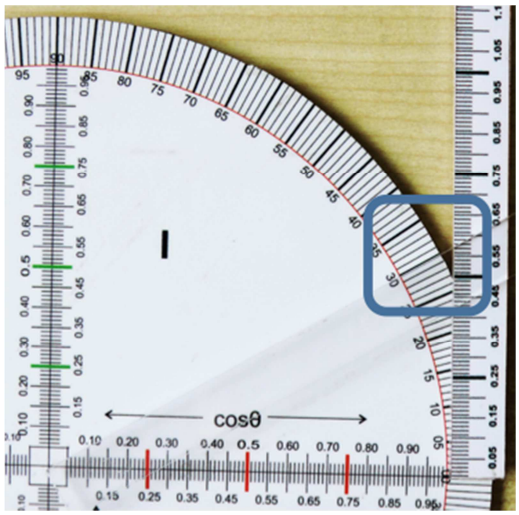

Figure 5: Measurement of Tangent values

(iv) Secant: To find the value of secant of an angle in first quadrant place blank linear strip perpendicular to x-axis at its unit value and positive marking linear scale along the line from center and the angle on the circumference of Trig Disc whose value need to be measured. Look at the intersection of positive marking linear scale and blank linear strip. This gives the value of secant of the angle as shown in Figure 6. e.g. Sec30^{o}=1.15. It shall be noted that for measuring values of secant of angles more than 75°, larger scales shall be used.

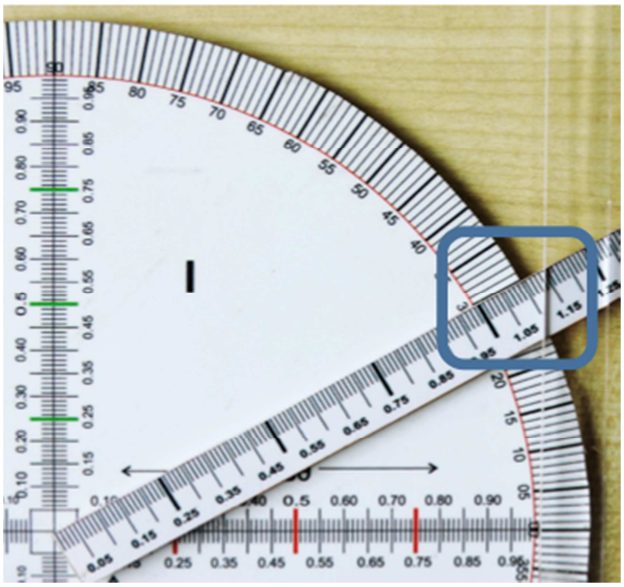

Figure 6: Measurement of Secant values

(v) Cotangent: To find the value of cot of an angle in first quadrant place blank linear strip along the line from center and the angle on the circumference of Trig Disc whose value need to be measured and positive marking linear scale perpendicular to y-axis at its unit value. Look at the intersection of positive marking linear scale and blank linear strip. This gives the value of cotangent of the angle as shown in Figure 7. e.g. Cot30^{o}=1.73. It shall be noted that for measuring values of cotangent of angles less than 15°, larger scales shall be used.

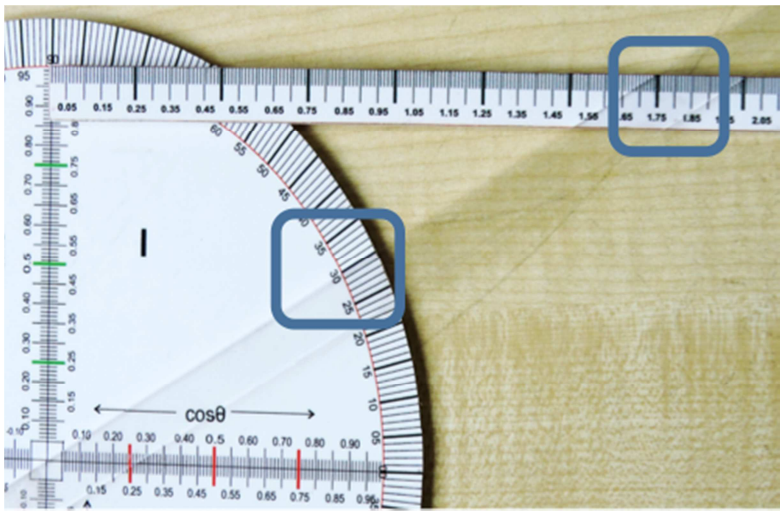

Figure 7: Measurement of Cotangent values

(vi) Cosec: To find the value of cosec of an angle in first quadrant place positive marking linear scale along the line from center and the angle on the circumference of Trig Disc whose value need to be measured and blank linear strip perpendicular to y-axis at its unit value. Look at the intersection of positive marking linear scale and blank linear strip. This gives the value of cotangent of the angle as shown in Figure 8. e.g. Cosec30^{o}=2.00. It shall be noted that for measuring values of cotangent of angles less than 15°, larger scales shall be used.

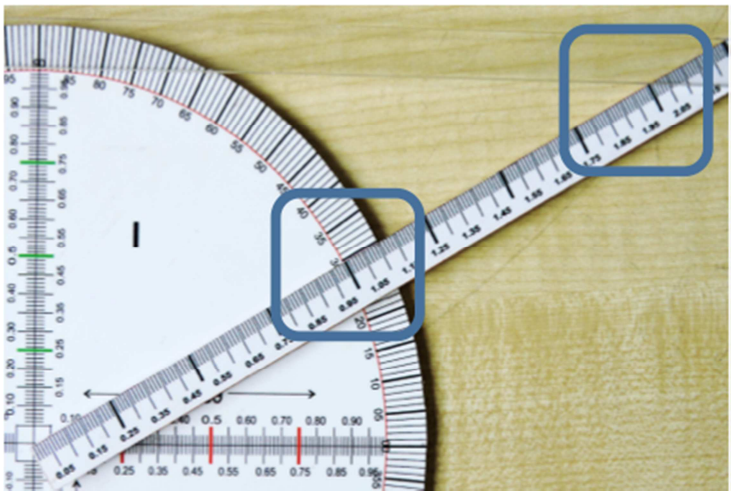

Figure 8: Measurement of Cosecant values

Similarly, by appropriately placing one of the scale and blank strip the values of all six trigonometric functions, namely, sine, cosine, tangent, cotangent, cosecant and secant can be determined in other quadrants of the circle. The appropriate method of placing the correct scale and blank strip in any of the four quarter is described in the Figure 9.

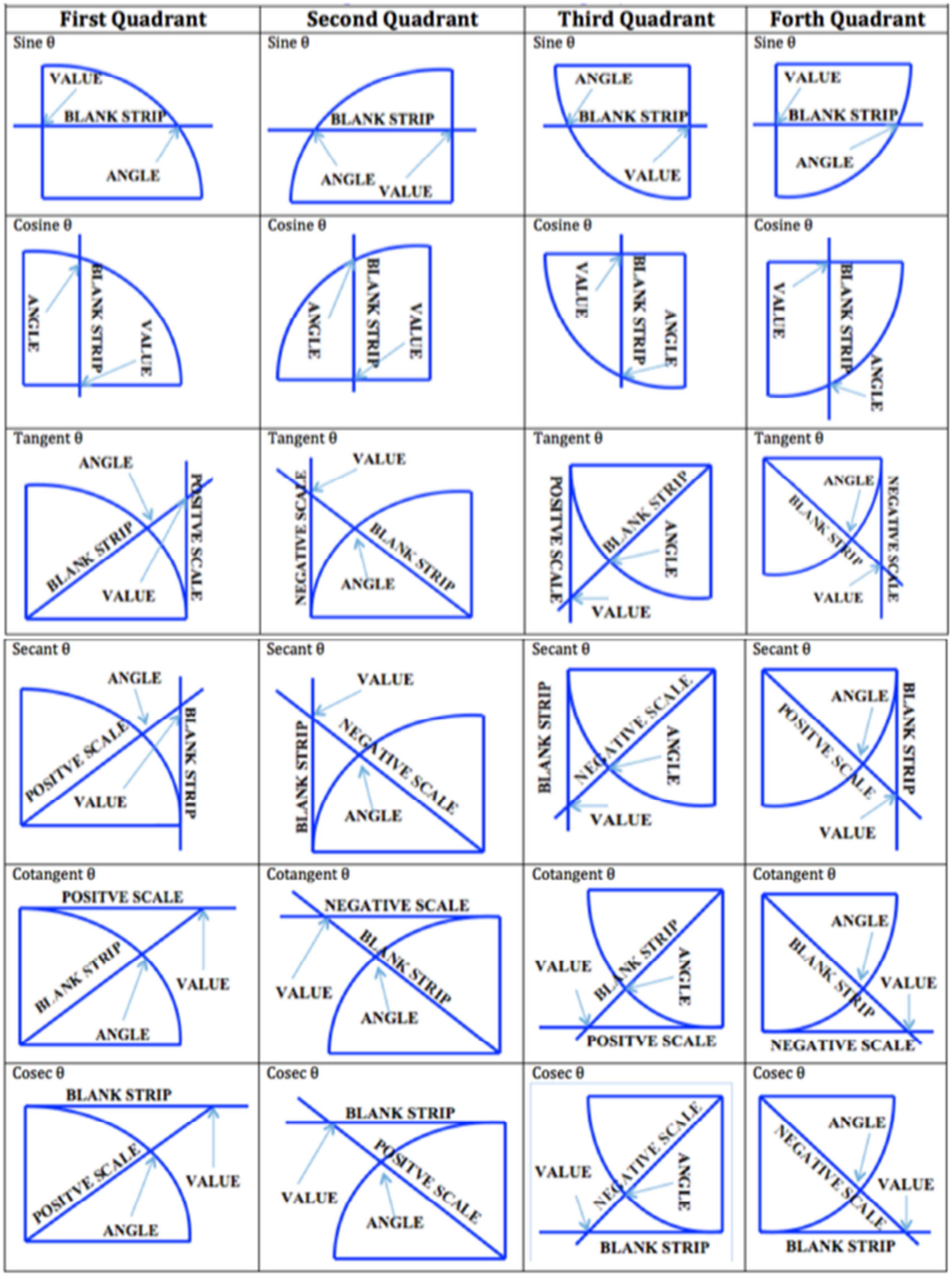

Figure 9: Method of placing type of scale and blank strip on Trig Disc for measuring values of various trigonometric functions in different quadrants of the circle.

3.4 Patent Application Number

For the present invention the patent application has been filled in India with application number 1068/DEL/2015 on 27 May 2016.

4 CONCLUSION

The present invention of Trig Disc provides a simple, accurate, easy and economical method of determining values of six trigonometric functions sine, cosine, tangent, cotangent, cosecant and secant in form of a handy portable device. The device consists of (i) a unit radius circular disc (with 360° angle scale indication on its circumference of 1° accuracy, X- and Y-linear scales markings with accuracy of 0.01 unit and marking of four quadrants of the circle), (ii) a corresponding linear scale with positive marking, (iii) a corresponding linear scale with negative marking and (iv) a blank transparent strip. With the device, the values of trigonometric functions can be determined up to an accuracy of 0.01 units with only one direct measurement on one of the provided scale by appropriately placing it on Trig Disc along with blank linear strip in respective quadrants and this too without need of any calculations. The patent application number for the reported device is 1068/DEL/2015.

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REFERENCES

[1] “Trigonometry visualizers and method of making same” by Justin P. Schoenwald, US patent number: US4435162 A, 6 March 1984.
[2] “Visual aid for teaching trigonometric functions” by Reza Djali, US patent number: 4655714 A, 7 April 1987.
[3] “Trigonometer” by Patrick Elie Kattan, U.S. patent no. 20140215840 A1, 7 August 2014.
[4] “Calculating device for trigonometric functions” by David C Andersen, U.S. patent 3556397 A, 19 January 1971.
[5] “Trigonometric function finding device” by Milton A Seale, U.S. patent number: US3042301 A, 3 July 1962
[6] “Calculation of trigonometric functions in an integrated circuit device” by Martin Langhammer, U.S. patent number: US8510354 B1, 13 August 2013.
[7] “Device for demonstrating and calculating trigonometric functions” by De Andrea J, U.S. patent number: US3826021 A, 30 July 1974

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The Use of Manipulatives Materials in the Teaching of Physics in Secondary Education in Nigeria: An Overview

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ABSTRACT: In order to succeed in physics especially in the Nigerian educational system, students must expand an understanding of abstract concepts. Elementary instructors often use manipulatives to represent concretely the abstract concepts that students are learning and to connect these concepts to previous knowledge as relates to physics. Traditionally, instructors and learners used concrete manipulatives, however, in many contemporary classrooms instructors and students also use manipulatives (pictorial and virtual). This review article will begin by defining, and providing examples and potential applications of manipulatives. Next, this review article will present the theoretical foundations and importance for teachers and students to use manipulatives in physics education in Nigerian educational system. Finally, this review article will review the literature on the impacts of teachers and students using physics manipulatives. The authors hope that this review article reveals the factors and conditions that may contribute to instructors' and learners successes and struggles with use the manipulatives.

KEYWORDS: Physics, Manipulatives, Teaching, Secondary Education, Nigeria.

1 INTRODUCTION

The majority of pupils in the primary school in Nigeria like sciences but they start developing decreasing interest in science at the lower post primary level (Junior Secondary School) and finally, they have zero interest in the higher post primary level (Senior Secondary School) because of the abstractness of the science subjects i.e. chemistry, physics, mathematics etc. The hate for mathematics at this level is of the same magnitude for physics, since mathematics is actually the language of physics. Teachers should always try to find ways to actively engage their students not only for understanding concepts but also to create elements of fun and excitement so that students' interest can be kindled. A manipulative material is an object(s) that can be handled by an individual in a sensory manner during which process, conscious and unconscious thinking will be fostered [6]. Using manipulative materials has become one way of involving students in fun learning that encourages motivation of students. Manipulatives have also been useful in making abstract ideas concrete for learners and thereby making for conceptual understanding [5]. The pedagogical context of this study is to promote effective learning through helpful teaching techniques using manipulatives in physics classrooms in Nigeria educational system. That means the teacher should not be a transmitter of knowledge but should instead act as a facilitator to the construction of knowledge for all learners. The fact that every classroom consists of students with different levels of cognitive ability, mathematical concepts means that teachers should focus on using multiple teaching strategies so that all students can benefit [3]. Manipulatives are different from teaching aids/ instructional material while the first is learners centered and the second is teachers centered.

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1.1 OBJECTIVES

The objectives of the study are to review the available literatures, discuss its importance and also recommend its uses in the Nigeria educational system.

2 LITERATURE REVIEW

So much has been done in the uses of manipulatives materials in the physical sciences available online in reputable journals. But the uses of these materials are not common in physics from the available literatures. As a result of empirical and anecdotal evidence that shows greater student achievement when manipulatives are used, districts throughout the country encourages their teachers to attend workshops that acquaints them with how to properly use manipulatives as instructional tools [5] [4]. It is important for children to have a variety of materials to manipulate and the opportunity to sort, classify, weigh, stack and explore if they are to construct mathematical/physical knowledge. "*In order to have opportunities to learn mathematical phenomena, children need firsthand experiences related to mathematical phenomena, interaction with other children and adults concerning these experiences and time to reflect on the experiences*" [16]. [8] applied a systematic method in his study of manipulatives, he took 55 sixth graders coming from three different classes of a primary school in Nicosia, Cyprus. All students of all three classes were taught about Electric Circuits during their science classes by the same teacher for 3 weeks (2 hours per week), with different condition and the results gotten was good. [10] Investigated how using physical or virtual manipulatives affected undergraduate students' conceptual understanding of heat and temperature in the context of the Physics by Inquiry curriculum. The study involved quantifying students' conceptual understanding into conceptual knowledge gains and the identification of students' concepts about temperature and changes in temperature. The aim of the latter identification was to examine whether the type and nature of student conceptions differed between experimentation with physical and virtual manipulatives. This present study of manipulatives is in the whole area of physics as a subject offered at the ordinary level of Nigeria educational system [7] [9] [11].

2.1 THE IMPORTANCE OF MANIPULATIVES IN SCIENCES

If technological development is what we need in the country then the foundation of science and technology should be taken very serious, this necessitates the present study. Manipulatives are very important to the learning of sciences especially the physical sciences (physics). [8] Made references to [12] frame work that involves a series of steps that require to be followed in order to reach a fine blending of Physical Manipulatives and Virtual Manipulatives. According to [10] the "*physical manipulatives in the area of thermodynamic involves the use of real instruments (thermometers), objects (beakers, styrofoam cups, and heaters) and materials (wood, aluminum, and water) in a conventional physics laboratory*". During the experiments feedback is available to students through the behavior of the real system (for example, water boils or not) and through the instruments that are used to monitor the experimental setup (for example, thermometers). In a study by [17] and reported by [1], "*the researcher used manipulatives to help reinforce and introduce mathematical ideas to a group of about 60, fifth-grade boys and girls. These students had been given a pretest which helped identify areas that needed improvement. The researcher found that the students were eager to learn using the manipulatives and experienced an average of 10% gain on the posttest over the same material*". [17] pointed out that many teachers do not use manipulatives because they feel they are too time-consuming, given the amount of material that now has to be covered in an academic year prior to standardized testing but the result gotten after the standardized test will be very good and impressive.

2.2 ITS USES/ APPLICATION IN NIGERIAN SCHOOLS

A brief introduction to the Nigerian secondary educational systems, the structure of this stage according to the government of Nigeria are listed below

- Secondary education shall be of six years duration and given at two stages of three years duration each; a junior secondary stage (or UBE year vii to ix) and senior secondary school.
- Curriculum activities of junior secondary school shall be pre-vocational and academic, and shall include all basic subjects which will enable pupils to acquire for further knowledge and develop skill.
- The senior secondary school shall be comprehensive and shall have a core curriculum designed to broaden student's knowledge and outlook.
- The minister is empowered to issue direction in respect of the curriculum in both stages of secondary education in order to maintain minimum standard.
- The core and optional subjects shall be subject to revision from time to time by the minister [13].

The secondary educational development since the independence was influenced by a number of factors [14]. Some of these factors include

- The expansion in primary education.
- The decision of government to implement the Ashby commission recommendations.
- The implementation of the decisions of Africa states at the Addis Ababa conference by Nigeria.
- The recommendations on the improvement of the content and method of secondary school curricula.

It is said that manipulatives will aids learning experiences at any particular time and space especially in the mathematics and physics, applying this concept discussed into our educational system will aid the developmental quest of the nation. Mathematics and physics are very important foundation to the development of science and technology of any nation, which is why, attention to these subjects from the very foundational level (post primary level), will help the country in the long run.

3 MANIPULATIVES IN PHYSICS

Manipulatives materials here are limited to the upper post primary educational system (senior secondary school) where physics is offered as one of the science subjects. The bases here are taken from the examination body called the West Africa Examination Council [15]. Below are the lay out as available in the syllabus of the above examination body. The materials that are needed in this educational level are enumerated and they will help in the understanding of the Physics.

3.1 INTERACTION OF MATTER, SPACE AND TIME

Here, the concept of matters, fundamental and derived units, position, distance and displacement, mass and weight, time, fluid, motion are discussed and the needed manipulatives ranges from the natures of matters; solid, liquid and gaseous, crystalline and amorphous materials, evidences of length, mass and time, measuring instruments, materials on motions of a body etc can be produced, sighted and be handled by the students when these topics are be taught in the class.

3.2 ENERGY: MECHANICAL AND HEAT

Here, the concepts of energy, work and power and heat are discussed with their respective manipulative materials whenever learning and teaching is taken place. The manipulatives materials needed here are solar, wind etc, thermometers and vacuum flask.

3.3 WAVE

Manipulatives materials needed here for effective learning and teaching experiences are ropes, springs, luminous and non-luminous bodies, pin-hole camera, mirrors, prism, optical fibres, lens, etc. these are designed so that it can be used effectively by the students.

3.4 FIELD

Manipulatives materials needed here for effective learning by the students are the needles, iron fillings, capacitors, resistors, cells, ammeters, voltmeters, conductors and semi-conductors, electrical motors, potentiometers, meter bridge, Wheatstone bridge, steel, alloys, mariner's compass, inductors etc

3.5 ATOMIC AND NUCLEAR PHYSICS

Manipulatives materials that aids learning in this area of physics are but not limited to, are the x-ray; its structure, production, types, properties, uses, hazards etc be represented pictorially for the benefit of the learner.

4 CONCLUSION AND RECOMMENDATION

This work has discussed extensively the important, needs and uses of physics manipulatives in secondary education system in Nigeria. From the above, it is been shown that manipulatives will aids learning experiences in physics at the level of focus. It uses, is highly recommended for the secondary school system in Nigeria if the nations quest for technological development is in view because it gives a good foundation to the development of science and technology at the very

beginning of education. As discuss above, it should be a package that is given to the students as the term begins. The subject matter is actually taken at senior secondary school level so these materials are given to students and are used every time the subject is been taught in the class for effectiveness of the learning process. It will also help in the retention of knowledge and transfer of knowledge at that level.

REFERENCES

[1] Kara Morgan White, (2012), The Effect of an Instructional Model Utilizing Hands-on Learning and Manipulatives on MATH Achievement of Middle School students in Georgia, Doctor of Education Thesis, Liberty University, Lynchburg, VA.

[2] Matthew Boggan, Sallie Harper, Anna Whitmire, (2010), Using manipulatives to teach elementary mathematics, Journal of Instructional Pedagogies, 3:1.

[3] Nahid Golafshani, (2013), Teachers' Beliefs and Teaching Mathematics with Manipulatives, Canadian Journal of Education, Laurentian University, 36:3

[4] Liza Cope, (2015), Math Manipulatives: Making the Abstract Tangible, Delta Journal of Education, delta state university, 5:1

[5] Bobby Ojose and Lindsey Sexton, (2009), The Effect of Manipulative Materials on Mathematics, The Mathematics Educator, California, USA, Vol. 12, No.1, 3-14.

[6] Geoff White, Paul Swan, Linda Marshall, (2009), A Mathematics Manipulatives Continuum, Edith Cowan University, Austraila.

[7] Jessica Strom, (2009), Manipulatives in Mathematics Instruction, an M.Sc thesis, Bemidji State University, Bemidji, Minnesota, USA.

[8] Zacharias C. Zacharia, Marios Michael, Giorgos Olympiou and Vasoula Papasozomenou, (2014), Blending Physical and Virtual Manipulatives to Improve Primary School Students' Learning in Physics,

[9] Taylor Martin, Ayiesha Lukong and Raven Reaves, (2007), The Role of Manipulatives in Arithmetic and Geometry Tasks, Journal of Education and human development, Volume 1, Issue 1.

[10] Zacharias C. Zacharia and Constantinos P. Constantinou, (2008), Comparing the influence of physical and virtual manipulatives in the context of the Physics by Inquiry curriculum: The case of undergraduate students' conceptual understanding of heat and temperature, American J. Phys. 76, 4&5.

[11] Lewis W. McClung, (1998), A study on the Use of Manipulatives and their Effect on Student Achievement in a High School Algebra I Class, Master of Arts in Education thesis, Salem Teikyo University, Salem, West Virginia.

[12] Olympiou, G., and Zacharia, Z. C. (2012). Blending physical and virtual manipulatives: An effort to improve students' conceptual understanding through science laboratory experimentation, Science Education, 96, 1, 21-47.

[13] Federal Government of Nigeria, (2004), National Policy on Education, 4th Editions, NERDC.

[14] Bello, S. A., (2003), Historical Development of Educational Administration in Nigeria, dedun publishers, Lagos.

[15] West Africa Examination Council (WAEC), Senior Secondary Certificate Examination Syllabus for 2014 and beyond.

[16] Seefeldt and Wasik (2006), Early education: three-, four-, and five-year-olds go to School (2nd ed.). Upper Saddle River: Pearson Education.

[17] Moch, Peggy L., (2001), Educating the Young Learner

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Graphical Representation of Real-Time Data from IoT

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ABSTRACT: The amount of data in this world has been exploding and expanding at an astounding rate. There is data coming in from almost every possible source. This data has to be carefully monitored and utilized in order to draw meaningful conclusions. For this sole purpose, analysis is done. Analysis of data makes it usable and transparent. This enables people with almost no technical knowledge understand the significance of the data captured. This paper focuses on the implementation of a medium for real-time graphical representation of data transmitted by IoT devices using favorable transmission process depending on the device. The medium chosen for this purpose is a website with a friendly user interface which makes it easy for people to study data, understand its importance and utilize it accordingly.

KEYWORDS: Internet of things(IoT), Raspberry Pi, Arduino, real-time graph, HTTP, TCP/IP, Requests, Interfacing, Model-View-Controller(MVC).

1 INTRODUCTION

With the constant progress in various fields of technology comes the need to understand and realize the importance of the purpose it solves. A device when used to solve a problem delivers the result in the form of information or values specific to that particular problem statement. This data is valuable and has to be stored in a secure location. The amount of incoming data is also unknown in some cases and a storage location with a suitable size has to be selected in order to avoid any discrepancies. A suitable and practical transmission process has to be implemented so as to avoid any loss of data or unnecessary overhead. The growing applications of IoT devices have resulted in the requirement of a medium to manage and monitor the data they provide. This paper explains the implementation of a website that has been created to study and analyze the data coming from IoT devices using the most viable option for the transmission process. The data captured is used to display a real-time graph in accordance with the values received.

Users can register themselves on the website and make their profiles before studying the data and getting the graph displayed. They can keep track of their previous records to compare with the current data in order to check the improvements or descent in the performance. The website offers the functionality of displaying a multiple lined real-time graph which can be used to display the values received as co-ordinates. The users will have to enter specific details of their device during the registration process such as device id, number of sensors, timeframe, parameters etc. This information will be used to draw the corresponding graph with correct parameters to make it easy for the user to see the data through a neat lined graph making the studying process simpler.

2 BACKGROUND

The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In this paper, the implementation of data transmission on two of the most popular IoT devices has been done. A computer which in this case is on the receiving end, acts as the server. The medium for graph analysis of the data sent on the server is a

website that supports various functionalities which are discussed later in the paper. A real-time graph is displayed on the website for the user to analyze and/or monitor the data coming from the external device. The server stores the data in a database and fetches it simultaneously to plot a real-time graph. Common networking protocols have been used to transmit the data from the device to the server. The incoming data are in the form of values for which suitable packages and libraries have been made use of. The transmission and plotting process work simultaneously to display a real-time graphical representation of the values.

3 DATA TRANSMISSION BETWEEN IOT DEVICE AND SERVER

The initial part of this paper involves connecting the IoT device and the server system so as to enable the transmission of data between the two devices. This paper focuses on two of the very popular IoT devices that are Raspberry Pi and Arduino. This entire setup procedure has two parts. The first part is the transmission of values to the server system from the IoT device. The second part is receiving the incoming values and storing them on the database server which has been explained later in the paper.

3.1 RASPBERRY PI

The Raspberry Pi is a capable little IoT device that can do everything a desktop does. The calculations and computations to solve the problem statement is done on the Pi itself. This device can run various scripts and codes and acts like a system that can be attached to other devices such as sensors to read its output or act as a component in drones etc. To establish connection between the Raspberry Pi and the server, a common networking protocol called HTTP is used. HTTP makes use of the TCP/IP protocol for transferring the values in order to avoid losing the data packets coming from a remote machine. UDP is not used because in case a UDP packet is lost, it is not retransmitted and UDP has no error recovery mechanism to retrieve the lost value.

To enable transmission of values, a python script is written on the Raspberry Pi. It can either be written in a separate file or incorporated in the original python file. HTTP has a package called Requests available which makes the value transmission fairly simpler. The Requests package can be imported in the beginning of the code to make use of its functionalities. Using this package, the GET method is implemented in order to send the values to the server such that they directly get stored in the database server. Now the values to be transmitted can be stored in an array, list, dict type etc. This preferred data structure is passed as a parameter in the GET method along with the URL of the server. The URL has to have the IP address of the server and the path of the PHP script written on the server side which makes sure the values go to the correct location in the database. Here is the code snippet for the mentioned procedure:

```
#sample data set
data={'id':'1','value':'2000'}
#URL containing IP and path of the PHP script
url='http://10.56.17.246/py_insert/insert_val.php'
#passing parameters in get method
r=requests.get(url,params=data)
```

This ensures that the PHP script written on the server side is correctly called so as to take care of the values received on the server end. The final URL can be printed to check if the script is running correctly or not in the following way:

```
print(r.url)
```

Expected output should look something like this:
http://10.56.17.246/py_insert/insert_val.php?id=1&value=2000

The value corresponding to id i.e. 1 gets stored in the id column in the database and same goes for the value column. In case the values are in large quantity and they have to be transmitted in a similar way, they will have to be stored in an array and this array will have to be passed as a parameter in the GET method in Requests library in the following way:

```
for i in range (specify range):
    url='http://10.56.17.246/py_insert/insert_val.php'
    r=requests.get(url,params=arr)
```

The loop runs until the entire array is traversed and the values keep getting sent to the server with the help of the GET method in a similar fashion as was done for hard-coded values. This completes the Raspberry Pi's role in transmission of data

3.2 ARDUINO

Arduino is an open-source platform consisting of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on your computer which can be used to write and upload computer code to the physical board.

Arduino has numerous applications in a wide variety of fields. Most of these projects require data handling, transmission, manipulation and analysis. The transmission process in Arduino uses the same GET method of Requests library in HTTP. A small piece of code can be added in the original code written on the Arduino's side to enable smooth transferring of data to the server. Again, transmission of values is focused upon so as to get real-time for the server to be able to plot a real-time graph of the corresponding values. The URL and the port number have to be declared in the code. The server's IP address is passed as a parameter in the GET method much like the case in Raspberry Pi. Following lines of code are required to be send hard-coded values to the server:

```
 if (client.connect(Server_IP_addr, portNum)) {
  // Make a HTTP request:
    client.print("GET /py_insert/insert_val.php?id=1&value=2000");
client.println("HTTP/1.1");
client.print("Host:");
client.println(Server_IP_addr);
client.stop();
            }
```

In case the values to be transmitted are stored in a variable, the variable itself is passed as a parameter in the GET method in the following manner:

```
//Define and declare the variable to be transmitted
int i=1;
int val=2000;
//To be written inside the transmission function
client.print("GET /py_insert/insert_val.php?id=");
client.print(i);
client.print("&value=");
client.print(val);
 client.println( " HTTP/1.1");
 client.print( "Host: " );
 client.println(Server_IP_addr);
```

This procedure is to be followed on the Arduino device's side in order to transmit values successfully to the server's database.

4 ROLE OF SERVER

The server is responsible for receiving the values coming from a remote device and storing it in a secure place accurately to keep it intact. The obvious choice for storage purpose is a database created on the server itself which can store large quantity of data. This database has to be first created on the server as per the device's requirements and then connected to the script that is responsible for loading the values into the database. The database can be connected using a basic PHP script which contains the username, password, localhost and the table name where the data has to be inserted.

The script that inserts the values into the desired table of the database contains an SQL query for the same. This SQL query makes use of the GET method and the exact same identification string which was used in the python script written on the Raspberry Pi has to be written in order to avoid any confusion and error. The SQL query in the PHP script that solves this purpose looks like this:

$SQL = "INSERT INTO sensor_log.table_sensor_log (sensor_id, timestamp, sensor_value) VALUES ('". $_GET ["id"]."', unix_timestamp(), '".$_GET["value"]."')";

This method works for both hard-coded and real-time values. This completes the process of loading values into the database server.

The source which in this case is an IoT device transmits data using the python script mentioned earlier in the paper using the HTTP Requests library. Interfacing between the remote device and the server is done so as to establish a connection. This is the base on top of which the actual transmission takes place. The dispatched data traverses this medium and reaches the database created on the server. The populating of data in the database in the correct corresponding table and column is made sure by the virtue of the PHP script written on the server itself which contains the necessary SQL query to do the same. Once the database has been populated, the values are fetched in order to plot the graph for the user. This part is implemented by the back-end of the website. The back-end acts as the intermediate stage between the source and the server system as it fetches the values and supplies them to the server. The graph plotting is also a part of the back-end and it uses the fetched values to display the graph on the front-end. The whole transmission procedure runs on TCP/IP protocol using HTTP request and response mechanism between the two systems.

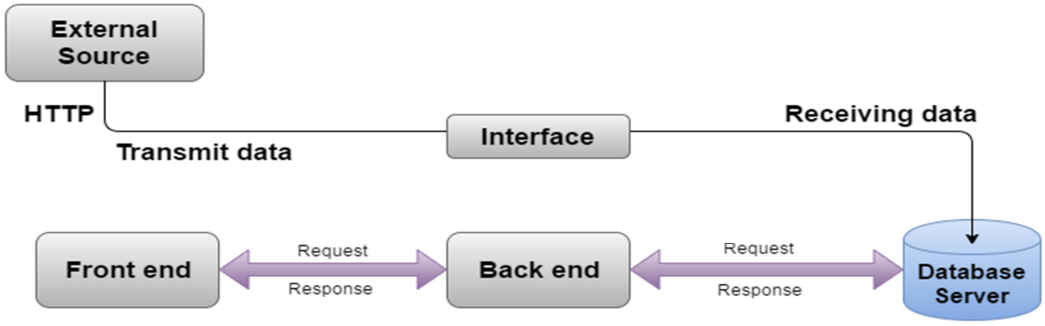

Fig. 1. The diagram shows the flow of data from the source and its handling on the server

5 WEBSITE IMPLEMENTATION

The two parts of website are the front-end which is responsible for the user-interface and the back-end which implements the various functionalities shown by the user-interface. The entire graphical representation medium i.e. the website makes use of the Model-View-Controller framework (MVC) which is an architectural pattern that separates an application into three main logical components: the **model**, the **view**, and the **controller**. Each of these components is built to handle specific development aspects of an application. A Model View Controller pattern is made up of the following three parts:

1. Model: The Model component corresponds to all the data related logic that the user works with. This can represent either the data that is being transferred between the View and Controller components or any other business logic related data. The Model is responsible for managing the data of the application. It responds to the request from the view and it also responds to instructions from the controller to update itself.

2. View: The View component is used for all the UI logic of the application. For example, the Customer view would include all the UI components such as text boxes, dropdowns, etc. that the final user interacts with. It is basically a presentation of data in a particular format, triggered by a controller's decision to present the data.

3. Controller: Controllers act as an interface between Model and View components to process all the business logic and incoming requests, manipulate data using the Model component and interact with the Views to render the final output. The controller is responsible for responding to user input and performs interactions on the data model objects. The controller receives the input, validates it and then performs the business operation that modifies the state of the data model.

6 BACK END

The back-end of this website consists of creating various functionalities involved in the website. The modules are to be coded individually and integrated later. The various parts of the back-end are:

- Creating a suitable database on the server as per requirements.
- Deciding the credentials required to access the database through a PHP file.
- Registration page.
- Login page.
- Connecting the registration page and login page to the database.
- Creating an authentication system that verifies the user's credentials.
- Fetching values from the database.
- Using a suitable data structure to store the values and calling the function to plot it.
- Storing and displaying the overview of the device.

The system of the database is taken care entirely by the back-end. The maintenance of the three principles of security which are confidentiality, integrity and authority in the database is also handled by the back-end. The website gives the functionality of registering multiple devices under the same username. This is done so that a person's account doesn't stay limited to just one device. A unique device id is given after registration of every device. This unique string can then be entered in the login page along with the password to monitor and study the data of that particular device.

Since the value transmission process is fast, more than one value reaches the database from the source. This might create a discrepancy when plotting the graph as a device can have only one value at a time on the graph. Hence, the following query is written to avoid this problem:

"SELECT distinct (unix_timestamp) as times, device_id FROM table_sensor_log WHERE device_id = '" . $deviceId . "'";

The above mentioned modules have been implemented using PHP and JavaScript codes and later called or included in the final HTML file that displays the webpage. The website uses MVC framework as mentioned earlier in the paper and for the back-end part, the two components of MVC are used namely Model and Controller.

The Model part involves creating a connection between the database present on the server and the login page where a user enters his/her credentials to login. The definitions of the authentication details of the database such as hostname, username, password and database name are specified. A function is created to get the necessary details of the user and another function checks the credentials and returns the value to a separate PHP file which is the Controller part of the login procedure.

The Controller part involves verification procedure of the user login and returns the corresponding value to the main file PHP file. It is also responsible for the logout event of the website.

A separate PHP file is written which is outside the Model-View-Controller part. It is used for the actions taking place on the login page i.e. filling of text fields and clicking on the submit button which triggers an event.

7 FRONT END

The front-end makes use of the View part. All the necessary images, themes and packages are stored here. It also keeps record of all the static attributes of the website which does not change according to the user's needs. It contains the images of the layout and the Bootstrap files required for the front-end. The Bootstrap files are basically the CSS, JavaScript and font folders that are to be included to match the requirements of the front-end. These files have classes for designing and implementation which are used later in the main file for the final webpage. Another feature called Templates is used inside View. This contains two sub parts namely Layout and Partial. Layout is responsible for deciding the actual layout of the web pages that are involved in the project. The layout for the home page which in this case is the login page itself is where the user can enter his/her credentials to access his/her profile. A separate file is used which creates the dashboard. This is used when the user successfully logs in and his/her profile gets displayed. The profile has a dashboard with various functionalities related to the analysis and device information. These layout files contain the libraries and packages of jQuery, Bootstrap, FusionCharts etc.

The Partials part contains files and PHP scripts that define the classes of features and functionalities implemented on the webpage. These are the classes that can be used directly later and hence act as small modules or API's for the front-end. In

this project, the Partials folder contains a PHP file for the admin layout and three other files for navigation bar, login form and sidebar. Twig is a composer used for combining the previously created files for various minor or major functionalities. A composer called Twig is used which is used to combine the layout pages created earlier in the main PHP file.

8 APPLICATIONS

An analysis based application is a necessity in almost all the projects that are under development or are being used already. Monitoring and representation of data is required everywhere in so as to be able to understand it and draw logical conclusions. Below are a couple of applications where this project is already being implemented:

8.1 BREATH ANALYSER

A breath analyser analyses the breath of the user using sensors which transmits value as analog output. This analog output is converted to a digital output using an Analog to Digital Converter (ADC) and received by the IoT device. This device can run the python script on its end and transmit the values to the server system. The server system fetches the values from the database to plot a real-time graph of the same. This will help the users monitor and get a good understanding of the data through a graphical representation.

8.2 DIET MONITOR

This device is used to monitor the amount of fat burn in the user's body. It has a gas sensor and a pulse sensor to measure the acetone level in the user's breath and the pulse of the user respectively. Accordingly, it generates ppm values for acetone and pulse value. If both these values are in a specified range, the device draws the conclusion that fat burn is possible. This generates data such as ppm values, pulse and amount of fat burn which have to be stored and analysed so that users can study their body better to lose fat accordingly.

9 CONCLUSION

Data is only valuable to us if it can be understood to draw meaningful conclusions about the source of the data. This makes the analysis the most important procedure when it comes to handling data. Many more features can be inculcated in order to support the graphical representation of the data for better analysis. For example, one can take the current data set, train it using a simple training algorithm and then implement a prediction algorithm to predict the future values on the server side system. Hence if given a proper investment of time and resources, this system can be applied to numerous projects in a wide variety of fields.

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REFERENCES

[1] Lobley, A., Lee Whitmore, and B. A. Wallace. "DICHROWEB: an interactive website for the analysis of protein secondary structure from circular dichroism spectra." Bioinformatics 18.1 (2002): 211-212.
[2] Jain, Eric, et al. "Infrastructure for the life sciences: design and implementation of the UniProt website." BMC bioinformatics 10.1 (2009): 1.
[3] Boute, Wim, and Jos Van Hove. "System and method for transmission of medical and like data from a patient to a dedicated internet website." U.S. Patent No. 7,082,334. 25 Jul. 2006.
[4] Richardson, Matt, and Shawn Wallace. Getting started with raspberry PI. " O'Reilly Media, Inc.", 2012.
[5] Vujović, Vladimir, and Mirjana Maksimović. "Raspberry Pi as a wireless sensor node: performances and constraints." *Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2014 37th International Convention on*. IEEE, 2014.
[6] Communication Technology, Electronics and Microelectronics (MIPRO), 2014 37th International Convention on. IEEE, 2014.
[7] Banerjee, Soham, et al. "Secure sensor node with Raspberry Pi." Multimedia, Signal Processing and Communication Technologies (IMPACT), 2013 International Conference on. IEEE, 2013.