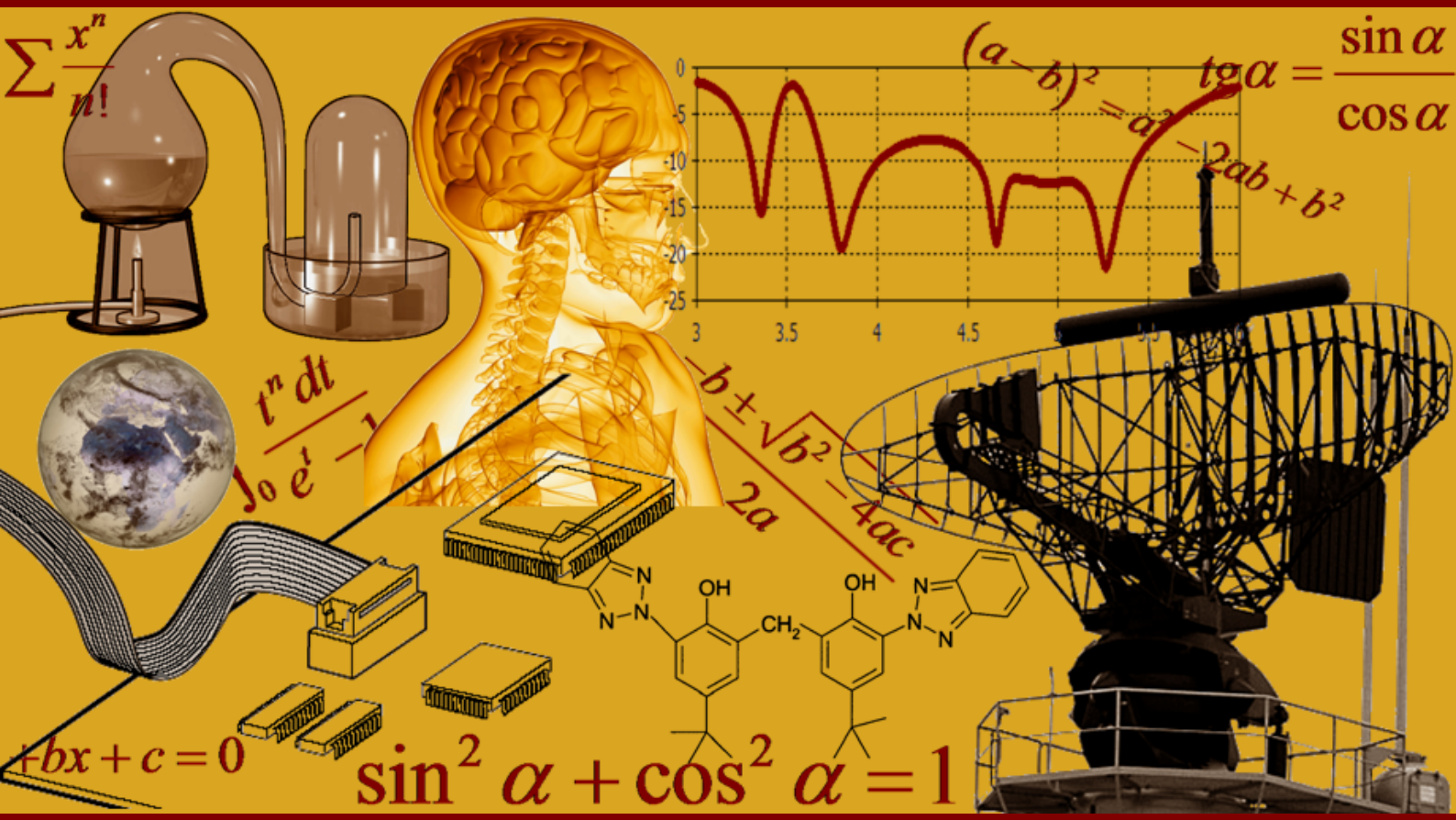
ISSN: 2351-8014 Impact Factor: 2.095

INTERNATIONAL JOURNAL OF INNOVATION AND SCIENTIFIC RESEARCH

Vol. 11 N. 2 November 2014



International Peer Reviewed Monthly Journal

Innovative Space of Scientific Research Journals
http://www.issr-journals.org/

International Journal of Innovation and Scientific Reseach

International Journal of Innovation and Scientific Research (ISSN: 2351-8014) is an open access, specialized, peer-reviewed, and interdisciplinary journal that focuses on research, development and application within the fields of innovation, engineering, science and technology. Published four times per year in English, French, Spanish and Arabic, it tries to give its contribution for enhancement of research studies.

All research articles, review articles, short communications and technical notes are sent for blind peer review, with a very fast and without delay review procedure (within approximately two weeks of submission) thanks to the joint efforts of Editorial Board and Advisory Board. The acceptance rate of the journal is 75%.

Contributions must be original, not previously or simultaneously published elsewhere. Accepted papers are available freely with online full-text content upon receiving the final versions, and will be indexed at major academic databases.

Editorial Advisory Board

K. Messaoudi, Hochschule für Bankwirtschaft, Germany
Sundar Balasubramanian, Medical University of South Carolina, USA
Ujwal Patil, University of New Orleans, USA
Avdhoot Walunj, National Institute of Technology Karnataka, India
Rehan Jamil, Yunnan Normal University, China
Sankaranarayanan Seetharaman, National University of Singapore, Singapore
Fairouz Benahmed, University of Connecticut Health Center, USA
Achmad Choerudin, ST.,SE.,MM., Academy Technology of Adhi Unggul Bhirawa, Indonesia
Mohammad Ali Shariati, Islamic Azad University, Science and Research Branch, Iran
Md Ramim Tanver Rahman, Jiangnan University, China
Rasha Khalil Al-Saad, Veterinary Medicine College, Iraq
Neil L. Egloso, Palompon Institute of Technology, Philippines
Sanjay Sharma, Roorkee Engineering & Management Technology Institute, India
Ahmed Nabile Emam, National Research Center (NRC), Egypt
Md. Arif Hossain Jewel, Rural Development Academy, Bangladesh
N. Thangadurai, Jayalakshmi Institute of Technology, India
Urmila Shrawankar, G H Raisoni College of Engineering, India
Goutam Banerjee, Visva-Bharati University, India
Santosh Kumar Mishra, S. N. D. T. Women's University, India
Anupam Kumar, Ashoka Institute of Technology & Management, India

Table of Contents

Evaluation Post-occupationnelle (Outil de diagnostic) du patrimoine architectural en situation de risque 222-230

Dr. Ammar Korichi, Dr. Krada Salah Eddine El Ayoubi, and Hachouf Mourad

The Role of Sexual Movies in the Sex Counselling and Their Impact on Moral Behaviour of Youth 231-236

Ch. Aqeel Ashraf, Muhammad Sher Juni, Irfan Haider, M. Sohail Sattar Gujjar, Muhammad Kaqbad Alam, Malik Asghar Ali Gill, and Javeria Kareem

DATA MINING INDUSTRIAL AIR POLLUTION DATA FOR TREND ANALYSIS AND AIR QUALITY INDEX ASSESSMENT USING A NOVEL BACK-END AQMS APPLICATION SOFTWARE 237-247

E. O. Ofoegbu, M. A. Fayemiwo, and M. O. Omisore

Analysis of Physico-Chemical Parameters in Harsi Reservoir Dabra, Gwalior District, Madhya Pradesh 248-258

Namrata , D. K. Sharma, and M. K. S. Khushwah Pawaiya, D. K. Sharma, and M. K. S. Khushwah

An Approach to Uncover Hidden Topics in Short & Sparse Web Documents 259-263

Sumayya Sameena and Rehana

Providing Privacy and Security for Cloud Data Using Data Mining 264-272

D. Bhu Lakshmi and S. Arundathi

Performance Comparison of Speed Control of Chopper fed DC Motor for Various Controllers 273-282

Nagulapati Kiran, Naga Raju, and Anil Kumar

Epidémiologie et résistance aux antibiotiques des isolats de Pseudomonas aeruginosa dans un hôpital pédiatrique marocain: implications thérapeutiques 283-290

Mehdi Chinbo, Mariame Moutachakkir, Amal Addebbous, Noureddine El Khoudri, Laila Chabaa, and Nabila Soraa

Human Capital and Economic Growth in Nigeria 291-294

Olalekan Oyedele

The Relationship between the Term Structure of Interest Rates and Nigeria Economic Growth and Inflation Rate 295-303

Olalekan Oyedele

Determination of Morphological and Nutritional Properties of Thaumatococcus daniellii and Effect of Harvesting Method on the Plant Growth 304-311

Agwu A. Ndukwe, Edidiong A. Enoh, and Queendalyn U. Aniere

A techno-energetic review on hydrogen production using wind energy 312-321

Sandeep Pandeyr and Hemshikha Saini

Assessment of the therapeutic role of Arabic Gum as Antioxidants on Cadmium induced kidney dysfunction in male albino rats 322-329

Marwan A. Ibrahim

Modeling social security institution financial resources 330-338

Moulay El Mehdi Falloul and Moulay Ali Falloul

Estimation d'un modèle à équations simultanée des variables macroéconomiques au Maroc 339-355

Moulay El Mehdi Falloul and Abdelali Saadallah

CMOS LNA Design for Ultra Wide Band - Review 356-362

K.B. Satale, A.R. Kaushik, and P.S. Deokar

Pass-through du Taux de change et inflation au Maroc : Une analyse en modèle VAR 363-370

Moulay El Mehdi Falloul

Analyse des composantes principales : cas d'un échantillon des prestataires logistiques de la région du grand Casablanca 371-378

Moulay El Mehdi Falloul

Treatment of Hospital and Biomedical Waste Effluent Using HUASB Reactor 379-386

M.P. Murugesan, P. Akilamudhan, A. Sureshkumar, and G. Arunkarthikeya

Prévalence des gènes de résistance plasmidique aux quinolones chez des entérobactéries communautaires isolées au Maroc 387-399

Loubna Jamali, Fatima Haouzane, Mohammed Bouchakour, Salwa Oufrid, Zineb Ghazlane, Naima El Mdaghri, Sellama Nadifi, and Mohammed Timinouni

Référentiel de management des ressources d'entreprises 400-412

Fettah Elmajdouly, Abdelfetah Adil, Said Ouaskit, and Mbarek Elbounjimi

Effects of Governance and Policy Reforms on Affordable Housing in Nigeria 413-419

Adiukwu Fidelis Onyekachi

Prospects and Challenges of Informal Settlements and Urban Upgrading in Abuja 420-426

Adiukwu Fidelis Onyekachi

Synthesis and Optical Characteristics of CdSe/ZnS core/shell Nanocrystals 427-432

M.R. Karim, Z. Ferdous, and Hilmi Ünlü

Effect of SiCp addition on the indentation hardness of as-cast Al metal matrix composites 433-438

Tawsif Ahmed Siddique, Md. Tanjidul Islam, Mohammad Sharear Kabir, and Md. Nasrul Haque

Data Security for Cloud Computing Using RSA with Magic Square Algorithm 439-444

A. Dharini, R.M. Saranya Devi, and I. Chandrasekar

Design a Phase Interleaving PFC Buck Boost Converter to Improve the Power Factor 445-449

Preti Tyagi and Sunder Singh

Behind The Eco Innovation Efforts: A Review of Dynamic Capabilities Theory 450-456

Lizwa Rashid, Juhaini Jabar, and Samer Shami

Modélisation et simulation des écoulements de surface dans le bassin versant du Bandama blanc : utilisation d'un modèle distribué (HYDROTEL) 457-470

Matta Amessan, Fernad Kouamé, Bi V. H. N'guessan, Kouamé Aka, and Jean Biémi

KINETICS AND EQUILIBRIUM STUDY OF ADSORPTION OF PHENOL RED ON TEFF (Eragrostis teff) HUSK ACTIVATED CARBON 471-476

Jemal Yimer Damte, O. P. Yadav, Tesfahun Kebede, and Jemal Mohammed

Détection localisée des zones dégradées de végétation par télédétection: application à la zone de transition entre le bassin sédimentaire et le socle cristallin (Centre – Bénin) 477-493

E.A. Tchibozo and O.P. Toundoh

Evaluation of Habitual Rice (Oryza sativa L.) Landraces of Bangladesh through Different Genetic Parameters 494-502

Muhammad Shahedul Alam, L. Hassan, M. M. Islam, S. N. Begum, and S. N. Islam

Electronic retailing: Exploring relationship among product quality and delivery services role in customer's commitment and loyalty in China 503-510

Muhammad Ziaullah, Yi Feng, and Shumaila Naz Akhter

Democracy and Ethno-Nationalism in Nigeria 511-514

Stephen Ayodeji Akinnimi

Phytochemical screening and health potentials of Morinda lucida Benth 515-519

T.O.A. Adeyemi, R.O. Ogboru, O.D. Idowu, E.A. Owoeye, and M.O. Isese

Detection of Sybil Attack using Received Signal Strength and Masquerade Attack using Mutual Guarding 520-526

A. Amalorpava Preethi and R. Boopathiraj

A comparative study of the Morphometric Analysis of High land sub-watersheds of Meenachil and Pamba Rivers of Kerala, Western Ghats, South India 527-532

E. K. Manju and A. V. George

PERCEPTION AND PRACTICE OF INTERMITTENT PREVENTION TREATMENT OF MALARIA AMONG PREGNANT WOMEN ATTENDING ANTE-NATAL CLINICS IN IBADAN NORTH EAST LOCAL GOVERNMENT AREA 533-542

Oluwakemi I. Adeniji and Foluso C. Odesola

Assessment of Heavy Metals and Antibiotic Resistance in Rhizobacteria Isolated from Rhizosphere Soils Contaminated with Tannery Effluents in Bahir Dar, Ethiopia 543-550

Melkamu Tamiru, Yosef Hamba, and Munees Ahemad

Classification Based On Stone Inscription Image 551-557

Mie Mie Tin and Mie Mie Khin

Influence of TV Dramas on the Dressing Style and Way of Talking of Women in Pakistan: A Case Study of Karor Lal Eason, Pakistan 558-565

Faisal Azeez, Muhammad Mukhdum Ali, Malik Muhammad Sher Ali Juni, Ch. Aqeel Ashraf, Salman Amin, Irfan Haider, Atif Umair, and Javeria Kareem

Investigating The Challenges In Revenue Collection Process: The case study of Ghana AMA property rate collection 566-576

Fati Tahiru, Samuel Agbesi, and Alexander Osei-Owusu

Study on Antimicrobial Activity of Barringtonia acutangula and Premna corymbosa, two widely distributed Shrubs of the Sundarbans 577-584

Md. Jalal Uddin and Rony Kumar Banik

An Empirical Evolution Framework of ICT in Education Sector of Pakistan 585-597

Arbab Kanwal, Mr. Fahad Jan, and Mr. Zubair Azhar

La certification qualité et la performance des organisations : Quelles convergences ? Etude de cas au sein de la Nouvelle Société AMADIR dans le grand Agadir 598-610

Lamia El Kahri, Ali Rachidi, and Mostapha Amri

A Comparative Study on Heat Transfer in Straight Triangular Fin and Porous Pin Fin under Natural Convection 611-619

Jitamitra Swain, Kumar Gaurav, Dheerendra Singh, Prakash Kumar Sen, and Shailendra Kumar Bohidar

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 222-230
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Evaluation Post-occupationnelle (Outil de diagnostic) du patrimoine architectural en situation de risque

Dr. Ammar Korichi, Dr. Krada Salah Eddine El Ayoubi, and Hachouf Mourad

Faculté d'Architecture et d'Urbanisme,
Université 3 Constantine, Algeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Within the Algerian context the urban historical centers are mainly composed by the old city of Ottoman era and the European city of the French era. These urban centers have experienced and continue to experience significant changes in their units, homogeneity and urban image. This phenomenon is accentuated with the natural growth of cities and the rural exodus. Therefore, urban development has complied with the economic imperatives alone, ignoring any historical urban structure reflecting the richness of different civilizations and cultures in the country. During the French period (1830 - 1962), the city was mainly inhabited by the Algerian population concentrated in the neighborhoods of the traditional city "Medina", and a European population concentrated in the colonial-type of houses. The city of Constantine which is considered the capital of eastern part of Algeria, by its size, its history and geographical position has seen many changes related to its structure and urban image. Also the city continues to undergo major transformations disregarding the context of historical urban city. Several scientific studies and research have allowed us to express the magnitude and importance of evaluation studies in the field of preservation of architectural heritage. Therefore, it is urgent to undertake scientific search in order to highlight the interest of this historical memory.

KEYWORDS: Algeria, urban development, civilizations.

1 INTRODUCTION

Le patrimoine architectural qui est constitué par les ensembles historique urbains qui par leurs homogénéité et unité comme par leurs intérêt et valeurs culturel et esthétique sont des richesses collectives considérables et irremplaçables. (BLEYON J.B., 1979.) Ils sont l'expression d'une mémoire sociale, culturelle et économique de notre histoire actuelle et future. Ces ensembles présentent un avenir pour notre passé, dont l'objet principal serait de veiller et d'éveiller l'intérêt de conscience des populations a l'égard de cet environnement urbain et architectural.

Précisément, dans le temps actuel, plusieurs menaces de formes multiples tendent à altérer ce patrimoine architectural.

Ces risques résultent essentiellement de différents phénomènes, tels que les facteurs dits classiques détérioration et les facteurs qui sont liés aux transformations générales du milieu de vie dues aux mutations socioéconomique.

L'unité, l'homogénéité et l'image de ces centres historiques urbains se modifie sans cesse, a bien des égards qui se manifestent par une accélération de la dégradation, la détérioration et la disparition d'une manière impitoyable et agressive de ce patrimoine architectural.

Par conséquent, il est urgent de continuer à persévérer et d'entreprendre des bases de réflexions scientifiques théoriques et pratiques qui permettent de mettre en évidence l'intérêt ce cette mémoire historique ainsi que la prise de conscience qui s'impose à son égard.

Corresponding Author: Dr. Ammar Korichi

Comment protéger, préserver et mettre en valeur le patrimoine architectural national et parallèlement, penser la ville pour définir le cadre bâti à proposer à l'Algérien d'aujourd'hui. Spécialistes et experts demeurent perplexes devant le « chaos visuel » et le « gâchis immense », en matière d'architecture et d'urbanisme.

« La production architecturale d'aujourd'hui n'a aucune chance de devenir le patrimoine de demain. » (KHELADI M. 1996) L'héritage bâti, ce patrimoine qui s'est constitué au fil des siècles et des millénaires, est sujet à de multiples agressions liées à l'abandon, au manque d'entretien ou aux aléas du temps. A défaut de proposer les bonnes réponses, au moins poser les vraies questions et évaluer les enjeux.

En Algérie, les centres urbains historiques des grandes villes sont généralement constitués par la « vieille ville » de l'époque ottomane et de la cité européenne de l'époque française ; ils exhibent un patrimoine multiséculaire matériel et immatériel remarquable.

Ces centres urbains historiques produit d'un double héritage, à connu de profondes mutations économiques, sociologiques et politiques liées principalement à une dynamique urbaine effrénée. Les pouvoirs publiques continuent à accepter un urbanisme d'improvisation, ignorant un patrimoine architectural et urbain, en perdition voire même menacé de disparition qui continu à subir des bouleversements importants.

Ce phénomène s'est accentue avec l'accroissement démographique d'une part et de la croissance urbaine d'autre part des villes. Par conséquent, le développement urbain s'est conformé aux seuls impératifs économiques, ignorant toute structure urbaine historique reflétant la richesse des différentes civilisations et cultures du pays. (GODFRIN G. 1999,)

Le centre ancien de la ville de Constantine à l' origine de la ville traditionnelle « La vieille ville », est composé d'un tissu mixte de type européen « habitations de la période Française », et traditionnelles « Medina ».

Durant la période française (1830 – 1962), la ville été principalement habité par une population autochtone algérienne concentrée au niveau des quartiers de la ville traditionnelle « la Medina », et une population européenne concentrée au niveau des habitations de typologie européenne.

La ville de Constantine qui est considérée comme la capitale de l'est Algérien par sa taille, son histoire et sa position géographique a connu beaucoup de mutations liées à sa structure et son image urbaine et aussi continue de subir des transformations majeures en faisant abstraction du contexte historique urbain de la ville.

Ce patrimoine architectural qui est important par l'histoire qu'il transmet et la vie urbaine qu'il perpétue risque la mutation générale ou la disparition totale. (SPIGAI V.et COLAROSSI P., 1993)

« Actuellement, pour des raisons multiples qui tiennent à l'occupation complète de l'espace, à la mondialisation des échanges, les biens patrimoniaux ont changé de statut dans le monde et les objets patrimoniaux sont reconnus comme des éléments structurants pour l'espace urbain et sont considérés comme d'importants marqueurs territoriaux ». (SEMMAR A., 2007)

La banalisation planifiée de nos lieux accompagnés de leur perpétuel inachèvement demeure incontestablement la résultante d'une politique basée sur un économisme étroit, une formation académique aux antipodes de contexte socio-historico-économique national et un fatalisme archaïque et réducteur.

Jamais encore, en Algérie, l'environnement bâti n'avait été aussi problématique et jamais moins sure son assise existentielle. Il n'est plus raisonnable de s'obstiner à porter exclusivement un effort sur le maintien de démarches et de conceptions anachroniques.

Les villes algériennes ont connu ces dernières décennies un bouleversement sans précédent sur les plans urbanistique et architectural. Pratiquement aucune ville, n'a échappé à cette fièvre de transformations accélérées et aux différents modes d'interventions sur leurs anciens tissus urbains dans l'objectif d'améliorer le cadre de vie de leurs populations.

Ces opérations qu'un fuseau de facteurs conjugués et complexes favorise leur ont fait perdre un pan de leur histoire par la perte progressive de l'image qu'ils ont véhiculé à travers le temps et ce lien à la mémoire, à l'identité et aux pratiques sociales. (CHOAY F., 1992.)

A la faveur des politiques urbaines de développement souvent définies dans l'urgence, et aussi des contraintes démographiques et socio-économiques non maîtrisées, les villages (patrimoine colonial hérité) qui ont servi de terrains d'assiette La pertinence de ce propos, puise sa raison d'être d'une double interrogation. La première dérive de l'impérieuse nécessité d'inclure une démarche d'évaluation post occupationnelle liées au patrimoine architecturale comme une question centrale. La deuxième motivation qui impact l'intérêt d'y recourir est la capitalisation gargantuesque de l'information scientifique fiable susceptible de contribuer à transcender les affres des réflexes et autres méthodes archaïques. Plusieurs

recherches et études scientifique ont permis d'exprimer l'ampleur et l'importance des études d'évaluation dans le domaine de la préservation du patrimoine architectural.

Afin de préserver et de sauvegarder ce patrimoine historique, une réflexion sur le développement d'une approche d'évaluation technique post-occupationnelle (EPO) de ce patrimoine architectural actuel et nécessaire et urgente, aux fins :

a- Evaluer l'étendue de la situation actuelle de ce patrimoine architectural et établir son état de délabrement et d'endommagement et les risques à encourir futurs.
b- Générer un apport scientifique ou une banque de données pouvant constituée un préalable indispensable pour intervenir dans les études de préservation de ce patrimoine architectural en situation de risque.

Constantine



Source: Architecture et patrimoine, école architecture Grenoble.

Le théâtre de Constantine (1883)



L'hôtel de ville (1902)



Le palais de justice (1918)





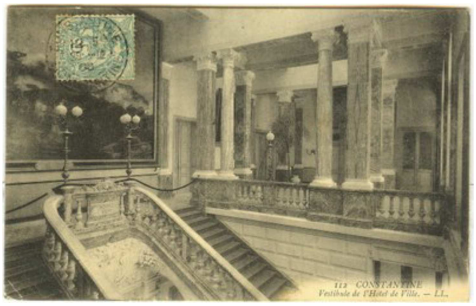
L'hôtel des postes (1908)



Le crédit foncier



L'escalier de l'hôtel de ville



Source: http://adcha-cartes-postales-constantine.blogspot.com

2 ANALYSE DU CONTEXTE DU PATRIMOINE ARCHITECTURAL ET CONSTITUTIONNEL

2.1 CONTEXTE ARCHITECTURAL

Le patrimoine architecturale et urbain historiques en en Algérie constitue une valeur spécifique, unique et précieuse pour l'histoire et la mémoire des générations actuelles et futures, aussi-il un atout et un potentiel considérable dans la mise en considération de l'image culturelle et esthétique de l'environnement urbain et architectural actuel.

La structure urbaine et architecturale de la ville de Constantine est essentiellement basée sur les fondements architecturaux et urbanistiques de la ville française de l'époque érigée depuis 1830 jusqu'à l'indépendance de l'Algérie en 1962.Ce patrimoine historique, continue de véhiculer la même mémoire, les mêmes repères et les mêmes images du développement urbain et architectural de la ville de Constantine. La ville de Constantine présente une image riche et varié du patrimoine historique. Cette richesse architecturale et urbanistique se manifeste par la combinaison d'un tissu ancien de la vieille ville de Constantine de l'époque Ottomane et la ville française ou européenne.

La structure urbaine et l'architecture de La ville européenne se distingue par les percées haussmanniens qui donnent des ouvertures splendides sur différents placettes urbaines, ainsi que par différents types d'édifices, allant du logement, commerces et administrations. L'architecture de cette époque se caractérise par des styles variés, du néoclassique, de l'Art-déco, moderne et du néo mauresque.

Afin de préserver ce patrimoine dans son état original et avant qu'il soit détruit ou modifiés d'une manière inappropriée, il fondamentalement urgent que des bases de réflexion scientifique et systématique rigoureuse concernant sa réhabilitation et rénovation soient entreprises

Les études d'évaluation post occupationnelle (EPO) dans le bâtiment deviennent un besoin vital pour s'assurer de la qualité de la réhabilitation et de la rénovation ainsi que la performance fonctionnelle et technique du bâtiment.

Cette réflexion vise à établir une approche d'évaluation post occupationnelle (EPO) fonctionnelle et technique à l'égard de la réhabilitation et la rénovation des édifices intégrés dans le patrimoine architecturale et qui est en situation de risque.

2.2 CONTEXTE INSTITUTIONNEL

En effet, jusqu'avant 1998, le patrimoine architectural et urbain de l'époque française en Algérie n'était pas considéré comme bien historique et culturel.

La législation en l'Algérie fonctionnait uniquement avec une ordonnance datant de 1968. Les assisses du patrimoine tenues en 1998 consacrèrent la loi 98-04, qui en réalité est une loi fondamentale. Et il a fallu attendre l'année 2003 pour voir apparaitre les différents textes d'application. Conséquemment a cette avancée législative, le patrimoine historique est reconnu comme patrimoine national présentant un intérêt culturel et moral considérable, et ainsi il a était permis aux autorités locales de procéder et d'entreprendre des interventions de conservation de réhabilitation et de rénovation.(www.m-culture.gov.dz, last visite juin 2013).

Depuis la promulgation d'une nouvelle loi relative à la protection du patrimoine culturel immobilier en Algérie, la réhabilitation des quartiers d'habitat colonial du Rocher de Constantine est devenue un élément fondamental des politiques urbaines.

L'an 2000 était le début de la requalification urbaine et architectural du patrimoine historique public, les opérations s'inscrivaient rarement dans une politique globale de requalification du patrimoine. Il s'agissait souvent d'opérations ponctuelles en réponse à des pressions exercées par la collectivité locale (répondre à une urgence : immeuble menaçant ruine, ..)

A partir de l'année 2002, une nouvelle législation est élaborée afin de donner un autre essore a la l »amélioration et la préservation du patrimoine urbain et architectural qui a été définie par : « la loi relative à l'amélioration du cadre bâti des communes ».

Cette loi consistait à ce que a généraliser les opérations de réhabilitation et de rénovation a l'ensemble du cadre bâti ans aucune distinction des différentes caractéristiques de chaque bâtisse et, sans tenir réellement compte de l'état de chaque immeuble et des spécificités du site. Désormais la nécessité de définir une politique de requalification du patrimoine s'impose avant d'engager de nouvelles opérations.

La réalisation d'une telle stratégie demande une identification technique de chaque immeuble, des origines de sa décadence, mais aussi des particularités des occupants et de leurs souhaits. Elle consiste également à analyser les stratégies des autres acteurs impliqués dans les opérations (collectivités locales, administrations, entreprises, organismes sociaux, etc.), et de considérer les possibilités de participation qu'ils s'offrent. Il est également important de se questionner sur la progression de la maîtrise d'ouvrage, son organisation, ses méthodes de gestion, la compétence du personnel et son attitude vis à vis des occupants, etc.

Eventuellement, les premiers résultats de cette opération ont montré, un très grand disfonctionnement et une qualité très piètre et inappropriée par rapport aux objectifs escomptés.

Les opérations de réhabilitation et de rénovation consistaient essentiellement à des ravalements de façade et des réhabilitations des parties communes.

Evidemment, les pouvoirs publics ont dénoncé le manque de professionnalisme ayant caractérisé les opérations de réhabilitation engagées pour relooker et restaurer le vieux bâti de Constantine en état de délabrement.

Donc, il paraît clair, qu'il existe des insuffisances considérables en apport scientifique et un manque drastique de fond et cumul documentaires relatifs à la conduction des opérations de réhabilitation et de rénovation du patrimoine architectural et urbain existant.

Il paraît aussi, que l'ensemble de des problèmes liés à la qualité de la préservation et de la rénovation du patrimoine architectural en situation de risque ainsi qu'a la performance des matériaux et techniques utilises n'ont pas été profondément analysés et étudiés avant leurs application.

De ce fait, il semble tout à fait évident, que le développement d'une réflexion concernant l'évaluation technique post occupationnelle EPO relatif à la préservation, la réhabilitation et la rénovation du patrimoine historique architectural et urbain nécessaire et urgente, et cela afin :

- **a-** D'éviter de répéter les même erreurs et lacunes identifiés au niveau des édifices supposée être réhabilité et rénover.
- **b-** D'assurer que les matériaux et les techniques utilisés sont que des dispositifs jugés adéquats, appropriés, efficaces et performants.

Ce processus d'analyse et d'investigation permet de générer un cumul de données et de connaissances scientifiques fiables pouvant être utilisées dans une première étape pour la formulation et l'élaboration d'un **Support ou Guide de la préservation, de réhabilitation et de rénovation du patrimoine architectural et urbain en situation de risque,** qui sans nul doute, permettra d'améliorer et de préserver la situation existante et future des différentes bâtisses en situation de risque en Algérie.

3 FORMULATION D'UNE APPROCHE D'EVALUATION TECHNIQUE POST OCCUPATIONNELLE RELATIVE A LA PRESERVATION ET A LA RENOVATION DU PATRIMOINE ARCHITECTURAL ET URBAIN EN SITUATION DE RISQUE.

La plupart des édifices représentant le patrimoine architectural de l'époque française sont en état de délabrement ou généralement susceptibles de se détériorer, en raison notamment de différents facteurs tels que le mauvais entretien et les méthodes de restauration et de rénovation entreprise qui sont inappropriés.

La rénovation ou la remise en état approprié est considéré comme une réparation minimale, afin de permettre la construction soit adaptée à son objectif principal.

Une fois les travaux de rénovation seront terminés, l'évaluation post-occupation (POE) peut être effectuée.

Cette démarche est définie comme étant un processus systématique d'évaluation des bâtiments en cours d'usage, de sorte que cette approche permet de mettre en évidence ou de cibler les défaillances, erreurs, disfonctionnements et amalgames et d'indiquer ou suggérer les outils ou les techniques nécessaires afin d'améliorer leurs conditions actuelles et pour guider la conception ,et la rénovation des futurs édifices.

POE sont généralement effectuées dans les 4 à 24 mois après période l'occupation ou de rénovation.

La POE est aussi déterminante dans la mise en évidence de la performance du bâtiment dans son aspect fonctionnel et technique. Aussi la POE se concentre sur les occupants de l'édifice et de leurs besoins. Elle permet de mieux comprendre les conséquences des décisions prises durant les phases passées de programmation, de conception et de réalisation du bâtiment, et de constitue une banque de donnée fiables qui servira comme un moyen pour fournir une rétroaction objective et subjective , afin d'éclairer les différentes phases de rénovation et de préservation du bâtiment tout au long de son cycle de vie,(Preiser, W.F.E., Rabinowitz, H.Z., White, E.T. 1988).

Ainsi donc, l'objectif d'une formulation d'une approche de recherche et d'évaluation technique de performance est de présenter un guide ou un canevas de recherche (Research framework) relatif au processus de l'évaluation post-occupationnelle d'un bâtiment ou d'un espace vécu **(POE)** qui peut être appliqué au niveau des opérations et programmes relatifs à la préservation et la rénovation du patrimoine architectural en situation de risque en Algérie.

En outre, cette démarche peut assigner des alternatives de programmes de recherche opérationnelle au niveau de différents espaces urbain et bâtisses, qui pourraient aider à améliorer les conditions existantes et futures et à trouver les solutions possibles.

L'évaluation post-occupationnelle ou **Evaluation de l'espace vécu** appelée communément **Post-Occupancy Evaluation (POE)** est un concept qui s'est développé la première fois dans les pays Anglo-Saxons. Plus tard ce concept devient largement adopté par des chercheurs en Europe continentale (en France, Belgique et en Suisse) sous l'expression de l'Evaluation **Post-Occupationnelle**. En effet, ce concept consiste à l'utilisation d'une série de méthodes qui laissent évaluer d'une manière systématique et rigoureuse (Objectivement et/ou Subjectivement) par rapport à des critères de performance qui sont aux préalables définis, des bâtiments occupés ou espaces vécus. L'évaluation de l'environnement de bâti (intérieur et extérieur) permet d'évaluer la performance et vérifier **l'Efficacité Effective (Effectiveness) et l'Efficience (Efficiency)** de la conception (**Design)** et de la réalisation de l'environnement bâti, afin de corriger et de rectifier autant que possible les incohérences et les insuffisances et d'éviter les erreurs similaires dans la conception, la construction et la realisation de futurs espaces et bâtiments, (Preiser et al. 1988), (Zimmerman et Martin, 2001)..

Bien que l'évaluation post-occupationnelle semble être un terme nouveau en architecture, en réalité c'est un concept qui a déjà eu une influence significative sur la programmation, conception et la réalisation de l'environnement bâti pendant les décennies précédentes.

En effet, les programmes de recherches relatifs à l'évaluation de performance de bâtiments occupés ou post-occupationnelle (**EPO**) sont considérés comme l'une des principales sources de progrès dans le domaine de la recherche architecturale (Markus T, Rabinowitz and Al,1986).

L'ensemble de ces chercheurs considère que les études d'évaluation de performance de bâtiments (EPB) ou (POE) comme un axe de recherche prioritaire, par lequel de meilleurs de meilleurs environnements (Bâtiments et Espaces) peuvent être conçus et réalisés.

Aussi, l'évaluation de performance est essentielle parce que à travers cette approche, les dispositifs relatifs à la conception et à la réalisation architecturale et technique (Design Features) jugés satisfaisants puissent être identifiés et répétés ainsi donc, les dispositifs non satisfaisants seront éliminés et les leçons peuvent être apprises à partir des erreurs du passé, ce qui permet de constituer une base solide pour améliorer la conception et la réalisation technique des bâtiments et des espaces existants et par conséquent la rétroaction ou le (**Feed-back**) pourra générer des bâtiments satisfaisants à l'avenir.

L'évaluation de performance constitue également un intérêt particulier aux différents clients et organisations possédants et/ou gérants des bâtiments, qui considèrent l'apport de l'évaluation comme un outil important et nécessaire aux fins de disposer de données et d'informations fiables concernant leurs investissements.

Elle permet aussi de fournir des perspicacités dans les conséquences de décisions des différentes phases du passé de la conception et de l'exécution résultante du bâtiment.

Ce besoin a été exprimé non seulement exprimé par les architectes et les universitaires, mais également par des organismes de clients, des services gouvernementaux, et des autorités locales qui veulent savoir ce qu'y arrivent avec précision de leurs (l'argent).

Les objectifs essentiels d'une approche d'évaluation de performance sont:

a- Identifier les différents problèmes liés à l' écart éventuel des différentes caractéristiques conceptuelles et techniques par rapport aux critères escomptés.
b- Identifier les inadéquations possibles liées à l'utilisation du bâtiment.
c- Constituer un cumul de données et d'informations fiables capables d'être utilisé par les clients, experts architectes dans le domaine de la préservation et la rénovation du patrimoine architectural existant

3.1 PROCESSUS D'ÉVALUATION

L'évaluation de performance d'un bâtiment ou d'un espace vécu est basée sur un processus qui est composé essentiellement par trois aspects:

a- Identification des méthodes d'évaluation qui pourraient être applicables pour le programme de recherche.
b- Définition des techniques, critères et normes pour le programme d'évaluation.
c- Définition du champ d'investigation du programme d'évaluation.

3.2 MÉTHODES D'ÉVALUATION

La plupart des études d'évaluation de performance ont utilisé une grande variété de méthodes examinées et testés qui incluent en général l'utilisation des mesures ou relevés, de l'observation, des interviews et des questionnaires, toutes ces méthodes présentent un degré raisonnable de validité et sont en général appropriées pour l'usage d'évaluer la performance des bâtiments et espaces en cours d'utilisation. Le choix des méthodes appropriées, pris individuellement ou combinées, semble dépendre de la particularité des problèmes étudiés, de la spécificité des situations produites et du but de l'étude d'évaluation. Parmi ces méthodes on, distingue: (SSBRT, 1996).

a. Photographie

b. Utilisation de la bande vidéo

c. Méthodes d'observation

d. observations directes

e. observations indirectes

f. interviews

g. Questionnaires

h. Enquêtes

3.3 CRITÈRES D'ÉVALUATION

La conduction d'un programme de recherche et d'évaluation nécessite une identification et une définition claire des techniques, des critères contre lesquels les bâtisses ou espaces étant étudiés peuvent être évalués.

La revue de littérature spécialisée révèle qu'en raison du caractère international

Du patrimoine architectural, il est possible de transférer des techniques, des normes et des standards relatifs à la préservation, la réhabilitation et la rénovation du patrimoine historique à partir d'autres pays , mais ce transfert devrait s'effectuer en tenant compte d'un certain nombre de facteurs tels que le climat et les considérations d'organisation et institutionnelles (Rawilson,1983).

Néanmoins, dans une première étape du programme d'évaluation, il est nécessaire d'explorer quels critères et technique de conception existent avant de commencer le programme de recherche.

3.4 LIMITE DU CHAMP D'INVESTIGATION

L'objectif d'initiation d'un champ d'investigation limité permet de clarifier et de mettre en évidence les différents aspects qui sont sujettes à l'évaluation, ainsi de maîtriser et de contrôler les moyens qui sont nécessaires et disponibles pour la bonne conduction du programme de recherche.

Afin de réaliser un programme d'évaluation effective, il serait nécessaire d'employer un personnel qualifié. Cette catégorie de personnel devrait non seulement être, expérimentée mais aussi spécialisé dans la préservation, la réhabilitation et la rénovation des édifices relevant du patrimoine architectural et urbain.

Bien que le champ d'investigation du programme de recherche et d'évaluation initial soit limité, il permettrait une acquisition d'expérience considérable sur laquelle, de futurs programmes à une échelle plus élargie pourraient être réalisés dans tout le pays.

Cette approche qui sera constituée essentiellement au départ par ces trois aspects et pourra être élargie à d'autres aspects si nécessaire, pourrait être adoptée comme démarche ou approche pour un programme d'évaluation technique relatif a la préservation et la rénovation du patrimoine architectural et urbain en Algérie.

Ceci constituera un processus de recherche scientifique rigoureux et opérationnelle pouvant aider à trouver des solutions possibles afin d'améliorer la situation des édifices en situation de risque.

Par conséquent, cette tentative de réflexion pourra constituer un support utile et fiable pour l'élaboration d'un programme de recherche concernant éventuellement l'évaluation technique post occupationnelle (EPO) du patrimoine architectural et urbain en situation de risque.

4 CONCLUSION

L'objectif de cette réflexion est de mettre en évidence de prime abord, l'importance du patrimoine architectural et urbain comme étant une richesse historique importante qui constitue une mémoire et une l'image du passé, aussi son rôle de patrimoine historique existant, consistant et dynamique dans la cohésion de la communauté et la structure sociale et culturelle du pays.

En second lieu, cette réflexion développe le concept de l'approche de l'évaluation de performance technique qui constitue la base fondamentale du processus de l'évaluation post-occupationnelle (EPO) relatif à la préservation, la réhabilitation et la rénovation du patrimoine historique architectural et urbain en situation de risque en Algérie.

REFERENCES

[1] BAILY GH., (1975), Le patrimoine architectural, conférence des pouvoirs locaux et régionaux de l'Europe, Ed. Deltat Vevey.
[2] Bernard M Feilden , (1994), " Conservation of Historic Building " , (Bernard M Feilden.
[3] BLEYON J.B., (1979), L'urbanisme et la protection des sites, Librairie Générale de Droit et de Jurisprudence, Paris.
[4] CHOAY F., (1992), L'allégorie du patrimoine, Ed.le Seuil, Paris.
[5] Ficher G.N, and Ficher G, (1977), "Evaluation des environnement de travail", Presses de l'Université de Montréal.
[6] GIOVANNONI G., (1995), L'urbanisme face aux villes anciennes, Ed le Seuil, Paris.
[7] GODFRIN G., (1999), Aménagement urbain et bâti existant, Ed.l.g.d.j, Paris.
[8] Guba, EG, (2006), and Lincoln, « Fourth Generation Evaluation », London Sage.
[9] Hillier,B, and Leaman, (1980), A « A New Approach to Architectural Research » RIBA Journal, London.
[10] KHELADI M., (1993), Urbanisme et systèmes sociaux : la planification urbaine en Algérie, Ed opu, Alger.
[11] LAURENT FRIER P., (1979), La mise en valeur du patrimoine architectural, Ed. Le moniteur. Paris.
[12] Markus, T, (1989), « The Role of building Performance », Brodbent, W.
[13] Moser, G, (2003), « Questionner, Analyser et Améliorer les relations a l'environnement », ed Armant collin, Paris.
[14] Preiser, W.F.E., Rabinowitz, H.Z., White, E.T. (1988). " Post-Occupancy Evaluation". New York.
[15] Rabiniwitz, HZ, and Canter, D, (1986), « Study of Building in Use », University of Wiscosin.
[16] Rawwilson, C, (19880), "Evaluation Manuel", Architectural Research Unit, London Research in Action »An integrated Design Study », Architectural Research and Teaching.
[17] SPIGAI V. et COLAROSSI P., (1993), « La stratification de la ville et du territoire, techniques d'analyse et projets de valorisation », Ed. Centro Analisi Sociale Progetti, Rome.
[18] SEMMAR A, (2007), « Algérie : SOS Patrimoine en danger in Urbamag ».
[19] Social service Building Team, (2006), « The Appraisal of Buidings », Oxford Brookes University.
[20] Zeisel, J, (2006), "Inquiry by Design" , Research Cambridge University .

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 231-236
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

The Role of Sexual Movies in the Sex Counselling and Their Impact on Moral Behaviour of Youth

Ch. Aqeel Ashraf[1], Muhammad Sher Juni[1], Irfan Haider[2], M. Sohail Sattar Gujjar[2], Muhammad Kaqbad Alam[1], Malik Asghar Ali Gill[1], and Javeria Kareem[1]

[1]Department of Communication Studies University of Sargodha, Pakistan

[2]Department of Business Administration, University of Sargodha, Pakistan

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The paper examines the concept of sex counselling and its significance in the contemporary society. It also dissects the misconceptions upheld by adolescents and their implications on their moral development. The paper further addresses the reasons why adolescents engage in non-marital sex and its consequences. The counselling methods and approaches for tackling this are discussed. The paper concludes by giving the implications of the approaches on the moral development of adolescents.

KEYWORDS: Sexual Movies, sex counselling, youth and moral behavior.

INTRODUCTION

In the good olden days, virginity was a virtue that every young woman must uphold. After the wedding ceremony in the old days, if the bride was not found as a virgin, it was a great disgrace to her family. This cultural practice then in the Nigerian society prevented ladies from engaging in non-marital sex. But, nowadays the reverse is the case. If a bride still keeps her virginity till her wedding night, she is seen as an uncivilized girl (Ola, 2000). Sexuality is an important aspect of growth. Proper upbringing and thorough training of the body and its functioning will be of great help to our adolescents.

According to McMahon and McMahon (1982), sexual desires and activities should be seen as natural tendencies and instincts that will come when they are needed and necessary. Sexuality involves physical, personal and symbolic aspect which is connected indirectly with the sex act. Sexuality must be viewed in the light of the society. Sex problems begin in adolescence and adolescents face major difficulties in handling their sex drives (Dacey and Travers, 2004).

According to Ventura, Mathew and Curtin (1998), adolescents who can go to their parents or other adults with questions about sex and those who get sex counselling from school or community programme have a better chance of avoiding pregnancy and other risks connected with sexual activity. Papalia (2004) observed that many societies have witnessed a revolutionary change in attitudes toward sexual activities. Many may not believe in keeping their virginity again. There may be no more fear in the heart of the young ones towards sexual activities. He opined that regarding non-marital or premarital sex, homosexuality, sexual minority and specific sexual acts are probably more open and permissive today in the life of the younger one than they have been at any time in recent history. Young people are exposed to sexual stimuli in magazines, on television and by the movies to a great extent than ever before. Parental monitoring during pre-adolescence affects the age at which adolescents start and begin sexual activity. He was of the view that adolescents who are knowledgeable about sex are more likely to use contraceptives consistently. They are also more likely to postpone sexual intimacy the most effective means of preventing sexual problems. Sex counselling can be regarded as a process of making an individual develop a positive and wholesome attitude towards sex. Sex counselling is a way of providing adolescents with valuable knowledge about sex so as to avert risks associated with sex such as teenage pregnancy, sexual diseases and emotional problems.

Corresponding Author: Muhammad Sher Juni

The issue of sex counselling should not be left in the hands of parents alone. Teachers, professional counsellors and more importantly the society should be involved. Sex counselling is the reproductive rite that gives one knowledge about one's body and value so that it cannot be abused. It, therefore, needs a right interpretation and according to Anyagwa (2001), it should not be compartmentalized. Parents are of different schools of thought on the issue of sexuality. Some parents are of the view that exposing a young girl or a young boy to sex issues could be dangerous. This school of thought believes that by telling a young person that having a sexual relationship with the opposite sex could result into pregnancy may prompt such an adolescent to practice and test whether it is true or not. The other school of thought believes that knowledge is power that such knowledge may prevent an adolescent from engaging in such act. To some parents, sex counselling is against their cultural beliefs. In some cultures, discussing sexual issue is a taboo; therefore, sexual discussion should be delayed to marriageable age before such discussion is welcomed. To negate this idea, some parents may see the school as mixture of many cultures. Therefore, it is very possible for a child to learn from another child who comes from another cultural background where sexual discussions are allowed. Some may be biased because of their religious belief. They may see sexual discussion as "sinful" and therefore to them it is better to avoid such discussion and allow the medical professionals to do so when there may be need for such information.

NEEDS FOR SEX COUNSELLING

Despite these different points of view, sex counselling may still be a necessary end in the development of adolescents. It should be seen as part of the formal education that every child needs to survive in the society. To prevent young adult from ignorance, they need to be told about issues surrounding their growth and developments. This will reduce the number of embarrassment they will receive when they begin to experience developmental changes. Apart from this, the knowledge of sex counselling will help young adults to differentiate fables from realities. Some parents are fond of telling their children's fables instead of the real thing in order to satisfy their quest for answers to their questions. For instance, a mother can tell her daughter that good girls don't get pregnant; only the bad girls get pregnant; the ones who stay out late and hang around with boys. But to the surprise of the girl she found herself pregnant after having sexual relationship with her boyfriend for the first time. She was surprised and said to herself "how could this have happened to me? So, all of these things my mother had told me were lies. To prevent this type of episode, sex counselling is inevitable in the life of young one. According to Feldman and Rosental (2002), adolescents are far more likely to have conversation about sex with their mothers than with their fathers. This is true of both female and male adolescents; although female adolescents report having more frequent conversations about sex with their mothers than their male counterparts do.

PHASES OF SEX COUNSELLING

Pre-adolescence sex counselling: sex counselling should begin as soon as a child is conscious of his or her sexuality. The basic instructions and training on sex will depend on the age and maturity of the individual child. The counselling on sex becomes more obvious at adolescence period. A child should be told the names the sex organs are called. And what he or she should not do with the sex organs. The child should know the little functions of the sex organ like using it to urinate and limit it to that until he is more mature to know other functions.

Adolescence Sex Counselling

The adolescence period is a turbulent one because the child is moving from childhood to adulthood. This period which acts as a bridge between childhood and adulthood for some children usually begins between 11 and 14years and continues to about 19 years. Adolescence is a period of storm and stress characterized by moodiness, inner turmoil and rebellion (Palotnik&Kouyoumdjian 2008).Another aspect of the life of the adolescents that requires proper sex counselling is the development of the self-concept. During adolescents, a person's self-concept is almost fully developed. However, frequently, the ideas one has about oneself are based on what others (parents, friends, relatives, teachers, counsellors and so on) think one is or should be. From these experiences with others, the person develops what is frequently referred to as the ideal self (the part of the self-concept based on the expectations of other people important to him. This ideal self frequently is challenged during adolescence because it is during this time that the person develops more independence and autonomy so that his real self (that part of the self-concept that is based on what the person feels about himself) can develop more fully.

This real self then develops as the adolescent has more experience in the world in general. This is why it is often during adolescence that such intense conflicts develop between parents and their children. It is in this conflict between the real and the ideal self that the person is able to develop further toward self-actualization.

PRE-MARITAL SEX COUNSELLING

Parents can introduce sex counselling to teach their young adolescents to accept themselves, their complexion, physique, height, family background and so on because they are unique and should not compare themselves with others around them.Another method of pre-marital sex counselling is good communication line between parents and their young adolescents. The communication between parents and their children should be open because communication may be everything to them. Sometimes, there are conflicts of opinions or ideas. Most of the time the adolescent succumbs to peer pressure which encourages a lot of immoral acts such as having sex, smoking, taking drugs and many more.

If the communication line is free, the child can tell the parents what he or she is going through and proper counsel can be given. If adequate sex counsel is received to face the challenge of growing up, then parents and their children will be protected from embarrassment of messing up while growing up. Parents should let their children see them as friends at all times. In this way, they may not want to keep anything bothering them away from their parents. According to Ventura, Mathew & Curtin (1988), most adolescents who are not ready for marriage are found pregnant and most of such pregnancies end in abortion. This is because they cannot open up to their parents what they are passing through. The aspect of sex counselling that is related to this study is the area of value judgment. In the Nigerian context, how is sexuality valued? According to Gump *etal* (2000), high level moral reasoning can be based on values other than justice. This implies that the type of justification given to what people believe affects their attitudes to sexual issues. It is very possible for young adolescents to justify why they are engaging in immoral behaviour and not the rightness or wrongness of it. A young adolescent girl whose needs are not met by the parents may justify the reason why she is involved in pre-marital sex. Her reason may be because of money and this shows the type of values she places on sexual issues. Killen *etal* (2000) buttress this point that moral development has a behavioural component which overlaps other aspects of personality which occur within a social context.

METHODS/APPROACHES IN SEX COUNSELLING

According to Kleinplatz (2001), counselling approaches in sex counselling depend on the client age, sexual orientation and present problems. There are lots of approaches in counselling like behaviouralcounselling, psychoanalytic counselling, client centered counselling, existential counselling and a host of others that could be applied to sex counselling. This paper is interested in using rational emotive behaviour therapy. This therapy's primary objective, according to Kottler (2004), is to help clients identify their patterns of irrational thinking; those habitual beliefs that lead one to misperceive reality and subsequently learn alternative tools of thinking that are in real-world terms, more logical, consistent, rational and scientific. This paper is interested in using cognitive restructuring which is another name for rational emotive behaviour therapy. Cormier & Cormier (1998) believe that cognitive restructuring has its roots in the elimination of distorted or invalid inferences, disputing irrational thoughts or beliefs and promoting rule governed behaviour. According to Kuehlwein (1992), cognitive restructuring has been used with gay men and lesbian women to help gay male clients examine and correct internalized heterosexist beliefs and thoughts. Wolfe (1992) has described the use of cognitive restructuring with a lesbian client in dealing with both parental and social discrimination as a result of her sexual orientation.

TREATMENT RATIONALE

To use this approach to help solve problems of clients requires the counsellor presenting contrast between selfenhancing or rational thought and self-defeating or irrational thought. It will enable the client to discriminate between their own-self enhancing and self-defeating thoughts during treatment. Many clients may be aware of their self-defeating thoughts but may be unaware of or unable to generate self-enhancing thoughts. The counsellor can prove a contrast by helping the client to see that they can develop more realistic thinking styles. The counsellor can contrast these two types of thinking by giving examples of both positive, enhancing self talk and negative, defeating self talk. The examples can reflect before, during or after a problem situation.

Example: A situation that makes a client uptight such as not yielding to a demand from a boyfriend (negative thought).

BEFORE MEETING

"What if I don't allow Caleb to have sex with me, what will happen?"

"What if he decides to break the relationship?

"I'll just blow this chance of establishing an intimate relationship".

DURING MEETING

"I am not happy about his demand for sex regularly".

"He is wishing that this relationship be cemented with sex".

"I'm thinking of leaving so as to be free from his demand".

"I'm sure he doesn't want to see me until I've made up my mind to please his sexual desire".

AFTER MEETING

"How stupid I must have sounded.

"I might as well not bother myself again about the relationship".Example of self-enhancing thoughts about the same situation.

BEFORE MEETING

"I am just going to be sincere and tell him my mind".

"I am just going to tell him the side effect of such a desire".

"I'll talk about something else that I enjoy".

DURING MEETING

"I am going to sustain this relationship but not by giving in to pre-marital sex".

"This is an issue that my mother had strictly warned me about".

"The chain reaction of premarital sex like abortion, unwanted baby and the likes can be avoided".

AFTER MEETING

"I can remember how easy it was for me to say my mind in issues of sexuality".

"I was able to be myself".

"I was able to say my mind without pretending".

These examples buttress the fact that people are likely to behave what they believe and what they tell themselves. The practice of self-enhancing thought will lose the grip of preservative, self, self-defeating thoughts and enable the client to formulate experiences more realistically (Beck 1993).In addition, the counsellor can query the client about the particular distressing situations encountered and the things the client thinks before, during and after the situations. The counsellor can say something like this "sit back and think about situations that are really upsetting to you. What are they and how then can you identify exactly what you are thinking about or telling yourself before you go to a counsellor?"

The counsellor can tell the client that a negative thought have a "worry quality" such as I'm afraid or a selforiented quality" such as I won't do well. It also includes elements of catastrophizing (if I fail, it will be awful) or exaggerating (If I never do well or I always blow it).According to Guidano (1995), clients who find it difficult to identify negative thoughts can engage in what he calls the movieola technique. This is the process whereby the client is instructed to run a scene of the situation in their heads.

Then as if (he or she) were in an editing room, the client is instructed to pan the scene, going back and forth in slow motion, thereby allowing the client to "zoom" in on a single scene, to focus on particular aspects" of the scene.Then, the counsellor can point out what the thoughts are, the link between the situation and the resulting emotion and ask the client to notice explicitly what the links seems to be.Other activities that will help parents to discuss sex counselling with their children are the following:

- Parents should shower their children with love. A child who is denied love at home can find it elsewhere and most times at the wrong places
- Parents should let their daughters know about their private body parts and what they are meant for. The uniqueness of their physique and structure should be emphasized. It is also important to let them know that it is of no use changing the natural structure. Parents should teach their daughters to understand that their virginity is their pride and nobody has the right to violate them. Parents should teach their daughters how to react to any immoral advances towards them. They should not allow anyone to take advantage of their sexuality.
- Parents should instill a strong sense of self-discipline and responsibility in their children.
- Parents should encourage their adolescent girls to dress properly by not exposing the sensitive parts of their bodies.
- Parents should not be shy or embarrassed to discuss sex counselling with their children.
- Parents should not leave the caring and upbringing of their children to outsiders, house-helps, relatives and the likes.

CONCLUSION

The rate at which adolescents engage in sexual activities these days cannot be compared to what it used to be in the past. Modern civilization and sexual revolution have affected our traditional cultural background to the extent that today nobody values virginity as it was in the past. Freedom is now at its highest peak. Youths are so free that sexual act can even be done in the open, and they are no longer ashamed to engage in such act. Some parents are even encouraging their young daughters and sons to have boyfriends and girlfriends. Sexual activity now serves as a weapon in people's hands to get anything. Students use sex to get "marks" from their lecturers. Politicians use it to get "positions" while civil servants use sex to get "promotion". Some others use it as commercial means of getting their livelihood. The major source of these problems of sexual activities is lack of sound sex counselling. Young ones need to be told the morphology of their body structure. They need to be counselled how to relate with the opposite sex and the consequences of engaging in pre-marital sex. Proper sex counselling will be of help, even though not all the counselled adolescents will yield to these instructions but some will accept the counsel and they can serve as good examples to others in the society. Therefore, sex counselling is a very important aspect of education that must not be ignored or handled carelessly. Adolescents need to be informed how to dress decently because a lot of them may be raped these days because of the way they expose their sensitive parts. Proper sex counselling will help solve all these problems. Counsellors too who are giving the counsels are expected to be role models showing good examples to their clients to emulate. The stages of sex counselling as emphasised in the body of this paper are equally important. A child should be exposed to sex counselling as early as he or she is able to recognize his sexuality and the world around him so that he will not be deceived and fall due to ignorance.

Giving them proper sex counselling at this stage will go a long way to help them solve sexual problems. The approach suggested in this paper is of utmost importance to solving sexual problems of adolescents including helping them to resolve their irrational beliefs. Cognitive restructuring approach exposes some of the irrational thinking of the adolescents and thereby prevents them from unnecessary problems. Some of them believe that they can use their bodies to get what they want. Some see it as a means of getting their livelihood. Others think that they may not get partners to marry especially the girls if they do not involve themselves in sexual activities. Exposing clients to cognitive restructuring approach will enable them to have self-enhancing thoughts that will give them positive approach to life and sexual issues.

REFERENCES

[1] Anyagwa, Emma (2001). "*Reproduction Rites Education not Sex Education*" The Comet. February 4, 17.

[2] Beck, J. S. (1995) Cognitive Therapy. New York: GuilfordCormier, S & Cormier, B. (1998). Interviewing Strategies for Helpers: *Fundamental Skills and Cognitive Behavioural Interventions*. New York:

[3] Brooks/Cole Company. Decay, J. S. and Travers, J. F. (2004) *Human Development across the Lifespan.* California: McGraw Hill.

[4] Guidano, V. F. (1995). Self- Observation in Constructive Psychotherapy in R. A. Neimeyer& M. J. Mahoney (Eds) *Construction in Psychotherapy* (pp. 155-168) Washington DC:American Psychological

[5] Association.Gump, L. S., Baker, R. C., and Roll, S. (2000). Cultural and Gender differences in Moral Judgement: *A Study of Mexican Americans and Anglo-Americans Hispanic Journal of Behavioural Science 22*, 78-93.

[6] Killen, M., Ardila-Rey, R., Barakkatz, M., & Wang P. L. (2000). Preschool Teacher's Perceptions about Conflict Resolution Autonomy, and the Group in Four Countries; United States Colombia, El Salvador, and Taiwan. Early Education and Development, 11, 73-92.

[7] Kleinplatze, P.J. (Ed.) (2001). New Direction in Sex Therapy: Innovations and Alternatives. New York: Brunner/Routledge.

[8] Kuehlwein K. T. (1992). Working with Gay Men in A Freeman & F. M. Dattilio (Eds), *Comprehensive Case Book of Cognitive Therapy* (pp. 249-255) New York: Plenum.

[9] McMahon, B. and McMahan, J. W. (1982) *Psychology:* The Hybrid Science. Illinois: Dorsey Press.Ola, I. (2002). "*Preparing your Child for Adolescence*" The Comet. January 23, 17.

[10] Papalia, D. E., Olds, S. W., Feldman, R. D. and Gross D. (2004) *Human Development* New York: McGraw Hill.

[11] Plotnik, R and Kouyoumojian (2008).*Psychology.* Canada: Wadsworth. Ventura, S. J., Mathew, T. J., & Curtin S. C. (1998). Declines in Teenage Birth Rates 1991-97: *National and State Patterns. National Vital Statistics Report* 47, 1-7.

[12] Wolfe, J. L. (1992). Working with Gay Women in A. Freeman & F. M. Dattilio (Eds) *Comprehensive Casebook of Cognitive Therapy.* New York: Plenum.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 237-247
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

DATA MINING INDUSTRIAL AIR POLLUTION DATA FOR TREND ANALYSIS AND AIR QUALITY INDEX ASSESSMENT USING A NOVEL BACK-END AQMS APPLICATION SOFTWARE

E. O. Ofoegbu[1], M. A. Fayemiwo[2], and M. O. Omisore[2]

[1]Department of Computer Engineering,
Oduduwa University, Ipetumodu, P.M.B. 5533, Ile-Ife, Nigeria

[2]Department of Mathematical Sciences,
Oduduwa University, Ipetumodu, P.M.B. 5533, Ile-Ife, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: An air pollution monitoring application system for analyzing and forecasting air pollutant data was developed in order to provide information about the quality of air we breathe. Two industrial environments were used as case studies namely Ife steel plant and Ibadan Asphalt Company. The application was developed using Microsoft visual studio 2012 for the client side and user interface while MYSQL was used for the database. System flowchart was used to design the application modules. Relevant data were collated from the data acquisition systems in Ile-Ife and Ibadan to develop the application. The application when implemented will enable users living and working in the area of study to know the extent at which the air is polluted, forecast the air data and store the collated data in a relational database which will be updated periodically for analysis. This study will attempt to help individuals to know the quality of air they breathe in any particular environment.

Keywords: Pollution, AQI, Air, Model.

1 INTRODUCTION

Air pollution is the introduction of chemicals, particles, biological materials, or other harmful materials into the earth's surface (Wikipedia, 2001). Air pollutants are airborne particles and gasses that occur in concentrations that endanger the health and well being of organisms thus disrupting the orderly function of the environment (Schultz et al 2009). Air pollution thus occurs when the air contains gases, dust, fumes or odour in harmful amounts.

However, informed observers will find these demands surprising so long as the developing countries are not ready to take responsibilities for managing immediate environmental concerns, such as urban air quality, within their own jurisdiction. Consistent with result from cities around the world, air pollution is attributed to the emission from transport, industry, energy and domestic sources, most places are exposed to significant ambient air pollution concentration due to increased reliance on small-scale petrol powered generators for commercial energy supply, uncontrolled open incineration of waste, major thermal power stations and substantial petrochemical activity within the city limits.

Nigeria is faced with so many types of air pollution but the main concern of this project work is the pollution of air caused by industrial emission. All air emission has a hazardous effect on human system such as Ozone and particles matter which causes a wide range of adverse health effects.

Ground-level ozone (O_3) is a product of nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of heat and sunlight. Motor vehicle exhaust, industrial emissions, gasoline vapors, and chemical solvents are among the major sources of NOx and VOCs responsible for harmful build up of ground-level ozone. Even at low concentrations, ozone can

Corresponding Author: E. O. Ofoegbu

trigger a variety of health problems such as lung irritation and inflammation, asthma attacks, wheezing, coughing, and increased susceptibility to respiratory illnesses.

Particles matter (PM), or airborne particles, include dust, dirt, soot, and smoke. Some particles are directly emitted into the air, for example, cars, trucks, buses factories, construction sites, and wood burning. Other particles are formed in the air when gases from burning fuels react with sunlight and water vapor. Such gases, from incomplete combustion in motor vehicles, at power plants and in other industrial processes, contribute indirectly to particulate pollution. PM can cause chronic bronchitis, asthma attacks, decreased lung function, coughing, painful breathing, as well as a variety of serious environmental impacts such as acidification of lakes and streams and nutrient depletion in soils and water bodies.

2 REVIEW OF RELATED LITERATURES

Wong Tze Wai (2009) studied an air pollution index reporting system. The Air Pollution Index (API) Reporting System is an important tool of communication risk. It informs the public of ambient air pollution, and the potential health risk, it imposes on groups such as children, elderly, and those with cardiovascular and respiratory diseases. People use the API to make decisions on outdoor activities; such as, schools and sports organizations, sports organization uses it to check the latest API figures to decide whether outdoor sporting events should be conducted on a certain day. An air pollution index system was developed in Hong Kong, with full justifications and implementation details.

WHO published a Monitoring ambient air quality for health impact assessment. The study shows the importance of the availability of valid information on population exposure to air pollutants, European Centre (WHO) for Environment and Health, organized a working group with the objective of defining the features of monitoring networks that gives room for assessing the potential exposure of the population to air pollution from ambient air. The air quality assessment must include links with population exposure and the pollution sources. The principles outlined in these report are intended to promote progressive modification of the networks monitoring air quality, to improve their usefulness for health impact assessment.

Gupta (2008) studied air quality in an urban region of Kolkata, which consist of residential, commercial and industrial sites, having high population density and pollution. Concentrations of ambient SO_2 (sulfur dioxide), NO_2, (nitrogen dioxide), NH_3 (ammonia) and PM_{10} was measure at selected residential, industrial sites and commercial site. The meteorological parameters (wind speed, wind direction, rainfall, temperature and relative humidity) were collected simultaneously from the Indian Meteorological Department, Kolkata. Winter concentrations of ambient such as SO_2, NO_2, NH_3 and PM_{10} were observed to be higher irrespective of the monitoring sites and duration of sampling.

Defra (2010) studied air quality across UK and EU, the report showed that the air quality index has increased in the improved last couple of decades. However, there are still some evidence of negative health effects and environmental damage caused by emissions of air pollutants such as Particulate matter (PM), Ammonia (NH_3), Oxides of Nitrogen (NOX) and Sulphurdioxide (SO_2). The study showed that the major air pollutants of concern in UK are PM, NOX, ozone (O_3) and NH_3. Meanwhile, climate change has emerged as a major global challenge with achievement of legally binding targets by 2050, a key priority for the UK Government and the devolved administrations (DAs). Across Government, work is now underway through the 2009 Low Carbon Transition Plan (LCTP) 1 to meet the carbon budget commitments from 2008 through to 2022.

Schultz R. B (2006) studied air pollution and weather pollution. Weather is linked in two ways. The first way is concerns about the influence that weather conditions have on the dilution and dispersal of air pollutants. The second way is the reverse which deals with the effect that air pollution has on weather and climate. Air is never perfectly clean, Examples of natural air pollution include: Ash, salt particles, pollen and spores, smoke and windblown dust. The study show the type of air pollution which are primary pollutant and secondary pollutant the major primary pollutants are: Particulate matter (PM), sulfur dioxide, nitrogen oxides, volatile organic compounds (VOCs), carbon monoxide, and lead. The **Clean Air Act of 1970** mandated the setting of standards for four of the primary pollutants Particulates, sulfur dioxide, carbon monoxide, and Nitrogen as well as the secondary pollutant ozone The study show that primary pollutants in the United States are about 31 percent lowers than 1970. In 1990, Congress passed the **Clean Air Act Amendments**, which further tightened controls on air quality. Regulations and standards regarding the provisions of the Clean Air Act Amendments of 1990 are periodically established and revised.

Jong-won kwon (2007) designed and implemented an air monitoring system using sensors. Each sensor was tested after survey for detecting air pollution. Secondly, wireless communication modules for monitoring system were developed using wireless sensor network technologies based on ZigBee and performance of modules was estimated in the real-fields. Through software program written in C, efficient routing in wireless networks was simulated using the TOSSIM simulator. Finally,

integrated wireless sensor board, which employs dust, CO_2, temperature/humility sensor and ZigBee modules was developed. The work accelerates the digital convergence age through continual research and development of technologies.

Kavi (2005) designed and implemented a wireless sensor network Air pollution Monitoring system. The work investigates the use of wireless sensors networks for air pollution monitoring in Mauritius. With the fast growing industrial activities on the island, the problem of air pollution is becoming a major concern. The paper proposed an innovative system named wireless sensor networks air pollution monitoring system to monitor air pollution in Mauritius through the use of wireless sensors deployed in huge numbers around the island. The system makes use of an Air Quality index in order to improve the efficiency of the system.

Casella (2004) designed software called Envista Air Resource Manager Software (ARM), Envista Air Resource Manager software (ARM) is a client-server application for supervisory control, management and analysis of data from Environmental, Meteorological and Hydrological monitoring networks. It is a powerful air quality software suite and has been designed to meet the needs of both air quality experts and general users alike. It's simple, easy-to and allows any user to produce professional tables or graphs. Customized dashboards can also be constructed and personalized data reports can be generated, files can be immediately converted into a CSV format and imported into other statistical packages.

3 MATERIALS AND METHOD

This section presents a detailed explanation of the research methodology adopted in this study. The materials that were consulted are briefed and also the method used to achieve the objectives of the system are given step-wisely.

3.1 DATA COLLECTION AND PROCESSING

This is the next phase after understanding the research problem. Business data are stored using different types of systems across an enterprise. The first step is to pull the relevant data to a database or data mart where the data analysis is applied. The data used in the context of this Research were samples of air pollution data from two polluted environments which are Ife steel plant and Ibadan Asphalt Company.

The data used for this project were grouped in excel file format based on the pollutant and the city being considered, thereafter the data in an excel format was uploaded on the SQL (Structured Query Language) Server for analysis. This operation was made easy as a result of the flexibility of the .net environment (Visual Studio) using LINQ (Language Integrated Query) to Excel.

3.1.1 DATA CLEANING AND TRANSFORMATION

Data cleaning and transformation is the most resource-intensive step in a data analysis project. The purpose of data cleaning is to remove noise and irrelevant information out of the dataset. The purpose of data transformation is to modify the source data into different formats in terms of data types and values. There are various techniques that can be applied to perform data cleaning and data transformation, *Data Type* Transform: this is the simplest data transform. An example is transforming a Boolean column type to integer. The reason for this transform is that some data analysis algorithms perform better on integer data, while others prefer Boolean data.

Much of the raw data contained in excel sheet were un-pre-processed, incomplete, and noisy. For example, the data in excel format initially contained fields that are obsolete or redundant, missing values, outliers, data in a form not suitable for input to our analysis model, and values not consistent with policy or common sense.

Table 1: Air Pollution Data

Year	So_2			No_2			Pm_{10}		
	Year	Month	Day	Year	Month	Day	Year	Month	Day
2000	80	125	1500	50	220	1000	100	25	
2001	80	125	350	45	85	846	125	21	5
2002	40	846	500	100	876	400	150	10	
2003	67	365	260	54	76	590	80	150	
2004	32	365	780	23	87	760	60	120	
2005	76	400	2620	43	150	320	150	30	30
2006	86	65	1500	51	50	65	200	20	
2007	43	150	550	55	40	55	175	10	
2008	90	125	743	49	120	300	140	5	
2009	20	50	1500	62	360	570	150	20	
2010	15	30	350	80	67	70	90	150	10
2011	54	87	540	85	120	80	120	10	
2012	50	341	1350	78	56	301	150	30	
2013	43	62	120	55	110	45	75	140	20
2014	61	120	110	70	125	400	50	120	

3.1.2 HANDLING MISSING DATA

Missing data is a problem that continues to plague data analysis methods. Even as our analysis methods gain sophistication, missing values in fields, especially in databases with a large number of fields are often encountered. The absence of information is rarely beneficial. All things being equal, more data is almost always better. Therefore, in order to handle the thorny issue of missing data, the missing value is replaced with:

a. some constant, which could be specified by the analyst;
b. the field mean (for numerical variables) or the mode (for categorical variables); or
c. a value generated at random from the variable distribution observed.

3.2 DATA FORECASTING MODEL

A data forecasting model or forecasting model can be thought of as a relational table. It contains key columns, input columns and predictable columns. Each model is associated with a forecasting algorithm on which the model is trained. Training a forecasting model means finding the pattern in the training dataset by using specified data forecasting algorithms with proper algorithm parameters. After training the model we store the patterns that the data forecasting algorithm discovered about the dataset. While a relational table is a container of records, a data forecasting model is a container of patterns. The system predicts three air pollution indicator levels for the next one hour, twenty-four hour or even a year. The inputs were general condition, wind direction, pressure, day temperature, night temperature, relative humidity and wind speed. Output parameters were sulfur dioxide, particulate matter and carbon monoxide.

3.2.1 MODEL CREATION

The concept of model creation simply deals with creating an empty data forecasting model, similar to the way a relational table is created.

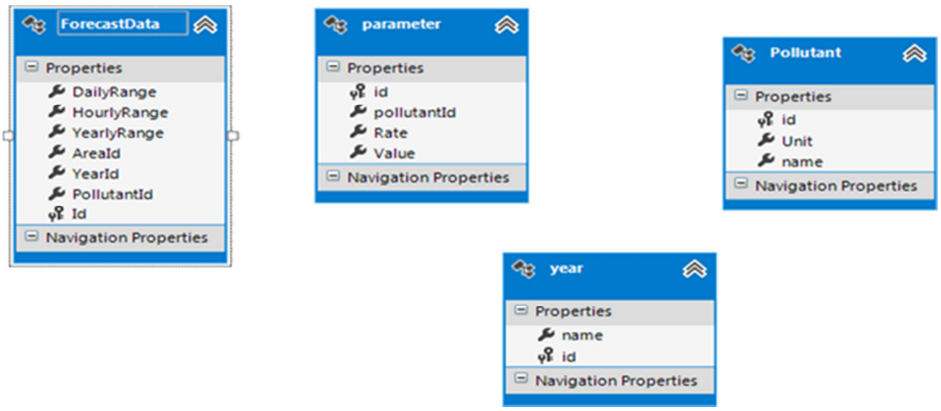


Figure 1: Diagram of the Relational Database Model Adopted

3.2.2 MODEL TRAINING

Model training is also called model processing. It is used to invoke the data forecasting algorithm to uncover knowledge about the training dataset. After training, patterns are stored in the model. Artificial neural network is used to train the network and forecast pollutant data for consecutive years. The network consists of 3 inputs, 4 hidden and 2 outputs. The input to the network model are pollutant data from previous years while the hidden layer consists of a sigmoid function and an hyper tan function that ensures the weight and biases helps to generate a reasonable pollutants data. Backward propagation medium is adopted to train the network and reverses its learning process if the needs arise. At the output end two sections of pollutant data are produced and the decision tree algorithm is then applied to determine the most viable data to be used as a forecast.

3.2.3 DECISION TREE ALGORITHM

Decision trees are powerful and popular tools for classification and prediction, decision trees represent rules, which can be understood by humans and used in knowledge system such as database. The principle idea of decision tree is to split the data recursively into subsets so that each subset contains more or less homogenous states of your target variable (predictable attributes). At each split in the tree, all input attributes are evaluated for their impact on the predictable attribute.

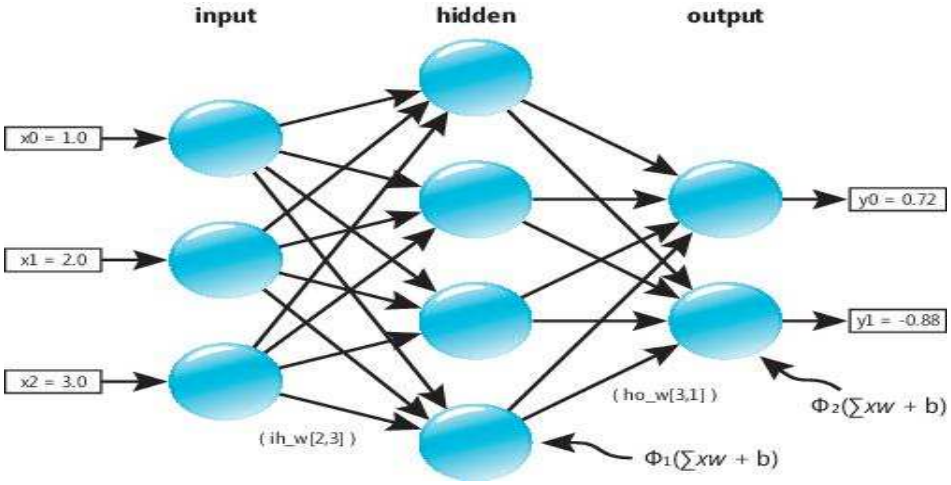


Figure 2: ANN Model

When this recursive process is completed, a decision tree is formed. There are few advantages of using decision trees over using other data forecasting algorithms, for example, decision trees are quick to build and easy to interpret. Each path from the root forms a rule. The key requirements of decision tree are:

a. **Attribute-value description:** Object or case must be expressible in terms of a fixed collection of properties or attributes (air quality i.e. good or bad).
b. **Predefined classes (target values):** the target function has discrete output values (Boolean or multiclass)
c. **Sufficient data:** enough training cases should be provided to learn the model.

Decision tree learning uses a decision tree as predictive models which maps observation about an item to conclude about an items target value. It is one of the predictive modeling approaches used in statistics, data mining and machine learning, in decision analysis tree can be used to visually and explicitly represent decisions and decision making. In data mining, decision tree describe data but not decisions; rather the resulting classification tree can be input for decision making. Decision tree is a method commonly used in data mining; the goal is to create a model that predicts the value of a target variable based on several input variables.

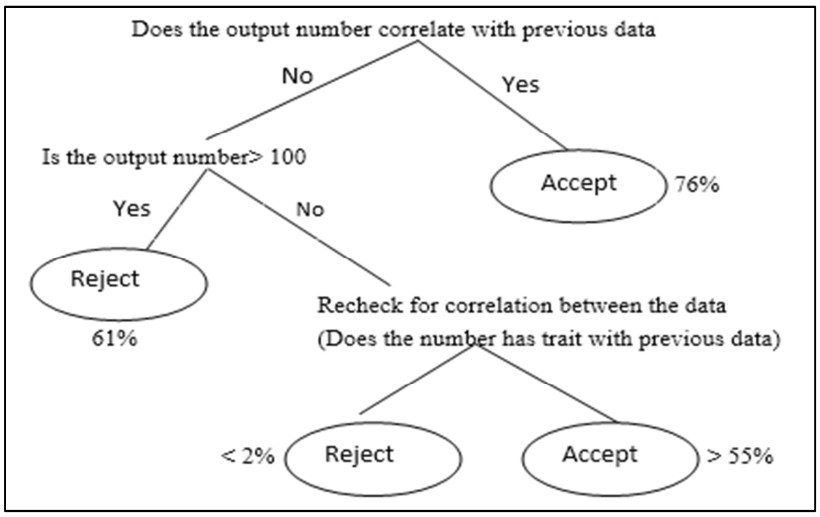


Figure 3: Decision Tree Used to Select Between the Two Output Values

3.3 SYSTEM ANALYSIS AND DESIGN

The air pollution data forecaster was written in a more interactive form, so as to help a user relate with the application more effectively. The front-tier of the application program developed was compiled in Microsoft Visual Studio 2012 framework while the SQL Server 2008 was used for the back end. This is to keep the data before the stage of pre-processing and analysis. The front tier has different modules which are linked together.

SYSTEM FLOW CHART

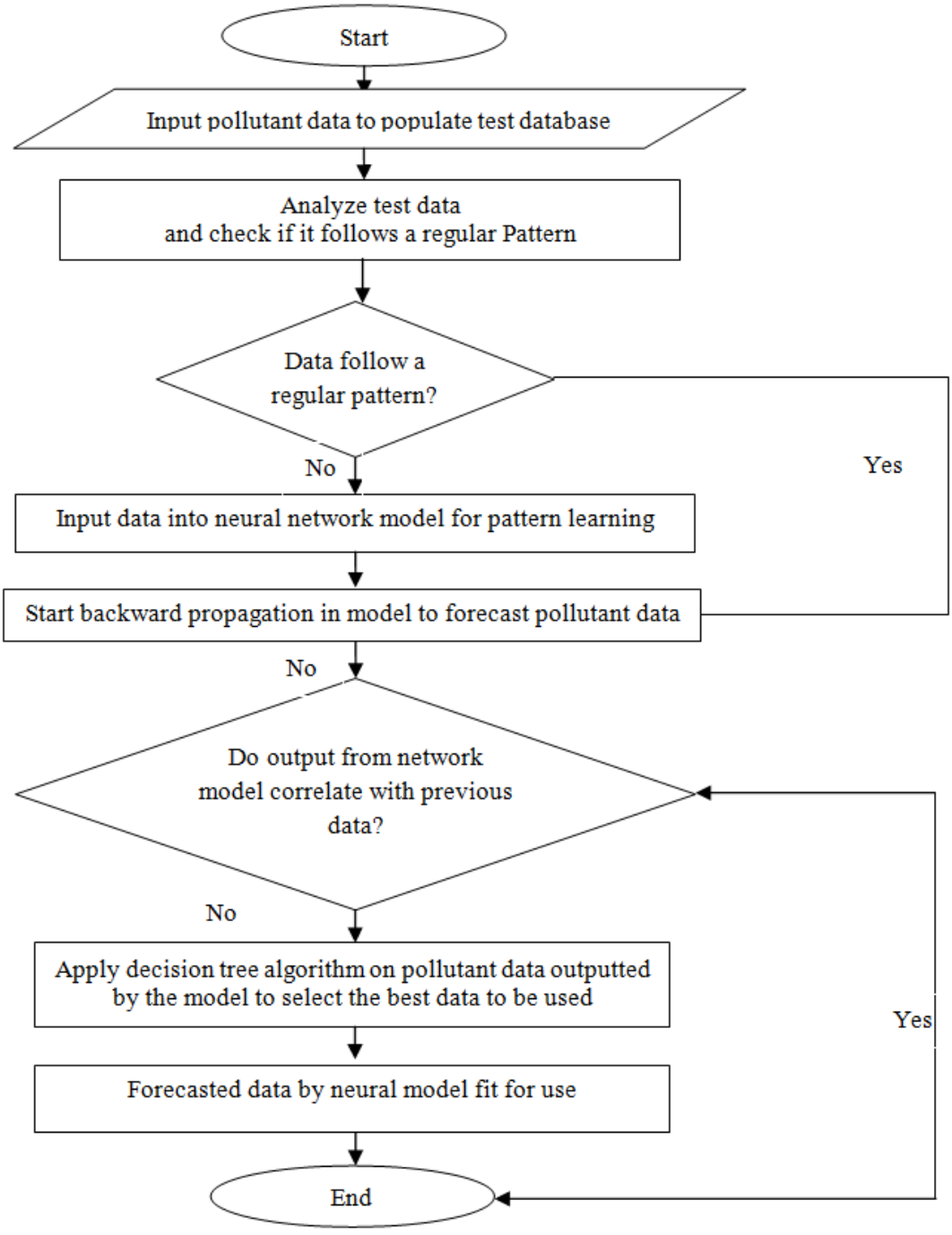


Figure 3: System Flow Chart

4 SYSTEM IMPLEMENTATION AND DISCUSSION

Implementation was done using Microsoft visual studio for the server controller (linkage between client and server) and data's were extracted from the database using SQL. The diagrams below shows interface of the system.

a. Add Pollutant Details: This section enables the user to add pollutant details which would enable the system to determine the kind of pollutant data to analyze. Pollutant name could be So_2,No_2 etc while its unit could be ug/m3 and mg/m3.
b. Add area details: This section enables the user to add area/s that would be considered during our data analysis.

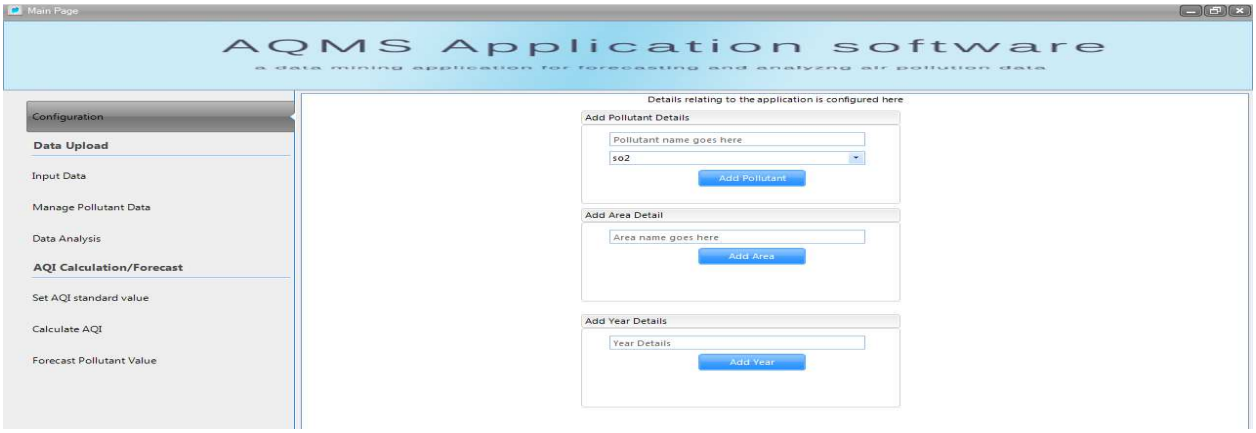


Figure 4: Configuration Section

c. Add year details: This section enables the user to add years that would ensure pollutant data for year added would be supplied.

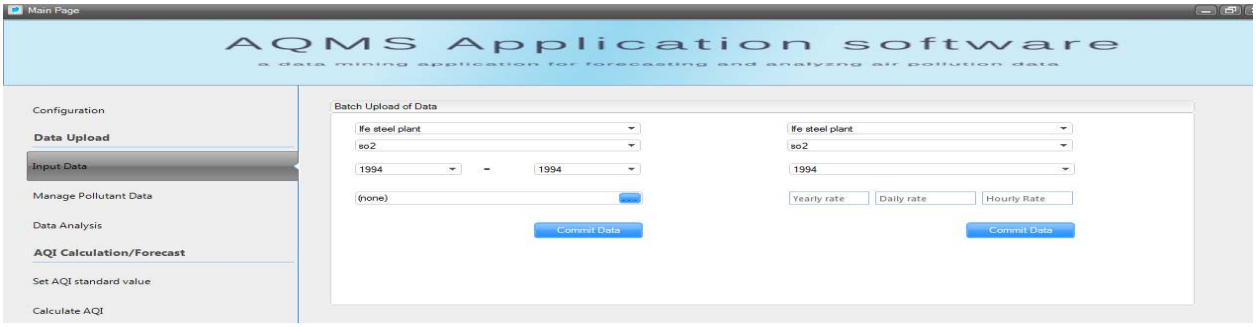


Figure 5: Batch Upload of Data

Data upload section enables the user to supply pollutant data that would ensure the system to perform its analysis and forecasting functionality, Data to be upload can be in form of an excel file or supplied individually under a selected year, area and particular pollutant

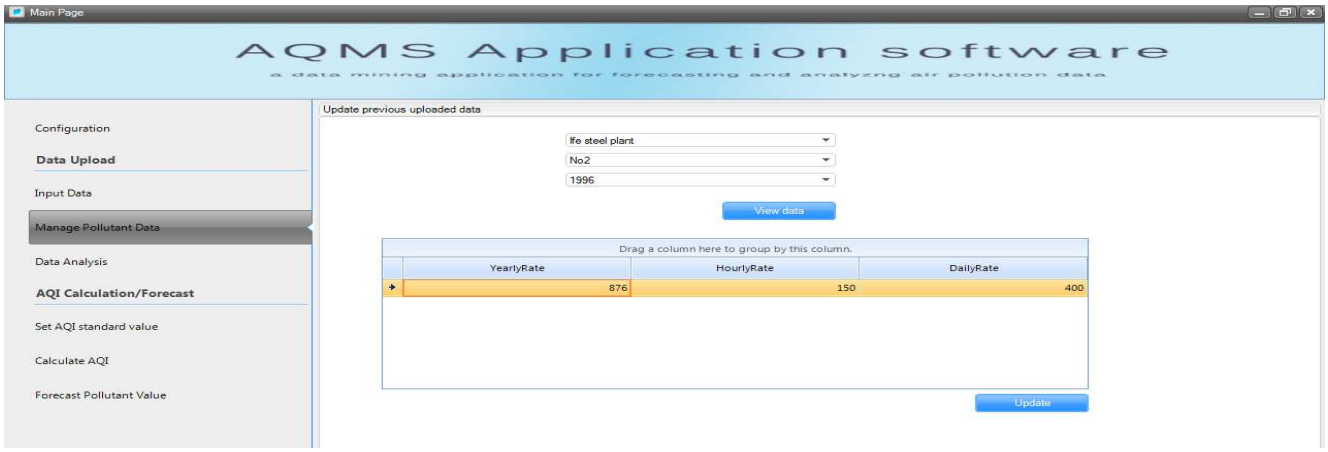


Figure 6: View Uploaded Data

This section allows the user to view previously enrolled data, to check for consistency in them and also change data values if there is need to.

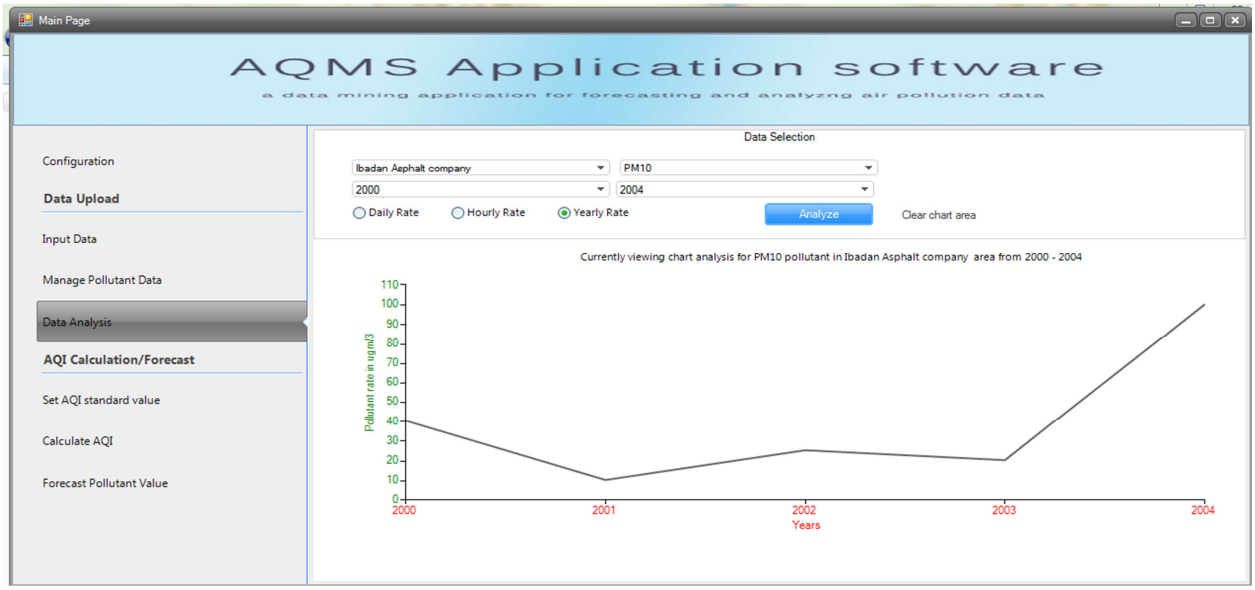


Figure 7: Data Selection and Analysis

This section provides a graphical interface that helps to analyze pollutant data from range of years selected and also area specified

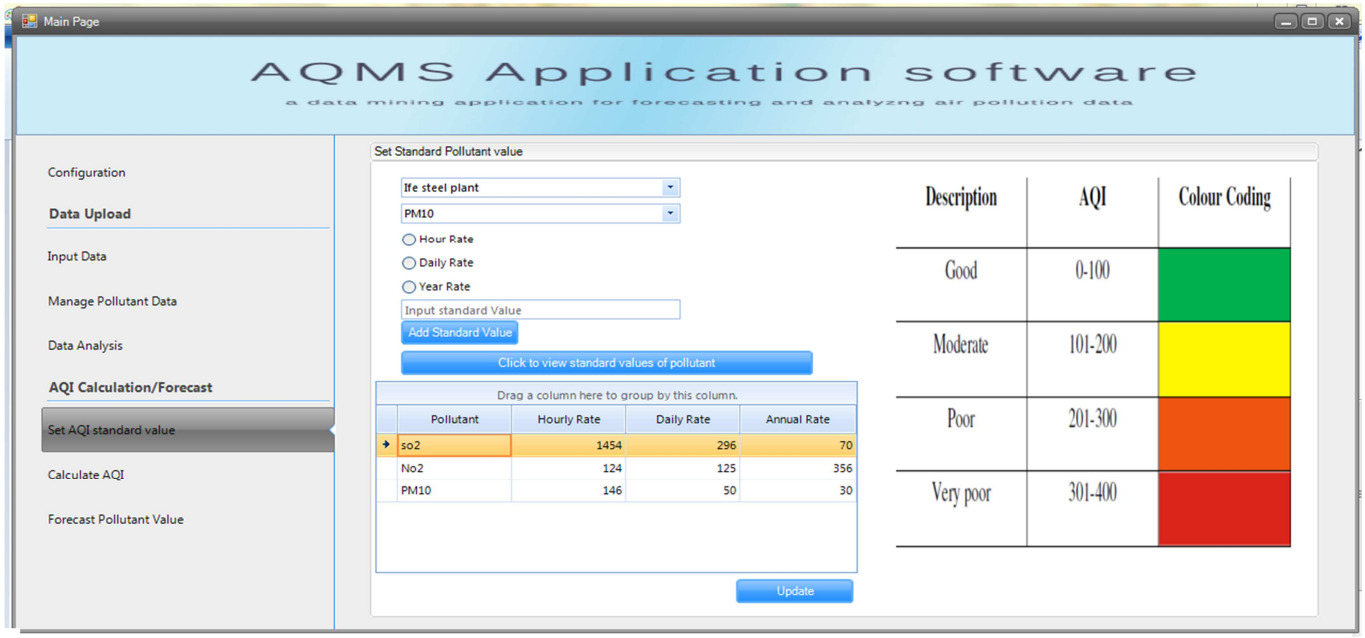


Figure 8: Set Standard AQI Pollutant Value

This section allows the user to supply standard value for pollutant data across diverse areas, hence ensuring a correct AQI value is calculated. It also provides a means of updating previous standard values.

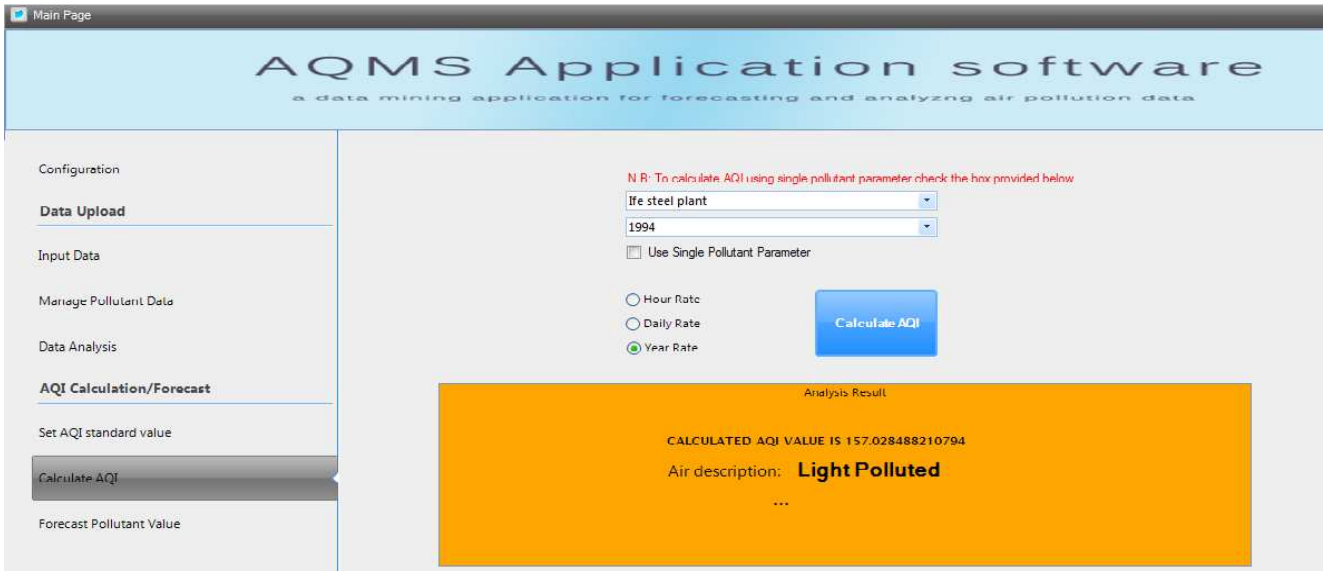


Figure 9: Calculation of AQI

This section provides a means to calculate AQI value of pollutant rate in a particular area in a specified year. Detailed description of the result is also displayed for user consumption.

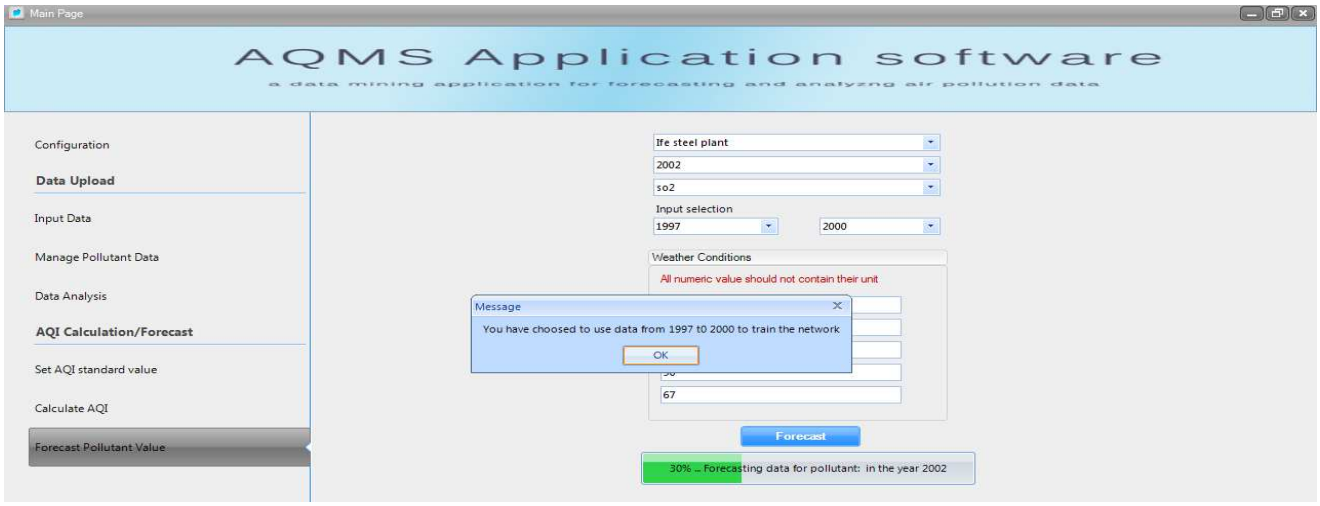


Figure 10: Forecast Pollutant Value

This section allows the system to perform its basic functionality which is to forecast pollutant data for a particular area in a specified year. The viability of the forecast result is a function of the input data from previous years

When forecasting weather conditions are put into consideration, because it affect the rate of pollution, all weather conditions are inputted, and the system forecast data for the selected year.

5 CONCLUSION AND FUTURE WORKS

Air pollution is the introduction of chemicals, particles, biological materials, or other harmful materials into the earth's surface (Wikipedia, 2001). Nigeria is faced with so many types of air pollution, but the main concern of this research effort is air pollution caused by industrial emissions. All air emission has a hazardous effect on human system such as Ozone and particulates matter, which causes a wide range of adverse health effects. The **AQMS** application software performs the analysis of pollutant information to calculate air quality index and for forecasting data, it allows people in a particular

location to monitor the quality of air they breathe in. Using this software, pollution rate can be reduced and people with cardiovascular disease will know the environment conducive for them to live.

In the light of increase in air pollution, it is apparent that there is no functioning air monitoring system in the country. It is recommended that building new systems especially for Air quality measurement is very essential and crucial.

This paper can also enable the development of other air monitoring system in other states to be developed which can be done via any programming language when data are generated. I recommend that further works should be done especially with the help of professionals in engineering and computer science while considering other pollutant in future work. Therefore, it is suggested that applications that run on web enabled mobile devices is incorporated to access air quality in different locations.

REFERENCES

[1] Air Pollution Definition Retrieved from Wikipedia (07-07-2014)

[2] Boehm Spiral Model Software Development process retrieved 08-06-2014

[3] Chattopadhyay S., Gupta S. and Saha R. N. (2010), "Spatial and Temporal Variation of Urban Air Quality A GIS Approach". Journal of Environmental Protection, 1: 264-277.

[4] Chelani A. B., Chalapati Rao C. V., Phadke K. M. and Hasan M. Z. (2002), "Formation of an Air Quality Index for India". International Journal of Environmental Studies, 59: 331-342

[5] Casella (2004)" Air quality monitoring: it's all connected, a solution based approach". www.Casellameasurement.com

[6] Clean air Act 1970 retrieved from Wikipedia (2013) "how air quality data is used".

[7] R. B Schultz (2010). "Air pollution"

[8] Defra (2010) "Air Pollution Action in a Changing Climate" retrieved (09-07-2014)

[9] Gupta A. K., Karar K., Ayoob S. and John K. (2008), Spatio-Temporal Characteristics of Gaseous and Particulate Pollutants in an Urban Region of Kolkata, India. Atmospheric Research, 87: 103-115.

[10] Gufran B., Ghude D. S. and Deshpande A. (2010), "Scientific Evaluation of Air Quality Standards and Defining Air Quality Index for India" Indian Institute of Tropical Meteorology Research Report No. Rr-127

[11] Kavi K. Khedo, Rajiv Perseedoss and Avinash Mungur (2005). "A Wireless Sensor Network Air Pollution Monitoring System" Department of Computer Science and Engineering, University of Mauritius

[12] Bharati M. Ramageri "Data Mining Techniques and Applications" Indian Journal of Computer Science and Engineering 301-305

[13] Wong Tze Wai : "A Study of the Air Pollution Index Reporting System" School of Public Health and Primary Care, The Chinese University of Hong Kong

[14] Upadhyaya G. and Dashore N. (2010), "Monitoring of Air Pollution by Using Fuzzy Logic". International Journal on Computer Science and Engineering, 2: 2282-2286

[15] WHO (2000), "Monitoring ambient air quality for health impact assessment" (WHO regional publications. European series; No. 85)

[16] Whitten Jeffrey (2003) ……"what are RAD model-advantages, disadvantages and when to use it?" ISTQBEXAM CERTIFICATION RETRIEVED (08-06-2014)

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 248-258
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Analysis of Physico-Chemical Parameters in Harsi Reservoir Dabra, Gwalior District, Madhya Pradesh

Namrata Pawaiya, D. K. Sharma, and M. K. S. Khushwah

Dept. of Zoology, S.M.S. Govt Model Science College Gwalior, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This study was aimed to estimate physico-chemical characteristic of Harsi reservoir. Harsi reservoir located in Dabra, Gwalior district, Madhya Pradesh is constructed on parwati River. Monthly study in physico-chemical parameters such as water temperature, depth, transparency, electrical conductivity, turbidity, total dissolved solids, pH, dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, chlorides, sulphates, nitrate, nitrite, phosphate, silicates, ammonia, BOD, COD, calcium, magnesium, sodium, potassium were analyzed from January 2011 to December 2011. The results indicated that physico-chemical parameters of the water were used for drinking, domestic use, irrigation and pisciculture.

KEYWORDS: Harsi reservoir, physical parameters, chemical parameters, Correlation coefficient.

INTRODUCTION

Quality of an aquatic ecosystem is dependent on the physic-chemical parameters of water. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics (Venkatesharaju et al 2010). Among the fresh water resources of the world pond, river, lakes, reservoirs and wetlands are important because they supply water for the population in the whole year. This they do by collecting rainwater through the water cycle, and sustain the stationary component of the hydrological cycle. They maintain the balance of the ecosystem components on which other systems depend. The lakes and reservoirs represent very complex and fragile ecosystems. The fresh water habitats are considered worthwhile not only as a supply resource but as a living system by which the global ecosystem is balanced. The physico-chemical characteristics play an important role in assessment of the water quality and trophic status of a water body. In Madhya Pradesh, there are many freshwater bodies in the form of rivers, lakes and man-made reservoirs in the state. The small, medium and large reservoirs in this state are estimated to be 1,72,575; 1,67,502 and 1,18,307 ha respectively with a total of 0.458 million ha (Sugunan 1997), contribute to the maximum water spread of all Indian states under manmade lakes. Gwalior and Chambal divisions are rich in water resources and have approximately 54,839 ha water area falling under reservoirs. The determination of good growth in water body include temperature, water temperature, dissolved oxygen, free carbon dioxide, hardness, turbidity, alkalinity etc. other parameters like biological oxygen demand and chemical oxygen demand indicate pollution of a given water body.

STUDY AREA

Harsi reservoir is constructed on Parwati river situated near Harsi village in Dabra, Gwalior District (Madhya Pradesh). It is situated about 100 km from Gwalior. Harsi reservoir was built over the parwati river during 1928-1935. The reservoir is covered by hills and small hillock by its three sides. The reservoir is geographically located between the latitude $25'47^0$ North and longitude to $77'58^0$East. The maximum hight of reservoir is 29.26 m, length is 21,333 m, total catchment area is 777.5 m^2 and total area cover by reservoir is 308,252 Km^3.

Corresponding Author: Namrata Pawaiya

METHODS AND MATERIAL

Water Samples were collected from four sampling stations A, B, C, and D from Harsi reservoir. The sampling was done in the first week of every month in early hours of the day i.e, around 9.00 to 11.00 a.m. during January to December 2011. The physico-chemical characteristics of water including water temperature, depth, transparency, pH, dissolved oxygen, free carbon-dioxide, total alkalinity, total hardness, chlorides, calcium and magnesium, were analyzed at the sampling stations, while other parameters including turbidity, electrical conductivity, total dissolved solids, nitrate-nitrogen, nitrite-nitrogen, sulphates, phosphates, silicates, biochemical oxygen demand, chemical oxygen demand, ammonia, sodium and potassium were analyzed in the laboratory within the 6 to 8 hr following the methods of APHA (1995) and Trivedy and Goel (1986). Four sampling stations viz., Station-A, B, C and D were established for analysis of physico-chemical parameters of water covering whole area of reservoir (Fig. 1). The satellite image of the reservoir is in Fig. 2.

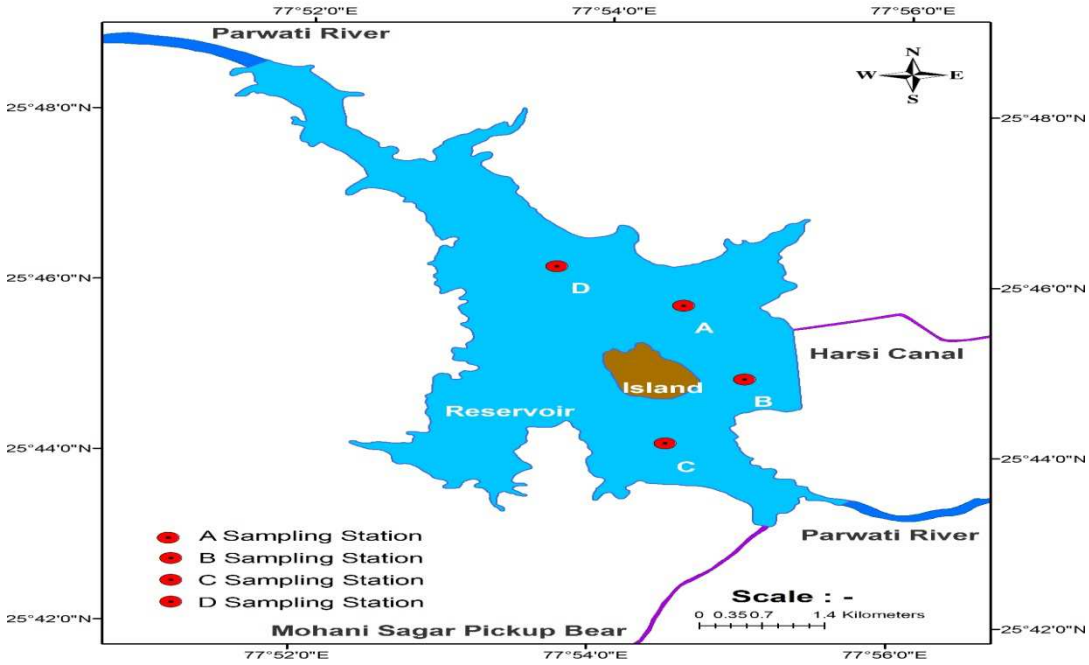


Fig 1. Location map and the sampling stations in Harsi reservoir

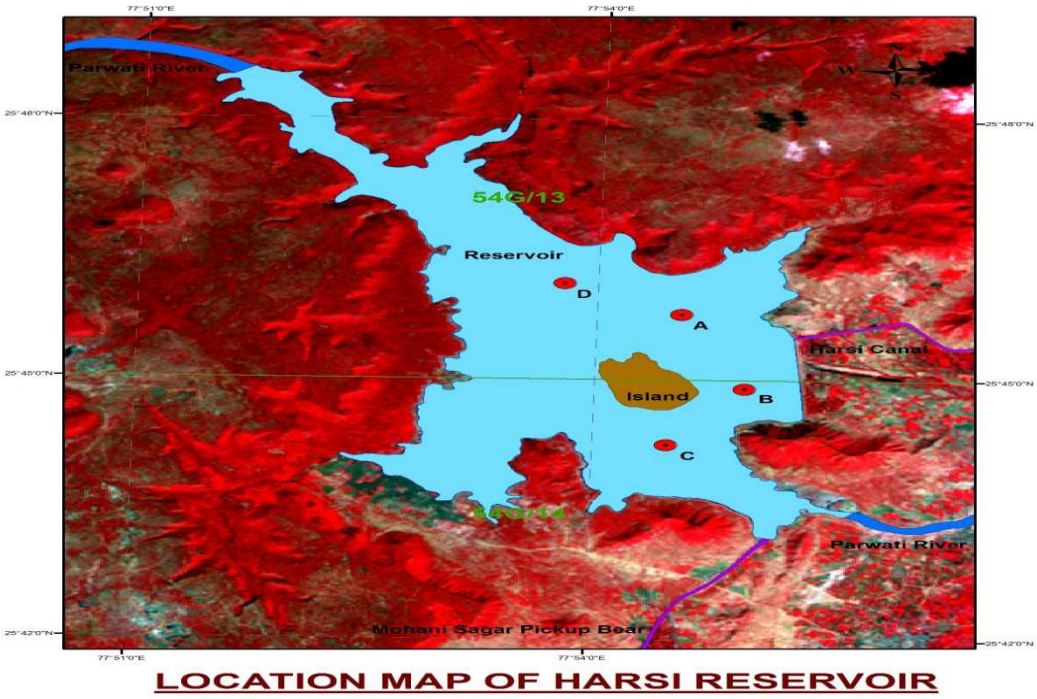


Fig 2. Satellite image of Harsi reservoir

RESULT AND DISCUSSION

The physico-chemical parameters are determinant of the quality of water. The average value of physico-chemical parameters of water during 2011 are given in table 1. The value of correlation coefficient (r) between physico-chemical parameters of water in harsi reservoir were calculate and given in table 2.

Water Temperature of reservoir water ranged from 18.10 °C to 32.08 °C in different month. temperature increased during summer month and decrease during winter month. Transparency indicates the productive nature of this water on the basis of clarity values as proposed by Sharma and Durve (1991). Transparency of the reservoir ranged from 106.25 cm to 153.50 cm. Electrical conductivity measures the capacity of a substance or solution to conduct electrical current. Electrical conductivity of the reservoir ranged from 177.62 $\mu S.cm^{-1}$ to236.90 $\mu S.cm^{-1}$. Turbidity is a measure of water clarity how much the material suspended in water decreases the passage of light through the water. Water turbidity value from 0.91 NTU to 3.14 NTU. The results supported by Dagaonkar and Saksena (1992), Garg et al (2006b) Medudhula.Thirupathaiah (2012) have also reported high turbidity during rainy season. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity. Total dissolved solids value ranged from 131.25 to 201.0 mgl^{-1} in different month . Similar result have been reported by Rao et al 2003, Kirubavathy et al 2005, Garg et al 2006b.

pH value is very important for plankton growth (Chisty, 2002). During present study water pH values were found 8.19 to 9.09. It is indicating alkalinity nature throughout the study period. This is in accordance with earlier reports by Wetzel (1975), who reported that the value of pH range from 8-9 units in Indian water. Dissolved oxygen is an important aquatic parameter. It plays crucial role in life processes of flora and fauna. In the present study the DO values found from 7.74 to 10.20 mgl^{-1}. Range of free carbon dioxide of the reservoir from Nil to 2.76. The carbon dioxide content of water depends upon the water temperature, depth, rate of respiration, decomposition of organic matter, chemical nature of the bottom and geographical features of the terrain surrounding the water body (Sakhare and Joshi, 2002). Total alkalinity is the total sum of carbonates and bicarbonates alkalinity. Total alkalinity range from 30.50 to 76.22 mgl^{-1} . In the present study total hardness ranged from 63.0 to 103.0 mgl^{-1} in different seasons. Khanna et al 2010 was also found higher total hardness during monsoon season and lowest total hardness during winter season.

Chloride play an important role in water quality determination. Chloride ranged from 21.43 to 30.86 mgl^{-1}. In this study High chloride value during summer season and low value during winter season. Similar observation have also been made by Lendh & Yeragi 2004; and Babar & Raje 2009.

Sulphates is an important constituent of hardness with calcium and magnesium and is one of the key nutrients in the aquatic environment. In the present study sulphates range from 1.11 to 4.16 mgl^{-1}. The higher value of sulphates recorded in summer moth and lower value of sulphates measured in winter month These result observed by Kirubavathy et al (2005), Khare et al (2007). During the study Nitrate fluctuated between 0.027 to 0.222 mgl^{-1}. High concentration of nitrate is drinking water is toxic (Umavathi et al 2007). Nitrogen is a major component of all organic matter. High concentration of nitrates are usefulfor irrigation but their entry into the water resources increases the growth of nuisance algae, macrophytes and triggers eutrophication and pollution (Trivedy & Goel 1986). High value of nitrate was observed during monsoon season and low during winter season. Similar result were observed by Saxena (1992), Garge et al (2006), Mustapha (2008). Nitrite represent an intermediate form during de-nitrification reactions in nitrogen cycle. Nitrate concentration found from 0.075 to 0.290. High concentration of nitrate found in summer season and low in winter season. Similar result was also also observe by Thialaga et al (2005).

Phoshpahtes is one of the most important nutrient and a limiting factor in the maintenance of reservoir fertility. During the study phosphate concentration ranged from 0.004 to 0.032 in different seasons. High concentration of phosphates observed during monsoon month and low phosphates value during winter. The variation may be due to the various processes like adsorption and desorption of phosphates and buffering action of sediment under varying environmental conditions (Rajasegar, 2003). Silicate is most abundant in sedimentary rocks and therefore, occurs generally in higher concentration in water located in such regions. During the study silicates ranged from 1.76 to 3.95. Higher concentration of ammonia is harmful for fishes and other life. In the present study, the ammonia content varied from 0.39 to 0.74. Higher values of ammonia found in summer season and lower value in winter season.

Biological oxygen Demand (BOD) is an important parameter to the oxygen required to degradation of organic matter. During the study period BOD recorded from 0.95 to 3.0 mg/l . higher value of BOD found in monsoon season and lower value in winter season. Garg et al., 2010 has also made similar observations in Ramsagar reservoir. Chemical oxygen demand is the oxygen consumed by the chemical break down of organic and inorganic substances in water. The COD of water increases with increasing concentration of organic matter (Boyd, 1981). In the present study, COD ranged from 18.46 to 36.16 mgl-1.

Calcium is an important micronutrient for all organism. Calcium content range from 18.46 to 36.12. The calcium value was high in rainy month and low in winter month. Khanna et al. 2010 has also reported the similar observation. Magnesium is essential for chlorophyll growth and acts as a limiting factor for the growth of phytoplankton (Dagaonkar and Saksena, 1992). Therefore, depletion of magnesium reduces the phytoplankton population. In the present investigation, the magnesium content from 3.02 to 7.87 mgl^{-1}. Sodium is a naturally occurring element in all water bodies. In the present investigation, sodium content found from 10.02 to 20.79 mgl-1. Potassium is also a naturally occurring element, but the concentrations in freshwater bodies remain quite lower than the sodium and calcium. In present study potassium varied from 1.54 to 4.80 mgl-1.

CORRELATION COEFFICIENT BETWEEN PHYSICO-CHEMICAL CHARACTERISTICS

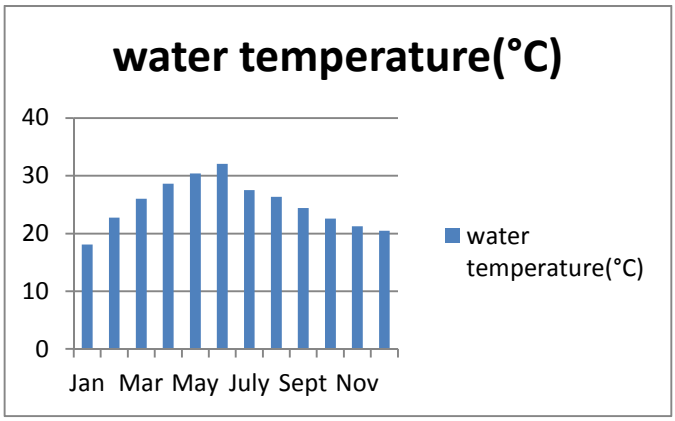
The correlation coefficient (r) between physico-chemical parameters are presented in table 2. In the present study show the high degree of positive correlation between temperature and electrical conductivity, temperature and total dissolved solids, temperature and total hardness, temperature and calcium, temperature and magnesium, temperature and chloride, turbidity and total dissolved solids, turbidity and electrical conductivity, turbidity and total hardness, electrical conductivity and total dissolved solids, electrical conductivity and total hardness, electrical conductivity and BOD, electrical conductivity and magnesium, total dissolved solids and total hardness, total dissolved solids and chloride, total dissolved solids and magnesium, COD and chloride, free carbon dioxide and pH, pH and magnesium, total hardness and calcium, total hardness and magnesium, chloride and magnesium, chloride and calcium, calcium and magnesium, BOD and total hardness, COD and chloride. In the present study high degree negative correlation found between dissolved oxygen and other parameters. Negative correlation between temperature and transparency, temperature and total alkalinity, turbidity and pH, turbidity and total alkalinity, electrical conductivity and pH, electrical conductivity and total alkalinity, total dissolved solids and pH, total alkalinity and calcium ,calcium and BOD, calcium and COD, BOD and total alkalinity, COD and Total alkalinity, BOD and COD. Free carbon dioxide has also show negative correlation between most of the parameters. Such a correlation of physico-chemical parameters has also been exhibited by several workers like Jha & Barat (2003), Kumar *et al.* (2007), Garg *et al.,* (2009 & 2010) and Ahangar *et al.* (2012).

Table 1: Average value of physico-chemical parameters of the Harsi reservoir (Jan to Dec 2011)

Parameters	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Water temperature (^{0}C)	18.10	22.75	26.0	28.61	30.39	32.08	27.50	26.34	24.43	22.56	21.27	20.48
Transparency (c. m)	141.75	132.25	139.25	127.25	131.50	127.0	114.50	106.25	121.75	138.25	141.75	153.50
E. conductivity (µS.cm^{-1})	183.07	177.62	200.92	209.87	214.55	212.05	234.50	236.90	228.97	204.45	199.65	186.87
Turbidity (NTU)	1.03	1.23	1.66	1.86	2.08	2.27	2.45	2.66	3.14	1.68	1.55	0.91
Total dissolved solids(mgL^{-1})	138.0	143.75	147.50	155.25	162.25	173.25	201.0	194.75	182.50	147.57	146.50	131.25
pH	8.54	8.19	8.35	8.62	8.79	9.09	8.59	8.18	8.19	8.51	8.49	8.55
Dissolved O_2 (mgL^{-1})	10.20	8.86	8.58	8.38	7.81	7.74	8.33	8.37	8.78	8.86	8.93	9.08
Free CO_2 (mgL^{-1})	0.897	1.08	0.560	NIL	NIL	NIL	NIL	1.02	2.21	1.40	2.76	1.59
T. Alkalinity (mgL^{-1})	52.45	30.50	39.40	38.45	59.87	76.22	55.77	69.10	45.22	56.0	42.07	61.57
T. Hardness (mgL^{-1})	72.0	74.50	76.50	81.0	85.25	90.50	103.0	94.25	83.0	79.75	70.0	63.0
Chloride (mgL^{-1})	21.43	25.05	29.19	26.83	26.19	30.86	29.49	25.26	21.47	23.12	21.90	21.53
Sulphate (mgL^{-1})	1.68	2.14	2.73	2.66	3.68	4.16	3.06	2.68	2.34	2.33	2.11	1.11
Nitrate-nitrogen (mgL^{-1})	0.027	0.046	0.049	0.071	0.068	0.069	0.113	0.222	0.074	0.057	0.064	0.045
Nitrite-nitrogen (mgL^{-1})	0.081	0.094	0.140	0.098	0.135	0.290	0.212	0.237	0.119	0.075	0.076	0.08
Phosphates (mgL^{-1})	0.007	0.008	0.005	0.010	0.015	0.025	0.032	0.021	0.022	0.014	0.007	0.004
Silicates (mgL^{-1})	1.93	2.47	2.78	3.23	3.46	3.67	3.95	3.45	3.93	2.72	2.22	1.76
Ammonia (mgL^{-1})	0.53	0.51	0.62	0.57	0.66	0.84	0.74	0.59	0.62	0.54	0.48	0.39
BOD (mgL^{-1})	1.39	1.67	1.81	1.98	2.32	2.66	2.79	3.0	2.81	1.27	0.95	0.97
COD (mgL^{-1})	24.62	28.25	34.48	30.34	36.40	44.89	51.08	42.43	41.25	44.36	38.25	21.13
Calcium (mgL^{-1})	18.84	18.46	20.72	30.15	32.72	28.48	36.16	26.49	20.59	22.15	23.48	22.32
Magnesium (mgL^{-1})	3.57	4.80	6.14	5.27	6.42	5.54	7.87	6.58	4.48	3.80	3.98	3.02
Sodium (mgL^{-1})	12.40	13.33	14.78	13.45	13.80	15.54	16.67	17.94	20.79	18.62	14.48	10.02
Potassium (mgL^{-1})	1.54	2.05	2.76	3.23	3.70	4.17	4.53	4.80	3.87	3.40	2.29	2.55

Table 2: Average value of physico-chemical parameters of the Harsi reservoir (January to December 2011)

	WT	TR	EC	TU	TDS	pH	DO_2	FC_{O2}	TA	TH	Cl	SO_4	NO_3	NO_2	PO_4	Si	NH_3	BOD	COD	Ca^+	Mg^+	Na^+	K^+
WT	1																						
TR	-0.55	1																					
EC	0.59	-0.83	1																				
TU	0.6	-0.83	0.92	1																			
TDS	0.52	-0.88	0.97	0.9	1																		
pH	0.5	0.17	-0.005	-0.07	-0.14	1																	
DO_2	-0.93	0.49	-0.58	-0.57	-0.54	-0.40	1																
FC_{O2}	-0.07	0.02	0.25	0.28	0.19	0.15	-0.07	1															
TA	-0.08	0.22	-0.32	-0.37	-0.29	0.29	-0.34	-0.18	1														
TH	0.69	-0.89	0.84	0.77	0.93	0.16	-0.61	-0.20	0.41	1													
Cl	0.81	-0.42	0.34	0.30	0.44	0.450	-0.72	-0.65	0.20	0.64	1												
SO_4	0.92	-0.53	0.53	0.57	0.57	0.56	-0.84	-0.19	0.38	0.72	0.80	1											
NO_3	0.33	-0.81	0.75	0.61	0.7	-0.26	-0.38	-0.09	-0.18	0.66	0.20	0.26	-1										
NO_2	0.62	-0.79	0.71	0.64	0.71	0.11	-0.65	-0.32	0.17	0.78	0.73	0.74	0.8	1									
PO_4	0.58	-0.8	0.82	0.81	0.84	0.21	-0.53	0.43	0.09	0.92	0.46	0.62	0.55	0.72	1								
Si	0.79	-0.83	0.87	0.92	0.89	0.13	-0.72	0.07	0.26	0.88	0.56	0.76	0.51	0.68	0.86	1							
NH_3	0.02	0.07	-0.07	0.1	0.01	-0.45	-0.66	-0.07	-0.27	0.80	0.79	0.91	-0.14	-0.18	-0.36	0.81	1						
BOD	0.71	-0.9	0.82	0.88	0.91	0.01	-0.60	-0.06	-0.13	0.87	0.53	0.67	0.65	0.82	0.83	0.91	0.02	1					
COD	0.53	-0.67	0.76	0.76	0.71	0.14	-0.56	0.45	-0.006	0.82	0.45	0.64	0.5	0.6	0.84	0.77	-0.21	0.62	1				
Ca^+	0.49	0.28	-0.19	-0.22	-0.34	0.55	-0.69	-0.46	-0.13	0.72	0.59	0.65	0.34	0.16	-0.33	0.63	0.21	-0.12	-0.32	1			
Mg^+	0.84	-0.43	0.34	0.31	0.23	0.38	-0.67	-0.42	-0.17	0.85	0.78	0.71	0.22	0.41	0.23	0.74	0.19	0.46	0.26	0.68	1		
Na^+	0.24	-0.64	0.72	0.82	0.78	0.29	-0.26	0.52	-0.23	0.58	0.60	0.32	0.74	0.8	0.85	0.68	0.22	0.58	0.79	-0.52	0.4	1	
K^+	0.72	-0.8	0.92	0.85	0.84	0.15	-0.74	0.32	-0.05	0.87	0.49	0.64	0.74	0.8	0.85	0.87	-0.11	0.83	0.79	-0.12	0.42	0.64	1



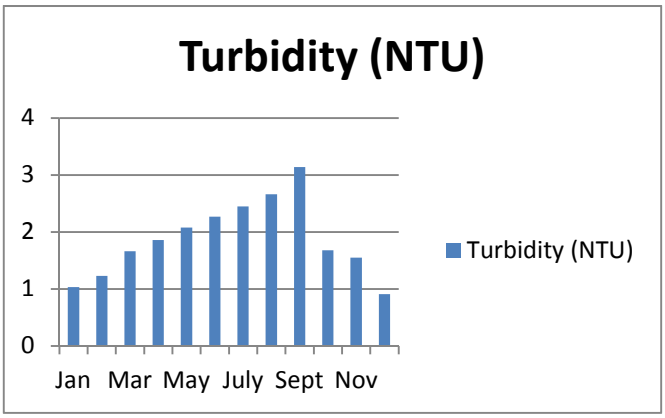


Fig 3. Showing monthly variations in Water temperature. Fig 4. Showing monthly variations in Turbidity.

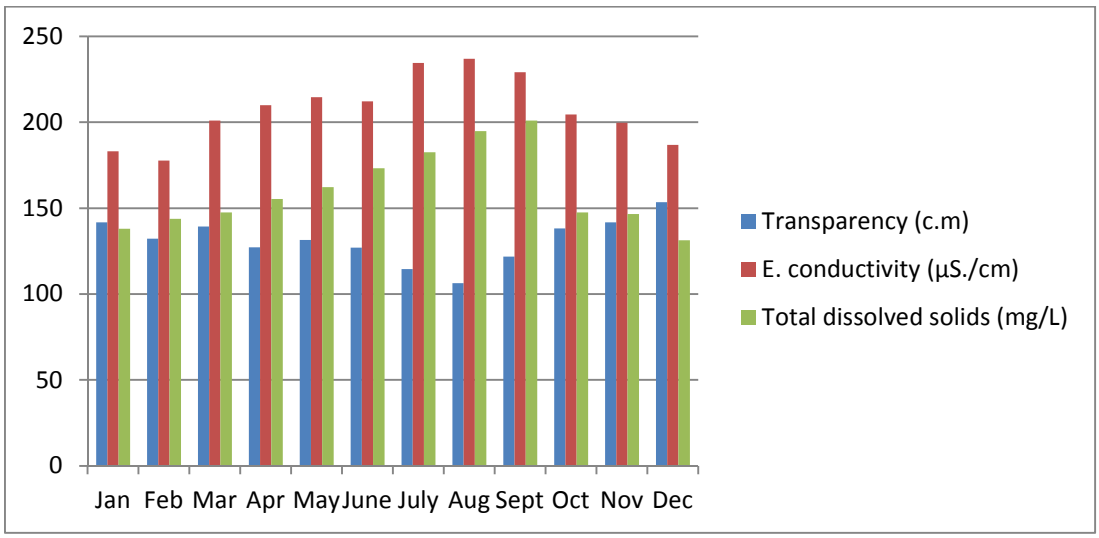


Fig 5. Showing monthly variations in Transparency, E.conductivity and Total dissolved solids.

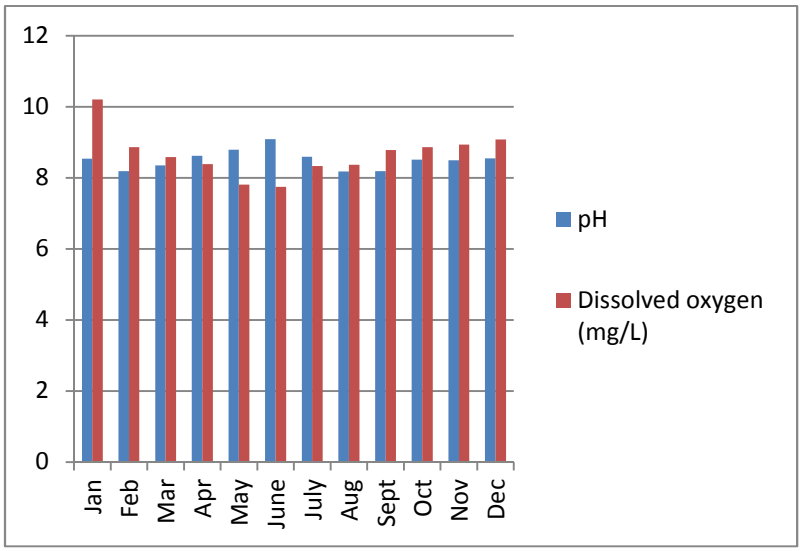


Fig 6. Showing monthly variations in pH and Dissolved oxygen.

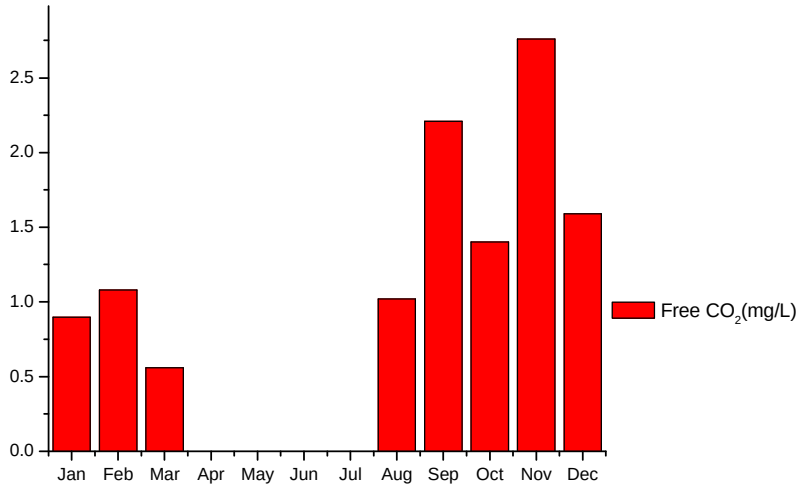


Fig 7. Showing monthly variations in Free carbon dioxide

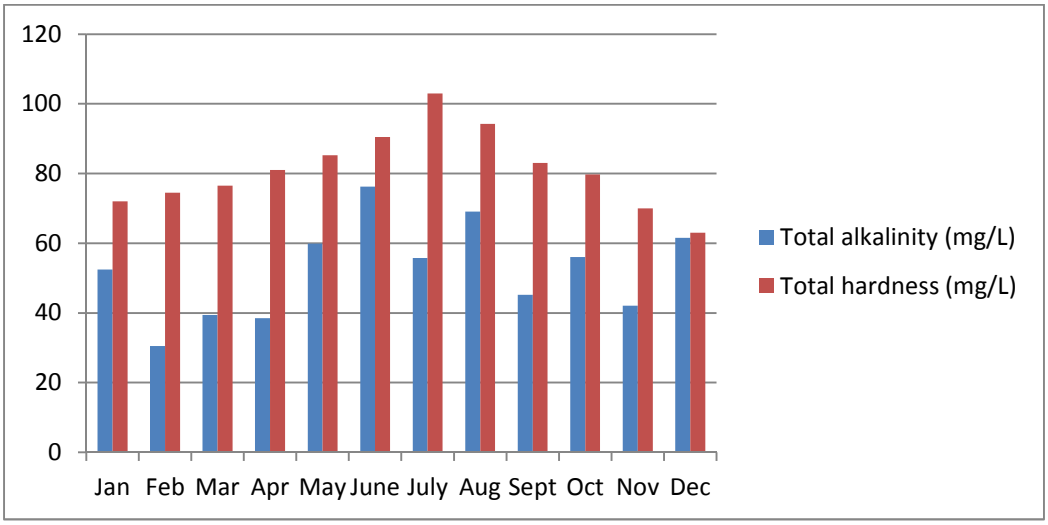


Fig 8. Showing monthly variations in Total alkalinity and Total hardness

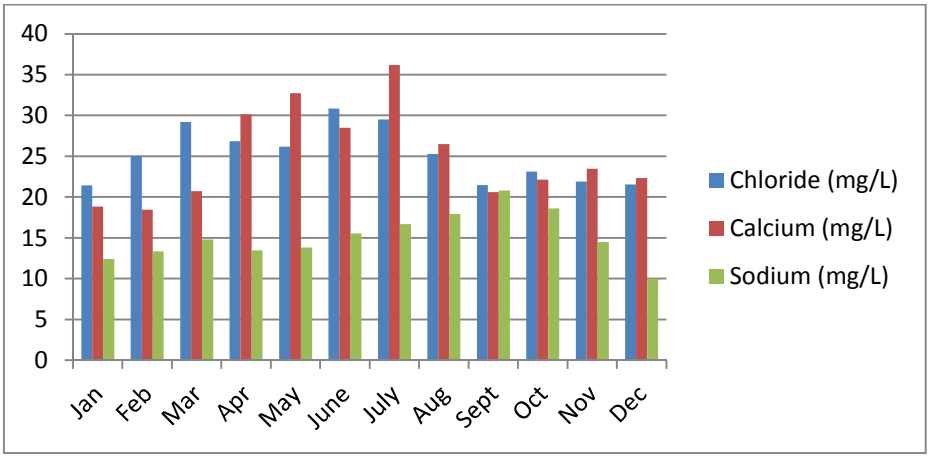


Fig 9. Showing monthly variations in Chloride, Calcium and Sodium

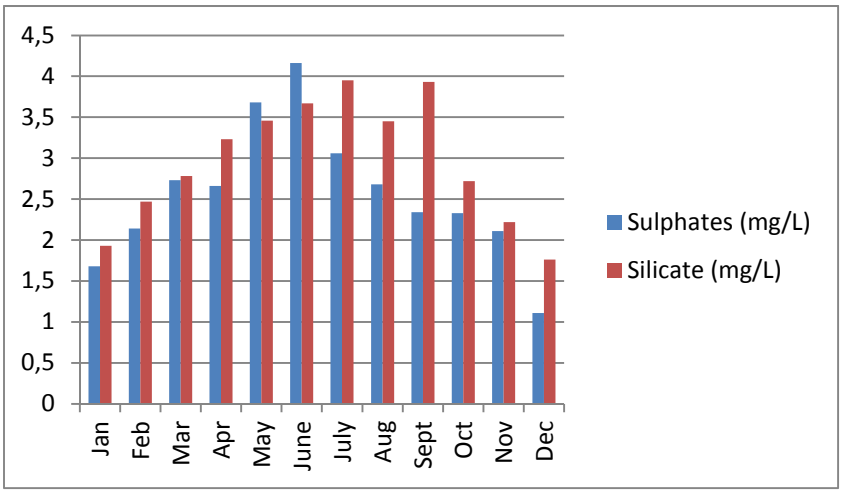


Fig 10. Showing monthly variations in Sulphates and Silicate

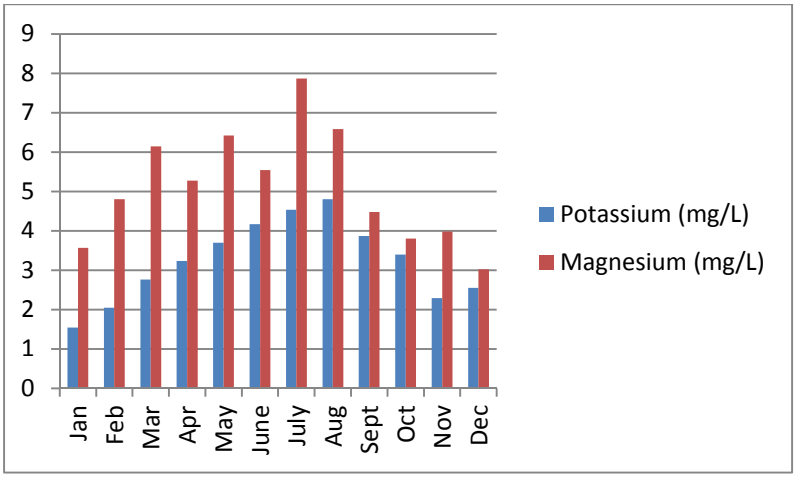


Fig 11. Showing monthly variations in Potassium and Magnesium.

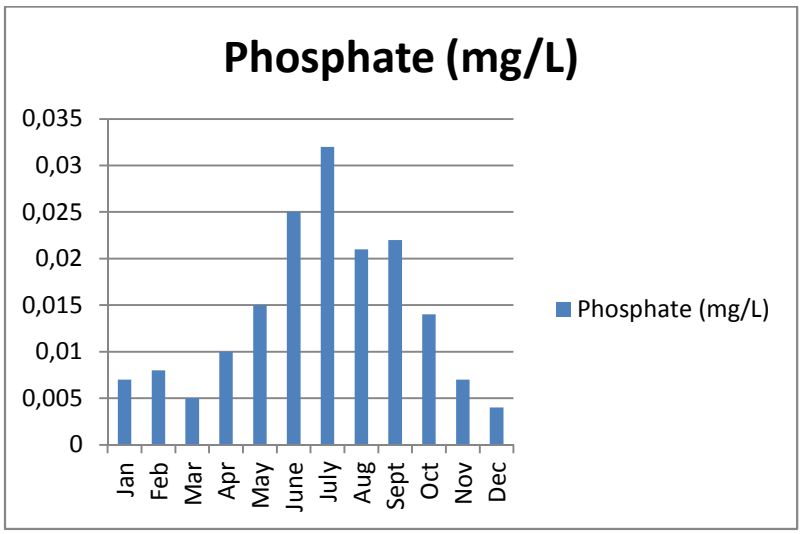


Fig 12. Showing monthly variations in Phosphate

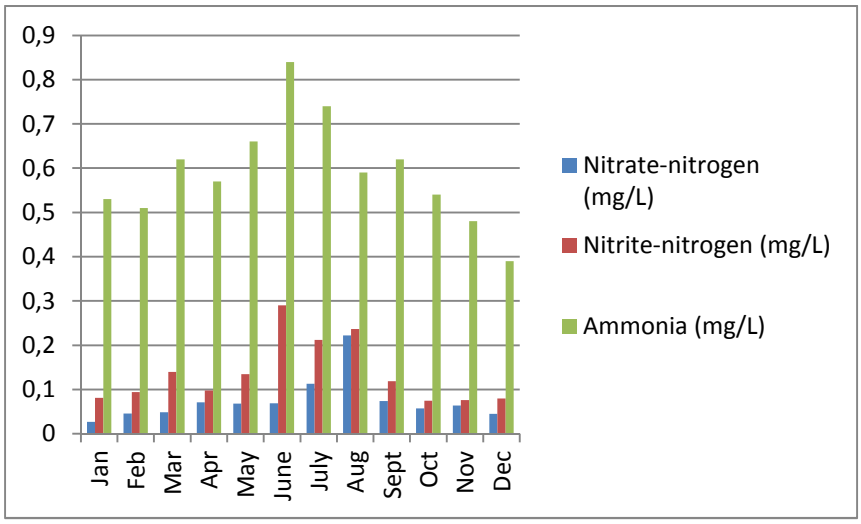


Fig 13. Showing monthly variations in Nitrate, Nitrite and Ammonia.

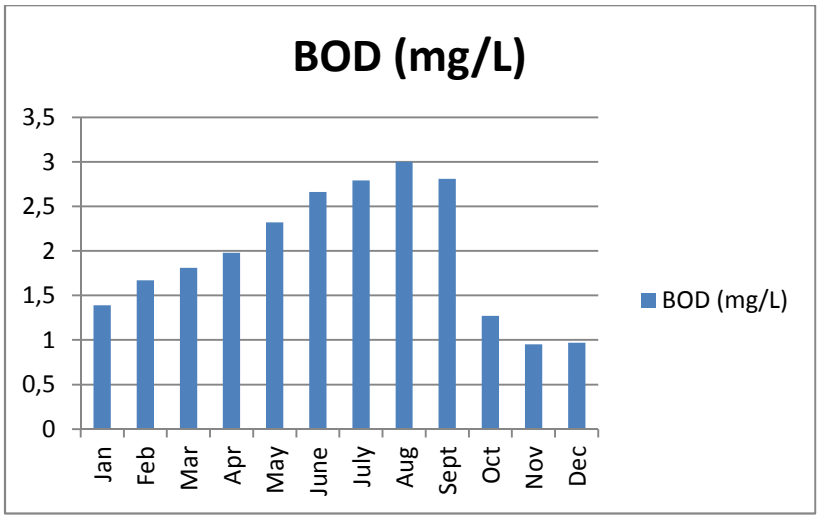


Fig 14. Showing monthly variations in BOD

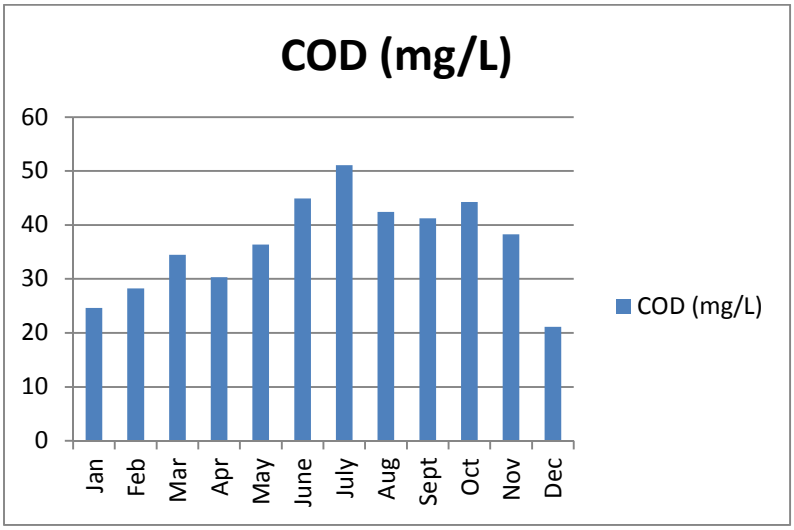


Fig 15. Showing monthly variations in COD

CONCLUSION

In conclusion, All physical and chemical parameters in harsi Reservoir water were within desirable limits. This reservoir have rich amount of nutrients which may be due to agricultural practices being done by farmers in surrounding catchment area of this reservoir and support relatively good biota. The results obtained from the present investigation shall be useful in future management of the reservoir.

ACKNOWLEDGEMENTS

The Authors are grateful to Principal, Head of Department and other staff of Zoology, SMS Govt Modern Science College Gwalior, Madhya Pradesh, India for providing necessary laboratory facilities this research work.

REFRENCES

[1] APHA (1995). Standard methods for examination of water and wastewater. Nineteenth Edition, Washington D.C.
[2] Ahangar, I.A., Saksena, D. N., Farooq, M. M. & Ahangar, M.A. (2012). Seasonal variations in physico- chemical characteristics of Anchar lake,
[3] Kashmir. International Journal of Advance and Biological Research, 2(2), 352-357.
[4] Babar, H.T. & Raje, G.B. (2009). Water quality indices of some stagnant water bodies in Chiplun, Maharashtra. Journal of Aquatic Biology, 24(2), 124-130.
[5] Boyd CE (1981). Water quality in warm water fish ponds. Craftmaster Printers Inc., Albama.
[6] Chisty. N., (2002), Studies on Biodiversity of Freshwater Zooplankton in Relation to Toxicity of selected Heavy Metals. Ph. D. Thesis submitted to M.L Sukhadia Univeristy Udaipur.
[7] Dagaonkar A, Saksena DN (1992). Physico-chemical and Biological characterization of a temple tank, Kaila Sagar, Gwalior, Madhya Pradesh. J. Hydrobiol. 8(1): 11-19.
[8] Fokmare AK, Musaddiq M (2002). A study of physico-chemical characteristics of Kapsi lake and Purna River waters in Akola District of Maharastra (India). Nat. Environ. Poll. Tech. 1: 261-263.
[9] Garg R.K, Rao RJ, & Saksena DN.(2006a).Nutrients and Trophic Status of Ramsagar Reservoir, Datia, Madhya Pradesh Nat. Environ.
[10] Garg, R. K., Rao, R. J. & Saksena, D.N. (2009). Water quality and conservation management of Ramsagar reservoir, Datia, Madhya Pradesh. Journal of Environmental Biology, 30(5), 909-916.
[11] Garg, R.K., Rao, R.J., Uchchariya, D., Shukla, G. & Saksena, D.N. (2010). Seasonal variations in water quality and major threats to Ramsagar reservoir, India. African Journal of Environment Science and Technology, 4(2), 61-76.
[12] Kaushik, S. & Saksena, D.N. (1994). The trophic status and habitat ecology of entomofauna of the water bodies at Gwalior, Madhya Pradesh. In: Perspective in Entomological Research (Agarwal, O.P., ed.), pp. 241-261. Scientific Publishers, Jodhpur.
[13] Kaushik, S. & Saksena, D.N. (1999). Physico-chemical limnology of certain water bodies of Central India. In: Freshwater ecosystems of India (Vijaykumar, K., ed.), pp. 1-58. Daya Publishing House, New Delhi.
[14] Khanna, D.R., Kumar, Arun, & Neeraj (2010). Physico-chemical characteristics of a fish pond near Roorkee. International Journal for Enviromental Rehabilitation and Conservation Volume I No. 2 2010 (52-60).
[15] Khare, S.L., Paul, S.R. & Dubey, A. (2007). A study on water quality of Khomph-Niwari lake at Chhattarpur (M. P.). Nature Environment and Pollution Technology, 6(3), 539-540.
[16] Kirubavathy, A.K., S. Binukumari, N. Mariamma and T. Rajammal: Assessment of water quality of Orathupalayam reservoir, Erode district, Tamil Nadu. J. Ecophysiol. Occup. Hlth., 5, 53-54 (2005).
[17] Lendhe, R.S. & Yeragi, S.G. (2004). Physico-chemical parameters and zooplankton diversity of Phirange-Kharbav lake, district Thane, Maharastra. Journal of Aquatic Biology, 19(1), 49-52.
[18] Medudhula, Thirupathaiah, Ch.Samatha, Chintha Sammaiah (2012), Analysis of water quality using physico-chemical parameters in lower manair reservoir of Karimnagar district,Andhra Pradesh. International journal of environmental sciences volume 3,no1.
[19] Mustapha, M.K.(2008).Assessment of the water quality of Oyun reservoir, Offa, Nigeria, using selected physico-chemical parameters Turkis Journal of Fisheries and Aquatic Science, 8, 309-319.
[20] Ramalingam Manikannan, Subramanian Asokan, Abdul Hameed Mohamed Samsoor Ali, (2012), Seasonal variations of physico- chemical properties of the Great Vedaranyam Swamp, Point Calimere Wildlife Sanctuary, South-east coast of India. African Journal Environmental Science and Technology Vol. 5(9), pp. 673-681, September 2011

[21] Rajasegar M (2003). Physico-chemical characteristics of the Vellar estuary in relation to shrimp farming. J. Environ. Biol., 24:95-101.
[22] Rao K D S, Ramakrishniah M, Karthikeyan M, Sukumaran PK (2003). Limnology and fish yield enhancement through stocking inMarkonahalli Reservoir (Cauvery River System). J. Inland Fish. Soc. India, 35: 20-27.
[23] Sharma, L. L and Darve, V.S., (1991), Water quality of 26 waters of Rajasthan in relation to phytoplankton. In Proc. Of the second Asian fisheries Forum. Asian fisheries society manila, Philippines, pp 915-918.
[24] Sakhare, V.B. & Joshi, P.K. (2002). Ecology of Palas-nilegaon reservoir in Osmanabad district Maharastra. Journal of Aquatic Biology, 18(2), 17-22.
[25] Saxena, Meenakshi (2012), Water quality and trophic status of Raipur reservoir in Gwalior, Madhya Pradesh Journal of Natural Sciences Research ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online) Vol.2, No.8, 2012.
[26] Sugunan, V.V. (1997). Reservoir fisheries in India. FAO Fisheries Technical Paper no, 423.
[27] Trivedy, R.K. and P.K. Goel: Chemical and Biological Methods for Water Pollution Studies, Environmental Publication, Karad, Maharastra, India (1986).
[28] Thilaga, A., S. Subhashini, S. Sobhana and K.L. Kumar: Studies on nutrient content of the Ooty lake with reference to pollution. Nat. Environ. Poll. Tech., 4, 299-302 (2005).
[29] Uchchariya Dinesh K. (2012), Study of Nutrients and Trophic Status of Tighra Reservoir, Gwalior, Journal of Natural Sciences Research ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online) Vol.2, No.8, 2012
[30] Umavathi, S., Longakumar, K and Subhashini., (2007), Studies on the nutrient content of Sulur pond in Coimbator, TamilNadu, Journal of ecology and environmental conservation, 13(5), pp 501-504.
[31] Venkatesharaju K., Ravikumar.P., Somashekar. R.K., Prakash. K.L., (2010), Physico-chemical and Bacteriological Investigationon the river Cauvery of Kollegal Stretch in Karnataka, Journal of science Engineering and technology, 6 (1), pp 50-59.
[32] Wetzel, R.G. (1975). Primary production and river ecology. Blackwell Scientific Publication, Oxford.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 259-263
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

An Approach to Uncover Hidden Topics in Short & Sparse Web Documents

Sumayya Sameena[1] and Rehana[2]

[1]M.Tech, Department of CSE,
NimraCollege of Engg. & Tech, Vijayawada,
Andhra Pradesh., India

[2]Assistant Professor in CSE Dept,
NimraCollege of Engg. & Tech, Vijayawada,
Andhra Pradesh., India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: My work introduces a hidden topic-based framework for processing short and sparse documents (e.g., search result snippets, product descriptions, book/movie summaries, and advertising messages) on the Web. The framework focuses on solving two main challenges posed by these kinds of documents: 1) data sparseness and 2) synonyms/homonyms. The former leads to the lack of shared words and contexts among documents while the latter are big linguistic obstacles in natural language processing (NLP) and information retrieval (IR). The underlying idea of the framework is that common hidden topics discovered from large external data sets (universal data sets), when included, can make short documents less sparse and more topic-oriented. Furthermore, hidden topics from universal data sets help handle unseen data better. The proposed framework can also be applied for different natural languages and data domains. We carefully evaluated the framework by carrying out two experiments for two important online applications (Web search result classification and matching/ranking for contextual advertising) with large-scale universal data sets and we achieved significant results.

KEYWORDS: Web mining, matching, Natural Language Processing, classification, clustering

1 INTRODUCTION

In this study, I developed the data diversity which has posed new challenges to Web Mining and IR research. Two main challenges we are going to address in this study are 1) short and sparse data problem and 2) synonyms and homonyms. In this we used on web search documents and e.g., search result snippets, product descriptions, book/movie summaries, and advertising messages) on the Web. We demonstrate that hidden topic-based approach can be a right solution to sparse data and synonym/ homonym problems.

We show that the framework is a suitable method to build online applications with limited resources. In this framework, universal data sets can be gathered easily because huge document collections are widely available on the Web. By incorporating hidden topics from universal data sets, we can significantly reduce the need of annotated data that are usually expensive and time-consuming to prepare. In this sense, our framework is an alternative to semi-supervised learning [2] because it also effectively takes advantage of external data to improve the performance.

2 PROBLEM STATEMENT

The main rule in this project search the data based on the search topic, display the data in short format or hidden the data. In the proposed system we are solving the two main challenges i.e., short and sparse data problem & synonyms and homonyms.

- Proposes the general framework of classification [1] and contextual matching with hidden topics.
- Describes the analysis of large-scale text/Web data collections that serve as universal data sets in the framework.

Describes how to build a matching and ranking model with hidden topics for online contextual advertising.

3 SCOPE

The main rule in this project hidden topic-based approach can be a right solution to sparse data and synonym/ homonym problems.

This section brings an in-detail description of hidden topic analysis of a large-scale Vietnamese news collection that serves as a "universal data set" in the general framework for contextual advertising mentioned earlier in With the purpose of using a large-scale data set for Vietnamese contextual advertising, we choose VnExpress as the universal data set for topic analysis. VnExpress is one of the highest ranking e-newspaper corporations in Vietnam, thus containing a large number of articles in many topics in daily life. For this reason, it is a suitable data collection for advertising areas.

4 OBJECTIVE

In this work data will be display the Tree view interconnected nodes. In this tree view data is display one tree view contain more than two nodes. Search Engine data display the Page Level but in this project data will display the Tree wise. A hidden topic-based approach is processing short and sparse documents in universal data set.

The proposed application can also be applied for different natural languages and data domains. We carefully evaluated the framework by carrying out two experiments for two important online applications (Web search result classification and matching/ranking for contextual advertising) with large-scale universal data sets. Area of work to data mining; data mining will allow us to retrieve data from huge amount of data, i.e. data mining techniques makes our work easy to get particular data.

By choosing this, I can provide the following features to the users:

- I can give reasons to the user why the particular getting for a particular query.
- I can provide dynamic Data search flow.
- I can improve the speed of the search.
- I can reduce the semantic web documents.

An e-commerce, online publishing, communication, and entertainment, Web data have become available in many different forms, genres, and formats which are much more diverse than ever before. Various kinds of data are generated everyday: queries and questions input by Web search users; Web snippets returned by search engines; Web logs generated by Web servers; chat messages by instant messengers blog posts and comments by users on a wide spectrum of online forums, e-communities, and social networks; product descriptions and customer reviews on a huge number of e-commercial sites; and online advertising messages from a large number of advertisers. However, this data diversity has posed new challenges to Web Mining and IR research[5]. Two main challenges we are going to address in this study are.

1) Short and sparse data problem and
2) Synonyms and homonyms.

5 A HIDDEN TOPIC BASED APPROACH

In this paper we discuss about the approach provides a Framework to gain additional knowledge from W in terms of hidden topics to modify and enrich the training set D in order to build a better classification model. Here, we callW "universal data set" since it is large and diverse enough to cover a lot of information (e.g., words/topics) regarding the classification task. The whole framework of "learning to classify with hidden topics" is depicted. The framework consists of five subtasks.

- collecting universal data set W,
- carrying out topic analysis for W,
- preparing labeled training data,
- performing topic inference for training and test data, and
- Building the classifier.

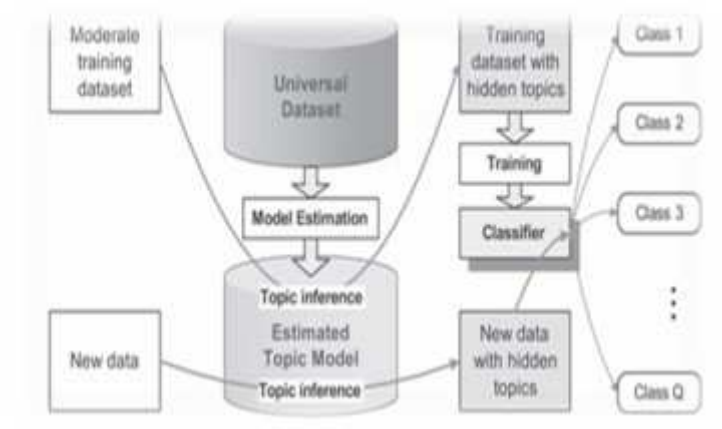


Fig-1: Framework of learning to classify sparse text/Web with hidden topics

(a) Choosing an appropriate " universal dataset"
(b) Doing topic analysis for the universal dataset
(c) Building a moderate size labeled training dataset
(d) Doing topic inference for training and futuer data
(e) Building the classifer

6 MATCHING/RANKING WITH HIDDEN TOPICS

A present our general framework for contextual page-ad matching and ranking with hidden topics discovered from external large-scale data collections.

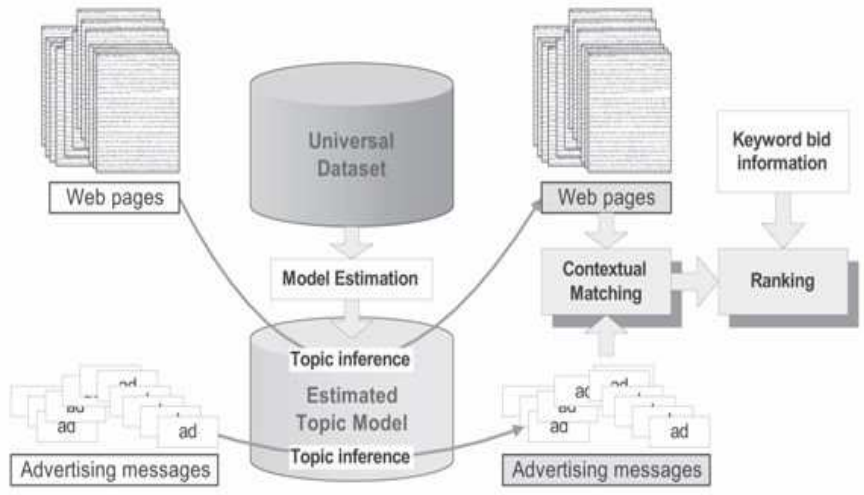


Fig-2: Framework of page-ad matching and ranking with hidden topics

(a) Choosing an appropriate " universal dataset"
(b) Doing topic analysis for the universal dataset
(c) Doing topic inference for web pages and ads
(d) Page-Ad matching and Ranking

7 GENERAL FRAMEWORK

We give a general description of the proposed framework: classifying, clustering, and matching with hidden topics discovered from external large-scale data collections. It is general enough to be applied to different tasks, and among

them we take two problems: document classification and online contextual advertising [3]as the demonstration. Document classification, also known as text categorization, has been studied intensively during the past decade.

Many learning methods, such as k nearest neighbors (k-NN), Naive Bayes, maximum entropy, and support vector machines (SVMs)[4], have been applied to a lot of classification problems with different benchmark collections and achieved satisfactory Results. However, our framework mainly focuses on text representation and how to enrich short and sparse texts to enhance classification accuracy.

8 APPROXIMATION METHODS

In this work, we show how we can efficiently calculate an approximation of the authority flow between two nodes (we generalize for multiple nodes as well) given the paths (trees for more than two nodes) with length up to M connecting the nodes. The latter problem has been extensively studied in prior work where efficient algorithms are presented to find all paths of a data graph (a graph of pages and hyperlinks for the web, or of data objects and their relationships for databases as we explain) connecting two nodes.

An analytical model is presented to estimate the quality of this approximation as a function of the maximum lengthM of the paths generated by the proximity algorithm. Also, we analytically calculate the error in ordering that this approximation imposes.

9 PAGE RANK ALGORITHM

A set of works has tackled the problem of improving the performance of the original Page Rank algorithm. Algorithms are presented in to improve the calculation of a global Page Rank. Jeh and Widom present a method to efficiently calculate the Page Rank values for multiple base sets, by precomputing a set of partial vectors which are used in runtime to calculate the Page Ranks. Tong et al. exploit structural properties of real graphs to efficiently perform random walk over large graphs and employ pre computation[6] to improve performance.

10 EXISTING SYSTEM

Due to the complexity of calculating the authority flow, current systems only use pre-computed authority flows in runtime. This limitation prohibits authority flow to be used more effectively as a ranking factor. The existing system have been developed to apply this principle

1. on the Web
   - Page rank
   - Topic Sensitive Page rank
2. Bibliographic data bases
   - Object rank
3. Biological data bases
   - Hubs of Knowles Project

The above system has some drawbacks

1. There is no way to explain to the user why a particular result is current score
2. The authority flow rates which have been shown to dramatically affect the results quantity in object ranks have to be set manually by a domain expert.
3. There is no query reformation methodology to refine the query results according to the user's preferences.

11 PROPOSED SYSTEM

The above system has some drawbacks.

1. There is no way to explain to the user why a particular result is current score
2. The authority flow rates which have been shown to dramatically affect the results quantity in Object ranks have to be set manually by a domain expert.
3. There is no query reformation methodology to refine the query results according to the user's preferences.

To resolve these problems in existing Proposal, we define authority flow between nodes in terms of the paths connecting the nodes. We initially focus on pair wise authority flows, that is, we approximate the authority flow between a base set comprised of a single node and a target node. We generalize to base sets with multiple nodes. To do so, we use the linearity theorem. We first estimate the relative error ES of the authority flow value calculated using the approximation method, and then we present how this error affects the ordering of the results of a query that uses authority flow as the ranking factor.

12 CONCLUSION

We presented a method to efficiently approximate the authority flow between a base set b and a node v. this method assumes no ieee transactions on knowledge and data engineering, Performance and quality experiments on performance with varying path length m. results' quality with varying path length performance and quality experiments on ds. Performance with varying path length. results' quality with varying path length m. prior knowledge of b or v, and hence, it is suitable for on- the-fly authority flow computation. Our work allows authority flow to be used in new real-time applications, like measuring the quality of a result tree in a proximity search system, or answering complex on the- fly queries. We also analytically prove the error of our approximation method and the error it imposes in the ordering of query results.

13 FUTURE ENHANCEMENTS

In my work, user enter any data will access Database but Future implementation using AJAX. Data will be access the client side only. I work is to develop the database only using sqlserver future implementation connect the different databases. Ever y request data access thought database future implementation data will access though XML or client side. This work does not maintain the historical data.

REFERENCES

[1] L. Baker and A. McCallum,"Distribuitional clustering of words for Text Classification,"Proc. ACM, SIGIR, 1998.

[2] A.Blum and T.Mitchell,"Combining labeled and unlabeled Data with Co-Training," Proc . 11th Ann. Conf .Computational Learning Theory (COLT), 1998

[3] A. Broder, M Fontoura, V. Josifovski, and L.Riedel," A Semantic Approach to Contextual Advertising, "Proc.ACM SIGIR, 2007.

[4] T.Joachims,"Text Categorization with SVMS: Learning With Many Relevant Feautures,"Proc.10th European Conf.Machine Learning (ECML), 1998

[5] D.Metzler, S.Dumais, And C. Meek," Similarity measures for Short Segments of Text," Proc.29th European Conf .IR Research (ECIR), 2007.

[6] A. Berger and A. Pietra and J. Pietra," A Maximum Entropy Approach To Natural Language Processing, "Computational Linguistics, vol.22, No.1.PP -39-71, 1996.

[7] P. Chatterjee, D. L. Hoffman, and T. P. Novak. Modeling the clickstream: Implications for web-based advertising efforts Marketing Science, 22(4):520–541, 2003

[8] R. Wang, P. Zhang, and M. Eredita. Understanding consumers attitude toward advertising. Proc. AMCIS, 2002.

[9] L. CAI and T. Hofmann. Text categorization by boosting automatically extracted concepts. Proc. ACM SIGIR, 2003.

[10] J. CAI, W. Lee, and Y. Teh. Improving WSD using topic features. Proc. EMNLP- CoNLL, 2007.

[11] D. Bollegala, Y. Matsuo, and M. Ishizuka. Measuring semantic similarity between words using Web search engines. Proc. WWW, 2007

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 264-272
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Providing Privacy and Security for Cloud Data Using Data Mining

D. Bhu Lakshmi[1] and S. Arundathi[2]

[1]Department of Computer science and engineering,
KNS Institute of technology,
Bangalore, Karnataka, India

[2]Department of Master of Computer Applications,
KNS Institute of technology,
Bangalore, Karnataka, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Cloud Computing provides a good model for the providers to deploy the computing infrastructure and applications on-demand. It offers greater flexibility to users by connecting to various computing resources and allowing access to IT enabled services. But it has the risk of privacy of user data and security. Thus security among the users of cloud is the most important concern. One of the security issue in cloud computing is data mining based attacks, which involves that the data can be analyzed continuously by an unanonymous person to get the valuable information. Using the single cloud provider this is a major problem among the clients in the cloud, because the outside attacker can analyze their data for a long time to gain the sensitive information. In this paper, we have given the data mining based attacks on cloud data and a method to prevent the attacks. In this paper, review of various data mining techniques is presented which can help achieve security of information on cloud. In today's fastest growing IT industry Cloud Computing is gaining much more popularity because the Cloud providers feel that it is very easy to manage the data in the cloud environment rather than normal web-sites in form of simple web pages. Every day the data seeking is being done by many users immensely. Here due to immense number of users seeking the data on daily basis there is a serious security concerns to the cloud providers as well as the data providers who put their data on the cloud computing environment. This paper provides solution of the security issues of cloud computing**.**

KEYWORDS: Cloud Computing, Data Mining, Security, Privacy etc.

1 INTRODUCTION

Cloud computing enables the end-users, small and medium-sized companies to access computational resources like storage, software etc. In cloud computing, with these vast amount of computing resources, users are able to solve their problems easily using the resources provided by cloud. Some of the cloud services include Software as a Service(SaaS), Platform as a Service(PaaS), Infrastructure as a Service(IaaS)[2]. The examples of cloud services provided by big organizations are: Elastic Compute Cloud(EC2) by Amazon, Google App Engine(GAE) by Google and SQL Azure by Microsoft etc. Using the cloud computing services, users are able to store their data in servers and access their data from anywhere and they need not worry about the loose of data due to disk faults, system breakdown etc. But there are several security issues in cloud like assurance and confidentiality of user data. The users who are entrusting the cloud provider may lose the access to his data either permanently or temporarily due to any unexpected event like malware attack. This unexpected event provides significant harm to the users. The providers in cloud can analyze the user data continuously and similarly the outside attackers who try to get access to the cloud can also analyze the user data. So, the user may lose his data privacy.

There are various data analysis techniques are available now to extract the sensitive information from cloud data. The outside attackers can use these techniques to get the sensitive information from cloud[10]. The potential threat to cloud

security may be data mining where the large volume of data belonging to a particular user will be stored in a single cloud provider. This single cloud provider approach is the maindrawback in cloud where the provider can use more powerful data mining algorithms to extract the private information of user. The second drawback of this approach is the attackers who have unauthorized access to the cloud can use the data mining techniques to extract the sensitive information in the user data.

In this paper, we present a approach to provide unique identity to the cloud users and servers known as Federated Identity Management and to prevent data mining attacks by using multiple cloud providers. The user data will be distributed among multiple cloud providers, so it will be a difficult task to the attackers to get the data. The key idea of our approach is to classify the user data, divide the data into small chunks and distribute these chunks to the various cloud providers. Simply, this approach consists of 3 steps: classification, fragmentation and distribution of data. Classification is a process where sensitive data is identified and appropriate mechanisms are implemented to maintain privacy of this sensitive data. Fragmentation is a process where the data is divided into small chunks. Distribution is a process where the divided chunks will be distributed to cloud providers. Distribution of data to a cloud provider can be done depending upon the reliability of cloud provider and data sensitivity. The reliability of a cloud provider means if the cloud provider is able to store the data chunks with such sensitivity. Using this approach, it is difficult for the attacker to get the data chunks from different providers and also mining sensitive information from these data chunks is a tedious process[8][9].

2 RELATIONSHIP BETWEEN CLOUD COMPUTING AND DATA MINING

Data Mining is the major growing field in IT industry which is also known as Knowledge Discovery in Databases(KDD)[1]. It is used to discover useful patterns from large volumes of data. In data mining, the main areas are like Frequent Pattern Mining, Association Rule Mining etc.

The term Cloud refers to a Network or Internet. In other words, we can say that Cloud is something which is present at remote location. Cloud can provide services over network i.e. on public networks or on private networks i.e. WAN, LAN or VPN. Applications such ase-mail, web conferencing, customer relationship management (CRM), all run in cloud.

Cloud Computing and Data Mining are closely related to each other. The interrelationship between these two is having its advantages and disadvantages. The advantage is: data mining has been used by cloud providers to provide better service to clients. The disadvantage is: attackers outside the cloud provider who is not having authorized access to cloud, will also use data mining to extract data from cloud. The extraction of useful data from cloud involves 2 factors: suitable amount of data and appropriate mining algorithms. There are so many mining algorithms which will work good to extract useful information from cloud which violated the user data privacy. For example, association rule mining algorithms[3] can be used to find association relationships between huge number of business transaction records etc. Thus data mining is becoming a powerful tool and possess more threats to cloud users.

CLOUD COMPUTING SECURITY CHALLENGES

Data protection tops the list of cloud concerns today. Vendor security capabilities are key to establishing strategic value, reports the 2012 Computerworld “Cloud Computing” study, which measured cloud computing trends among technology decision makers.

When it comes to public, private, and hybrid cloud solutions, the possibility of compromised information creates tremendous angst. Organizations expect third-party providers to manage the cloud infrastructure, but are often uneasy about granting them visibility into sensitive data.

There are complex data security challenges in the cloud:

- The need to protect confidential business, government, or regulatory data
- Cloud service models with multiple tenants sharing the same infrastructure
- Data mobility and legal issues relative to such government rules as the EU Data Privacy Directive
- Lack of standards about how cloud service providers securely recycle disk space and erase existing data
- Auditing, reporting, and compliance concerns
- Loss of visibility to key security and operational intelligence that no longer is available to feed enterprise IT security intelligence and risk management

Specific security challenges pertain to each of the three cloud service models:

Software as a Service (SaaS)
Platform as a Service (PaaS)
Infrastructure as a Service (IaaS)

- **SaaS** deploys the provider's applications running on a cloud infrastructure; it offers anywhere access, but also increases security risk. With this service model it's essential to implement policies for identity management and access control to applications. For example, with Salesforce.com, only certain salespeople may be authorized to access and download confidential customer sales information.
- **PaaS** is a shared development environment, such as Microsoft™ Windows Azure, where the consumer controls deployed applications but does not manage the underlying cloud infrastructure. This cloud service model requires strong authentication to identify users, an audit trail, and the ability to support compliance regulations and privacy mandates.
- **IaaS** lets the consumer provision processing, storage, networks, and other fundamental computing resources and controls operating systems, storage, and deployed applications. As with Amazon Elastic Compute Cloud (EC2), the consumer does not manage or control the underlying cloud infrastructure. Data security is typically a shared responsibility between the cloud service provider and the cloud consumer. Data encryption without the need to modify applications is a key requirement in this environment to remove the custodial risk of IaaS infrastructure personnel accessing sensitive data.

TECHNIQUES FOR PROTECTING DATA IN THE CLOUD

Traditional models of data protection have often focused on network-centric and perimeter security, frequently with devices such as firewalls and intrusion detection systems. But this approach does not provide sufficient protection against APTs, privileged users, or other insidious types of security attacks.

Many enterprises use database audit and protection (DAP) and Security Information and Event Management (SIEM) solutions to gather together information about what is happening. But monitoring and event correlation alone do not translate into data security.

At a time when regulation and compliance issues are at an all-time high, it's dangerous to assume that monitoring, collecting, and storing logs can protect the organization from security threats, as they are reactive controls. In today's environment, both data firewalls and data security intelligence are essential to adequately protect the enterprise from new and different types of attacks.

It's critical that CISOs implement a data security strategy that provides a veritable firewall around the data itself for comprehensive protection. Advanced data security solutions provide CISOs with an early warning system about an attack, render the content unusable, and leverage automation and big data analytics to continuously analyse logs and other information about their environment such as security events and data flow.

While many organizations have implemented encryption for data security, they often overlook inherent weaknesses in key management, access control, and monitoring of data access. If encryption keys are not sufficiently protected, they are vulnerable to theft by malicious hackers. Vulnerability also lies in the access control model; thus, if keys are appropriately protected but access is not sufficiently controlled or robust, malicious or compromised personnel can attempt to access sensitive data by assuming the identity of an authorized user.

2.1 ORIGIN AND DEFINITION OF CLOUD COMPUTING

The Internet rapidly began to grow up in the 1990s and, the progressively more complicated network infrastructure and enlarged bandwidth developed in the recent years have considerably improved the strength of various application services available to users through the Internet, hence, marking the beginning of cloud computing network services. Cloud computing services use the Internet as a communication medium and convert information technology resources into services for end-users, including software services, computing platform services, development platform services, and basic infrastructure leasing.

Primary significance of Cloud computing lies in allowing the end users to access computation resources through the Internet. The unusual features of cloud computing include the storage of user data in the cloud and the lack of any need for software installation on the client side. Provided that the user is able to connect to the Internet, all of the hardware resources in the cloud can be used as client-side infrastructure. Normally, cloud computing applications are demand-driven, providing various services according to user requirements, and service providers charge by metered time, instances of use, or

defined period. Cloud computing can be defined as "a type of parallel and distributed system which consists of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers".[1] The cloud computing concept can be understood in a more better way by following the below given figure:[1]

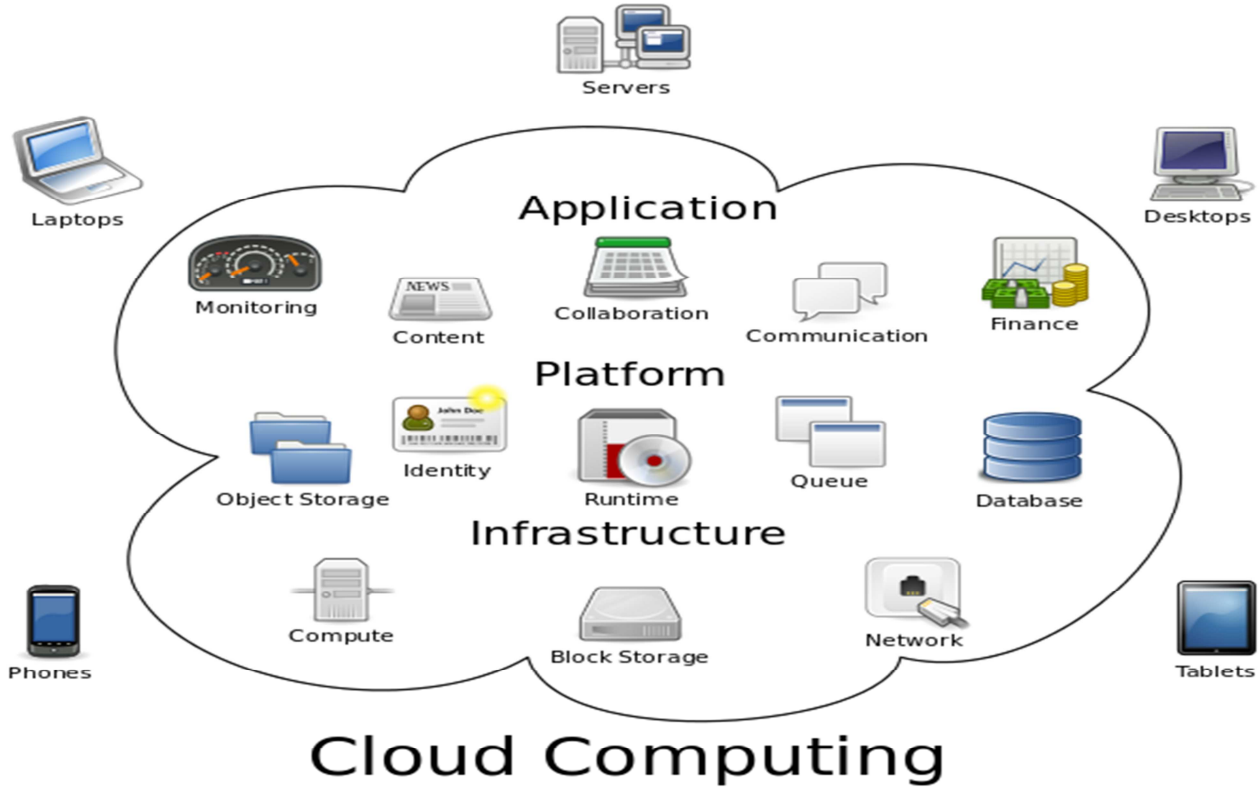


Fig. 1. Figure to represent cloud computing concept map

The architecture of cloud services can be divided into three levels: infrastructure, platform, and application software. Application software builds the user interface and shows the application system's functions. To build a cloud computing application as a service requires infrastructure, platform and application software which can be obtained from a single provider or from different service providers. If the income for cloud services mainly comes from charging for infrastructure, this business model can be referred to as Infrastructure as a Service (IaaS). If income comes mainly from charging for the platform,the business model can be referred to as Platform as a Service (PaaS). If income mainly comes from charging for applications or an operating system, the business model can be referred to as Software as a Service (SaaS). The model being proposed in this paper uses SaaS concept.

2.2 ORIGIN AND DEFINITION OF DATA MINING

Data mining is to find knowledge, and knowledge is represented through certain patterns. Association rule is the most often used method in data mining, which finds out the association between data and various objects by finding the potential dependence among data. Classification and clustering can be used to sort out things by characterizing the common significance among different things. The disadvantage of data mining in centralized database, generally have the several following points: network traffic is considered less, mining efficiency is low and the degree of spatial complexity is high. The most classic classification data mining are classification methods based on distance, classification methods based on decision tree, Bayesian classification and so on. Data mining techniques have been extensively used in various applications. However, the mistreat of these techniques may lead to the discovery of sensitive information. Researchers have recently made efforts at hiding sensitive association rules. However, undesired side effects, e.g., non-sensitive rules falsely hidden and spurious

rules falsely generated, may be formed in the rule hiding process. [5] Privacy has become an significant issue in Data Mining. Many methods have been brought out to solve this problem. The basic aspect which we are concerned about in this paper is of association rule mining which preserves the confidentiality of each database. In order to find the association rule, each participant has to share their own data. Thus, a lot of privacy information may be put out or been illegally used. [6] Data mining can be defined as "the process that attempts to discover patterns in large data sets". The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use.

The following figure explains the different steps which comprise the overall data mining process:

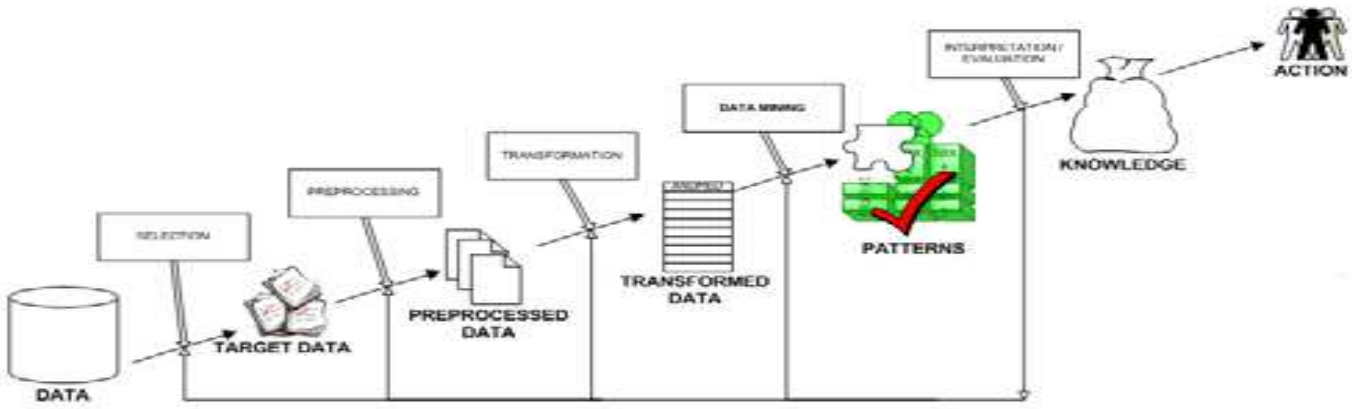


Fig. 2. Figure to represent steps in data mining process

3 PRIVACY PRESERVING DATA MINING IN CLOUD

3.1 PROTECTION FROM DATA MINING BASED ATTACK USING DISTRIBUTED CLOUD ARCHITECTURE

Data mining can be a potential threat to cloud security because of the fact that entire data belonging to a particular user is stored in a single cloud provider. The provider gets an opportunity due to a single storage provider approach to use powerful mining algorithms or tools that can extract private information of the user. Mining algorithms require a reasonable amount of data as a result of which the single provider architecture suits the purpose of the attackers. The job of attackers is also eased because of single cloud storage provider approach. These attackers have unauthorized access to the cloud and use data mining to extract information.

In this approach data is distributed multiple cloud providers so that data mining becomes a difficult job to the attackers. The key idea of this approach is to categorize user data, split data into chunks and provide these chunks to the proper cloud providers. This approach consists of categorization, fragmentation and distribution of data. The categorization of data is done according to mining sensitivity. Mining sensitivity in this context refers to the significance of information that can be leaked by mining. Categorization allows to identify sensitive data and to take proper initiatives to maintain privacy of such data. Fragmentation and distribution of data among providers reduce the amount of data to a particular provider and thus minimize the risk associated with information leakage by any provider. This distribution is done according to the sensitivity of data and the reliability of cloud providers. A cloud provider is given a particular data chunk only if the provider is reliable enough to store chunks of such sensitivity. Distribution restricts an attacker from having access to a sufficient number of chunks of data and thus prevents successful extraction of valuable information via mining. Even if an attacker manages to access required chunks, mining data from distributed sources remains a challenging job.

This distributed approach provides two major benefits first, it improves privacy by making the attacker's job complicated by increasing the number of targets and decreasing amount of data available at each target. Second, it ensures the greater availability of data.

This system consists of two major components Cloud Data Distributor and Cloud Providers[14]. The Cloud Data Distributor receives data in the form of files from clients, splits each file into chunks and distributes these chunks among cloud providers. Cloud Providers store chunks and responds to chunk requests by providing the chunks.

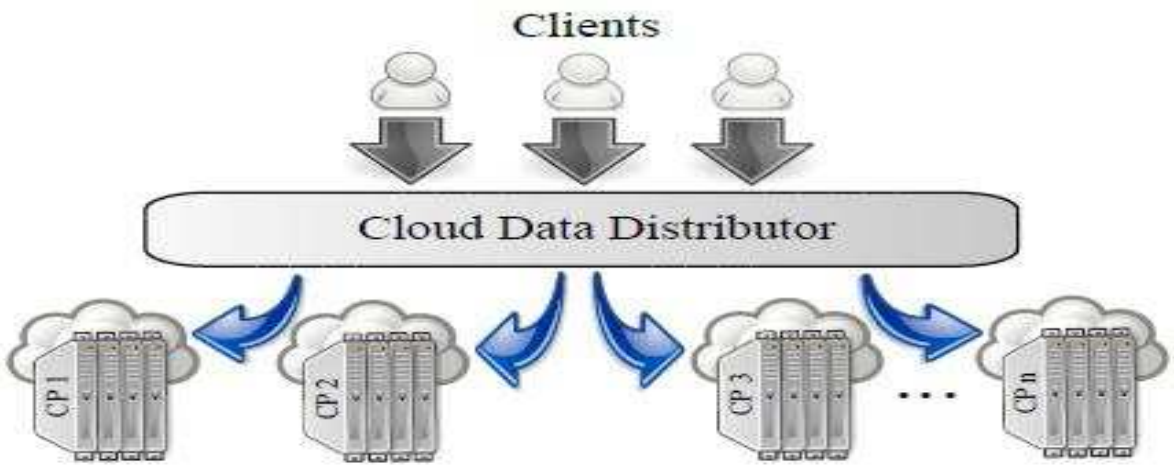


Fig. 3. System Architecture

I) CLOUD DATA DISTRIBUTOR

Cloud Data Distributor receives data (files) from clients, performs fragmentation of data (splits files into chunks) and distributes these fragments (chunks) among Cloud Providers. It also participates in data retrieving procedure by receiving chunk requests from clients and forwarding them to Cloud Providers. Clients do not interact with Cloud Providers directly rather via Cloud Data Distributor. To perform distribution and retrieval of data (chunks), the Cloud Data Distributor needs to maintain information regarding providers, clients and chunks. Hence, it maintains three types of tables describing the providers, the clients and the chunks.

II) CLOUD PROVIDERS

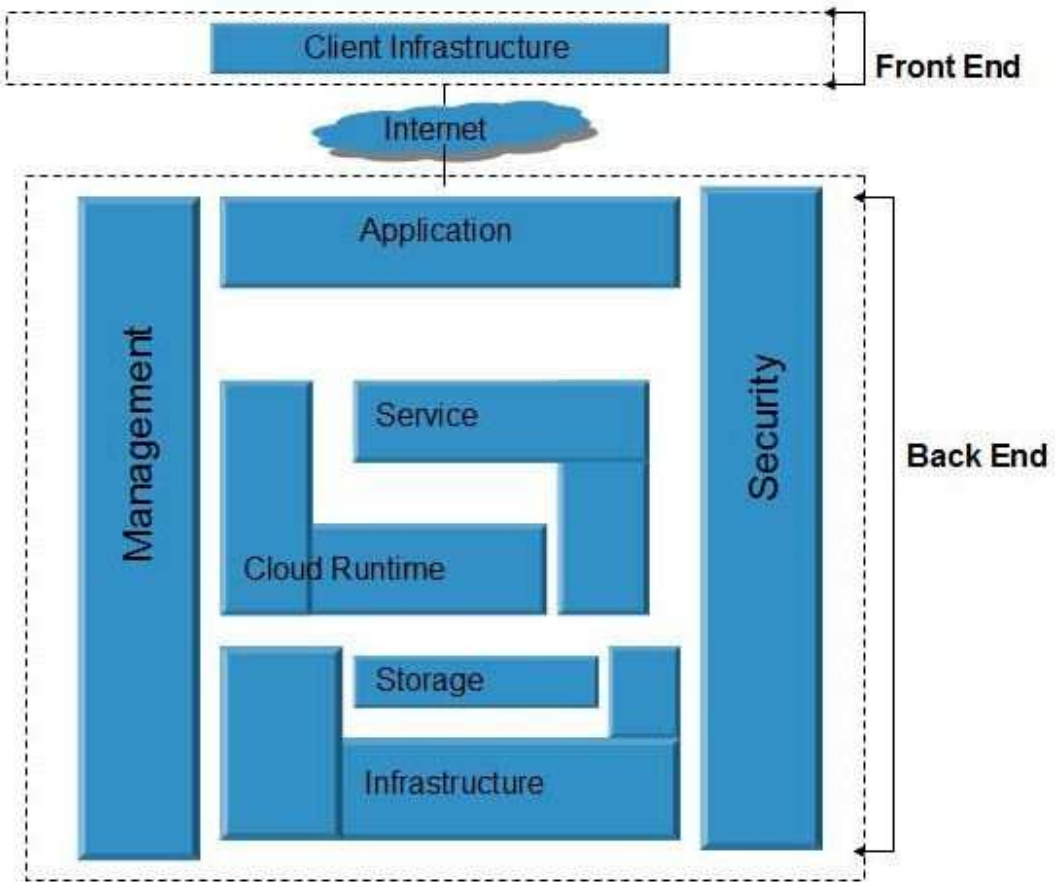
The important tasks of Cloud Providers are storing chunks of data, responding to a query by providing the desired data, and removing chunks when asked. Providers receive chunks from the distributor and store them. Each provider is considered as a separate disk storing clients' data. Certain factors such as distribution of chunks, maintaining privacy levels, reducing chunk size, addition of misleading data contributes to the effectiveness of the system.

4 CLOUD ARCHITECTURE

The Cloud Computing architecture comprises of many cloud components, each of them are loosely coupled. We can broadly divide the cloud architecture into two parts:

- Front End
- Back End

Each of the ends are connected through a network, usually via Internet. The following diagram shows the graphical view of cloud computing architecture:



FRONT END: refers to the client part of cloud computing system. It consists of interfaces and applications that are required to access the cloud computing platforms, e.g., Web Browser.

BACK END: refers to the cloud itself. It consists of all the resources required to provide cloud computing services. It comprises of huge data storage, virtual machines, security mechanism, services, deployment models, servers, etc.

5 CLOUD COMPUTING SECURITY

Security in cloud computing is a major concern. Data in cloud should be stored in encrypted form. To restrict client from direct accessing the shared data, proxy and brokerage services should be employed.

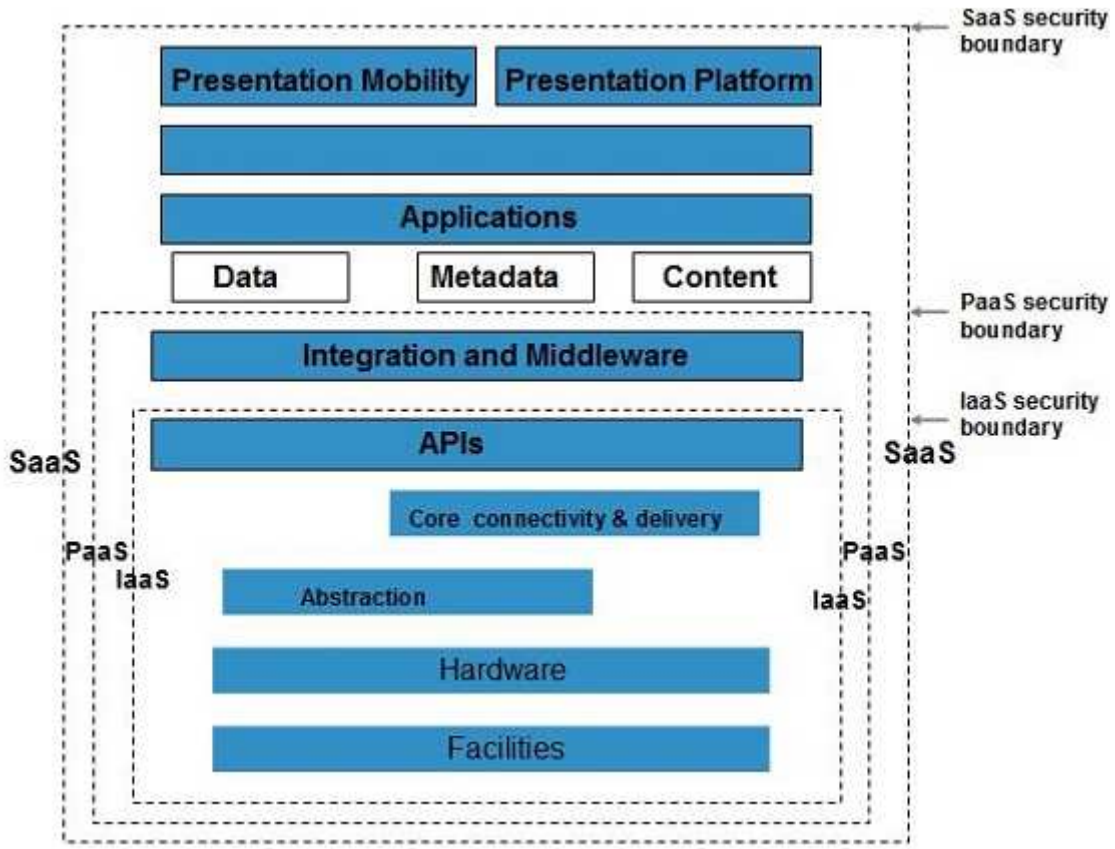
SECURITY PLANNING

Before deploying a particular resource to cloud, one should need to analyze several attributes about the resource such as:

- Select which resources he is going to move to cloud and analyze its sensitivity to risk.
- Consider cloud service models such as **IaaS, PaaS**, and **SaaS**. These models require consumer to be responsible for security at different levels of service.
- Consider which cloud type such as **public, private, community** or **hybrid**.
- Understand the cloud service provider's system that how data is transferred, where it is stored and how to move data into and out of cloud.

SECURITY BOUNDARIES

A particular service model defines the boundary between the responsibilities of service provider and consumer. **Cloud Security Alliance (CSA)** stack model defines the boundaries between each service model and shows how different functional units relate to each other. The following diagram shows the **CSA stack model:**



KEY POINTS TO CSA MODEL

- IaaS is the most basic level of service with PaaS and SaaS next two above levels of service.
- Moving upwards each of the service inherits capabilities and security concerns of the model beneath.
- IaaS provides the infrastructure, PaaS provides platform development environment and SaaS provides operating environment.
- IaaS has the least level of integrated functionalities and integrated security while SaaS has the most.
- This model describes the security boundaries at which cloud service provider's responsibility ends and the consumer's responsibilities begin.
- Any security mechanism below the security boundary must be built into the system and above should me maintained by the consumer.
- Although each service model has security mechanism but security needs also depends upon where these services are located, in private, public, hybrid or community cloud.

6 CONCLUSION

Cloud service providers as well as other third parties use different data mining techniques to acquire valuable information from user data hosted on the cloud. We have discussed the impact of data mining on a single cloud and have proposed a distributed structure to eliminate mining based privacy threat on cloud data. Finally, we also discussed a technique to secure or protect the privacy of the forecasting reports for the company. These reports could be used by companies to increase their sales. This technique protects the predictions that are generated as a result of mining and secure it from interception.

REFERENCES

[1] M .Kantardzic, "Data Mining: Concepts, Models, Methods and Algorithms", John Wiley & Sons Inc.,2002.
[2] "Introduction to Cloud Computing Architecture", Sun Microsystems, 2009.
[3] "Top 10 Algorithms in Data Mining", Springer-Verlag London Ltd.,2007.
[4] H. Abu-Libdeh, L. Princehouse and H. Westherspoon, "RACS:A Case for Cloud Storage Diversity" ACM, pp. 229–240, 2010.
[5] N. Santos, K.P. Gummadi, R. Rodrigues, "Towards Trusted Cloud Computing",USENIX,2009.
[6] G. Aggarwal, M. Bawa, R. Motwani,"A Distributed Architecture for Secure Databases", CIDR proceedings, 2005.
[7] Kevin D. Bowers, Ari Juels, Alina Oprea, "HAIL
[8] G.M. Weiss, "Data Mining in the Real World: Experiences, Challenges and Recommendation", DMIN, pages 124-130, 2009.
[9] Q. Yang, X. Wu, "Ten Challenging Problems in Data Mining Research", IJITDM, pp 597-604, 2006.
[10] R. Chow, P. Golle, M. Jakobsson, E. Shi, J. Staddon, "Controlling data in the Cloud: Outsourcing computation without outsourcing control", Proceedings of the 2009 ACM Workshop on Cloud Computing Security (CCSW 2009); pp 85-90, 2009.
[11] Jiong Xie, Shu Yin, Zhiyang Ding, "Improving Map Reduce Performance through Data Placement in Heterogeneous Clusters", proceedings in IPDPS,2010.
[12] Jianzong Wang, Zhuo Liu, Peng Wang,"Data Mining of Mass Storage Based on Cloud Computing".
[13] Himel Dev, Tanmoy Sen, Madhusudan Basak, and Mohammed Eunus Ali, "An Approach to Protect the Privacy of Cloud Data from Data Mining Based Attacks",. 2012 SC Companion: High Performance Computing, Networking Storage and Analysis.
[14] Introduction to Cloud Computing Architecture by Sun Microsystems, Inc., june 2009.
[15] Amazon Web Services: Overview of Security Processes, may 2011.
[16] H. Abu-Libdeh, L. Princehouse, and H. Weatherspoon. Racs: a case forcloud storage diversity. In ACM SoCC, pages 229–240, 2010.
[17] G. Aggarwal, M. Bawa, P. Ganesan, H. Garcia-molina, K. Kenthapadi, R. Motwani, U. Srivastava, D. Thomas, and Y. Xu. Two can keep a secret: A distributed architecture for secure database services. In InProc. CIDR, 2005.
[18] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. H. Katz, A. Konwinski, G. Lee, D. A. Patterson, A. Rabkin, I. Stoica, and M. Zaharia. Above the clouds: A berkeley view of cloud computing. Technical report, EECS Department, University of California, Berkeley, 2009.
[19] P. Asst. Prof . PSV Vachaspati. Quantum attack resistant cloud. World of Computer Science and Information Technology Journal, 1:283–288,2011.
[20] M. Bramer. Principles of Data Mining. Springer, 2007.
[21] M. Brantner, D. Florescu, D. A. Graf, D. Kossmann, and T. Kraska. Building a database on s3.In J. T.-L. Wang, editor, ACM, pages 251–264, 2008.
[22] S. H. Brown. Multiple linear regression analysis: A matrix approach with matlab. Alabama Journal of Mathematics, 2009.
[23] R. Chow, P. Golle, M. Jakobsson, E. Shi, J. Staddon, R. Masuoka, and J. Molina. Controlling data in the cloud : Outsourcing computation without outsourcing control. pages 85–90, 2009.
[24] C. Clifton and D. Marks. Security and privacy implications of datamining. In ACM SIGMOD Workshop, pages 15–19, 1996.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 273-282
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Performance Comparison of Speed Control of Chopper fed DC Motor for Various Controllers

Nagulapati Kiran, Naga Raju, and Anil Kumar

EEE Department,
Anil Neerukonda Institute of Technology and Sciences, Sangivalasa
Visakhapatnam, Andhra Pradesh, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This paper presents a comparative study of speed control of a separately excited DC motor by using different type of controllers. .Conventional controllers are commonly being used to control the speed of the DC motors in various industrial applications. It's found to be simple, robust and highly effective when the load disturbance is small. But during high load or rapid variation of load, the fuzzy technique based controllers proves to be fast and reliable. Using chopper input voltage can be varied and thus speed can be varied. For better performance of the DC motor various kind of controller namely P-I, I-P, Fuzzy logic controller are used. Proportional-Integral type controller is used to eliminate the delay and provides fast control. However, the P-I controller has some disadvantages such as: sluggish response to a sudden load change, the high starting overshoots and sensitivity to controller gains. So, the relatively new Integral Proportional (I-P) controller is proposed to overcome the disadvantages of the P-I controller .After obtaining the model of separately excited DC motor, it is simulated using MATLAB (Simulink) environment. Then fuzzy logic controller has been designed and performance has been observed. Finally a comparative study is done between all the controllers.

KEYWORDS: Chopper, P-I Controller, I-P Controller, Fuzzy Logic Controller, Speed Control, DC Motor

1 INTRODUCTION

High performance motor drives are very much essential for industrial application. Most of the industries demand variable speed operation of motor. As synchronous motor is a constant speed motor so it is used in industries which demands constant speed operation of motor. Speed of DC motor can be varied below and above the rated speed by terminal voltage control and field flux control respectively. So DC motor is used in many applications such as steel rolling mills, electric vehicles, electric trains, electric cranes and robotic manipulators require speed controller to perform its tasks smoothly. DC motors provide good control of speed for acceleration and deceleration. Speed controller of dc motors is carried out by means of voltage control in 1981 by Ward Leonard for the first time.

Because of their simplicity, reliability, and low cost DC drives have long been used in industrial applications. Compared to AC drives system DC drives are less complex .For low horsepower ratings DC drives are normally less expensive. DC motors have been used as adjustable speed machines since long and a wide range of options have evolved for this purpose. DC motors are capable of providing starting and accelerating torque 4 times the rated torque. DC motors have long been the primary means of electric traction. They are also being used for mobile equipment like quarry, golf carts, and mining applications. DC motors are portable and well fit to special applications, like industrial equipment and machineries that are not easily run from remote power sources.

DC motor is a SISO (Single Input and Single Output) system which has torque/speed characteristics compatible with most mechanical loads. This makes a DC motor controllable over a wide range of speeds by proper adjustment of the terminal voltage. The regulated voltage sources used for DC motor speed control have gained more importance after the introduction of thyristors as switching devices in power electronics .Then semiconductor components such as MOSFET, GTO and IGBT

Corresponding Author: Nagulapati Kiran

have been used as electric switching devices. As the theory of DC motor speed control is extendable to other types of motors as well, hence DC motors are always a good option for advanced control algorithm.

2 CHOPPER

2.1 PRINCIPLE OF OPERATION

A chopper is a high speed on-off switch which converts fixed DC input voltage to a variable DC output voltage. A Chopper is considered as a DC equivalent of an AC transformer as they behave in an identical manner. Choppers are more efficient as they involve one stage conversion.

Choppers are now being used all over world for rapid transit systems. These are also used in marine hoist, trolley cars, mine haulers and forklift trucks. It is predicted that in future electric automobiles will be using choppers for their speed control and braking purpose. Chopper offer high efficiency smooth control, regeneration facility and faster response. The power semiconductor devices used for a chopper circuit can be force commutated thyristor, power BJT, IGBT, GTO and MOSFET based chopper are also used. These devices are represented by a switch. When the switch is being "off", current does not flow. Current flows through the load when switch is "on". When we switch it "on" it connect the load with source and when we put it at "off" it disconnect the load from source at a very fast speed .The on-state voltage drop of power semiconductor devices is nearly 0.5V to 2.5V across them. But for the sake of simplicity, the voltage drop across these devices is considered to be zero but practically it is not zero.

As mentioned above, a chopper is considered to be DC equivalent of AC transfer. Voltage can be step up or step down by varying the duty ratio of chopper as it is done by varying the turns ration in a transformer. from the figure we can see that during the period Ton, chopper is on and hence load voltage is equal to source voltage Vs and during the period Toff, chopper is off and hence load voltage is zero. In this way, a chopped dc voltage is produced at the load terminal.

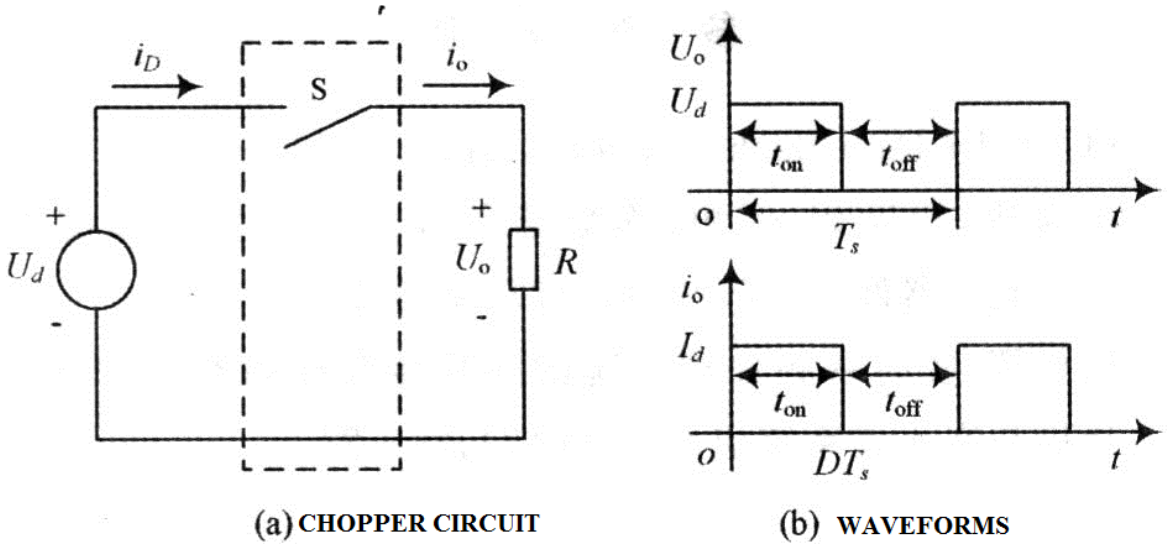


Figure 1. Chopper Circuit and its waveform

2.2 CONTROL METHODS

The average value of output voltage Vo can be controlled through changing duty cycle by opening and closing the semiconductor switch periodically. Followings are the different control strategies for varying duty cycle:

- Time Ratio Control
- Current Limit Control

2.2.1 TIME RATIO CONTROL

In this control scheme, time ratio is varied. This is done in two ways:

- Constant Frequency System

In this scheme, on-time is varied but chopping frequency f is kept constant. This is also called Pulse-width modulation scheme.

- Variable Frequency System

In this scheme, the chopping frequency f is varied and the on-time or off-time remains constant. So, duty ratio is varied either by keeping Ton constant or Toff constant.

2.2.2 CURRENT LIMIT CONTROL

In this control method, turning on and off of chopper circuit is decided by the previous set value of load current. The set values are upper limit of load current and lower limit of load current that is maximum and minimum load current. When the load current reaches the upper limit, chopper is being switched off. When the load current falls below lower limit, the chopper is being switched on. Switching frequency of chopper can be controlled by varying the maximum and minimum level of load current.

3 MODELLING OF SEPARATELY EXCITED DC MOTOR

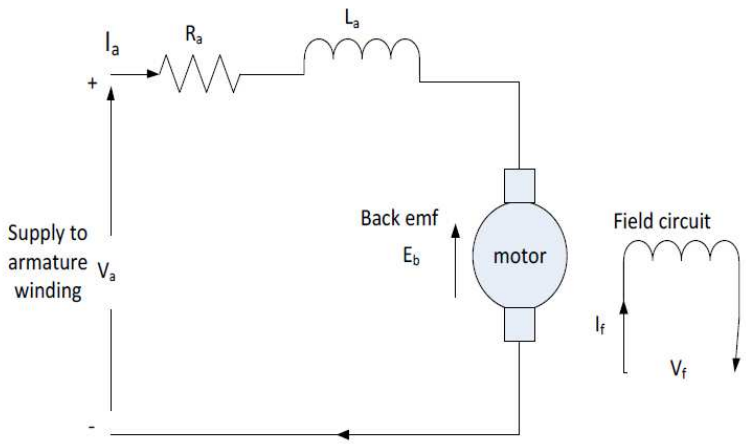


Figure 2. Separately Excited DC Motor Model

The armature equation is shown below:

$$V_a = E_b + I_a R_a + L_a(\frac{dI_a}{dt})$$

Where

V_a is armature voltage in volts.
E_b is motor back emf in volts
I_a is armature current in amps
R_a is armature resistance in ohms
T_L is load torque in Nm
T_d is torque developed in Nm
J is moment of inertia in kg/m2
B is friction coefficient of the motor
w is angular velocity in rad/sec

Taking Back EMF Constant as K_b and Electrical toque constant as K_T, Equation for back emf of motor can be written as :

$$E_b = K_b w$$

$$T_d = K_T I_a$$

From Motor's Basic Armature equation and taking Laplace Transform on both sides of equation: We get,

$$I_a(s) = (V_a - E_b)/(R_a + L_a s)$$

From Torque equation, we have

$$w(s) = (T_d - T_L)/(Js + B)$$

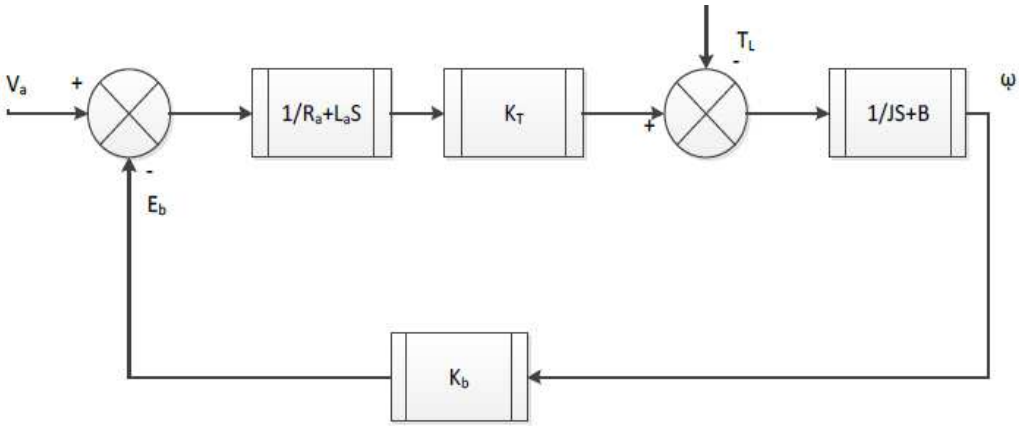


Figure 3. Block Model of Separately Excited DC Motor

4 P-I AND I-P CONTROLLERS

A comparative study of PI & IP control scheme for a dc drive has been done here. The response of both P-I and I-P the controller for a change in speed reference and load torque is discussed. A one quadrant GTO chopper is used as power conditioning unit in the experimental set up using a separately excited dc motor. Most DC motor drives are operated as closed-loop speed control system.

A simple proportional gain in the speed loop may not be sufficient to provide a precise control on the speed of drives. This may results in a high overshoot and also an undesirable steady state error in speed. Therefore some kind of compensation technique has to be employed to improve the performance of the drive. The mostly used compensation method for DC motor drive is the proportional plus integral (P-I) control.

4.1 PROPORTIONAL-INTEGRAL (P-I) CONTROLLER

The block diagram of the motor drive with the P-I controller has one outer speed loop and one inner current loop, as shown in Fig. 1. The speed error EN between the reference speed NR and the actual speed N of the motor is fed to the P-I controller, and the Kp and Ki are the proportional and integral gains of the P-I controller. The output of the P-I controller E1 acts as a current reference command to the motor, C1 is a simple proportional gain in the current loop and KCH is the gain of the GTO thyristor chopper. For analysis the electrical time constant can be neglected, since it is very small as compared to mechanical time constant of the motor.

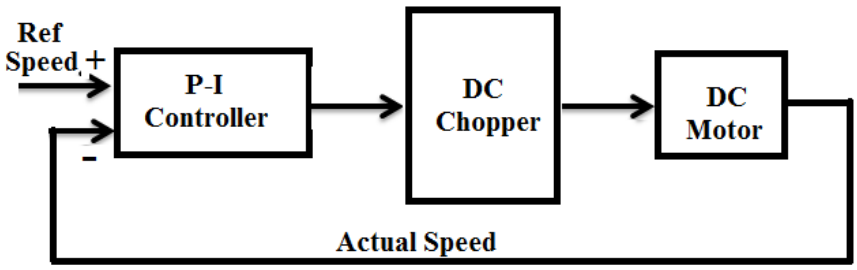


Figure 4. P-I Controller based Speed Control of Chopper fed DC Motor

4.2 INTEGRAL -PROPORTIONAL (I-P) CONTROLLER

The block diagram of motor drive with the I-P controller has the proportional term KP moved to the speed feedback path. There are three loops one speed feedback loop, one inner current loop, and one feedback loop through the proportional gain KP. The speed error EN is fed to a integrator with gain KI and the speed is feedback through a proportional gain KP.

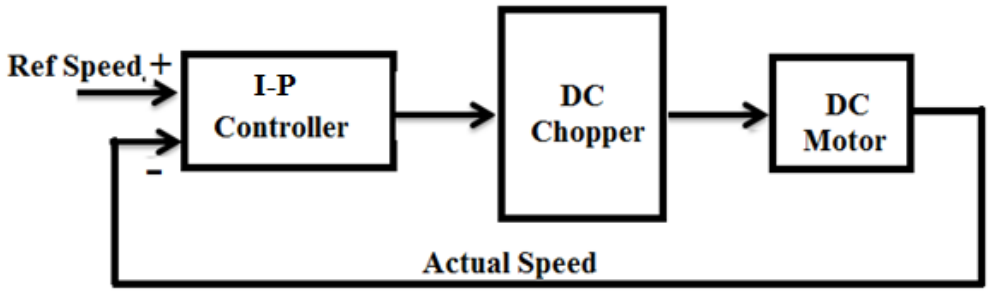


Figure 5. I-P Controller based Speed Control of Chopper fed DC Motor Comparative Analysis of Speed Response of Chopper Fed DC Motor using P-I and I-P Controller

The MATLAB/SIMULINK Model for Speed Control of Chopper fed DC Motor using P-I Controller is shown below:

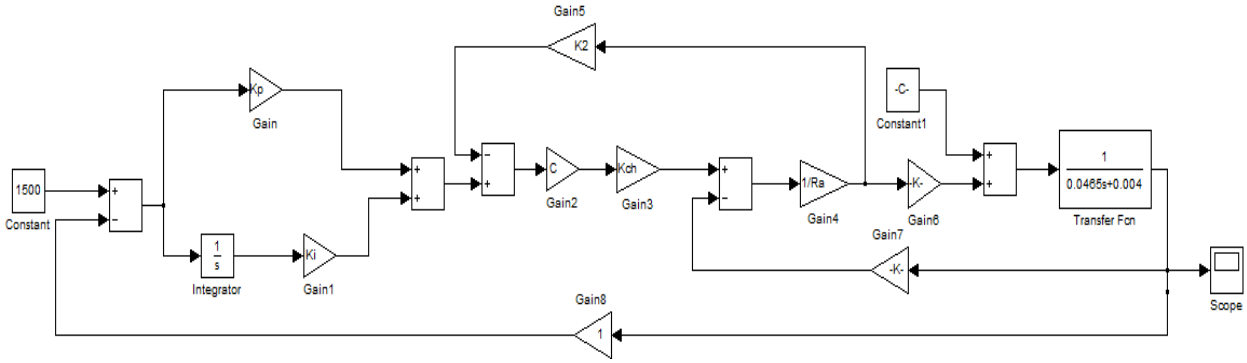


Figure 6. Simulink Model of P-I Control for Chopper fed DC Motor

The MATLAB/SIMULINK Model for Speed Control of Chopper fed DC Motor using I-P Controller is shown below:

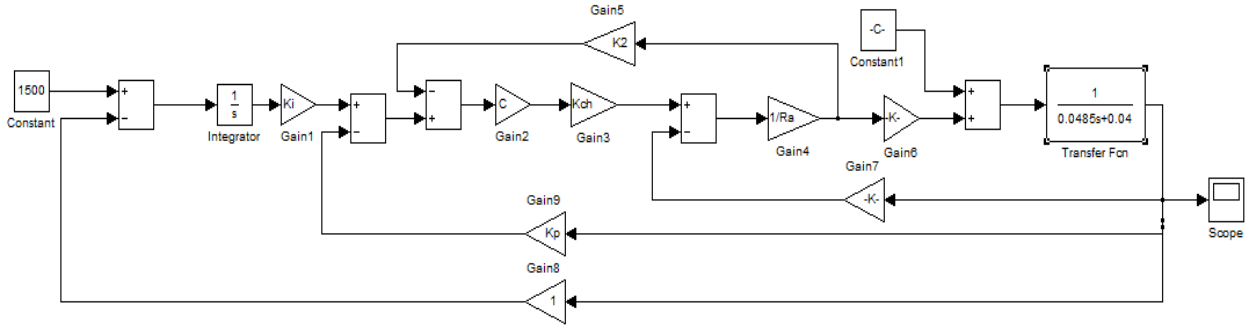


Figure 7. Simulink Model of I-P Control for Chopper fed DC Motor

In case of the P-I controller an overshoot in speed can be seen, but the I-P scheme shows Negligible overshoot. It is clear from Figs.12 that the I-P controller performs slightly better than the P-I controller. The following table shows a comparison between PI and IP controller.

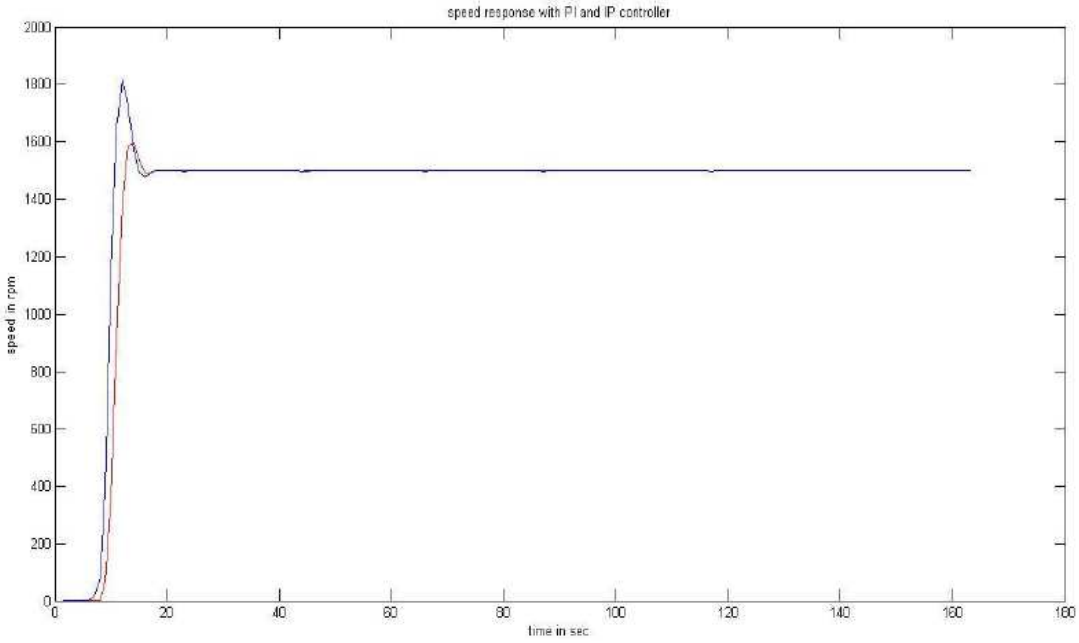


Figure 8. Comparison of Speed Response of Chopper fed DC Motor using P-I and I-P Controllers

	P-I Controller	I-P Controller
% Mp	20%	7.67%
Rise Time	10.4 sec	12 sec
Settling Time	18 sec	19 sec

5 FUZZY LOGIC CONTROLLER

Fuzzy logic control is one of the control algorithm based on a linguistic control strategy, which is being derived from expert knowledge into an automatic control strategy. Fuzzy logic control doesn't need any kind of difficult mathematical calculation like the others control system. While the others type of control system use difficult mathematical calculation to provide a model of the controlled plant, fuzzy uses only simple mathematical calculation to simulate the expert knowledge. Although it doesn't need any difficult mathematical calculation, but it give good performance in a control system. Thus, it can be one of the best available answers today for a broad class of challenging controls problems.

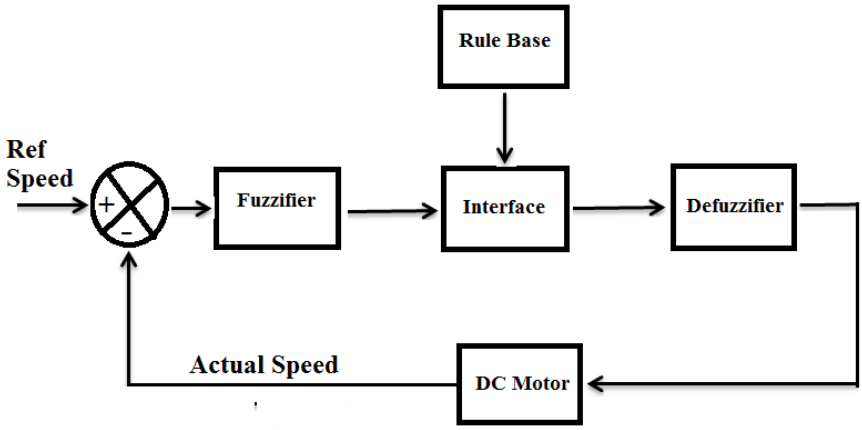


Figure 9. Block Diagram of Fuzzy Logic Controller

5.1 FUZZIFICATION MODULE

This process converts the measured inputs called crisp input, into the fuzzy linguistic values. The first step in designing a fuzzy controller is to decide which state variables represent the system dynamic performance must be taken as the input signal to the controller. Generally Fuzzy logic uses linguistic variables instead of any precise or numerical variables. The process of transforming a numerical variable (real number or crisp variables) into a linguistic variable (fuzzy number) is called Fuzzification. System variables, which are generally used as the fuzzy controller inputs includes states error, state error integral, state error derivative or etc. Here speed error and its derivative i.e change in speed error are chosen as the input signals.

5.2 RULE BASE

A collection of the expert control rules (knowledge) needed to achieve the control goal. This process will perform fuzzy logic operations and result the control action according to the fuzzy inputs.

5.3 DEFUZZIFICATION MODULE

The reverse of Fuzzification is called Defuzzification. It is the transformation of a fuzzy quantity into a precise quantity, just like fuzzification is the conversion of a precise quantity to a fuzzy quantity. The use of Fuzzy Logic Controller (FLC) produces required output in a linguistic variable (fuzzy number).As per the real world requirements, the linguistic variables should to be transformed to a crisp output.

5.4 MEMBERSHIP FUNCTION

The most important things in fuzzy logic control system designs are the process design of membership functions for inputs and outputs and design of fuzzy if-then rule knowledge base. A membership function is a graphical representation of the magnitude of participation of each input. There can be different memberships functions associated with each input and output response. In this study, we used the triangular membership function for input and output variables. The quality of control which can be achieved using fuzzy controller is determined by the number of membership function .With increase in the number of membership function, the quality of control improves. When the number of linguistic variables increases, the

computational time and required memory also increases. Therefore, a compromise has to be considered between the quality of control and computational time to choose the number of linguistic variables. For the speed control of DC motor study, seven linguistic variables for each of the input and output variables are used to describe them.

5.5 FUZZY RULE BASE FOR SPEED CONTROL OF DC MOTOR

e / ce	NB	NM	NS	Z	PS	PM	PB
NB	NB	NB	NB	NB	NM	NS	Z
NM	NB	NB	NB	NM	NS	Z	PS
NS	NB	NB	NM	NS	Z	PS	PM
Z	NB	NM	NS	Z	PS	PM	PB
PS	NM	NS	Z	PS	PM	PB	PB
PM	NS	Z	PS	PM	PB	PB	PB
PB	Z	PS	PM	PB	PB	PB	PB

Figure 10. Fuzzy Rules Table

6 SIMULINK MODEL OF SPEED RESPONSE OF CHOPPER FED DC MOTOR USING FUZZY CONTROLLER

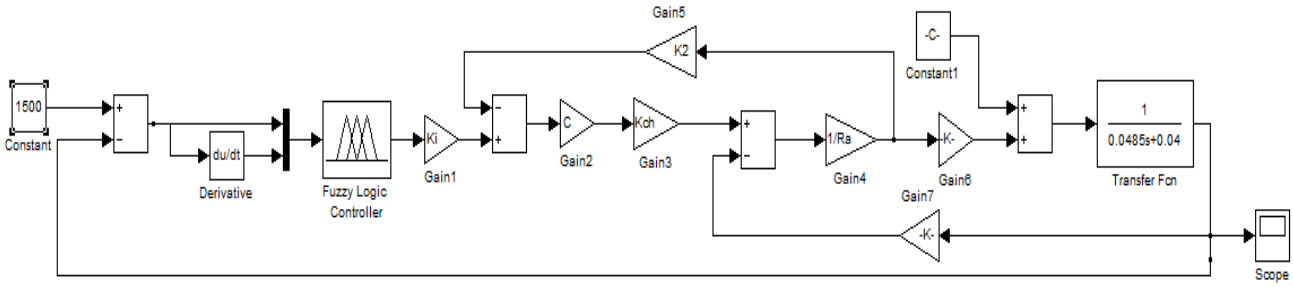


Figure 11. Simulink Model of FLC Control for Chopper fed DC Motor

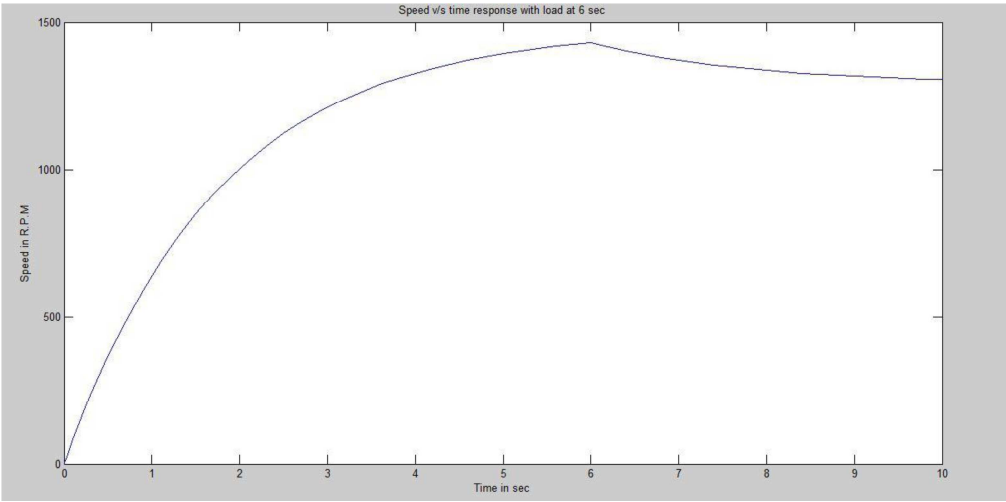


Figure 12. Speed Response of Chopper fed DC Motor using Fuzzy Logic Controller

	P-I Controller	I-P Controller	Fuzzy Logic Controller
% Mp	20%	7.67%	0%
Rise Time	10.4 sec	12 sec	3.9 sec
Settling Time	18 sec	19 sec	4.5 sec

The performance of fuzzy controllers is compared by setting the reference speed to 1500 rpm from the initial condition. The results are shown in Figs. The performance of fuzzy controller is also tested by applying a large step change in load at time 6 sec. The system response for the above case is shown in Figs. In fuzzy control system we have smooth control with less overshoot and no oscillations than P-I and I-P controllers. It is observed that I-P controller provides more advantages over the traditional P-I controller such as limiting the overshoot in speed, thus the overshoot in starting current can be reduced.

7 CONCLUSION

A comparison has been done between the performance of P-I and I-P controller for dc motor control by setting the reference speed to 1500 rpm. The response is shown in Figs.12. It is clear from Figs.12 that the I-P controller performs slightly better than the P-I controller. The speed of a separately excited DC Motor has been successfully controlled by using fuzzy logic controller technique. The performance of fuzzy controller is compared by setting the reference speed to 1500 rpm from the initial condition. It has been found that fuzzy logic controller performs in a better way than the other conventional controllers with less overshoot and no oscillations. Graph for the speed response of separately excited DC Motor using fuzzy logic controller is compare with graph for the speed response of separately excited DC Motor without fuzzy logic controller.

REFERENCES

[1] M. I. Jahmeerbacus, M. K. Oolun, C. Bhurtun and K. M. S. Soyjaudah, "Speed-Sensor less Control of converter-fed Dc Motor", *In Africon.IEEE'99*, pp.453-456, 1999.

[2] J. Nie, and T.H. Lee, (1997). Self-organizing rule-base control of multivariable nonlinear servomechanisms, *Fuzzy set and systems* 91: 285-304.

[3] D.A. Likens and S.B. Hasnain. "Self-organizing Adaptive Fuzzy Controller." *Fuzzzy set and systems*, Vol. 80,1996, pp. 295-313.

[4] G .K Dubey, Fundamentals of Electrical Drives. New Delhi, Narosa Publishing House, 2009.

[5] Li-Xim Wang. A Course in Fuzzy System and Control. Prentice-Hall International, Inc. 1997.

[6] E. H. Mamdani "*Applications of Fuzzy Algorithm for simple Dynamic Plant*." Proceeding IEEE., Vol.121, No.12, 1974. pp. 1585-1588.

[7] P.K. Nandam, and P.C. Sen, "*A comparative study of proportional integral (P-I) and integral-proportional (I-P) controllers for dc motor drives*," Int. Jour. of Control, Vol. 44, pp. 283-297, 1986.
[8] Gilberto C.D. Sousa, and Bimal K. Bose, "A fuzzy set theory based control of phase- controlled converter dc machine drive", IEEE Trans. Industry Applications,Vol. 30, No.1, pp. 34-43, 1994.
[9] Zadeh, L. A. et al. 1996 *Fuzzy Sets, Fuzzy Logic, Fuzzy Systems*, World Scientific Press, ISBN 9810224214.
[10] Yodyium Tipsuwan and Mo-Yuen Chow, "*Fuzzy Logic microcontroller implementation for DC motor speed control*", IEEE Transactions on Power Electronics, V0l.11, No.3, June 1999, pp 1271-1276.
[11] V.S.C. Raviraj and P.C. Sen, "*Comparative Study of Proportional- Integral, Sliding Mode, and Fuzzy Logic Controllers for Power Converters*", IEEE Trans. on Industry Application, vol.33, no. 2, Mar/Apr 1997 pp.518- 524.
[12] Chinnaiyan V. Kumar, Jerome Joritha, Karpagam, J. S.Sheikh Mohammed, Design and Implementation of High Power DC-DC converter and speed control of dc motor using TMS 320F240DSP, Proceedings of India International Conference on Power Electronics, 2006.
[13] B.K Bose., Power electronics and motor drives recent technology advances, Proceedings of the IEEE International Symposium on Industrial Electronics, IEEE, 2002, pp 22-25.
[14] Saffet Ayasun, Gultekin Karbeyaz, DC motor speed control methods using MATLAB/SIMULINK and their integration into undergraduate courses, 2008.
[15] Chuen Chien Lee, "Fuzzy *logic in control systems: Fuzzy logic controller*- part I", IEEE trans. on system, man and cybernetics vol 20, No. 2, mar/ apr 1990.
[16] The Math works Inc.,MATLAB/Simpower System demos/ Chppper-fed DC motor Drive.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 283-290
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Epidémiologie et résistance aux antibiotiques des isolats de *Pseudomonas aeruginosa* dans un hôpital pédiatrique marocain: implications thérapeutiques

[Epidemiology and antimicrobial resistance of *Pseudomonas aeruginosa* isolates in a Moroccan pediatric hospital: therapeutic guidelines]

Mehdi Chinbo[1], Mariame Moutachakkir[1], Amal Addebbous[1], Noureddine El Khoudri[2], Laila Chabaa[1], and Nabila Soraa[1]

[1]Laboratoire de microbiologie, Hôpital Mère enfant,
CHU Mohammed VI, Université Cadi AYYAD, Marrakech, Maroc

[2]Laboratoire d'écologie humaine, Faculté des sciences Semlalia,
Université Cadi AYAAD, Marrakech, Maroc

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: *Pseudomonas aeruginosa* infections in pediatric units are redoubted because of their high level of morbidity and mortality and the increased risk of therapeutic failure. Our aim was to access the profile of antibiotic resistance among *P. aeruginosa* isolats and guide the choice of an adapted antibiotic therapy against *P. aeruginosa* pediatric infections. A descriptive study has been conducted over a period of 4 years at the Mother - Child department of the University Hospital of Marrakech (Morocco). 168 stains of *P. aeruginosa* were isolated. *P. aeruginosa* infections were frequently occurred on an immunosuppression context. Specimens were dominated by pus (29.7%). *P. aeruginosa* bacteremia represented 20.8%. Multidrug-resistant *P. aeruginosa* stains (MDR) has represented 25.6% of all isolates. The highest rate of multidrug resistance has concerned pediatric and neonatal intensive care units (66.1%). The most active antibiotics were amikacin, imipenem, and ciprofloxacin. The cephalosporinase phenotype conferring resistance to ceftazidime was involved in 15 % of the strains. The imipenemase phenotype conferring resistance to all beta-lactams has concerned 4.7% of isolates. The antibiotic combinations piperacillin/tazobactam-amikacin has been chosen as an empirical antibiotic therapy against invasive *P. aeruginosa* infections in pediatric units. This study showed a high frequency of multidrug resistant *P. aeruginosa* in pediatric intensive care units. Monitoring of local epidemiology and antibiotic resistance of *P. aeruginosa* is fundamental to guide the clinicians to choose an appropriate antibiotic therapy.

KEYWORDS: *Pseudomonas aeruginosa*, pediatric unit, multidrug resistance, antibiotics.

RESUME: Les infections à *Pseudomonas aeruginosa* en milieu pédiatrique sont redoutables du fait de leur morbi-mortalité élevée et le risque accru d´impasse thérapeutique. L´objectif de l´étude est de déterminer le profil de résistance aux antibiotiques des isolats de *P. aeruginosa* et guider le choix d´une association antibiotique adaptée pour le traitement des infections à *P. aeruginosa* chez l´enfant. Une étude descriptive a été menée sur une période de 4 ans au niveau du Pôle Mère- Enfant du CHU de Marrakech (Maroc). 168 souches de *P. aeruginosa* ont été isolées. Les infections à *P. aeruginosa* surviennent principalement sur un terrain d´immunodépression. Les sites d'isolement étaient dominés par les pus (29,7%), suivis des bactériémies (20,8%). Les souches multirésistantes (PAMR) ont représenté 25,6% de l´ensemble des isolats. Les taux de multirésistance les plus élevés ont concerné les services de réanimation pédiatrique et néonatale (66,1%). Les antibiotiques restant actifs étaient l´amikacine, l´imipenème, et la ciprofloxacine. Le phénotype céphalosporinase conférant la résistance à la céftazidime a concerné 15% des souches. Le phénotype imipenèmase conférant la résistance à l´ensemble des Bêtalactamines a concerné 4,7% des souches. L´association pipéracilline/tazobactam-amikacine a été retenue pour une antibiothérapie probabiliste visant les infections invasives à *P. aeruginosa* chez l´enfant. Ce travail rapporte une fréquence

Corresponding Author: Mehdi Chinbo

élevée des souches de *P. aeruginosa* multi résistants en milieu de soins intensifs pédiatriques. La surveillance étroite de l´épidémiologie locale et de l´état des résistances aux antibiotiques du *P. aeruginosa* est fondamentale pour guider le clinicien vers le choix d´une antibiothérapie appropriée.

MOTS-CLEFS: *Pseudomonas aeruginosa*, pédiatrie, multirésistance, antibiotiques.

1 INTRODUCTION

Pseudomonas aeruginosa est un bacille gram négatif opportuniste fréquemment incriminé dans les infections nosocomiales chez les enfants immunodéprimés ou en soins intensifs [1]. Grâce à sa capacité à persister dans les milieux hospitaliers, ses résistances naturelles et son pouvoir d´acquisition de multiples mécanismes de résistance aux antibiotiques (bêtalactamases, pompe à efflux, imperméabilité membranaire) [2], *P. aeruginosa* représente un problème majeur en milieu hospitalier. Il est responsable d´une morbi-mortalité infantile élevée avec un risque d'échec et d´impasse thérapeutique. Au cours des deux dernières décennies, l´augmentation de la prévalence des infections à *P. aeruginosa* multirésistants (PAMR) a été rapportée par plusieurs centres hospitaliers à travers le monde [3,4]. En l´absence de nouvelles thérapeutiques efficaces contre ce germe dans un futur proche, la surveillance périodique de l´épidémiologie locale et de l´état de résistance aux antibiotiques est fondamentale pour guider le choix d´une antibiothérapie probabiliste appropriée [5]. Les difficultés liées à la gestion d´une antibiothérapie chez l´enfant hospitalisé pour infection à PAMR, ainsi que l´absence d´études locales traitant ce sujet a motivé la réalisation de cette étude dans un hôpital pédiatrique marocain afin d´adopter des recommandations thérapeutiques pratiques.

2 PATIENTS ET MÉTHODES

2.1 ISOLATS

Une étude descriptive incluant 168 isolats non répétitifs de *P. aeruginosa* a été réalisée à partir des données du laboratoire de microbiologie sur une période de 4 ans entre Janvier 2010 et Décembre 2013. Ce travail a été fait au Pôle Mère-Enfant du centre hospitalier universitaire de Marrakech, structure hospitalière tertiaire dotée d´une capacité litière de 246 lits d'hospitalisation fonctionnels réparties sur 4 services pédiatriques : réanimation pédiatrique, néonatologie, pédiatrie, chirurgie pédiatrique. Tous les enfants dont l´âge était ≤15 ans ont été inclus dans l´étude. L´identification du *P. aeruginosa* a été réalisée sur la base de l´aspect des colonies et leur pigmentation sur les milieux de culture, le test à la cytochrome oxydase positif ainsi que les galeries biochimiques d´identification API NE (Biomérieux).

2.2 ETUDE DE LA SENSIBILITE AUX ANTIBIOTIQUES

L´antibiogramme a été déterminé par la méthode de diffusion des disques d´antibiotiques sur milieu gélosé Müller-Hinton, et l´interprétation a été faite selon les normes du comité de l´antibiogramme de la société française de microbiologie (CA-SFM). L´antibiogramme standard a concerné la liste des antibiotiques recommandée par le CA-SFM: pénicillines (ticarcilline, pipéracilline), inhibiteur de Bêtalactamases (pipéracilline/tazobactam), céphalosporines de troisième génération (céftazidime), monobactams (aztréonam), carbapenèmes (imipenème), aminosides (amikacine, tobramycine, gentamycine), fluoroquinolones (ciprofloxacine) et polymixines E (colistine). Une souche de *P. aeruginosa* est dite sauvage lorsqu'elle exprime uniquement ses résistances naturelles. Le *P. aeruginosa* peut acquérir des résistances envers la famille des pénicillines, des céphalosporines ou des carbapenèmes. Le (Tableau I) rappelle les différents phénotypes de résistance du *P. aeruginosa* aux Bêtalactamines. Une souche de *P. aeruginosa* est dite multirésistante (PAMR) lorsqu'elle résiste à plusieurs familles d'antibiotiques incluant la céftazidime et/ou l´imipenème.

Tableau I : Phénotypes de résistance du Pseudomonas aeruginosa aux Bêtalactamines

Phénotypes de résistance	Classes des Bêtalactamines				
	Pénicillines		Céphalosporines		Carbapenèmes
	ticarcilline	pipéracilline	aztréonam	céftazidime	imipenème
Phénotype 1 sauvage	S	S	S	S	S
Phénotype 2 pénicillinase	R	R	S	S	S
Phénotype 3 imperméabilité	R	S	R	S	S
Phénotype 4 pénicillinase +imperméabilité	R	R	R	S	S
Phénotype 5 céphalosporinase de haut niveau	R	R	R	R	S
Phénotype 6 imperméabilité sélective	S	S	S	S	R
Phénotype 7 imipenèmase	R	R	R	R	R

2.3 ANALYSE STATISTIQUE

L'analyse statistique et la saisie des données a été réalisée par le logiciel SPSS version 17. Le test de Khi-deux et le test exact de Fisher ont été utilisés pour établir la corrélation entre le taux des PAMR et i) le type de prélèvements et ii) le type de service. Dans tous les cas, une valeur P <0,05 a été considérée comme significative. Des courbes ROC (Receiver Operating Characteristic) avec mesure de la zone sous la courbe (ZSC) ont été établis pour choisir l´association antibiotique la plus appropriée pour le traitement des infections à *P. aeruginosa* dans notre contexte. Les associations pipéracilline/tazabactam-amikacine, céftazidime-amikacine et ciprofloxacine-amikacine ont été comparées avec l´association référence imipenème-amikacine. Une ZSC se rapprochant de 1 témoigne d´une sensibilité élevée de l´association antibiotique en question.

3 RÉSULTATS

Durant cette période, 168 souches de *P. aeruginosa* ont été identifiées. Les services de réanimation pédiatrique et néonatale ont représenté 43,4% de l´ensemble des isolats en milieu pédiatrique suivi par les services de pédiatrie (31%) et de la chirurgie infantile (19,5%) (Tableau II). L´âge des enfants était compris entre 2 jours et 15 ans avec un sexe ratio M/F de 0,7. Au niveau du service de pédiatrie, l´infection à *P. aeruginosa* est survenue sur un terrain d´insuffisance rénale chronique terminale (4 cas) suivie des leucémies aigues et lymphomes (5 cas), un cas d´aplasie médullaire post chimiothérapie a été retrouvé. Au niveau des services de réanimation pédiatrique et néonatale, l´infection à *P. aeruginosa* s´est particulièrement greffée sur un terrain de pathologie respiratoire (2 cas), de pathologie digestive et dénutrition (7 cas), de traumatisme (3 cas) ou de prématurité (2 cas). Les souches de *P. aeruginosa* ont été isolées principalement des pus de péritonites appendiculaires en chirurgie pédiatrique. En réanimation pédiatrique et néonatale, ces germes ont été retrouvés essentiellement dans les hémocultures, les cathéters et les prélèvements respiratoires (Tableau II). L´amikacine était l´antibiotique le plus actif (6% de résistance) suivie par l´imipenème (11%) et la ciprofloxacine (13%) (Figure 1). La résistance à la céftazidime était de 15% et touchait essentiellement les services de réanimation pédiatrique. La résistance aux Bêtalactamines par production d'une imipenèmase a été retrouvée chez 4,7% des souches (Tableau III). Aucun cas de résistance à la colistine n´a été enregistré.

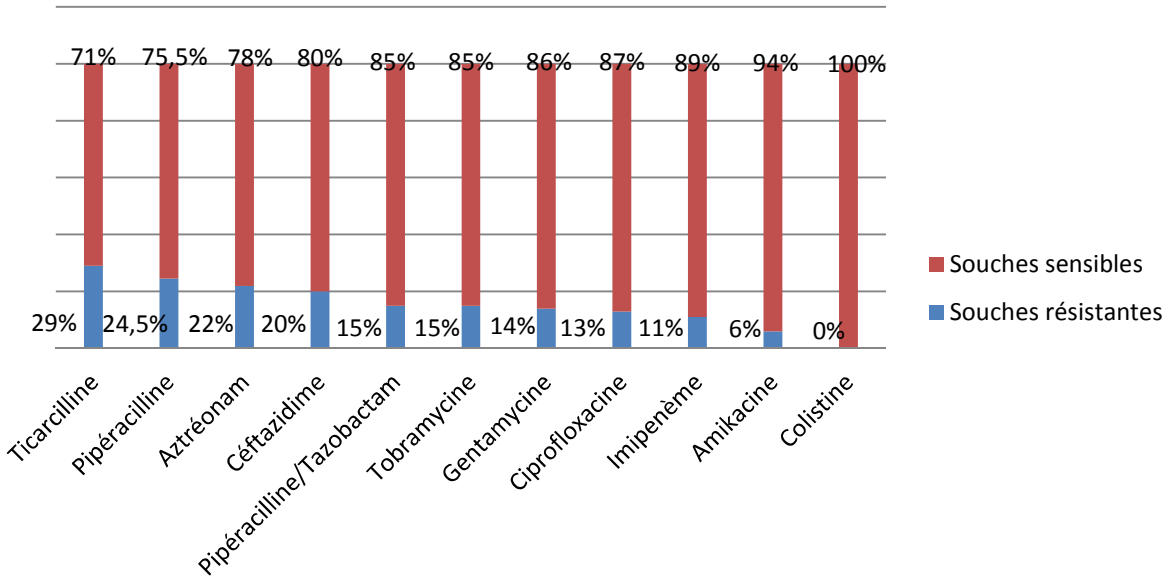


Figure 1 : Taux de résistance du Pseudomonas aeruginosa aux antibiotiques sur 4 ans en milieu pédiatrique à Marrakech

Le PAMR a représenté 25,6% de l´ensemble des souches isolées touchant les services de réanimation pédiatrique et néonatale (67,4%) et isolées principalement des hémocultures et des cathéters. La répartition des PAMR en fonction des services pédiatriques et des sites de prélèvement n´était pas significative ($P > 0,05$) (Tableau IV). A partir des courbes ROC (Figure 2), l´association amikacine - pipéracilline/tazobactam était l'association la plus sensible, suivie de l´association ciprofloxacine-amikacine et de l´association céftazidime-amikacine.

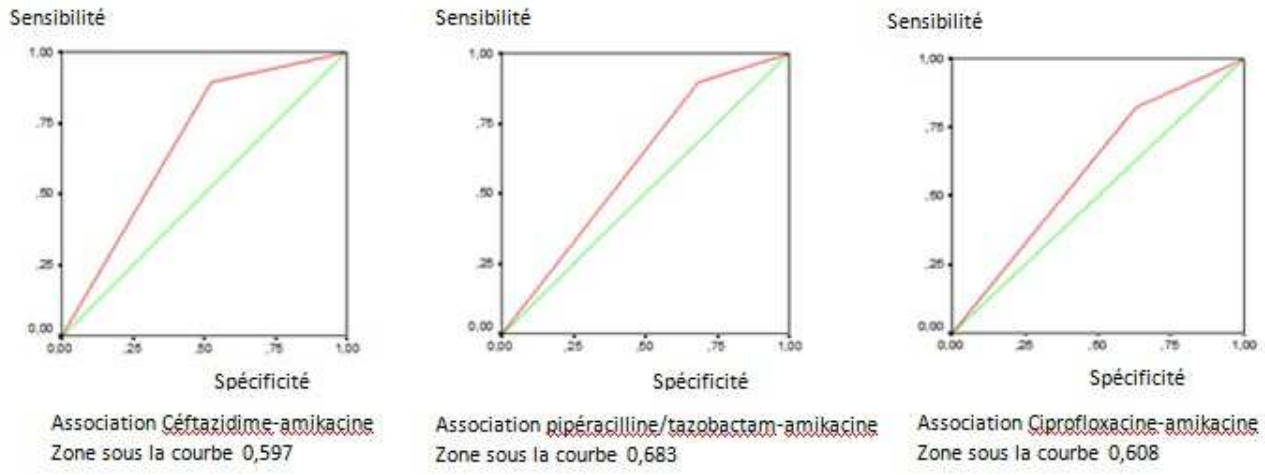


Figure 2 : Taux de sensibilité des associations antibiotiques contre le Pseudomonas aeruginosa en fonction de la zone sous la courbe

Tableau II : Répartition des isolats de Pseudomonas aeruginosa en fonction des services pédiatriques et des types de prélèvements sur 4 ans en milieu pédiatrique à Marrakech

	Nombre des isolats par services pédiatriques					
Types de prélèvements	Pédiatrie n=52 (%)	Réanimation pédiatrique n=45 (%)	Chirurgie pédiatrique n=33 (%)	Réanimation néonatologie n=28 (%)	Onco/hématologie pédiatrique n=10 (%)	TOTAL n=168 (%)
Pus	15(8,9)	3 (1,8)	29 (17,2)	3 (1,8)	-	50 (29,7)
Hémoculture	8 (4,7)	13 (7,7)	-	10 (5,9)	4 (2,4)	35 (20,8)
Urines	22 (13,0)	3 (1,8)	1 (0,6)	-	6 (3,6)	32 (19,0)
Cathéters	1 (0,6)	13 (7,7)		14 (8,3)		28 (16,7)
Prélèvement distal protégé	2 (1,2)	8 (4,7)	-	-	-	10 (5,9)
Liquide d´aspiration bronchique	1 (0,6)	4 (2,4)	1 (0,6)	1 (0,6)	-	7 (4,2)
Liquide péritonéal	-	1 (0,6)	2 (1,2)	-	-	3 (1,8)
Expectoration	2 (1,2)	-	-	-	-	2 (1,2)
Coproculture	1 (0,6)	-	-	-	-	1 (0,6)

Tableau III : Phénotypes de résistance du Pseudomonas aeruginosa aux Bêtalactamines 4 ans en milieu pédiatrique à Marrakech

Résistances	Aucune	TIC PIP	AZT	TIC PIP AZT	CTZ	IMP	Toutes Les Bêtalactamines
Réanimation pédiatrique n=45 (%)	21 (46,6)	2 (4,4)	3 (6,7)	1 (2,2)	11 (24,4)	1 (2,2)	6 (13,3)
Réanimation néonatale n=28	11 (39,2)	3 (10,7)	2 (7,1)	1 (2,4)	7 (16,6)	4 (9,5)	0 (0)
Pédiatrie n=52 (%)	35 (67,3)	6 (14,2)	1 (2,0)	1 (2,0)	4 (7,7)	3 (5,7)	2 (2,0)
Chirurgie pédiatrique n=33 (%)	27 (81,8)	2 (6,0)	0 (0,0)	0 (0,0)	2 (6,0)	2 (6,0)	0 (0,0)
Onco/ hématologie pédiatrique n=10 (%)	8 (80)	0 (0)	1 (10)	0 (0)	1 (10)	0 (0)	0 (0)

TIC: ticarcilline ; PIP: pipéracilline ; AZT: aztréonam ; CTZ: céftazidime ; IMP: imipenème

Tableau IV : Répartition des isolats de Pseudomonas aeruginosa sauvages et multirésistants sur 4 ans en milieu pédiatrique à Marrakech

	Total n=168 (%)	*P. aeruginosa* sensible à la céftazidime n=125 (%)	PAMR* n=43 (%)	*Khi-deux*	*P*
Age					
<1 mois	28 (16,7)	17 (60,8)	11 (39,2)		
1 mois-5 an	64 (38,0)	49 (76,6)	15 (23,4)	3. 32	0,189
5-15 ans	76 (45,3)	59 (77,6)	17 (22,4)		
Sexe					
-Masculin	68 (40,5)	49 (39,2)	19 (44,2)	0,56	
-Féminin	100 (59,5)	76 (60,8)	24 (55,8)		
Service					
-Réanimation pédiatrique et néonatale	73 (43,4)	44 (35,2)	29 (67,4)	2,03 ***	0,36
-Pédiatrie médecine	62 (37,0)	53 (42,4)	9 (21,0)		
-Chirurgie pédiatrique	33 (19,6)	28 (22,4)	5 (11,6)		
Type de prélèvement					
-Hémoculture	35 (20,8)	22 (17,6)	13 (30,2)	1,79 ***	0,77
-Cathéters	28 (16,7)	16 (12,8)	12 (28,0)		
-Pus	50 (29,8)	42 (33,6)	8 (18,6)		
-Prélèvements respiratoires**	19 (11,3)	14 (11,2)	5 (11,6)		
-Autres liquides biologiques	36 (21,4)	31 (24,8)	5 (11,6)		

** Pseudomonas aeruginosa Multi-Résistant*

*** Prélèvements respiratoires : prélèvement distal protégé, liquide d'aspiration bronchique, expectoration.*

**** test exact de Fisher*

4 DISCUSSION

Pseudomonas aeruginosa est un germe fréquemment incriminé dans les infections nosocomiales en unités de soins intensifs et chez des patients en état d´immunodépression [6]. L´évolution dramatique de la résistance aux antibiotiques se heurte à l´absence de découverte de nouvelles thérapeutiques antipseudomonales, et impose dès lors une surveillance rigoureuse de l´épidémiologie locale et de l´état des résistances actuelles pour adapter l´usage des antibiotiques à notre contexte. Cette étude a rapporté, à l´instar de certains travaux [7], une certaine prédilection des infections à *P. aeruginosa* chez les enfants atteints de cancers hématologiques (leucémies aigües lymphoblastiques et myéloblastiques), de pathologies rénales (insuffisance rénale chronique terminale) ou de pathologies digestives et malnutrition. Le déclin de la réponse immunitaire associé à la neutropénie serait à l´origine des infections opportunistes à *P. aeruginosa*. Tous comme l´adulte [8], les services de réanimation sont les plus concernés par les infections à ce germe et totalisent 43,4% de l´ensemble des isolats. Les prélèvements de pus ont occupé le premier rang 29,5% et provenaient principalement du service de chirurgie pédiatrique certes, mais le taux important d´hémoculture positive à *P. aeruginosa* (20,8%) a fait toute la particularité de cette étude contrairement aux diverses études menées qui avaient plutôt tendance à isoler le germe principalement sur les prélèvements respiratoires [9]. A noter que 65,7% de l´ensemble des bactériémies à *P. aeruginosa* ont été retrouvées au service de réanimation pédiatrique. Ceci s´explique par l´hospitalisation prolongée, la transmission manuportée [10], l´utilisation importante d´antibiotiques en milieux de réanimation de façon prolongée [11] qui sélectionne les mutants résistants à partir d'une souche sauvage ou peu résistante préalablement acquise présente dans la flore endogène. L´usage de dispositifs invasifs qui constituent une porte d´entrée du germe est aussi un facteur de risque, en témoigne les taux élevés des isolats de *P. aeruginosa* sur les cathéters, les liquides d´aspiration bronchique et les prélèvements distaux protégés sur ventilation mécanique en provenance du dit service [12]. Le taux de multirésistance enregistré sur les prélèvements des cathéters s´explique par la production de biofilm par le *P. aeruginosa* autours des dispositifs biomédicaux et qui lui procure une résistance aux antibiotiques administrés par voie parentérale. La sensibilité du *P. aeruginosa* aux différents antibiotiques est très hétérogène et connait une variabilité importante à la fois en intra-hospitalier (services du même hôpital) et en inter-hospitalier (hôpitaux d´une ville/pays donné) [13]. Les auteurs expliquent cela par la diversité de l´écologie locale du *P. aeruginosa* ainsi que par la différence des habitudes et des protocoles thérapeutiques au sein des structures hospitalières. L´analyse des résultats de la sensibilité du *P. aeruginosa* aux Bêtalactamines concernera principalement la sensibilité du PAMR à l´imipenème et la céftazidime, puisque les souches non multirésistantes ou sauvages restent toujours sensibles à ces deux molécules et ne posent pas de problèmes thérapeutiques. Ce travail a montré une importante sensibilité des souches multirésistantes à l´imipenème (76,8%), contre 44,2% de sensibilité à la céftazidime, alors que 4,7% des PAMR résistaient à l´ensemble des Bêtalactamines. Plusieurs travaux pédiatriques [14,15] rapportent l´activité supérieure de l´imipenème sur les PAMR par rapport à celle de la céftazidime, puisque ces souches surexpriment le plus souvent le gène *ampC* de façon

constitutive et irréversible, conséquence d'une derépression par mutations du gène *ampC* ou de ses gènes régulateurs (principalement *ampD*) [16]. La résistance du *P. aeruginosa* à l´imipenème par imperméabilité est un mécanisme relativement peu fréquent. En effet, le risque de sélection d'un mutant résistant par perte de D2 (porine) au cours du traitement d'une infection à *P. aeruginosa* par imipenème est de l'ordre de 20 à 30%. Patzer et *al* [4] rapportent par contre des taux croissants de la résistance à l´imipenème. Ces résultats ne représentent donc pas une règle absolue en l´absence d´études cliniques ayant établi de façon formelle la supériorité d´un antibiotique sur l´autre. Le choix entre ces molécules dépend donc des données épidémiologiques et bactériologiques locales. Huit souches de *P. aeruginosa* résistants à la fois à l´imipenème et la céftazidime ont été retrouvées. La résistance aux carbapenèmes par production de carbapenèmases plasmidiques est un signe alarmant du fait du risque accru de diffusion horizontale et verticale au sein des structures hospitalières pédiatriques [17]. Les souches de *P. aeruginosa* résistantes à la pipéracilline/tazobactam ont représenté 15%. Selon Kim et *al* [18], cette combinaison est souvent utilisée en pratique clinique du fait de son spectre large et le peu d´effets indésirables. Au sein de la famille des aminosides, l´amikacine était la molécule la plus active contre le *P. aeruginosa* dans cette étude (96% de sensibilité). Plusieurs auteurs [19] rapportent cette activité rapide et synergique de l´amikacine contre le *P. aeruginosa* et peut donc, dans notre contexte, figurer dans toute association antibiotique antipseudomonale. La ciprofloxacine figure parmi les 3 premiers antibiotiques actifs sur le *P. aeruginosa* dans ce travail, cependant sa contre indication chez l´enfant limite son utilisation au cas particuliers. L´analyse des résultats statistiques des associations antibiotiques accorde à l´association imipenème-amikacine la place de référence, puisqu´elle reste l´association la plus synergique, la plus sensible et possédant le plus large spectre antibactérien. De ce fait, elle reste l´association idéale préconisée pour une antibiothérapie orientée visant des souches multirésistantes [20]. En revanche, l´association pipéracilline/tazobactam-amikacine offre un excellent compromis entre spectre, maniabilité et résultats cliniques en témoignent plusieurs études [21] qui rapportent une bonne activité bactéricide. Avec une sensibilité assez proche de celle de l´association imipenème-amikacine, elle reste la plus appropriée pour un traitement probabiliste visant les infections à *P. aeruginosa* en milieu pédiatrique. L´association ciprofloxacine-amikacine peut s´avérer utile pour cibler les souches résistantes à l´imipenème et la céftazidime. En cas de résistance à toutes les associations antibiotiques possibles, le recours à la colistine pour le traitement de ces enfants se justifie malgré sa néphrotoxicité.

5 CONCLUSION

Ce travail rapporte un taux important de *P. aeruginosa* multirésistant (25,6%) en milieu pédiatrique principalement aux niveaux des services de réanimation pédiatrique et néonatale. Le taux considérable de bactériémies et d´infections sur cathéters à *P. aeruginosa* rencontré dans ces services rend compte du manque à gagner en termes de qualité des soins au sein de ces structures. Des mesures d´hygiène renforcées couplées à une surveillance régulière de l´épidémiologie locale et de l´état des résistances du *P. aeruginosa* sont les seuls garants d´une prise en charge adéquate au sein de nos structures hospitalières. Le taux élevé de résistance à la céftazidime et la bonne sensibilité à la pipéracilline/tazobactam dans cette étude fait suggérer au cliniciens l´utilisation de l´association pipéracilline/tazobactam-amikacine comme traitement probabiliste de première ligne des infections à *P. aeruginosa* et l´association imipenème-amikacine pour un traitement orienté visant les *P. aeruginosa* multirésistants.

CONFLITS D´INTERETS

aucun

REFERENCES

[1] Grisaru SG, Lerner GL, Keller N, Berger H, Passwell JH, Barzilai A. *Pseudomonas aeruginosa* bacteremia in children: analysis of trends in prevalence, antibiotic resistance and prognostic factors. Pediatr Infect Dis J 2000;19:959-63.

[2] Pagani L, Montengoli E, Migliavacca R, Nucleo E, Pollini S, Spalla M, et al. Multifocal detection of multidrugresistant *Pseudomonas aeruginosa* producing the PER-1 Extended Spectrum beta-lactamase in Northern Italy. J Clin Microbiol 2004;42:2523-2529.

[3] Babay HAH. Antimicrobial Resistance among Clinical Isolates of *Pseudomonas aeruginosa* from Patients in a Teaching Hospital, Riyadh, Saudi Arabia, 2001-2005. Jpn J Infect Dis 2007;60:123-125.

[4] Patzer JA, Dzierzanowska D. Increase of imipenem resistance among *Pseudomonas aeruginosa* isolates from a Polish paediatric hospital 1993-2002. Int J Antimicrob Agents 2007;29:153-158.

[5] Karlowsky JA, Draghi DC, Jones ME, Thornsberry C, Friedland IR, Sahm DF. Surveillance for Antimicrobial Susceptibility among Clinical Isolates of *Pseudomonas aeruginosa* and *Acinetobacter baumannii* from Hospitalized Patients in the United States, 1998 to 2001. Antimicrob Agents Chemother 2003;47:1681-1688.

[6] Walkty A, DeCorby M, Nichol K, Mulvey MR, Hoban D, Zhanel G. Antimicrobial susceptibility of *Pseudomonas aeruginosa* isolates obtained from patients in Canadian intensive care units as part of the Canadian National Intensive Care Unit study. Diagn Microbiol Infect Dis 2008;61:217-221.

[7] Qingli Z, Jennifer C, Smith C, Qiujiao Z, Zhongqin G, Noni E, et al. A five-year review of *Pseudomonas aeruginosa* bacteremia in children hospitalized at a single center in southern China. International Journal of Infectious Diseases 2012;16:628-632.

[8] Van-Eldere J. Multicentre surveillance of *Pseudomonas aeruginosa* susceptibility patterns in nosocomial infections. Journal of Antimicrobial Chemotherapy 2003;51:347-352.

[9] Siva GP, Nor AS, Ramelah M. Antimicrobial susceptibility of clinical isolates of *Pseudomonas aeruginosa* from a Malaysian Hospital. Malaysian Journal of Medical Sciences 2009;16:27-32.

[10] Fuca M, Jakob K, Kathleen J, whittier S, Della Latta P, Factor S, Rubenstein D, Saiman L. endemic *Pseudomonas aeruginosa* infection in a neonatal intensive care unit. England Journ Med 2000;343:695-700.

[11] Aloush V, Navon-Venezia S, Seigman-Igra Y. Multidrug-resistant *Pseudomonas aeruginosa*: risk factors and clinical impact. Antimicrob Agents Chemother 2006;50:43-8.

[12] Christina S, Carmen P, Laura G, Fe T, Adriana M, Angeles DM, et al. Influence of carbapenem resistance on mortality and the dynamics of mortality in *Pseudomonas aeruginosa* bloodstream infection. International Journal of Infectious Diseases 2010;14:73-78.

[13] Gupta V, Datta P, Agnihotri N, Chander J. Comparative in vitro Activities of Seven New beta-Lactams, Alone and in Combination with beta-Lactamase Inhibitors, Against Clinical Isolates Resistant to Third Generation Cephalosporins. Braz J Infect Dis 2006;10:22-25.

[14] Désirée C, Simone C, Ottavio Z, Giulio Z, Rosaria M, Susanna L, et al. Multidrug-resistant *Pseudomonas aeruginosa* infection in children undergoing chemotherapy and hematopoietic stem cell transplantation. Haematologica 2010;95:1612-1615.

[15] Rodríguez-Morales A, Rodríguez C, Garcia A, Pastran B, Jiménez I, Meijomil P. Antimicrobial resistance of *Pseudomonas aeruginosa* in pediatric infections. Int J Infect Dis 2005;11:84-85.

[16] Lister PD, Wolter DJ, Hanson ND. Antibacterial-resistant *Pseudomonas aeruginosa*: clinical impact and complex regulation of chromosomally encoded resistance mechanisms. Clin Microbiol Rev 2009;22:582-610.

[17] Grall N, Andremont A, Armand-Lefèvre L. Résistance aux carbapénèmes : vers une nouvelle impasse. Journal des Anti-infectieux 2011;13:87-102.

[18] Kim MK, Xuan D, Quintiliani R, Nightingale CH, Nicolau DP. Pharmacokinetic and pharmacodynamic profile of high dose extended interval piperacillin–tazobactam. J Antimicrob Chemother 2001;48:259-267.

[19] Berna K, Alev GA. In-vitro activities of various antibiotics, alone and in combination with amikacin against *Pseudomonas aeruginosa*. International Journal of Antimicrobial Agents 2001;18:567-570.

[20] Raja NS, Singh NN. Antimicrobial susceptibility pattern of clinical isolates of *Pseudomonas aeruginosa* in a tertiary care hospital. J Microbiol Immunol Infect 2007;40:45-49.

[21] David S, Burgessa B, Surakit N. Cefepime, piperacillin/tazobactam, gentamicin, ciprofloxacin, and levofloxacin alone and in combination against *Pseudomonas aeruginosa*. Diagnostic Microbiology and Infectious Disease 2002;44:35-41.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 291-294
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Human Capital and Economic Growth in Nigeria

Olalekan Oyedele

Centre for Continuing Education, Federal University of Technology, Akure, Ondo State, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The paper examined the impact of human capital on economic growth in Nigeria, with the aim of providing additional evidence on the relationship between human capital and economic growth. A health adjusted education indicator is used as proxy for human capital which was calculated by taking enrolment rate at primary level and then multiplied the value with expenditure on health as percentage of GDP. The study employed Nigeria annual data, from 1980 to 2011 and Generalised Method of Moment(GMM) techniques in the analysis. Sargan test of over-identifying restrictions was conducted to verify the results obtained from Generalised Method of Moment and the Sargan test showed that the results obtain is valid and reliable. The estimated results provide evidence of positive relationship between human capital and economics growth in Nigeria. The health adjusted education indicator used was found to be highly determined economic growth in Nigeria. The study concluded that special attention should be given to health and education sectors simultaneously in Nigeria, such as increased budgetary allocation to the two sectors and to ensure proper implementation of programs in these two sectors in other to increase returns from these two sectors.

KEYWORDS: School Enrollment, Health, Government Spending, Gross Domestic Product, Education.

1 INTRODUCTION

Human capital theory has being of the most influential theory in setting the framework of Government policies since the early 1960's among the countries. The concept of human capital recognizes that labour is equal and the quality of labour can be improved by investing in them. The greater the society invests in human capital, the greater the economic growth of that society. Human capital is not only a major growth determinant but also, a channel to ease poverty and improve quality of human beings in general.[7]

The impact of human capital on economic growth has been studies extensively in the literature. The long list includes; {2; 5; 6; 11}. The existing studies employed either education or health related indicators or both as a proxy for human capital development. However, the variable of human capital is measure through different method and there is slight difference in the conclusion drawn from these studies from each other, since conclusion was based on the measure of human capital used. The differences in the result may be as a result of measure of human capital used. For example, a variable school was taken as proxy of human capital which was constructed through taking the percentage of working age population (12 to 17) enrolled in secondary schools. This percentage was multiplied by working age population that is of school age (15 to 19). This measure of human capital was found to be positively related to economic growth.[8]

Enrolment rates at primary, secondary, and higher schooling levels were also taken as proxies for human capital in a study conducted for Pakistan and India, Whereas, to study the effect of human capital on economic growth. The results of the study varied with different proxies of human capital taken in the study. Enrolment rate in primary school was found to be positively related and significance only in India, while higher education only bound to be positively related and significant in Pakistan.[2]. Another proxy for human capital in the literature is the stock of human capital which was calculated through the perpetual inventory method using the secondary enrolment. The measure was found to be positively impacted growth.[1]

Human capital was also, captured by health adjusted education indicator, which was calculated by taking enrolment rate at primary level and then multiplied the value with expenditure on health as percentage of GDP. This measure was used to

empirically investigate the relationship between human capital and economic growth in Pakistan economy. The measure of human capital was found to be positively related to economic growth in Pakistan.[5]

In Nigeria the study on the relationship between human capital and economic growth is not a new idea. Just like the studies mention above, the existing studies in Nigeria used both education and health indicators to captured human capital. Indicators such as Government's expenditure on education, primary school enrolment rate, secondary school enrolment rate, tertiary enrolment rate, life expectancy at birth, fertility rate and government expenditure on health were used as proxy for human capital. The empirical evidences from these studies are not robust supporting positive impact of human capital[4;8;10]. From the studies the entire variable used except secondary enrolment rate to captured human capital in Nigeria are not significant, this is contrary to the existing studies. Using different method of measurement may likely to have different effect. Therefore, this study will follows Faisal et al[5] by using health adjusted education variable to examine the effect of human capital on economic growth in Nigeria. According to them, this measurement is a better measure of human resources development, since health is an important factor of determining the return from education and improvement in health tends to increase the learning from a given level of education. With this study additional evidence of the relevance of human capital in economic growth in Nigeria will be provided.

The rest of the paper is divided into four sections, model specification is presented section two, measurement of variable is presented in section three, while section four cover the analysis of the estimated results and section five is conclusion.

2 MODEL SPECIFICATION

To explore the relationship between human capital and growth in Nigeria, the study follows the existing work by adopting standard Cobb-Douglas production function with labor, physical capital and human capital as input factors. In line with these scholars, the formulation below was employed.

$$GDP_t = A_t GCF_t^{\propto} LBF_t^{\propto 1} HC_t^{\propto 2} \quad (1)$$

Converting the above equation in log form will give;

$$logGDP_t = logA_t + \propto logLBF_t + \propto_1 logGCF_t + \propto_2 logHC_t + \mu_t \quad (2)$$

Where logGDP is the log of Gross Domestic Product as dependent variable, and logGCF is the log of Gross Capital Formation proxy for physical capital and the variable logLBF is log of labour force, logHC is the measure of human capital and μ is error term. A-priori one expects a positive sign for all explanatory variables.

3 MEASUREMENT OF VARIABLES AND SOURCES OF DATA

The Gross Domestic Product is measured as GDP per capital, LBF is the labour force and is measured as total number of age 15 and older who is economical active, GCF is the gross capital formation and is measured by divide Gross Capital Formation over GDP, and HC is the human capital variable and is constructed by multiply primary school enrollment rate with government expenditure on health divide by GDP, following Faisal et al[5]. The data on the entire variables used in this study are obtained from secondary sources. Data on Gross Domestic Product, Gross Capital formation and labour force are obtained from world development indicators(WDI,2012). Primary school enrollment rates and expenditure on Health data are sources from CBN Annual Report and Statement of Accounts (several issues).

The sample period is 1980-2011 and the model estimated by Generalized Method of Moments (GMM) which takes into accounts the possible endogeneity of the explanatory variables. The lagged values of labour force, gross capital formation and Human capital variable and dependent variables act as instruments.

4 ESTIMATED RESULTS

4.1 DESCRIPTIVE STATISTICS

This section presents summary statistics of the parameters in the model. Tables 1 report summary statistics for the variables of interest. All the variables used for the econometric investigation in this study covers the period 1980-2011. All the series display a high level of consistency as their mean and median values are within the range of maximum and minimum values of the series. The deviations of actual data from their mean value are very small.

Table 1: Descriptive statistics of data(Sample 1980- 2011)

Variables	LOG(LBF)	LOG(HC)	MOR	LOG(GCF)
Mean	17.35885	1.120077	8.090663	2.384702
Meadian	17.35092	4.317916	7.971871	2.371529
Maximum	17.76037	5.327116	8.584335	3.561650
Minimum	16.96631	-4.591042	7.810521	1.697265
Std. Dev	0.248164	4.100527	0.233175	0.426864
Skewness	0.052375	-0.144281	0.862983	1.058737
Kurtosis	1.679617	1.078632	2.294095	4.096241
Jarque-Bera	2.339177	5.033229	4.636346	7.580587
Probability	0.310495	0.080732	0.098453	0.022589
Observations	32	32	32	32

This table reports the summary statistics of the main regression variables

4.2 EMPIRICAL ANALYSIS

In an attempt to examine the relationship between human capital and growth in Nigeria, this study employed Generalised Method of Moment(GMM). GMM is known to be robust to heteroskedasticity and autocorrelation of unknown form and it has several advantages over other estimation techniques such as OLS. Table 2 report regression results for Generalised Method Moments estimate for the model. The reliability of the GMM estimate depends on the validity of the instruments. To test for the validity of the instrument used, we examine the value of the J- statistic and instrument rank of the GMM estimate. Table 2 shows the results of estimated models. From table 2 the instrument rank is greater than the number of estimated coefficients therefore, we may use it to construct Sargan test of over-identifying restrictions. The Sargan statistic is distributed as (p - k), where k is the number of estimated coefficients and p is the instrument rank. Constructing the Sargan test of over- identifying restrictions which is computed using 'scala pval = @chisq(P-K)' under the null hypothesis that over-identifying restrictions are valid. In this case a higher P-value indicates that instruments used are valid. The Probability values for the sargan test carried out using J- Statistic and instrument rank for the model estimated in table 2 is 0.99999 which indicates rejection of null hypothesis. Therefore, the instruments used in table 2 are valid, which shows that the results in table 2 are reliable. From the results in table 2, signs of estimated coefficients move in line to their prior expectations and all the variables of the model are statistically significant. The main variable adjusted human capital is positive and significance at 1 percent level of significance, other variables used in the analysis(LBF, GCF) are also positive and significant.

In conclusion, the results obtained shows that the measure of human capital used played a significant role in economic growth in Nigeria. Unlike other empirical studies in Nigeria that focused on human capital development and growth, evidence from these studies are not robust supporting positive relationship. Though these studies used either education or health indicator variables as the measure of human capital

Table 2: Estimated Result

Dependent variable: logGDP per capital

Independent Variables	Coefficient
LOG(LBF)	0.385774*** (19.35068)
LOG(GCF)	0.564741*** (3.989678)
LOG(HC)	0.049962*** (3.876578)
J- Statistics	12.4
Instrumental Rank	5

, **, * indicate 10%, 5%, and 1% level of significance. Figures in parenthesis are t- statistic*

Sources: *Author's Computations*

5 CONCLUSION

In this study our main aim was to provide additional evidence on the relationship between human capital and economic growth. The proxy of human capital in this study was health adjusted education indicator following Faisal et al[5]. Based on the examination of the relationship between human capital and economic growth, the study found that proxy for human capital used play important role in explaining the growth process in Nigeria. Therefore, policy makers should pay special attention on health and education sectors simultaneously, such as increased budgetary allocation to the two sectors and to ensure proper implementation of programs in these two sectors in other to increase returns from these two sectors in Nigeria.

REFERENCES

[1] Abbas, Q. and Foreman-Peek,. Human Capital and Economic Growth in Pakistan 1960-2003. Cardiff Economics Working Papers, E2007/22. 2007.
[2] Abbas, Q. The Role of Human Capital in Economic Growth: A Comparative Study of Pakistan and India. Pakistan Development Review 39:4 part 2{winter 2000} pp. 451-473. 2000.
[3] Abbas, Q. Endogenous Growth and Human Capital. A Comparative study of Pakistan and Srilanka. The Pakistan Development Review, 40:4 Part 2 {winter 2001} pp. 987-1007. 2001.
[4] Adeniyi and Abiodun, Health Expenditure and Nigeria Economic Growth. European Journal of Economics, Finance and Administrative Sciences. Issue 30. 2011
[5] Faisal and abdul, Human Capital and Economic Growth: Time Series Evidence from Pakisttan. Pakistan Business Review, January 2011.
[6] Howitt, P. Health, Human Capital and Economic Growth: A Schumpeterian Perspective. Seminar paper for Pan American Health Organization. 2005
[7] Kasim, M et al; Human Capital Investment. The social sciences: medwell Journals vol. 5. No.3. 2010
[8] Lawanson, O.I.: "Human Capital Investment and Economic Development in Nigeria: The Role of Education and Health". Oxford Business & Economic Conference Programme. 2009
[9] Mankiw, N. Gregory; David Romer, and David N. Well;. A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics, 107, pp. 407-437. 1992
[10] Owolabi S.A, and Okwu, A.T; A Quantitative Analysis of the Role of Human Resource Development in Economic Growth in Nigeria. Eroupean Journal of Economics, Finance and Administrative Sciences, Issue 27. 2010
[11] Osipain, Ararat; Human Capital-Economic growth nexus in the former Soviet Bloc. MRPA Paper No. 8463.2007

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 295-303
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

The Relationship between the Term Structure of Interest Rates and Nigeria Economic Growth and Inflation Rate

Olalekan Oyedele

Centre for Continuing Education, Federal University of Technology, Akure, Ondo State, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The paper examined the relationship between term structure of interest rate and economic activity and also investigated the relationship between term structure of interest rate and inflation rate in Nigeria. This was with a view of providing additional evidence on the predictive power of term structure of interest rate in Nigeria. The study employed quarterly time series data, from 1986-2008. The period was chosen based on the availability of one of the data used(14 years government bond). The study employed Dynamic Ordinary Lest Square(DOLS) techniques in the analysis. The diagnostics test conducted showed that the results obtain is valid and reliable. The estimated result shows that term structure of interest rate being the difference between interest rates of different maturities had positive and long run relationship with economic activity and inflation rate in Nigeria. The study concluded that the positive and significant of term structure of interest rate indicated that, term structure of interest rate in Nigeria does contain information about future inflation rate and economic activities. The study suggested that monetary authority should be consistent in interest rate policy formulation and Government should also bolster its activity in the Government securities market, as all these will improve the predictive ability of term structure of interest rate about future activities in Nigeria.

KEYWORDS: Interest rate, Economic Activity, Growth, Monetary Indicator,

1 BACKGROUND TO THE STUDY

Term structure of interest rate is defined as the different between long term interest rate and short term interest rate. There is a consensus among economists that the term structure of interest rate is positively correlated with future economic activity and has been used by policy makers as a complement to the information in monetary aggregate. Within the range of indicators considered by the Eurosystem as possible drivers of economic activities, special attention was giving to term structure of interest rate that has been traditionally considered a channel for the transmission of monetary impulses to the real variables.

The predictive content of the term structure of the interest rates for future economic growth is crucial at least for four reasons, first it is essential for private businesses as it assists them in deciding how much capacity will be required to meet future demand. Second, predicting economic activity is important for government to forecast budgetary surplus or deficits more accurately. Third, it also aids the central banks in deciding the stance of current monetary policy. Fourth, if the interest rate spread is sizeable and it contains predictive power for real GDP growth foreign investment will be attracted[58].

Using information about expectation of future macroeconomic variable as summarized in the current term structure of interest rates is attractive since high quality financial data is typically available in real time, monetary policy rule based on this information, therefore may be better suited for dealing with immediate economic conditions, rather than rules based on more slowly gathered macroeconomic data[52]

The term structure of interest rates is generally conceded to contain some information that may be of use to both market participants and to the monetary authority. The use of interest rates as predictor of the business cycle dates back to Burns and Mitchell[9] who included them in a list of useful variables to forecast real economic activity. Later, Kessel[33] provided

evidence, for the first time about the co-movement between the term structure and the business cycle, and the slope of the term structure of interest rates associated with economic downturns or recoveries.

In the course of the 1990s numerous empirical studies have provided evidence that gives compelling empirical support for that notion in a number of countries. The long list includes {Caporale[10]; Dotsey[14]; Ducker[15]; Estrella and Hardouvelis[21]; Haubrich and Dombrosky [29]; Hu [30]; Kozickl[36]; Peel and Taylor[49]; Plosser and Rouwenhust[48]}.

Although the literature on the term structure is extensive very few studies have been carried out in less developed countries (Nigeria inclusive). For example, Teriba[57] in his study examined the information content of interest rates spread on industrial output and GDP, but his analysis did not examine the effect of this term structure on inflation rate for Nigeria and his study covers manly the period of interest rate regulation. It is against this background and given the fact that policy on interest rate is not stable in Nigeria that this study will analyse the effect of term structure of interest rates on economic activity in Nigeria.

The rest of the paper is divided into five sections, summary of literature is presented in section two, model specification is presented section three, measurement of variable is presented in section four, while section five cover the analysis of the estimated results and section six is conclusion.

2 SUMMARY OF LITERATURE

Table 1: Summary of Empirical Findings in Developed Countries

Author/Year	Country	Data type and Frequency	Methodology	Results/Conclusions
Mishkin (1990)	USA	1953-1987 (monthly data)	Econometric model, OLS	Suggests that the shorter maturity term does not contain a great deal of information about future path of inflation. But at longer maturities, the term structure of interest rate can be used to help assess future inflationary pressures
Robertson (1992)	UK	1955-1975 (quarterly data)	Cointegration techniques, OLS	At maturities of up to about four year, term structure reflect future inflation.
Frankel and Lown (1994)	USA	1960-1991 (quarterly data)	OLS	Term structure of interest rates performed better in predicting inflation over the period of study.
Engsted(1995)	OECD	1962-1993 (quarterly data)	Cointegration techniques, VAR	Long term interest rates reflect expected future inflation
Estralla and Mishikin(1997)	USA, France, Germany, Italy, UK	1973-1995 (quarterly data)	Probit model, VAR, OLS	The study used different variables to capture future economic situation, and concludes that term structure of interest rates can be used for prediction of economic activities and inflation
Davis and Fagan(1997)	European union countries	1970-1992 (quarterly data)	Ordinary least square	The longer maturity term is statistically significant for output and inflation in all except Spain, Italy, and France.
Chen(1991)	USA	1954-1988 (quarterly data)	Forecasting model, OLS	The term structure of interest rates can predict future growth rate of GNP up to five quarters ahead.
Estrella and Hardovelis(1991)	USA	1973-1990 (quarterly data)	Econometric model, OLS	Term structure of interest rates can predict cumulative changes in GNP for up to sixteen quarters.
Harvey(1997)	Canada	1958-1995 (quarterly data)	CCPA model, OLS	The term structure of interest rates in Canada contain important information about economic growth
KimandLimpaphayom(1997)	Japan	1975-1991 (quarterly data)	Generalised method of moment(GMM)	The term structure of interest rates is useful for discovering the expectations of market participants in Japan during the deregulation period.
Alles(2001)	Australia	1976-1993 (quarterly data)	Regression model, OLS	There is positive relationship between term spread and GDP growth in Australia.
Peel and Loannidis (2002)	USA, Canada	1972-1999 (quarterly data)	Output growth forecasting model, OLS	The spread has a significant predictive content for real GDP change
Alonso et al(2001)	Spain	1973-1995 (quarterly data)	OLS	The study found little information content pertaining to the predictive ability of the term spread.
Martinez-serna and Navarro-Aribas(2003)	Spain	1993-2001 (quarterly data)	OLS	Using consumer confidence indicator(CCI) and economic sentiment indicator(ESI), the results indicated that Spanish term structure contains useful information to predict the expected economic growth.
Valadkani(2004)	European union countries	1980-2002 (quarterly data)	Output growth model, OLS	The study found that increase in the interest rates spread results in rise in GDP growth over the succeeding seven time quarters.

Table 2: Summary of Empirical Findings in Developing countries

Author/ Year	Country	Data type and frequency	Methodology	Main Results and Conclusion
Neil(1996)	South Africa	1974-1993 (quarterly data)	Econometric model, OLS	The yield curve is positively related to the growth in real GDP.
Modman(2002)	South Africa	1979-2001 (quarterly data)	Probit model, Ordinary Least Square(OLS)	The term structure successfully predicts the turning points of the business cycle in South Africa
Castelanos(2003)	Mexico	1970-2000 (quarterly data)	Ordinary Lest Square(OLS)	A positive relationship between interest rate differential and economic activity is detected.
Sahinbeyoglu and yalcin(2002)	Turkey	1991-1999 (quarterly data)	Econometric technique, OLS	The term structure of nominal interest rates have a significant but negative impact on the future path of inflation
Sheile(2006)	South Africa	1987-1995 (quarterly data)	Econometric technique, Generalised method of moment(GMM)	The term structure successfully predicted real economic activity during the entire research period
Teriba(2006)	Nigeria	1997-1995 (quarterly data)	Econometric technique, OLS	The term structure spread does predict real activity in Nigeria.

2.1 CONCLUSION

From the above, it can be concluded that empirical literatures on the effect of term structure of interest rates on economic activity and inflation are very few in developing countries especially the effect of the term structure on future inflation rate, Nigeria is also inclusive. Therefore this study will empirically study the relationships between term structure of interest rates and future inflation rate as well as economic activity in Nigeria

3 MODEL SPECIFICATION

To investigate the relationship between term structure and economic activities, the study adopted a model formulated by Kim and Limpaphayom[34]. Therefore this study uses the following equations (using real GDP and Inflation rate as proxy for Economic activities);

$$rgdp_t = \propto + \theta_1 term_t + \theta_2 M_{2t} + \theta_3 ASI_t + \mu_t \quad (1)$$

$$infr_t = \propto + \propto_1 m_{2t} + \propto_2 rgdp_t + \propto_3 term_t + \mu_t \quad (2)$$

From equation (1) rgdp is Gross domestic Product Growth at market prices, α is Intercept term, Term is the tern structure of interest rates, M2 represents broad money supply, and ASI represent Nigeria stock exchange all share index. A priori, a positive relationship is expected between term structure, Money supply(m2), all share index(ASI) and real GDP.

From equation two, infr is Inflation rate, M_2 is Broad money supply, term is Term structure of interest rate and rgdp is real gross domestic product. A priori, a positive sign is expected for the term structure, Rgdp and money supply.

4 MEASUREMENT OF VARIABLE

The variables employed in this study are measured as follows;

Rgdp which is the dependent variable measured as change in real gross domestic product, the term structure is measure as the spread between 14year federal government bond and three month treasury bill rate. The inflation rates are measured by percentage change in consumer price indices(200=100). The data on the entire variables used in the empirical study are obtained from secondary sources. These sources include the various issues of central banks of Nigeria (CBN) publications namely: statistical bulletin, Annual reports and Statement of Accounts, Economic and Financial Review and International Financial Statistics.

The quarterly data used covers the period 1986:1- 2008:4. The choice of 1986 is because it marks the era of financial deregulation in Nigeria and we chose 2008 because the study used 14years government bond to constructed term structure which no longer available after this time. For consistence purpose we decided to use this period to see if within this period the main variable which is term structure predicted economic activities. The two models in the study was estimated by Dynamic Ordinary Lest Square(DOLS) econometric technique.

5 ECONOMETRIC ANALYSIS AND RESULTS

5.1 DESCRIPTIVE STATISTICS

For the purpose analyzing the effect of term structure of interest rate on economic activity in Nigeria, this section initially examines the descriptive statistics of data series employed in this study. The descriptive statistics of data series gives information about sample statistics such as mean, median, minimum value, maximum value and distribution of the sample measured by the skewness, kurtosis and the Jaque-Bera statistic. Table 3 reports the descriptive statistics of data employed in this study.

Table 3 shows that all the series display a high level of consistency as their mean and median values are perpetually within the maximum and minimum values of these series. Moreover, the low standard deviation of nearly all the data series indicates the deviations of actual data from their mean value are very small. The skewness and kurtosis statistics provide useful information about the symmetry of the probability distribution of various data series as well as the thickness of the tails of these distributions respectively. These two statistics are particularly of great importance since they are used in the computation of Jarque-Bera statistic, which is used in testing for the normality or asymptotic property of a particular series.

Table 3: Descriptive statistics of data(Sample 1986:1-2008:4)

Variables	RGDP	M2	ASI	INFR	TERM
Mean	9.8059	11.5812	8.1634	4.8531	1.6946
Meadian	9.7312	11.5817	8.6566	3.6256	1.7650
Maximum	10.7781	14.7239	11.0512	20.1273	2.5300
Minimum	8.9752	8.6429	4.9473	-4.7953	-1.5700
Std. Dev	0.4672	1.7513	1.8220	5.5142	0.6212
Skewness	0.40780	-0.0771	-0.3178	0.9621	-3.0714
Kurtosis	2.2020	1.9024	1.8680	3.4653	15.3493
Jarque-Bera	4.9918	4.7089	6.4608	15.0216	729.2427
Probability	0.0824	0.0949	0.0395	0.0005	0.0000
Observations	92	92	92	92	92

This table reports the summary statistics of the main regression variables

5.2 TIME SERIES PROPERTIES OF DATA

To examine the effect of term structure of interest rate on economic activity proxy by real gross domestic product and inflation rate in Nigeria, it becomes crucial to examine the time-series properties of our data. To actually test for unit root this study employed the Augmented-Dickey Fuller tests. Table 4, shows that the real GDP, all share index(asi) and broad money supply are non-stationary in level. However, at first difference variables became stationary. This means that the null-hypothesis of unit root is rejected at 1% level of significance after first difference.

Table 4 Augmented Dickey-Fuller Test

	Level		First difference	
variables	Intercept	Intercept with trend	Intercept	Intercept with trend
RGDP	-1.6244	-3.3866***	-4.2480*	-4.1364*
ASI	-1.6664	-1.3989	-3.1572**	-3.3122***
M2	-1.0088	-27875	-4.3102*	-4.1493*
TERM	-3.9842*	-3.9823**	-14.7763*	-14.7456*
Inflr	-2.8311***	-3.1800***	-10.0585*	-10.0161*

Notes: (*)(**)(***) means that unit root (non-stationarity) is rejected at the 1%, 5%, 10% level of significance.

5.3 EMPIRICAL ANALYSIS

The study employed Dynamic OLS in estimating the parameters in equation (1). That is the relationship between term structure of interest rates and economic growth in Nigeria. The beauty of the DOLS technique stems from the fact that it is a robust single estimation approach that eliminate regressors endogeneity problem and correct for serially correlated error. In applying the DOLS technique, various information criteria [Akaike Information Criterion, Schwatz Bayesian Criterion and Hannan Quinn Criterion} are initially employed in determination of the number of lags to be included in the model. The study employed 4-lags and 4-leads in the estimation process. Table 5 shows results of the estimated model. To arrive at table 5, a parsimonious result was obtained by specifying a model with regressors of four lags and four leads. This was done with the intention of choosing the best specified model. Therefore, the study reports the results of parsimonious Dynamic OLS specification in table 5

The diagnosis of the regression results indicates that the R-squared and adjusted-R-squared of 0.91 implies that 91% of the real gross domestic product is explained by the various regressors included in the model. This also means that the model display goodness of fit. The D.W statistics of 1.88 as well as the Breusch-Godfrey LM test [F=1.313, P>0.05], also indicates that the regression model does not suffer from the problems of autocorrelation. Table 5 also shows that the estimated parameters conform to their apriori signs. The diagnostic statistics in table 6 as well as the estimated parameters therefore implies that the model can be relied upon in making useful inference about the relationship between term structure of interest rates and real gross domestic product in Nigeria.

From Table 5, it is evident that a positive and long-run relationship exists between real gross domestic product and term spread. This relationship is positive and statistically significant at the 5 percent level. The significance of the term spread in the DOLS regression model implies that the term spread can be used in predicting real activity in Nigeria.

Table 5: Relationship between Term Structure and GDP
(Dependent Variable is Real GDP)

Regressor	Coefficient	S. E	T-Ratio {prob}
C	6.7306	0.56067	12.00471{.000}
LOGMS	0.51215	0.080372	6.37231 {.000}
LOGASI	0.26145	0.062715	4.1688 {.000}
TERM	0.051605	0.021082	2.4478{.012}
DLOGM2[-1]	-0.30095	0.22322	-1.3482[.182]
DLOGM2 [-2]	-0.37218	0.21756	-1.71707[.092]
DLOGM2 [-3]	-0.24779	0.20910	-1.1851[.240]
DLOGM2[-4]	-0.57514	0.21504	-2.6746[.009]
DLOGM2[+1]	0.26313	0.20217	1.3015[.197]
DLOGM2[+2]	0.46025	0.19990	2.3024[.024]
DLOGM2[+3]	0.32815	0.19855	1.65271[.103]
DLOGASI[-1]	0.23825	0.13260	1.7968[.077]
DLOGASI[-4]	0.15723	0.13398	1.1735[.245]
DLOGASI[-2]	-0.083818	0.12444	-1.67356[.503]
PIDUM	0.15483	0.68602	2.2569[.027]
R-Squared	0.91190	R-Bar-Squared	0.89246
S.E.R	0.10891	Fstart.F[15,68]	46.9221[.000]
R.S.S	0.80654	DW-Statistic	1.8845

Author compilation

Table 6: Diagnostic Test on Estimated Results Presented in Table 5

Test Statistics	LM Version	F Version
A: Serial correlation	CHSQ[4]= 7.9437[.195]	F[4, 59] = 1.3132[.219]
B: Functional form	CHSQ[1]= 9.2113[.089]	F[1,62]= 6.9097[.079]
C: Heteroscedasticity	CHSQ[1]= 4.0125[.189]	F[1,81]= 3.0548[.364]

A: Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C: Based on the regression of squared residuals on squared fitted values

Another objective of this paper is to investigate the relationship between term structure of interest rates and inflation. The study also employ the Dynamic Ordinary Least Squares{ DOLS} economics technique. Table 7 Shows that the regression model has a good fit; this is indicated by the coefficient of multiple determination{R-Squared} of 0.56898. The R-Square of approximately 57 percent indicates that almost 57 percent of variation in inflation rate {Infr} is explained by various regressors included in the model. Moreover, the D.W statistic of approximately 2, means that the regression model does not suffer from the problem of autocorrelation. This result is further corroborated by the Breusch-Godfrey LM test {F=1.2102}, P-Value >0.05}, which suggest the estimated regression does not suffer from serial correlation of residuals. With respect to the Ramsey's Regression Equation Specification Error Test {RESET}, presented in table 8, the result from the model shows that it does not suffer from specification error such as omitted variable, incorrect functional form or correlation between the regressors and the residuals.

From the result in Table 7, it is evident that most of the estimated parameters have the a prior signs. The results indicates that a positive and long-run relationship exist between money supply and inflation. This means that an increase in money supply will bring about increase in the general price level. This relationship is not only positive but statistically significant at the 5 percent level. This is indicated by the probability value {p-value} of 0.029. The result therefore implies that increase in money supply is one of the basic factors causing inflation in Nigeria. The result also shows that a negative and significant long-run relationship exist between real gross domestic product and inflation {t-value = -0.16718, p-value <0.05}. This indicates that increase in output proxied by real gross domestic product{rgdp} would mitigating inflation. With respect to the relationship between inflation and term structure, Table 7, indicates that the term spread {term}, which is the difference between the long and short term interest rate is positively related to inflation. This means that the higher the term spread the lower the rate of inflation and vice-versa. This result, however, is also statistically significant at the 5 percent level. The significance of the term structure of interest rate in the regression model can be attributed to the financial sector reforms. For a very long time, the structure of interest rate in Nigeria was fixed and under administrative control. This result corroborates that of sahinbeyoglu and Yalcin[53] who found that a positive relationship exist between term structure of interest rates and future path of inflation in Turkey.

Table 7: Relationship between Term Structure and Rate of Inflation (dependent Variable is Inflation rate)

Regressor	Coefficient	Standard Error	T Ratio [prob]
C	-0. 53051	0.50649	-1.0474{.299}
LOGMS	0. 25472	0.012029	2.1175{.029}
LOGRGDP	-0.16718	.55441	-3.01541{.003}
TERM	-0. 056624	0.015025	3.7687[.001]
DLOGM2[-1]	0.37922	0.10282	3.6884[.000]
DLOGM2 [-2]	0.17493	0.097400	1.7960 [.077]
DLOGM2 [-4]	0.16348	0.96253	1.6984 [.094]
DLOGM2 [+1]	-0. 3667	0.098861	-3.6685 [.001]
DLOGM2 [+2]	-0. 21262	0.094052	-2.2607[.027]
DLOGRGDP [-3]	-0. 24773	0.18218	-1.3598 [.179]
DLOGRGDP [-4]	-0. 60386	0.14434	-4.1836 [.000]
DLOGRGDP [+1]	0.15558	0.16018	0.971261[.335]
DLOGRGDP [+4]	0.31402	0.098305	3.1943 [.002]
DTERM [-2]	-0. 016085	0.010682	-1.5058 [.137]
DTERM [-3]	-0. 021360	0.010585	-2.0180 [.048]
DTERM [+1]	0.034343	0.018204	1.8866 [.064]
DTERM [+2]	0.015772	0.016264	0.969731[.336]
DTERM [+3]	0.023810	0.013081	1.8202 [.073]
DTERM[+4]	0.016584	0.012307	1.3475 [.183]
PIDUM	0.063316	0.021403	2.9585 [.018]
R- Squared	57	R- Bar-Squared	44
S.E.R	.04998	F-stat. F [19, 63]	4.3771 [.000]
R.S.S	0.15720	DW- Statistic	1.6871

Author compilation

Table 8: Diagnostic Test on Estimated Results Presented in Table 7

Test Statistics	LM Version	F Version
A: Serial correlation	CHSQ {4} = 6.2937{.178}	F {4, 59} = 1.2102{.316}
B: Functional form	CHSQ{1}= 7.2111{.008}	F{1, 62} = 5.8096{.019}
C: Heteroscedasticity	CHSQ{1}= 2.0435{.153}	F{1, 81}= 2.0446{.1571}

A: Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C: Based on the regression of squared residuals on squared fitted values

6 CONCLUSION

This study examined the relationship between term structure of interest rate and proxy for economic activities which GDP and inflation rate. The study used Dynamic Ordinary Lest Squares (DOLS) techniques to analysed the relationship. The study fund term structure of interest rate, being the difference between interest rates of different maturities incorporates an element of expected change in rates and thus indicative of changes in real economic activity and inflation rates. The results indicated that, term structure of interest rate in Nigeria does contain information about future inflation rate and economic activities. Based on these findings, the study suggests that term structure of interest rate could be used to predict future economic activity and inflation rate in Nigeria. However, unstable pattern of interest rates due to inconsistency in policy formulation affect the information content of term structure of interest rate. Therefore, the monetary authority should be consistent in their policy formulation and Government should also, bolster its activity in the Government securities market. All these will improve the predictive ability of term structure of interest rate about future activities in Nigeria.

REFERENCES

[1] Alles, L. The Australian Term Structure as a Predictor of Real Economic activity. The Australian Economic Review, 4:788. 2001

[2] Alonso,F Ayuso ,J and Martinez-Pages,J. How Informative are the Financial Assets in Spain? Revista de Economia Aplicada. 3,25:5-38. 2001

[3] Andrews D. Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation. Econometrica, 59, 3L817-858. 1991.

[4] Ang, A. and Plazzesi, M. A no-Arbitrage Vector Autoregression Of Term Structure Dynamics with Macro Economic and Latent Variables. Journal of Monetary economics,50(4), 745-787. 2003.

[5] Athanasios, O. and Wei. M Evolving Macro Economic Perceptions and the Term Structure of Interest Rates. Central Bank of Cyprus. 2007.

[6] Bernard, H. and Gerlch S, Does the Term Structure Predict Recession? "The international Evidence". Bank for international Settlement. 1996.

[7] Benjamin , F and Karen,T. RECENT Developments in Australian bond Yields. 2007.

[8] Brooks, C., Introductory Econometrics for Finance (5th Ed). United Kingdom: Cambridge University Press. 2002.

[9] Burns , A.F and Mitchell S, Measuring Business Cycles. New York National Bureau of Economics Research. 1946.

[10] Caporale, G. M., "The Term Structure as a Predictor of Real Economic Activity: Some Empirical Evidence", *Discussion Paper* No. DP 4-94, Centre for Economic Forecasting, London Business School, February 1994.

[11] Campbell , J, and Hamao, Y., The interest rate process and the term structure of interest rates in Japan. Working paper, centre on Japanese Economy and Business. Columbia University. 1991.

[12] Chen, N.F. , 'Financial investment opportunities and the macroeconomy. *Journal of Finance*, vol. 46, pp. 529-54. 1991

[13] Davis, P.E., and Fagan, G., Are financial spreads useful indicators of future inflation and output growth in EU Countries. Journal of Applied Econometrics**.** 12, 6:701-714, 1997.

[14] Dotsey, M., 'The predictive content of the interest rate term spread for future economic growth", *Economic Quarterly*, Federal Reserve Bank of Richmond, Vol. 84, No. 3. 1998.

[15] Dueker, M .J., "Strengthening the case for the yield curve as a predictor of U.S recession", *Review,* Federal Reserve Bank of St. Louis Vol.79, March/April, 1997.

[16] Deutsche, Determinants of the Term Structure of Interest Rates Approaches to Combining Arbitrage free models and Monetary Macro Economics. 2006

[17] Elna Moolma, Predicting Turning Points in the South African Economy. The South African Journal of Economic vol.6, no 2. 2003.

[18] Engsted, T.,(1995). Does the long-term interest rate predict future inflation?
[19] Estrella, A, Why Does Yield Curve Predict Output and Inflation? Federal Reserve Bank of New York. 2005.
[20] Estrella, A, The Yield Curve as a Leading Indicator: Frequently Asked Question (online) Available: www.nyJrb.org/research (Assessed:10th May 2006).
[21] Estrella, A and Hardouvelis, G.A. The term structure as a predictor of real economic activity. The journal of Finance,46, 2:555576. 1991.
[22] Estrella, A and Mishkin, F.S, The Term Structure of Interest Rates and it Role in Monetary Policy for The European Central Bank. NBER working Papers Series 5279.1995.
[23] Estrella, A and Mishkin, F.S, The predictive power of the term structure of interest rates in Europe and the United States Implication for the European Central Bank. European Economic Review. 41, 7: 13751401. 1997.
[24] Fama, E.F: Term Structure forecasts of Interest Rates. Monetary Policy-Making Under Uncertainty, Monthly Bulletin, vol. January,pp.43-55. 2001.
[25] Frankel, J. A. and Lown, C. S: "An Indicator of Future Inflation Extracted from the Steepness of the Interest Rate Yield Curve along its EntireLength", *Quarterly Journal of Economics*, pp. 517 – 530. 1994.
[26] Gujarati, D.N: Basic Econometrics (4th Ed). Boston: McGraw-Hill Irwin.2003.
[27] Harvey, C.R: The real term structure and consumption growth. Journal of fixed income. 1, 3:7-19. 1998.
[28] Harvey, C.R: The relation between the term structure of interest rates and Canadian economic growth. The Canadian Journal of Economics, 30, 1:169-193.1997.
[29] Haubrich, J. G. and A. M. Dombrosky: "Predicting Real Growth Using the Yield Curve", *Economic Review,* Federal Reserve Bank of Cleveland, Quarter 1,Vol.32, 26-32. 1997.
[30] Hu, Z: The yield curve and real activity. IMF Staff Papers. 40, 4:781-806. 1993.
[31] Jorion, P. and Mishkin, F: "A Multi-country comparison of term structure forecasts at Long Horizons", *Journal of Financial Economics*, **29**, 59 - 80,North - Holland. 1993
[32] Kanagasabapathy, K. and Goyal, R: Yield Spread as Leading Indicator of Real Economic Activity, An Empirical Exercise on the Indian Economy. IMF Working Paper no. 02/91. 2002.
[33] Kessel, R.A: The Cyclical Behaviour of the Term Structure of Interest Rates. NBER Occasional Paper, 91, 1965.
[34] Kim, K.A. and Limpaphayom, P: The effect of economic regimes on the relation between term structure and real activity in Japan. Journal of Economics and Business. 49:379-392. 1997.
[35] Komla, D. and Martin, O: Forecasting Real Interest Rates, Using the Yield Curve, Evidence From Ghana. Bank of Ghana working paper WP/BOG-2004/07.
[36] Kozicki, S: "Predicting Real Growth and Inflation with Yield Spread", *Economy Review*, Federal Reserve Bank of Kansas City, 4th Quarter, 39-57.1997.
[37] Marvin, G: Using the Term Structure of Interest Rates for Monetary Policy. Federal Reserve Bank of Richmond Economic Quarterly , Volume 84/3. 1998.
[38] Martinez –Serna, M.I., and Navarro-Arribas, E: The term structure of interest rates and expected Economic growth. Available(Online);www.efmaem.org/Accepted. Spain, 2003.
[39] Mishkin, F.S: Predicting U.S. recessions: Financial Variables as leading indicators. The Review of Economics and Statistics. 80, 1: 45-61.1998.
[40] Mishkin, F. S: "What Does the Term Structure tell us about future Inflation?" *Journal of Monetary Economics*, 25, 77-95. 1990.
[41] Mishkin, F.S: The information in the longer maturity term structure about future inflation. The Quarterly Journal of Economics. 105, 3:815-828. 1990.
[42] Mishkin, F. S: "Yield Curve", in *The New Palgrave Dictionary of Money and Finance* (1992), pp. 816-818.
[43] Mishkin, F. S. (1992b), "Is the Fisher Effect for real? A Re-examination of the relationship between Inflation and Interest Rates", *Journal of Monetary Economics*, 30, 195-215.
[44] Mishkin, F. S: *Economics of Money Banking and Financial Markets*, 4th edition, HarperCollins College Publishers, NY, Chapter 7, "The Risk and Term Structure of Interest Rates", pp. 149-172.1995.
[45] Nagayasu, J: The Term Structure of Interest rates and Monetary Policy During a Zero Interest Rates Period. IMF Working Paper WP/03/208. 2003.
[46] Nelson, C.R. and G. W. Schwert: "Short-term Interest Rates As Predictors of Inflation: On Testing the Hypothesis that the Real Rate of Interest is Constant," American Economic Review, 67, p. 478-86.1977.
[47] Nel, H: The term structure of interest rates and economic activity in South Africa. The South Africa Journal of Economics 64, 3:161-174.1996.
[48] Plosser, C. T. and Rouwenhorst, K. G: "International term structures and real economic growth", *Journal of Monetary Economics*, 33, pp. 133 - 155.1994.
[49] Peel, D. A. and Taylor, M. P: "The Slope of the Yield Curve and Economic Activity: Tracing the Transmission Mechanism", *Economics Letters*, 59 353-360.1998.

[50] Peel, D.A. and Ioannidis, C: Empirical Evidence on the Relationship between the Term Structure of Interest Rates and future Real Output changes when there are changes in policy regimes. (Online) Available: www.sciencedirect.com.2002
[51] Robertson, D, : Term Structure Forecasts of Inflation. The Economic Journal. 102, 414: 1083-1093. 1992
[52] Rudebusch, G. D.: "Federal Reserve Interest Rate Targeting, Rational Expectations, and the Term Structure", *Journal of Monetary Economics*, 35, 245- 274. 1995.
[53] Sahinbeyoglu, and Yalcin.: The Term Structure of Interest Rates- What Does it Tell About Future Inflation? Central Bank of The Republic of Turkey. Discussion Paper. No.2000/2
[54] Shehile, T. : The Term Structure of Interest Rates and Economic Activity in South African. Department of Economics and Economics History Rhodes University Grahamstown.2006.
[55] Stuart, H. and Mohamed, S.: Consumption Asset Pricing And The Term Structure. Manchester Business School University of Manchester, 2007.
[56] Tao . What Makes the Yield Curve Moved. Federal Reserve Bank of San Francisco Economics Letter, Number 2003-15, June 6, 2003.
[57] Teriba ,: Informative content of interest rates spread in Nigeria. Nigeria Economic associate,2006.
[58] Valadkkani, A.: Does the Term Structure Predict Australia's Future Output Growth. Faculty of Commerce, Papers University of Wollongong, 2004.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 304-311
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Determination of Morphological and Nutritional Properties of *Thaumatococcus daniellii* and Effect of Harvesting Method on the Plant Growth

Agwu A. Ndukwe, Edidiong A. Enoh, and Queendalyn U. Aniere

Department of Environmental Management, Faculty of Environmental Sciences,
Nnamdi Azikiwe University, Awka, Anambra state, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: *Thaumatococcus daniellii* (Miraculous berry) belonging to the family maranthaceae is one of the sweeteners found in the tropical forest. However in Nigeria, because of the excessive use of this species as wrapping leaf, very little is known about its fruit as a source of sweetener. Although the leaves are sold in the market as wrapping leaf for bean budding (moi-moi) and other cooked foods such as rice. Information on the propagation of this species and utilization of its parts is very scanty making the species one of the threatened forest species. The objectives of this study were therefore to determine; the nutritional properties of the gelatinous layer of the fruit and the effects of various harvesting methods on the plant growth. The gelatinous layer of the fruits of *Thaumatococcus daniellii* is a sweetener known as "Thaumatin". Thaumatin is a sweet-tasting, flavor – enhancing protein. Some of the proteins in the thaumatin family are natural sweeteners roughly 2000 times more potent. The morphological characteristics of the stands of this species were measured using standard methods. The nutritional and the phytochemical composition of the gelatinous layer extracts of the fruits were analyzed in the laboratory using standard methods, while two harvesting methods were used to determine the effect of harvesting on the plant growth. The mean values of the morphological characteristics of stands of *Thaumatococcus daniellii* were as follows; stem height (154.9cm), stem girth (2.26cm), petiole length (24.86cm), petiole girth (1.69cm), leaf area (1018.93cm^2). The phytochemical analysis of the gelatinous layer extracts of the fruit showed that it contains saponin (0.19%), flavonoids (0.41%), phenol (0.06%), HCN (0.81%), Tannin (0.16%), Alkaloid (0.11%), Phytate (0.05%). The nutritional analysis of the gelatinous layer extract of the fruits showed that it contains calcium (6.68mg/100g), magnesium (0.60mg/100g), Ash (5.80%), Fibre (0.41%), Protein (19.01), Nitrogen (3.04%). The result obtained showed that the species are highly nutririous and the sugar content of its fruit can be easily substituted for white sugar and also used in pharmaceutical industries for children syrups. The best harvesting method is the ground level harvesting method. Conservation of this species and should be promoted.

KEYWORDS: *Thaumatococcus daniellii*, Thaumatin, Morphological properties, Nutritional properties, Harvesting methods.

1 INTRODUCTION

Thaumatococcus daniellii (Miraculous berry) and its products have continued to be of immense benefit to the people in the tropics. A large number of people depend on it for economic purpose. The species are multipurpose perennial herb that offers the widest assortment of uses. It has a soft-jelly like fruit that contain a high amount of protein (sweeter). The plant is of global prominence, consequent upon the discovery of "Thaumatin", a non-caloric sweeter derived from the arils of plants which is reportedly about 1600 times sweeter than sucrose (Zemanek and Wasserman, 1995).

It is a member of the maranthaceae family. It has long slender stalk reaching heights of about 2 – 3 metres. The stalk germinates into a single tough, almost round and versatile leaf of varying sizes depending on the age and habitat of the plant (Makinde and Taiwo, 2004). It is a multi-purpose perennial herb that offers wide range of uses with its leaves, fruits, stalks and rhizomes. It has been domesticated in most parts of South-western Nigeria, where it contributes to the economy of the

Corresponding Author: Edidiong A. Enoh

rural population (Osemeobo, 2005; Arowosoge and popoola, 2006). All parts of the plant are useful, with the stalk used to sweeten foods locally and in the production of Thaumatin (Elemo et. al, 1999), while the leaves are used for thatching roofs and in wrapping foods. The leaves are popularly used as a wrapping material for different categories of food such as unprocessed meat and kola nuts; semi processed foods such as fermented locust beans; processed foods such as cooked rice, beans, maize meal, pounded yam etc. the use of leaves as a food wrapper/preservation material is no more restricted to the local populace resident in the villages and suburbs. It has gained widespread acceptance not only in the towns and cities of South-western Nigeria, but also in some parts of the United States and South Americas, where it is now acceptable for food packaging (wrapping),as not only exotic but also for flavor enhancing (Thorn, 2004).

Depending on location and locality, various types of plant leaves are used as wrappers, example, banana/plantain leaf, i.e. Musa Sapentium, Musa paradisiacal, cola nitida and *Thaumatococcus daniellii* leaves (Adegunloye et. al. 2006), to package and present foods to clientele. The use of these leaves, are very ancient ways (traditions) of the people, the basis of which cannot be easily ascertained, but a cursory look at these leaves reveal that they all have large surface areas i.e. can be used to hold/package/wrap large volumes of food. Quite many populations depend on this plant for economic benefit. The sweetener contained in the seed of *Thaumatococcus daniellii* can be used in pharmaceutical industries, mineral-drink and confectionery industries. The fruit can be used in mitigating the bitterness in quinine or render insipid palm wine palatable. It is also added to palm wine and stale food to improve their taste (Oladele, 1994). There is unprecedented rise in acceptability of the gelatinous layer of the fruit as sweetener used in pulp and paper industries, pharmaceutical industries and confectionery industries (De lucca et. al. 2005).

The most important use of *Thaumatococcus daniellii,* however, is its use as a sweetener or taste modifier. The arils of the fruit contain thaumatins, a mixture of extremely sweet proteins. For that reason, *Thaumatococcus daniellii* is traditionally used for sweetening bread and flavouring palm wine. Since the mid-90s, it is used as sweetener and flavor enhancer by the food and confectionary industry in many countries, substituting synthetic sweeteners (Taiwo, 1995). Integrating *Thaumatococcus daniellii* in cropping systems or plantations seems to be a promising way to lessen these short comings, contributing to both income generation and diversification of crop production by small farmers. The species is a large rhizomatous flowering herb, native to the rain forests of Ghana and surrounding African nations. It is also an introduced species in the rainforests of Northern Australia. It grows 3-4m in height and has a large papery leaves up to 46cm long. It bears pale purple flowers and a soft fruit containing a few shiny black seeds (Gibbs et. al. 1999).

1.1 OBJECTIVES OF THE STUDY

The objectives of this study were to determine the:

1. Morphological characteristics of its stands
2. Interrelationships among the morphological characteristics
3. Effect of harvesting method on subsequent growth
4. Nutritional and phytochemical properties of the gelatinous layer of fruits of *Thaumatococcus daniellii*

1.2 SCOPE OF THE STUDY

This study examined the characteristics of *Thaumatococcus daniellii* stands. It also analyzed nutritional, anti-nutritional phytochemical composition of its fruits in the laboratory using adequate and standard analytical procedures. Effect of harvesting technique on plant regrowth was carried out in Michael Okpara University of Agriculture, Umudike, Abia State – Nigeria, where *Thaumatococcus daniellii* farm has been established.

1.3 THE STUDY AREA

This study was carried out in Michael Okpara University, Umudike, Abia State – Nigeria which lies on a latitude of 5º28.66'N and longitude of 7º32.56'E. It has an altitude of 122m above sea level. Umudike has the following mean annual climate data, 2238mm rainfall, which is biannually distributed between March-July and September-October or early November, with break in August. Minimum and maximum temperature of 23ºc and 32ºc and relative humidity 65-80% (Agro metrological station, NRCRI, Umudike).

2 MATERIALS AND METHODS

2.1 METHODOLOGY USED IN MORPHOLOGICAL CHARACTERISTICS OF *THAUMATOCOCCUS DANIELLII*

Materials used when determining the morphological characteristics of stands of *Thaumatococcus daniellii* include:

1. Rake: used to rake under the *Thaumatococcus daniellii* stands
2. Measuring tape: used in taking height and length measurements of stem and petiole of randomly selected *Thaumatococcus daniellii* stands
3. Thread: used in taking girth measurement of both stem and petiole
4. Ruler: used in measuring the thread length used in taking measurement of stem and petiole girth
5. Graph book: used in calculating the leaf area of *Thaumatococcus daniellii*
6. Knife: used in cutting stands of *Thaumatococcus daniellii* to determine the effect of harvesting techniques
7. Pen and Pencil: used in taking records of lengths of stands of *Thaumatococcus daniellii*
8. Gum: used in gumming/joining one or two graph sheets together

Methods applied when determining the morphological characeteristics of *Thaumatococcus daniellii* include:

1. Racking of *Thaumatococcus daniellii* stands to make it clean
2. 120 stands of *Thaumatococcus daniellii* were randomly selected and tagged numerically
3. The following measurements were taken per plant i.e. (1-120); stem height in centimeters, stem girth in centimeters, petiole length in centimeters, petiole girth in centimeters, and leaf area in centimeters squared (cm^2).

2.2 METHODOLOGY USED IN DETERMINING THE EFFECT OF HARVESTING METHODS ON PLANT REGROWTH

Two harvesting techniques were used. Sixty (60) stands of *Thaumatococcus daniellii* were selected for each method, giving a total of 120 plants. The first method involved cutting each stand and 5cm above ground level while the second method involves cutting the stands from the soil surface i.e. at the point of shoot connection to the rhizome.

2.3 METHODOLOGY APPLIED DURING NUTRITIONAL AND PHYTOCHEMICAL ANALYSIS OF THE GELATINOUS LAYER (THAUMATIN) OF *THAUMATOCOCCUS DANIELLII*

The fruits of *Thaumatococcus daniellii* were collected from the plant stands (being subterranean in nature) and analyzed at the central laboratory of the National Root Crops Research Institute, Umudike, Abia State.

3 NUTRITIONAL ANALYSES

3.1 DETERMINATION OF MOISTURE CONTENT

This was determined using the gravimetric method developed by James (1995). Five grams (5g) of each sample was weighed into previously weighted moisture and dried in the oven for 3hours. In the first instance, it was cooled in a desiccator and reweighed. It was then returned to the oven for further drying during which it was weighed at hourly interval until there was no further reduction in weight i.e. a constant weight was obtained. By weight difference, the weight of moisture was determined and expressed as a percentage of the sample weight.

3.2 DETERMINATION OF PROTEIN CONTENT

The kjeldaly method (Pearson 1976; James 1995 and Clang 2003) was used. The total Nitrogen was determine and multiplied with the factor 6.25 to obtain the protein. Procedure: one-half gram (0.5g) of each sample was digested by boiling in 10mls of concentrated H_2SO_4 in the presence of sodium catalyst. The sample was boiled under a fume cupboard until a clear solution was obtained. The digest was diluted to 100mls in a volume flask with distilled water. An adequate (10mls) of the diluted digest was mixed with equal volume of 45% NaOH solution in a Kjeldaly distillation apparatus. The mixture was distilled and the distillate was collected into 10mls of 4% Ban acid solution in which 3 drops of mixed indicator (Mettyl red and bromocresol green) was added. A total of 50ml distillate was collected and filtrated against 0.02 H_2SO_4 solutions from green to a deep red endpoint.

3.3 DETERMINATION OF ASH CONTENT

Ash content was determined gravimetrically following furnace incineration (Ogunwale, 1986; James, 1995). A measured weight of the sample was weighed into a previously weighed porcelain crucible. The sample in the crucible was burnt to ashes in an electric mottle furnace at a temperature of 5500c after 3 mins (when the sample became grey ash), it was carefully put in a desiccator to cool, and then it was reweighed. By weighing, the weight of ash was obtained and passed as a percentage of the sample analyzed.

3.4 DETERMINATION OF FAT CONTENT

This was determined by the continuous solvent extraction gravimetric method (as stated by Min and Boff, 2003). A solvent apparatus was used in the process. 5g of the sample was wrapped in a weighed filter paper and put in a solvent roflare flask. The roflare flask was mounted unto an oil extraction flask containing 300mls of petroleum. The upper end of the roflare flask was connected to a condenser. When heated, the solvent condensed into the roflare flask and covered the wrapped sample. The sample remained in contact with the sample until the roflare flask filled and siphoned over there by carrying extracted oil down to the boiling flask. This process was allowed to go on repeatedly for about 4 hours after which the sample is carefully removed with the aid of a pair of forceps. It was dried in the oven at 100 Celsius for 30mins, cooled in a desiccator and weighed. The weight of fat was less i.e. reduced and expressed as a percentage of the sample weight.

3.5 DETERMINATION OF CRUDE FIBRE

The Weende method by James (1995) was employed. 5g of each sample was defatted (as in fat determination). The defatted sample was boiled under roflare in 150ml of 1.25% of H_2SO_4 solution for 30mins. It was washed in several portions of distilled water using a twofold muslin cloth to retain the particles. The washed sample was boiled again for 30mins in 150mls of 1.25% of NaOH solution. After washing again in several portions of distilled water, it was put in a weighed porcelain crucible and dried in the oven at 105ºc for 1 hour. It was cooled in a desiccator and weighed. Following this, the dried weighed sample was burnt to ashes in furnace, cooled again in desiccator and weighed.

3.6 DETERMINATION OF CARBOHYDRATE

Carbohydrate was determined by Cleifeaur as the Nitrogen Free Extract (NFE) as described by James (2003). The formula below was used;

%CHO = 100 - % (protein + fat + fibre + Ash)

4 METHODS OF ANALYSIS FOR MINERAL

Mineral content of the test sample was determined following dry ash acid extraction method (Udoh and Oguhwale, 1980; James, 1995). A weighed sample was ashed (as in ash analysis). The resulting ash was dissolved in 10mls of 2m Ha solution and diluted to 100mls in a volume flask. This extract was used for mineral determination using appropriate method for specific minerals as described below.

4.1 DETERMINATION OF CALCIUM AND MAGNESIUM BY COMPLEXIOMETRIC TITRIETRY

Calcium and magnesium in the sample extract were determined by the versanate complexiometric titrimetry (James, 1995). A portion (20mls) of the sample extract was poured into a conical flask and a pinch of a mixed masking agent (Potassium cyanide and potassium ferrayaide) was added to it, shaken to dissolve and then 20mls of ammonia buffer solution (to raise the PH to 10.0). It was filtrated against 0.02N EDTA solution using erichrome black T as indicator. Titration was done from mauve to a permanent blue end point. A reagent blank was also treated as described above and titrated. The above titration was for combined calcium and magnesium (both Ca_2t and Mg form complex with EDTA at PH 10.0). A second titration was done for calorie. The same procedure was followed however, sodium cyanide was used in place of ammonia (to raise the PH to 12.0 where only Ca_2t form complex with EDTA). Also sodium dark blue was used as indicator in place of Erichrome black – T. The end point colour remained mauve to blue. In each case, a reagent blank was titrated as well.

4.2 DETERMINATION OF PHOSPHORUS

This was determined by the vanadohydrate calorimetric method (James, 1995). A portion of the sample extract was mixed with equal volume of phosphorus reagent (ammonium metavanadate + ammonium molybdate). The mixture was allowed to react for 5mins before it was diluted to 50mls with distilled water. A reagent blank was prepared with 2mls distilled water and treated as described above. Meanwhile, a standard phosphorous solution was prepared and analyzed as described above. The reagent blank was used to bring the instrument at zero before measurement was made.

5 METHOD OF ANALYSIS – PHYTOCHEMICALS

The test plants were screened to determine the presence of specific phytochemical group. The methods described by authors – Harbarne, 1973; Sofowara, 1993 were employed. Aqueous and ethanoic extracts were obtained from the plants and used in the screening test. The procedures are described below:

5.1 TEST FOR TANNING

About 2mls of aqueous extract of each test plant was used with few drops of dilute ferric chloride solution in a test tube. The formation of thick greenish – black precipitation gave a positive result for the presence of tannins in the test sample extract.

5.2 TEST FOR SAPONIN

The presence of saponin in the plant extracts was confirmed following a froth test. About 2mls of the aqueous extract was treated with 5mls of distilled water in a test tube. The mixture was shaken vigorously and observed for the presence of a stable froth (test for positive result for saponin presence in plant extract).

5.3 TEST FOR PHILABOTAMINGS

A portion of the aqueous extract of each plant was mixed with equal volume of 1% aqueous hydrochloric acid solution in a test tube. The mixture was boiled, and the deposition of red precipitation gave a positive result for philabatamins.

5.4 TEST FOR FLAVONOIDS

This was done by the alkaline – acid test. NH_3 solution was mixed with equal volume of the aqueous extract of the sample. The resulting yellow colouration was treated with dilute HCl solution and the disappearance of the yellow colour gave an indication of the presence of flavonoid.

5.5 TEST FOR CYANOGENIC GLYCOSIDE (HCN)

Cyanogenic glycosides are substances which on glycolysis will yield hydrocyanic acid (HCN). The alkaline piorate calorimetric method was used for the test. 1g of the sample (processed) was disposed in 150mls of distilled water in a conical flask and a strip of alkaline piorate paper was suspended over it. After an overnight incubation, the piorate paper was obtained for colour change from yellow to orange indicating the presence of cyanide.

5.6 TEST FOR ALKALOID

The alkaloid extract of the test plant was treated with Meyer's reagent. An orange colouration gave a positive test for the presence of alkaloid.

5.7 TEST FOR PHENOLS

Total phenol was determined using the folin-ciocaltean calorimetric method (AOAC, 1990). A weighed sample (0.2g) was dispersed in 10mls of pure methanol. It was filtered to obtain the extract used in the analysis. 1ml of the extract was mixed with equal volume (1ml) of folin-ciocaltean reagent in 50mls volume. Similarly, 1ml of standard phenol solution was treated

the same way in a separate flask. 2mls of Na_2CO_3 was added to each of the flask and mixed very well. Their respective absorbance was read in a speedtrophotometer with a reagent blank at zero.

6 STATISTICAL ANALYSIS

Data collected were analyzed using tables and graphs. The regression analysis carried out showed the relationships between the following:

1. Petiole girth on petiole length
2. Leaf area on stem height
3. Petiole length on stem girth
4. Petiole length on stem height
5. Stem girth on petiole girth
6. Leaf area on stem girth
7. Petiole length on leaf area
8. Leaf area on petiole girth
9. Stem girth on stem height
10. Multiple regression of stem height on leaf area, stem girth, petiole girth and petiole length

7 RESULTS AND DISCUSSION

7.1 MEANS AND RANGE VALUES FOR THE MORPHOLOGICAL CHARACTERISTICS OF *THAUMATOCOCCUS DANIELLII*

Table 1: Means and range values for the morphological characteristics of Thaumatococcus daniellii

MORPHOLOGICAL CHARACTERISTICS	MEANS	RANGES
Stem Height (cm)	15.9	(73.0 – 226.8)
Stem Girth (cm)	2.26	(1.6 – 2.5)
Petiole Length (cm)	24.86	(11.1 – 16.2)
Petiole Girth (cm)	1.69	(1.3 – 2.0)
Leaf Area (cm^2)	1018.93	(870.11 – 1323.06)

7.2 NUTRITIONAL COMPOSITION OF "THAUMATIN" CONTENT OF *THAUMATOCOCCUS DANIELLII*

Table 2: Nutritional composition of "thaumatin" content of Thaumatococcus daniellii fruits

NUTRIENT ANALYSIS	MEAN VALUES
Moisture content (%)	83.9
Protein content (%)	19.01
Crude fibre (%)	0.42
Ash (%)	5.80
Fat (%)	3.85
MINERALS	
Calcium (Mg/100g)	6.68
Magnesium (Mg/100g)	0.60

7.3 PHYTOCHEMICAL COMPOSITION OF "THAUMATIN" IN *THAUMATOCOCCUS DANIELLII* FRUITS

Table 3: Phytochemical composition of "thaumatin" in Thaumatococcus daniellii fruits

ANALYSIS	MEAN VALUES
Saponin (%)	0.19
Flavonoid (%)	0.14
Phenol (%)	0.06
Tannin (%)	0.16
Alkaloid (%)	0.11
Phytate (%)	0.05
Fat content (%)	3.85
Hydrogen cyanide HCN (Mg/1kg)	0.81

8 DISCUSSIONS

This study of the morphological characteristics of ***Thaumatococcus daniellii*** stands and fruits through nutritional, phytochemical and regression analysis is an attempt to unravel the scientific benefits derivable from the use of its leaves, fruits and stalks in weaving mats and the seeds extract (thaumatin) as a sweetener used in pharmaceutical and confectionery industries.

The finding of phytochemical analysis reveals the presence of saponin, phytate, fat, alkaloid, tannin, phenol and hydrogen cynate which means it is edible and from the various contents, it reveals that the fat content is highest while the alkanoid content is the least.

Thaumatococcus daniellii is known to produce secondary metabolites that complement their elites which consider the packaging (wrapping) as not only exotic, but also flavor enhancing (Thorn, 2004). There are about 250,000 – 500,000 species of plants in existence but only very few of these have been screened for their microbial potentials (De lucca et. al., 2005).

8.1 MORPHOLOGICAL CHARACTERISTICS OF *THAUMATOCOCCUS DANIELLII* STANDS

The results of the morphological characteristics on table one (1) show that the plant growth height ranges from at least 73.0cm – 226.8cm), while its average mean growth is about 154.9cm. From the table also, it can be seen that the leaf area ranges from 870.1cm^2 to 1323.06cm^2 while its average leaf area is about 1018.93cm^2. The table 1 also shows that the stem girth ranges from at least 1.6cm to 2.5cm with an average stem girth of about 2.26cm. It also shows the petiole length and petiole girth which ranges from 11.1cm to 16.2cm and 1.3cm to 2.0cm respectively, with an average petiole length of 24.86cm and an average petiole girth of 1.69cm.

8.2 NUTRITIONAL COMPOSITION OF *THAUMATOCOCCUS DANIELLII* FRUITS (THAUMATIN)

From the nutritional analysis of table two (2), thaumatin contains moisture, protein, crude fibre, fat, ash and minerals which include magnesium and calcium. The table shows that the moisture content is highest while the magnesium content is least with 0.60%, the calcium content is also high with about 6.68%. Calcium has the highest mineral content. The protein content is about 19.0%.

8.3 PHYTOCHEMICAL COMPOSITION OF THAUMATIN

The phytochemical analysis showed that the fruit "thaumatin" contains saponin, flavonoid, phenol, tannin, alkanoid and phytate. The table 3 shows that hydrogen cyanide has the highest content with about 0.81 Mg/Kg followed by the flavonoid content with about 0.41%. Saponin content is about 0.19%. Tannin content about 0.16%, alkanoid content is about 0.11%, phytate content is very low with about 0.05% and phenol content about 0.06%.

9 CONCLUSION

In conclusion, there is need to sustainably produce ***Thaumatococcus daniellii*** in Nigeria. The most economic and realistic means is to improve on the technology of producing sweetener from its "Thaumatin" in which appear on the interim, the most economic potential of the plant that have attracted global attention. The sweetener which serves as whole food could be substituted for sugar. Developing this technology and marketing will invariably encourage the cultivation of ***Thaumatococcus daniellii*** not only by the local farmers but also by pharmaceutical and confectionery industries. The phytochemical contents of this species made it a source of raw material for industries. Also, since this species can regenerate itself quickly from the rhizomes as observed in harvesting method involving cutting from the soil surface, it could be introduced to farmers as weed suppressor and its sustainability can be well assured.

10 RECOMMENDATION

1. Awareness (public) should be increased on the local knowledge and practices of developing ***Thaumatococcus daniellii***. Also, the importance of ***Thaumatococcus daniellii*** should be highlighted.
2. It is recommended that "thaumatin" be used in beverage, confectionery and pharmaceutical industries. It is an internationally traded commodity with a market value of 400 Euros.
3. With the thaumatin market ripe for expansion increase, pressure is expected on the natural resource, hence; need to sustainably produce ***Thaumatococcus daniellii*** on a commercial basis.
4. Before working on a ***Thaumatococcus daniellii*** plot, reconnaissance survey is recommended with relevance to sustainable harvesting and its propagation.
5. From the result of nutritional and phytochemical analysis obtained, it is recommended that people substitute table sugars for this natural sugar as it contains mineral and nutrients including protein.
6. From the result of the morphological characteristics obtained, it is highly recommended that during harvesting, the stand should be cut from the ground surface to facilitate fast regrowth.
7. From the result of the morphological characteristics regarding its growth height, it is recommended that it be grown in areas were sunlight is visible because some stalks are short for easy photosynthesis.
8. Because it contains carbohydrate from the result of nutritional analysis, it is recommended that it be used as source of energy in domestic homes.

REFERNCES

[1] Adegunloye, D. V., Agarry, O. O., Adebolu, T. T. and Adefuyi, F. C., (2006): Effect of leaf packaging on the microbiological assessment of some food items. *Journal of Agriculture* (pp 12 – 18)

[2] AOAC (1990): Methods of analysis, Vol 15, Issues 1-2. Association of official analytical chemists, 15th edition, Washington DC.

[3] De Lucca, A. T., Cleveland, K., Rajasekara, S. and Brown, R. (2005): Fungal properties of CAY-1, a plant saponin for emerging fungal pathogens. 45th interscience conference in antimicrobial agents and chemotherapy abstract, F-490, pp 180

[4] Elemo, B. O.; Adu, O. B.; Ogunrinola, O. O.; Efuwape, T. O.; Olaleye, K. O. and Kareem, A. A. (2011): Biological evaluation of Thaumatococcus daniellii waste protein. Pakistan journal of nutrition 10(11): 1048-1052, ISSN 1680-5194

[5] Harborne J. B. (1973): Phytochemical methods; Chapman and Hall, Ltd, London. Pp 49-188

[6] Min, D. B. and Boff, J. M. (2003): Chemistry and reaction of singlet oxygen in food composition; Food science safety 1:58-72

[7] National Root Crops Research Institute, (2009): Agro meteorological station, Umudike, Abia State, Nigeria

[8] Oladele, A. A., (1994): Socio-economic studies of miraculous berry (Thaumatococcus daniellii) in the rain forest of Osun State. Unpublished B.Sc dissertation of Lagos State University

[9] Pearson, D. (1976): The chemical analysis of foods, 7th edition; Churchill living stone, London

[10] Sofowa, A. (1993): Medicinal plants and medicine in Africa. John Whilley spectrum books, Ibadan, Nigeria. Pp 120-123

[11] Thorn, S.; Jensen, L.; Kearney, M. H; Sandelowski, M. (2004): Qualitative metasynthesis; reflections on methodological orientation and ideological agenda. Qualitative health research 14 (10): 1342-1365

[12] Udoh, E. J. and Ogunwale, J. A. (1980): Laboratory manual for the analysis of soils, plants and water samples. Department of Agronomy, University of Ibadan, Ibadan, Nigeria

[13] Zemanek B. P. and Wasserman E. C. (1995): Influence of P^H on thermo-degradation of thaumatin in aqueous solution. Food research international; Elsevier science Ltd, Great Britain, Vol 30, No. 9, pp 707.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 312-321
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

A techno-energetic review on hydrogen production using wind energy

Sandeep Pandeyr and Hemshikha Saini

Centre for Energy Studies,
Indian Institute of Technology,
New Delhi, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Renewable energy technology (RET) is gaining too much popularity now a day as these are considered as best replacement for fossil fuel based energy. Specially wind and solar energy gained much attention in developed as well as in developing countries. But one should also consider that these sources are not continuous, solar radiation is available at most 10 hours a day and wind also depends on particular geographical location. Due to their variable nature operator need to store energy from these sources so that power demand can be met during peak hours. But now during power oversupply, operators curtail these resources. The curtailment rates are expected to increase in future as RET shares increasing continuously.

Instead of curtailment one can store the energy but it is seen that storage is not as favourable as curtailment. So we suggest that instead of curtailment and storage in conventional electro-chemical battery system one should go for electricity storage in form of hydrogen. For this electrolysis is the best way. In this paper we will review the hydrogen production by electrolysis and its use in RET.

KEYWORDS: renewable energy storage, electrolysis by wind energy, wind energy storage option, curtailment vs. storage, hydrogen production.

1 INTRODUCTION

Nowadays, energy from renewable sources gained much more attention as these are considered as least carbon emitting sources and uses abundantly freely available resources. This paper describes how wind energy can be used for hydrogen generation. Paper starts with brief discussion on favouring this technology especially for the wind energy system. Then we move our discussion to basis of electrolysis. The objective of paper is to look into currently available these kind of technology.

Hydrogen is considered as clean fuel which can be directly use as fuel for IC engine or gas turbine, also hydrogen is having highest heating value which indicates its higher energy density. Theoretically water vapour is the only emission but due to high temperature NO_X is also formed but it can be controlled by ultra-lean operation of engine. Furthermore, hydrogen can be used in fuel cells for remote area and military applications. Currently most of the hydrogen is produced by cracking carbonaceous fuels. So this will further increase GHGs and emission. As a solution hydrogen production from RET seems to be best option available.

2 HYDROGEN PRODUCTION METHODS

Hydrogen is an energy carrier not an energy source. Hydrogen can be produced by several methods as shown in Figure (1), ranging from hydrocarbon fuels to water. *Water electrolysis* is one of the oldest and matured technology available for hydrogen production and it gives very pure hydrogen as compared to other methods but major drawback is that it uses electricity and it is an expensive process. A brief discussion on production technologies along with cost is provided by Timothy Lipman (2011). *Steam Methane Reforming (SMR)* is a process in which hydrocarbon derived gas is react with steam

Corresponding Author: Sandeep Pandeyr

and produce hydrogen and carbon dioxide in presence of catalysts. SMR produces hydrogen rich gas (70-75%) along with carbon dioxide (6-14%), carbon monoxide (7-10%) and methane (2-6%) on a dry mass basis. In *gasification of coal and other hydrocarbons*, coal and other hydrocarbon fuels are partially oxidised, it yields a mixture of hydrogen and carbon monoxide. Hydrogen can also be produced from water by *Electrolysis process,* in which water is split into hydrogen and oxygen by using electricity in an electrolyser. There are several other methods like, *thermolysis, photolysis, bio-photolysis* etc.

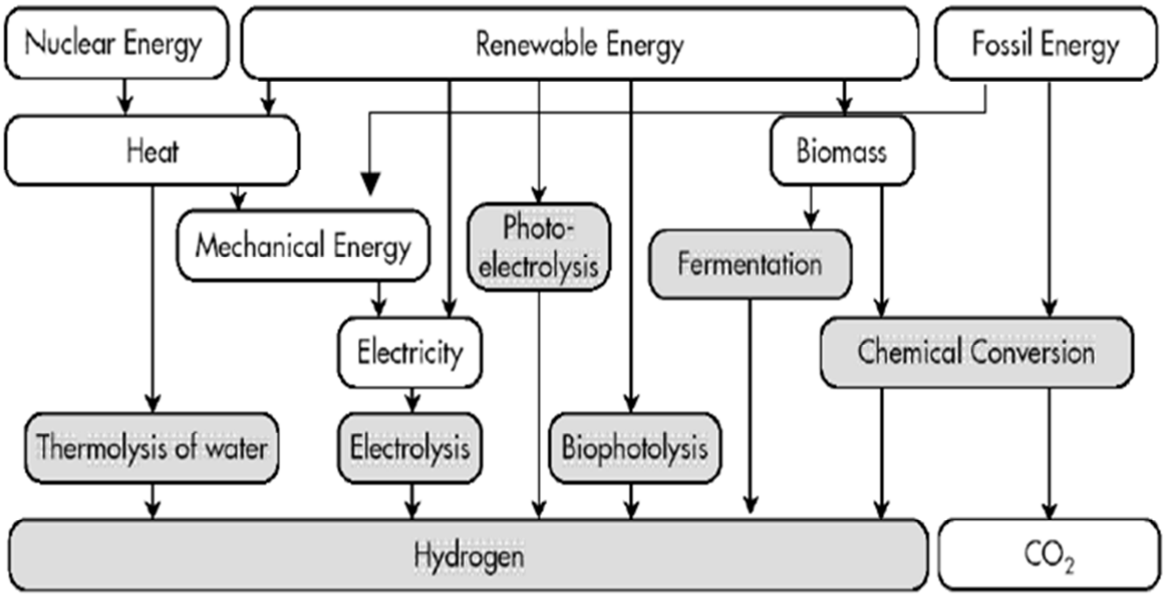


Fig. 1. Hydrogen production methods

3 REASONS FOR HYDROGEN PRODUCTION USING WIND ENERGY

Hydrogen can be produced by electrolysis which uses electricity; source can be anything like fossil fuel based electricity, solar PV, wave energy or any other resource. By using electricity from fossil fuel is worthless as it involves carbon emissions while generating electricity. Therefore, one should go for the RET for hydrogen production.

As RET, we have various technologies in which wind and solar PV dominate the world RET share. Wind power contribution is increasing at the rate of 30% annually and installed capacity was 238GW at the end of 2011[2]. Also if see with respect to India wind power installed capacity is 20298.83MW (Grid interactive power) by the end of January-2014[3]. While for Indian context solar PV based installed capacity is 2208.36MW (Grid interactive power) by the end of January-2014[3]. Their share expected to increase with supportive government policies.

These technologies provide a cleaner, sustainable and low carbon energy sources, but these technologies generate electricity from variable, weather-dependent resources.

In Figure 2 [4], variation of power demand and power generation by renewable (solar, wind and hydroelectric) with respect to time is shown. It is seen that with the assumption of the production is constant from midnight to 0800 h. It peaks from 0800 h to noon and falls rapidly thereafter till 1600 h. After that it decreases slowly till 2200 h and then is constant up to midnight. It is clear that there is a wide mismatch between the supply and demand curves. The supply is more than the demand for about 7 h from 9 a.m. to 4 p.m. when the sun is shining. For the remaining period of about 17 h, it is less than the demand. So during the power oversupply period there are two options; one is to store the energy and the other is to simply curtail the energy.

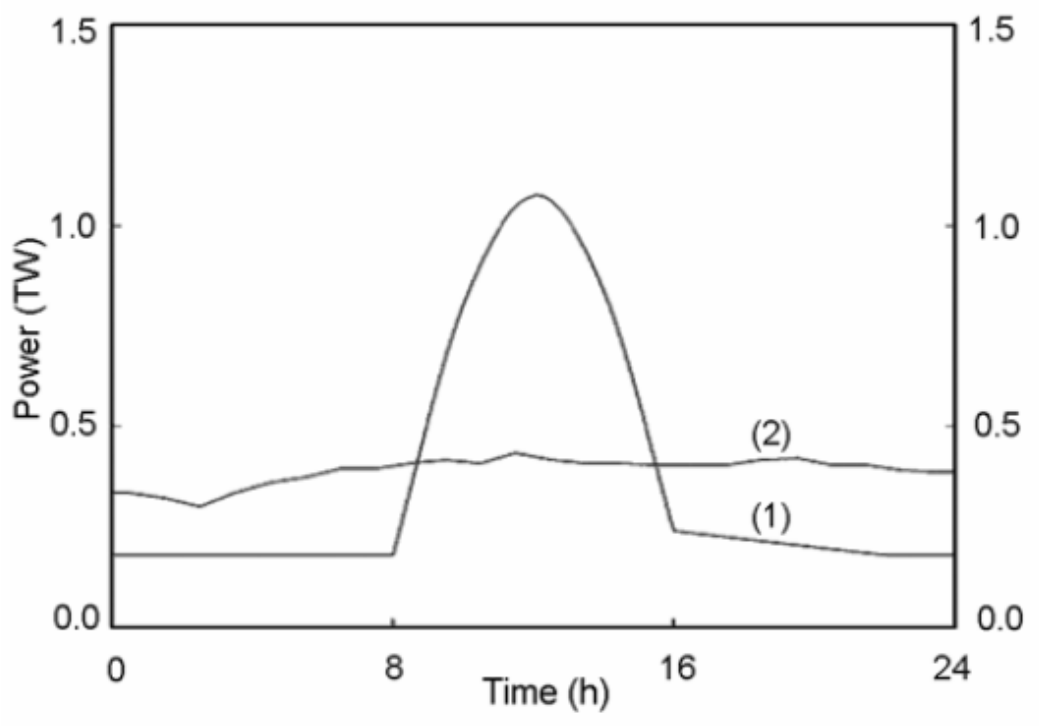


Fig. 2. Comparison of diurnal variation of production (curve 1) and demand (curve 2) over a typical sunny day.

Now moving our discussion towards the energetic side to evaluate under what conditions production of hydrogen is favourable from wind energy. In brief we are discussing the conditions under which energy from wind or solar PV should be store or curtail the oversupply. Charles J. Barnhart *et al.* (2013) [1] have derive the conditions for the same in their paper. They use an energetic model for the same, named Energy Return on Investment (EROI). It is the ratio of the energy delivered by a process/device to the energy used directly and indirectly in that process/device.

$$EROI = \frac{Life\ cycle\ energy\ delivered}{Life\ cycle\ energy\ invested}$$

Similarly ESOI is analogous to EROI, it is the ratio of electrical energy stored over the lifetime of a storage device to the amount of embodied electrical energy required to build the device. ESOI is specially defined for the purpose of comparison of different storage.

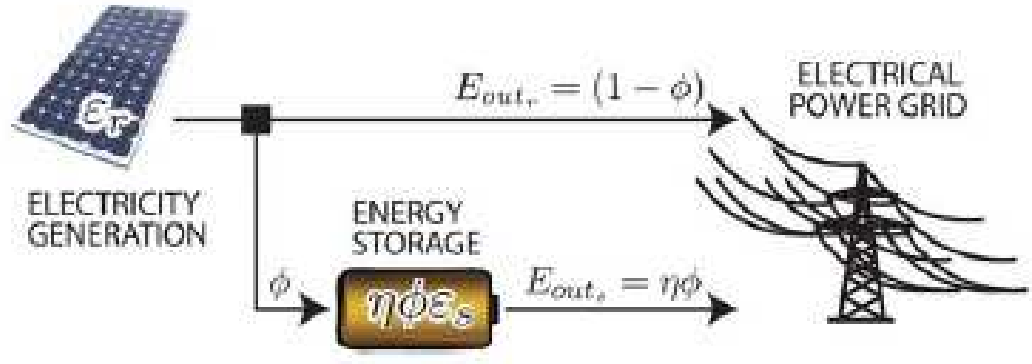


Fig. 3. Energy flow from RET [1]

If φ is the curtailed or store portion then for charging-discharging efficiency 100%, relationship between EROI and ESOI is given as:

$$\frac{ESOI}{EROI} = 1 - \phi$$

When this equality holds, curtailment and storage yield the same grid scale EROI. Otherwise, from an energy efficiency perspective, one of the two conditions exists:

(i) When $\frac{ESOI}{EROI} > 1 - \phi$ → In this condition one should store the electrical output from the renewable energy technology.

(ii) When $\frac{ESOI}{EROI} < 1 - \phi$ → In this condition one should avoid the storage, instead of storage curtail the generation of electricity from the renewable energy technology.

Graph (1) [1] shows the variation of EROI with respect to ESOI for different value of curtailment to storage fraction (φ) for equality relation. From this curve one can easily make decision regarding the whether to store or curtail the generation of electricity. Table (1) and (2) [1] provides data for different parameters used for ESOI and EROI calculation.

Table 1. Data used in NEA of variable resources by storage technologies.

Storage	η	ƛ	D (%)	ε_e	ESOI
Li-ion	90	6000	80	136	32
Nas	75	4750	80	146	20
PbA	90	700	80	96	5
VRB	75	2900	100	208	10
ZnBr	60	2750	80	151	9
CAES	70	25000	NA	22	797
PHS	85	25000	NA	30	704

Table 2. EROI Data for generation technologies

Generation	EROI
Wafer PV	8
Wind	86

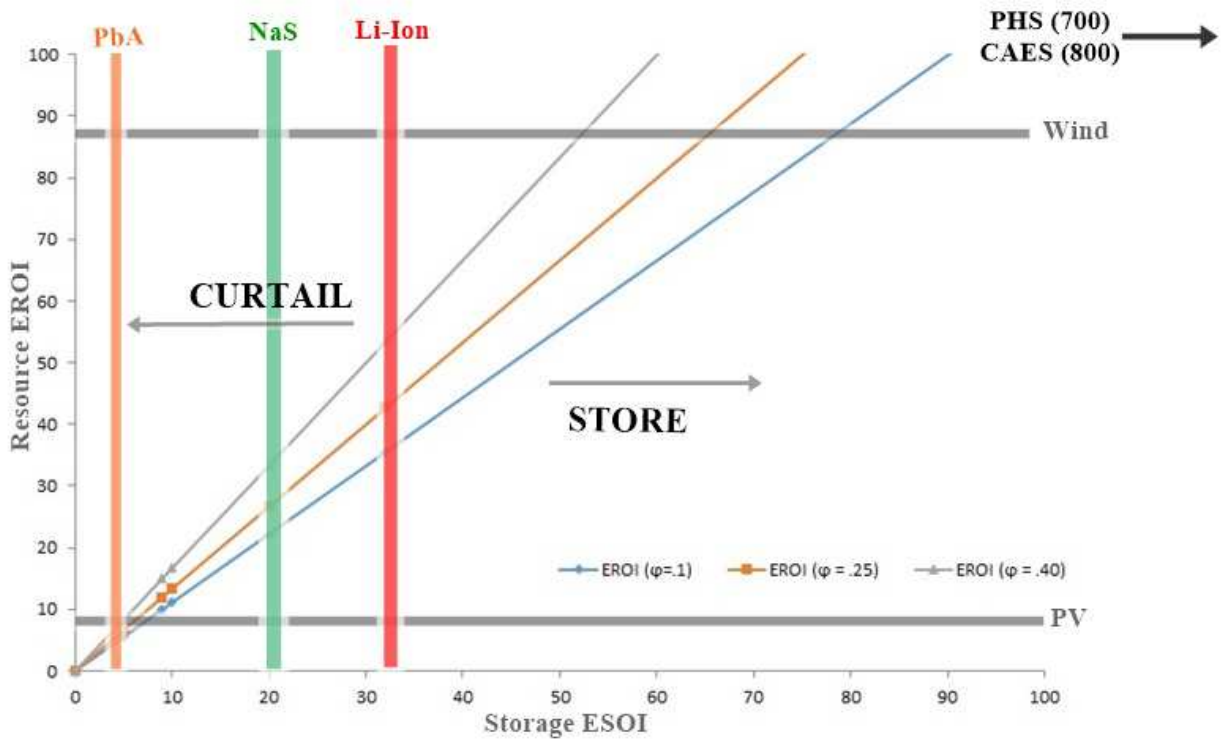


Fig. 4. Various combinations of resource EROI (y-axis) and storage ESOI (x-axis) for different value of curtailment or storage fraction (φ).

This plot simply tells that, from net energy perspective electricity generated using solar PV technologies can be stored efficiently using electrochemical based storage technologies like NaS, PbA, Li-ion etc. while wind power should be stored with more energetically favourable storage options such as compressed air energy storage etc.

Moving forward from this conclusion, that if someone wants to store energy instead of curtailment then instead of conventional battery storage one should use new technologies like PHS and CAES. In this paper we suggests that during oversupply one should use that energy from wind turbine and using electrolysis process produce hydrogen from locally available water and transport that hydrogen to near utilization point i.e. in Gas turbine or IC engine power plant.

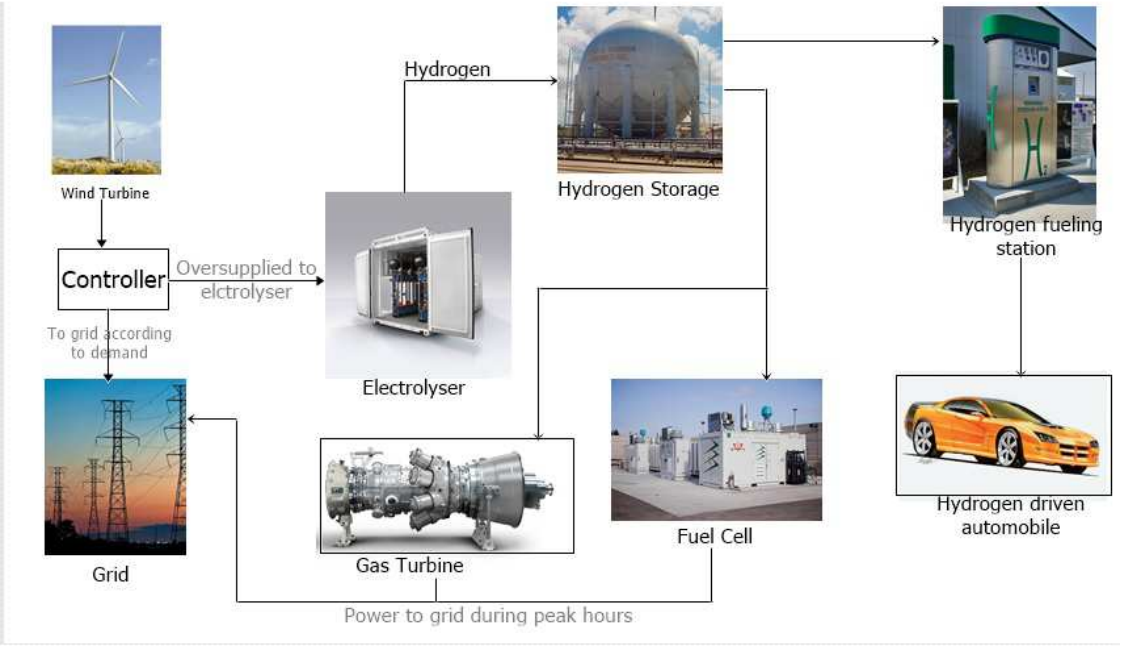


Fig. 5. A flow chart of Hydrogen production from wind and its utilization

We are encouraging hydrogen production by wind oversupplied energy, the reason behind is that hydrogen is clean fuel not only for a power plant but also for an automobile. Table (3) compares the various ignition properties for the Hydrogen as compared to other fuels which shares a major market share. Octane rating of Hydrogen is high so one can go for higher compression ratio to increase thermal efficiency. Flammability limit is also high so ultra-lean operation can be possible. Yet self-ignition temperature is high but it will ignite easily as minimum ignition energy is very small.

Table 3. Comparison of ignition properties for various fuels

Property	Hydrogen	Methane	Gasoline
Research Octane Number (RON)	>130	120	86-92
Flammability limit (in air, volume %)	4-75	5-15	1-7.6
Minimum ignition energy (mJ)	.02	.29	.24
Flame temperature (^{O}C)	2045	1875	2200
Auto ignition temperature (in air, ^{O}C)	586	540	230-500
Maximum flame velocity (m/s)	3.46	.43	-

Apart from this, ideally Hydrogen using power plant will emits water vapour only but in practical NO_X is also present which can be suppressed by ultra-lean operations.

4 BASICS OF ELECTROLYSIS

The most abundant source of hydrogen is water. Electrolysis is the most promising option for hydrogen production from RET. When used with renewable sources of electricity, it can produce hydrogen with zero or near zero GHGs emissions. As only water is used in the process, it can produce 99.995% pure hydrogen and oxygen. [5]

Water electrolysis is now developed technology, and it has been used for production ranging from a few cm^3/min to thousands m^3/h. It is relatively efficient (>70%), but because it need high grade of energy (i.e. electricity), hydrogen produced by this process is expensive. But as we shown above that wind power oversupply can be used for hydrogen production instead of curtailment.

An electrical power source is connected to two electrodes, or two plates (typically made from some inert metal such as platinum, stainless steel or iridium) which are placed in the water. Hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode (the positively charged electrode).

Assuming ideal faradaic efficiency, the amount of hydrogen generated is twice the number of moles of oxygen, and both are proportional to the total electrical charge conducted by the solution. However, in many cells competing side reactions dominate, resulting in different products and less than ideal faradaic efficiency.

In pure water at the negatively charged cathode, a reduction reaction takes place, with electrons (e^-) from the cathode being given to hydrogen cations to form hydrogen gas (the half reaction balanced with acid):

Reduction at cathode: $2\ H^+(aq) + 2e^- \rightarrow H_2(g)$

At the positively charged anode, an oxidation reaction occurs, generating oxygen gas and giving electrons to the anode to complete the circuit:

Oxidation at anode: $2\ H_2O(l) \rightarrow O_2(g) + 4\ H^+(aq) + 4e^-$

The same half reactions can also be balanced with base as listed below. Not all half reactions must be balanced with acid or base. Many do, like the oxidation or reduction of water listed here. To add half reactions they must both be balanced with either acid or base.

Cathode (reduction): $2\ H_2O(l) + 2e^- \rightarrow H_2(g) + 2\ OH^-(aq)$

Anode (oxidation): $4\ OH^-(aq) \rightarrow O_2(g) + 2\ H_2O(l) + 4\ e^-$

Combining either half reaction pair yields the same overall decomposition of water into oxygen and hydrogen:

Overall reaction: $2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$

The number of hydrogen molecules produced is thus twice the number of oxygen molecules. Assuming equal temperature and pressure for both gases, the produced hydrogen gas has therefore twice the volume of the produced oxygen gas. The number of electrons pushed through the water is twice the number of generated hydrogen molecules and four times the number of generated oxygen molecules.

The minimum necessary cell voltage for the start-up of electrolysis, E^o_{cell}, is given under standard conditions (P, T constant) by following equations:

$$E^o_{cell} = \frac{-\Delta G^o}{n.F}$$

Where, ΔG^o is the change in Gibb's free energy under standard conditions and n is the number of electrons transferred. In cell, change in volume is smaller as compared to that of pressure. Therefore instead of open cell (P, T=constant), we can assume it as closed cell (V, T=constant). So Gibb's free energy is replaced by the Helmhotz's free energy.

$$E^o_{cell} = \frac{-\Delta A^o}{n.F}$$

Where, $\Delta A^o = \Delta H^o - TR\Delta n - T\Delta S^o$

Analysing for, water electrolysis:

$\Delta H^o = 285.8\ kJ/mol, \qquad \Delta n = 1.5, \qquad \Delta S^o(H_2) = 130.6\ J/mol.K,$

$\Delta S^o(O_2) = 205.1\ J/mol.K\ , \qquad \Delta S^o(H_2O) = 70\ J/mol.K\ ,$

$\Delta S^o_{total} = 130.6 + \frac{1}{2} * 205.1 - 70 = 163.14\ J/mol.K$

$\Delta G^o = \Delta H^o - T\Delta S^o = 237.2\ kJ/mol$, at STP

$\Delta A^o = 233.1\ kJ/mol$

Therefore, $E^o_{cell} = 1.21\ V$, for closed cell.

And, $E^o_{cell} = 1.23\ V$, for open cell.

For both the case, i.e. open and closed cell, the minimum necessary cell voltage for the start-up of electrolysis, E^o_{cell} is in the range of 1.2 V, which is easily achievable by a wind turbine.

Here we are presenting some data from commercial electrolysis systems *(Source: NREL, USA)*; the data of five companies' electrolysis units, commercially. For these systems, the water-to-hydrogen conversion efficiencies ranges from 80%-95% and hydrogen purities ranges from 99.8%-99.9998%. The system energy efficiency, defined as the higher heating value (HHV) of hydrogen divided by the energy consumed by the electrolysis system (system means electrolyser, rectifier and other auxiliaries) per kilogram of hydrogen produced, ranges from 56% for Proton company's Proton Exchange Membrane (PEM) process to 73% for Stuart and Norsk company's Hydro's bipolar alkaline systems. Other observations are shown in table (4) [6].

Table 4. Commercially available electrolysis units (Source: NREL, USA)

Manufacturer	Technology	System Energy Requirement (kWh/kg)	H2 production rate (kg/yr)	Power Required for Max. H2 Production Rate (kW)	H2 Product Pressure (psig)
Avalence	Unipolar Alkaline	56.4-60.5	320-3600	2-25	Upto 10000
Proton	PEM	62.3-70.1	400-7900	3-63	~200
Teledyne	Bipolar Alkaline	59.0-67.9	2200-33000	17-240	60-115
Stuart	Bipolar Alkaline	53.4-54.5	2400-71000	15-360	360
Norsk Hydro	Bipolar Alkaline (High Pressure)	53.4	7900-47000	48-290	~230
	Bipolar Alkaline (atmospheric pressure)	53.4	39000-380000	240-2300	0.3

5 REVIEW ON PRESENT RESEARCH

5.1 NREL'S WIND-TO-HYDROGEN PROJECT:

United States' primary laboratory for renewable energy and energy efficiency research and development NREL, in partnership with Xcel Energy, launched a wind-to-hydrogen (Wind2H2) demonstration project at the National Wind Technology Centre in Boulder, Colorado. The Wind2H2 project links wind turbines to electrolysers, which pass the wind-generated electricity through water to split it into hydrogen and oxygen. The hydrogen can then be stored and used later to generate electricity from an internal combustion engine or a fuel cell.

The *Wind2H2* project uses two wind turbine technologies: a Northern Power Systems 100-kW wind turbine and a Bergey 10-kW wind turbine. Both wind turbines are variable speed, meaning the blade's speed varies with wind speed. Such wind turbines produce alternating current (AC) that varies in magnitude and frequency (known as wild AC) as the wind speed changes.

The energy from the 10-kW wind turbine is converted from its wild AC form to direct current (DC) and then used by the electrolyser stack to produce hydrogen from water. The energy from the 100-kW wind turbine is monitored with a power transducer, and stack current on the 33-kW alkaline stack is varied proportionally. Apart from it, system has a10 kW photovoltaic modules (multi-crystalline) which gives DC power directly.

For hydrogen production, system has two HOGEN 40RE polymer electrolyte membrane electrolysers from Proton Energy Systems and one Teledyne HMXT-100 alkaline electrolyser. Teledyne produces 12 kg of hydrogen per day while HOGEN 40RE Electrolyser can produce 2.27 kg of hydrogen per day. Hydrogen gas obtained from the electrolysers is at 1034.2 kPa, for storage purpose it is compressed to 24.13 MPa with the help of hydrogen diaphragm compressor. Compressed hydrogen is then stored in the Hydrogen storage tanks (storing capacity is 85 kg at 24.13 MPa). This stored hydrogen is used to produce electricity during peak hour by an internal combustion engine. This small IC engine plant can produce 60 kW of electricity. There is a PEM fuel cell, which runs on stored hydrogen and it can produce 5 kW electricity, which can be used to meet peak hour's demand.

In 2009, NREL installed a new compressor, tank, and hydrogen dispenser to enable refuelling of fuel cell vehicles. From December 2008 through September 2009, NREL operated a Mercedes Benz F-Cell fuel cell vehicle. Hydrogen from wind and PV were compressed to high pressure to fill the vehicle's 1.8-kg storage tank. The vehicle travels around 110 miles between refuelling.

5.2 POWER TO GAS PROJECT

Power to gas [7] is a technology that converts renewable electricity into hydrogen or methane. The gas can be transported in the gas infrastructure and stored and then used in different application areas. If necessary, it is converted to electricity again. In this paper we are dealing with hydrogen production from wind energy mainly.

5.3 PILOT PLANT FALK HAGEN

Power to Gas is a similar project as of NREL's Wind2H2; storing surplus energy from renewable sources, such as solar and wind power, until it is required, balancing long-term fluctuations in generation. E.ON is building a pilot plant in Falkenhagen, Germany to convert excess wind power into hydrogen by electrolysis process. The hydrogen will be carried via pipeline to a connection point on the NG grid, where it will be injected into ONTRAS/VNG's high pressure transmission pipelines. The Falkenhagen storage plant will produce up to 360Nm^3/h of hydrogen from about 2 MW wind power through electrolysis. The hydrogen will be fed into the natural gas pipeline at around 2% by volume, at a maximum operating pressure of 55bar (gas), effectively storing and transporting renewable energy.

The work scope will include the engineering, construction, commissioning and start-up of a containerized 2MW electrolyser and compression plant. In addition the project will provide a power substation, metering station, hydrogen pipeline and natural gas grid access station. By storing oversupplied energy in the form of hydrogen which otherwise will be waste will increase the overall plant efficiency drastically.

5.4 RWE DEMONSTRATION PLANT

In this demonstration plant, 100 kW of electrical output is used with PEM electrolysis to produce hydrogen. The hydrogen produced in the plant is fed into the regional RWE gas network. With 100 kW_e input, PEM electrolyser can produce 200Nm^3/h of hydrogen.

5.4.1 THÜGA DEMONSTRATION PLANT

This is an initiate of 13 companies at Frankfurt. In this demonstration project with 320 kW_e, 60 Nm^3/h of hydrogen is supposed to be produced which will be fed to the gas network with an operating pressure of 300 kPa.

5.5 EMERALD H2 AND NORFOLK WIND ENERGY

This project is solely intended to produce hydrogen from wind energy. A small fraction of that hydrogen, (< 5 %), will be used for fuel cell, capable of generating 1 MW of electricity during peak hours of electricity demand. The rest would be sold for use in a wide variety of industrial applications, from oil refining and chemical production to metals fabrication and electronics manufacturing. This plant of 10 MW wind facility that would annually produce more than 500,000 kilograms of hydrogen. This is about 20 times more hydrogen than a wind-to-hydrogen demonstration project in Boulder, Colorado of NREL.

Apart from above discussed projects, Sotavento Wind Farm [8] with rated 17.56 MW capacity is operational, there are feasibility studies are going on in various countries. LAîche-Hamane et al. [9] have estimated hydrogen production for an average wind speed of 7.5 m/s at 30 m height, 3900 Nm^3 for 10 kW wind turbine, 25350 Nm^3 for 50 kW and 99150 Nm^3 for 250 kW for south Algeria.

6 CONCLUSION

For wind energy oversupplied, battery storage is not recommended as discussed in previous sections. So we are suggesting hydrogen production and its storage. This stored hydrogen can be used to meet peak demand or fuel of an automobile. Most hydrogen is "reformed" from natural gas or other fossil fuels by stripping out the hydrogen atoms, a process that creates greenhouse gas emissions and eliminates some environmental benefits. Hydrogen is also produced through electrolysis using sources of electricity, such as fossil fuels, that generate air emissions. The hydrogen production from RETs allows researchers to explore how to make hydrogen without producing greenhouse gases or other harmful by-products. Yet there is embodied GHG with RETs but these are very small as compared to steam reforming methods. Therefore, hydrogen production from RETs should be encouraged instead of curtailment of energy.

REFERENCES

[1] Barnhart Charles J, Dale Michael, Brandt Adam R, Benson Sally M, The energetic implications of curtailing versus storing solar- and wind-generated electricity, The Royal Society of Chemistry, 2013.

[2] World energy consumption, http://en.wikipedia.org/wiki/World_energy_consumption, last accessed on April, 2014.

[3] India's renewable energy,http://www.mnre.gov.in/mission-and-vision-2/achievements/, last accessed on April, 2014.

[4] Sukhatme S P, Can India's future needs of electricity be met by renewable energy sources? Current Science, Vol. 103, No. 10, 25 November 2012, pp. 1153-1161.

[5] Giudici Federico A, Feasibility Study of hydrogen production using electrolysis and wind power in Patagonia, Argentina, 2008.

[6] Technology Brief: Analysis of Current-Day Commercial Electrolyzers, NREL USA, September, 2004.

[7] Strategieplattform Power to Gas, http://www.powertogas.info/ , last accessed on June, 2014.

[8] Porto M Rey, Carretero T, Aguado M, Garde R, H2 Production in Sotavento Wind Farm, 18th World Hydrogen Energy Conference 2010.

[9] Aîche-Hamane L et al. Estimation of hydrogen production from different wind turbine sizes in the south of Algeria, Revue des Energies Renouvelables ICRESD-07 Tlemcen 2007, pp. 129 – 134.

[10] Lipman Timothy, An overview of hydrogen production and storage systems with renewable hydrogen case studies, , A clean energy state alliance report, 2011.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 322-329
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Assessment of the therapeutic role of Arabic Gum as Antioxidants on Cadmium induced kidney dysfunction in male albino rats

Marwan A. Ibrahim

Assistant Professor of Applied Physiology,
Department of Medical Laboratories,
Faculty of science / Majmaah University,
Zulfi, Riyadh, Saudi Arabia

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Many industrial emissions and the exhaust of vehicles contain heavy metals . Cadmium, (Cd) is one of these heavy metals and is emitted in the gas and dust remnants of some factories like copper smelters. Cadmium has a half-life of greater than ten years in human and thus accumulates in the body over the time. It is a potentially neurotoxic pollutant and approximately 50% of the body burden of cadmium can be found in the kidney. Cadmium produces proximal tubule dysfunction and tissue injury. This injury may progress to a chronic interstitial nephritis. This study aimed to investigate the effect of Arabic gum on renal disorder induced by cadmium on male rats. The results obtained showed that daily intrapreitoneal injection of 2 mg cadmium chloride ($CdCl_2$) / Kg b. wt / day for ten weeks induced renal toxicity in rats. Serum urea, creatinine, sodium (Na), potassium (K), phosphorus (P) and total calcium (Ca) were evaluated one and two weeks post-cadmium induction. Significant ameliorations were noted in these parameters after daily treatment with a dose 0.5 g/kg of Arabic gum during the experimental period.

KEYWORDS: Cadmium, Arabic gum, Serum renal function, Electrolytes, Kidney dysfunction.

1 INTRODUCTION

Chronic exposure of non-smoking human and animals to cadmium (Cd) is primarily through food and results in hepato-renal toxicity. In the workplace, inhalation of cadmium (Cd) containing dust and fumes is the major route of exposure. Cadmium has a half-life of greater than ten years in human and thus accumulates in the body overtime [1],[2]. The earliest adverse effect of cadmium on the kidney is usually an increased excretion of specific proteins in urine [3],[4]. Approximately, 50 percent of the body burden of cadmium can be found in the kidney. Cadmium produces proximal tubule dysfunction and injury characterized by increases in urinary excretion of glucose, amino acids, calcium and cellular enzymes. This injury may progress to a chronic interstitial nephritis [5].

A very interesting aspect of cadmium nephrotoxicity is the role of metallothionein. Metallothionein is low-molecular weight, cysteine-rich, metal binding protein that has a high affinity for cadmium and other heavy metals. In general, the exposure to $CdCl_2$, cadmium – metallothionein complex formed and released either from intestinal cells or hepatocytes. The cadmium metallothionein complex is freely filtered by the glomerulus and is reabsorbed by the proximal tubule. Inside the tubular cells it is thought that lysosomal degradation of the cadmium–metollothionein results in the release of "Free" cadmium which in turn induces renal metallothionein production [6].

Arabic gum (AG) is known as acacia gum which is a brittle, odourless and generally tasteless material that contains a number of neutral sugars, acids, calcium, potassium and other electrolytes. It is a dietary fiber derived from the dried gummy exudates of the stems and branches of Acacia Senegal [7]. The molecular weight of the gum is large and estimates suggest the weight lies in the range of 200000 to 600000 Daltons. It is easily soluble in water without increasing viscosity but does not dissolve in alcohol [8]. AG is built upon a backbone of D-galactose units with side chains of D-glucuronic acid with L-

Corresponding Author: Marwan A. Ibrahim

rhamnose or L-arabinose terminal units [9]. It is a branched- chain, complex polysaccharide, either neutral or slightly acidic, found as a mixed calcium, magnesium and potassium salt of a polysaccharidic acid (arabic acid) [10]. Idris et al. reported that AG comprised of 39-42% galactose, 24-27% arabinose, 12-16% rhamnose, 15-16% glucuronic acid, 1.5-2.6% protein, 0.22-0.39% nitrogen, and 12.5-16.0% moisture[11]. The chemical composition of AG can vary with its source, the age of the trees from which it was obtained, climatic conditions and soil environment [12].

AG was used primarily in the food industry to modify the physical properties of foods as an emulsifier and stabilizer and as food additive in sodas and candies. Also, it was used in a clinical study of cholesterol reduction at a dose of 15 g per day [13]. In folk medicine, AG has been reported to be used internally for the treatment of inflammation of the intestinal mucosa. At an appropriate dosage, it was used to modify intestinal transport. Externally, it was used to cover inflamed surfaces [14]. AG has been used in pharmaceuticals as a demulcent and soothes irritated mucous membranes. Consequently, it is used widely in topical preparations to promote wound healing and as a component of cough and some gastrointestinal preparations. Also it has been shown to inhibit the growth of periodontics bacteria and the early deposition of plaque [15].

Acacia gum has long been used in traditional medicine and in everyday applications. The Egyptians used the material as glue and as a pain-reliever base. Arabic physicians treated a wide variety of ailments with the gum, resulting in its current name [16]. Today, it is used widely in the pharmaceutical industry as a demulcent and in the cooking industry to give body and texture to processed food products [17].

AG contains a peroxidase enzyme which forms coloured complexes with certain amines and phenols and enhances the destruction of many pharmaceutical products including alkaloids and readily oxidizable compounds and also it has been identified as a trypsin inhibitor [17].

AG is primarily indigestible to both humans and animals and after passing the small intestine it is fermented under the influence of microorganisms in the colon to short chain fatty acids, particularly propionic acid. Such degradation products are absorbed in the human colon and subsequently utilized energetically in metabolism[18].

Either end stage renal failure or end stage renal disease requires renal replacement therapy (RRT) in the form of either dialysis or renal transplantation for survival. However, provision of RRT requires expert teams, working in specialized units, which makes therapy of patients with renal failure expensive. Maintenance peritoneal dialysis and hemodialysis sustain the lives of approximately 250000 uremic patients in developing countries [19]. The number of end-stage renal disease patients requiring renal replacement therapy (RRT) has increased dramatically throughout the world during the last decades [20].The cost of treating uremia represents a growing demand on the health care systems of both rich and poor countries, the last being affected most. The literature is replete with publications on the impact of nutrition on kidney disease [21]. Most dietary attempts to treat chronic renal failure (CRF) and to decrease uremia use a protein restriction regimen (PRR) [22]. An alternative dietetic approach has relatively recently been proposed, based on fermentable carbohydrate (FC) supplementation of the diet[23]. This has been claimed to result in a similar urea-lowering effect by increasing urea nitrogen (N) excretion in stools, with a concomitant decrease in the total N excreted in urine of adults [24] and children [25].

Sodium Na^+ is the major positive ion (cation) in body fluid outside of cells and potassium K^+ is the major one inside the cells. Many processes in the body require electrical signals for communication. The movement of sodium and potassium is critical in generation of these electrical signals. Therefore variations in these cations level can cause cells to malfunction and can be fatal. Sodium and potassium regulate the total amount of water in the body and work to maintain the body's water balance also they play a role in critical body functions. One possible explanation for potassium's protective effect against hypertension is that increased potassium may increase the amount of sodium excreted from the body [26],[27].

This study aimed to investigate the effect of Arabic gum on some essential renal functions disorder caused by cadmium induction. A daily oral dose of 0.5 g/kg of AG has been administrated to nephrotoxic rats for two weeks post cadmium induction. Renal functions as urea, creatinine and some electrolytes such as Na, K, Ca and P were evaluated in serum.

2 MATERIAL AND METHODS

This study was carried out on male albino rats ***Rattus rattus*** as an animal model for induction of renal disorder. 40 adult male albino rats were employed in the current study. Animals were allowed ten days pre-experiment period to adapt to laboratory conditions in order to avoid any complications along the course of the experiment. They were housed in metallic cages at 28±2^{o}C and 50% relative humidity and received food and water ad-libitum with fresh supplies presented daily. The

animals were divided at random into four equal groups (ten rats each) on the base of body weight (140 ± 20g) and according to the different treatment of the animals:

1- The first group received no treatment and represented the control group.
2- The second group received AG as a daily oral dose of 0.5 g/kg body weight dissolved in water for 14 days according to [28].
3- The third group were daily injected intraperitoneally with cadmium chloride at a dose of 2 mg / kg b.wt. for the same period as described by [29].
4- The fourth group received a cadmium chloride at a dose of 2 mg / kg b.wt. then followed by daily oral dose of 0.5 g/kg AG for 14 days.

Venous blood of all the groups was collected from the venous plexus of the eye by standard venipuncture with glass capillary tubes at the end of the 1^{st} and the 2^{nd} weeks post cadmium induction. The Sera were separated using cooling centrifuge and kept frozen at -20^{o}C up to the time of estimation. Serum urea, creatinine and total calcium were measured spectrophotometrically according to [30], serum Na and K were measured by ion selective electrode according to [31] and phosphorus was estimated according to [32].

2.1 STATISTICAL ANALYSIS

All recorded data were expressed as mean ± standard error and analyzed by applying the following mathematical principles, two-way analysis of variance (ANOVA) test followed by Duncan's multiply range test [33],[34].

The Statistical Package for the Social Sciences (SPSS) version 15 at a statistical significance level of $P < 0.05$ and 95% confidence interval were used.

- Evaluation of significant difference between the different treatments (F1) and also between 1^{st} and 2^{nd} week (F2).
- Na/K ratio = [(Na value in mEq/l) / (K value of the same group in mEq/l)] × 100

3 RESULTS AND DISCUSSION

Cadmium is a known human carcinogen and one of the components of tobacco which together with water and food contamination represent the main sources of non – occupational exposure in the general population [35]. Many studies were carried out on the physiological and histological effects of cadmium in human beings [36] and on laboratory animals [37],[38],[39].

Our present findings clearly indicated that exposure to cadmium led to a significant dysfunction in the kidney represented by a significant increment in the concentration of creatinine, urea, of the groups which treated with cadmium chloride at the 1^{st} and 2^{nd} weeks post cadmium induction compared to the control groups. These results are in accordance with the data obtained by [40],[41],[42],[43].

Treatment of the cadmium groups with AG decreased significantly the elevated urea and creatinine levels to be within the control levels. These results agree with [44],[45] who induced chronic renal failure (CRF) by adenine in animal model of human and tested the effect of AG. They found that AG alleviates the adverse effects of chronic renal failure in animal.

Dietary supplementation with AG may be an alternative to renal replacement therapy RRT to improve the quality of life and reduce or eliminate the need for dialysis in children with end stage renal disease (ESRD) in some developing countries [46],[47]. This is based on an increase in bacterial growth rate and activity in the gut. More advanced study has shown that AG is fermented by intestinal bacteria to short chain fatty acids propionate. The dominant bacteria which is most likely to be responsible for fermentation is *Prevotella ruminicola* [48]. Colonic bacteria produce ureases that hydrolyze urea to ammonia and CO_2. The resultant ammonia can then be incorporated into bacterial proteins, which are subsequently excreted in the bacterial mass fraction of the feces. The net result is increased nitrogen excretion in the feces [49].

Clinically, AG has been tried in patients with chronic renal failure, and it was claimed that it reduce urea and plasma creatinine concentrations and reduces the need for dialysis from 3 to 2 times per week [50].

In Middle Eastern countries, AG is used in the traditional treatment of patients with chronic kidney disease and end stage renal disease. It increases fecal nitrogen excretion, lower serum urea nitrogen concentration in patients with chronic renal failure and decreases production of free oxygen radicals [51].

Intestinal AG fermentation leads to the formation of several degradation products including short-chain fatty acids [52]. Accordingly, AG treatment may enhance serum butyrate concentrations which have potential beneficial effects in renal disease by suppressing both basal and stimulated pro- fibrotic cytokine transforming growth factor-beta1 (TGF-beta1) by renal epithelial cells [53]. In the intestine, AG may modify the function of the reabsorbing epithelial cells [54].

Fecal bacterial mass and fecal nitrogen content were significantly increased during supplementation with AG compared with the baseline low protein diet (LPD) or supplementation with pectin. Serum urea nitrogen was significantly decreased during supplementation with Arabic gum compared with the baseline LPD or supplementation with pectin. Chronic renal failure (CRF) patients consuming a LPD supplemented with 50 g Arabic gum/d had greater fecal bacterial masses, greater fecal nitrogen excretion, and lower serum urea nitrogen than those consumed the LPD alone or supplemented with 1 g pectin/d. Because elevated concentrations of serum urea nitrogen have been associated with adverse clinical symptoms of CRF, the results suggest that Arabic gum may be a useful adjunct to a LPD for increasing excretion of nitrogenous wastes in feces [49]. Other study by Ali et al. [55] on rat models of acute renal failure showed that Arabic gum may also improves renal function independently of its action on fecal bacterial ammonia metabolism, but its effect is attributed to a decrease in the generation of free oxygen radicals.

Table 1. Mean and standard error of urea and creatinine after 1st and 2nd weeks post-cadmium treatment.

Renal functions	Treatments	1st week	2nd week	D.T.1 (treatment)
Urea *(mg/dl)* F1 = 7.102 * F2 = 3.342 *	**Control**	21.21± 0.20	21.18± 0.17	A
	Arabic gum	21.11± 0.19	20.69± 0.31	A
	Cd treatment	54.36±1.82	51.36±1.77	B
	Cd treatment + AG	25.11± 1.02	23.37± 1.13	A
D.T.2 (time) Urea		B	A	
Creatinine *(mg/dl)* F1 = 12.037 * F2 = 04.213 *	**Control**	0.50±0.02	0.47±0.03	A
	Arabic gum	0.48±0.03	0.51±0.02	A
	Cd treatment	1.79±0.06	1.71±0.05	B
	Cd treatment + AG	0.88±0.05	0.79±0.04	A
D.T.2 (time) Creatinine		B	A	

** Significant and no asters means non-significant.*

- *P<0.05, F1 and F2 are the values of two ways ANOVA test.*
- *D.T.1 and D.T.2 are Duncan test symbols, (1) for different treatments and (2) for different times.*
- *Different litters in the same column indicated significant difference between different treatments.*
- *Different litters in the same row indicated significant difference between 1st and 2nd weeks.*
- *Letters in columns and rows are independent.*

Pharmacologically, AG has been claimed to act as an anti-oxidant, and to protect against experimental hepatic, renal and cardiac toxicities in rats. Also, AG has been claimed to alleviate the adverse effects of chronic renal failure in humans. Reports on the effects of AG on lipid metabolism in humans and rats are at variance, but mostly suggest that AG ingestion can reduce plasma cholesterol concentrations in rats. AG has pro-absorptive properties and can be used in diarrhea. Previous studies have suggested an association between a low fiber intake and subsequent cardiovascular risk and very few studies have examined therapeutic intervention by Arabic gum supplementation of the diet [56].

According to Duncan test, the results in table (2) showed significant increase in serum K of the Cd treated groups as compared to the control group at the 1st and 2nd week post-cadmium induction. These results could be explained as those of Seifter (2011) [57] who reported that kidneys normally remove excess potassium from the body. High potassium levels are more likely to occur when the kidneys are not working properly and are less able to get rid of potassium.

The elevated level of K decreased significantly to be close to the control level when treated with AG. This can be explained as a result of kidney amelioration after treatment with AG.

According to Duncan test, table (2) showed significant decrease in serum Na levels of the Cd treated group compared to the control group in the 1st and 2nd week post-cadmium induction. The explanation for the decreased serum sodium (Na) level of the Cd group is that the increased potassium level due to kidney malfunction may increase the amount of sodium

excreted from the body [58]. Treatment of the Cd treated group with AG increased significantly the reduced Na levels to be close to the control level. Studies performed in healthy mice have suggested that Arabic gum decreases urinary sodium excretion and it could be the reason that raised serum Na in Cd treated group decreased significantly after AG treatment [54].

Table 2. Mean and standard error of some electrolytes (Na, K, Ca and P) after 1st and 2nd weeks post- cadmium induction.

Renal functions	Treatments	1st week	2nd week	D.T.1 (treatment)
Sodium (Na) *(mEq/l)* F1 = 6.732* F2 = 12.723*	**Control**	151.6±0.58	150.9±0.54	B
	Arabic gum	149.7±0.67	148.5±0.59	B
	Cd treatment	138.0±0.73	139.4±0.71	A
	Cd treatment + AG	148.2 ±0.88	148.9±0.79	B
D.T.2 (time) Na		B	A	
Potassium (K) *(mEq/l)* F1 = 4.332* F2 = 3.527*	**Control**	5.4±0.19	5.2±0.21	A
	Arabic gum	5.3±0.26	5.1±0.28	A
	Cd treatment	7.7±0.28	7.2±0.23	B
	Cd treatment + AG	6.5±0.38	5.8±0.24	A
D.T.2 (time) K		B	A	
Calcium (Ca) *(mg/dl)* F1 = 1.078 F2 = 0.012	**Control**	10.7±0.12	10.5±0.16	A
	Arabic gum	10.4±0.07	10.2±0.23	A
	Cd treatment	09.8±0.09	10.1±0.07	A
	Cd treatment + AG	10.4±0.17	10.6±0.22	A
D.T.2 (time) Ca		A	A	
Phosphorus (P) *(mg/dl)* F1 = 3.163* F2 = 6.546*	**Control**	5.1±0.11	4.8±0.13	B
	Arabic gum	4.8±0.19	4.7±0.16	B
	Cd treatment	3.9±010	4.4±0.05	A
	Cd treatment + AG	4.7±0.25	4.8±0.21	B
D.T.2 (time) P		A	B	

** Significant and no asters means non-significant.*

- *P<0.05, F1 and F2 are the values of two ways ANOVA test.*
- *D.T.1 and D.T.2 are Duncan test symbols, (1) for different treatments and (2) for different times.*
- *Different litters in the same column indicated significant difference between different treatments.*
- *Different litters in the same row indicated significant difference between 1st and 2nd weeks.*
- *Letters in columns and rows are independent.*

Table (2) also shows, according to Duncan test, that serum P was decreased significantly in the Cd treated group. Although most publications reported an increase in P level in CKD, Rubin explained that the levels of serum phosphorus in patients with CKD remain within the normal range or may even be modestly below the normal range, since the re-absorption of phosphorus from the renal tubules is reduced, thereby increases P excretion and decreases its serum level. As the glomerular filtrate rate (GFR) declines (stage 4 of CKD) the serum P increases [59].

Goldman and Schafer reported that in case of CRF serum sodium and P usually be normal but may be low, serum potassium raised and serum calcium: may be normal, low or high [60]. In this study, results of serum Ca in table (2) show non-significant difference either between different treatments or different times.

AG exhibits pharmacological effects related to interference with gastro- intestinal absorption of nutrients. Nasir et al. showed that AG blunted intestinal absorption of Na^+ and water in healthy mice while enhanced calcium and magnesium uptake [54]. In a rat model of chronic osmotic diarrhea, AG exerted pro-absorptive properties by increased sodium and water absorption [61].

It is particularly important that the signs and symptoms of changes in plasma potassium concentrations should be particularly recognized and quickly treated, because the changes are potentially life threatening [62], so, it was helpful to evaluate Na/K ratio different groups.

The figure (1) shows the variation in Na/K ratio in different treated groups at 1st and 2nd weeks post-Cd induction. From the figure (1), it is clear that the Na/K ratio decreased in the Cd-treated groups about 16.0% compared with the control group. These results agree with Roth and Tyler who evaluated the low Na/K ratio in dogs suffering from different diseases including renal failure [63]. Also from the figure (1), it is clear that Na/K ratio of AG treated group decreased only about 4.0% compared with the control group. This implies that the treatment of the Cd-treated group with AG improved the deceased Na/K ratio by about 12.0%.

According to Earlbaum and Quinton, the Na/K ratio was significantly decreased with renal failures [64]. The serum Na/K ratios were more closely related to serum potassium concentrations than serum sodium concentrations. There is close correlation between progression of renal disease and blood pressure and furthermore, there is a large body of evidence which suggests that management of hypertension has profound beneficial effects delaying progression of renal disease.

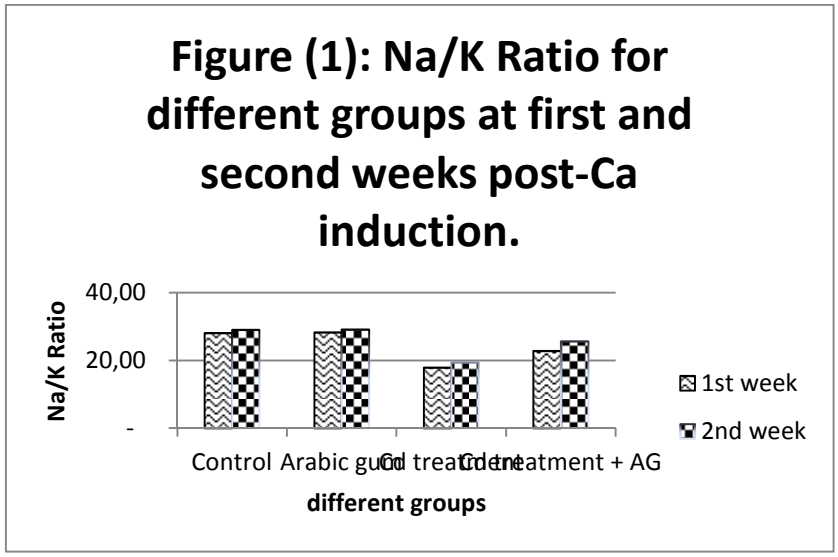


Figure (1): Na/K Ratio for different groups at first and second weeks post-Ca induction.

The alterations in blood pressure were occurred over a relatively short time and will translated into marked improvement in renal outcome [65]. The most striking finding in David et al. study is the reduction of blood pressure in all the groups supplemented with AG [66]. The lack of alteration in serum electrolytes and fluid balance in the patient cohort with significant renal failure can be added to the previous data on the safety and tolerance of AG in humans [67]. Cd-induced nephropathy and chronic oxidative renal damage and Arabic gum may reduce Cd-induced nephropathy by inhibiting chronic oxidative stress [68].

4 RECOMMENDATION

Results in tables (1) and (2) show significant enhancement in the level of urea, creatinine, K, Na and P at the 2nd week as compared to the 1st week post- Cd induction. This enhancement recommended the beneficial supplementation of daily diet intake with AG due to their effective roles in building the general body resistance parameters and immunity system. It also aid in decreasing the destructive and harmful effects caused by Cd in the kidney function. This correction was dependent on time of treatment.

5 CONCLUSION

In conclusion, AG which sometimes used in medications, has been claimed to alleviate the adverse effects of chronic renal failure. The current study showed significant amelioration of the studied kidney parameters after daily treatment with a dose of 0.5 g/kg of AG, hence, it can be used as a potent therapeutic in the treatment of renal disorder (urea, creatinine and

some electrolytes) resulted from cadmium toxication. The data support the dietary fiber hypothesis which states that there is a relationship between dietary fiber consumption and the improvement in renal malfunction. Since it is used till now as food supplement, so, further studies are needed to utilize AG pharmacologically in therapy.

REFERENCES

[1] Shaikh, Z. A. ; Vu, T. T. and Zaman, K. (1999) : Oxidative stress as a mechanism of chronic cadmium –induced hepatotoxicity and renal toxicity and protection by antioxidant . Toxicol. Appl. Pharmacol., 154 (3) : 256 – 263.

[2] Durak, I. ; Ozturk, H.S. ; Dikmen, B. ; Guven, C. ; Cimen, M.Y. ; Buyukkocak, S. ; Kacmaz, M. and Avci, A. (1999) : Isoflurane impairs antioxidant defense system in guinea pig kidney . Can. J. Anaesth ., 46 (8) : 797 – 802.

[3] Lauwerys, R. and Bernard, A. (1990) :Early markers of cadmium nephrotoxicity: Biological significance and predictive value . Toxicol. Environ. Chem. 27 : 65.

[4] WHO . Environmental Health Criteria 134 : Cadmium . Geneva : WHO , 265 (1992).

[5] Smith, C.M. and Reynard, A.H. (1998) : Essentials of pharmacology . Published by Saunders Company . W.B.A. division of Hartcout & Brace company Philadelphia.

[6] Zhou, T. ; Zhou, G. ; Song, W. ; Eguchi, N. ; Lu, W. ; Lundin, E. ; Jin, T. and Nordberg, G. (1999) : Cadmium-induced apoptosis and changes in expression of p 53, c-jun and MT-I genes in testes and ventral prostate of rats . Toxicology ., 142 (1) : 1 – 13.

[7] Younes, H., Garleb, K., Behr, S., Remesy, C. and Demigne, C. (1995), J. Nutr., 125, 1010-1016.

[8] Tiss, A., Carriere, F. and Verger, R. (2001), Anal. Biochem., 294, 36-43.

[9] Leung, A.Y. and Foster, S. (1980): Encyclopaedia of Common Natural Ingredients Used in Food, Drugs and Cosmetics, J. Wiley and Sons, New York.

[10] Verbeken, D., Dierckx, S. and Dewettinck, K. (2003), Appl. Microbiol. Biotechnol., 63, 10-21.

[11] Idris, O.H.M., Williams, P.A. and Phillips, G.O. (1998), Food Hydrocoll., 12, 379-388.

[12] Al Assaf, S., Phillips, G.O. and Williams, P.A. (2005), Food Hydrocoll., 19, 647-660.

[13] Haskell, W.L., Spiller, A.G., Jensen, C.D., Ellis, B.K. and Gates, J.E. (1992), Am. J. Cardiol., 69, 433-439.

[14] Xuan, N.T., Shumilina, E., Nasir, O., Bobbala, D., Götz, F. and Lang, F. (2010), Cell Physiol. Biochem., 25(6), 641-648.

[15] Clark, D.T., Gazi, M.I., Cox, S.W., Eley, B.M. and Tinsley, G.F. (1993), J. Clin. Periodontol., 20, 238-243.

[16] Dobelis, I.N. (1986) : Magic and Medicine of Plants, Pleasantville, NY, Reader's Digest Association, Inc.

[17] Duke, J.A. (1985), In: Handbook of Medicinal Herbs, Boca Raton, CRC Press.

[18] Phillips, G.O. (1998), Food Addit. Contam., 15, 251-264.

[19] Friedman, E.A. (1996), Am. J. Kidney Dis., 28, 943-950.

[20] Locatelli, F., Del Vecchio, L., Pozzoni, P. and Manzoni, C. (2006), J. Nephrol., 19, 6-11.

[21] Lacson, E. Jr., Ikizler, T.A., Lazarus, J.M., Teng, M. and Hakim, R.M. (2007), J. Ren. Nutr., 17, 363-371.

[22] Chaturvedi, S. and Jones, C. (2007), Cochrane Database Syst. Rev. 17, CD006863.

[23] Winchester, J.F. and Salsburgh, J.A. (2004), Minerva Urol. Nefrol., 56, 215-221.

[24] Ali, B.H., Al Moundhri, M., Eldin, M.T., Nemmar, A., Al Siyabi, S. and Annamalai, K. (2008), Exp. Biol. Med. (Maywood), 233, 891-896.

[25] Al Mosawi, A.J. (2007), Journal of Tropical Paediatrics, 53(5), 362-365.

[26] Clark, N. (1990), In: Sports Nutrition Guidebook, Leisure Press, Illinois.

[27] Shorecki, K. and Ausiello, D. (2011) : Cecil Medicine, 24th ed., Chap. 118, Saunders Elsevier, Philadelphia.

[28] Abdou, M.I. (2012): Influence of gum arabic on renal dysfunction in rat induced by whole body gamma irradiation; ISOTOPE & RAD. RES., 44(1), 231-244.

[29] Gulati, S. ; Gill, K.D. and Nath, R. (1986) : Effect of cadmium on lipid composition of the wean-ling rat brain. Acta Pharmacol. Toxicol., 59 : 89 – 93.

[30] Tietz, N.W. (1995) : Clinical guide to laboratory tests, 3rd ed., WB Saunders company, Philadelphia, p. 102.

[31] Gunaratna, P.C., Koch, W.F., Paule, R.C., Cormier, A.D., D'Orazio, P., Greenberg, N., O'Connell, K.M., Malenfant, A., Okorodudu, A.O. and Miller, R. (1992), Clin. Chem., 38(8 Pt 1), 1459-1465.

[32] Tietz, N.W. (1990) : Clinical guide to laboratory tests, 2nd ed., WB Saunders company, Philadelphia, p. 444-447.

[33] Duncan, D.B. (1955): "Multiple ranges and multiple F-test Biometric." 11:1 – 42.

[34] Snedecor, G.W. and Cochran, W.G. (1982): "Statistical Methods" 7th Ed. Iowa State University Press. Am., Iowa, USA.

[35] Tiran, B. ; Karpf, E. and Tiran , A. (1995) : Age dependency of selenium and cadmium content in human liver , Kidney and thyroid . Arch. Environ. Health. 50 (3) : 242 – 246.

[36] Ortega, E. ; Lorenzo, M.L. ; Lopez, M.C. and Cabrera, C. (1998) : Cadmium contamination of vegetable crops , farmlands and irrigation waters . Rev. Environ. Contam. Toxicol., 154 : 55 – 81.

[37] Gumuslu, S. ; Yargicoglu, P. ;Agar, A.; Edremitlioglu, M. and Aliciguzel,Y. (1997) :Effect of cadmium on antioxidant status in alloxane-induced diabetic rats. Biol. Trace. Elem. Res., 57: 105-114.
[38] Shaikh, Z. A. ; Vu, T. T. and Zaman, K. (1999) : Oxidative stress as a mechanism of chronic cadmium – induced hepatotoxicity and renal toxicity and protection by antioxidant . Toxicol. Appl. Pharmacol ., 154 (3) : 256 – 263.
[39] Pourahmed, J. and O'Brien, P. (2000) : A comparison of hepatocyte cytotoxic mechanisms for Cu +2 and Cd+2 . Toxicology ., 143 (3) : 263 – 273.
[40] El-Abaid, N. M.(1997): Effects of garlic administration on 4- chemicals induced hepatotoxicity and tumor incidence in rats. J. Egypt. Ger. Soc. Zool., 24 (A) : 273-285.
[41] Moawad, K.M. and Abdel – Dayem, S.M. (1998): Effect of royal jelly pretreatment on acute cadmium toxicity in male albino rats 2- kidney and bone . Egypt . J . Histol . 21 (10) 1998 : 123-136.
[42] Mohamed, N.E. (2011), J. American Science, 7(6), 406-412.
[43] Maret, Wolfgang; Moulis, Jean-Marc (2013). "Chapter 1. The Bioinorganic Chemistry of Cadmium in the Context of its Toxicity". In Astrid Sigel, Helmut Sigel and Roland K. O. Sigel.Cadmium: From Toxicology to Essentiality. Metal Ions in Life Sciences 11. Springer. pp. 1–30.
[44] Ali BH. Does gum Arabic have an antioxidant action in rat kidney? Ren Fail. 2004;26(1):1–3.
[45] Ali, B.H., Al-Salam, S., Al Husseni, I., Kayed, R.R., Al-Masroori, N., Al-Harthi, T., Al Zaabi, M. and Nemmar, A., Exp Biol Med (Maywood), 235(3), 373-382 (2010).
[46] Al Mosawi, A.J. (2004), Pediatr. Nephrol., 19, 1156-1159.
[47] Charles, O., Cecil. (2005): Saudi Aramco World, 56, 2.
[48] Kishiimoto, A., Ushida, K., Phillips, G.O., Ogasawara, T. and Sasaki, Y. (2006), Current Microbiology, 53(3), 173-177.
[49] Bliss, D.Z., Stein, T.P., Schleifer, C.R. and Settle, R.G. (1996), Am. J. Clin. Nutr., 63, 392-398.
[50] Suliman, S.M., Hamdouk, M.I. and Elfaki, M.B. (2000) : Sudan Association of Physicians, 17th Conference, Friendship Hall, Khartoum, Sudan.
[51] Al-Majed, A.A., Mostafa, A.M., Al-Rikabi, A.C. and Al-Shabanah, O.A. (2002), Pharmacol. Res., 46, 445-451.
[52] Bliss, D.Z., Pediatr. Nephrol. (2004), 19, 1069-1070.
[53] Matsumoto, N., Riley, S., Fraser, D., Al-Assaf, S., Ishimura, E., Wolever, T. et al. (2006), Kidney International, 69(2), 257-265.
[54] Nasir, O., Artunc, F., Saeed, A., Kambal, M.A., Kalbacher, H., Sandulache, D. et al. (2008), J. Renal Nutrition, 18(2), 230-238.
[55] Ali, B.H., Al-Qarawi, A.A., Haroun, E.M. and Mousa, H.M. (2003), Renal Failure, 25(1), 15-20.
[56] Baker, T. (2012), Georgia Healthy Science University, Augusta, GA.
[57] Seifter, J.L. (2011) : Cecil Medicine, 24th ed., Chap. 119, Saunders Elsevier, Philadelphia.
[58] Clark, N. (1990) : Sports Nutrition Guidebook, Leisure Press, Illinois.
[59] Rubin, S.I. (1997), Vet. Clin. Small Anim., 27(6), 1331-1354.
[60] Goldman, L. and Schafer, A.I. (2011) : Cecil Medicine, 24th ed., Saunders Elsevier, Philadelphia.
[61] Ibrahim, M.A., Kohn, N. and Wapnir, R.A. (2004): J. Nutr. Biochem., 15, 185-189.
[62] Pak, S. (2000): J. Vet. Sci., 1(1), 61-65.
[63] Roth, L. and Tyler, R.D. (1999): J. Vet. Diagn. Invest., 11(1), 60-64.
[64] Earlbaum, A.M. and Quinton, P.M. (1981), Nephron., 28(2), 58-61.
[65] Lewington, S., Clarke, R., Qizibash, N., Peto, R. and Collins, R. (2002), The Lancet, 360(9349), 1903-1913.
[66] David, A.G., Kazunari, U., Aled, O.P. and Stephen, G.R. (2009), Food Hydrocolloids, 23, 2410-2415.
[67] Doi, Y., Ichihara, T., Hagiwara, A., Imai, N., Tamano, S., Orikoshi, H. et al. (2006), Food and Chemical Toxicology, 44(4), 560-566.
[68] Cosar, R., Yurut, C.V., Eskiocak, S., Ozen, A., Altaner, S., Ibis, K., Turan, N., Denizli, B., Uzal, C., Saynak, M., Parlar, S., Caloglu, M., Uregen, B. and Kocak, Z. (2011), Medical Oncology, 24.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 330-338
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Modeling social security institution financial resources

Moulay El Mehdi Falloul[1] and Moulay Ali Falloul[2]

[1]Ph.D candidate in applied economics and finance,
Hassan II University of Mohammedia,
Mohammedia, Morocco

[2]Ph.D in magnetism and electrical engineering,
Hassan II University of Casablanca,
Casablanca, Morocco

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This paper focuses on the modeling of financial resources of private social security organism, namely the determination of models or process able to reproduce the evolution of this component. From the optimal model chosen, monthly forecasts are established. Financial resources modeling and forecasts resulting are obtained by application of the univariate analysis of Box-Jenkins method, which is the most suitable for the study of time series like the series of monthly financial resources of social security scheme administered by the institution. This approach is to determine the model that allows more faithfully the reproduction of the evolution of the financial resources of the institution and forecasting on a determined horizon.

KEYWORDS: financial resources modeling, time series, stationary, ARIMA, BOX and JENKINS.

1 INTRODUCTION

The objective of this study is to propose a modeling of social security institution financial resources. To do this, the social security institution financial resources, will be modeled from the method "ARIMA - BOX-JENKINS '.

This note is endeavoring to present the following points:

- A brief survey of the theoretical framework ARIMA models
- An analysis of the social security institution financial resources;
- Research of the most appropriate model for the social security financial resources (identification and validation of models to reproduce the series);
- Determination, from the model chosen the expected values of the financial resources for the prospective period.

2 THEORETICAL FRAMEWORK

2.1 ARIMA MODELS

The ARIMA model, proposed by Box and Jenkins, is generally recommended for model series or stochastic stationarity variables. This methodology is invoking the process ARMA, a noted autoregressive part AR, with a moving average part, noted MA.

In a stationary Autoregressive process of order p, the observation presents Y_t is generated by a weighted average of the past observations until the p^{th} period in the following form:

AR(p) : $Y_t = \sum_{1}^{p} \Phi_i y_{t-i} + \varepsilon_t \qquad \forall t \in Z$

Or $Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \ldots\ldots\ldots + \phi_p Y_{t-p} + \varepsilon_t$

Where ϕ_i are parameters to be estimated positive or negative; ε_t is a hazard.

The identification of the order p is established using the variable correlogram. Indeed, it is shown that the simple correlogram of an AR (p) process is characterized by a geometric decay of its terms and that the partial correlogram has its only p first different terms of 0. The step that follows "identification and estimation" parameters is the test of quality. A good approximation by Autoregressive process AR (p) translates into two types of tests [1]:

- Tests on the parameters: student tests, ϕ is significant at 5% if risk:

$\left|\hat{\Phi} / \hat{\sigma}(\Phi)\right| > 1{,}96.$

- Tests on white noise: Ljung-box test (Q_{LB}) and Portmanteau test (Q_P))

H0 : $\varepsilon_t \sim BB$

$Q_{LB} = [(T+2)\, T \sum_{j=1}^{M} \hat{e}_j / T - j\,] \sim \chi^2_{(M-P)}$ et $Q_P = T \sum_{j=1}^{M} \hat{e}_j \sim \chi^2_M$

Where M =Min[T/2, $3\sqrt{T}$] and P number of parameters to be estimated.

Two statistics Q_{LB} and Q Q_P test the degree of autocorrelations of errors.

Regarding the process of moving average of order q, they allow to estimate each observation y by reference to a weighted average of hazards until the q th period.

MA(q) : $Y_t = \sum_{1}^{q} \theta_i \varepsilon_{t-i} + \varepsilon_t \qquad \forall t \in Z$

Or even $Yt = \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots\ldots\ldots + \theta_q \varepsilon_{t-q} + \varepsilon_t$

In this process, as in Autoregressive model AR, hazards are generated by a process of the white noise type.

The simple correlogram of MA (q) process is characterized by the q first terms that are significantly different from 0. Thus, we can determine the order q through a review of simple correlations (ACF).Estimate quality is assessed against the same tests used at the level of the AR process

ARMA models represent the processes that simultaneously combine values and past mistakes. They are defined by the equation:

ARMA (p,q) : $(1- \phi_1 B- \phi_2 B^2 - \ldots\ldots - \phi_p B^p) Y_t = (1- \theta_1 B- \theta_2 B^2 - \ldots\ldots - \theta_q B^q)\, \varepsilon_t$.

The identification and estimation of this type of models are based on the same combined principles for Autoregressive models AR (p) and medium mobile MA (q) [2].

The ARIMA, autoregressive integrated moving average model is an extension of the simple model ARMA. Generally an ARIMA (p, d, q) model takes the form:

$\phi(B)\,(1-B)^d Y_t = \theta(B)\, \varepsilon_t + C$

$\phi(B)$, $\theta(B)$: polynomials of order p and q respectively. ϕ_i ,θ_i respectively represent the parameters of the Autoregressive and moving average; d is the order of differentiation and B is the delay operator.

The selection of an ARIMA (p, d, q) model is the result of four main steps:

Step 1: identification of the first values of p, d, and q orders is based on the study of simple and partial correlograms.
Step 2: estimation of parameters θi and ϕi is based on a maximization of the likelihood through iterative process functions.

Step 3: the parameters being estimated, the estimation results must be examined by reference to tests on the meaning of the parameters and the quality of residues (absence of autocorrelation). :

Step 4: the choice of the most appropriate model among all the estimated models is carried out on the basis of two criteria: Akaike (AIC) and Schwartz (SC), which measure the quality of approximation of reality by the model chosen.

3 PRELIMINARY ANALYSES OF FINANCIAL RESOURCES

Taking into account the terms of the support of financial resources, the complete situation in respect of a fiscal year is arrested after 24 months of the financial year in question. Therefore, the analysis will focus on the series of monthly values recorded in the declared wage from January 1994 to December 2002 that there is (X_t).

The processed data are from extraction stopped at 31/08/2004; the representation of the raw series of monthly returns for the chosen period is as follows:

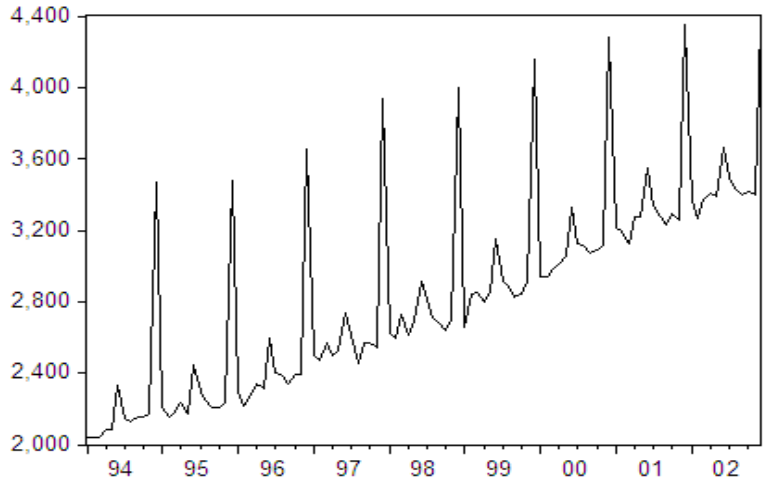


Fig. 1. Evolution of monthly financial resources Jan-94 to Dec-02

After adjustment of outlier values yields the following smoothed series:

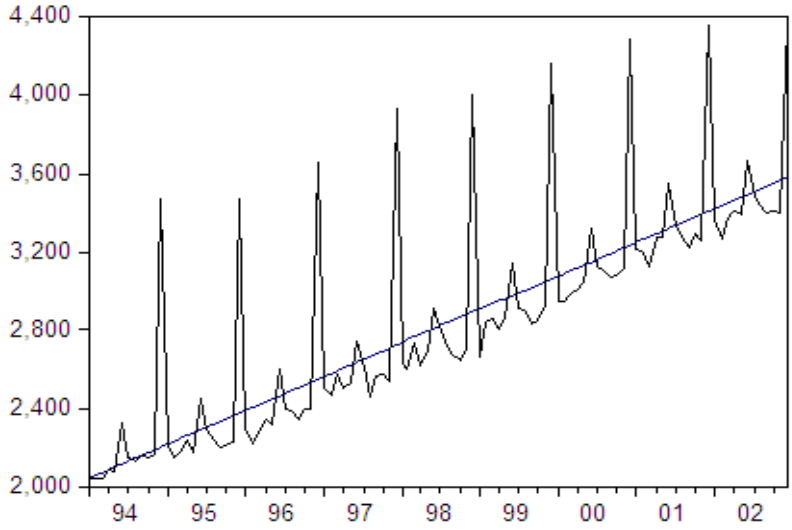


Fig.2. Evolution of monthly financial resources (smoothed series) Jan-94 to Dec-02

The obtained series indicates a growing trend over time and suggests a non-stationary mean. In addition this series presents a seasonality marked by spikes at regular intervals in June and December.

We hereby present the simple correlogram of the corrected series (Xt), which confirms the presence of seasonality:

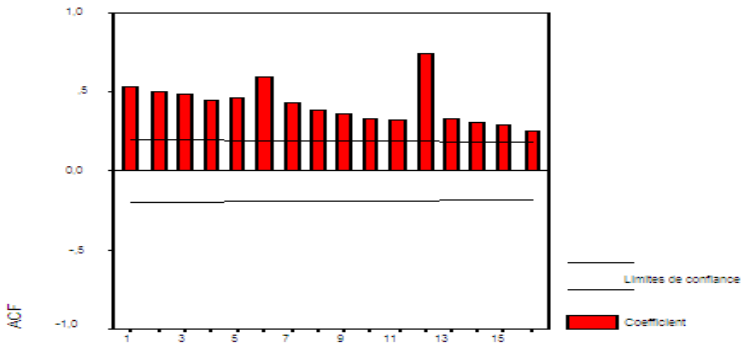


Fig.3. Simple financial resources correlogram X_t

One notes that all simple correlations of the series are significant. The peak in the period K = 12, confirms the presence of seasonality of periodicity equal to 12. What indicates to differentiate the seasonal and non-seasonal part of the series (X_t) to make it stationary.

4 IDENTIFICATION AND VALIDATION OF THE MODEL

To stationnarize series (X_t), is a simple differentiation of order 1 by applying the operator defined for the following series:

$Y_t = \nabla X_t$ *où* $\nabla X_t = (X_t - X_{t-1})$

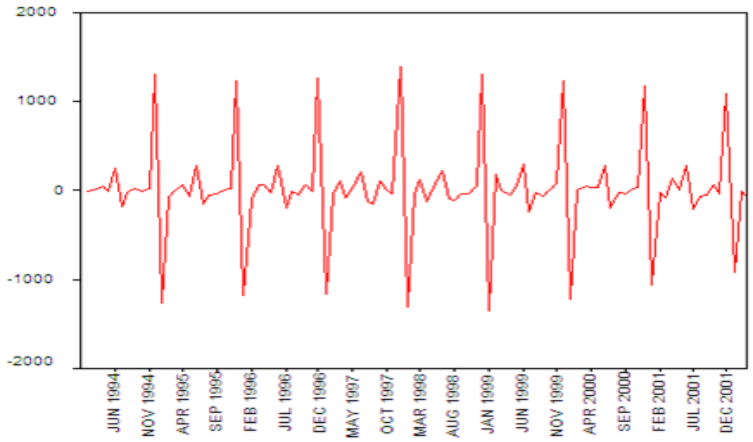


Fig.4. Monthly financial resources X_t 1st differentiation

The new series Y_t has more tendency (the mean and the variance are stable and independent of the time). However, there is always a seasonal behavior that appears clearly in the form of significant peaks to delay k = 12 in the following this simple correlogram.

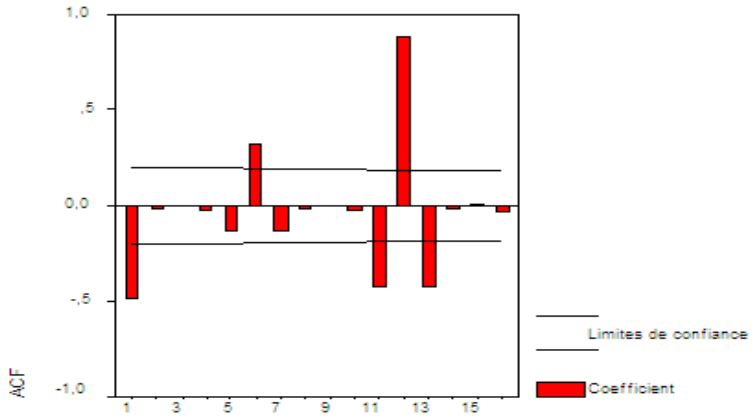


Fig.5. Simple financial resources correlogram y_t

In the step that follows, is the elimination of this seasonality, applying differentiation to the series Y_t of order 1 with a frequency equal to 12 using the operator ∇_{12} [3]*:*

$$w_t = \Delta_{12} Y_t = \Delta\Delta_{12} X_t = \left(X_t - X_{t-1}\right) - \left(X_{t-12} - X_{t-13}\right)$$

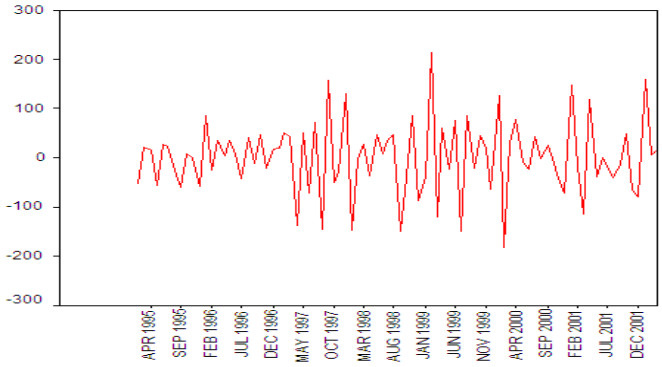


Fig.6. Monthly financial resources X_t 2nd differentiation

The graph of the W_t series highlights the presence of an average zero, a relatively constant variance and the lack of seasonality. Thus, it can be concluded that the new W_t series is a stationary series [4].

The conditions are now fulfilled for research into the family of models ARMA model that best fits the data of the Z_t series.

The determination of such a model requires passing through three phases:

- Model specification;
- Estimation of the parameters of the model;
- Validation of the model.

4.1 ARIMA MODELS

The usual method is to rely on the shape of autocorrelation and partial autocorrelation of the studied series (possibly transformed) functions in order to choose a model ARMA or possibly several models which will be examined:

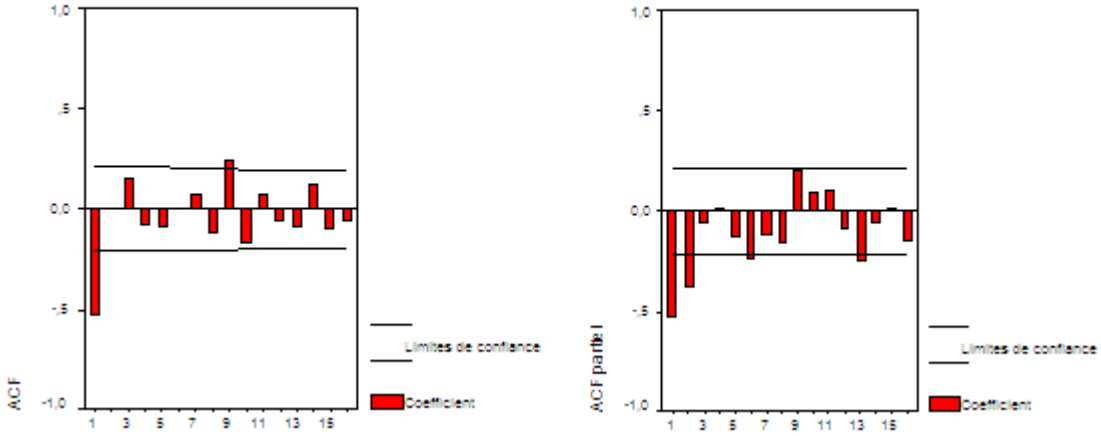


Fig.7. Autocorrelation and partial autocorrelation function time series of financial resources

The simple correlogram has its first significantly different term of 0 (characteristic of the mobile medium order process 1: MA (1)), which leads to analyze this process including the wording is as follows:

$$w_t = \varepsilon_t - \varphi_1 \varepsilon_{t-1} \Leftrightarrow w_t = (1-\varphi_1 B)\varepsilon_t$$

The partial correlogram has its first two terms significantly non-zero (characteristic of the Autoregressive of order 2 processes: AR (2)), which leads to also consider this process which the mathematical formulation is presented below:

$$w_t = \theta_1 w_{t-1} + \theta_2 w_{t-2} + \varepsilon_t \Leftrightarrow (1-\theta_1 B - \theta_2 B) w_t = \varepsilon_t$$

A third process to analyze is one that combines the two previous processes (MA (1) and AR (2)) noted ARMA (2.1) and the mathematical formulation is as follows:

$$w_t - \theta_1 w_{t-1} - \theta_2 w_{t-2} = \varepsilon_t - \varphi_1 \varepsilon_{t-1} \Leftrightarrow (1-\theta_1 B - \theta_2 B) w_t = (1-\varphi_1 B)\varepsilon_t$$

After identification of the three models, is the estimation of their parameters by the method of maximum likelihood, which is to determine the value of the parameter to estimate (the comments function) which ensures the highest probability of occurrence of these observations.

The results of the parameters estimated for each model are shown below:

Table 1. Estimation of the parameters for each model

	Model MA (1)	Model AR (2)		Model ARMA (2.1)		
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Estimate	0,746	-0,755	-0.342	-0.097	0.0004	0.692
Standard deviation	0.069	0.110	0.100	0.193	0,160	0.161
T statistic	10,542	-7,032	-3,619	-0.502	0.002	4,288

4.2 MODEL VALIDATION

Two types of tests are used for the validation of the models: on the meaning of the parameters of the different models and test the variety of their residues.

4.2.1 TESTS ON PARAMETERS

The coefficients of the first two models (AR (2) and MA (1)) are significantly different from zero at the 5% threshold. In fact their student's T-distribution is higher in absolute terms, the critical value of 1.96 (see table above).

On the other hand, the model coefficients ARMA (2.1) are not all different from zero at the 5% threshold, including coefficients of part autoregressive for which Student's T is lower, in absolute terms, the critical value of 1.96 (see table above). This leads to spread this model of the analysis suite.

4.2.2 TESTS ON RESIDUALS

When the process is well estimated, residues (difference between the observed values and the values estimated by the model) must behave like a white noise. It should be noted later $\hat{\varepsilon}_t$ the residuals of the model estimation.

Test of nullity of the average:

Table 2. Test of nullity of the average

Models	T statistic
Model MA (1)	0,422
Model AR (2)	0.264

The average of the residues of the two models may be considered to be zero at the 95% threshold. In fact their student's T-distribution is less than the critical value of 1.96 in absolute (see table above).

Test of autocorrelation of the residuals:

If residues *(ε_t , $t \in Z$) obey a white noise, it must not exist autocorrelation in the series. You can then use the following tests:*

-Study of the simple autocorrelogram (ACF) and the partial autocorrelogram (PACF): it shall be verified that there is no autocorrelation and partial autocorrelation significantly non-zero for the process studied.
- Ljung-Box test

The analysis of the autocorrelograms of both models shows that there is no significant autocorrelation between residues.

Analysis of the residuals of the model series MA (1)

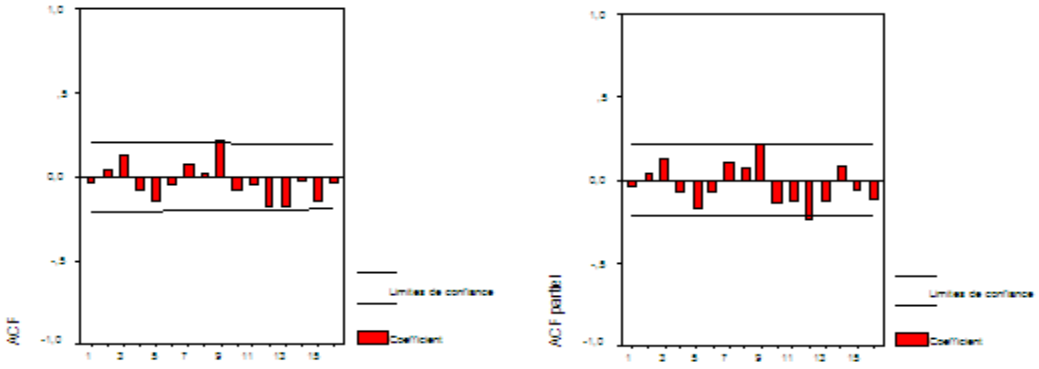


Fig.8. Autocorrelation and partial autocorrelation function time series of financial resources

Analysis of the series of the residuals of the AR (2)

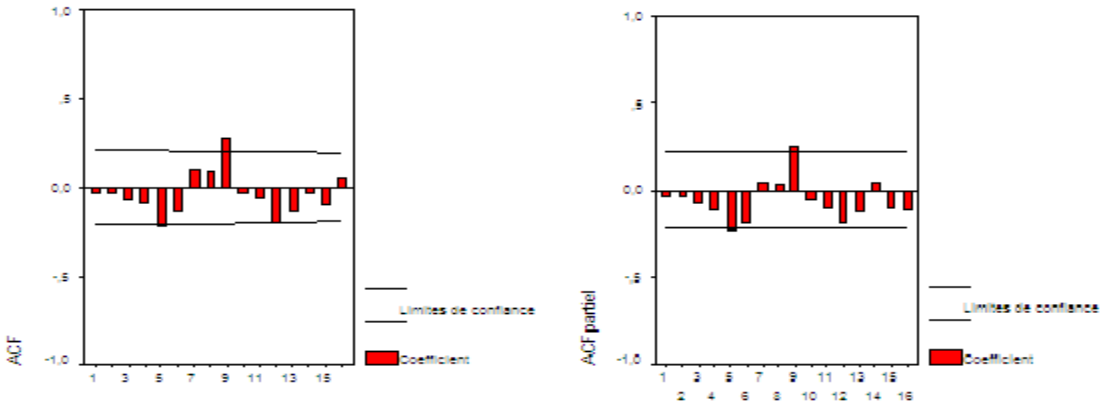


Fig.9. Autocorrelation and partial autocorrelation function time series of financial resources

The global test of Ljung-Box (White noise test) **for** the two models has provided the following table:

Table 3. The global test of Ljung_Box

Delay	Model MA (1)		Model AR (2)	
	Ljung-Box value	Prob. of meaning	Ljung-Box value	Prob. of meaning
1	0.112	0.741	0.074	0.770
2	0.274	0.842	0.144	0.910
3	1.722	0.635	0.644	0.874
4	2,314	0.685	1,441	0.852
5	4,242	0.514	5,752	0.325
6	4,445	0.642	7,441	0.287
7	4,914	0.671	8,442	0.258
8	4,945	0.742	9,112	0.342
9	9,564	0.341	16,752	0.050
10	10,188	0.445	16,963	0.074
11	10.385	0,458	17,241	0.105
12	13.564	0.335	21,163	0.044
13	16,652	0.214	23,153	0.055
14	16,742	0.275	23,244	0.054
15	18,925	0.218	24,242	0.061
16	19,122	0.262	24,442	0.084

The meaning of 'Ljung-Box test probabilities are all higher than 0.05 for both models. Therefore, it can be concluded that residues do not significantly of a white noise process deviate.

At the end of this step, we could consider that the two models estimated AR (2) and MA (1) are satisfactory.

5 SELECTION OF THE MODEL

It is to choose the best of the two models validated in the previous step on the basis of criteria of information**.** Concretely these criteria are constructed as functions of variance of the model estimated residues and the number of parameters to estimate.

The goal is to find the model that minimizes this function with respect to these two arguments; it retains the criterion of Akaike (AIC) and Bayesian Schwartz (SBC) criterion [5].

The following table shows the calculated value of these two criteria for each model:

Table 4. The global test of Ljung_Box

Criteria	Model MA (1)	Model AR (2)
AIC	943,402	948,852
SBC	944,857	923,745

The model MA (1) (a) of the criteria those are lower than those of the AR (2). Thus, it can be concluded that the best model is the model MA (1).

The equation of the model chosen is as follows:

$$W_t = \varepsilon_t - 0{,}746\ \varepsilon_{t-1} \Leftrightarrow W_t = (1\text{-}0{,}746\mathrm{B})\,\varepsilon_t$$

Where:

$$w_t = \nabla_{12} Y_t = \nabla\nabla_{12} X_t = (X_t - X_{t-1}) - (X_{t-12} - X_{t-13})$$

6 CONCLUSION

At the end of this step, we could consider that the two models estimated AR (2) and MA (1) are satisfactory and this model allows more faithfully the reproduction of the evolution of the financial resources of the institution and forecasting on a determined horizon.

REFERENCES

[1] G.E.P Box, and G.M Jenkins: Time Series analysis: forecasting and control, 2nd edition, Holden-Day, 1976.
[2] R. Bourbonnais : Économétrie, Manuel et exercices corrigés, 7e édition. DUNOD, Paris, 2009.
[3] R. Bourbonnais and M. Terraza : Analyse des séries temporelles en économie, 1er édition. PUF, 1998.
[4] C. Brooks: Introductory Econometrics for Finance, 2nd edition. Cambridge University Press, 2008.
[5] J. Hamilton: Time series analysis, 1st edition, Princeton University Press, 1994.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 339-355
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Estimation d'un modèle à équations simultanée des variables macroéconomiques au Maroc

[Estimation of a simultaneous equations model of macroeconomic variables in Morocco]

Moulay El Mehdi Falloul[1] and Abdelali Saadallah[2]

[1]Doctorant en économie et finance appliquée,
Université Hassan II Mohammedia,
Mohammedia, Maroc

[2]Docteur d'état en sciences,
Université Rabat Agdal,
Rabat, Agdal, Maroc

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The objective of this paper is to estimate a model of simultaneous equations on macroeconomic data from 1980 to 2011. In fact economic phenomena of any complexity are described by a set of variables and their modeling requires in general more of a mathematical relationship, or equation, connecting these quantities, referred to as simultaneous equations models. There are endogenous variables, which are determined by the model, and the exogenous variables determined or fixed outside of it.

KEYWORDS: Simultaneous equations Model, consumption, investment, money supply, interest rate.

RESUME: L'objectif de cet article est d'estimer un modèle d'équations simultanées sur les données des statistiques Macroéconomiques de 1980 à 2011.En fait, les phénomènes économiques de quelque complexité sont décrits par un ensemble de variables, et leur modélisation requiert en général plus d'une relation, ou équation, reliant ces grandeurs, on parle alors de modèles à équations simultanées. On distingue les variables endogènes, qui sont déterminées par le modèle, et les variables exogènes déterminées ou fixées en dehors de celui-ci.

MOTS-CLEFS: Modèle à équations simultanées, la consommation, l'investissement, l'offre de monnaie, taux d'intérêt.

1 INTRODUCTION

Les phénomènes économiques de quelque complexité sont décrits par un ensemble de variables, et leur modélisation requiert en général plus d'une relation, ou équation, reliant ces grandeurs, on parle alors de modèles à équations simultanées. On distingue les variables endogènes, qui sont déterminées par le modèle, et les variables exogènes déterminées ou fixées en dehors de celui-ci [1].

Corresponding Author: Moulay El Mehdi Falloul

La modélisation opère en trois phases:

1- la conception, c'est à dire l'écriture ou la spécification du modèle ;
2- l'estimation des équations du modèle, selon des techniques appropriées ;
3-la résolution du modèle, préalable à son emploi pour la simulation ou la prévision.

Naturellement, dans la réalité, les choses ne sont pas séquentielles et la mise au point d'un modèle opère par allers et retours entre les trois étapes ci-dessus.

Cependant, dans le cadre de ce travail, nous allons procéder par l'analyse exploratoire des données. Dans cette étape, il va s'agir d'étudier l'évolution et le comportement de nos variables dans le temps. Si elles sont non stationnaires, les stationnariser selon leurs types de non stationnarité.

Ensuite, nous allons identifier nos équations. Cette étape est nécessaire car elle nous permet de trouver la meilleure méthode d'estimation pour chacune des équations du modèle. Elle est par ailleurs suffisante parce que l'application aveugle de la méthode de moindres carrés ordinaires peut conduire à des résultats fallacieux dans la mesure où l'hypothèse de l'indépendance entre la variable explicative et l'erreur n'est pas respectée.

La troisième étape est l'estimation. On peut estimer les paramètres de la forme structurelle du modèle lorsque les équations sont exactement identifiées et sur-identifiées. On distingue les méthodes à information limitée et les méthodes à information complète. Les premières consistent à estimer le modèle équation par équation, sous l'hypothèse qu'il n'existe pas de corrélations entre les aléas des différentes équations. Les secondes considèrent le modèle dans sa globalité et estiment les paramètres sous l'hypothèse qu'il n'existe pas de corrélations entre les aléas inter-équations [2].

2 ANALYSE EXPLORATOIRE DES DONNEES

L'objectif de cette section est d'effectuer une analyse de l'impact du taux de change sur la croissance économique. Nous avons retenu un ensemble de variables qui reflète le contexte marocain. Ces variables sont : produit intérieur brut (Y), les importations des biens et services (M), les dépenses de la consommation administrations (G), les dépenses de la consommation des ménages (C), le taux du change (Txch), formation brute de capital fixe (I), prix de consommation (P), masse monétaire (M3), taux d'intérêt (r) et les exportations des biens et services (X). La base de donnée contient les variables en données annuelles de 1980 jusqu'à 2011 elles proviennent des sources des données de Bank al MAGHRIB.

2.1 EVOLUTION ET TENDANCES DES VARIABLES DU MODELE

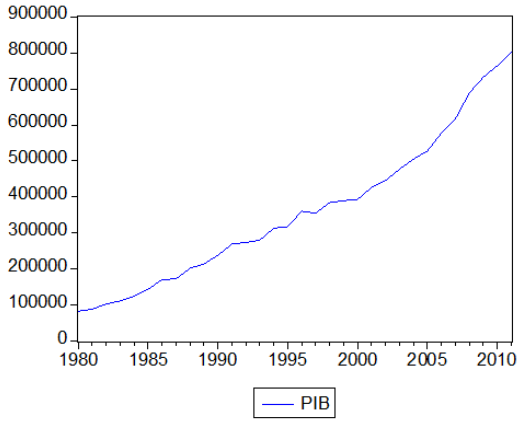


Fig. 1. L'évolution du produit intérieur brut entre 1980 et 2011

Le produit intérieur brut au Maroc est évalué d'une façon continue de 1980 jusqu'au 2011 ou il passe d'une valeur de 100 milliards de DH en 1980 à 800 milliard de DH en 2010. Cette performance est le résultat de l'augmentation de la valeur ajoutée du secteur primaire et de la bonne apparence du secteur non agricole.

Cette croissance devrait encore être principalement portée par la demande intérieure, que sont venues alimenter les augmentations de salaires et la hausse des investissements dans le logement social, les travaux publics et l'équipement industriel. Ce graphique montre clairement que le produit intérieur brut n'est pas stationnaire puisque qu'on constate une tendance ascendante.

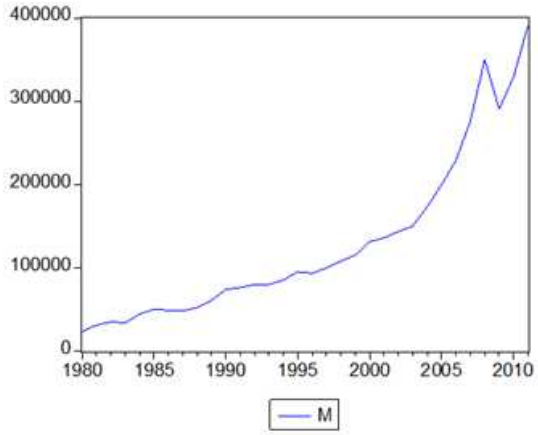


Fig. 2. L'évolution des importations des biens et services entre 1980 et 2011

En ce qui concerne les importations marocaines, on constate que cette évolution est caractérisée par une tendance haussière puisqu'elles sont devenues en 2008 soixante fois plus importantes qu'en 1980, passant d'une valeur de 40000 millions de DH en 1980 à 400000 millions de DH en 2010.En 2009, la valeur des importations a connu une légère diminution due à l'augmentation des prix de pétroles, chose qui est due à la crise et son impact sur le volume des échanges commerciaux, pour qu'elles reprennent ces évolutions après cette date

Ce graphique montre clairement que les importations marocaines ne sont pas stationnaires puisque qu'on constate une tendance ascendante

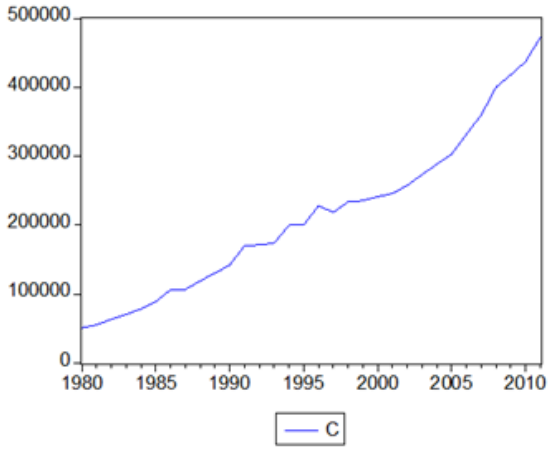


Fig. 3. L'évolution de la consommation finale des ménages entre 1980 et 2011

Pour l'ensemble de la période 1980-2011, la valeur moyenne annuelle des dépenses de consommation finale des ménages est presque de 300 milliards de DH. C'est en 2011 qu'elle a enregistré le plus haut niveau proche de 490 milliards de DH et c'est en 1980 qu'elle a enregistré le plus bas niveau (150 milliards de DH). Donc les dépenses de consommation finale ont évolués en 2011 presque trois fois par rapport à 1980 **.**Ce graphique montre clairement que les dépenses de consommation finale des ménages marocaines ne sont pas stationnaires puisque qu'on constate une tendance ascendante.

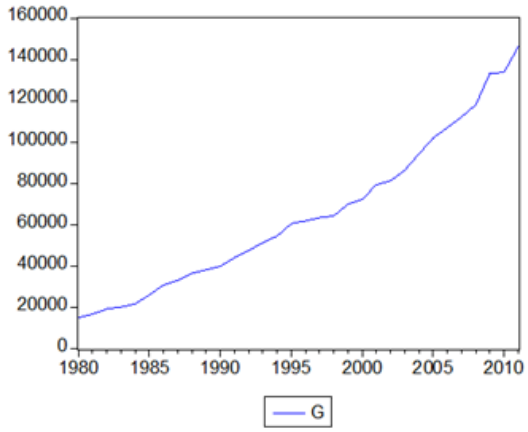


Fig. 4. L'évolution des dépenses gouvernementales entre 1980 et 2011

Pour l'ensemble de la période 1980-2011, la valeur moyenne annuelle des dépenses de consommation finale des administrations est presque de 90 milliards de DH. C'est en 2011 qu'elle a enregistré le plus haut niveau proche de 160 milliards de DH et c'est en 1980 qu'elle a enregistré le plus bas niveau (15 milliards de DH). Donc les dépenses de consommation finale des administrations ont évolués en 2011 presque onze fois par rapport à 1980. Cet accroissement des dépenses publiques est lié à la volonté du gouvernement d'atténuer l'impact de la crise mondiale. Ce graphique montre clairement que les dépenses de consommation finale des administrations marocaines ne sont pas stationnaires puisque qu'on constate une tendance ascendante.

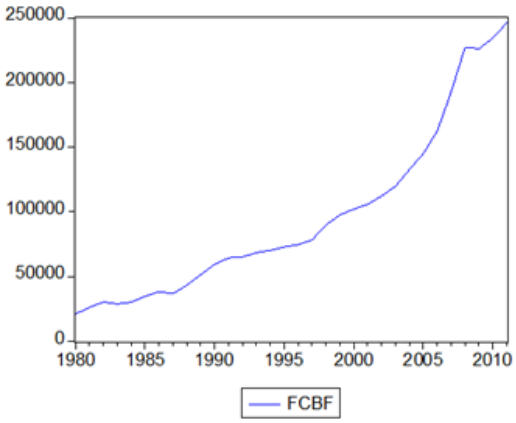


Fig. 5. L'évolution de la formation brute du capital fixe entre 1980 et 2011

Ce graphique montre clairement que les formations brutes de capital fixe marocaines ne sont pas stationnaires puisque qu'on constate une tendance ascendante. En ce qui concerne la formation brute de capital fixe, on constate que cette dernière est demeurée croisant jusqu'à l'année 1988 et à partir de 1989 elle a connu une augmentation jusqu'à l'année 2011. Cette hausse est expliquée par des investissements dans le logement social, les travaux publics et l'équipement industriel.

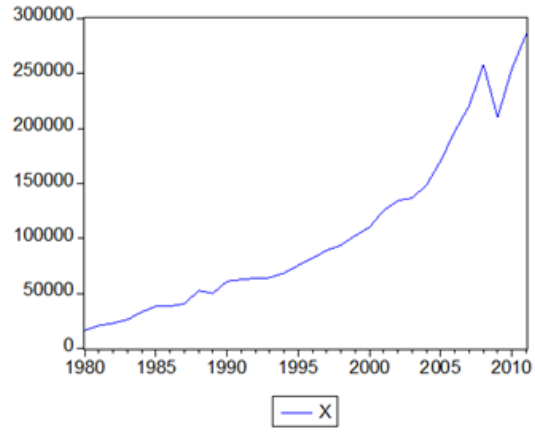


Fig. 6. L'évolution des exportations des biens et services entre 1980 et 2011

La valeur des exportations de biens et services a progressivement évolué au cours de la période étudiée sauf en 2009 ou elle a significativement baissé. Ainsi a-t-elle passé d'une valeur de 30 milliards de DH en 1980 à 250 milliards de DH en 2008.ceci s'explique, en grande partie par la performance des phosphates qui ont participé en 2008 de 33% dans les exportations du Maroc. On remarque que le niveau des exportations a baissé en 2009, chose qui est due à la crise et son impact sur le volume des échanges commerciaux, pour qu'elles reprennent ces évolutions après cette date Ce graphique montre clairement que les exportations de biens et services marocaines ne sont pas stationnaires puisque qu'on constate une tendance ascendante.

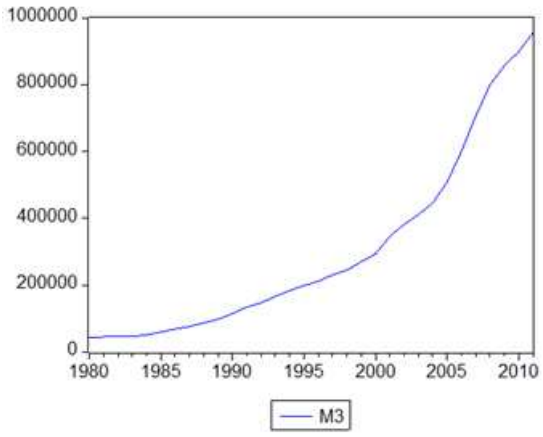


Fig. 7. L'évolution de la masse monétaire M3 entre 1980 et 2011

Ce graphique montre clairement que la masse monétaire n'est pas stationnaire puisque qu'on constate une tendance ascendante, en ce qui concerne la masse monétaire on constate que cette dernière a connu une augmentation continue jusqu'à l'année 2011.

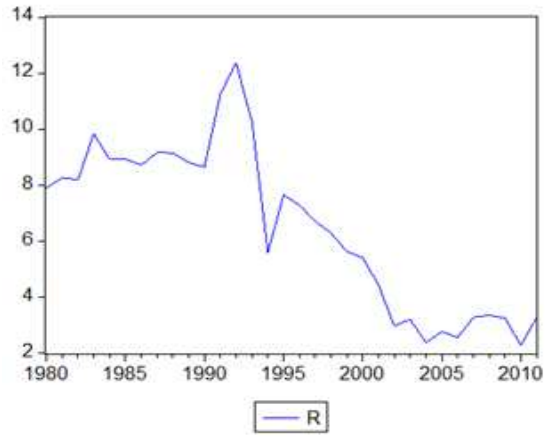


Fig. 8. L'évolution du taux d'intérêt entre 1980 et 2011

Ce graphique présente l'évolution de taux d'intérêt marocain durant la période 1983 jusqu'à 2011.Ce graphique montre clairement l'évolution du taux d'intérêt marocain par rapport à son niveau de l'année 1983et de 2000.

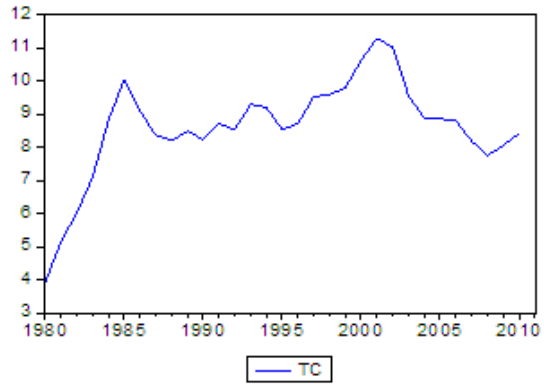


Fig. 9. L'évolution du taux de change entre 1980 et 2011

Ce graphique présente l'évolution du taux de change réel Marocaine durant la période 1980 jusqu'à 2011 montre clairement l'évolution du taux de change Réel Marocaine par rapport à son niveau de l'année 1980 et de l'an 2000. Il montre aussi la dépréciation du DH Marocain au cours de ces dernières années.

3 DETERMINATION DE L'ORDRE D'INTEGRATION DES VARIABLES

Depuis que l'économétrie a perçu, que la validité des estimations est tributaire de la stationnarité des variables ; il est recommandé de toujours commencer par chercher l'ordre d'intégration des variables dans tout travail d'économétrie.

Cela est d'autant plus important et pertinent dans la présente étude que les variables utilisées dans le modèle sont toutes des variables macro - économiques, qui d'ordinaire sont non stationnaires.

3.1 RÈGLE DE DÉCISION

La détermination de l'ordre d'intégration des variables est faite suivant les tests de racine unitaire. A ces tests, appliqués à l'aide du logiciel Eviews 6 (version 5) sont attachés des règles de décision précises permettant de se prononcer sur l'ordre d'intégration des variables.

Dans les différents tests appliqués ici, le nombre de retards retenus est celui correspondant au test pour lequel la statistique Akaike (Akaike info criterion) est la plus faible [2] .

Le nombre de retards étant retenu sur la base de la statistique Akaike, la stationnarité de la variable est jugée à partir de la comparaison entre les statistiques ADF (Augmented Dickey Fuller test statistic) et critical value (Mackinnon Critical Values for rejection of Hypothesis of a unit root. c'est- à-dire la valeur critique Mackinnon).

L'alternative d'hypothèses qui se présente à l'issue du test est la suivante :

H0: racine unitaire ou non stationnarité.
H1 : non racine unitaire ou stationnarité.

Si |ADF| < |Valeur Critique de Mackinnon| alors l'hypothèse H0 est acceptée. Par conséquent la série est non stationnaire.
Si |ADF| > |Valeur Critique de Mackinnon| alors l'hypothèse H1 est acceptée. Cela traduit la stationnarité de la série.

Les tests sont appliqués à niveau, puis en différence, au cas où il y aurait présence de racine unitaire à ce premier stade. Eviews 6 fournit les résultats des fonctions d'autocorrélation simple (collone AC) et partielle (colonne PAC), avec les correlogrammes respectifs. Vu dans le corrélogramme (voir annexe), les probabilités sont tous inférieur à 5%, ce qui veut dire que le bruit n'est pas blanc. A partir des tests de Dickey-Fuller nous allons examiner si les processus sont non stationnaires.

3.2 TESTS DE STATIONNARITE DE DICKEY FULLER AUGMENTED (ADF)

Une série chronologique est stationnaire si son espérance et sa variance restent inchangées dans le temps. En d'autres termes la série stationnaire ne comporte ni saisonnalité, ni tendance. Dickey et Fuller (1979 ; 1981) ont mis au point un test permettant non seulement de détecter l'existence d'une tendance mais aussi de déterminer la bonne manière de stationnairiser une série [3].

Le test de racine unitaire indique l'ordre d'intégration des séries. Il en découle donc qu'une série est intégrée d'ordre 1 s'il convient de la différencier une fois avant de la stationnariser. Il est important de préciser que le choix porté sur le Dickey Fuller Augmented se justifie par le fait qu'il tient compte du nombre de retard. C'est le test qui tient compte de l'hypothèse qu'il n'y a aucune raison pour que, à priori ; l'erreur soit non corrélée. Mais les deux tests se font de la même manière, seules les tables statistiques diffèrent.

Par souci de synthèse et compte tenu du nombre important des tests appliqués, le tableau ci - dessous résume les résultats des tests de racine unitaire appliqués à l'ensemble des variables.

Tableau 1. Tests de stationnarité au seuil 5%

TEST DE STATIONNARITE (AU seuil de 5%)					
Variables	Stationnarité		Dickey-Fuller (ADF)		Probabilité
	oui/non	ordre d'intégration	Valeur des statistiques	Valeur critique	
PIB	oui	I(1)	-7.575008	-3.568379	0.0000
C	oui	I(1)	-5.971697	-2.963972	0.0000
FBCF	oui	I(1)	-5.480982	-2.967767	0.0001
G	oui	I(1)	-5.280405	-3.568379	0.0009
X	oui	I(0)	-3.873206	-3.562882	0.0256
M	oui	I(1)	-5.974294	-3.568379	0.0002
r	oui	I(1)	-6.387200	-2.963972	0.0000
M3	oui	I(2)	-6.046163	-3.574244	0.0001
Tc	oui	I(2)	-4.989376	-3.587527	0.0022

Il en découle que les six variables (C, M, FBCF, G, M3,Pib,Nx, Tc et R) sont non stationnaires à niveau (ne sont pas I(0)). Probablement ils sont intégrés d'ordre 1. L'examen de l'ordre d'intégration des variables se poursuit en différence première et pour les six variables dans un souci de lecture d'un même niveau d'intégration. Les deux variables (M3 et Tc) sont non stationnaires à niveau (ne sont pas I(1)). Ils sont intégrés d'ordre I(2).

Les résultats des tests de racine unitaire en différence secondaire montrent la stationnarité des variables, autorisant ainsi l'étude d'estimation d'un modèle d'équations simultanées à partir de ces variables.

En effet, pour les deux variables : |ADF| > |Valeur Critique de Mackinnon| au seuil de 5%.Ce qui permet d'accepter l'hypothèse alternative H1 de stationnarité des variables correspondantes.

4 MODELE D'EQUATIONS SIMULTANEES, IDENTIFICATION ET ESTIMATION

Dans cette partie on suppose qu'il n'y a pas de taux de change et que seul le taux d'intérêt qui inclut dans les équations. Comme nous l'avions précisé ci-haut, cette section consiste à présenter le modèle d'équations simultanées et l'identifier.

4.1 TESTS DE STATIONNARITE DE DICKEY FULLER AUGMENTED (ADF)

4.1.1 FORME STRUCTURELLE

Considérons le modèle macro-économique sous forme structurelle :

Yt = Ct + It + Gt + Nxt (E1)

Ct = a_0 + a_1 Yt + u_{1t} (E2)

It = α_0 $I_{(-1)}$ + α_1 Y- α_2 rt + u_{2t} (E3)

M = β_0 + β_1 $Y_{(-1)}$ - β_2 rt +u_{3t} (E4)

rt = b_0 + $b_1 Txch$ + u_{4t} (E5)

Ce modèle comporte cinq équations et dix variables économiques. La première équation est identité (aucun paramètre n'est à estimer).

Les variables exogènes sont les variables non expliquées par une relation.

- Les variables retardées : $I_{(-1)}$, $Y_{(-1)}$ et
- Les variables « véritablement exogène » solde de la balance commerciale, les dépenses gouvernementales G, Taux de change et $I_{(-1)}$

Les variables endogènes sont celles qui sont déterminées par une relation de comportement : Pib, Fbcf, Masse monétaire, consommation et taux d'intérêt.

Les éléments u_{1t} u_{2t} u_{3t} , u_{4t} désignent les perturbations aléatoires et l'indice «t» désigne la période de temps.

ao, a1, α_0 , α_1 , α_2 , β_0 β_1 β_2 b_0 , b_1 sont des paramètres structurels.

On constate que des variables endogènes d'une équation apparaissent en tant que variables explicatives d'une autre équation. Ce double statut de certaines variables entraine un biais dans les estimations des coefficients lorsque nous employons les MCO, équation par équation.

Ce modèle comporte cinq équations dont une identifié (E1). En effet, cette équation, il n'y a aucun coefficient à estimer et par conséquent pas de terme aléatoire. L'équation (E2) est une fonction de consommation, l'équation (E3) est une fonction d'investissement, l'équation (E4) est relative à l'offre de monnaie et (E5) relative à la fonction de change.

4.1.2 FORME REDUITE

Nous allons donc chercher à transformer le modèle initial en un modèle où les variables endogènes ne sont exprimées qu'en fonction des variables exogènes.

Apres substitution et remplacement des variables, les équations structurelles sont alors équivalentes aux équations réduites (les variables endogènes sont exprimées en fonction des seules variables exogènes)

(E5) Equilibre du marché des biens et services

$Yt = \frac{1}{1-a1} + \frac{1}{1-a1}(I+G+Nx+u1t)$

$\mathbf{Yt = \frac{1}{1-a1} + \frac{1}{1-a1} I + \frac{1}{1-a1} G + \frac{1}{1-a1} Nx + \frac{1}{1-a1} u1t}$

$Yt = \prod 0 + \prod 1 I + \prod 2 Gt + \prod 3 Nx + \prod 4 u1t$

Avec : $\prod 0 = \frac{1}{1-a1}$; $\prod 1 = \frac{1}{1-a1}$; $\prod 2 = \frac{1}{1-a1}$ $\prod 3 = \frac{1}{1-a1}$ **et** $\prod 4 = \frac{1}{1-a1}$

(E6) Fonction de consommation

$Ct = \frac{a0+a1(1-a0)}{1-a1} + \frac{a1}{1-a1}(I + Gt + Nx) + \frac{1}{1-a1} u1t$

$Ct = \frac{a0+a1(1-a0)}{1-a1} + \frac{a1}{1-a1} I + \frac{a1}{1-a1} Gt + \frac{a1}{1-a1} Nx) + \frac{1}{1-a1} u1t$

$Ct = \prod 0 + \prod 1 I + \prod 2 Gt + \prod 3 Nx - \prod 4 u1t$

Avec: $\prod 0 = \frac{a0+a1(1-a0)}{1-a1}$; $\prod 1 = \frac{a1}{1-a1}$; $\prod 2 = \frac{a1}{1-a1}$ $\prod 3 = \frac{a1}{1-a1}$ et $\prod 4 = \frac{1}{1-a1}$

(E7) Fonction d'investissement

$It = I_{(-1)} + \alpha_0 Y - \alpha_1 rt + u_2$

Avec $Yt = \frac{1}{1-a1} + \frac{1}{1-a1}(I+G+Nx+u1t)$

On remplace y par sa valeur on obtient :

$It = I(-1) + \frac{\alpha_0}{1-a1} + \frac{\alpha_0}{1-a1} I + \frac{\alpha_0}{1-a1} G + \frac{\alpha_0}{1-a1} Nx - \alpha_1 rt + \frac{1-a1+\alpha_0}{1-a} ut$

Avec : $\prod 0 = I(-1) + \frac{\alpha_0}{1-a1}$; $\prod 1 = \frac{\alpha_0}{1-a1}$; $\prod 2 = \frac{\alpha_0}{1-a1}$ $\prod 3 = \frac{\alpha_0}{1-a1}$ et $\prod 4 = \alpha_1$

et $\prod 5 = \frac{1-a1+\alpha_0}{1-a}$

(E8) Fonction offre de monnaie

$$M^{\circ} = \frac{\delta(b+Io)}{1-a} + \frac{\delta}{1-a} GT + \frac{\delta}{1-a} NX - \left(\frac{\delta.\alpha}{1-a} + \beta\right) Rt$$

$M^{\circ} = \prod 0 + \prod 1 Gt + \prod 2 Nx - \prod 3 Rt$

Avec: $\prod 0 = \frac{\delta(b+Io)}{1-a}$; $\prod 1 = \frac{\delta}{1-a}$; $\prod 2 = \frac{\delta}{1-a}$; $\prod 3 = \frac{\delta.\alpha}{1-a} + \beta$

4.1.3 TRANSFORMATION MATRICIELLE

On considère le système d'équation :

$Y_t - C_t - I_t - G_t - NX_t = 0$ (E1)

$C_t - a_0 - a_1 Y_t = u_{1t}$ (E2)

$It - I_{(-1)} - \alpha_0 Yt + \alpha_1 rt = u_{2t}$ (E3)

$M^{\circ} - \beta_0 - \beta_1 Y_t + \beta_2 Rt_t = u_{3t}$ (E4)

$rt - b_0 - b_1 Txch = u_{3t}$ (E5)

A partir du système d'équations présenté ci-haut, nous allons isoler les termes du choc à droite du signe d'égalité. Le modèle devient :

Le modèle sous forme matricielle s'écrit :

$$\begin{pmatrix} 1 & -1 & -1 & 0 \\ -a_1 & 1 & 0 & 0 \\ -\alpha_0 & 0 & 1 & 0 \\ -\beta_1 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} Y \\ C \\ I \\ M \end{pmatrix} + \begin{pmatrix} -1 & -1 & 0 & 0 \\ 0 & 0 & 0 & -a_0 \\ 0 & 0 & -\alpha_1 & -I_{(-1)} \\ 0 & 0 & -\beta_2 & -\beta_0 \end{pmatrix} \begin{pmatrix} G \\ NX \\ r \\ \mu \end{pmatrix} = \begin{pmatrix} 0 \\ \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{pmatrix}$$ soit B Y + C X = ui $_t$

Avec μ = vecteur unité

4.2 IDENTIFICATION

Condition d'ordre : K – k >= m - 1
Condition de rang ρ(A)>=(M-1)(M-1) => ordre de la matrice.
M = nombre de variables endogènes dans le modèle
K = nombre de variables exogènes dans le modèle
m = nombre de variable endogène dans une équation
k = nombre de variables exogènes dans une équation

La condition de rang détermine si l'équation en question est identifié ou non, alors que la condition d'ordre détermine si elle est exactement identifiée ou sur identifiée.

Condition de rang est déterminé par le rang de la matrice, qui devrait avoir une dimension (M-1), où m est le nombre de variables endogènes.

Cette matrice est formée à partir des coefficients des variables (à la fois endogènes et exogènes) exclus de cette équation en particulier, mais inclus dans les autres équations du modèle.

Les conditions d'identification : Condition de rang et d'ordre

1. Si $K - k > m - 1$ et le rang de $\rho(A)$ est M-1 donc l'équation est sur identifié
2. Si $K - k = m - 1$ et le rang de $\rho(A)$ est M-1 alors l'équation est exactement identifié
3. Si $K - k \geq m - 1$ et le rang de $\rho(A)$ est inférieur à M-1 alors l'équation est sous identifiée
4. If $K - k \leq m - 1$ l'équation structurelle est non identifiée. Le rang de $\rho(A)$ est inférieur M-1 dans ce cas.

4.2.1 L'EQUATION DE CONSOMMATION

Ct = b + a Yt + u_{1t}

Selon La condition de rang : K-k = 4 et m – 1 = 1

Donc K-k est supérieur à m-1 : (K-k > m-1)

D'où, l'équation de consommation est sur-identifiée → Par conséquent l'équation est estimé par la méthode DMC.

4.2.2 L'EQUATION D'INVESTISSEMENT

It - α_0 $I_{(-1)}$ - α_1 Yt+ α_2 rt = u_{2t}

Selon La condition de rang : K-k = 2 et m – 1 = 0

Donc K-k est supérieur à m-1 : (K-k > m-1)

D'où, l'équation d'investissement est sur-identifiée → Par conséquent l'équation est estimé par la méthode DMC.

4.2.3 L'EQUATION DE L'OFFRE DE MONNAIE

$M - \beta_0 - \beta_1 Y_t + \beta_2 Rt_t = u_{3t}$

Selon La condition de rang : K-k = 3 et m – 1 = 2

Donc K-k est supérieur à m-1: (K-k > m-1)

D'où, l'équation est sur-identifiée → Par conséquent l'équation 4 est estimé par la méthode DMC.

4.2.4 L'EQUATION DU TAUX D'INTERET

$rt - b_0 - b_1 Txch = u_{3t}$

Selon La condition de rang : K-k = 3 et m – 1 = 0

Donc K-k est supérieur à m-1: (K-k > m-1)

D'où, l'équation est sur-identifiée → Par conséquent l'équation 5 est estimé par la méthode DMC

Les équations étant toutes sur-identifiées, il est licite d'estimer les coefficients de ce modèle à l'aide de la méthode des DMC.

4.3 ESTIMATION

Nous appliquons maintenant la méthode des DMC pour chacune des trois équations :

Les résultats des estimations sont fournis par Eviews.

4.3.1 ESTIMATION DES DIFFERENTES EQUATIONS DU MODELE

Tableau 2. Estimation de L'équation de consommation

Dependent Variable: DR
Method: Least Squares
Date: 06/12/13 Time: 23:32
Sample (adjusted): 2 32
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Txch	-0.339730	0.180780	-1.879244	0.0703
C	2.826881	1.598843	1.768079	0.0876

R-squared	0.108558	Mean dependent var	-0.148826
Adjusted R-squared	0.077819	S.D. dependent var	1.282823
S.E. of regression	1.231898	Akaike info criterion	3.317331
Sum squared resid	44.00963	Schwarz criterion	3.409846
Log likelihood	-49.41862	F-statistic	3.531559
Durbin-Watson stat	2.200944	Prob(F-statistic)	0.070295

EQUATION DU MODELE :

Ct = 0.009 + 0.69.logPib
(1.333339) (3.319633) (.) = t de student
Avec R^2= 0.75 DW=2.30 n=31

R^2 = 0,75% cela signifie que la variation de la consommation explique 75% de la variation de produit intérieur brut.

F_{cal} > Ft : on accepte l'hypothèse que les paramètres estimés de la régression ne sont pas tous nuls, donc le modèle est globalement significatif.et La variable explicative est globalement un effet significatif sur la consommation.

Dw =2.30 : la statistique de Durbin et Watson laisse augurer d'une 'autocorrélation des erreurs ce qui va être confirmé par la suite

Cette analyse repose sur la consommation globale, c'est donc une approche macroéconomique. La relation consommation / revenu est déterminée par la notion de propension moyenne à consommer.

On constate qu'il existe une relation significative entre le produit intérieur brut et la consommation des ménages : Lorsque le revenu augmente de 1% la consommation augmente de 69%. En d'autre terme, les ménages épargnent une part croissante de leur revenu au fur et à mesure que celui-ci s'accroît.

Tableau 3. Estimation de L'équation de l'investissement

Dependent Variable: LOGFBCF
Method: Least Squares
Date: 06/10/13 Time: 23:42
Sample (adjusted): 2 32
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFBCF(-1)	0.770159	0.101127	7.615752	0.0000
LOGPIB	0.214225	0.091599	2.338728	0.0267
R	-0.003733	0.002293	-1.628539	0.1146

R-squared	0.991929	Mean dependent var	4.901746
Adjusted R-squared	0.991352	S.D. dependent var	0.294045
S.E. of regression	0.027344	Akaike info criterion	-4.268867
Sum squared resid	0.020936	Schwarz criterion	-4.130094
Log likelihood	69.16744	Durbin-Watson stat	1.190967

Equation du modèle :

FBCF **= 0.770** $FBCF_{(-1)}$ **+ 0.214 Pib – 0.0037 r**

(7.615752) (2.338728) (-1.628539) (.) T.student

R^2=0.99 n = 31 DW=1.190

Le coefficient de détermination R^2 égal à 0,99. Ceci signifie que 99% de l'investissement est expliquée par le modèle.

- **TEST DE STUDENT**

H0 :a1=0

H1 :a1#0

Tcal > Tth rejet de H0 il y a une relation statistiquement significative entre l'investissement et le produit intérieur brut .

H0 :a2=0

H1 :a2#0

Tcal <Tth accepte de H0, la relation entre investissement et taux d'intérêt n'est pas significative.

Dw =1.190: la statistique de Durbin et Watson laisse augurer d'une 'autocorrélation des erreurs ce qui va être confirmé par la suite.

Le tableau présente l'estimation de l'équation de l'investissement par les DMC. Ce tableau montre que le variable investissement est expliqué par le variable investissement de l'année précédente, le produit intérieur brut ainsi que le taux d'intérêt.

On constate que le taux d'intérêt agit négativement et qui est significative.

Tableau 4. Estimation de L'équation de l'offre de monnaie

Dependent Variable: LOGM3
Method: Least Squares
Date: 06/11/13 Time: 23:37
Sample (adjusted): 2 32
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGPIB(-1)	1.300502	0.049722	26.15531	0.0000
R	-0.025101	0.004619	-5.434218	0.0000
C	-1.630232	0.295588	-5.515215	0.0000

R-squared	0.988112	Mean dependent var	5.312413
Adjusted R-squared	0.987262	S.D. dependent var	0.423021
S.E. of regression	0.047743	Akaike info criterion	-3.154218
Sum squared resid	0.063822	Schwarz criterion	-3.015445
Log likelihood	51.89038	F-statistic	1163.613
Durbin-Watson stat	0.659367	Prob(F-statistic)	0.000000

Equation du modèle:

M° = 1.300 logPib - 0.025 logR - 1.630232

(26.15531) (-5.434218) (-5.515215) (.) T de student

R^2= 0.98 DW=0.65 n=31

Le coefficient de détermination R^2 égal à 0.98. Ceci signifie que 98% de l'offre de monnaie est expliquée par le modèle.

F_{cal} > Ft : on accepte l'hypothèse que les paramètres estimés de la régression ne sont pas tous nuls, donc le modèle est globalement significatif.et La variable explicative est globalement un effet significatif sur l'offre de monnaie.

- **TEST DE STUDENT**

H0 :a1=0

H1 :a1#0

Tcal > Tth rejet de H0 il y a une relation statistiquement significative entre l'offre de monnaie et le produit intérieur brut.

H0 :a2=0

H1 :a2#0

Tcal <Tth accepte de H0 la relation entre l'offre de monnaie et taux d'intérêt n'est pas significative.

Dw=0.65 la statistique de Durbin et Watson laisse augurer d'une 'autocorrélation des erreurs ce qui va être confirmé par la suite

Le tableau suivant présente l'estimation de l'équation de l'offre de monnaie par les Two-Stage Least Squares. Ce tableau nous montre que seuls la variable explicative (produit intérieur brut de l'année précédente) est significatif. Ainsi, on peut conclure que pendant cette période de l'histoire économique marocaine, l'offre de monnaie est expliquée par cette variable.

Tableau 5. Estimation de L'équation du taux de change

Dependent Variable: DR
Method: Least Squares
Date: 06/12/13 Time: 23:32
Sample (adjusted): 2 32
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Txch	-0.339730	0.180780	-1.879244	0.0703
C	2.826881	1.598843	1.768079	0.0876

R-squared	0.108558	Mean dependent var	-0.148826
Adjusted R-squared	0.077819	S.D. dependent var	1.282823
S.E. of regression	1.231898	Akaike info criterion	3.317331
Sum squared resid	44.00963	Schwarz criterion	3.409846
Log likelihood	-49.41862	F-statistic	3.531559
Durbin-Watson stat	2.200944	Prob(F-statistic)	0.070295

Equation du modèle:

r = 2.826 - 0.339 Txch

(-1.879244) (1.768079) (.) T de student

Avec R^2= 0.108 DW=2.200 n=31

Le coefficient de détermination R^2 égal 0.108 . Ceci signifie que 10,8% du taux de change est expliquée par le modèle.

F_{cal} < Ft : on rejet l'hypothèse que les paramètres estimés de la régression ne sont pas tous nuls, donc le modèle est globalement n'est pas significatif. et La variable explicative est globalement n'est pas un effet significatif sur le taux de change.

- **TEST DE STUDENT**

H0 :a1=0

H1 :a1#0

Tcal <Tth accepte de H0 la relation entre taux d'intérêt et taux de change n'est pas significative.

Dw=2.200 : la statistique de Durbin et Watson laisse augurer d'une 'autocorrélation des erreurs ce qui va être confirmé par la suite

Il existe bien une influence inverse du taux de change sur le taux d'intérêt, chaque augmentation du taux de change de 1%, diminue le taux d'internet de 39%.

Le tableau suivant présente l'estimation de l'équation taux d'intérêt par MCO. On constate que la variable taux de change agit négativement et qui n'est pas significatif.

4.3.2 TEST DE DURBIN WATSON (DW)

4.3.2.1 Les variables exprimées à la même période

Le test de Durbin Watson permet de détecter une auto- corrélation des erreurs d'ordre un. Il repose sur l'estimation d'un modèle autorégressif de premier ordre pour les résidus estimés[4].

Le test d'hypothèse est le suivant :

Ho : p = 0

H1 : p $\neq$ 0

Ou p < 0 ou p >0, attention le seuil n'est alors pas le même.

Pour tester l'hypothèse nulle Ho, nous calculons la statistique de Durbin et Watson :

$$DW = \frac{\sum_{t=2}^{n}(e_t - X_{t-1})^2}{\sum_{i=1}^{n} e_t^2}$$ Où e_t sont les résidus de l'estimation du modèle.

La statistique de Durbin Watson est comprise entre zéro et quatre. L'hypothèse nulle d'absence d'auto- corrélation des erreurs est acceptée lorsque la valeur de cette statistique est proche de deux.

Des valeurs critiques au seuil de 5% (resp.d1 et d2, avec d1>d2) ont été tabulées.

L'interprétation du test de Durbin Watson est alors la suivante :

1-si la valeur calculée de la statistique de DW est inférieur à la valeur tabulée d1 alors il existe une auto- corrélation positive (ou p>0)

2- si la valeur calculée de la statistique de DW est comprise entre d2 et 4-d2, il n'est pas possible de rejeter l'hypothèse nulle d'absence d'auto- corrélation des résidus (ou p=0). Cet intervalle est autrement dit l'intervalle pour il n'existe pas d'auto-corrélation des erreurs.

3- si la valeur calculée de la statistique de DW est supérieur à la valeur tabulée 4-d1 alors il existe une auto- corrélation négative (ou p<0).

4- Les autres situations correspondent à des zones d'indéterminations.

- **Le cas de l'équation de consommation**

DW = 2.30 avec n = 31 et K = 1
d1 = 1.36 et d2 = 1.50 donc d2< DW < 4-d2
Donc on accepte l'hypothèse Ho : p=0 il y absence d'autocorrélation.

- **Le cas de l'équation du taux d'intérêt**

DW = 2.20 avec n = 31 et K = 1
d1 = 1.36 et d2 = 1.50 donc d2< DW < 4-d2
Donc on accepte l'hypothèse Ho : p=0 il y absence d'autocorrélation.

4.3.2.1 Le modèle à décalage

- **Le cas de l'équation d'Investissement**

Dans le cas des modèles à décalages peuvent inclure comme variables retardées aussi bien la variable endogène que les variables exogène. Dans ce type de modèle autorégressif, le test de Durbin et Watson a une puissance réduite et est biaisé. C'est pourquoi il convient d'utiliser une autre statistique, celle du « h » de Durbin. la statistique utilisée est la suivante [5]:

$$h = \rho\sqrt{\frac{n}{1-\sigma_{b1}^2}}$$

Avec ρ =1 dw/2 (dw est la statistique de Durbin et Watson calculée par le modèle)

n= nombre d'observation

σ_{b1}^2 = variance estimée du coefficient $b1$ à partir du modèle.

Cette statistique h est distribuée de manière asymétrique comme une variable normale centrée réduite. Ainsi, il y a équivalence entre les deux tests d'hypothèse suivant :

$$H_0 : \rho = 0 \qquad H_0 : h = 0$$
$$H_0 : \rho \neq 0 \qquad H_1 : h \neq 0$$

Si $|h| \leq t^{\frac{\alpha}{2}}$, nous acceptons l'hypothèse nulle d'indépendance des erreurs.

($t^{\frac{\alpha}{2}}$ = valeur issue de la loi normale pour un test bilatéral au seuil de α .).

Nous allons procéder à l'estimation par la méthode de Cochrane-Orcutt : donc le modèle en présence d'autocorrélation d'ordre 1

Tableau 6. Estimation de L'équation d'investissement

Dependent Variable: LOGFBCF
Method: Least Squares
Date: 06/06/13 Time: 09:54
Sample (adjusted): 3 32
Included observations: 30 after adjustments
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFBCF(-1)	0.653323	0.145725	4.483247	0.0001
LOGPIB	0.320077	0.131680	2.430710	0.0223
r	-0.006162	0.003058	-2.015042	0.0543
AR(1)	0.418604	0.217906	1.921030	0.0658

R-squared	0.993802	Mean dependent var	4.917845
Adjusted R-squared	0.993087	S.D. dependent var	0.284836
S.E. of regression	0.023682	Akaike info criterion	-4.524629
Sum squared resid	0.014582	Schwarz criterion	-4.337803
Log likelihood	71.86944	Durbin-Watson stat	1.833201

Inverted AR Roots .42

Equation du modèle :

FBCF = 0.653323 FBCF(-1) + 0.320 Pib - 0.0061 r + $[AR = 0.418]$

(4.483247) (2.430710) (-2.015042) (.) T.student

Avec R^2=0.99 n = 30 DW=1.83

Au Maroc le taux d'intérêt est faible, théoriquement valable : quand on augmente le taux d'intérêt de 1%, l'investissement publique augmente de 0.6% puisqu'il existe une partie publique qui est indépendante du taux d'intérêt.

Dans le cas marocain il y'a un impact de l'investissement retardé et le produit intérieur brut qui est le taux d'investissement.

Tableau 7. Estimation de L'équation de l'offre de monnaie

Dependent Variable: LOGM3
Method: Least Squares
Date: 06/07/13 Time: 06:54
Sample (adjusted): 3 32
Included observations: 30 after adjustments
Convergence achieved after 9 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGPIB(-1)	1.485632	0.083431	17.80662	0.0000
r	-0.012887	0.004537	-2.840310	0.0086
C	-2.737207	0.479554	-5.707822	0.0000
AR(1)	0.658138	0.106345	6.188720	0.0000

R-squared	0.994983	Mean dependent var	5.334506
Adjusted R-squared	0.994404	S.D. dependent var	0.411661
S.E. of regression	0.030794	Akaike info criterion	-3.999411
Sum squared resid	0.024655	Schwarz criterion	-3.812584
Log likelihood	63.99116	F-statistic	1718.827
Durbin-Watson stat	2.325556	Prob(F-statistic)	0.000000

Inverted AR Roots	.66

Equation du modèle :

M = 1.485 Pib(-1) - 0.0128 r - 2.737207 + $[AR = 0.658]$.

(17.80662) (-2.840310) (-5.707822) (.) T.student

R^2=0.99 n = 30 DW=2.32

5 CONCLUSION

Cette analyse repose sur la consommation globale, c'est donc une approche macroéconomique. La relation consommation / revenu est déterminée par la notion de propension moyenne à consommer. On constate qu'il existe une relation significative entre le produit intérieur brut et la consommation des ménages : Lorsque le revenu augmente de 1% la consommation augmente de 69%. En d'autre terme, les ménages épargnent une part croissante de leur revenu au fur et à mesure que celui-ci s'accroît. Au Maroc le taux d'intérêt est faible, théoriquement valable : quand on augmente le taux d'intérêt de 1%, l'investissement publique augmente de 0.6% puisqu'il existe une partie publique qui est indépendante du taux d'intérêt.

REFERENCES

[1] D. Romer: Advanced Macroeconomics, 2nd edition. McGraw-Hill Book Co, 2001.
[2] C. Brooks: Introductory Econometrics for Finance, 2nd edition. Cambridge University Press, 2008.
[3] R. Bourbonnais : Économétrie, Manuel et exercices corrigés, 7e édition. DUNOD, 2009.
[4] H. Greene: Econometric Analysis, 1st edition .MacMillan, 2005.
[5] I Cadoret et Al : Econométrie appliquée, 1ère éd., De Boeck, Bruxelles, 2004.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 356-362
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

CMOS LNA Design for Ultra Wide Band - Review

K.B. Satale, A.R. Kaushik, and P.S. Deokar

Assistant Professor, Department of Electronics and Telecommunication,
KVNNIEER, Nashik, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Low Noise Amplifier (LNA) functions important role in receiver designs. In, microwave receiver LNA circuit plays important role in quality factor of receiver. At radio frequency range, trade-off characteristics like gain, noise figure, stability, power consumption and complexity forces designer for various circuit's simulation for optimizing those. An LNA design presents a considerable challenge because of its simultaneous requirement for high gain, low noise figure, good input and output matching and unconditional stability at the lowest possible current draw from the amplifier. For short range and high data rate wireless applications UWB technology offers a promising solution to the radio frequency. As LNA is most important block included in the UWB front-end RF receiver, we focused this paper on review of LNA design using CMOS technique.

KEYWORDS: Low Noise Amplifier (LNA), Ultra Wide Band (UWB), Complementary Metal Oxide Semiconductor (CMOS), Signal to Noise Ratio (SNR),

1 INTRODUCTION

Due to CMOS technology cost effectiveness and compatibility with silicon-based system on-chip (SOC) technology, it can be considered the most prevailing technology for RF integrated circuits (RFIC) implementation. In February 2002, UWB frequency range (3.1 GHz-10.6 GHz) was approved by the Federal Communication Commission (FCC) for commercial application [1]. UWB wireless technology has the capability of transmitting data over a wide spectrum of frequency bands with very low power, high data rates and at very low cost.

LNA can be considered one of the most important blocks included in the UWB front-end RF receiver. The role of the LNA is to receive and amplify signals over the ultra-wide band frequency range. LNA specifications include low and flat noise figure, high and flat power gain, good input and output impedance matching, good reverse isolation and acceptable linearity.

The UWB technology offers several advantages, such as wide bandwidth, large throughput, and robustness to jamming. This technology is suitable for short range and high data rate wireless applications. UWB technology offers a promising solution to the radio frequency (RF) spectrum drought by allowing new services to coexist with the other radio systems with minimal or no interference. An UWB CMOS LNA design using an input CG stage can be used to reduce the circuit complexity and power consumption.

This paper reviews various low Noise Amplifier Parameters and LNA design circuits using Current reuse circuit and CMOS Circuit using shunt- series Cascode stage.

2 UWB TECHNOLOGY

Ultra Wide Band (UWB) technology has been designed to bring convenience and mobility of high speed wireless communication to homes and offices. It is specifically designed for short range Wireless Personal Area Networks (WPANs). In the spring of 2002, the Federal Communications Commission (FCC) established an unlicensed communication band (3.1-10.6 GHz) and restricted transmitted power levels within that band to be below the noise floor, specifically below-41.3dBm/MHz, thereby allowing for the possibility of commercial Ultra-Wideband (UWB) systems.

Corresponding Author: K.B. Satale

There are basically two different system level communication strategies employed to efficiently utilize the entire UWB spectrum, namely, direct sequence UWB (DS-UWB) and carrier-based orthogonal frequency division multiplexing (OFDM) [6]. The Multi-band OFDM Alliance (MBOA) supports a type of OFDM architecture referred to as MBOFDM. The UWB-Forum is proposing a form of IRUWB called Direct-Sequence UWB (DS-UWB).

2.1 UWB TRANSCEIVER

A basic block diagram of the UWB transceiver, including a transmitter and a receiver, is shown in Figure 2.1. The baseband Digital Signal Processing (DSP) unit controls the messaging and signaling of information. The DSP unit also synchronizes the system clock. The main function of the receiver is to amplify the signal without amplifying the noise.

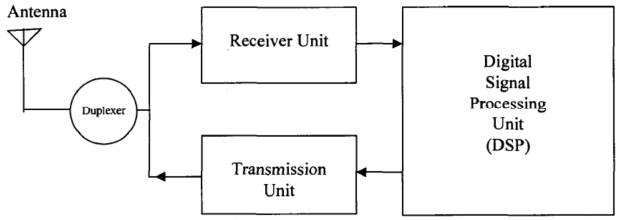


Figure 2.1:Block Diagram of UWB Tranreceiver

The block diagram of a UWB receiver is shown in Figure 2.5. The receiver features a Low Noise Amplifier (LNA) followed by a mixer (demodulator). The mixer removes the carrier from the received radio frequency signal. Usually there is an automatic gain control block between the mixer and the Analog to Digital Converter (ADC). The purpose of this block is to balance the amplification or attenuation of the received signal in a way that it utilizes the maximum range of the ADC. The analog to digital converter then converts the analog signals to digital data which is fed to the DSP to process the transmitted data. The signal is then fed to the DSP block for baseband processing. In this context it is clear that an ultra-wideband LNA should pass all the frequencies between 3.1 to 10.6 GHz. Such an amplifier must feature wideband input matching to a 50 Q antenna for noise optimization and filtering of the out-of-band interferers. Moreover, it must show flat gain with good linearity and minimum possible noise figure over the entire bandwidth.

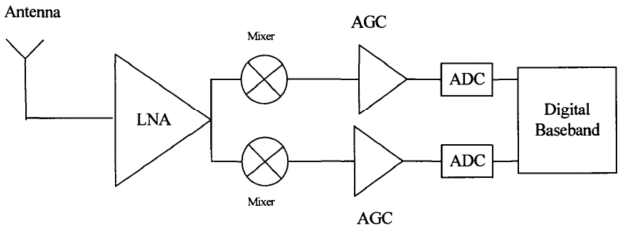


Figure 2.2: Block diagram of receiver

3 LNA PARAMETERS

The Low Noise Amplifier (LNA) is the first gain stage of a receiver. It must meet several specifications at the same time, which makes its design challenging. The received signal should have a certain Signal to Noise Ratio (SNR) in order to allow proper detection. Therefore, noise added by the circuit should be reduced as much as possible. The gain, stability and noise figure of the LNA are usually measured using the scattering parameters (S-parameters)

3.1 TWO-PORT S-PARAMETERS

Scattering Parameters (sometimes called S-parameters) have become the default standard in characterizing the performance of microwave systems and circuits. S-parameters relate incident and reflective waveform amplitude and phases between every port within a two-port network by,

$$\begin{bmatrix} V_1^- \\ V_2^- \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix} \begin{bmatrix} V_1^+ \\ V_2^+ \end{bmatrix} \quad (3.1)$$

Where, -*Vi* = voltage phasor of the waveform traveling away from port-*i* (reflected waveform), and *Vi* = voltage phasor of the waveform traveling toward port-*i.*

Fig3.1 gives a graphical depiction of the traveling reflective and incident waveforms acting on a two port network.

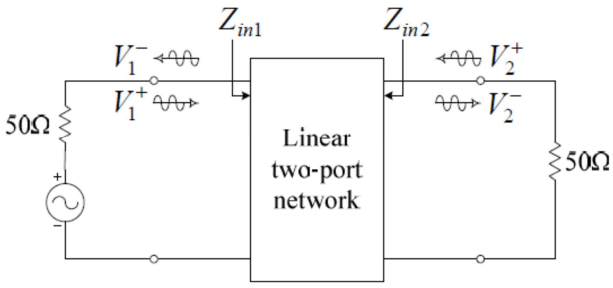


Figure 3.1: Two-port network

3.2 IMPEDANCE MATCHING

In order to reduce reflections, input and output matching networks must be added to the analog signal processing device. In addition to maximizing the power transferred (no waveform reflections) to the load, matching networks can also be used to minimize noise influence and/or to linearize the frequency response of a system. For DC circuits, the maximum power theorem states that the maximum power available from the source will be transferred to the load provided the real internal source resistance is equal to the real impedance of the load.

For AC Circuits, the maximum power transfer occurs when the complex internal impedance of the source equals the complex conjugate of the load impedance. Therefore, when the source is connected to the load, the internal impedance of the source connects in series with the load impedance and the inductive and capacitive reactance of the load and source compensate for each other and a real impedance results. Since the imaginary part of complex impedance depends on frequency, complex impedance matching is very difficult to realize over a very large bandwidth. Circuits such as an LNA will load the source with a very complex impedance profile versus frequency, and thus a simple complex conjugate is hard to realize over all of the frequency. Wideband impedance matching can be realized with either high order passive networks or active devices

3.3 NOISE FIGURE

Noise figure has commonly been adopted as the metric of choice when characterizing receiver sensitivity. Noise factor (F) is measured as the ratio of input signal to noise ratio and degraded signal to noise ratio.

$$F = \frac{\left(\frac{S}{N}\right)}{\left(\frac{S}{N}\right)_{out}} \quad (3.6)$$

Noise figure is essentially the same metric of performance except expressed in a more convenient manner and is given by following equation, which is simply the logarithmic to base ten of noise factor [7].

$$NF = 10\log(F) \quad (3.7)$$

3.4 STABILITY

Stability may be the most important property of any system. If the system is not stable, then it may be prone to uncontrollable oscillations which can internally damage the system. And depending on the system application, it could be hazardous to system operators. In the case of an LNA however, un-stability can cause internal circuitry damage and ensure that the amplifier will not work. The Rollett stability factor, denoted by k, is given by the following expression,

$$K = \frac{1 \quad |S_{11}|^2 \quad |S_{22}|^2 + |\ \ |^2}{2|S_{12}\|S_{21}|} \tag{3.8}$$

Where, $\Delta = S_{11}S_{22} - S_{12}S_{21}$

An amplifier is unconditionally stable if $K > 1$

4 CMOS LNA CIRCUITS

4.1 CMOS USING CURRENT REUSE CIRCUIT

Figure 4.1 shows the CMOS UWB LNA utilizing the current-reused technique.

LC high-pass filter of C1 and L1is employed as the input matching network, and the inter-stage network composed of the inductors LG, LD and capacitor CG performs a current-reused function to achieve high power gain. In addition, an inductor LB is connected between the main circuit and the output buffer for further bandwidth extension due to a series LC resonance with the gate capacitance of M4 [7].

The current-reused configuration can be considered as a two stage cascade amplifier, where the first stage is the CS amplifier (M_1), and the second stage is the cascode amplifier (M_2 andM_3) with an additional buffer stage at the output. NotethatM$_3$ is the common-gate stage of the cascode configuration, which eliminates Miller effect and provides a better isolation from the output return signal. The purpose of using L_G and C_G is to perform a series-resonant with C_{gs} of M_2 for a low impedance path, while the impedance of L_D is adequately large in the desired bandwidth to provide a high impedance path to block the signal [2].

Current-reused function can work properly as L_D exceeds a certain value, and is not affected by the selection of C_G and L_G. The resonate circuit composed of L_G and C_G .Therefore, the current- reused function is maximized at around the resonant frequency [3].

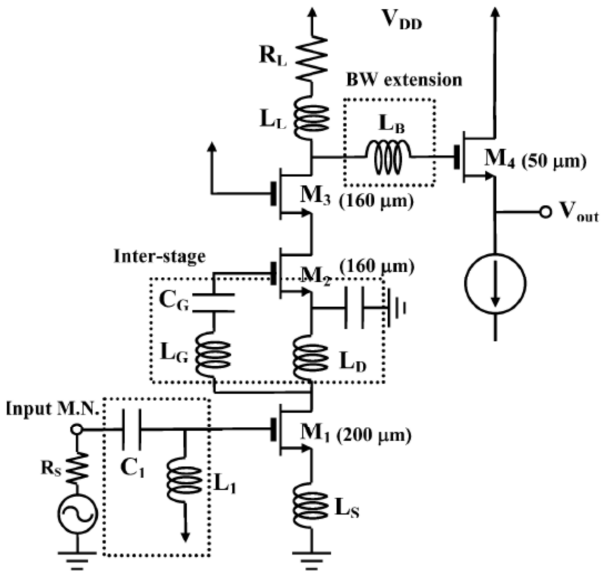


Figure 4.1: Current Reused LNA

4.2 CMOS USING SHUNT- SERIES CASCODE STAGE

Low Noise Amplifier shown in Fig 4.1consists of three stages- input stage, cascode stage, and output stage.

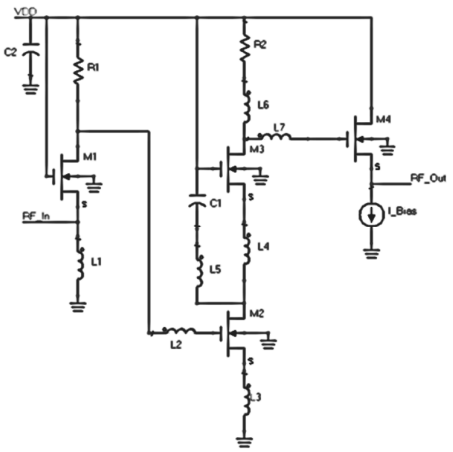


Figure 4.2: LNA Design

4.2.1 INPUT STAGE

The input stage for above LNA has a CG amplifier as the first stage to provide input matching. In CG amplifier the resistance looking into the source terminal is 1/gm.

The input impedance is given by the equation,

$$Z \approx \frac{sL_1}{1+\left(sC_{gs1}+g_{m1}\right)sL_1} \tag{4.1}$$

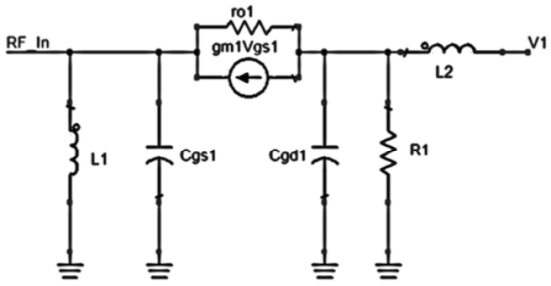


Figure 4.3: Equivalent Circuit for Input Stage

A conventional Cascode Amplifier employing current reuse technique and shunt-series peaking is used as the second stage in order to provide a sufficient gain with a wider 3-dB bandwidth [4]. The current reuse [3] topology is constructed by using C1, L4 and L5. The combination ofL5 and C1 provides a low resistance path, as a consequence of which the input signal can be amplified twice through the two paths available. The shunt-series peaking [5] is used to enhance the bandwidth

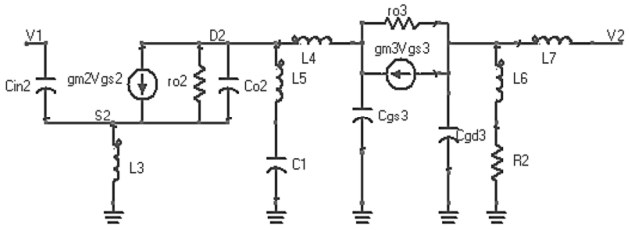


Figure 4.4: Equivalent Circuit for Cascade Stage

The gain achieved by this second stage is given by the equation,

$$A_{v2} = \frac{g_{m2} g_{m3} Z_{L2} Z_{L3}}{1 + g_{m2}(sL_3)} \tag{4.2}$$

Where,

$$Z_{L2} \approx \left(sL_5 + \frac{1}{sC_1} \right) // \left(sL_4 + \frac{1}{sC_{gs3}} + \frac{1}{g_{m3}} \right) \tag{4.3}$$

$$Z_{L3} \approx (sL_6 + R_2) // \left(sL_7 + \frac{1}{sC_{gs4}} + \frac{1}{g_{m4}} \right) \tag{4.4}$$

4.2.2 OUTPUT STAGE

A buffer is added to provide the output impedance matching. The equivalent circuit for output stage is shown in fig 4.4. This buffer is simply a source follower (M4) which has low output impedance thereby enabling easy output matching. The drain resistance of the transistor M4 serves as the load of the UWB LNA.

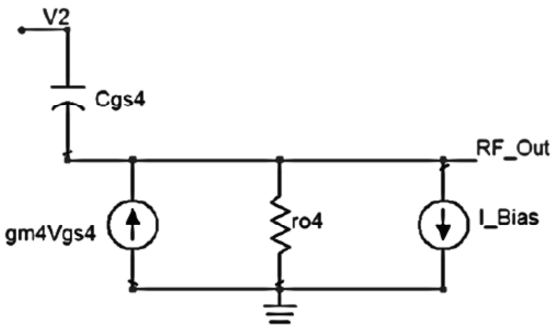


Figure 4.5: Equivalent Circuit for Output Stage

The output impedance of the proposed LNA is given by the equation,

$$Z_{out} \approx r_{o4} \tag{4.5}$$

The gain of buffer is given by equation,

$$A_{v3} \approx \frac{g_{m4} r_{o4}}{1 + g_{m4} r_{o4}} \tag{4.6}$$

So, overall gain of proposed LNA is given by equation,

$$A_{v,total} = A_{v1} \times A_{v2} \times A_{v3} \tag{4.7}$$

5 CONCLUSION

In LNA design it is required to achieve a high power gain in order to reduce the effect of noise introduced by the subsequent stages at the receiver front end, high noise factor to have original signal and also input matching, output matching, reverse isolation, power consumption, stability are taken into consideration. In order to improve gain of LNA CMOS current reused technology is used. If bandwidth enhancement is required CMOS using shunt series cascode stage is used.

REFERENCES

[1] Federal Communications Commission (FCC), "First Report and Order", 2002.
[2] Zhe Yang Huang, et al, "A 0.18μm CMOS Current Reused LNA with Gain Compensated for UWB Wireless Receiver", 23rd International Technical Conference on Circuits/Systems, Computers and Communications, pp: 437-440, 2008Megha.
[3] K. Yousef, et al, "A 2-16 GHz CMOS Current Reuse Cascaded Ultra wideband Low Noise Amplifier", Electronics, Communications and Photonics Conference (SIECPC), pp: 1-5, 2011.
[4] VaithianathanVenkatesan, "CMOS Low Noise Amplifier with Shunt –Series Peaking for Ultra Wide Band Communication Systems", International Journal of Electrical Engineering, ISSN 0974-2158 Volume 5, Number 4 (2012), pp. 489-500.
[5] Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits,"Second edition, Cambridge University Press, New York, NY, 2004.
[6] L. Yang, G. B. Giannakis, "Ultra-Wideband Communications – An Idea Whose Time Has Come," IEEE Signal Processing Magazine, pp. 26-54, November 2004.
[7] Yi-Jing Lin, Shawn S. H. Hsu, Member, IEEE, Jun-De Jin, and C. Y. Chan, "A 3.1–10.6 GHz Ultra-Wideband CMOS Low Noise Amplifier With Current-Reused Technique", ieee microwave and wireless components letters, vol. 17, no. 3, march 2007.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 363-370
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Pass-through du Taux de change et inflation au Maroc : Une analyse en modèle VAR

[Exchange rate pass-through and inflation in Morocco: A VAR model analysis]

Moulay El Mehdi Falloul

Doctorant en économie et finance appliquée,
Université Hassan II Mohammedia,
Mohammedia, Maroc

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The objective of this paper is to examine empirically the pass-through of the exchange rate changes on the domestic prices. In order to take into account of bi-directional effects, as well as other macroeconomic factors, between domestic inflation and exchange rate changes, a vector autoregression (VAR) analysis is used, with four variables that are: the oil BRENT price, nominal effective exchange rate, consumer price index and the output gap. Empirical findings shows that innovations on the exchange rate cause a similar response on the consumer price index (CPI), also the consumer price index is influenced by the price of the BRENT barrel.

KEYWORDS: Exchange rate, inflation, VAR model, CPI, price of the BRENT barrel.

RESUME: L'objectif de ce papier est d'examiner empiriquement la réaction des prix domestiques à cette variation du taux de change. Afin de prendre en compte les effets réciproques entre inflation domestique et variation du taux de change, ainsi que les effets des autres variables, nous adopterons une démarche en termes du modèle VAR avec quatre variables à savoir, le prix du baril Brent, le taux de change effectif nominal, l'indice des prix à la consommation et l'out put gap . Les résultats empiriques que les innovations sur le taux de change entraînent une réponse similaire sur l'indice des prix à la consommation (IPC), par ailleurs l'indice des prix à la consommation est influencé par le prix du baril BRENT.

MOTS-CLEFS: Taux de change, inflation, modèle VAR, IPC, prix du baril BRENT.

1 INTRODUCTION

Etant donné le degré élevé d'ouverture de l'économie marocaine, le pays adopte un régime de change intermédiaire qui est destiné à transiter vers un régime de change flexible. En effet ce régime s'applique sur un panier de devises qui a pour pondération 80 % de l'euro et 20% du dollar en tenant en considération respectivement les poids des échanges économiques du pays avec ses principaux partenaires qui sont l'Union Européenne et les Etats Unis d'Amérique.

De ce fait, le canal taux de change semble avoir un rôle important entant que mécanisme de transmission de la politique monétaire. En outre, ce canal s'avère intéressant dans la mesure où le Maroc transite vers un régime de changes flottant et une politique monétaire axée sur le ciblage d'inflation.

La compréhension des canaux de transmission de la politique monétaire est donc, un préalable pour la conduite d'une politique monétaire efficiente.

Or, la recherche systématique de la compétitivité de l'économie par la dépréciation de la valeur de la monnaie nationale risque de conduire l'économie à une inflation incontrôlable (Calvo, Reinhart et Vegh, 1995) [1].

Corresponding Author: Moulay El Mehdi Falloul

Par ailleurs, il est crucial d'évaluer la réaction des prix domestiques au taux de change nominal (pass-through) vu ses implications importantes pour la politique monétaire [2].

Le pass through mesure l'effet d'une variation du taux de change nominal sur les prix à travers les fluctuations des prix des produits importés En effet, le taux de change affecte l'inflation soit indirectement, du fait que le taux de change réel affecte le prix relatif entre les biens domestiques et les biens étrangers et par conséquent affecte la demande domestique, soit directement, dans la mesure où le taux de change exerce une influence sur les prix des biens importés inclus entant qu'une composante de l'indice des prix à la consommation, et par conséquent sur l'ensemble des biens domestiques.

2 REVUE DE LA LITTÉRATURE

2.1 LES FACTEURS EXPLICATIFS DU PASS-THROUGH

Dans un modèle d'oligopole de Cournot, Dornbusch (1987) [3] suggère que l'ampleur du pass-through est déterminée par la proportion des firmes étrangères présentes sur le marché local par rapport aux entreprises locales. Taylor (2000) [4] montre que le degré de pass-through augmente avec le niveau d'inflation. (Gagnon et Ihrig, 2004) [5] précise que la crédibilité et l'efficacité de la politique monétaire à maintenir un taux d'inflation bas doivent amener les firmes à anticiper la non persistance de tout choc négatif du taux de change sur l'inflation et par conséquent elles ne répercutent pas directement sur leurs prix l'effet change. (Goldfajn and Valdes, 1999) [6] précise la surévaluation de la monnaie domestique est un déterminant important de la dépréciation future de cette monnaie.

McKinnon(1963) montre d'un côté, un degré d'ouverture élevé peut signifier, comme le une forte sensibilité de l'économie aux variations du taux de change. Par contre, dans le cas d'un régime du taux de change fixe, toute action pour stabiliser l'inflation se traduit par une volatilité au niveau de la production (Devereux, 2001) [7].

2.2 QUELQUES TRAVAUX EMPIRIQUES SUR LE SUJET

Choudhri et Hakura (2001) [8], pour un échantillon de 71 pays, ont trouvé que le pass-through est corrélé positivement avec le taux d'inflation. Devereux et Yetman (2003) [9] montre que le pass-through est associé positivement avec le taux d'inflation, mais cette relation n'est pas linéaire vue que le degré de pass-through baisse dans le temps. Goldfajn et Werlang (2000) [10] ont trouvé que le coefficient de pass-throug est d'autant plus élevé que l'horizon temporel de référence est lui-même éloigné.

Choudhri et Hakura (2001) [8], Taylor (2000) [4] ont conclu que ce faible degré du pass-through est associé à une tendance mondiale à la baisse de l'inflation à partir des années 1990. Gagnon et Ihrig (2004) [5] ont trouvé que les pays avec un taux d'inflation faible et stable semblent avoir des degrés faibles du pass-through et qu'au cours de cette période, ces pays connaissaient une baisse du niveau et de la variabilité de l'inflation.

D'autres travaux tels que McCarthy (2000) [11], Faruqee (2004) [12] et Ito et Sato (2006) [13] ont utilisé l'approche VAR pour analyser la transmission des différents chocs sur le taux de change à l'inflation.

3 EVOLUTION DE L'INFLATION ET DU TAUX DE CHANGE AU MAROC

3.1 TAUX DE CHANGE ET INFLATION AU MAROC

Le Maroc est en train de mettre en œuvre une politique de ciblage d'inflation du taux de change effectif réel dans le but de préserver la compétitivité du pays. Cette politique consiste à ajuster périodiquement le taux de change nominal pour maintenir le taux de change effectif réel constant. Cette politique s'avère efficace si le pays évite les pièges dont elle peut tomber. Généralement, cette politique peut s'accompagner de la persistance d'une inflation élevée et du mauvais alignement du taux de change.

Le choix de ciblage du taux de change pour le Maroc reflète la volonté des autorités d'indexer le taux de change nominal au niveau des prix domestiques afin d'éviter toute perte de compétitivité. Toutefois, une règle du taux de change réel constant empêche le taux de change nominal de servir comme un point d'ancrage nominal ; tout choc attaquant le niveau des prix domestiques peut être fortement amplifié par une dépréciation rapide du taux de change et une croissance monétaire rapide. De même, toute dépréciation du taux de change peut entraîner une hausse de l'inflation.

Désormais, les conditions du ciblage d'inflation au Maroc sont en presque réunis soient:

- L'adoption d'une loi bancaire qui étend le champ de supervision de Bank A Maghrib à toutes les institutions financières et d'un projet de loi sur l'indépendance de Bank Al Maghrib qui constitue une révision fondamentale des statuts de l'Institut d'Emission ;
- L'amélioration des mécanismes de transmission de la politique monétaire ;
- Le renforcement et le développement du secteur financier, notamment le marché des capitaux, en vue de rationaliser le système de financement de l'économie et de maintenir la stabilité économique et financière.

Dans ce qui suit nous allons voir l'évolution des principales variables de cette étude, en l'occurrence l'indice des prix à la consommation et le taux de change effectif nominal.

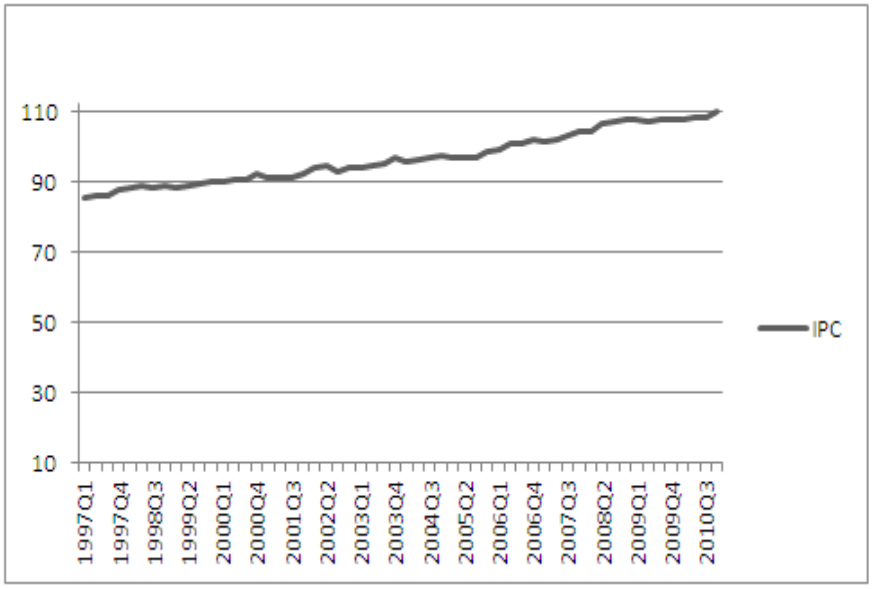


Fig. 1. Evolution de l'indice des prix à la consommation entre 1997 et 2010

L'indice des prix à la consommation prend en considération l'ensemble de la population urbaine sur 17 villes tout en négligeant « la condition de la vie moyenne ».

Les pondérations d' IPC a pour référence l'enquête nationale sur la consommation et les dépenses des ménages et elles s'effectuent sur la base d'un panier contenant 478 biens, il est calculé sur la base de la méthode de Laspeyres en chaîne qui représente une nouvelle formule a l'avantage de permettre l'actualisation du panier, la pondérations et la résolution du problème des produits saisonniers, ′cette méthode entreprend le calcul de cet indice au niveau de chaque ville, avant de procéder par une agrégation pondérée afin de former un indice du pouvoir d'achat national.

Ainsi l'IPC sera considéré comme étant l'une des variables clés de notre modélisation qui va jouer le rôle d'une variable de mesure, en illustrant l'impact qu'auraient les chocs du taux de change sur l'inflation domestique.

IPC est lité par définition à l'inflation via la formule suivante :

$$\text{Taux d'inflation } = (IPC_n - IPC_{n-1}) / IPC_{n-1}$$

La courbe de l'IPC est ascendante sur toute la période étudiée, ce qui peut être expliqué par l'augmentation des prix des produits de base ainsi que ceux pétroliers. Si on analyse D'autre part l'IPC connait une grande disparité régionale.

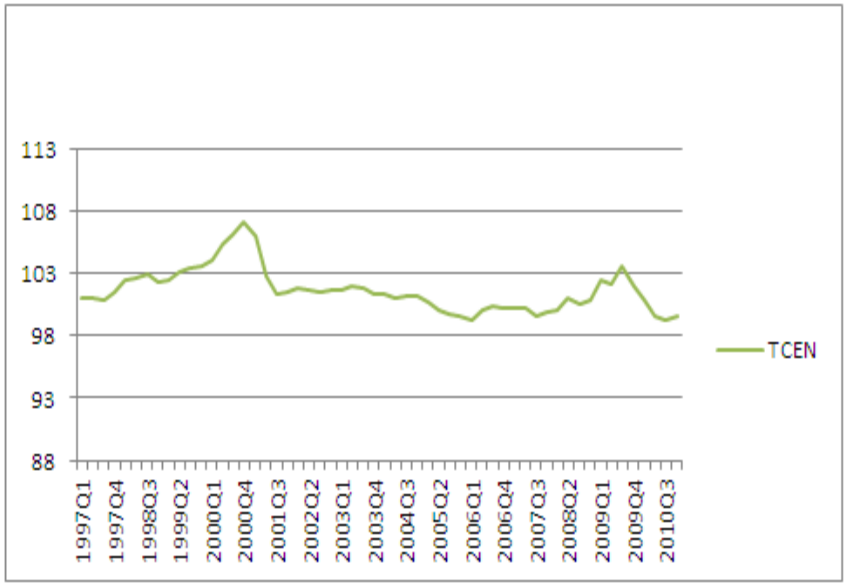


Fig. 2. Evolution du taux de change entre 1997 et 2010

Le taux de change effectif nominal est le taux qui permet d'éliminer les variations relatives aux fluctuations des prix et par conséquence ne garder que les chocs en provenance des variations nominales du taux de change, aussi nous avons ce taux et non pas un taux de change bilatéral, il va nous permettre de tenir compte du poids que représente les principaux pays partenaires dans la détermination du cours du dirham.

Pour le calculer nous procédons par la démarche suivante :

$$Taux\ de\ change\ effectif\ nominal = 100 G_{(t=1)}^{N} (e_{it})^{(cp_i)}$$

Ou

n : nombre de pays .

$e_{it} = taux\ de\ change_{it} / taux\ de\ change_{it}$, e_{it} étant l'indice du taux de change à la période t rapporté au taux de change à la période de base t=0.

Taux de change$_{it}$: La valeur en monnaie du $i^{éme}$ pays partenaire du Maroc au temps t ;

CPi : Le coefficient de pondération relatif au $i^{éme}$ pays, tel que $\sum_{i=1}^{n} CP_i = 1$

G: La moyenne géométrique.

Par ailleurs, la variation du taux de change peut impacter significativement la demande ainsi que garder un seuil limite de la compétitivité du pays vis-à-vis des différents concurrents.

4 MÉTHODOLOGIE DE TRAVAIL

4.1 COMMENT CHOISIR ENTRE UVAR, SVAR, CVAR (MCVE)

Si l'objectif est l'inférence, l'estimation de paramètres (par exemple de quantifier les réponses SR), on doit se préoccuper de la non-stationnarité, utilisez VECM. Si les variables sont I(1) et il n'y a aucun vecteur de CI, le modèle peut être non spécifié, il faut le spécifiez de nouveau. S'il n'y a aucun modèle théorique qui fournit un vecteur de cointégration, il faut procéder à la différence première des variables. Vous devez également utiliser VECM si votre objectif est les implications LR du modèle.

Si l'objectif est la prévision ou les réponses impulsionnelles (p. ex., analyse des politiques monétaires: comment les variables répondent à des chocs de politique monétaires compte tenu de ces contraintes politiques, fonction de réaction des

banques centrales, combien doit on changer pour compenser la hausse des taux de chômage?), on n'a pas besoin de se préoccuper de la non-stationnarité. Ajouter un nombre suffisant de retards pour enlever la corrélation et faire les erreurs intégré et de procéder à l'analyse. Ne pas ajouter le terme CI vous fera perdre de l'efficacité, mais cela n'affectera pas les prévisions ou les réponses impulsionnelles [14].

Si les variables sont corrélées entre elles, les termes d'erreur dans l'UVAR vont être corrélés entre les équations. Pour identifier les chocs, on devra les rendre orthogonaux → non corrélée entre équations. Il existe deux possibilités :

- Utiliser un VAR récursif (décomposition de Cholesky). Mais c'est ad hoc et les résultats sont dépendants de l'ordre.

Impose IR restrictions contemporains SVAR sur les niveaux si les variables sont I(1) ou I(0). Ajouter suffisamment de décalages pour obtenir les erreurs intégrées. Avec ces hypothèses « identification », les corrélations peuvent être interprétées causalement. Ex: une règle de Taylor définit le taux d'intérêt égal à l'inflation et le chômage décalés (= régression à variables instrumentale) et l'équation de taux d'intérêt dans le VAR.

Et imposer LR restrictions (Blanchard et Quesnel). Vous devez avoir au moins une variable I (1), et toutes les séries dans la VAR doivent être intégrées. Faire la différence première la variable I (1) pour exécuter le VAR avec les autres variables intégré (la première différenciation doit être théoriquement significative).

L'analyse par le modèle VAR de l'effet du taux de change présente les avantages suivants :

- cette technique nous permettra d'identifier les chocs structurels suite à la décomposition de Cholesky. De même, elle permet d'examiner les effets des chocs structurels des autres variables macroéconomiques sur l'inflation domestique.
- Elle permet de décomposer l'effet des chocs structurels sur l'inflation pour distinguer les chocs sur le taux de change et les autres chocs.

Nous procédons pour analyser le pass-through pour le cas de la du Maroc, à l'usage d'un modèle VAR avec quatre variables l'indice des prix à la consommation (IPC), le taux de change effectif nominal €, le prix du baril de pétrole (BRENT) et l'out put gap relatif au PIB.

Soit $Y = (y_t^1, y_t^2, .., y_t^m)$ un processus vectoriel stationnaire centré de dimension n , une modélisation VAR (p) de ce vecteur s'écrit :

Soit $Y = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + u_t$

Avec $A(L) y_t = u_t$

Avec $A(L) = (1 - A_1 L - A_2 L - \ldots - A_p L + u_t)$ tel que $t = 1 \ldots T$; $iid\ N\ (0, \sum\ )$

L' représente le vecteur des racines du polynôme Ødont les éléments sont tous supposés supérieurs à 1.

La simulation d'un modèle VAR standard dont les innovations ne sont pas instantanément reliées par exemple $Cov(\varepsilon_t^i, \varepsilon_t^i) = 0 \ \forall i \neq j$ revient à simuler tour à tour les effets d'un choc sur l'une des innovations sans prendre en considération les éventuels effets de ce choc sur la variation d'une autre innovation [15].

5 ANALYSE EMPIRIQUE

5.1 LES DONNÉES

La présente étude porte sur des données trimestrielles étalant entre le premier trimestre de 1977 et le quatrième trimestre de l'année 2010.Comme nous avons vu plus haut les variables faisant l'objet de cette étude sont ; variables l'indice des prix à la consommation (IPC), le taux de change effectif nominal €, le prix du baril de pétrole (BRENT) et l'out put gap relatif au PIB. La source des données de toutes les variables est les statistiques financières de la Banque Centrale du Maroc et le Haut-Commissariat au Plan.

La propriété de stationnarité des séries temporelles de ces variables est testée par l'ADF (Augmented Dickey- Fuller). Les résultats sont présentés dans le tableau 2 qui montre que le prix du baril BRENT, l'indice des prix à la consommation et le

taux de change nominal ne sont pas stationnaires au niveau mais le sont à la différence première. Ce test de racine unitaire montre aussi que le l'out put gap relatif au PIB est stationnaire au niveau pour un intervalle de confiance de 99%.

Ainsi, les variables endogènes du modèle, y= (ΔBRENT, Δ*IPC,* ΔE, OP_GAP)*',* sont supposées stationnaires ce qui nous permet de procéder à l'estimation du modèle VAR. L'ordre du retard est choisi sur la base du critère de Schwarz.

Table 1. Les tests Augmented Dikey Fuller

	Augmented-Dikey Fuller	
Variables	t-statistique	Valeur critique
BRENT	-4 ,415026	-3.495145
?BRENT	-6.772118*	-3.495489
OP_GAP	-5.322454*	-3.495488
E	-3.2449024	-3.495141
?E	-5.103103*	-3.495141
IPC_SA	-2.484125	-3.493458
? IPC_SA	-9.077458*	-3.495358

* Significativité à 1%

5.2 RÉSULTATS ET INTERPRÉTATION

L'examen de l'ampleur du pass-through des chocs sur le taux de change aux différentes variables macroéconomiques et en particulier à l'inflation nous a permis de mesurer les effets d'une dépréciation du taux de change. Les réponses impulsives accumulées (représentées par les traits continus) sont présentées au cours d'un horizon de 10 trimestres (soit 30 mois).

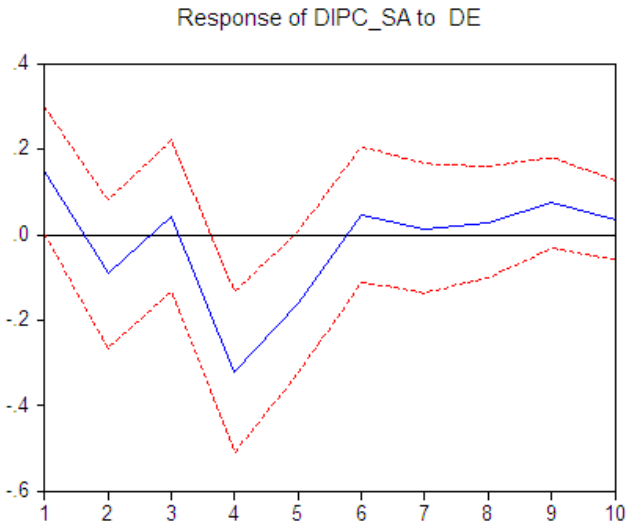


Fig. 3. La réponse de l'inflation aux chocs sur le taux de change

La figure 3 indique que tout choc sur le taux de change entraîne une réaction précoce sur le niveau général des prix. Celui-ci baisse au cours des deux premiers mois à la suite hausse des prix des produits importés, puis il connaît une augmentation au cours du deuxième trimestre s en réponse à l'augmentation du taux de change puis un regain de confiance de la demande locale des produits importés et ensuite le niveau général des prix baisse encore suite à la baisse de la valeur du dirham au cours du 4ème trimestre, pour atteindre son point moyen au cours du temps.

Il nous parait opportun d'examiner de passage l'ampleur des chocs des prix du baril du BRENT sur l'indice des prix à la consommation, puisque nous estimons que les prix du pétrole importé est un facteur déterminant dans l'évolution de l'inflation.

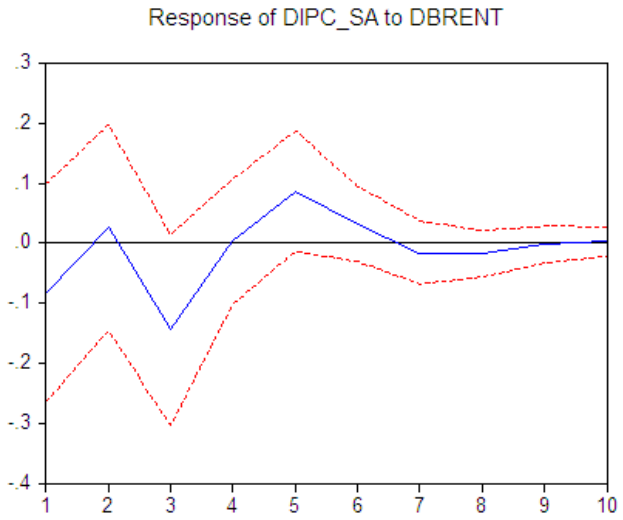


Fig. 4. La réponse de l'inflation aux chocs sur le prix du baril BRENT

La figure 2 trace l'effet des chocs externe (inflation importée), autrement dit la hausse du coût de la vie suite à l'augmentation du prix du baril BRENT, ce qui confirme l'importance et le poids de l'énergie dans l'économie marocaine pétrolifère. En effet, l'indice des prix à la consommation augmente au cours des deux premiers trimestres à la suite hausse des prix de du BRENT importés, puis il connaît une diminution au cours 3ème trimestre en réponse à la diminution de la demande locale du BRENT et ensuite le prix de l'essence augmente assez faiblement au cours du 4ème mois pour atteindre son presque point initiale au cours du 5ème mois et puis l'effet se dissipe dans le temps.

5.2.1 FONCTION DE LA DÉCOMPOSITION DE LA VARIANCE

L'examen de l'ampleur du pass-through des chocs sur le taux de change aux différentes variables macroéconomiques et en particulier à l'inflation nous a permis de mesurer les effets d'une dépréciation du taux de change. Les réponses impulsives accumulées (représentées par les traits continus) sont présentées au cours d'un horizon de 10 trimestres (soit 30 mois).

Fig. 5. Fonction de la décomposition de la variance

Period	DBRENT	OP_GAP	DE	DIPC_SA
1	0.492680	9.143039	6.823498	83.54078
2	2.963445	13.92249	8.247288	74.87678
3	5.670014	14.35524	8.227673	71.74707
4	4.364439	11.05449	25.98657	58.60451
5	4.111134	10.61291	28.99567	56.28029
6	4.163148	12.95351	28.11687	54.76647
7	4.654211	13.47797	27.79614	54.07168
8	4.660180	13.67083	27.82420	53.84479
9	4.759503	13.52420	28.43343	53.28287
10	4.819402	13.81514	28.42287	52.94259
11	4.825929	13.80522	28.40738	52.96147
12	4.826238	13.80183	28.42286	52.94907
13	4.827521	13.85462	28.41499	52.90287
14	4.826000	13.85527	28.43470	52.88403
15	4.826197	13.85444	28.43844	52.88092

6 CONCLUSION

Cette étude nous a montré que sur en période allant de 1997 à 2010, les innovations sur le taux de change entraînent une réponse similaire sur l'indice des prix à la consommation (IPC). Le degré du degré de répercussion sur l'indice des prix à la consommation au Maroc est aux alentours de 28 % dans le moyen et long terme. De plus il est clair qu'il a une hausse du coût de la vie suite à l'effet de l'augmentation du prix du baril BRENT.

Ces résultats ont des conséquences importantes en termes d'application des politiques économiques. Premièrement, un degré de degré de répercussion élevé du taux de change sur les prix à la consommation peu influencer la prévision de l'inflation future de la part des banquiers et pourtant un élément essentiel dans la conduite de la politique monétaire est la prévision de l'inflation future et la conduite des politiques de compensations juste nécessaires pour sauvegarder le pouvoir d'achat des ménages. Deuxièmement, du fait que les prix à l'importation sont très sensibles aux mouvements du taux de change, ceci ne permettra pas d'améliorer le pouvoir d'achat des ménages Marocains.

REFERENCES

[1] Calvo. G. A, Reinhart. C. M et Vegh. C. A, « Targeting the Real Exchange Rate: Theory and Evidence » Journal of Development Economics, vol 47 N° 1 pp. 97- 134, 1995.

[2] Samia Jebali et Al, "Taux de change et Inflation une analyse e modèle VAR du canal du taux de change" : Cas de la Tunisie, 23 p, 2006.

[3] Dornbusch, R, "Exchange Rates and Prices ", American Economic Review 77, pp 93-106, 1987.

[4] Taylor, J, "Low inflation, Pass-through, and the Pricing Power of Firms", European Economic Review, Vol 44, 1389-1408, 2000.

[5] Gagnon et Ihrig, "Monetary Policy and Exchange Rate Pass-through" International Journal of Finance and Economics, 9, pp 315-338, 2004.

[6] Goldfajn, I. et Valdés. R, "The Aftermath of Appreciations ", Quarterly Journal of Economics, vol. 114, No. 1, 1999.

[7] Devereux M et Yetman J, "Etablissement des prix et transmission des variations du taux de change: théorie et vérification empirique", Bank of Canada, séminaires et recherche, pp. 375-400, 2003.

[8] Choudhri et Hakura, "Exchange rate pass-through to domestic prices : Does the inflationary environment matter" Journal of International Money and Finance, vol 25, pp 614-639, 2001.

[9] Devereux M et Yetman J, "Etablissement des prix et transmission des variations du taux de change: théorie et vérification empirique", Bank of Canada, séminaires et recherche, pp.375-400, 2003.

[10] Goldfajn. I et Werlang. S, "The Pass-through from Depreciation to Inflation: A Panel Study" Texto Para Discussao 424, Département d'Economie Puc Rio, 2000.

[11] Mc Carthy, J, "Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies," Staff Reports, 111, Federal Reserve Bank of New York, 2000.

[12] Faruqee, H, "Exchange Rate Pass-Through in the Euro Area: The Role of Asymmetric Pricing Behavior," IMF Working Paper WP/04/14, International Monetary Fund, 2004.

[13] Ito, T et K. Sato, "Exchange Rate Change and Inflation in Post-Crisis Asian Economies: VAR Analysis of the Exchange Rate Pass-Through" NBER Working Paper 12395, 2006.

[14] H. Greene: Econometric Analysis, 1st edition .MacMillan, 2005.

[15] I Cadoret et Al : Econométrie appliquée, 1ère éd., De Boeck, Bruxelles, 2004.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 371-378
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Analyse des composantes principales : cas d'un échantillon des prestataires logistiques de la région du grand Casablanca

[Principal component analysis : case of a sample of logistics service providers of the great Casablanca region]

Moulay El Mehdi Falloul

Doctorant en économie et finance appliquée,
Université Hassan II Mohammedia,
Mohammedia, Maroc

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The principal component analysis, introduced by Hotelling in 1933, is a descriptive method which is aimed at the analysis of the data tables which does not have a particular structure, in other words, comments at first glance with no distinction between variables, or between individuals. The PCA aims to summarize information contained in an array consisting of large number of rows and columns, a few graphs in two dimensions, and more a number of digital features. We will use this method to analyze a sample of logistics service providers in the region of the great Casablanca in Morocco.

KEYWORDS: Principal component analysis, random sample, logistics service providers, explained variance, component diagram.

RESUME: L'analyse en composante principale, introduite par Hotelling en 1933, est une méthode descriptive qui a pour but l'analyse des tableaux des données qui ne présente pas une structure particulière, autrement dit, des observations ne comportant à priori aucune distinction, ni entre variables, ni entre individus. L'objectif de l'ACP est de résumer l'information contenue dans un tableau constitué de nombre élevé de lignes et de colonnes, en quelques représentations graphiques à deux dimensions, plus un certain nombre de caractéristiques numériques. Nous allons utiliser cette méthode pour analyser un échantillon des prestataires logistiques de la région du grand Casablanca au Maroc.

MOTS-CLEFS: Analyse en composante principale, échantillon aléatoire, prestataires logistiques, variance expliquée, diagrammes des composantes.

1 INTRODUCTION

Le contexte dans lequel on applique cette technique est le suivant: on observe sur N individus P caractères ou variables quantitatives présentant des relations multiples qu'on veut analyser.

Décrire à l'aide d'un graphique le lien entre deux variables quantitatives est simple: il suffit de porter sur deux axes orthogonaux les valeurs des variables en question pour observer à l'œil le lien entre les deux variables, quitte à effectuer ensuite une analyse ou des tests statistiques plus précis. Pour 3 variables, une démarche analogue mène à un graphique à 3 dimensions ou en perspective. Pour 4 variables et plus, il n'est plus possible de procéder de la même manière, et travailler par couple de variables ou par triple de variables risque de masquer des interactions complexes [1]. D'où l'idée de mettre au

point une technique permettant de résumer l'information apportée par ces P caractéristiques en la détruisant le moins possible. Cette technique utilise des combinaisons linéaires des variables, elle est donc mieux adaptée aux relations linéaires.

2 LES BASES MATHÉMATIQUES DE L'ACP

2.1 LA PROCÉDURE POUR OBTENIR LES COMPOSANTS

Première composante principale ≡*combinaison linéaire* $a_1^t Z$ *qui maximise*

$Var\ (a^t Z)$ *Sous réserve de* $a^t a = 1$ *et*

$$\Leftrightarrow \quad Var\ (a_1^t Z) \geq Var\ (b^t Z) \quad pour\ tout\ b^t b = 1$$

Deuxième composante principale ≡combinaison linéaire $a_2^t Z$ qui maximise $Var\ (a^t Z)$ sous réserve de $a^t a = 1$, $a_2^t a_2 = 1$.

Et $Cov\ (a_1^t Z, a_2^t Z) = 0$. $\Leftrightarrow$ $a_2^t Z$ Maximise $Var(a^t Z)$ et n'est pas également corrélées avec la première composante principale.

À l'ième étape, **la *i*^{ème} *composante principale*** ≡combinaison linéaire $a_i^t Z$ qui maximise $Var\ (a^t Z)$ sous réserve de $a^t a = 1$, $a_i^t a_i = 1$.

et $Cov\ (a_i^t Z, a_k^t Z) = 0, k < i$. $\Leftrightarrow$ $a_i^t Z$ maximise $Var(a^t Z)$ et n'est pas également corrélées avec la première composante principal (i-1)t.

Intuitivement, ces composantes principales avec grande variance contiennent des informations « importantes ». En revanche, ces composantes principales avec petite variance peuvent être « redondantes » [2]. Par exemple, supposons que nous ayons 4 variables Z_1, Z_2, Z_3, et Z_4 .

Soit $Var\ (Z_1) = 4, Var\ (Z_2) = 3, Var\ (Z_3) = 2$

Et $Z_3 = Z_4$.

En outre, supposons que Z_1, Z_2, Z_3 sont mutuellement non corrélées. Ainsi, parmi ces quatre variables, seulement 3 d'entre eux sont nécessaires puisque deux d'entre eux sont les mêmes. En utilisant la procédure pour obtenir les principales composantes ci-dessus, alors la première composante principale est

$$\begin{bmatrix} 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \end{bmatrix} = Z_1,$$

La deuxième composante principale est

$$\begin{bmatrix} 0 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \end{bmatrix} = Z_2,$$

La troisième composante principale est $\begin{bmatrix}0 & 0 & 1 & 0\end{bmatrix}\begin{bmatrix}Z_1\\Z_2\\Z_3\\Z_4\end{bmatrix} = Z_3$

Et la quatrième composante principale est

$$\begin{bmatrix}0 & 0 & \frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}}\end{bmatrix}\begin{bmatrix}Z_1\\Z_2\\Z_3\\Z_4\end{bmatrix}=\frac{1}{\sqrt{2}}(Z_3-Z_4)=0$$

La quatrième composante principale est donc redondante. Autrement dit, seulement 3 morceaux « important » des informations cachées dans Z_1, Z_2, Z_3 et Z_4 .

Théorème :

$a_1, a_2, \ldots, a_p$ sont les vecteurs propres de Σ valeurs propres correspondants

$\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_p$ [3]. En outre, l'écart des principales composantes sont les valeurs propres $\lambda_1, \lambda_2, \ldots, \lambda_p$. C'est. $Var\ (Y_i) = Var\ (a_i^t Z) = \lambda_i$

Justification

Puisque Σ est symétrique et inversible, $\Sigma = P \Lambda P^t$, où *P* est une matrice orthonormée, Λ est une matrice diagonale avec des éléments diagonaux $\lambda_1, \lambda_2, \ldots, \lambda_p$, la i[ème] colonne de *P* est le vecteur orthonormé a_i $(a_i^t a_j = a_j^t a_i = 0, i \neq j, a_i^t a_i = 1)$ et λ_i est la valeur propre de Σ correspondant à a_i [4].

Ainsi,

$\Sigma = \lambda_1 a_1 a_1^t + \lambda_2 a_2 a_2^t + \ldots + \lambda_p a_p a_p^t$.

Pour tout vecteur unitaire $b = c_1 a_1 + c_2 a_2 + \ldots + c_p a_p$ ($a_1, a_2, \ldots, a_p$ est une base de R^P),

$c_1, c_2, \ldots, c_p \in R$, $\sum_{i=1}^{p} c_i^2 = 1$,

$$Var\ (b^t Z) = b^t \Sigma b = b^t (\lambda_1 a_1 a_1^t + \lambda_2 a_2 a_2^t + \cdots + \lambda_p a_p a_p^t) b$$
$$= c_1^2 \lambda_1 + c_2^2 \lambda_2 + \cdots + c_p^2 \lambda_p \leq \lambda_1 \quad ,$$

Et

$Var\,(a_1^t Z) = a_1^t \Sigma a_1 = a_1^t (\lambda_1 a_1 a_1^t + \lambda_2 a_2 a_2^t + \cdots + \lambda_p a_p a_p^t) a_1 = \lambda_1$.

Ainsi, $a_1^t Z$ ***est la première composante principale et*** $Var(a_1^t Z) = \lambda_1$.

De même, pour tout vecteur *c* satisfaisant $Cov\,(c^t Z, a_1^t Z) = 0$,

Puis $$c = d_2 a_2 + \ldots + d_p a_p,$$

Où $$d_2, d_3, \ldots, d_p \in R$$

Et $$\sum_{i=2}^{p} d_i^2 = 1 .$$

Puis,

$$Var(c^t Z) = c^t \Sigma c = c^t (\lambda_1 a_1 a_1^t + \lambda_2 a_2 a_2^t + \cdots + \lambda_p a_p a_p^t) c$$
$$= d_2^2 \lambda_2 + \cdots + d_p^2 \lambda_p \le \lambda_2$$

Et

$$Var\,(a_2^t Z) = a_2^t \Sigma a_2 = a_2^t (\lambda_1 a_1 a_1^t + \lambda_2 a_2 a_2^t + \cdots + \lambda_p a_p a_p^t) a_2 = \lambda_2$$

Ainsi, $a_2^t Z$ ***est la deuxième composante principale et*** $Var(a_2^t Z) = \lambda_2$.

Les autres composantes principales peuvent être justifiées de la même façon.

2.2 ESTIMATION

Les principales composantes ci-dessus sont les principales composantes théoriques. Pour trouver les composantes principales « estimées », nous estimons que la matrice de variance-covariance théorique Σ de l'échantillon variance-covariance $\hat{\Sigma}$ [5],

$$\hat{\Sigma} = \begin{bmatrix} \hat{V}(Z_1) & \hat{C}(Z_1, Z_2) & \cdots & \hat{C}(Z_1, Z_p) \\ \hat{C}(Z_2, Z_1) & \hat{V}(Z_2) & \cdots & \hat{C}(Z_2, Z_p) \\ \vdots & \vdots & \ddots & \vdots \\ \hat{C}(Z_p, Z_1) & \hat{C}(Z_p, Z_2) & \cdots & \hat{V}(Z_p) \end{bmatrix},$$

Où

$$\hat{V}(Z_j) = \frac{\sum_{i=1}^{n} (X_{ij} - \overline{X}_j)^2}{n-1},\ \hat{C}(Z_j, Z_k) = \frac{\sum_{i=1}^{n} (X_{ij} - \overline{X}_j)(X_{ik} - \overline{X}_k)}{n-1},\ j, k = 1, \ldots, p.$$

Où les $\overline{X}_j = \frac{\sum_{i=1}^{n} X_{ij}}{n}$. *Ensuite, supposons que* $e_1, e_2, \ldots, e_p$ *sont des vecteurs propres orthonormés de* $\hat{\Sigma}$ *correspondant aux valeurs propres* $\hat{\lambda}_1 \ge \hat{\lambda}_2 \ge \cdots \ge \hat{\lambda}_p$ *. Ainsi, l'*$i^{ème}$ *composantes principales estimée est* $\hat{Y}_i = e_i^t Z, i = 1, \ldots, p.$ *et la variance estimée de la composante principale estimée d'IE est* $\hat{V}(\hat{Y}_i) = \hat{\lambda}_i$.

3 CONSTRUCTION DE LA BASE DE DONNEES ET RESULTATS

3.1 CONSTITUTION DE L'ÉCHANTILLON

Nous avons constitué notre base des données sur la base d'un échantillon de 17 sociétés de prestations du service logistique choisies selon la technique du tirage aléatoire, ces entreprises opèrent essentiellement dans la région du grand Casablanca. Notre échantillon se compose sept principales caractéristiques métriques ; le montant du capital social en million de dirhams, la surface des entrepôts en mettre carrés, le nombre de véhicules et équipements logistiques, le nombre de palettes de capacité de stockage par entreprise et le nombre de collaborateurs de chaque entreprise.

3.2 RÉSULTATS DE L'ÉTUDE

3.2.1 STATISTIQUES DESCRIPTIVES DES VARIABLES

Tableau 1. Statistiques descriptives

	Moyenne	Ecart-type	n analyse	etype/moyenne
capital	1397647,06	2130344,84	17	1,524236623
surface	13447,65	31129,584	17	2,314871669
nmbrvehicule	38,94	46,623	17	1,197303544
nmbrepalettes	1128,82	2922,321	17	2,588828157
nmbrecollaborateur	64,29	78,801	17	1,225711619

D'après Le coefficient de variation, on peut conclure que toutes les variables sont très dispersées, ce qui indique que les entreprises ont des profils très hétérogènes.

3.2.2 MATRICE DE CORRÉLATION DES VARIABLES INITIALES

Tableau 2. Statistiques descriptives

		capital	surface	Nombre de véhicules	Nombre de palettes	Nombre de collaborateur
Corrélation	capital	1,000	,940	,292	,311	,627
	surface	,940	1,000	,328	,224	,659
	nmbrvehicule	,292	,328	1,000	,573	,680
	nmbrepalettes	,311	,224	,573	1,000	,256
	nmbrecollaborateur	,627	,659	,680	,256	1,000

Dans l'ensemble les variables sont moyennement et faiblement corrélées, néanmoins on note une assez forte corrélation entre le montant du capital de l'entreprise et la surface de de stockage (0.940).

3.2.3 CHOIX DES COMPOSANTES PRINCIPALES

Tableau 3. Variance totale expliquée

Composante	Valeurs propres initiales			Extraction Som mes des carrés des facteurs retenus		
	Total	% de la variance	% cumulés	Total	% de la variance	% cumulés
1	3,009	60,174	60,174	3,009	60,174	60,174
2	1,151	23,028	83,201	1,151	23,028	83,201
3	,641	12,824	96,025			
4	,150	3,008	99,033			
5	,048	,967	100,000			

La première a une valeur propre de 3.009 qui représente 60.174% de la variance totale des variables initiales. Les 2 premières composantes contribuent, tous les deux, à 83.201% de la variance initiale.

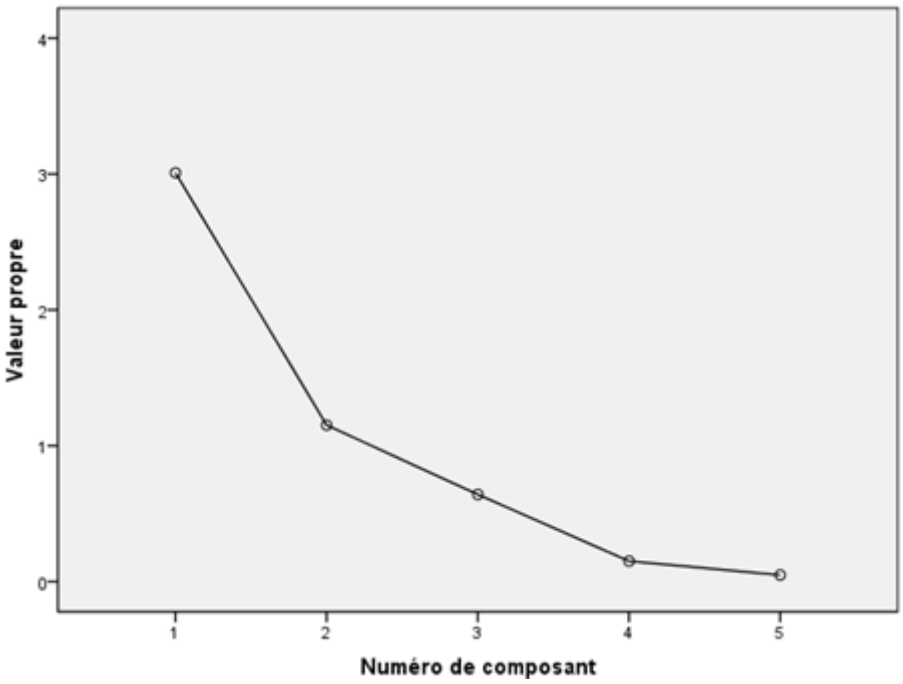


Fig. 1. Graphique de valeurs propres

D'après le graphe des valeurs propres, on peut retenir deux composantes principales, la différence entre la deuxième et le troisième est très important.

Tableau 4. *Qualité de représentation*

	Initial	Extraction
capital	1,000	,915
surface	1,000	,947
nmbrvehicule	1,000	,848
nmbrepalettes	1,000	,712
nmbrecollaborateur	1,000	,738

Les deux composantes contribuent à 91.5% de la variance du montant du capital.

D'après le tableau de la qualité de représentation, les deux composantes sont suffisantes pour synthétiser les variances de la majorité des variables.

Tableau 5. *Graphique de valeurs propres*[a]

	Composante	
	1	2
surface	,860	-,456
nmbrecollaborateur	,859	-,013
capital	,857	-,424
nmbrvehicule	,710	,586
nmbrepalettes	,541	,648

a. 2 composantes extraites.

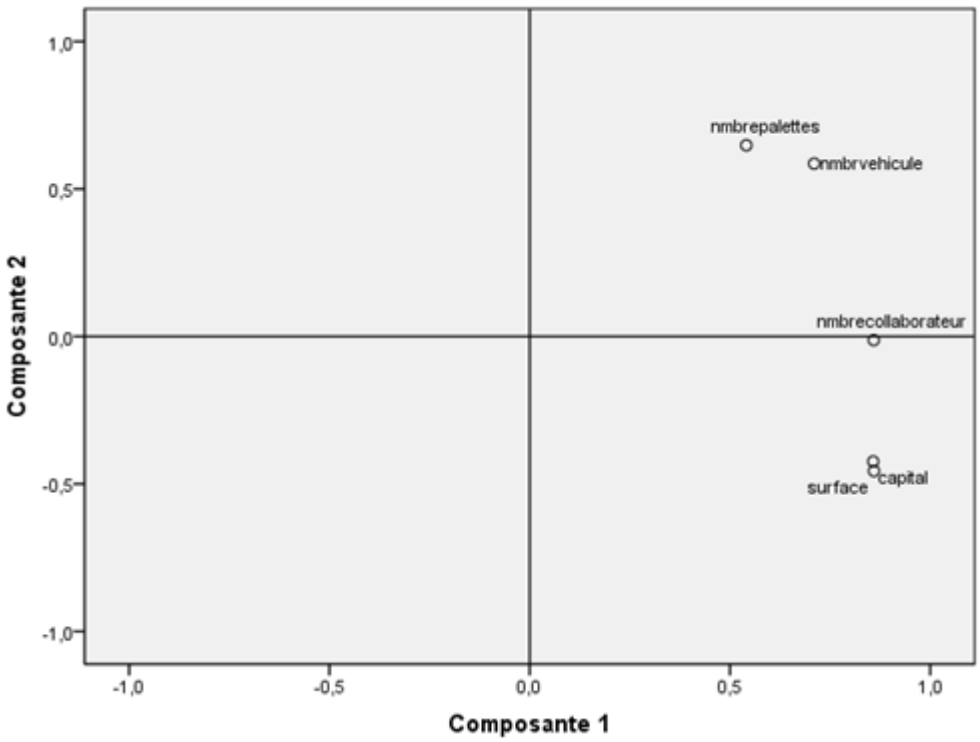


Fig. 2. *Diagramme des composantes*

La première composante est fortement corrélée avec la surface de stockage, le capital investi et le nombre de collaborateurs

La deuxième composante est assez corrélée avec le nombre de véhicules et le nombre de palettes. Elle est négativement corrélée avec la surface de stockage, le capital et le nombre de collaborateur. On peut conclure que la deuxième composante met en opposition deux catégories d'entreprises, une catégorie qui détient un très important capital fixe et une deuxième catégorie qui détient un capital variable assez important.

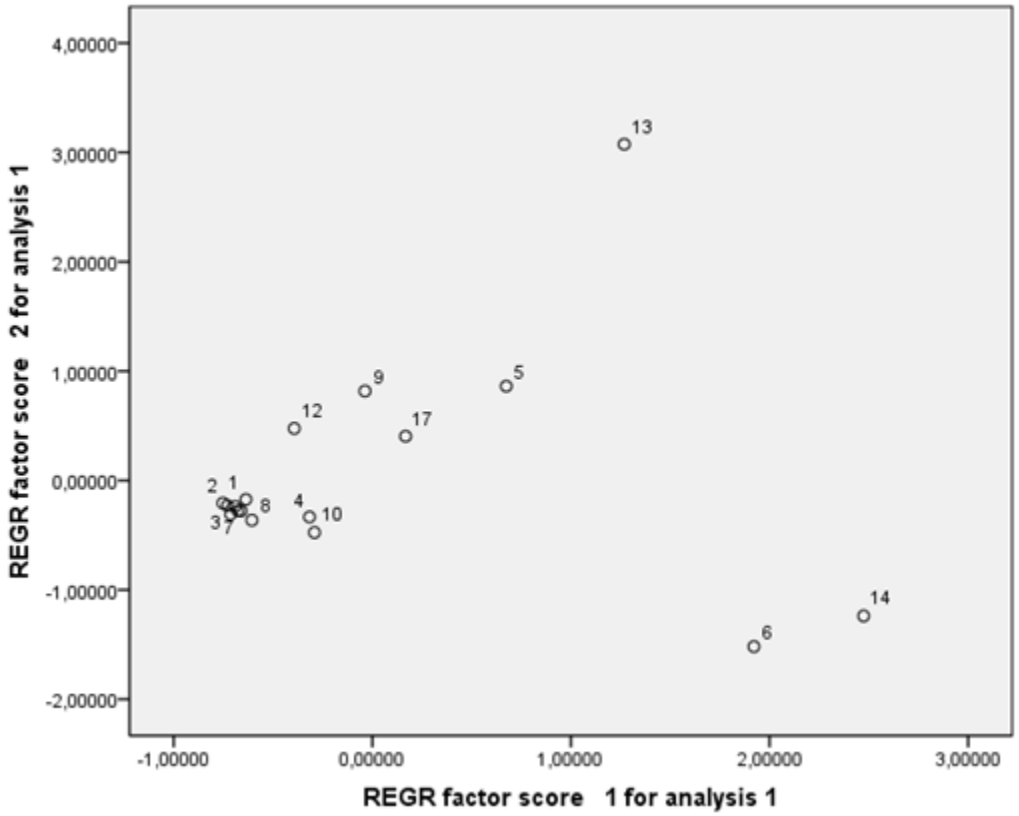


Fig. 3. Représentation des individus

Le graphe des individus montre que les entreprise 6 et 14 représentent les plus grandes entreprises en terme de capital fixe et, l'entreprise 13 représente la plus grande entreprise en terme de capital fixe, les autres entreprises ont un comportement qui n'est pas bien défini.

4 CONCLUSION

Le principe d'une Analyse en composante principale est donc de remplacer les variables initiales, généralement corrélées, par des variables non corrélées de variances progressivement décroissantes, les premières pouvant faire l'objet d'une interprétation particulière et les dernières pouvant être négligées.

REFERENCES

[1] M. M. Tatsuoka: Multivariate analysis, Wiley, 1st edition, 1988.
[2] J.F. Hair et Al: Multivariate data analysis with readings, MacMillan, 7th edition, 1995.
[3] R. Tomassone : Régression nouveaux regard sur une ancienne méthode statistique,2nd édition, Masson, 1992.
[4] B. Escofier et J.Pages : Analyse factorielles simples et multiples. Objectifs, méthodes et interprétation, Dunod, 2nd edition, 1990.
[5] S. Chatterjee and B. Price: Regression analysis by example, 2nd edition, Wiley, 1991.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 379-386
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Treatment of Hospital and Biomedical Waste Effluent Using HUASB Reactor

M.P. Murugesan, P. Akilamudhan, A. Sureshkumar, and G. Arunkarthikeya

Department of Chemical Engineering,
Erode Sengunthar Engineering College, Thudupathi,
Erode, Tamil Nadu, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The Most of Hospitals are making a surgical treatments having a lot of medical waste it contains large volumes of water in their surgical operations. But during this process the water gets contaminated. This implies the need for waste water treatment before discharge. Waste treatment refers to the activities required to ensure that waste has the least practicable impact on the environment. Improvement in determining the effects of medical waste discharges have led to the passage of stringent environmental laws, which defined the degree of treatment necessary to protect water quality. In this present study enhanced the reactor designed and different parameter. The anaerobic treatment is considered one of the most efficient methods for treating several types of effluents. This is due to its scope for treating high rate of simply biodegradable matters and wastewater. The up flow anaerobic sludge blanket (UASB) technology was considered as the most popular method in which the highest rate of organic materials can be removed. Nonetheless, the long start up interval of UASB reactor requires more understanding of the biological process inside the reactor. During this study, which lasted for 50 days, two distinct phases were carried out according to the ambient temperature. The temperature of the waste water entering the reactor was naturally ranged from 26^0c to 30^o c and no heat exchanger was used. From this experimental work enhanced for treatment efficiency of effluent by varying the different parameters like hydraulic retention time and various organic loading rates. On the basis of the results in optimal hydraulic retention time and organic loading rate BOD, COD and TSS was removed respectively.

KEYWORDS: Anaerobic process, HUASB Reactor, Ambient temperature, Hydraulic retention time (HRT), Organic loading rate (OLR), Methane.

1 INTRODUCTION

The modified up flow anaerobic sludge bed (UASB) technique developed by industrial technology research institute (ITRI) has been applied to industrial waste water treatment. 25 full scale treatment plants and more than 50 modified UASB reactors have been installed for industrial waste water purification including food processing, brewery, distillery, pulp and paper textile, chemical and petro chemical industries. Anaerobic processes characterized by its low production of sludge, and its generation of energy comparing with the aerobic treatment. The development of use of anaerobic waste water treatment had been started in Netherlands, whereby the UASB system was firstly used on treatment of beverage industry, distilleries and fermentation industries, food and paper industries.

Waste treatment refers to the activities required to ensure that waste has the least practicable impact on the environment. In many countries various from of waste treatment are required by law. In surgical treatments large amount of water is used. But during this process the water gets contaminated. Hospital waste have maximum amount of BOD, COD, Turbidity, PH, Toxic metal. This implies the need for waste water treatment before discharge. Improvement in determining the effects of biomedical waste discharges have led to the passage of stringent environmental laws, which defined the degree of treatment necessary to protect water quality. In this present study enhanced the reactor designed and different parameter.

Corresponding Author: M.P. Murugesan

Recently, the use of aerobic technology has been expanded, where it comprised the treatment of chemical and petrochemical industry effluents, and the UASB concept is also considered more than suitable for the domestic waste water treatment especially in warm climates in tropical countries. Tropical, over the last decades, up flow anaerobic sludge blanket (UASB) technology has been commonly used, due to its all- round performance for high-low organic content waste water treatment. The operational parameters that are specially mentioned in literature have been controlled the process. The high rate reactor was widely used for the treatment of several types of waste water in up flow anaerobic sludge blanket reactors developed by Lettinga (2001). The up flow anaerobic hybrid reactors (UAHR) configuration has combined the advantages of both UASB and up flow anaerobic filters(UAF) while minimizing their limitations and the reactor is efficient in the treatment of dilute to high strength waste water at high organic loading rates and short HRT. Anaerobic digestion has been applied with different degrees of success to the treatment of liquid and solid wastes from the tannery waste. YanfangNIU and Xingyuan MA et al., had published experimental result as the maximum removal rate of COD is 91.6%, The macromolecule organic compounds are degraded into the small molecular organic acid by the acidate bacteria firstly, among which acetic acid is the most and then the small molecular organic acids are degraded into CH4 and CO2 by the methanogenus, realizing the transformation from waste to resource. Gangesh Kumar and asaudhan et al., has focused on the design analysis indicates that the design of the sewage treatment plant is adequate and appropriate. According to the standard design considerations the design criteria has been found complying.

Sunny Aiyuk and Philip Odonkor et al (2010) UASB process for the direct treatment of domestic sewage was effective in producing effluents with somewhat low amounts of organic matter, but not sufficient for efficient recycling/reuse. There were serious limitations inherent within the system: inefficiency in removing nutrients, and difficulties in removing suspended solids, leading to rapid rise in sludge bed height and frequent sludge removal. The high rate of sludge production, due to the accumulation of SS, was certainly a disadvantage, as sludge handling in full-scale installations can be expensive. E.Ravendranath and Chitra kalyanaraman et al (2010) this study shows high up flow anaerobic sludge blanket reactor was studied for different operating and design parameters are hydraulic retention time (HRT), organic loading rate (OLR) for treatment characteristics of leather effluent. Lu wang and Xingyuan Ma have been investigated for number of reported on the bio conversion of biomass by different investigators For example; the anaerobic digestion of solid refuses like municipal solid wastes.

1.1 BIO-MEDICAL WASTE

Bio-medical wastes are defined as waste that is generated during the diagnosis, treatment or immunization of human beings or animals, or in research activities thereto, or in Animal the production of biological1. Animal waste: Carcasses, body parts, etc. that have been inoculated with microorganisms infectious to humans. Human blood and blood products: Waste blood and materials containing free-flowing blood. Cultures and stocks: Culture dishes, blood specimen tubes, devices used to Transfer, inoculate, and mix cultures that are infectious to humans. Pathological waste: Tissue coming from biopsies, surgery, obstetrical procedures or autopsies. Sharps waste: All hypodermic needles, syringes & tubing with needles attached, scalpel blades and lancets. Respiratory isolation waste: waste contaminated with blood or other potentially infectious bodily fluids from humans isolated for disease spread by respiratory or droplet transmission.

1.2 CHEMICALS ARE USED AS BIOMEDICAL

- 0.2% phenol
- Chlorine
- Iodine
- Boric acid
- Bithion
- Chloroxylenon (Dettol)
- 60-90% ethanol
- Chlorohexidine gluconate
- Mercurochrome.

Table 1. Pharmaceuticals industry waste water characteristics

S No	Parameters	Standard Effluent
1	BOD	900-4000PPM
2	COD	2000-6000PPM
3	PH	1.5-6.0
4	TSS	500-2000PPM
5	TDS	1350-7250PPM
6	OILS % GREASE	35-2000PPM

1.3 EFFECTS OF BIOMEDICAL WASTE

- Tropical disease
- Skin disease
- Malariya
- HIV
- Jaundice
- Enviromental effect

These kinds of problems consider that HUASB Reactor can be designed in the treatment of Medical waste, Pharmaceutical waste, Biomedical and Hospital waste effluent. The several favorable characteristics of anaerobic processes, such as low cost, operational simplicity, low bio solid production and considerable biogas production, together with suitable environmental conditions are contributed to highlight anaerobic systems for the treatment of tannery waste in small communities of tropical regions. Although different types of anaerobic treatment system have been applied to a great variety of industrial and biomedical wastes, so far the anaerobic treatment concept is rarely used for tannery waste. To compare the different anaerobic treatment systems, the UASB concept looks the most attractive option for tannery waste treatment. The present work evaluates an important design parameter for a UASB reactor that is hydraulic retention time (HRT). The performance of UASB reactor was assessed by applying various HRTs. From this experimental work enhanced for treatment efficiency of biomedical and hospital waste effluent by varying the different parameters like hydraulic retention time and various organic loading rates. On the basis of the results in optimal hydraulic retention time and organic loading rate BOD, COD and TSS was removed respectively.

2 EXPERIMENTAL SETUP AND PROCEDURE

2.1 UASB REACTOR

Up flow anaerobic sludge blanket (UASB) technology, normally referred to as UASB reactor, is a form of anaerobic digester that is used in the treatment of waste water. The UASB reactor is a methanogen (methane producing) digester that evolved from the anaerobic clarigester. A similar but variant technology to UASB is the expanded granular sludge bed (EGSB). A diagrammatic comparison of different anaerobic digester can be found here. UASB uses an anaerobic process whilst forming a blanket of granular sludge with suspense in the tank. Waste water flows upwards through the blanket and is processed (degraded) by the anaerobic microorganisms. The upward flow combined with the settling action of gravity suspends the blanket with the aid of flocculants. The blanket begins to reach maturity at around 3months. Small sludge granules begin to form whose surface area is covered in aggregations of bacteria. Eventually the aggregates form into dense compact biofilms referred to as “granules”. Bio gas with a high concentration of methane is produced as a byproduct. The heat produced as a byproduct of electricity generation can be reused to heat the digestion tank. Sugars dissolved in the liquid waste stream can be converted in to gas quickly in the liquid phase which can exit the system is less than a day. Up flow anaerobic sludge blanket (UASB) technology, normally referred to as UASB reactor, is a form of anaerobic digester that is used in the treatment of wastewater. The UASB reactor is a methanogenic (methane-Producing) digester that evolved from the anaerobic digester. A similar but variant technology to UASB is the expanded granular sludge bed (EGSB) digester. A diagrammatic comparison of different anaerobic digesters can be found here.

Table 2. Construction details

S.No	Particulars	Specification
1	Material of construction	Glass
2	Inner diameter	6.5cm
3	Height	65cm
4	Packing material	Foam
5	Packing height	26cm

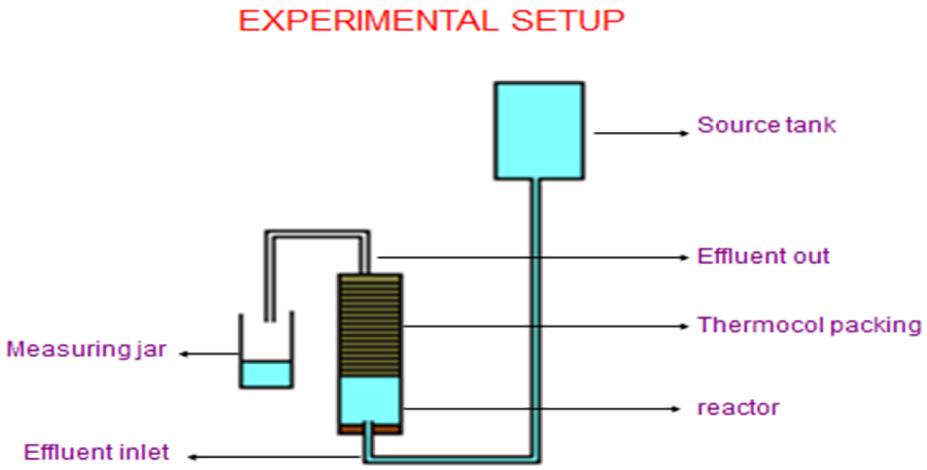


Fig. 1. Experimental Setup Of HUASB Reactor Design

The main components of the HUASB are,

- Inlet and outlet distribution system
- Sampling port
- Packing media

UASB uses an anaerobic process whilst forming a blanket of granular sludge which suspends in the tank. Wastewater flows upwards through the blanket and is processed (degraded) by the anaerobic microorganisms. The upward flow combined with the settling action of gravity suspends the blanket with the aid of flocculants. The blanket design to reach maturity at around 3 months and Small sludge granules begin to form whose surface area is covered in aggregations of bacteria. In the absence of any support matrix, the flow conditions create a selective environment in which only those microorganisms, capable of attaching to each other, survive and proliferate. Eventually the aggregates form into dense compact biofilms referred to as “granules”. A picture of anaerobic sludge granules can be found here.

2.2 SLUDGE

The sludge granules have many advantages over conventional sludge flocs are dense compact bio-film, High settle ability, High mechanical strength, Balanced microbial community, High methanogic activity, Resistance to toxic shock, Biogas with a high concentration of methane is produced as a by-product, and this may be captured and used as an energy source, to generate electricity for export and to cover its own running power. The technology needs constant monitoring when put into use to ensure that the sludge is maintained, and not washed out (there by losing the effect). The heat produced as a by-product of electricity generation can be refused to heat the digestion tanks. The blanketing of the sludge enables a dual solid and hydraulic (liquid) retention time in the digesters. Solids requiring a high degree of digestion can remain in the reactors for periods up to 90 day. Sugars dissolved in the liquid waste stream can be converted into gas quickly in the liquid phase which can exit the system in less than a day.

The sludge granules have many advantages over conventional sludge flood.

- Dense compact bio-film
- High settle ability
- High mechanical strength
- Balanced microbial community
- High ethnologic activity
- Resistance to toxic shock

2.3 SAMPLING AND ANALYSIS

The reactor is fixed and the set up was done as per the plan. This is followed by the loading of waste water for the formation of sludge blanket. The waste is prepared by mixing poultry waste and cow dung in equal proportions with water. The reactor is left undisturbed for the function of the sludge and growth of anaerobic microorganisms on the foam packing provided at the top portion of the reactor. After two months it is observed that the reactor is at the start up stage. Now the reactor can be loaded with tannery waste for treatment. Effluent from the tanning industry has been collected. The effluent was analyzed to found various parameters like COD, pH, turbidity, TDS and amount of chromium. The initial values were found to be as follows;

COD = 2000-4000ppm, Tss =500-2000ppm, TDS = 1350-7250ppm

pH = 1.5-6 and BOD = 900-4000ppm

For experimental convenience the effluent is diluted with water. The samples after dilution, has the following values for different parameters. The COD value is found to be 448 mg/l. Then it would be difficult for the microorganisms to grow. The values of turbidity and TDS are found to be 1438 and 1752 respectively. The diluted effluent is then reached in the HUASB for different flow rates. The sample is analyzed at the end of each 7^{th} day. The experiment is repeated for another flow rate of the effluent. This procedure is repeated for 10 different flow rates and the results are tabulated.

3 RESULTS AND DISCUSSIONS

The experiment shows there is considerable reduction in the amount of chromium. The reactor also shows effective reduction in the values of COD, TDS, pH and turbidity. It is noted that the reactor is more effective at very low flow rates.

3.1 POTENTIALS FOR IMPROVEMENT

The tannery waste contains heavy metals and toxic metals in it. The treatment in the HUASB is showing considerable reduction. This is due to the bio sorption of these elements by the anaerobic microorganisms. By inoculating some other anaerobic microorganisms which can be brown in the HUASB reactor there is a great chance of reducing the amount of harmful metals like chromium, copper, calcium, zinc etc., this can be increased the quality of the treated biomedical waste to further extent.

3.2 MEASUREMENT OF TDS

The two principal methods of measuring total dissolved solids are gravimetry and conductivity. Gravimetric methods are the most accurate and involve evaporating the liquid solvent and measuring the mass of residues left. This method is generally the best, although it is time-consuming. If inorganic salts comprise the great majority of TDS, gravimetric methods are appropriate. Electrical conductivity of water is directly related to the concentration of dissolved ionized solids in the water. Ions from the dissolved solids in water create the ability for that water to conduct an electrical, which can be measured using a conventional conductivity meter or TDS meter. When correlated with laboratory TDS measurements, conductivity provides an approximate value for the TDS concentration, usually to within ten-percent accuracy.

3.3 ORGANIC LOADING RATE

In wastewater treatment, the rate of introduction organic compounds is defined as organic loading rate. The organic loading rate can be calculated as follows.

$$\text{Organic loading rate} = \frac{\text{Design flow x COD/day}}{\text{Volume}}$$

When input COD <5000 mg/l using the method based on OLR is not effective in operation process because the granular sludge will be hardly formed.

$$\text{Hydraulic retention time} = \frac{\text{Volume of Reactor}}{\text{Influent flow rate}}$$

The volume of UASB reactor V = Q × HRT

The area of the UASB reactor A = V/Q

Table 3. Experimental results

S.No	Flow rate (L/day)	HRT (day)	Up flow velocity (m/day)	OLR (mgCOD/L.day)
1	1	2.157	0.301	242.93
2	0.9	2.397	0.271	218.637
3	0.8	2.696	0.241	194.344
4	0.7	3.081	0.211	170.051
5	0.6	3.595	0.181	145.758
6	0.5	4.314	0.151	121.465
7	0.4	5.392	0.12	97.172

The minimum flow rate is enhanced for higher microbial growth and reduced for Biological oxygen demand (BOD), Chemical oxygen demand (COD), Total dissolved solids (TDS), Turbidity, chromium and High rate of production of methane gas. The treatment efficiency of high up flow anaerobic sludge blanket reactor is dependent on the flow rate.

Table 4. Experimental results for removal efficiency of HUASB Reactor

S.No	Flow rate (L/Day)	Removal Efficiency (%)		
		COD	Turbidity	TDS
1	1	79.96	90.19	69.98
2	0.9	74.61	88.82	69.06
3	0.8	72.9	86.27	67.16
4	0.7	70.22	85.49	64.8
5	0.6	67.55	83.92	62.25
6	0.5	64.31	80.58	60.22
7	0.4	60.87	79.02	57.86

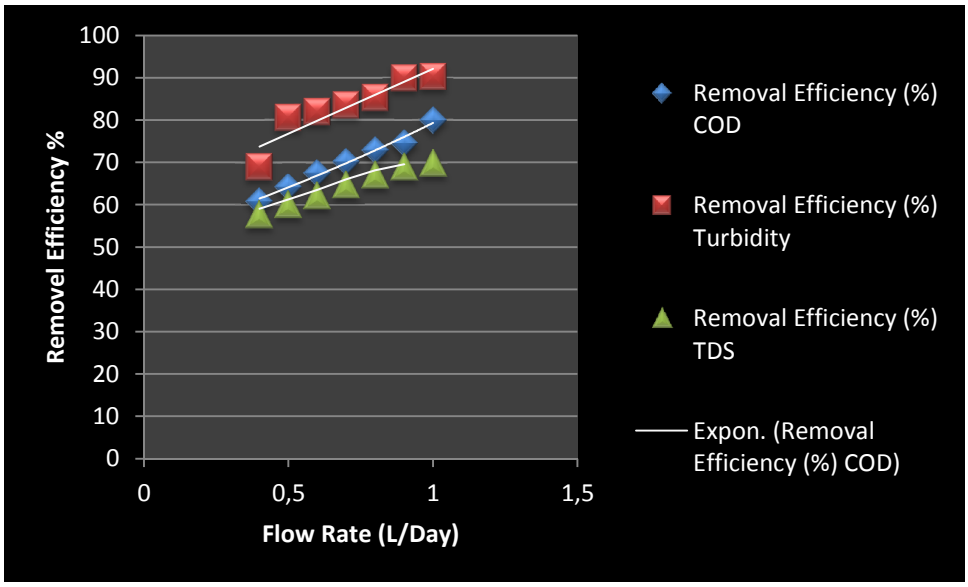


Fig. 2. Experimental Results for Efficiency of HUASB Reactor

4 CONCLUSION

In the high up flow anaerobic sludge blanket reactor was studied for different operating and design parameters are hydraulic retention time (HRT), organic loading rate (OLR) for treatment characteristics of biomedical waste effluent. In our study is observed that the untreated biomedical effluent have harmful effects on the environment. So we have to consider from this treatment process. It will have reduce the environmental effect and Study the characteristics of Biomedical effluent. Detailed literature survey suggests that the HUASB reactor is suitable to treat the leather effluent. Mainly from this study focused on BOD, COD, Turbidity, TDS, PH and Chromium reduction. In this study observed as PH is maintained at a range of 8 – 9, it will promote microbial growth. The maximum COD removal of 81% is obtained in the HUASB reactor at an OLR range of 50 – 60 mg COD/l day. The maximum Turbidity removal of 73% is obtained at an OLR range of 70 – 80 mg COD/l day. From this study concluded that maintain the minimum flow rate and using of different backing materials. Detailed survey suggested that the HUASB reactor is suitable to treat the biomedical waste effluent.

ACKNOWLEDGMENT

This research work had been done supported by the chemical Engineering laboratory from Erode Sengunthar engineering College at erode under the guidance of Prof. Dr. A. Akilamudhan. The Author would like to express their gratitude to the Erode Sengunthar Engineering college management given that continuous motivation and support for this study. The author also wishes acknowledge Dr.Senthilkumar, Mr.G.Srinivasan, Mr.M.P.Selvaraju and wishes acknowledge in our parents helped for financial support.

REFERENCES

[1] Van der Last and A.R.M. Lettinga G, "Anaerobic treatment of domestic sewage under moderate climatic (Dutch) conditions using up flow reactors at increased superficial velocities." Water Sci. Tech., 25, 167-178, 1992.

[2] Elmitwalli T.A, and Zandvoort M.H, Zeeman G, Bruning H. and Lettinga G, "Low temperature treatment of domestic sewage in upflow anaerobic sludge blanket and anaerobic hybrid reactors." Wat. Sci. Tech, 39(5), 177–185, 1999.

[3] YanfangNIU and Xingyuan MA, "Treatment of high density tannery effluent by UASB process" *Shaanxi University of Science and Technology*, Shaanxi, P.R.China.

[4] Gangesh Kumar and asaudhan "Optimization of Municipal waste water treatment by UASAB reactor and polishing pond" ISSN: 2320-425.

[5] Sunny Aiyuk and Philip Odonkoral, "Technical Problems Ensuing From UASB Reactor Application in Domestic Wastewater Treatment without Pre-Treatment" *International Journal of Environmental Science and Development,* Vol.1, No.5, December 2010, ISSN: 2010-0264, 2010.

[6] E.Ravendranath and Chitra kalyanaraman, "Effect Of Recirculation rate on anaerobic treatment of fleshing using UASB Reactor with Recovery Of Energy "*Journal of scientific & industrial research, Vol.69, October 2010.*

[7] Lu wang and Yong-feng Li., Biohydrogen "production and wastewater treatment by anaerobic fermentation with UASB Process" 1-4: 2001.

[8] Xingyuan Ma and Qi Liu, Jun Ma., "Study on the Inhibitory Effect of Mimosa Extract on Anaerobic Fermentation" 1169-1172:2011.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 387-399
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Prévalence des gènes de résistance plasmidique aux quinolones chez des entérobactéries communautaires isolées au Maroc

[Prevalence of plasmid mediated quinolone resistance genes among enterobacteria isolates in Moroccan community]

Loubna Jamali[1-2], Fatima Haouzane[1], Mohammed Bouchakour[1], Salwa Oufrid[1], Zineb Ghazlane[1], Naima El Mdaghri[1], Sellama Nadifi[2], and Mohammed Timinouni[1]

[1]Laboratory of Molecular Bacteriology, Pasteur Institute of Morocco, Casablanca, Morocco

[2]Laboratory of Medical Genetics and Molecular Pathology, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: *Introduction:* Quinolones have a powerful antimicrobial activity and are frequently prescribed in general medicine. This study aims to evaluate the emergence of plasmid mediated quinolone resistance «PMQR» genes among enterobacterial isolates from Morocco.
Material and methods: 237 enterobacterial strains were isolated from community setting. Resistance to antibiotics and the detection of extended-spectrum β-lactamases (ESBL) were conducted according to the recommendations of the French Society of Microbiology; PMQR, ESBL (*TEM*, *SHV* and *CTX- M*) and *AmpC* genes were screened by PCR. The *aac(6')-Ib-cr* gene was identified by PCR-RFLP. All PCR products were sequenced. Conjugation experiments were done using the sodium azide-resistant strain *E. coli* $K_{12}J_5$.
Results: 26.3% of the strains are resistant to at least 5 antibiotics; 7 strains (3%) show an ESBL phenotype. The prevalence of «PMQR» genes is 11.10%: the *qnr* gene was found in 6 isolates with a rate of 1.7% for *qnrS1* and 0.9% for *qnrB* (B5, B6). The *aac(6')-Ib-cr* gene was detected in 8.5% of the strains. The *qnrA* and *qepA* genes were not found. Conjugation experiments showed that the genes *qnrS1*, *aac(6')-Ib-cr* and CTX-M-15 have been co-transfered together and that these genes are carried on conjugative plasmids of high molecular weight.
Conclusion: This study confirms the dissemination of *qnr* and *aac(6')-Ib-cr* in Moroccan community setting. However, the high level of antibiotic resistance concerns a high risk of transmission of multidrug-resistant bacteria and challenges the authorities for surveillance of resistance policy.

KEYWORDS: Antibiotic resistance; Quinolones, Enterobacteriaceae; PMQR; *ESBL;* Community setting

RESUME : *Introduction:* Les quinolones sont des antibactériens puissants, fréquemment prescrits en médecine générale. Cette étude vise à évaluer l'émergence des gènes de résistance plasmidique aux quinolones « PMQR » en milieu communautaire chez des entérobactéries isolées au Maroc.
Matériel et Méthodes: 237 souches d'entérobactéries ont été collectées au niveau des laboratoires privés d'analyses médicales. La résistance aux antibiotiques et la détection des β-lactamases à spectre étendu (BLSE) ont été réalisées selon les recommandations de la Société Française de Microbiologie. La recherche des gènes PMQR, BLSE (TEM, SHV, CTX-M) et AmpC a été effectuée par PCR. Le gène *aac(6')-Ib-cr* a été identifié par PCR-RFLP; Tous les produits de PCR ont été séquencés. Les expériences de conjugaison sont réalisées en utilisant la souche d'*E.coli* $K_{12}J_5$ résistante à l'azide de sodium.
Résultats: 26.3% des souches présentent une résistance à au moins 5 antibiotiques; 7 souches (3%) montrent un phénotype BLSE. La prévalence des entérobactéries porteuses des gènes « PMQR » est de 11.10%: Le gène *qnr* est retrouvé chez 6 souches avec un taux de 1.7% pour *qnrS1* et 0.9% pour *qnrB* (B5, B6). Le gène *aac(6')-Ib-cr* a été détecté chez 8.5% des

isolats. Aucune souche n'héberge les gènes *qnrA* et *qepA*. Les expériences de conjugaison ont montré que les gènes *qnrS1*, *aac(6')-Ib-cr* et CTX-M-15 ont été co-transférés et qu'ils sont portés par des plasmides conjugatifs de haut poids moléculaire. *Conclusion:* Cette étude confirme l'émergence des PMQR au Maroc. Le haut niveau de résistance aux antibiotiques et la transmission de bactéries multi résistantes interpellent les autorités pour une politique de surveillance performante.

MOTS-CLEFS: Antibiorésistance ; Quinolones ; Entérobactéries ; PMQR ; BLSE, milieu communautaire

1 INTRODUCTION

Les quinolones sont massivement utilisées pour le traitement d'une grande variété d'infections bactériennes chez l'homme. Ainsi, les infections des voies urinaires, constituent le deuxième motif de prescription d'antibiotiques en médecine générale, après les infections des voies respiratoires.

L'utilisation abusive des quinolones, a conduit à l'apparition d'une résistance augmentée à ces antibiotiques, ce qui représente une préoccupation majeure de santé publique.

Cette résistance a été longuement considérée comme étant d'origine chromosomique (Soit par : une modification de la cible, un défaut d'accumulation dans la bactérie, une diminution de la pénétration de la paroi, ou encore par un efflux important des quinolones).

Lors des dernières décennies, quatre nouveaux mécanismes de résistance à médiation plasmidique ont été décrits à savoir, les gènes *qnr* (A, B, S, C et D) qui agissent par protection de la cible, le gène *aac(6')-Ib-cr* impliqué dans la modification de la cible, le gène *qepA*, et le gène *oqxAB* qui codent pour des protéines formant des pompes d'efflux actif, expulsant l'antibiotique à l'extérieur de la cellule bactérienne [1], [2],[3],[4].

Sur le plan phénotypique, la résistance dite à bas niveau conférée par ces mécanismes reste difficilement décelable, mais son association éventuelle aux mécanismes chromosomiques induit une augmentation considérable des CMI de la ciprofloxacine pouvant atteindre 1 à 2 µg/mL [2].

Toutefois, peu de données sont disponibles en Afrique sur la prévalence de ces gènes de résistance plasmidique chez les entérobactéries. C'est ainsi que notre étude, se veut à la fois prospective, analytique et comparative, s'intéressant surtout aux entérobactéries isolées en milieu communautaire marocain, dans une optique visant à étudier leur contenu génétique plasmidique quant à ces mécanismes de résistance aux quinolones. La présente s'intéresse également à l'étude de la coexistence de ces gènes PMQR avec les gènes de résistance aux β-lactamines.

2 MATÉRIEL ET MÉTHODES

2.1 SOUCHES BACTÉRIENNES

Deux cents trente-sept souches d'entérobactéries ont été recueillies entre mai 2008 et juin 2009, au niveau des laboratoires privés d'analyses médicales des villes d'El Jadida (n=186), et de Settat-Berrechid (n=51) situées respectivement dans deux régions importantes du Maroc occupant des positions géographiques stratégiques connaissant une forte dynamique géographique : la région Doukkala-Abda et la région Chaouia Ouardigha.

2.2 SENSIBILITÉ AUX ANTIBIOTIQUES

La sensibilité aux antibiotiques a été déterminée par diffusion en gélose de Mueller-Hinton (BioRad) et la catégorisation clinique des souches a été faite selon les recommandations du Comité de l'Antibiogramme de la Société Française de Microbiologie (CA-SFM). La production de bêta-lactamase à spectre élargi (BLSE) a été détectée par le test de double synergie suivant les recommandations du CA-SFM. Les CMI ont été déterminées par E-test selon les recommandations du fabricant (AES, AB Biodisk, Suède) (Clinical and Laboratory Standards Institute) [5].

2.3 RECHERCHE DES GÈNES DE RÉSISTANCE PLASMIDIQUE AUX QUINOLONES

L'ADN est extrait par choc thermique : Six colonies sont resuspendues dans 300 µl d'eau distillée stérile puis chauffée à 100°C pendant 5 min. Après centrifugation (5 min, 13.000 x g), le surnageant est conservé à -20°C [6].

Le dépistage des 3 gènes se fait soit par PCR simplex permettant de cibler un seul gène à la fois (*qepA* et *aac*), ou encore par PCR multiplex, utilisée pour amplifier simultanément plusieurs gènes (pour les 3 gènes *qnr A, B* et *S)* [7], [8].

Les souches d'*Escherichia coli, E. coli* U2A2118 (*qnrA*), *E. coli* U2A2119 (*qnrB*), *E. coli* U2A2120 (*qnrS*), *E. coli* U2A1528 (*aac(6')-Ib*), *E. coli* TOP10/p AT791 (*qepA*) sont utilisées comme contrôles positifs.

Les amorces utilisées figurent dans la table1. La réaction d'amplification se fait dans un thermocycleur GeneAmp PCR System 2400 (Applied Biosystems, Warrington, UK).

2.4 DÉTERMINATION DU VARIANT GÉNÉTIQUE PLASMIDIQUE *AAC(6')-IB-CR*

La détermination du variant génétique plasmidique *aac(6')-Ib-cr* se fait par PCR-RFLP en utilisant l'enzyme de restriction FokI selon le protocole décrit par Park et ses collaborateurs[9].

2.5 CRIBLAGE DES GÈNES DE RÉSISTANCE AUX B-LACTAMINES

La recherche des gènes β-lactamases (TEM , SHV, et CTXM), AmpC (DHA), a été effectuée par PCR en utilisant les protocoles décrits par Périchon et Guessennd [3], [7].

Les souches de référence utilisées sont :

E. coli U2A21790 (CTX-M1), *Salmonella spp* U2A1446 (TEM), *Salmonella spp* U2A1446 (SHV), *K. pneumoniae* U2A 2240 (Dha-1). Les amorces utilisées sont mentionnées au niveau de la table 2.

2.6 TRANSFERT GÉNÉTIQUE

Les expériences de transfert génétique de conjugaison ont été réalisées en milieu liquide en utilisant la souche *E.coli* $K_{12}J_5$ résistante à l'azide de sodium comme souche réceptrice [10].

2.7 SÉQUENÇAGE

Après purification, les produits d'amplification sont séquencés en utilisant le kit BigDye Terminator Cycle Sequencing. Les séquences ont été réalisées à l'aide du séquenceur capillaire ABI PRISM 3130 (Applied Biosystems). Les comparaisons avec les séquences connues sont effectuées avec le programme BLAST du National Center for Biotechnology Information.

2.8 TYPAGE MOLÉCULAIRE

L'étude de la clonalité est réalisée par l'électrophorèse en champs pulsé [11], [12].

3 RÉSULTATS

Afin de permettre une meilleure analyse des souches récoltées, et dans le but d'avoir des résultats rigoureusement interprétables, nous avons jugé opportun de procéder en premier lieu à une étude clinique des souches, laquelle étude prend en considération, l'âge, le sexe des patients, la nature et l'origine des prélèvements ainsi que l'identité des espèces bactériennes, leurs fréquence d'isolement, et également leur répartition régionale.

3.1 ETUDE CLINIQUE DES SOUCHES BACTÉRIENNES

3.1.1 RÉPARTITION DES SOUCHES D'ENTÉROBACTÉRIES EN FONCTION DES ESPÈCES BACTÉRIENNES ET DE L'ORIGINE

Dans le milieu communautaire, *E.coli* constitue l'espèce prédominante avec un pourcentage de 68%, suivie de *Klebsiella* spp (15.7%). Le taux des autres espèces bactériennes varie entre 0,9% et 5,1% (Table 3).

3.1.2 RÉPARTITION DES SOUCHES BACTÉRIENNES EN FONCTION DE L'ÂGE ET DU SEXE DES PATIENTS

Les résultats de l'étude de la distribution des souches bactériennes en fonction de l'âge et du sexe du patient sont mentionnés dans la Table4.

En se basant sur les données découlant du tableau, on peut constater que la quasi-totalité des espèces d'entérobactéries sont plutôt isolées chez les femmes 79,75 % (189 /237) que chez les hommes 20,25 % (48/237) et ceci en tenant compte de toutes les tranches d'âge. On remarque aussi que ces bactéries sont plus abondantes chez les adultes que chez les enfants et les nouveaux nés (Table 4).

3.2 ETUDE PHENOTYPIQUE : ETUDE ET ANALYSE DE L'ANTIBIOGRAMME

3.2.1 ETUDE DU PROFIL DE RÉSISTANCE AUX ANTIBIOTIQUES

L'analyse du profil de résistance aux antibiotiques de l'ensemble des souches étudiées montre que : Pour *E.coli*, les résistances les plus élevées ont été observées pour l'amoxicilline (76,7%), l'association amoxicilline-acide clavulanique (40,5%), le triméthoptime sulfaméthoxazole (54%), la ceftazidime (32,6%), l'aztreoname (30,5%). Par ailleurs, le niveau de résistance à l'acide nalixidique et à la ciprofloxacine, est relativement élevé avec respectivement 25% et 17,4%.

Chez les souches de *Klebsiella spp*, les résistances au cotrimoxazole, à l'amoxicilline-acide clavulanique, et à la céftazidime étaient respectivement de 74,3%, de 45,7%, et de 40%. Le taux de résistance aux autres antibiotiques ne dépassant pas 1%.

En ce qui concerne les autres souches d'entérobactéries, les souches de *Providencia spp*, et *Enterobacter spp,* ont des niveaux de résistance élevés à la plupart des antibiotiques testés.

En outre, Les souches porteuses de gènes de résistance plasmidique aux quinolones, montrent une résistance augmentée au triméthoptime sulfaméthoxazole (SXT), à l'amoxicilline (AMX), et aux quinolones (NA : Acide Nalidixique; CIP : Ciprofloxacine). Elles montrent une sensibilité flagrante aux céphalosporines (FOX : Céfoxitine, CAZ :Ceftazidime, CTX : Céfotaxime) et aux aminogycosides (GN: Gentamicine; AM: Amikacine).

L'analyse du profil de résistance aux antibiotiques des souches étudiées, montre que 26.3% présentent une résistance à au moins 5 antibiotiques. Aucune souche n'a montré une résistance à l'imipénème et à l'amikacine. Sept souches 3% (7⁄237) présentent le phénotype BLSE.

3.2.2 PROFIL DES SOUCHES PORTEUSES OU PAS DE GÈNES DE RÉSISTANCE À MÉDIATION PLASMIDIQUE

Les souches porteuses des gènes *qnr* et /ou *aac(6')-Ib-cr* montrent une résistance augmentée au triméthoprime sulfaméthoxazole, à l'amoxicilline, et aux quinolones. Elles montrent une sensibilité flagrante aux céphalosporines et à la gentamicine (Table 8). Les souches *qnr* positives sont toutes sensibles à l'amikacine, et présentent des profils similaires vis-à-vis de la ciprofloxacine et de la levofloxacine.

3.2.3 PRÉVALENCE DU PHÉNOTYPE BLSE

Sur les 237 souches, 2% présentent un phénotype BLSE.

3.3 ETUDE GÉNOTYPIQUE

3.3.1 INVESTIGATION ET ÉTUDE DE LA PRÉVALENCE DES GÈNES DE RÉSISTANCE PLASMIDIQUE AUX QUINOLONES : QNR(A, B ET S), AAC(6')-IB-CR, QEPA

La prévalence du gène *qnr* est de 2.6%, avec une prédominance du gène *qnrS1* (1.7%), suivi du *qnrB* (0.9%) : *qnrB5* (0.45 %) et *qnrB6* (0.45 %) avec une absence du gène *qnrA* (0%) (Tables 5 et 6).

La prévalence des Entérobactéries porteuses d'au moins un gène de résistance plasmidiques aux quinolones est de 11,10%.

La prévalence du gène *aac(6')-Ib-cr* parmi les souches criblées est estimée à 8.5%, tandis qu'aucune ne contenait le gène *qepA*.

3.3.2 ETUDE COMPARATIVE DES GÈNES QNR (A, B ET S) ET AAC(6') -IB-CR EN FONCTION DE L'ESPÈCE

La répartition des gènes de résistance plasmidique aux quinolones selon l'espèce montre que les gènes *qnr* sont plus fréquents chez *Citrobacter freundii* 25% (1/4), suivie de *Klebsiella spp* 5.4% (2/37), et d'*E.coli* 1.24% (2/161).

Quant à la prévalence du gène *aac(6')-Ib-cr, elle est estimée à* 8.5%, ce déterminant est retrouvé chez *Klebsiella spp* 10.81% (4/37), *Proteus spp* 10% (1/10) et *E.coli* 9.31% (15/161).

Toutefois, il conviendrait de signaler que les souches positives au gène *aac* 10.6% (25/237), présentent abondamment le variant *aac(6')-Ib-cr* (80%) et faiblement le variant *aac(6')-Ib* (20%) (Table 6).

3.3.3 ETUDE COMPARATIVE DE L'ASSOCIATION DU PHÉNOTYPE BLSE ET DES GÈNES DE RÉSISTANCE À MÉDIATION PLASMIDIQUE

L'étude des associations des gènes de résistance *qnr* et *aac(6')-Ib-cr* entre eux d'une part , et avec le phénotype BLSE d'autre part, montre que les souches EBLSE contenant le gène *aac(6')-Ib-cr* sont les plus nombreuses (3%), suivies des entérobactéries coexprimant les gènes *qnr et aac(6')-Ib-cr* (1.3%), ainsi que ceux présentant les association *qnr BLSE* (1.3 %) et *qnr-aac (6')-Ib-cr BLSE*(1.3 %) (Table 6).

La répartition géographique des gènes PMQR, montre que ces derniers sont plus fréquents au niveau de la région d'El Jadida : *qnr* 2.7% (5/186), et *aac (6')-Ib-cr* 8.6% (16/186) contre 2 % (1/51) pour le gène *qnr et* 7.9% (4/51) pour *aac (6')-Ib-cr* dans la région de Settat-Berrechid.

3.3.4 TRANSFERT GENETIQUE ET TYPAGE MOLECULAIRE

Les gènes *qnrS1*, *aac(6')-Ib-cr* et CTX-M-15 ; portés par des plasmides conjugatifs de haut poids moléculaire, ont été co-transférés ensemble après conjugaison.

Les transconjugants de la souche *qnr* (souche 64) témoignent d'une baisse de sa sensibilité vis à vis du Cip, Nal, LE, GM et TB (Table 7).

L'analyse clonale des souches d'*E.coli* porteuses des gènes *qnr*, n'a montré aucune similarité entre ces isolats (Figure1).

4 DISCUSSION

La prédominance des espèces d'*E.coli* et de *Klebsiella spp* parmi les souches analysées, avérées majoritairement uropathogènes, est en accord avec d'autres études dont celle de Anatoliotaki et McIsaac [8], [13]. Ceci s'expliquerait par le fait que l'espèce *E.coli* constitue l'agent bactérien le plus incriminé [14], [15], et est donc considérée le premier responsable d'infections communautaires et nosocomiales [16], [17]. Ceci serait dû à la physiopathologie de l'infection urinaire qui est dans l'ensemble ascendante, et à la forte colonisation du périnée par les entérobactéries d'origine digestive, spécialement par *E.coli* [18].

Ceci s'appui davantage par l'existence de facteurs spécifiques d'uropathogénicité chez *E.coli*, tel que les adhésines, qui permettent à la bactérie de s'incruster dans l'épithélium urinaire, empêchant ainsi son évacuation par les vidanges vésicales.

Quant à *Klebsiella spp*, elle maintient sa pérennité dans les urines, qui sont naturellement acides, neutralisant la prolifération bactérienne, en secrétant une enzyme dite uréase ayant comme rôle l'alcalinisation des urines.

Toutefois, si on se base sur le facteur sexe du patient, on remarque que sur l'ensemble de notre échantillonnage, il y a une marge de différence considérablement élevée avec une prédominance du sexe féminin par rapport au sexe masculin, et ce, dans toutes les tranches d'âge, avec une fréquence augmentée chez l'adulte.

Cette observation est en concordance avec les données bibliographiques. Cependant, ceci pourrait être attribué aux causes anatomiques telles que la brièveté de l'urètre, la proximité des orifices anal et vaginal, aux mauvaises habitudes d'hygiène, surtout suite aux rapports sexuels, durant la période de grossesse, ou encore à l'utilisation de spermicide, ou au prolapsus de l'utérus et de la vessie [18]. Cette même constatation a été rapportée par d'autres auteurs, notamment en France et en Inde [8], [19].

Selon la présente étude, la prévalence des gènes *qnr* à l'échelle communautaire marocaine est de 3,96%, avec une prédominance du gène *qnrS* (S1) (2,64%), suivi du *qnrB* (B5, B6) (1,32%) et une absence du déterminant génétique *qnrA*(0%). Certes la prévalence des gènes PMQR est variable d'une espèce à l'autre, mais *E.coli* et *Klebsiella spp,* restent les plus représentées, comme le confirme notre étude au Maroc et celles de d'autres équipes de recherche dont celle de Jiang en chine [20].

Ces fréquences sont inférieures à celles rapportée en Côte d'Ivoire, où le gène *qnrB* était le plus fréquent (14,6%) suivi du *qnrA* (9,9%) et *qnrS* (2,7%) [7].

La fréquence des BLSE (3%) est nettement inférieure à celle rapportée en Chine (8%)[20] et supérieure à celle observée en France (0,7%) [21].

Notre étude confirme la présence du gène *aac(6')-Ib-cr* en milieu communautaire Marocain; d'autres études ont également rapporté sa présence parmi les souches BLSE et non BLSE au Maroc et ailleurs [22], [23]. Sa prévalence est de 8.5% avoisinant celle décrite au Canada (11,3%) [24]. Cette prévalence reste relativement élevée par rapport à celle rapportée en Corée (2,16%) [25]. Aucun des isolats ne contient le gène *qepA.*

Cependant, la présente étude confirme l'abondance des gènes *qnr*, et *aac(6')-Ib-cr* spécialement chez les souches d'entérobactéries BLSE.

En effet, depuis 2007, notre équipe de recherche, la première équipe à avoir cherché la présence des gènes PMQR dont notamment le gène *qepA* en Afrique du Nord (en 2009), n'a pas encore identifié ce gène parmi plus de 644 entérobactéries testées BLSE et non BLSE, d'origine communautaire ou nosocomiale; par ailleurs, la prévalence de ce gène reste faible à l'échelle mondiale variant en moyenne entre 0,3% et 0,8% [26]. D'autres études ont montré que ce gène a été détecté en Belgique, au Japon, en France, en Corée, au Canada, au Royaume unis et en Brésil; rapportant même un pourcentage atteignant (5,6%) [27] et de (15,8%) en Chine [23].

La coexistence des gènes *qnrA, qnrB, qnrS* s'est avérée également nulle.

Par ailleurs, Lors des deux dernières décennies, de nombreuses études ont montré l'augmentation, de part le monde, des infections à entérobactéries productrices de bêta-lactamases à spectre étendu (EBLSE), peu de temps après l'introduction des céphalosporines de 3^{ième} génération dans les pratiques médicales. Elles sont de plus en plus impliquées dans les infections tant nosocomiales que communautaires et constituent un réel problème de santé publique [28]. Actuellement, ce mécanisme de résistance, connait une propagation mondiale de plus en plus préoccupante voire même alarmante. Cependant, les BLSE sont le plus souvent localisées sur des plasmides conjugatifs transmissibles aussi bien au sein des souches bactériennes d'une même espèce qu'entre les espèces et genres bactériens ; notre étude confirme ceci à travers les expériences de conjugaison effectuées sur une souche d'*E. coli* (souche 64) et l'analyse de son contenu plasmidique et de celui de son transconjugant, qui ont pu montrer que *qnrS1, aac(6')-Ib-cr* et CTX-M-15 ont été co-transférés à la fois et que ces gènes sont portés par des plasmides conjugatifs de haut poids moléculaire(≥125Kb), appuyant ainsi, la co-transférabilité plasmidique de la résistance au bêta-lactamines et aux quinolones (Table7).

Ces enzymes ont été rapportées la première fois en 1983 dans les isolats de *K. pneumoniae* et leur taux de dissémination parmi les bactéries a considérablement augmenté dans le monde entier depuis le début des années 1990 [29].

Des études ont montré que les entérobactéries productrices de BLSE sont le plus souvent importées dans les établissements de soins à partir de patients porteurs de la bactérie au niveau digestif au moment de leur entrée dans l'établissement, le portage digestif communautaire étant fréquent y compris pour les personnes non soumises à des traitements antibiotiques comme cela a pu être décrit en Espagne[30].

Il a été montré récemment en France que les animaux d'élevage pourraient être porteurs de gènes de résistance et que la consommation de leur viande contaminée pourrait être un des facteurs de dissémination de ce type de résistance au niveau communautaire [31].

La prévalence des entérobactéries, productrices de BLSE varie d'un pays à un autre et d'une institution de santé à l'autre [32], [33], [34].

Ainsi, les résultats obtenus ont montré que la prévalence des souches productrices de BLSE est de (2,26%) dans les régions étudiées: Doukkala-Abda et la région Chaouia Ouardigha. Ce pourcentage est situé au même niveau qu'aux Etats Unis (0 à 25%) et avoisine les taux rapportés en Hollande (2%), en Allemagne (2,6%) et en France (5,2%), est inférieure à ceux décrits en Afrique du sud (15%) et en Cameroun (12%) et à ceux rapportés en Egypte (38,5%) et en Grèce (27,4%) [35], [36].

La synthèse des études de la sensibilité aux antibiotiques effectuées au sein de notre laboratoire, montre qu'au niveau du milieu communautaire étudié, la majorité des souches sont résistantes souvent à au moins cinq antibiotiques voire même à au moins deux familles d'antibiotiques. Plusieurs souches multirésistantes ont été observées. Cette multirésistance peut s'expliquer par le fait que les gènes responsables de ces résistances pourraient être portés par le même plasmide, par la coexistence de plusieurs mécanismes de résistance ou par la production de plusieurs types enzymatiques [24],[37],[38],[39]. Ainsi, certains auteurs suggèrent la codiffusion des BLSE et des autres résistances aux antibiotiques par le même plasmide de conjugaison [1].Ainsi, il conviendrait de rappeler que chez les souches hébergeant les gènes *aac(6')-Ib-cr* et *qnr*, l'analyse des CMI vis à vis de la ciprofloxacine et de l'acide nalidixique a montré différents phénotypes de résistance aux quinolones. Le mécanisme de résistance médié par ces 2 gènes est différent et leur action est cumulative.

Cette multi- résistance peut être également associée à une utilisation abusive des antibiotiques dans la communauté [40], [41]. Cette constatation, met l'accent sur la nécessité de contrôler la sur-consommation d'antibiotiques comme l'a recommandé Ficca et ses collaborateurs [42].

Ces résistances acquises sont la conséquence de la pression de sélection due au large usage de ces antibiotiques et de leur déterminisme génétique qui fait qu'elles ont un pouvoir de dissémination important.

Table 1. Liste des amorces utilisées dans l'étude des gènes qnr(A, B,S), aac(6')-Ib et qep A

Gènes	Amorces [a]	Séquence des amorces (5'→3')	Position[b]	Taille de l'amplifiat (pb)	Numéro d'accession	Références
qnrA1 to 5	*qnrA*(+) *qnrA*(-)	TTCTCACGCCAGGATTTGAG TGCCAGGCACAGATCTTGAC	339-358 910-891	571	AY070235	Guessennd et *al*, 2008
*qnrB*1 to 9	*qnrB*(+) *qnrB*(-)	TGGCGAAAAAATT(GA)ACAGAA GAGCAACGA(TC)GCCTGGTAG	54-73 648-630	594	DQ351241	Guessennd et *al*, 2008
*qnrS*1 to 2	*qnrS*(+) *qnrS*(-)	GACGTGCTAACTTGCGTGAT AACACCTCGACTTAAGTCTGA	101-120 489-469	388	DQ485529	Guessennd et *al*, 2008
aac(6')-Ib	*aac(6')-Ib*(+) *aac(6')-Ib*(-)	ATGACTGAGCATGACCTTG AACCATGTACACGGCTGG	442-460 918-901	476	A28388	Perichon et *al*, 2007
qepA	*qepA*(+) *qepA*(-)	TGGTCACGCCATGGACCTCA TGAATTCGGACACCGTCTCCG	92-112 1228-1208	1137	EF150886	Perichon et *al*, 2007

La détermination du variant génétique plasmidique *aac(6')-Ib-cr* a été faite par PCR-RFLP en utilisant l'enzyme de restriction *FokI* selon le protocole utilisé décrit par[9].

a : (+), amorce sens ; (-) : amorce anti sens
b : la numérotation des nucléotides débute au codon d'initiation des gènes PMQR ; pb : Paire de bases

Table 2. Liste des amorces utilisées dans le criblage des gènes CTX-M, TEM, SHV et DHA

Gène	Amorce[a]	Séquence	Position[b]	Taille de l'amplifiat (pb)
CTX-M	CTX-M1 (+) CTX-M1(-)	GGTTAAAAAATCACTGCGTC TTGGTGACGATTTTAGCCGC	65-84 928-909	863
TEM	a216(+) a217(-)	ATAAAATTCTTGAAGACGAAA GACAGTTACCAATGCTTAATCA	1-21 1080-1059	1079
SHV	os-5(+) os-6(-)	TTATCTCCCTGTTAGCCACC GATTTGCTGATTTCGCTCGG	23-42 818-799	795
DHA	dhaM(+) dhaM(-)	AACTTTCACAGGTGTGCTGGGT CCGTACGCATACTGGCTTTGC	1244 -1265 1648 -1628	405

a (+), amorce sens ; (-) : amorce antisens.
b : la numérotation des nucléotides commence au codon d'initiation du gène de type 1.

Table 3. Répartition des souches d'entérobactéries communautaires en fonction de l'espèce

Espèce bactérienne	Nombre
E. coli	161(68%)
Klebsiella spp	37 (15.7%)
Enterobacter spp	12 (5.1%)
Proteus spp	10 (4.3%)
Providencia spp	7 (3%)
Citrobacter spp	4 (1.7%)
Pseudomonas spp	4 (1.7%)
Serratia spp	2 (0.9%)

Table 4. Répartition des souches bactériennes en fonction de la tranche d'âge et du sexe des patients

Age	**Nouveau-nés**		**Enfants**		**Adultes**		**Total**	
Sexe / Espèce	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
***E.coli* (n=161)**	3	2	31	12	100	13	134	27
Klebsiella spp (n= 37)	4	1	2	0	26	4	32	5
***Enterobacter* spp (n=12)**	1	1	2	0	5	3	8	4
***Proteus* spp (n=10)**	0	0	0	1	6	3	6	4
***Citrobacter* spp (n=4)**	0	1	0	0	2	1	2	2
***Providencia* spp (n=7)**	0	0	1	0	4	2	5	2
***Pseudomonas* spp (n=4)**	0	0	0	0	1	3	1	3
***Serratia* spp (n=2)**	0	0	0	0	1	1	1	1
Total (n=237)	8	5	36	13	145	30	189	48

F : *Féminin,* ***M :*** *Masculin*

Table5.Répartition des gènes PMQR et des associations des gènes en fonction des régions

Souches (n=237)	**Qnr (6)**	***QnrA*** (0)	***QnrB*** (2)	***QnrS*** (4)	***Aac*** (25)	***AacIb*** (5)	***Aac (6')-Ib-cr*** (20)	***QepA*** (0)	**BLSE** (7)	**Association Qnr-*Aac(6')-Ib-cr*** (3)	**Association Qnr BLSE** (3)	**Association *Aac (6')-Ib-cr* BLSE** (7)	**Association Qnr-*Aac (6')-Ib-cr*BLSE** (3)
El Jadida (n=186)	(n=5) 2.7% (5/186)	(n=0) 0%	(n=2) 1.1% (2/186)	(n=3) 1.7% (3/186)	(n=20) 10.8% (20/186)	(n=4) 2.2% (4/186)	(n=16) 8.6% (16/186)	(n=0) 0%	(n=4) 2.2% (4/186)	(n=2) 1.1% (2/186)	(n=2) 1.1% (1/186)	(n=4) 2.2% (4/186)	(n=2) 1.1% (2/186)
Settat-Berrechid (n=51)	(n=1) 2 % (1/51)	(n=0) 0%	(n=0) 0%	(n=1) 2% (1/51)	(n=5) 9.8% (5/51)	(n=1) 2% (1/51)	(n=4) 7.9% (4/51)	(n=0) 0%	(n=3) 5.9% (3/51)	(n=1) 2% (1/51)	(n=1) 2% (1/51)	(n=3) 5.9% (3/51)	(n=1) 2% (1/51)
Fréquence Globale	**2.6%**	**0%**	**0.9%**	**1.7%**	**10.6%**	**2.1%**	**8.5%**	**0%**	**3%**	**1.3%**	**1.3 %**	**3%**	**1.3%**

Table6.Répartition des gènes PMQR et des associations des gènes en fonction des espèces bactériennes

Souches (n=237)	***Qnr*** (6)	***QnrA*** (0)	***QnrB*** (2)	***QnrS*** (4)	***Aac*** (25)	***AacIb*** (5)	***Aac (6')-Ib-cr*** (20)	***QepA*** (0)	**BLSE** (7)	**Association Qnr-*Aac(6')-Ib-cr*** (3)	**Association Qnr BLSE**(3)	**Association *Aac (6')-Ib-cr*BLSE** (7)	**Association Qnr-*Aac (6')-Ibcr* BLSE** (3)
***E.coli** (161) 67%*	1.24% (2/161)	0% (0)	0.62% (1/161)	1.86% (3/161)	11.18% (18/161)	1.86% (3/161)	9.31% (15/161)	0% (0)	2.48% (4/161)	1.24% (2/161)	1.24% (2/161)	2.48% (4/161)	1.24% (2/161)
***Klebsiella spp**(37) 12%*	5.4% (2/37)	0% (0)	0% (0)	5.4% (2/37)	10.81% (4/37)	0% (0)	10.81% (4/37)	0% (0)	8.1% (3/37)	2.7% (1/37)	2.7% (1/37)	8.1% (3/37)	2.7% (1/37)
***Enterobacter spp**(12)3.88%*	0% (0)	0% (0)	0% (0)	0% (0)	8.33% (1/12)	8.33% (1/12)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
***Proteusspp**(10) 3.23%*	0% (0)	0% (0)	0% (0)	0% (0)	20% (2/10)	10% (1/10)	10% (1/10)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
***Citrobacterfreundii** (4) 1.68%*	25% (1/4)	0% (0)	25% (1/4)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
***Pseudomonas spp**(4)1.68%*	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
***Providencia spp** (7) 2.95%*	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
***Serratia spp** (2) 0.8%*	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0%(0)	0%(0)
Fréquence Globale	**2.6%**	**0%**	**0.9%**	**1.7%**	**10.6%**	**2.1%**	**8.5%**	**0%**	**3%**	**1.3%**	**1.3 %**	**3%**	**1.3%**

Table7. Répartition des gènes PMQR en fonction de l'espèce et de la région et étude de la CMI « Concentration minimale inhibitrice » en (µg/mL) chez les souches qnr positives

							Cip		NA		LE		K		GM		TM		AN	
Code	**Espèce**	**Origine**	**Date d'isolement**	***Qnr***	***aac(6')-Ib-cr***	**BLSE**	**CMI**	**CC**	**CMI**	**CC**	**CMI**	**CC**	**CMI**	**CC**	**CMI**	**CC**	**CMI**	**CC**	**CMI**	**CC**
18	*Kp. P*	Settat	10/08/2008	*S1*	*+*	CTX-M15/ TEM1/ SHV12	256	R	512	R	512	R	512	R	ND	ND	4	S	4	S
72	*E. coli*	El Jadida	13/12/2008	*B5*	*+*	CTX-M15/ TEM1	0.064	S	1	S	0.064	S	12	I	6	S	4	S	1.5	S
120	*E. coli*	El Jadida	23/04/2008	*S1*	__	_____	>32	R	>32	R	>32	R	16	R	>32	R	>32	R	2	S
196	*Cit.freu*	El Jadida	01/01/2004	*B6*	__	_____	0,13	S	8	S	0.125	S	2	S	0.25	S	0.5	S	2	S
212	*Kp.p*	El Jadida	23/04/2008	*S1*	__	_____	0,5	S	8	S	1	S	2	S	0.25	S	0.5	S	2	S
64	*E. coli*	El Jadida	16/05/2008	*S1*	*+*	CTX-M15	128	R	512	R	512	R	12	I	12	I	6	R	1.5	S
64 Tc	*E.coli*	__	_____	*S1*	*+*	CTX-M15	1	S	8	S	0.094	S	12	I	8	R	4	I	1.5	S
$K_{12}J_5$	*E.coli*	__	_____	__	__	_____	0,02	S	4	S	0,02	S	0,75	S	0,5	S	0,5	S	0,75	S

Kp.p: *Klebsiella pneumonia*; *E.coli*: *Escherichia coli*, Cit. freu : *Citrobacter freundii*;Tc: Transconjugant; Cip: Ciprofloxacine; NA: Acide nalidixique; LE: Levofloxacine; K: Kanamycine; GM: Gentamycine; TM :Tobramycine; AN : Amikacine

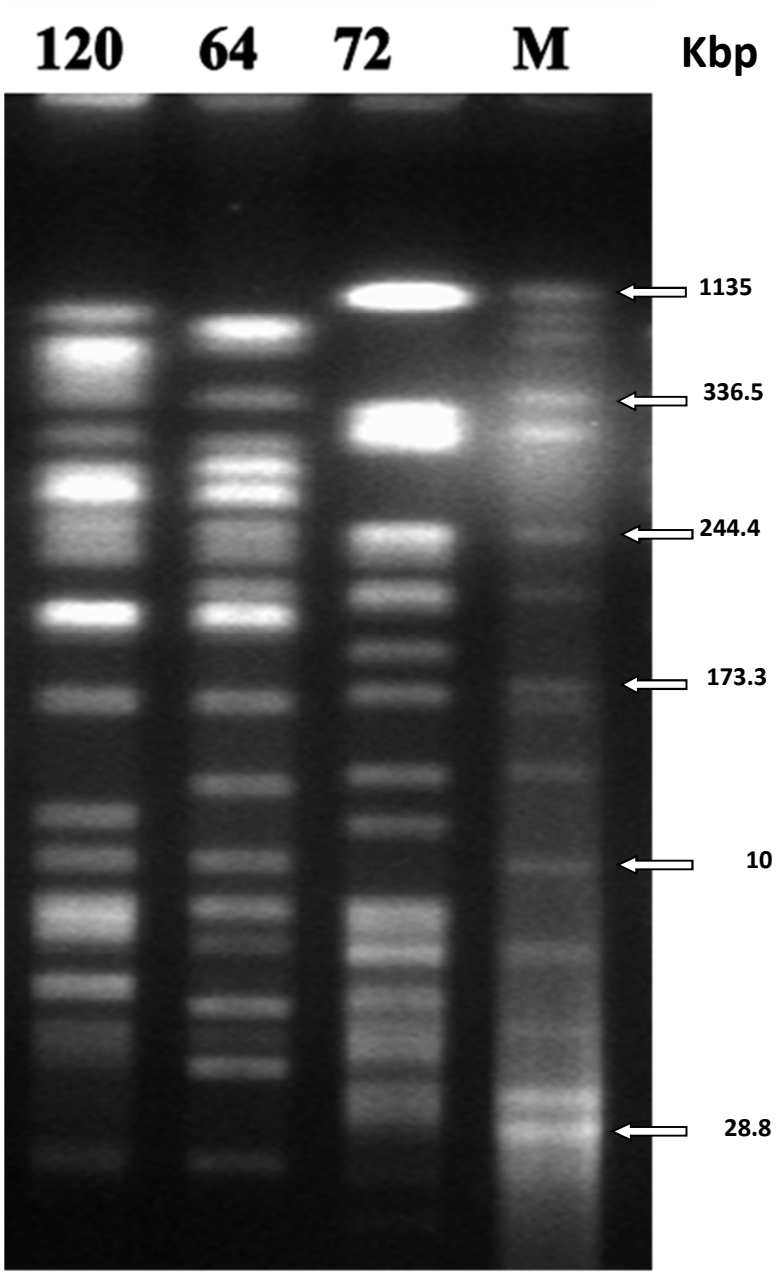


Figure 1. Electrophorèse en champs pulsé des souches d'E.coli porteuses des gènes qnr

M : Salmonella brandrup, Kbp : Kilo base pairs

5 CONCLUSION

Cette étude met l'accent sur la présence et la dissémination des PMQR en milieu communautaire marocain parmi les entérobactéries non BLSE et BLSE, confirmant le caractère inquiétant de la diffusion de la résistance aux quinolones chez les isolats étudiés, surtout parmi ceux ayant le phénotype BLSE. Ceci témoigne d'un potentiel adaptatif performant des espèces d'entérobactéries. Par conséquent, la cessation de l'antibiothérapie automatique traumatisante, l'usage rationnel des antibiotiques, la sensibilisation et la conscientisation des praticiens et professionnels de la santé sur l'usage raisonné et raisonnable des fluoroquinolones et de tout autre composé antibactérien ainsi que l'instauration d'un système performant de surveillance des souches multi résistantes, s'avèrent indispensables, garantissant la pérennité de leur efficacité clinique face aux pathogènes humains et animaux.

REMERCIEMENTS

Au Professeur Patrice Courvalin unité des agents antibactériens : Institut Pasteur Paris, France et aux laboratoires d'analyses médicales des villes d'El Jadida, Settat et Berrechid.

REFERENCES

[1] L. Martínez-Martínez, A. Pascual, et G. A. Jacoby, « Quinolone resistance from a transferable plasmid », *The Lancet*, vol. 351, n° 9105, p. 797‑799, mars 1998.

[2] A. Robicsek, J. Strahilevitz, G. A. Jacoby, M. Macielag, D. Abbanat, C. Hye Park, K. Bush, et D. C. Hooper, « Fluoroquinolone-modifying enzyme: a new adaptation of a common aminoglycoside acetyltransferase », *Nat. Med.*, vol. 12, n° 1, p. 83‑88, janv. 2006.

[3] B. Perichon, P. Courvalin, et M. Galimand, « Transferable Resistance to Aminoglycosides by Methylation of G1405 in 16S rRNA and to Hydrophilic Fluoroquinolones by QepA-Mediated Efflux in Escherichia coli », *Antimicrob. Agents Chemother.*, vol. 51, n° 7, p. 2464‑2469, juill. 2007.

[4] J. Strahilevitz, G. A. Jacoby, D. C. Hooper, et A. Robicsek, « Plasmid-Mediated Quinolone Resistance: a Multifaceted Threat », *Clin. Microbiol. Rev.*, vol. 22, n° 4, p. 664‑689, oct. 2009.

[5] Clinical and Laboratory Standards Institute, « Performance standards for antimicrobial disk susceptibility tests ». 2007.

[6] S. Honoré, C. Lascols, D. Malin, R. Targaouchi, V. Cattoir, P. Legrand, C.-J. Soussy, et E. Cambau, « [Investigation of the new QNR-based mechanism of quinolone resistance among enterobacterial strains isolated in Henri-Mondor hospital 2002-2005] », *Pathol. Biol. (Paris)*, vol. 54, n° 5, p. 270‑279, mai 2006.

[7] N. Guessennd, S. Bremont, V. Gbonon, A. Kacou-NDouba, E. Ekaza, T. Lambert, M. Dosso, et P. Courvalin, « Résistance aux quinolones de type qnr chez les entérobactéries productrices de bêta-lactamases à spectre élargi à Abidjan en Côte d'Ivoire », *Pathol. Biol.*, vol. 56, n° 7‑8, p. 439‑446, nov. 2008.

[8] E. G. Maria Anatoliotaki, « Antimicrobial resistance of urinary tract pathogens in children in Crete, Greece. », *Scand. J. Infect. Dis.*, vol. 39, n° 8, p. 671‑5, 2007.

[9] C. H. Park, A. Robicsek, G. A. Jacoby, D. Sahm, et D. C. Hooper, « Prevalence in the United States of aac(6')-Ib-cr Encoding a Ciprofloxacin-Modifying Enzyme », *Antimicrob. Agents Chemother.*, vol. 50, n° 11, p. 3953‑3955, nov. 2006.

[10] L. Meradi, A. Djahoudi, A. Abdi, M. Bouchakour, J.-D. Perrier Gros Claude, et M. Timinouni, « Résistance aux quinolones de types qnr, aac (6')-Ib-cr chez les entérobactéries isolées à Annaba en Algérie », *Pathol. Biol.*, vol. 59, n° 4, p. e73‑e78, août 2011.

[11] M. E. Kaufmann, « Pulsed-Field Gel Electrophoresis », in *Molecular Bacteriology*, N. Woodford et A. P. Johnson, Éd. Humana Press, 1998, p. 33‑50.

[12] F. C. Tenover, R. D. Arbeit, R. V. Goering, P. A. Mickelsen, B. E. Murray, D. H. Persing, et B. Swaminathan, « Interpreting chromosomal DNA restriction patterns produced by pulsed-field gel electrophoresis: criteria for bacterial strain typing », *J. Clin. Microbiol.*, vol. 33, n° 9, p. 2233‑2239, sept. 1995.

[13] W. J. McIsaac, T. Mazzulli, J. Permaul, R. Moineddin, et D. E. Low, « Community-acquired antibiotic resistance in urinary isolates from adult women in Canada », *Can. J. Infect. Dis. Med. Microbiol.*, vol. 17, n° 6, p. 337‑340, 2006.

[14] S. W. MacGowan, P. Sidhu, T. Aherne, D. Luke, A. E. Wood, M. C. Neligan, et E. McGovern, « Atrial myxoma: national incidence, diagnosis and surgical management », *Ir. J. Med. Sci.*, vol. 162, n° 6, p. 223‑226, juin 1993.

[15] P. Weber, « Etat actuel de la sensibilité à la ciprofloxacine des bactéries isolées en pratique de ville : résultats d'une enquête multicentrique », *Médecine Mal. Infect.*, vol. 23, n° 5, p. 342‑347, mai 1993.

[16] V. Jarlier, M.-H. Nicolas, G. Fournier, et A. Philippon, « Extended Broad-Spectrum -Lactamases Conferring Transferable Resistance to Newer -Lactam Agents in Enterobacteriaceae: Hospital Prevalence and Susceptibility Patterns », *Clin. Infect. Dis.*, vol. 10, n° 4, p. 867‑878, juill. 1988.

[17] M. H. Nicolas et F. Espinasse, « Evolution de la flore responsable des infections nosocomiales », Evolution et tendances., vol. Infection nosocomiale et resistance aux antibiotiques, Paris: Arnette, 1993, p. 13‑28.

[18] K. Larabi, A. Masmoudi, et C. Fendri, « Étude bactériologique et phénotypes de résistance des germes responsables d'infections urinaires dans un CHU de Tunis : à propos de 1930 cas », *Médecine Mal. Infect.*, vol. 33, n° 7, p. 348‑352, juill. 2003.

[19] M. Akram, M. Shahid, et A. U. Khan, « Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in J N M C Hospital Aligarh, India », *Ann. Clin. Microbiol. Antimicrob.*, vol. 6, n° 1, p. 4, 2007.

[20] Y. Jiang, Z. Zhou, Y. Qian, Z. Wei, Y. Yu, S. Hu, et L. Li, « Plasmid-mediated quinolone resistance determinants qnr and aac(6')-Ib-cr in extended-spectrum -lactamase-producing Escherichia coli and Klebsiella pneumoniae in China », *J. Antimicrob. Chemother.*, vol. 61, n° 5, p. 1003‑1006, mars 2008.

[21] S. Honoré, C. Lascols, D. Malin, R. Targaouchi, V. Cattoir, P. Legrand, C.-J. Soussy, et E. Cambau, « Émergence et diffusion chez les entérobactéries du nouveau mécanisme de résistance plasmidique aux quinolones Qnr (résultats hôpital Henri-Mondor 2002–2005) », *Pathol. Biol.*, vol. 54, n° 5, p. 270‑279, mai 2006.

[22] N. Karah, « Prevalence of plasmid-mediated quinolone resistance in Norwegian and Swedish clinical isolates of Escherchia coli and Klebsiella spp. », 2008.

[23] M. Bouchakour, K. Zerouali, J. D. P. Gros Claude, H. Amarouch, N. El Mdaghri, P. Courvalin, et M. Timinouni, « Plasmid-mediated quinolone resistance in expanded spectrum beta lactamase producing enterobacteriaceae in Morocco », *J. Infect. Dev. Ctries.*, vol. 4, n° 12, p. 779‑803, déc. 2010.

[24] J. D. Pitout, K. S. Thomson, N. D. Hanson, A. F. Ehrhardt, E. S. Moland, et C. C. Sanders, « beta-Lactamases responsible for resistance to expanded-spectrum cephalosporins in Klebsiella pneumoniae, Escherichia coli, and Proteus mirabilis isolates recovered in South Africa », *Antimicrob. Agents Chemother.*, vol. 42, n° 6, p. 1350‑1354, juin 1998.

[25] S.-Y. Kim, Y.-J. Park, J. K. Yu, Y. S. Kim, et K. Han, « Prevalence and characteristics of aac(6')-Ib-cr in AmpC-producing Enterobacter cloacae, Citrobacter freundii, and Serratia marcescens: a multicenter study from Korea », *Diagn. Microbiol. Infect. Dis.*, vol. 63, n° 3, p. 314‑318, mars 2009.

[26] T. Nordman, N. Santavirta, et K. Eriksson, « Developing an instrument to evaluate suffering related to care », *Scand. J. Caring Sci.*, vol. 22, n° 4, p. 608‑615, déc. 2008.

[27] P. J. Baudry, K. Nichol, M. DeCorby, P. Lagacé-Wiens, E. Olivier, D. Boyd, M. R. Mulvey, D. J. Hoban, et G. G. Zhanel, « Mechanisms of resistance and mobility among multidrug-resistant CTX-M–producing Escherichia coli from Canadian intensive care units: the 1st report of QepA in North America », *Diagn. Microbiol. Infect. Dis.*, vol. 63, n° 3, p. 319‑326, mars 2009.

[28] C.-C. Adjidé, M. Biendo, F. Rousseau, F. Hamdad-Daoudi, D. Thomas, G. Laurans, B. Canarelli, O. Obin, M. Hénicque, J.-L. Schmit, et F. Eb, « [Extended-spectrum betalactamases producing Escherichia coli: a new health-care associated infection threat?] », *Pathol. Biol. (Paris)*, vol. 54, n° 8‑9, p. 510‑517, nov. 2006.

[29] Y. Glupczynski, C. Berhin, et H. Nizet, « Antimicrobial susceptibility of anaerobic bacteria in Belgium as determined by E-test methodology », *Eur. J. Clin. Microbiol. Infect. Dis. Off. Publ. Eur. Soc. Clin. Microbiol.*, vol. 28, n° 3, p. 261‑267, mars 2009.

[30] A. Valverde, T. M. Coque, L. García-San Miguel, F. Baquero, et R. Cantón, « Complex molecular epidemiology of extended-spectrum beta-lactamases in Klebsiella pneumoniae: a long-term perspective from a single institution in Madrid », *J. Antimicrob. Chemother.*, vol. 61, n° 1, p. 64‑72, janv. 2008.

[31] D. Meunier, E. Jouy, C. Lazizzera, M. Kobisch, et J.-Y. Madec, « CTX-M-1- and CTX-M-15-type β-lactamases in clinical Escherichia coli isolates recovered from food-producing animals in France », *Int. J. Antimicrob. Agents*, vol. 28, n° 5, p. 402‑407, nov. 2006.

[32] P. A. Bradford, « Extended-Spectrum β-Lactamases in the 21st Century: Characterization, Epidemiology, and Detection of This Important Resistance Threat », *Clin. Microbiol. Rev.*, vol. 14, n° 4, p. 933‑951, janv. 2001.

[33] P. L. Winokur, R. Canton, J. M. Casellas, et N. Legakis, « Variations in the prevalence of strains expressing an extended-spectrum beta-lactamase phenotype and characterization of isolates from Europe, the Americas, and the Western Pacific region », *Clin. Infect. Dis. Off. Publ. Infect. Dis. Soc. Am.*, vol. 32 Suppl 2, p. S94‑103, mai 2001.

[34] D. L. Paterson et R. A. Bonomo, « Extended-Spectrum -Lactamases: a Clinical Update », *Clin. Microbiol. Rev.*, vol. 18, n° 4, p. 657‑686, oct. 2005.

[35] S. K. Bouchillon, B. M. Johnson, D. J. Hoban, J. L. Johnson, M. J. Dowzicky, D. H. Wu, M. A. Visalli, et P. A. Bradford, « Determining incidence of extended spectrum β-lactamase producing Enterobacteriaceae, vancomycin-resistant *Enterococcus faecium* and methicillin-resistant *Staphylococcus aureus* in 38 centres from 17 countries: the PEARLS study 2001–2002 », *Int. J. Antimicrob. Agents*, vol. 24, n° 2, p. 119–124, 2004.

[36] K. Lee, J. H. Yum, D. Yong, H. M. Lee, H. D. Kim, J.-D. Docquier, G. M. Rossolini, et Y. Chong, « Novel Acquired Metallo-β-Lactamase Gene, blaSIM-1, in a Class 1 Integron from Acinetobacter baumannii Clinical Isolates from Korea », *Antimicrob. Agents Chemother.*, vol. 49, n° 11, p. 4485‑4491, janv. 2005.

[37] C. C. Sanders, « New β-Lactams: New Problems for the Internist », *Ann. Intern. Med.*, vol. 115, n° 8, p. 650, oct. 1991.

[38] D. Sirot, « Extended-spectrum plasmid-mediated beta-lactamases », *J. Antimicrob. Chemother.*, vol. 36 Suppl A, p. 19‑34, juill. 1995.

[39] G. A. Jacoby, « EXTENDED-SPECTRUM β-LACTAMASES AND OTHER ENZYMES PROVIDING RESISTANCE TO OXYIMINO-β-LACTAMS », *Infect. Dis. Clin. North Am.*, vol. 11, n° 4, p. 875‑887, déc. 1997.

[40] G. Kahlmeter, « Prevalence and antimicrobial susceptibility of pathogens in uncomplicated cystitis in Europe. The ECOaSENS study », *Int. J. Antimicrob. Agents*, vol. 22, p. 49‑52, oct. 2003.

[41] K. M. Killgore, K. L. March, et B. J. Guglielmo, « Risk factors for community-acquired ciprofloxacin-resistant Escherichia coli urinary tract infection », *Ann. Pharmacother.*, vol. 38, n° 7‑8, p. 1148‑1152, août 2004.

[42] G. Ficca, M. Chauvel, D. de Moüy, et Membres du Réseau des Biologistes de Ville de l'AFORCOPI-BIO, « [Prevalence of community-acquired methicillin-résistant Staphylococcus aureus] », *Médecine Mal. Infect.*, vol. 36, n° 4, p. 207‑212, avr. 2006.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 400-412
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Référentiel de management des ressources d'entreprises

[Companies resources management standard]

Fettah Elmajdouly[1], Abdelfetah Adil[2], Said Ouaskit[3], and Mbarek Elbounjimi[4]

[1]Responsable logistique, MAGHREB STEEL,
R.N.9 km 10 Ahl loughlam Tit Mellil, BP 3553, Casablanca 20600, Maroc

[2]Professeur enseignant, Université Hassan II-Mohammedia,
Faculté des Sciences Ben M'Sik, Boulevard Cdt Driss Harti, BP 7955, Ben M'Sik, Casablanca, Maroc

[3]Professeur enseignant, Université Hassan II-Mohammedia,
Faculté des Sciences Ben M'Sik, Boulevard Cdt Driss Harti, BP 7955, Ben M'Sik, Casablanca, Maroc

[4]Doctorant, Université de Québec à Trois Rivières,
3351, boul. des Forges, C.P. 500, Trois-Rivières (QC) G9A 5H7, Canada

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This article presents the results of the development of an enterprise resources management referential. This referential is an inspiration to the principles of the system of quality management mainly process approach, leadership, employee involvement and the continuous improvement loop (Plan, Do, Cheek and Act). We considered four types of resources, human resources, material resources, information system and enterprise providers. This may be considered as a practical guide for the implementation of the process of resource management of the company, as audit questionnaire and guidelines for improving the process.

KEYWORDS: resource management, human Resources, material resources, information system, supplier, process approach, continuous improvement.

RESUME: Cet article présente les résultats des travaux de développement d'un référentiel de management des ressources pour les entreprises. Ce référentiel est une inspiration des principes du système de management de la qualité, principalement l'approche processus, le leadership, l'implication du personnel et la boucle d'amélioration continue (Planifier, faire, vérifier et améliorer). Nous avons considéré quatre types de ressource à savoir, les ressources humaines, les ressources matérielles, le système d'information et les fournisseurs de l'entreprise. Cette contribution peut être considérée comme guide pratique pour la mise en place du processus de management des ressources de l'entreprise, comme questionnaire d'audit et lignes directrices pour l'amélioration de ce processus.

MOTS-CLEFS: management des ressources, ressources humaines, ressources matérielles, système d'information, fournisseur, approche processus, amélioration continue.

Corresponding Author: Fettah Elmajdouly

1 INTRODUCTION

Dans un marché concurrentiel, la gestion des ressources de l'entreprise constitue aujourd'hui un enjeu stratégique majeur. C'est un potentiel important de création de valeur pour le client : qualité de service, performance en délai et en réactivité. C'est aussi un des principaux lieux où se joue une partie de la rentabilité de l'entreprise, par la rationalisation des coûts liés ressources.

Cet article se veut une présentation d'un référentiel de management des ressources de l'entreprise. Pour y parvenir, la première partie de cet article présente notre problématique de recherche. Dans la deuxième partie, nous présentons notre référentiel de management des ressources de l'entreprise. Finalement, la troisième partie de l'article est consacrée au questionnaire du référentiel proposé.

2 PROBLÉMATIQUE

La recherche dans le domaine de management des ressources s'intéresse généralement à des sujets succincts, en traitant un type de ressource ou un métier par exemple ''la fonction Directeur et Responsable Logistique'' [1], ''La gestion des ressources humaines sous contraintes dans les zones logistiques'' [2] et ''Définition d'un modèle générique des compétences du responsable logistique'' [3].

Des référentiels métiers ont traité le sujet de management des ressources comme l'ASLOG [4], l'EVALOG [5] et le SCOR [6]. L'étude des ces référentiels, avec confrontation aux exigences et contraintes des entreprises, a montré que, de manière générale, ces référentiels n'assurent pas les principes suivants :

- Le pilotage de la démarche de management des ressources dans le cadre d'une approche processus.
- La mise en évidence de la responsabilité de la direction dans la planification du processus de management des ressources et de ses objectifs.
- La boucle d'amélioration continue PDCA.
- Une gestion adéquate et optimisée des ressources.
- La mise en évidence de la planification comme un outil indispensable pour le bon fonctionnement et l'amélioration du processus de management des ressources.

Notre problématique de recherche s'inscrit dans le cadre de l'élaboration d'un référentiel de mise en place, de mesure et d'amélioration des performances du processus de management des ressources, intégrant ces principes, afin d'aider l'entreprise à mieux réussir sa démarche. Un tel référentiel doit répondre aux exigences et contraintes des entreprises en terme de définition, de description et d'explication des concepts, des bonnes pratiques, des méthodes et des outils, de manière simple à comprendre et à implémenter.

3 PRÉSENTATION DU RÉFÉRENTIEL DE MANAGEMENT DES RESSOURCES

3.1 GÉNÉRALITÉS

Le présent référentiel est une inspiration de la norme du système de management de la qualité ISO 9001 [7] et des référentiel de management de la logistique l'ASLOG [4], l'EVALOG [5] et le SCOR [6]. Il constitue, en même temps, un guide pratique pour la mise en place du processus de management des ressources de l'entreprise, un questionnaire d'audit et des lignes directrices pour l'amélioration du processus. Il constitue un véritable check-list de la performance par l'approche managerielle adoptée et les bonnes pratiques de gestion des ressources.

Pour atteindre sa finalité, ce référentiel se caractérise par :

- La simplicité : il est à noter que ce référentiel est compatible avec l'ISO 9001 [7] ce qui simplifie l'intégration dans les entreprises certifiées ISO 9001 [7] en intégrant des procédures existantes comme la gestion documentaire, l'audit interne et les actions correctives et préventives, etc., tout en profitant de l'expérience accumulée du système de management de la qualité.
- Une gestion adéquate et optimisée des ressources : la gestion des ressources est centralisée dans un processus « Management des ressources », qui traite tous les types de ressources d'une manière harmonisée, a pour objectif la simplification et l'optimisation de la gestion des ressources.
- La mise en évidence de la responsabilité de la direction dans la planification du processus management des ressources et de ses objectifs.

- Basé sur la boucle d'amélioration continue PDCA : conception du processus management des ressources dans la logique du PDCA en commençant par le processus de planification (P), puis le processus de métier (D), ensuite le processus de mesure (C) et enfin le processus d'amélioration (A) dans une boucle fermée assurant l'amélioration continue du système.

3.2 STRUCTURE DU MODÈLE

Le référentiel de management des ressources, comporte un questionnaire d'audit réparti en trois chapitres :

- Chapitre 1 : Planification du processus management des ressources.
- Chapitre 2 : Management des ressources.
- Chapitre 3 : Mesure, analyse et amélioration.

3.3 DESCRIPTION DES CHAPITRES DU RÉFÉRENTIEL

3.3.1 CHAPITRE 1 – PLANIFICATION DU PROCESSUS MANAGEMENT DES RESSOURCES

Le premier chapitre, issu de la norme ISO 9001 [7], décrit, dans une première partie, de manière générale, les exigences en matière de planification du processus management des ressources, la documentation et les enregistrements associés. Dans une deuxième partie, il met en évidence la responsabilité de la direction de l'entreprise et traduit le deuxième principe du modèle de processus ISO 9000 [8] intitulé « Leadership », manifesté dans l'engagement de la direction, l'établissement de la politique et les objectifs de management des ressources.

Ce premier chapitre représente l'axe « Plan » ou « planifier » de la boucle PDCA.

3.3.2 CHAPITRE 2 – RÉFÉRENTIEL MANAGEMENT DES RESSOURCES

Ce chapitre, représente l'axe « Do » ou « faire » de la boucle PDCA. Il traite quatre types de ressources : les ressources humaines, les ressources matérielles, le système d'information et les fournisseurs de l'entreprise. Il est riche en bonnes pratiques de management des ressources à savoir, la détermination des besoins et la gestion des ressources, la gestion des aléas, la maîtrise des coûts, la prise en considération des besoins en ressources dès la phase projet, les investissement en ressources, etc.

Les fournisseurs restent encore trop souvent la ressource délaissée dans les considérations stratégiques de l'entreprise. Si une entreprise perd quelques pourcents de ses clients, l'attention des dirigeants, analystes et actionnaires est immédiate. A l'opposé, la perte de fournisseurs fait rarement l'objet de débats au sein de ces instances. Pourtant leur contribution aux résultats de l'entreprise n'est plus à démontrer. Les fournisseurs clé, capables d'accompagner une entreprise dans l'accomplissement de ses objectifs, ne sont pas interchangeables. Les entreprises qui réussissent à travailler de manière optimisée avec eux en retirent des avantages en termes d'accès à l'innovation, de rapidité d'adaptation aux changements multiples de leur environnement, à l'optimisation des échanges et des flux, et à l'amélioration constante, synchronisée, de leurs outils opérationnels. Ils sont donc devenus des sources de valeur [9].

3.3.3 CHAPITRE 3 - MESURE, ANALYSE ET AMÉLIORATION

Enfin, le chapitre « Mesure, analyse et amélioration », issu de la norme ISO 9001 [7], constitue les deux derniers axes de la boucle PDCA qui sont « Check » ou « Mesurer et surveiller » et « Act » ou « Agir » pour améliorer. La surveillance se manifeste sous trois aspects à savoir, la satisfaction client, l'audit interne et la surveillance et la mesure des processus. Ensuite, l'analyse des données de la surveillance qui est exploitée dans l'amélioration de l'efficacité du processus, assurée par une démarche d'amélioration continue incluant les actions correctives et préventives.

4 MANAGEMENT DES RESSOURCES : LIGNES DIRECTRICES POUR LES ENTREPRISES

4.1 PLANIFICATION DU PROCESSUS DE MANAGEMENT DES RESSOURCES

4.1.1 PROCESSUS MANAGEMENT DES RESSOURCES – EXIGENCES GÉNÉRALES ET DE DOCUMENTATION

4.1.1.1 GENERALITES

L'organisme doit établir, documenter, mettre en œuvre et entretenir un processus de management des ressources et en améliorer en permanence l'efficacité conformément aux exigences de ces lignes directrices. Pour cela l'organisme doit :

- Déterminer le domaine d'application du processus management des ressources, y compris le détail et la justification des exclusions.
- Déterminer la séquence et les interactions de ce processus avec le reste des processus de l'entreprise.
- Déterminer les critères et les méthodes nécessaires pour assurer l'efficacité du fonctionnement et de la maîtrise de ce processus.
- Assurer la disponibilité des ressources et des informations nécessaires au fonctionnement et à la surveillance de ce processus.
- Surveiller, mesurer et analyser ce processus.
- Mettre en œuvre les actions nécessaires pour obtenir les résultats planifiés et l'amélioration continue de ce processus.

Lorsque l'organisme décide d'externaliser une activité ayant une incidence sur les performances du processus de management des ressources, il doit en assurer la maîtrise. La maîtrise des processus externalisés doit être documentée.

4.1.1.2 MAITRISE DES DOCUMENTS

Les documents requis pour le processus de management des ressources logistiques doivent être maîtrisés. Les enregistrements sont des documents particuliers qui doivent être maîtrisés conformément aux exigences du paragraphe suivant. Une procédure documentée doit être établie pour :

- Approuver les documents quant à leur adéquation avant diffusion;
- Revoir, mettre à jour si nécessaire et approuver de nouveau les documents;
- Assurer que les modifications et le statut de la version en vigueur des documents sont identifiés;
- Assurer la disponibilité sur les lieux d'utilisation des versions pertinentes des documents applicables;
- Assurer que les documents restent lisibles et facilement identifiables;
- Assurer que les documents d'origine extérieure sont identifiés et que leur diffusion est maîtrisée;
- Empêcher toute utilisation non intentionnelle de documents périmés, et les identifier de manière adéquate s'ils sont conservés dans un but quelconque.

4.1.1.3 MAITRISE DES ENREGISTREMENTS

Les enregistrements doivent être établis et conservés pour apporter la preuve de la conformité aux exigences et du fonctionnement efficace du processus de management des ressources. Les enregistrements doivent rester lisibles, faciles à identifier et accessibles. Une procédure documentée doit être établie pour assurer l'identification, le stockage, la protection, l'accessibilité, la durée de conservation et l'élimination des enregistrements.

4.1.1.4 GESTION DES DONNEES LIEES AUX RESSOURCES

Les données de la détermination des besoins en ressources et de la gestion des ressources doivent être :

- Gérées de manière adéquate : donnée statique, dynamique, formule en fonction d'un ensemble de paramètres, etc.
- Enregistrées.
- Mises à jour quant à leur adéquation permanente.

Une analyse globale des données de management des ressources permettant de localiser les points fort et faible est établie, présentée à la direction et utilisée dans le cadre de l'amélioration du système de management de la logistique.

4.1.2 RESPONSABILITÉ DE LA DIRECTION DE L'ENTREPRISE

4.1.2.1 ENGAGEMENT DE LA DIRECTION

Afin de fournir la preuve de son engagement au développement et à la mise en œuvre du processus de management des ressources ainsi qu'à l'amélioration continue de son efficacité, la direction doit :

- Etablir la politique de management des ressources.
- Assurer que des objectifs de management des ressources sont établis.
- Mener des revues de direction.

4.1.2.2 POLITIQUE DE MANAGEMENT DES RESSOURCES

La direction doit assurer que la politique de management des ressources :

- Est adaptée à la finalité de l'organisme.
- Comprend l'engagement à satisfaire aux exigences et à améliorer en permanence l'efficacité du processus de management des ressources. Ces exigences comprend les exigences réglementaires, légales, normatives en vigueur, protection de l'environnement, satisfaction clients et autres parties intéressées
- Fournit un cadre pour établir et revoir les objectifs.
- Est communiquée et comprise au sein de l'organisme.
- Est revue quant à son adéquation permanente.

4.1.2.3 OBJECTIFS DE MANAGEMENT DES RESSOURCES

La direction doit assurer que les objectifs de management des ressources sont établis aux fonctions et aux niveaux appropriés au sein de l'organisme. Ces objectifs doivent être :

- Mesurables et cohérents avec la politique de management des ressources et la politique générale de l'organisme.
- Revues quant à leur adéquation permanente.

4.2 MANAGEMENT DES RESSOURCES

4.2.1 RESSOURCES HUMAINES

4.2.1.1 GENERALITES

Le personnel de l'entreprise doit être compétent sur la base de la formation initiale et professionnelle, du savoir-faire et de l'expérience.

4.2.1.2 DETERMINATION DES BESOINS ET GESTION DES RESSOURCES HUMAINES

L'organisme doit :

Déterminer les compétences et l'effectif du personnel nécessaires pour le fonctionnement de l'entreprise et pour la réalisation de ses objectifs. Le résultat doit être sous forme de description des fonctions et d'effectifs nécessaires.

Avoir une méthode d'évaluation et de qualification basées sur des critères issus de la nature des activités de l'entreprise et de ses objectifs.

Déterminer les compétences et les effectifs disponibles par la méthode d'évaluation et de qualification.

Assurer que les membres du personnel ont conscience de la pertinence et de l'importance de leurs activités et de la manière dont ils contribuent à la réalisation des objectifs de l'entreprise.

Accueillir et former le nouveau personnel, y compris le personnel temporaire. Le programme d'intégration comprend une sensibilisation à la politique de l'entreprise et à ses objectifs.

Identifier et analyser les écarts de compétence, de conscience et d'effectif, entreprendre des actions (sensibilisation, mutation, formation, recrutement, etc.) afin d'éliminer les écarts (l'écart peut être un manque ou un excès de ressources).

Gérer ces actions dans un plan RH, dont les objectifs sont clairement définis et compatible avec la politique de management des ressources, compris par les employés concernés, la mesure de son efficacité est assuré et pilotés par le management.

4.2.1.3 ENVIRONNEMENT DE TRAVAIL

L'organisme doit déterminer et gérer l'environnement de travail physique et moral nécessaire pour le fonctionnement des processus de l'entreprise et pour la réalisation de ses objectifs.

La gestion de l'environnement de travail doit être planifiée afin de favoriser le développement d'un climat de travail sein conduisant à la satisfaction du personnel de leur travail et contribuant à l'amélioration des performances de l'entreprise. Pour cela l'entreprise doit améliorer :

- La sécurité au travail : maîtrise des risques professionnels biologique, chimique, mécanique, physique, électrique, incendie/explosion, routiers, psychosociaux, etc.
- La qualité des relations sociales et de travail : la reconnaissance du travail, le respect, l'écoute, l'information, le dialogue social, la participation aux décisions, etc.
- La qualité du contenu du travail : autonomie, variété des tâches, degré de responsabilité, etc.
- La qualité de l'environnement physique : bruit, éclairage, vibrations, ambiance thermique, qualité de l'air, hygiène des locaux, etc.
- La qualité de l'organisation du travail : capacité d'appui de l'organisation dans la résolution des dysfonctionnements, démarches de progrès, réduction de la pénibilité de travail, adaptation du travail à l'homme, anticipation de la charge de travail, etc.
- Les possibilités de réalisation et de développement professionnels : formation, acquis de l'expérience, développement des compétences, etc.
- La conciliation entre vie professionnelle et vie privée : rythmes et horaires de travail, accès aux services, transports, garde des enfants, etc.

Le niveau de satisfaction du personnel est parmi les indicateurs les plus importants de l'organisme.

4.2.1.4 GESTION DES ALEAS

L'organisme doit :

Prendre des mesures préventives pour lisser la charge du personnel en cas de variations des activités.

Nommer et former des intérims pour chaque tache importante, afin de remplacer le titulaire en cas d'indisponibilité.

Assurer que l'intérim a les mêmes autorités qu'au titulaire (au moins en cas d'indisponibilité du titulaire) en termes des accès au système d'information, validation des documents et des demandes, réclamations, etc.

Les différents aléas, les risques et les conséquences qui en découlent doivent être identifiées.

Mettre en place, tester, mesurer l'efficacité et améliorer un plan de sécurisation basé sur des actions comme la polyvalence et la flexibilité du personnel et la possibilité d'augmentation des heures de travail (H. Sup) afin de palier aux aléas tel que l'augmentation de charge, maladie, absentéisme, etc.

4.2.1.5 MAITRISE DES COUTS LIES AUX RESSOURCES HUMAINES

L'organisme doit :

Maîtriser les coûts dépensés sur les ressources humaines : masse salariale, transport du personnel, restauration, formations, services sociaux, etc.

Identifier et répertorier les activités effectuées par le personnel de l'entreprise pour imputer les coûts des ressources humaines sur les centres de coûts preneurs selon une méthode de calcul et de répartition adéquate.

Calculer les ratios des coûts des ressources humaines (par service, par produit, par quantité produite ou vendue, etc.). L'analyse et la comparaison de ces ratios par rapport aux normes et standards, s'ils existent, et/ou à des données de benchmarking font des pratiques courantes du management de l'entreprise.

Déterminer des objectifs pour ces ratios et mettre en place des actions afin de rester cohérent avec ces objectifs.

4.2.1.6 PRISE EN COMPTE DES BESOINS EN RESSOURCES HUMAINES DANS LA PHASE PROJET

L'organisme doit :

Prendre en compte le processus d'allocation des ressources humaines nécessaires lors de l'exécution des projets de production, de développement de nouveaux produits, de nouveaux marchés, etc. tel que planifié par la direction, suivre le taux d'avancement, comparer avec l'avancement du projet global, mettre en place des actions visant à rattraper les retards s'il y en a lieu. Prendre en considération l'instabilité des activités prévues lors du démarrage ou du lancement dans le processus (taux de changement de programme élevé, production non standard, dégagement des rebuts en grande quantité, demande instable ou difficile à prévoir, etc.).

4.2.2 RESSOURCES MATÉRIELLES

4.2.2.1 GENERALITES

La notion de ressources matérielles est bien étendue, elle englobe les machines de production, les moyens de transport, de manutention, les locaux administratifs et industriels, les airs de stockage, de conditionnement et de circulation des flux, etc. Le matériel informatique est traité dans le chapitre « système d'information ».

L'organisme doit déterminer, fournir et entretenir les ressources matérielles nécessaires pour le fonctionnement de l'entreprise et pour la réalisation de ses objectifs.

4.2.2.2 DETERMINATION DES BESOINS ET GESTION DES RESSOURCES MATERIELLES

L'organisme doit déterminer les performances et la capacité des ressources nécessaires pour le fonctionnement de l'entreprise et pour la réalisation de ses objectifs. La capacité doit être exprimée en unités significative et exploitable (durée, tonnage, etc.).

Une méthode de mesure des performances et de qualification basées sur des critères issus de la nature des activités de l'entreprise et de ses objectifs existe et appliquée.

Les performances nominales des ressources disponible sont identifiées, les performances réelles sont mesurées, les écarts ou les rapports entre le réel et le nominal sont calculés, analysé et font l'objet des actions d'amélioration.

Les résultats de mesure des performances sont utilisés pour la qualification des ressources par rapport aux besoins.

Les écarts entre le besoin et le disponible sont identifiés, des actions sont entreprise afin d'éliminer les écarts (l'écart peut être un manque ou un excès de ressources). Les performances des ressources disponibles doivent être identifiées sur la base des performances réelles.

Des facteurs de sécurité doivent être déterminés et appliqués sur les besoins en capacité et les capacités réelles en fonction du taux de service objectif.

Les processus d'acquisition et de gestion des ressources contribuent au respect des règles de sécurité, de santé de travail et d'environnement.

Les ressources disponibles doivent être identifiées selon une méthode d'identification ou de codification adéquate permettant leur suivi.

Des procédures de maintenance corrective, préventive ou prédictive existent et appliquées. La mesure d l'efficacité et les actions d'amélioration contribuent au bon fonctionnement des processus de l'entreprise et à la réalisation de ses objectifs.

4.2.2.3 GESTION DES ALEAS

Des mesures préventives sont prises pour lisser la charge des activités de l'entreprise afin d'optimiser l'utilisation des ressources en cas de variations des activités.

Les différents aléas, les risques et les conséquences qui en découlent doivent être identifiées.

L'organisme doit mettre en place, tester, mesurer l'efficacité et améliorer un plan de sécurisation basé sur des actions comme la flexibilité des ressources, la possibilité d'augmentation du temps d'ouverture et la sous-traitance, afin de palier aux aléas tel que l'augmentation de charge, les pannes, etc.

Les ressources critiques ou goulets doivent être identifiées, classées et gérées de manière spécifique dans le plan de sécurisation.

4.2.2.4 MAITRISE DES COUTS LIES AUX RESSOURCES MATERIELLES

Les éléments des coûts consommés par chaque ressource y compris l'amortissement sont bien identifiés, imputés sur la ressource concernée.

Identifier et répertorier les activités traitées par chaque ressource matérielle pour imputer ces coûts sur les centres de coûts preneurs selon une méthode de calcul et de répartition adéquate.

Calculer les ratios des coûts des ressources matérielles (par service, par produit, par quantité produite ou vendue, etc.). L'analyse et la comparaison de ces ratios par rapport aux normes et standards, s'ils existent, et/ou à des données de benchmarking font des pratiques courantes du management de l'entreprise.

Déterminer des objectifs pour ces ratios et mettre en place des actions afin de rester cohérent avec ces objectifs.

4.2.2.5 PRISE EN COMPTE DES BESOINS EN RESSOURCES MATERIELLES DANS LA PHASE PROJET

Prendre en compte le processus d'allocation des ressources matérielles nécessaires lors de l'exécution des projets de production, de développement de nouveaux produits, de nouveaux marchés, etc. tel que planifié par la direction. Le taux d'avancement est suivi et comparé avec l'avancement du projet global. Des actions sont mises en places visant à rattraper les retards s'il y en a lieu. L'instabilité des activités prévues lors du démarrage ou du lancement est prise en considération dans les besoins (taux de changement de programme élevé, production non standard, dégagement des rebuts en grande quantité, etc.).

4.2.2.6 INVESTISSEMENTS EN RESSOURCES MATERIELLES

L'organisme doit assurer que les investissements en ressources matérielles émanent des études préalables en vue d'obtenir l'optimum en termes de coûts et de taux de service ou pour répondre à d'autres axes figurant dans la politique l'entreprise (qualité, sécurité, environnement, etc.).

Par ailleurs, la mise en place des moyens automatisés a fait l'objet d'une étude démontrant leur utilité par rapport aux moyens traditionnels. Leur mise en œuvre en toute sécurité par des personnels formés est documentée.

Des méthodes de calcul comparatif pour l'arbitrage entre « acquisition de nouvelles ressources » et « maintient des ressources disponibles » font des pratiques courantes des responsables de gestion des ressources.

4.2.3 SYSTÈME D'INFORMATION

4.2.3.1 GENERALITES

La notion de système d'information englobe les moyens matériels et logiciels nécessaires pour le fonctionnement des flux d'information et de communication : parc pc, imprimantes, matériels de réseaux, de téléphonie, les logiciels, ERP, etc.

L'organisme doit déterminer, établir et entretenir le système d'information nécessaire pour le fonctionnement de l'entreprise et pour la réalisation de ses objectifs.

4.2.3.2 DETERMINATION DES BESOINS ET GESTION DU SYSTEME D'INFORMATION

L'organisme doit déterminer les besoins en gestion de flux d'information nécessaires pour le fonctionnement de l'entreprise et pour la réalisation de ses objectifs : les données à gérer, les procédures à informatiser, les workflows, les plannings, les activités, les indicateurs, etc.

Une méthode de mesure de performances et de qualification basées sur des critères issus de la nature des activités de l'entreprise et de ses objectifs existent et appliquée.

Les performances du système d'information sont mesurées, les écarts sont analysés et font l'objet des actions d'amélioration.

Les résultats de mesure de performances sont utilisés pour la qualification du système d'information par rapport aux besoins.

Les écarts entre les performances cibles et les performances constatées sont identifiés, des actions sont entreprise afin d'éliminer ces écarts.

Des procédures de maintenance corrective, préventive ou prédictive existent et appliquées pour le système d'information. La mesure de l'efficacité et les actions d'amélioration contribuent au bon fonctionnement de l'entreprise et à la réalisation de ses objectifs.

4.2.3.3 GESTION DES ALEAS

Les risques et les menaces pouvant affecter le système d'information sont analysées. Des actions sont mises en places pour garantir la sécurité du système d'information, leur efficacité est attesté par les résultats.

Les différents aléas, les risques et les conséquences qui en découlent doivent être identifiées.

Mettre en place, tester, mesurer l'efficacité et améliorer un plan de sécurisation afin de faire face aux aléas.

Les ressources critiques doivent être identifiées, classées et gérées de manière spécifique dans le plan de sécurisation.

4.2.3.4 MAITRISE DES COUTS LIES AU SYSTEME D'INFORMATION

Les éléments des coûts consommés par le système d'information et ses composantes sont bien identifiés, imputés sur les centres des coûts preneurs selon une méthode de calcul et de répartition adéquate.

Identifier et répertorier les activités le système d'information pour imputer ces coûts sur les centres de coûts preneurs selon une méthode de calcul et de répartition adéquate.

Calculer les ratios des coûts du système d'information (par service, par produit, par quantité produite ou vendue, etc.). L'analyse et la comparaison de ces ratios par rapport aux normes et standards, s'ils existent, et/ou à des données de benchmarking font des pratiques courantes du management de l'entreprise.

Déterminer des objectifs pour ces ratios et mettre en place des actions afin de rester cohérent avec ces objectifs.

4.2.3.5 PRISE EN COMPTE DES BESOINS EN SYSTEME D'INFORMATION DANS LA PHASE PROJET

Prendre en compte le processus de mise en place du système d'information nécessaires lors de l'exécution des projets de production, de développement de nouveaux produits, de nouveaux marchés, etc. tel que planifié par la direction. Le taux d'avancement est suivi et comparé avec l'avancement du projet global. Des actions sont mises en places visant à rattraper les retards s'il y en a lieu. L'instabilité des activités prévues lors du démarrage ou du lancement est prise en considération dans les besoins (taux de changement de programme élevé, production non standard, dégagement des rebuts en grande quantité, etc.).

Investissements en système d'information

L'organisme doit assurer que les investissements en système d'information émanent des études préalables en vue d'obtenir l'optimum en termes de coûts et de taux de service ou pour répondre à d'autres axes figurant dans la politique de l'entreprise (qualité, sécurité, environnement, etc.).

Par ailleurs, la mise en place des moyens automatisés (récupération des données des automates vers le système de gestion, transfert des données externes par EDI, e-commerce, workflows, etc.) a fait l'objet d'une étude démontrant leur utilité par rapport aux moyens traditionnels. Leur mise en œuvre en toute sécurité par des personnels formés est documentée.

Des méthodes de calcul comparatif pour l'arbitrage entre « acquisition de nouvelles ressources » et « maintient des ressources disponibles » font des pratiques courantes des responsables de gestion du système d'information.

4.2.3.6 EXIGENCES SUR LA CONCEPTION ET LES PERFORMANCES GENERALES

Le système d'information de l'entreprise fournit aux acteurs les informations nécessaires aux besoins de gestion et surtout pour la prise de décision.

La conception du système d'information globale de l'entreprise permet l'extraction et l'exploitation facile des données dans un environnement aisément accessible et exploitable (Excel par exemple).

Les désignations des informations de la base de données du système d'information sont reproductibles et maîtrisées. Les rapports, les bases de données sont uniques, on reproduit la même information par tout.

L'ergonomie du système est bien travaillée, le niveau de satisfaction des utilisateurs est parmi les indicateurs les plus importants du système d'information.

L'entreprise a la capacité et sait recevoir les informations externes sous forme informatique (EDI ou outils basés sur le WEB), si elles sont disponibles chez le client. Le transfert électronique de données réduit les risques d'erreurs de saisie ou de traduction. Les temps de transfert sont diminués, engendrant une meilleure réactivité.

Le système permet de mesurer le niveau du service, le respect des bons pratiques et des engagements.

L'utilisation d'un système de gestion intégré des processus de l'entreprise permet d'éviter la double saisie des données, de réduire les temps de traitement, de minimiser les erreurs, de réduire les coûts et d'augmenter le taux de service.

La mise en place et la gestion des verrous et des alertes permettent d'éviter les erreurs et les retards de traitements.

Le système fournit systématiquement des états de contrôle ou de bouclage permettant de s'assurer du bon fonctionnement des processus de l'entreprise.

4.2.4 LES FOURNISSEURS

4.2.4.1 GENERALITES

La notion du fournisseur est bien étendue, elle englobe les fournisseurs de produit, de service, de logiciels, de machine, les transporteurs, les compagnies maritimes, les intermédiaires, les ports, les armateurs, les formateurs, les consultants, etc.

Les procédures et les responsabilités liées à l'interface fournisseurs sont bien identifiées et respectées.

4.2.4.2 CHOIX DES FOURNISSEURS

Les critères clés de choix des fournisseurs sont fixés et respectés : qualité, délai de livraison, taux de service, flexibilité, prix, etc.

Ces critères sont issus de la politique générale de l'organisme et répond à ses objectifs.

4.2.4.3 MANAGEMENT DE LA RELATION FOURNISSEURS

La gestion de la relation fournisseur est planifiée afin de minimiser les risques et les aléas du flux amont et d'augmenter le taux de service fournisseurs.

Des catégories des fournisseurs sont définies selon des critères pertinents. Les fournisseurs réputés « incontournables » sont identifiés. Des règles de gestion et des objectifs sont instaurées pour chaque catégorie.

Des objectifs concernant les éléments principaux de performance : qualité, délais, taux service, fiabilité, coûts et chiffre d'affaire réalisé sont instaurés par catégorie de fournisseurs.

Une base de données de la relation fournisseur contenant l'historique des opérations, les opérations encours, les performances, les partenariats, les litiges, etc. est gérée et utilisée pour des fins d'analyse et de prise de décision.

Pour les principaux fournisseurs, la logique de partenariat est toujours recherchée. Les partenariats sont documentés et établies afin de sécuriser les flux amont. L'efficacité est attestée par les résultats.

De plus, il est clairement établi que toutes les obligations contractuelles pourront faire l'objet de contrôles et de mesure de performance auprès des fournisseurs.

En outre, les bases, les modèles de ces contrats et les cahiers des charges sont améliorés en permanence par retour d'expériences.

4.2.4.4 INTERFACE DE COMMUNICATION AVEC LES FOURNISSEURS

La communication externe avec les fournisseurs est planifiée afin d'améliorer le service achat et approvisionnement. Les standards des informations échangées et des modalités de transmission sont préétablies et peuvent être modifiées pour une commande, pour un fournisseur ou pour un produit. Ces modalités précisent les conditions des échanges et le suivi du respect des engagements. Elles sont parfaitement connues et appliquées.

Des dispositions efficaces sont déterminées et mise en œuvre pour communiquer avec les fournisseurs à propos :

- des informations relatives au produit et du service à acheter;
- du traitement des consultations, des contrats, des partenariats ou des commandes;
- des retours d'information vers les fournisseurs, y compris les réclamations.

Les collaborateurs chargés d'établir et/ou de négocier les cahiers des charges et les contrats ont été formés au droit du contrat et peuvent communiquer avec des fournisseurs de langue différente en fonction des besoins.

L'entreprise dispose d'une liste de contacts pour chacun de ses fournisseurs (tel, fax, mail, etc.).

4.2.4.5 GESTION DES ALEAS

Les principaux facteurs de risques de rupture des flux fournisseurs sont identifiés et une série de mesures est préparée pour chacun d'eux : dispositions de sécurité, double source, par exemple. Des actions sont engagées pour limiter ces facteurs de risque.

Les défaillances sur le flux amont sont immédiatement identifiées. Pour les fournisseurs dont la fiabilité n'est pas suffisante, des dispositions de sécurité (stock, règle de décalage, etc.) sont en place. De plus, les principaux fournisseurs s'engagent contractuellement à mettre en place des solutions alternatives qui permettent de résoudre les problèmes auxquels ils peuvent être confrontés (grève, périodes de congés massifs, etc.).

En outre, les fournisseurs générant régulièrement des non-conformités en termes de qualité, quantités et/ou délais sont clairement identifiés. Des actions sont engagées avec eux pour atteindre la performance souhaitée. Si les progrès ne sont pas significatifs dans un délai défini, les fournisseurs défaillants sont remplacés.

4.3 MESURE, ANALYSE ET AMÉLIORATION

4.3.1 GÉNÉRALITÉS

L'organisme doit planifier et mettre en œuvre les pratiques de surveillance, de mesure, d'analyse et d'amélioration nécessaires pour assurer la conformité du processus de management des ressources et pour améliorer en permanence l'efficacité du système de management de la logistique.

Ceci doit inclure la détermination des méthodes applicables, y compris les techniques statistiques, ainsi que l'étendue de leur utilisation.

4.3.2 SURVEILLANCE ET MESURES

4.3.2.1 SATISFACTION DU CLIENT DU PROCESSUS MANAGEMENT DES RESSOURCES

L'organisme doit surveiller les informations relatives à la perception des clients internes et externes sur le niveau de satisfaction de ses exigences relatives au processus de management des ressources comme une des mesures de la performance de ce processus.

Les méthodes permettant d'obtenir et d'utiliser ces informations doivent être déterminées (enquêtes de satisfaction, indicateurs de performances, suivi des réclamations, etc.).

4.3.2.2 AUDIT INTERNE

L'organisme doit mener des audits internes à intervalles planifiés pour déterminer si le processus management des ressources :

- Est conforme aux dispositions planifiées par l'entreprise et aux exigences du présent article.
- Est mis en œuvre et entretenu de manière efficace.

Un programme d'audit doit être planifié en tenant compte de l'état et de l'importance du processus management des ressources de l'entreprise, ainsi que des résultats des audits précédents. Les critères, le champ, la fréquence et les méthodes d'audit doivent être définis. Le choix des auditeurs et la réalisation des audits doivent assurer l'objectivité et l'impartialité du processus d'audit. Les auditeurs ne doivent pas auditer leur propre travail.

Les responsabilités et les exigences pour planifier, mener les audits, rendre compte des résultats et conserver des enregistrements doivent être définies dans une procédure documentée.

L'encadrement responsable du domaine audité doit assurer que des actions sont entreprises sans délai indu pour éliminer les non-conformités détectées et leurs causes. Les activités de suivi doivent inclure la vérification des actions entreprises et le compte-rendu des résultats de cette vérification.

4.3.2.3 SURVEILLANCE ET MESURE DES PROCESSUS

L'organisme doit utiliser des méthodes appropriées pour la surveillance et la mesure du processus management des ressources. Ces méthodes doivent démontrer l'aptitude du processus à atteindre les résultats planifiés. Lorsque les résultats planifiés ne sont pas atteints, des corrections et des actions correctives doivent être entreprises.

4.3.3 ANALYSE DES DONNÉES

L'organisme doit déterminer, recueillir et analyser les données appropriées pour démontrer la pertinence et l'efficacité du processus management des ressources et pour évaluer les possibilités d'amélioration de son efficacité.

Ceci doit inclure les données résultant des activités de surveillance et de mesure ainsi que d'autres sources pertinentes internes et externes à l'entreprise.

4.3.4 AMELIORATION

4.3.4.1 AMELIORATION CONTINUE

L'organisme doit améliorer en permanence l'efficacité du système de management de la logistique en utilisant la politique logistique, les objectifs logistique, les résultats d'audits, l'analyse des données, les actions correctives et préventives ainsi que la revue de direction.

4.3.4.2 ACTION CORRECTIVE

L'organisme doit mener des actions pour éliminer les causes de non-conformités afin d'éviter qu'elles ne se reproduisent. Les actions correctives doivent être adaptées aux effets des non-conformités rencontrées.

4.3.4.3 ACTION PREVENTIVE

L'organisme doit déterminer les actions permettant d'éliminer les causes de non-conformités potentielles afin d'éviter qu'elles ne surviennent. Les actions préventives doivent être adaptées aux effets des problèmes potentiels.

5 CONCLUSION

Nous avons proposé, dans cet article, un référentiel de mise en place, de mesure et d'amélioration des performances du processus management des ressources pour les entreprises. Le but de ce travail est d'offrir un outil performant aux entreprises pour réussir leur démarche de management des ressources en s'appuyant sur l'expérience de la démarche qualité et ses principes.

La structuration du référentiel, basée sur la boucle d'amélioration continue PDCA donne une méthodologie logique et facile à suivre tout en assurant l'amélioration continue du processus en entier. La description des bonnes pratiques en matière de management des ressources est détaillée et cohérente. Ces caractéristiques permettent de qualifier ce référentiel en tant que guide pratique pour l'instauration, la mesure des performances, le maintien et l'amélioration de la démarche de management des ressources.

Ce référentiel se limite au traitement du processus management des ressources internes des entreprises et ne propose pas de formules détaillées des indicateurs de performance.

Ainsi, les perspectives d'exploitation et d'amélioration de ce modèle peuvent être envisagées à deux niveaux :

- La transposition du référentiel pour couvrir le cas des entreprises d'une chaîne logistique étendue, en introduisant d'autres principes comme la mutualisation des ressources par exemple.
- L'amélioration du chapitre 3 « Mesure, analyse et amélioration », en proposant des formules d'indicateurs compatibles avec les principes du présent référentiel.

REFERENCES

[1] L.Livolsi, '' Directeur et Responsable Logistique : différences et évolutions au travers des offres d'emploi publiées,'' Logistique & Management, vol. 15 – no. 2, pp. 7—18, 2007
[2] S. Claye-Puaux, ''La gestion des ressources humaines sous contraintes dans les zones logistiques,'' Logistique & Management, vol. 15 – no. 2, pp. 31—41, 2007
[3] L. Bironneau et B. Le Roy, '' Définition d'un modèle générique des compétences du responsable logistique,'' Logistique & Management, vol. 15 – no. 2, pp. 31—41, 2007.
[4] Association Française pour la Logistique ASLOG, (2006), ''Référentiel de l'Association Française pour la Logistique''.
[5] Odette International Limited et Automotive Industry Action Group, (2006), ''Référentiel EVALOG''.
[6] Supply Chain Council Inc., (2010), ''SCC Supply Chain Operations Reference Model SCOR Version 10.0''.
[7] AFNOR, (2008), ''Norme ISO 9001, Systèmes de management de la qualité – Exigences''.
[8] AFNOR, (2005), ''Norme ISO 9000, Systèmes de management de la qualité – Principes essentiels et vocabulaire''.
[9] Les Fournisseurs : Mieux Gérer une Composante de notre Capital Immatériel, 2012. [On ligne] disponible : http://www.sourcing-plus.com/docs/fournisseurs-capital-immateriel-profession-achat-dec-2012.pdf (24 Août 2014).

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 413-419
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Effects of Governance and Policy Reforms on Affordable Housing in Nigeria

Adiukwu Fidelis Onyekachi

Department of Architecture,
Obafemi Awolowo University, Ile- Ife, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This paper reviews Governance Policy on Housing, by evaluating the reform agenda of successive government from colonial administration to President Goodluck Jonathan's New Housing Policy. What are the achievements and failures in the pursuit of affordable housing? Drawings lessons from experiences in housing in the UK, China, South Africa and other developed economies, the paper affirm that preceding housing policies of Government were largely unsuccessful due to observed order of nepotism, corruption, poor political will in implementation strategies, lack of transparency and due process. The concept of social housing in Nigeria is acclaimed, but can it be the much awaited answer to Nigeria's housing problem? The paper affirms in strong terms that success is a possibility if necessary factors required for its achievement are in place and strengthened. Paper in conclusion, suggests measures for achieving affordable housing in Nigeria.

KEYWORDS: Affordable Housing, Housing Finance, Housing Policy, Land Access, Social Housing

1 INTRODUCTION

Most scholars and researcher are of the view that the housing policy initiative by President Shagari in 1979 on the concept of 'Affordable Housing', was unable to meet the nation's housing needs because it was, based on the principle that houses will be, provided by government. Though commendable, this policy is viewed by many scholars and researchers as the variance in the 21st century Nigeria that we as a nation must resolve, in order to meet the nation's housing aspiration. According to Ajanlekoko (2001), amongst human basic needs, housing arguably represents the greatest challenge. A buoyant housing sector is an indication of a strong base for economic growth and social development. This importance of housing demands resolute commitment, intelligent planning, and effective implementation strategies for developmental programs. A rational and effective policy must therefore be developed to shape the foundation and framework for the much-needed housing development. This paper, which is presented, in interrelated parts examines Governance Policies, its reforms agenda, condition of housing, land Access, Housing delivery and affordability; impact of policy reform on components of housing and National Development, and the new policy of social housing. Lessons from other nations are understudied to deduce probable solutions for the nation's quest for affording housing for all. Housing Policy of government at state and local government, is not a subject of discuss in this article. A particular significance in view is the effect of Government policy reforms on housing delivery and affordability.

1.1 POLICY

Merriam-Webster's Dictionary defined policy as a definite course or method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions. Also, it is a high-level overall plan embracing the general goals and acceptable procedures especially of a governmental body.

Corresponding Author: Adiukwu Fidelis Onyekachi

1.2 HOUSING POLICY

A housing policy is a set of guidelines provided by government aimed at meeting the peoples housing needs through a set of appropriate strategies, which involve fiscal, institutional, legal and regulating framework. Grisgby, et al (1975) opined a national housing policy as the "result of multitude of laws, administrative regulations and actual administrative practices" for effective housing delivery.

1.3 HOUSING AND NATIONAL DEVELOPMENT

In a major way, housing fulfils the psychosocial needs of a society, and serves as a hope where an individual is able to express his or her need for privacy and territoriality, psychological and social security, refuge and protection against natural elements of climate. In addition, housing serves as the avenue where an abundant flow of socio-cultural interaction and services are accessible (place for social interaction, education, recreation, sports, social welfare, health, shopping and transportation). National Planning commission (NPC, 2009), reports 15% - 40% of the monthly expenditure of a household in Nigeria is spent on housing. Kenyl (2007),opined that housing contributes 30% - 40% of gross domestic product (GDP) in emerging economies and accounts for 60% - 80% in developed economies; whereas in private and public investment, housing accounts for 15% - 35% of total investment nationwide (NPC, 2009) and employs diverse class of skilled and unskilled labor. Improvement in the sector will boost the living standard of the public resulting in economic growth and national development. Thus, economists now see development in housing as greatly importance to the wider macro economy and several studies have been undertaken on how development in the housing sector affects macro economic growth and development (Ogbuefi and Adesanmi, 2004).

1.4 HOUSING DELIVERY AND AFFORDABILITY

What must Nigeria do to achieve affordable housing for public needs? This is a question researchers, scholars, stakeholder and government have tried over the years to answer. In today's contemporary world, Housing delivery and affordability is, a concern of all stakeholders- prospectors, individual, groups, professionals, and government. Agbola (2005) define a house as an economic resource, providing space for production and access to income-earning prospects. It is an institution, created for a wide-ranging purpose. Ownership of a house is important in most societies as it confers some forms of privilege. Efficient housing delivery and affordability therefore, will enhance the quality of life.

1.5 HOUSING CONDITION IN NIGERIA

Recent research findings projects nearly 80% of Nigerians living in rented housing as compared with South Africa 18%. The housing challenge in Nigeria has become a persistent dilemma compounded by unsuccessful government program to achieve solutions that encourage a broad participation in the delivery process. Housing is a universal problem, associated with the challenge of increasing cost of production (a direct cumulative effect of high cost of building materials, population growth, high-energy) and financial capacity (Adiukwu, 2011). Studies show that the national housing deficit from1991 increased from 7million in to worrisome estimate of 12 - 15 million units in 2008 and over 16million in 2013. This represents housing for 130-140million people of which more than 65% represent the low and medium income groups of Nigeria population. This signifies about 85% of the housing demand for the nation. However most of the housing developments are not within the reach of this significant group.

1.6 COMPONENTS OF HOUSING DELIVERY IN NIGERIA

The major components of housing are structured and controlled by government policies. Their appropriateness and effectiveness, therefore, depend largely on the quality of policies and implementation strategies. Agbola (1998) emphasized the idea of housing as both a product and a process, which includes economic, sociological, and psychological trend.

1.6.1 LAND ACCESS AND HOUSING FINANCE

Reform in housing sector requires reforms in other sectors of the economy such as financial institutions supporting housing acquisitions. Thus, a housing reform that is, anchored on mortgage will lead to reforms in the financial sector with a view of evolving an efficient mortgage market (both primary and secondary), while reforms in land administration aims at ensuring accessibility of land to all Nigerians. Government intervention in the delivery of affordable housing includes direct or indirect policies to alter the availability, accessibility, and affordability of land and housing by the populace. This usually, may

involve a paradigm shift in social policy, land ownership laws (such as from government ownership to liberalization), housing development and ownership by government housing. These, unarguably, have created both negative and positive effects on the overall economy.

Nigerian Federal Government established a two-tier housing finance structure, with the Federal Mortgage Bank of Nigeria (FMBN) as the apex institution and a decentralized network of Primary Mortgage Market institutions such as building societies, housing co-operatives, home savings and loans associations. This aims to streamline processes and organizational relationships within the housing finance system and encourage expansion in private initiative. The legal framework for the organization and implementation of the apex role of FMBN is, defined by the Mortgage Institutions Decree No.53 of 1989.

1.6.2 NATIONAL HOUSING FUND (NHF)

The concept of the National Housing Fund as proposed in the National Housing Policy is to ensure a continuous flow of long-term funding for housing development and to provide affordable loans for low-income housing. The promulgation of the National Housing Fund Decree heralds the emergence and establishment of an array of mortgage finance institutions in Nigeria. The intention of the scheme appear as good, but the modalities of disbursement of loans to the mortgage institutions to lend to the members of the public have not been worked out and as such most potential clients have been frustrated by the high interest rate and cost of funding. The National Housing Fund was overhauled to encourage more depositors, thereby increasing the mortgage obligations. In the new arrangement, workers are, made to; contribute 2.5% of their monthly salary to the Fund. Contributors are entitled to a N5 million loan at an interest rate of 6% for a period of 30 years after six months of contribution. The capital base of Primary Mortgage Institutions (PMIs), which are charged with the responsibility of disbursing loans funded by the NHF to the borrowers, was increased to N100 million. Various reforms were, also carried out in other key sectors of the economy to encourage private investment in mortgage securities through institutional pension funds, and bank consolidation, which reversed the apathy to mortgage, and real estate financing. Despite this restructuring, a large fraction of the populace cannot secure loan from these institutions. Transaction charges and the cumbersome process of registration of titles, which make the perfection of legal mortgages difficult, are some of the major factors responsible for this low patronage (NPC, 2009). The cumulative charges of consent fees, capital gains tax, stamp duty and registration fees, cost as high as 40% of property value in some states in Nigeria. The inability of the borrower to provide a reliable guarantor and low monthly income are major shortcoming. However, as the macroeconomic policy shift influences the housing sector reforms, the implications on housing are equally enormous. This was appropriately captured by Karnad (2004) where he observed that policy orientation is being gradually altered particularly with the realization that macroeconomic stability and housing sector are inextricably linked and the ability of housing finance as a development activity has a great offshoot on the overall economy.

2 GOVERNANCE POLICIES

Grigsby and Rosenbug (1975) affirmed that policies are often consciously derived, and thus, have a life cycle. This policy cycle comprises principally of policy design and formulation, policy implementation and policy appraisal. Kaul (1997) supports this affirmation, and asserts that in the realm of the public sector, policy is the instrument for guiding action along the pre-determined route and limit discretionary powers of public officials.

2.1 EVALUATION OF GOVERNANCE POLICY

2.1.1 COLONIAL ADMINISTRATION (BEFORE 1960)

In this era, the major concern of the Colonial government was separating white inhabited quarters from other Nigerians. Some isolated 'accidental events' led to the development of some forms of legislation on housing and the urban environment. These includes-

- The Bubonic plague of1928, which led to the creation (same year) of the Lagos Executive Development Board (LEDB). In 1929, the LEDB created to deal with slum clearance of Lagos because of the bubonic plague; had on the introduction of the African staff Housing Loans Scheme in 1956, which commenced building houses for sale to African Civil Servants in Lagos.
- The railway workers' strike of 1945, which forced the government to develop staff quarters at Surulere in Lagos.
- During the era of internal self governance in Nigeria and in the 1950s, Regional government, bye-laws established Housing Corporations which not only produced houses for sale, but also, allocated serviced plots for private housing development and provided mortgage finance for the first time to non civil servants.

2.1.2 POST-INDEPENDENCE (1960-1978)

The Housing Corporations of the Regional Governments, after independence is, strengthened and they evolved into the Association of Housing Corporations of Nigeria (AHCN). The Military regime of Gen. Yakubu Gowon set up Federal agencies on housing and urban development, example is the Federal Housing Authority (FHA) created by law in 1973, to coordinate a nationwide housing program. The Federal Ministry of Housing, Urban Development, and Environment were, created in 1975 and setup the following committees and Panels-

- The committee on the Standardization of Housing Types and Policies (1975) and their efforts resulted in the acceptance of low-income housing concepts and strategies of the World Bank and International Monetary Fund (IMF).
- The Rent Panel (1976) whose review of the structure and level of rent in the Nation resulted in the creation of State Rent Tribunals.
- The Land Use Panel (1977) which led to the promulgation in 1978 of the Land use Act. This Act was, aimed at guaranteeing easier access to land for development; however, it created a new set of problems.
- The major cause of failure of these housing programs is traceable to inappropriate policy formulation, and poor implementation of programs.

2.1.3 DEMOCRATIC GOVERNANCE (1979-1983)

President Shehu Shagari's in an attempt to fulfill campaign promise, at inception of his government, set out to construct forty thousand (40,000) housing units per annum, this aggregating to one-hundred and sixty thousand (160,000) units at the end of its truncated 4-year term. However, only thirty-two thousand (32,000) units were completed (FGN, 2004), representing only about 25% of the set target. A major problem notorious in this era was widespread corruption with impunity and indiscipline of the government at all levels.

2.1.4 MILITARY REGIME (1985-1990)

General Babangida initiated in 1985 a ten-man committee to formulate a new National Housing Policy with ambitious housing targets to achieving goals. Many scholars are of the opinion that the policy lacked strategic plans for implementation attributed to poor political will and unfavorable economic policies of the government like the Structural Adjustment Program (SAP), Second-Tier Foreign Exchange Markets (SFEM), etc. as a result housing became more limited in supply and costly relative to income.

2.1.5 MILITARY REGIME / DEMOCRATIC GOVERNANCE (1991-2001)

A new National Housing Policy was, launched in 1991 and spanned about six (6) years, involved all the relevant stakeholders in the housing sector. A major aspect of this new policy was the re-organization of the housing finance sector as the pivot of this policy. Despite the acclaim granted the policy, the National Housing Policy – NHP - (2004) stated that by the beginning of 1999, housing development had been, neglected and that a "no-housing" situation existed in Nigeria, as about 60% of Nigerian are said to be "without house". The failures of the housing programs of this period were not, blamed on the formulation of policy. It was evidently, a problem of poor implementation strategies and widespread corruption.

2.1.6 DEMOCRATIC GOVERNANCE (2002 – 2007)

The administration of Chief Olusegun Obasanjo, in its determined effort to alleviate the deterioration housing situation in Nigeria laid the foundation of a more articulated and pragmatic policy. This aims to evolve a more practical approach to solving housing problems. The year 2002, National Housing and Urban Development Policy provided a legal framework for the housing sector reform in the nation. The National Housing Policy (2004) enunciates the configuration of the Nigerian urban settlements of the future and the housing policy for the nation. The policy represents a major shift in government view on how to promote mass housing for the citizens and involves a large number of private sector, real estate developers and State Housing Corporations in the development of estates with houses for sale at affordable rates. This promoted the growth of many small and medium scale industries, in providing local construction materials, with the aim of keeping the cost of housing production within reasonable limits. This put the private sector developers as the fulcrum of housing delivery in Nigeria. Thus, in line with changing global trend of economic liberalization, and to foster greater private sector participation, government facilitated the development of large number of private sector real estate developers, and building materials

manufacturers. This gave birth to Real Estate Developers Association of Nigeria (REDAN) and Building Materials Producers Association of Nigeria (BUMPAN). The other vital elements of the reform involves proposal for the reform of legal, institutional and regulatory provisions that currently inhibits mass housing delivery, housing market efficiency, finance and private sector participation. As part of reform, a new Federal Ministry of Housing and Urban Development was, established with a task to regulate, promote, monitor, coordinate, and supervise a private sector-driven housing delivery. By 1999 about 60% of Nigerians are said to be homeless (Federal Republic of Nigeria, 2004). This led to the formulation of a new housing policy with the policy of a private sector led economy. The three (3) key areas of the policy are Public-Private Partnership (PPP), Monetization Policy, and Mortgage Financing Restructuring. The next subsection will briefly discuss the PPP initiative of Government.

2.1.7 PUBLIC-PRIVATE PARTNERSHIP (PPP)

Public-Private Partnership is a policy, which cedes majority of housing delivery to the private sector. The role of the government is to provide an enabling environment of site and services for the private sector to invest and operate in a free market. The program tailored to attract private capitals is to include innovations like Build, Operate and Transfer (BOT) and Repair, Operate and Transfer (ROT). The fundamental problem observed with this initiative is equating housing need to housing demand and when housing is included among the production of goods, it then becomes a product. The rationale for the policy shift is a response to perceived failures in the public sector and the better performance of private ownership (Baryliss, 2006). Thus, widespread privatization became part of a global ideological shift in emphasis towards a more efficient and market-driven economy.

3 NEW HOUSING POLICY 2012

In a move to address the housing challenge faced by the nation, President Goodluck Jonathan approved a new national housing policy aimed at ensuring the construction of one million houses annually to boost infrastructural development. A new dimension in the policy is the idea of social housing, a situation where every citizen 'counts' in the provision of affordable housing. The concept of social housing is contentious. A school of thought believes the government should drive it by making housing available and free for certain people as is done in the UK. The government differs, insisting that it would rather provide an enabling environment for the private sector to drive the concept. Housing policy approach in Nigeria has tended to alternate as most scholars concur, between the 'welfare mixed economy' and the 'free market model'. (Akeju, 2007) affirms Government needs to focus on providing favorable investment climates, infrastructure and mortgage facilities.

3.1 SOCIAL HOUSING

Social housing is a term used to describe housing owned and managed by the state, and are not intended for profits, with the noble intend of providing housing for the less privileged of the society, in so case affordable rental housing. It is the provision of affordable, non-profit driven, mass produced houses for low income earners. For many Nigerians, housing is a big challenge. They cannot afford to rent a house let alone build one. Presently, there is a housing gap of 16 million. How does the nation bridge the gap? This is the difficult issue to which the government seems not to have an answer. Article 25 of the Universal Declaration of Human Rights states that "everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing, medical care and necessary social services and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control". Those who cannot afford a roof over their heads are those who don't earn income (the elderly, single parents, orphans and the unemployed). In the United Kingdom (UK), such people are provided free housing. In order to ensure mass housing, options in alternative materials that de-emphasize or minimize the use of cement is a focus in the new policy reform. It is an open secret that cement is a strong factor in the escalating cost of housing production in Nigeria. The author disagrees with the position of government on some aspect of social housing, because Olotuah (2000) reiterates the social responsibility of government in housing and the dangers inherent in abdicating its social duties in housing provision, moreover the concept worldwide is government providing housing free to the underprivileged citizen (single mothers, orphans, elder citizens and the unemployed. Many scholars and researchers had argued that as a signatory to the United Nations Declaration of Human Rights which recognizes housing as a human right, Nigeria must join her developed counterparts in putting in place policies that will boost homeownership among Nigerians and develop social housing for the no-income and low-income earners). A means the government can deliver social housing many scholars concur is by allocating free land to developers and controlling the price either for sale or rentals at the completion of the houses. This could come in the author's view of percentage like 30 per cent of the houses built allocated for social housing while 70 per cent at a cost.

3.2 LESSONS FROM OTHER ECONOMIES IN MANAGING THEIR HOUSING CRISIS

China's affordable Housing Strategy policy focused on solving the housing problems of low and medium income citizens and was able to deliver 12 million housing units within a 5 years period through the adoption of an integrated and sustainable housing development program. A recent reports from South African indicates over 50% of her populace living in their own wholly paid houses, attributed to the success of the South Africa Housing Strategy in the Reconstruction and Development Plan (RDP) program where 2.3million houses were delivered at the cost of R29.5billion for 15 years. The government introduced a zero tax (transfer duty) policy on housing that cost less than R500, 000 and 5% for units costing R500, 000 and R1million. Here, Government Housing subsidies played a key role for more than 2.8million households benefited from such subsidy.

3.3 LESSONS FOR NIGERI

Given the socio-economic and political significance of housing and infrastructure, government at all level and their agencies must be involved in housing delivery. Many scholars and researchers have advocated that government use the PPP concept as an effective tool. To achieve this, a government policy that supports the needed framework must be in place and strengthened. This should include more participation of the private sector with government intervention by subsidies. However, the balance is changing in response to economic and political policies that are supporting the development of independent social housing institutions. Government should therefore complete the mortgage sector reforms and encourage in strong terms Housing Cooperatives to transform into Real Estate Investment Trust (REITs) or Primary Mortgage Institutions (PMIs) as concurred by many scholars and researchers.

4 RECOMMENDATION

- Government should accord necessary priority to housing in budgetary allocation yearly in order to meet set targets of providing affordable housing.
- Administrative constraints within the operations of mortgage housing institutions, on land acquisition and mortgage finance should be waived.
- Political aid necessary for effective performance of housing institutions is imperative and need to be strengthened and corruption discouraged.
- Nigeria needs strong institutions to evolve and sustained thus transparency, due process and accountability should be strongly strengthened.

5 CONCLUSION

The paper thus examined Governance Policy within the framework of socio-political and economic conditions of the nation. It is, observed that a major index of failure of policies is corruption; the housing policy that presently concedes the major aspect of housing delivery to private developers is still inadequate, in the context of social housing. This is because majority of the houses provided by developers are beyond the reach of the masses due to the exorbitant price tag on them. The best policy option in the author's opinion, and shared by many scholars and researchers is that which facilitates self-help ownership at affordable price. Nigeria's housing finance system needs reinforcement through enabling laws and institutions that guarantee the urban and rural citizens easy access to credit facilities; consequently the housing reforms of government have had far-reaching effects on the psyche and socio-economic life of the people and the nation.

REFERENCES

[1] Adiukwu, F.O. (2011) *Compressed Stabilized Earth Blocks for Low-Cost Housing Production in Nigeria*-A paper presented at the International Conference on Research and Capacity Building. Theme: "*Attaining Africa's 21st Century Development Goals"* Organized by the International Research and Capacity Building Foundation and held at *the theatre Conference Hall University of Ghana, East Legon, Accra;* 15th and 16th, of September, 2011.

[2] Agbola T. (1998) *The Housing of Nigerians: A review of policy development and Implementation.* Research report No. 14, Development Policy Centre, Ibadan.

[3] Agbola, S.B. (2005) *"The Housing Debacle",* Inaugural Lecture Delivered at the University of Ibadan, Ibadan, 4 August.

[4] Ajanlekoko, J.S. (2001*) "Sustainable Housing Development in Nigeria- The Financial and Infrastructural Implication",* Paper Delivered of the International Conference on Spatical Information for sustainable Development, Nairobi, 2-5 October.

[5] Akeju, A.A. (2007) *"Challenges to Providing Affordable Housing in Nigeria"*, Paper presented at the 2nd Emerging Urban Africa International Conference on Housing Finance in Nigeria, Abuja, Oct. 17-19, 2007

[6] Barylisa, Kate (2006) "*Privatization Theory and Practice*": A critical Anaysis of Policy Evolution in the Developing Context" in Jamo, K.S. Ben Fine (ed) The New Development Economics, Tulika Books. Zeal Books, London.

[7] Federal Republic of Nigeria (2004). *"Draft of National Urban Development Policy, 2004"* Federal Ministry of Works and Housing, Abuja.

[8] Grigsby, W.G. et al (1975) *Urban Housing Policy,* APS Publications, Inc., New York.

[9] Karnad, R.S. (2004) *Housing Finance and the Economy: Regional Trends*, South Asia Perspective. Housing Development Finance Corporation Limited, India.

[10] Kenyl, C (2007). *Construction, Corruption and Developing Countries",* World Bank Policy Research Working Paper 4271

[11] National Planning Commission (2009). *"Report of the Vision 2020 National Technical Workshop Group on Housing", Nigeria Vision 2020 Programme*, NPC, Abuja

[12] Ogbuefi, J.U. and Adesanmi, M.A. (2004) "*The Effect of Macro Economic Factors on Housing Investment*" The Estate Surveyor. Vol 27 No. 1, March, 2004.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 420-426
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Prospects and Challenges of Informal Settlements and Urban Upgrading in Abuja

Adiukwu Fidelis Onyekachi

Department of Architecture,
Obafemi Awolowo University, Ile- Ife, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The paper studies Informal settlements in Abuja, from the analytical framework of poverty and homelessness. The environmental, socio-economic and cultural feature associated with population growth, is, highlighted to underscore the severity of issues. Drawings lessons from experiences of squatter settlement in Brazil, India, South Africa and other developed economies; paper underscores Government policies and interventions in upgrading 'slums' and 'squatters' settlements. The paper in conclusion suggests needs to improve and upgrade the general quality of the physical conditions of the environment of urban slums and squatters' settlements in the developed edges (Karu, Durumi, Nyanya, and Maraba) of Abuja, Nigeria.

KEYWORDS: Homelessness, Informal settlement, Poverty, Urban Upgrading

1 INTRODUCTION

Abuja with population of, 778,567 (NPC, 2006) is a planned modern city with magnificent buildings, and good road network, have undergone a growth rate of about 30 percent each year as evidence shows from recent reports. Large-scale migration from rural areas and other cities in Nigeria, particular, is amongst major reasons for population increase. Less than 30 years of being the capital city of Nigeria, there are informal settlements in the midst of magnificent modern buildings. "Squatter settlements" and "shantytowns" are, spreading rapidly in and outside the city limits (satellite towns) like *Karu, Durumi, Nyanya, and Maraba* amongst others. Many residents in these suburbs lack amongst others drainage, good physical and environmental conditions, sanitation, sewerage, and safe drinking water; their drinking water comes from wells and hand-pumped water boreholes. United Nations Human Settlements Program (UN-Habitat, 2003) reports, that squatters and urban poverty is not only a manifestation of population explosion, demographic change, and globalization; but also, the result of failed policies, poor governance, corruption, inappropriate regulation, dysfunctional land markets, deficient financial systems and a fundamental lack of political will. The population of residents in squatters and shantytowns in Abuja is rising daily. According to a report by the Global Urban Observatory (2003), urban poverty in developing Nations is usually concentrated in squatters and other informal settlements; and, these cities lack decent housing, inadequate facilities like water supply, sanitation, sewerage, drainage, community centers, and health care. This condition is similar to Abuja and many other cities in developing Nations. However, most of the residents of these informal settlements play important roles in the economy of the Abuja. They remain neglected. Regular fires, diseases, environmental degradation, crime, and evictions at short notice are constant experience of the large fraction of population in these settlements. This paper will in subsequent section suggest ways to bring better quality of life in these areas.

2 LITERATURE REVIEW AND CONCEPTUAL ISSUES

Rapid urbanization and inadequate capacity to cope with the housing needs of people in urban areas have contributed to the development of informal settlements. Living in these settlements often poses major health risks. Sanitation and drinking water quality are often poor, with the result that residents are, exposed to a wide range of unhealthy living conditions. Overcrowding can contribute to stress, violence and increased problems of drugs and other social related problems. The

Corresponding Author: Adiukwu Fidelis Onyekachi

environmental quality of an urban area has a serious effect on the health condition of residents. The negative consequences of poor environmental quality affect every aspect of their lives as well as the livability and health of the community at large. In many parts of the world millions of people live in informal urban settlements especially in developing Nations where lack of resources and inadequate infrastructural facilities lead to degradation of the environment. The issue of informal settlements in Abuja as the administrative center of Nigeria has been, aggravated by high rate of migration from other cities, people in search of better lives. The next section and subsections discusses informal settlements, poverty, and environmental condition of squatter settlers in Abuja. Socioeconomic and cultural quality of people living in these areas is, emphasized.

2.1 INFORMAL SETTLEMENTS

According to UN Habitat (2011), informal settlements are:

i) residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim, or which they occupy illegally;
ii) Unplanned settlements, and areas where housing, is not in compliance with existing planning and building regulations.

An informal settlement is a dwelling constructed usually without a formal design and standard specifications with regard to legal rules and regulations controlling urban developments in an urban areas, and usually of temporary structures. These settlements usually would not have access to public utilities like power, clean portable water, sanitation, and drainage. Social services like schools, hospitals, entertainment, churches, mosques, markets are rare. They are common features in developing Nations and are product of an urgent need for shelter by the urban poor. Informal settlements occur when land administration and planning fails to address the needs of the whole community. However, high land values and the basic instinct to survive are causing people to move and their activities to other urban and semi urban areas of *Karu, Durumi, Nyanya, and Maraba in* Abuja. In addition, some policies of the government are causing some important government agencies and institutions to be located outside the metropolitan area.

2.2 POVERTY

According to UNDP (2003), 80% of Nigerians lives under the poverty line (less than $1.00 per day). An equivalent of ₦160.00 exchange rate in 2014. The figure A. shows the endless and vicious cycle of poverty.

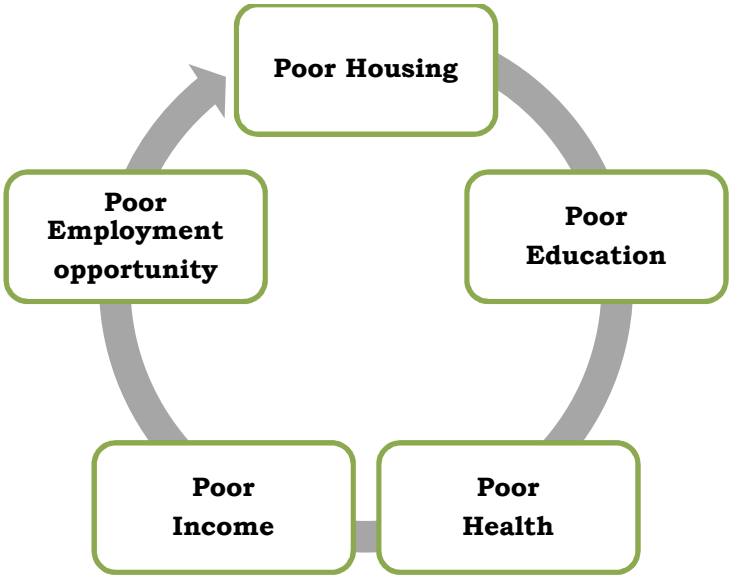


Fig. A: The Cycle of Poverty

Table: 1. Shows the effect of poverty on the demographic of Nigeria where now about 70% of its populace is poor (FOS and CIA, 2010). UN's World Summit on Social Development, the 'Copenhagen Declaration', states that Poverty is a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education, and information.

Table 1. Nigeria: Trend in Poverty Level, 1980-2010

	1980	1985	1992	1996	2010
Poverty level	28.1%	46.3%	42.7%	65.6%	70%
Estimated Total Population	65m	75m	91.5m	102.3	150m
Population Poverty	17.7m	34.7m	39.2m	67.1m	105m

Sources: *Compiled and calculated by the author from: federal (Nigeria) office of statistics' report for 1980 to 1996 and CIA World Fact Book February 2010*

Poverty has a social dimension (poor quality of housing and the living environment, i.e. lack of access to basic services like clean water, health care, education etc.). Abuja is one of the most rapidly urbanizing cities in Africa, faced with challenges of squatter settlers. The shelters are, built by the efforts of the squatters who cannot afford to secure legal or formal land or a safe site on which a house can be, built. Informal land developments provide shelter for over 85% of the population of urban residents in most developing Nations (UNCHS, 1996 and 2000; Durand-Lasserve, 1997).

2.2.1 URBAN POVERTY

Urban Poverty according to the Copenhagen, resolution (2000) is strongly associated with high levels of environmental risk. This is largely due to poor quality and overcrowded housing conditions and the inadequacies in provision of water, sanitation, drainage, health care, garbage/waste collection, poor percolation resulting into flood, building on waterways and pollution of land, air, and water. Daramola and Ibem (2010) affirmed that the concentration of more people in urban areas has brought more pressure on the land space for the production of food, infrastructure, housing, and industrialization. The movement affects the capacity of the environment to cope, as each additional person increases the demand on the infrastructure and the natural system and as result creating ecological imbalance with adverse environmental penalty in hazards and disaster.

2.3 HOMELESSNESS

The Housing (Homeless Persons) Act 1977 of the UK makes Housing Authorities responsible in respect of persons who are homeless or threatened, with homelessness. Circular no. 90/77 explains British Government's policy while Circular no. 116/77 is the code of guidance prepared by the Secretary of State for the Environment. A person is, classed homeless if:

She/he together with any person who might normally reside with her/him has

- no accommodation or cannot secure entry to her/his accommodation or it is probable that occupation of her/his accommodation will lead to violence,
- His accommodation consists of a moveable structure and there is no place, he is entitled to place it, and reside in it.
- Threatened with Homelessness if it is likely that he will become homeless within 28 days

3 CAUSES OF INFORMAL SETTLEMENTS

The following are amongst major influencing factors causing the increasing size and demography of informal settlements in Abuja

- The inability of the economy to cater for the housing needs of the low income and no income groups who form the majority.
- The deficit in housing supply as a result of a combination of factors including high population and urbanization growth rates, couples with high incidents of poverty amongst the population
- Failures to give the housing sector its due priority in general economic development. The sector competes with all others in accessing the limited resources of finance, management, labor, materials, and land
- Housing and urban development policies that tend to favor production of formal housing.

4 CHARACTERISTICS OF INFORMAL SETTLEMENT

4.1 LAND TENURE

Government owns most of this land. Some are, owned privately for speculation or actual development that is still on the drawing board waiting funding, approval or feasibility.

The land unused or no longer in use for long periods is easy targets for settlement for the homeless. Informal settlements spring upon these lands. Many poor and low-income families excluded from access to land and housing in the formal sector in Abuja find refuge in the informal settlements where land, housing is, purchased, and built according to means and capacity. They have no security of tenure because of lack of certificate of occupancy. However, many informal settlement residents has rights and interests in the land on which they live, having validly acquired land from legitimate land holding families or communities.

4.2 ENVIRONMENTAL CONDITION

In many parts of the world millions of people live in informal urban settlements especially in developing Nations where lack of resources and inadequate infrastructural facilities lead to degradation of the environment. Environmental degradation, inadequate basic services, and infrastructure in these areas are on the increase. Deteriorating environmental conditions populate poverty. Presently these areas in Abuja reflects the embodiment of the contemporary decay of urban life as evident in the standard of living, congested apartments, degraded environment, crime, among others.

4.3 THE STRUCTURES AND SOCIAL AMENITIES

Most structures are temporary, made of mud walls and roofs or mud walls and grass or other roof covering. Very few are more permanent, in concrete walls and occasionally tiled with no formal approval for building. They also lack social amenities like cinemas, theatre.

4.4 INFRASTRUCTURE

There usually in some cases, no electric power, no piped waters in the house, No roads, no sanitation, no drainage (Adiukwu, F.O & Akinsola F.F, 2011). There are a few latrines and contraptions used as bathrooms. Security outfit like a police station is lacking. The residents organize their own vigilante groups. Similarly, the residents themselves organize one of the other social infrastructures.

They build their own churches, mosques, and dispensaries.

4.5 LEGAL

Informal settlements are human habitats but without formal license, lease, and the tenants pay rent to unofficial property owners.

4.6 ECONOMIC & FINANCIAL

People with very low incomes and no obvious economic power occupy the informal settlements. They are not attractive to the regular investor who seeks a handsome return on investment. The issue of urban poverty in Nigeria as exemplified by the situation in Abuja being the administrative centre of Nigeria has, been aggravated by high rate of rural urban migration tied with the inability of the urban areas to create jobs for the immigrants.

4.7 SOCIO-CULTURAL

Informal settlements create their own ways of life that are typical for that kind of community.

There is harmony and comfort with the circumstances. People have made friends. Upgrading would disrupt a set pattern of life, since it will call for evacuation, displacement, relocation, and new neighborhoods.

4.8 INTERVENTIONS

Driven by the quest to eliminate or drastically curb the spread of informal settlements, the government utilizes forced eviction as a tool of urban engineering with counter-productive outcomes. Urban experts estimates that 800,000 urban residents were, forcibly evicted from informal settlements, in Abuja from the year 2003 to 2007. Every time informal settlements are, destroyed, people's livelihoods, home and place of solace is shattered. In addition to the broad range of social, economic, psychological, cultural, and 'havoc' inflicted on the victims, forced eviction has helped in no small measures to stimulate the growth of new informal settlements with more complex dimensions.

5 PROSPECTS OF UPGRADING INFORMAL SETTLEMENTS

In 2001, urban experts estimate that 924 million people, or 32% of the world's urban population, lived in slums, 43 per cent in developing nations, and 6 % in developed economies. This is projected to, rise to 2 billion, in 30 years. Because of this trend, there is growing global concern about slums, as manifested in the recent United Nations Millennium Declaration and subsequent identification of new development priorities by the international community. Slums are a physical and spatial manifestation of urban poverty and intra – city inequality. However, slums do not accommodate all of the urban poor, nor are all slum dwellers always poor. In facing the challenge of slums, urban development policies should more vigorously address the issue of livelihoods of slum dwellers and urban poverty, going beyond traditional approaches that concentrate on improvement of housing, infrastructure, and the physical environmental conditions. Up-scaling and replication of slum upgrading is among the most important of the strategies acclaimed by most researchers and scholars that have received greater emphasis in recent years, though it should be recognized that slum upgrading is only one solution among several others. For slum policies to be successful, the apathy and lack of political will of government needs to be, reversed. There is great potential for enhancing the effectiveness of slum policies by fully involving the urban poor and those traditionally responsible for investment in housing development. This requires urban policies to be more inclusive. National approaches to slums and to informal settlements in particular, have generally shifted from negative policies such as forced eviction, neglect, and involuntary resettlement, to more positive policies such as self-help, and *in-situ* upgrading, and right– based policies.

Abuja finds herself faced with the challenge and opportunity to house her citizens better and make decent amenities available to all as a matter of right. This has a direct impact on the national security and national conscience. Strategies to deal with squatters need to be, given adequate consideration much more than the provision of housing and physical services. They need to consider, among other things, questions of governance and political will; of ownership and rights; of social capital and access; and of planning, coordination, and partnerships between all the various partners in urban activities.

5.1 STRATEGIES FOR UPGRADING INFORMAL SETTLEMENTS

There are many overall strategies for upgrading informal settlements, but the primary goals of upgrading projects are to provide secure land tenure in informal and often illegal areas, and to improve basic infrastructure and service delivery. Upgrading housing and retrofitting infrastructure for water supply, sanitation, transport, and energy services are critical for improving the lives of slum dwellers. Where feasible community groups should be, allowed, and supported to, play active roles in preparing and executing plans for slum upgrading. Slum upgrading requires a stronger focus on networked technologies, such as sewers, piped water, and electricity grids. Investments in improved sanitation should receive high priority to improve the quality of life and reduce the high burden of oral-fecal diseases in informal settlements caused by widespread open defecation. The high density of informal settlements makes sanitation particularly precarious. Where space constraints are high, low- cost communal toilet blocks have been, used successfully. Effective hygiene education and awareness building programs are essential to create demand for sanitation and to ensure adequate use by all household. Other investments required as part of slum upgrading include storm drainage, community facilities, local markets, and street lighting and Health services.

5.1.1 JOBS CREATION

Good infrastructure attracts domestic and foreign investment, which is necessary for large-scale job creation. A task for urban planners is to improve industrial efficiency and attract foreign investors with industrial parks, export-processing zones, or other designated areas for private sector development. Equally important are measures to support the informal sector, where most of the urban poor work in low paid, low productivity, and low security jobs.

5.1.2 PROVIDING ALTERNATIVES TO SLUM FORMATION

Abuja like many other cities in developing nations will continue to grow at a fast pace, local authorities and national governments need to strengthen urban planning and development strategies to provide alternatives to slum formation. Government needs to make land available to the poor at affordable prices and ensuring the provision of housing and infrastructure. Moreover, transport services at the fringes of the city and urban planning can provide alternatives to the formation of new slums. Local authorities should also provide much of the trunk infrastructure in development areas and establish clear regulatory standards regarding minimum land plot sizes, infrastructure standards, and so forth. Sound urban planning and standards are central in averting or mitigating the impact of floods, landslides, and storms. This calls for setting up of standards in liaison with the "settlers", the professionals, the builders, the local authorities. Upgrade of informal settlements would be the act of improving and creating order in the dwelling communities.

5.1.3 EXPANDING INFRASTRUCTURE

To complement the upgrading of individual informal settlements, most scholars and researchers affirm that citywide infrastructure and services need to be extended, and upgraded. A high priority should be meeting the transport needs through investments in transport services and infrastructure, such as footpaths, kerbing, bus lanes, roads, and mass transit systems. In many cases, investments in mass transit systems do not require expensive infrastructure. In the developed economies, many large cities have successfully developed efficient bus-based mass transit systems that can provide transport services to the poor at a moderate charge. Also important are policy changes to improve the availability of low- cost means of transport, including bicycles. In addition, effective regulation of industrial water and air pollution must complement an urban development strategy to ensure safe urban environment. Solid waste disposal using well designed landfills, wastewater and sewage treatment need to be, provided.

5.1.4 DEALING WITH LICENSES

According to the Doing Business in 2007 report, getting a license for construction permits or approvals in Nigeria it takes 16 procedures. There are usually delays in receiving permits for construction. The procedures are complex and expensive. This encourages illegal construction as well as squatter settlements with its attendant health and environmental risks. Reforming licensing requirements in Nigeria by reducing the processing time as well as decreasing the costs – would not only increase the size of the formal construction sector but also reduce the costs of housing construction.

6 CONCLUSION

As Abuja continues to develop, innovative policies and practices are, needed so that development is equitable and sustainable. The initiatives of South Africa in addressing squatter settlements, for example, have been very successful in which people living in informal settlements, who had no urban services were supplied with water, sanitation, and access to housing. In Brazil, there have been cases where slum dwellers are given right to, land. Abuja being a federal capital city needs infrastructure, and basic services to cope. It has been, ascertained that the urban "squatter" resident lack basic infrastructural facilities and live in unsafe condition. The majority of them are poor. Therefore, adequate infrastructure facilities and decent housing are some measures suggested for an effective urban upgrading.

REFERENCES

[1] Adiukwu, F.O and Akinsola F.F (2011) "Solid Waste Management and Urban Transformation in Nigeria: *Ethical Issues*", Nigerian Journal of Environmental Research and Policies, Volume 6, No.3, pp.127-131

[2] Daramola A & Ibem I (2010): Urban Environmental Problems in Nigeria: Implications For Sustainable Development". *Journal of Sustainable Development in Africa 12(1)*

[3] Durand-Lasserve, A. (1997): 'Regularizing land markets', Habitat Debate 3(2): 11–12

[4] Global Urban Observatory (2003): Squatters of the World: The face of urban poverty in the New Guidance Sheets. London: DFID *Retrieved July 13, 2013, from http://www.livelihoods. or http://www.unhabitat.org/*

[5] National Population Commission (2006) – Nigeria's *National Population Figures,* NPC

[6] UNCHS/HABITAT (1996): An Urbanizing World. *Global Report on Human Settlements. London:* Oxford University Press (for United Nations Centre for Human Settlements).Urban Poverty and Environmental Conditions in Informal Settlements of Ajegunle, Lagos Nigeria

[7] UN-HABITAT (2003); Squatters of the World: The Face of Urban Poverty in the New Millennium. Nairobi. *Retrieved on july12, 2012 from http://www.unhabitat.org/publication/slumreport.pdf*

[8] UNDP (2003) - *Human Development Index 2002*. New York: UNDP.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 427-432
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Synthesis and Optical Characteristics of CdSe/ZnS core/shell Nanocrystals

M.R. Karim[1-2], Z. Ferdous[2], and Hilmi Ünlü[1]

[1]Department of Physics,
Istanbul Technical University, Maslak 34469,
Istanbul, Turkey

[2]Department of Physics,
Dhaka University of Engineering & Technology, Gazipur,
Gazipur, Bangladesh

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The CdSe/ZnS core-shell nanocrystals (NCs) are synthesized by a simple and low cost chemical route. The optical properties of the prepared samples are characterized by UV–Vis absorption spectroscopy, fluorescence spectroscopy, quantum yields (QYs) and Transmission electron microscopy (TEM). The studies show that CdSe/ZnS nanocrystals sizes at the first excitonic absorption peak increase with increasing time and temperatures. The spectroscopic study of the prepared CdSe/ZnS core-shell nanoparticles shows that the crystal size of the nanoparticles are in the range of 4.47-5.41nm. TEM results reveal that CdSe nanoparticles are well-ordered crystallized with average particle sizes 4.5-5.5 nm. Fluorescence analysis of the synthesized CdSe/ZnS NCs samples reveals that CdSe/ZnS NCs of the crystal size range 5.25-5.74 nm exhibit luminescence output peak around 550-570 nm. The homogenous formation of CdSe/ZnS NCs core-shell are confirmed by the maintained full-width at half maximum (FWHM) of fluorescence emission spectra for the samples prepared under different time. At the room temperature fluorescence QYs of CdSe/ZnS NCs are 27%-45%.

KEYWORDS: Quantum dots, Quantum yield, TEM, Absorbance and Fluorescence emission spectra.

1 INTRODUCTION

Semiconductor quantum dots are tiny clusters of semiconductor material, fabricated length scales between nanometers and a few microns. Quantum dots (QDs) are important because of their applications in solar cells, light-emitting diodes (LEDs), fluorescent biosensors etc [1-4]. A semiconductor quantum dot (also known as 'nanocrystal'or 'quantum box' and abbreviated as 'QD' or 'NC' or 'QB') is a three dimensional (also known as 'zero dimensional') confined structure of semiconductor compounds whose dimensions lie in the range 1nm-20nm. Nanocrystals of one material can be embedded in a shell of another material, and in some cases epitaxial growth is even possible. For example, the growth of epitaxial shells of ZnS around spherical and core CdSe nanoparticles are well established. The UV-Vis absorption spectroscopy (UV-Vis analysis) and fluorescence spectroscopy (FL analysis) reveals the energy state in CdSe/ZnS NCs that causes luminescence [1-2]. The proper passivation of the nanocrystal surfaces is necessary to achieve a high quantum yield (QY). The inorganic passivation of nanocrystal with higher band gap materials, resulting in core/shell structure nanocrystals such as CdSe/ZnS and CdSe/CdS, showed high quantum efficiency up to 50% because of the robust passivation of the surface defects and also the quantum confinement effect which enhances exciton recombination in the core [5-10]. In the present investigation, we address the fluorescence QYs in CdSe/ZnS NCs by determining the ratio of the number of photons emitted to the number of photons absorbed in a given sample. We used UV–Vis absorption and fluorescence spectra for optical properties and TEM for morphological and structural studies.

Corresponding Author: M.R. Karim

2 SYNTHESIS OF CDSE/ZNS NANOCRYSTALS

The CdSe nanocrystals were synthesized by using modifications of R. He and H. Gu's method [11]. 0.69g cadmium acetate and 2.5 mL oleic acid were dissolved with 10 mL phenyl ether in three neck flask. The reaction mixture was heated 140^0C under stirring and continuous nitrogen flow, and then the mixture was cooled. 3 mL 1M TOPSe was added to mixture, rapidly, heated to 160^0-170^0C and 1-20 min. The ZnS nanocrystals have been synthesized by using modifications of Chang-Qing Zhu et. al [6]. Typically, the resulting core solution (reaction for 1-20 min), $Zn(OAc)_2 \cdot 2H_2O$ (0.085 mmol) and S powder (0.085 mmol) were mixed together in the reaction vessel. The reaction volume was adjusted to 15 mL by adding paraffin liquid. Next, with stirring, the mixture was degassed at 80 °C for 20 min. Afterward, temperature was set to 160 °C to 170 °C for the shell growth under N_2 atmosphere. The reaction mixture was cooled to room temperature after 50 min. To grow shell ZnS with different thicknesses around a CdSe core, a seeding-growth technique [7] was applied. After samples cooling to room temperature, the purposed method has been done 1 mL aliquot crude solution has washed with methanol and isolated by centrifugation to remove excess insoluble organics and salts that may have formed during the reaction. After fine isolation of growth CdSe/ZnS, the precipitation has been dissolved with different volume of hexane.

3 CHARACTERIZATION

The reaction process was monitored by UV-Vis absorption spectra with aliquots taken from different time and temperature. In addition to characterize quantum dots, the absorption spectra were used to estimate the size. The fluorescence emission spectra were measured at room temperature using by a fluorescence spectrophotometer. We intend to find the wavelength at which the prepared samples show fluorescence peaks. With excitation wavelength, FL spectra are taken at room temperature. The QYs of NCs were calculated by following the procedure which was used previously [12-14] by comparing with Rhodamine-101 in ethanol, with an assumption of its QYs as 95%, and using data estimated from the fluorescence and the absorption spectra.

$$\phi_x = \phi_s \left(\frac{I_x}{I_s} \right) \left(\frac{A_s}{A_x} \right) \left(\frac{n_x^2}{n_s^2} \right)$$

In this equation, Where

I_x (sample) and I_s (standard) are the integrated emission peak areas;

A_x (sample) and A_s (standard) are the absorption;

n_x (sample) and n_s (standard) are the refractive indices of the solvents;

and Φ_x and Φ_s are the fluorescence QYs for the sample and the standard, respectively.

4 RESULTS AND DISCUSSIONS

Record the absorbance spectra of different CdSe/ZnS nanocrystals. Determine the wavelength (λ_{max}) of the absorbance peaks. The absorbance peaks are identified in the CdSe/ZnS nanocrystals optical spectra shown below in fig 1.

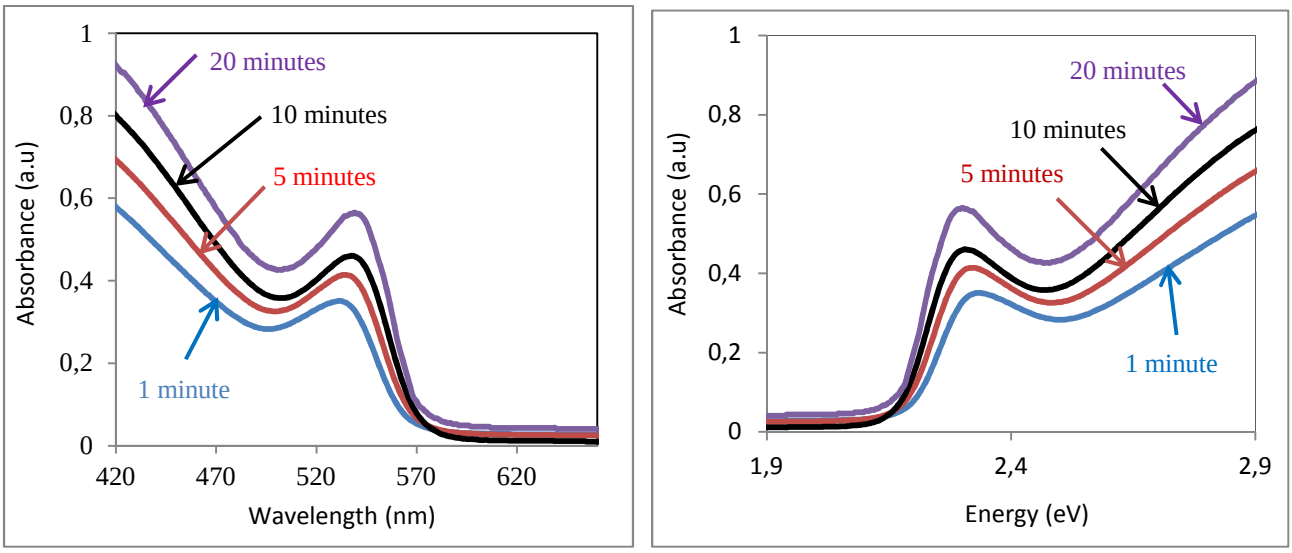


Fig. 1. Absorbace spectra vs (a) wavelength and (b) energy of CdSe/ZnS Nanocrystals at 160^0 C for different times.

In addition temperature effect, we explained time effect of the growth of quantum dots during the reaction process. For this purposed, different reaction times were used to synthesize to CdSe/ZnS NCs. UV-vis absorption spectra explained the formation of the different size according to variation of the reaction time. Fig.1 showed that size of the CdSe/ZnS NCs responded the reaction temperature. At higher reaction temperature larger particles were obtained. Synthesis at high temperatures results in high rate attaching and larger particle size and quick growth of the nanoparticle which are included in Table 1.

Table 1: Values of Particle size and number of CdSe/ZnS NCs for various time and temperatures.

Reaction Temp. (^{o}C)	Reaction Time (Min)	Peak Absorbance Wavelength (nm)	Exciton Energy, (eV)	Quantum Dots Size (nm)	Particle Number
160	1	532	2.33	4.4701	6194
	5	535	2.32	4.9364	6412
	10	538	2.31	4.9842	6640
	20	539	2.30	5.0038	6718
170	1	549	2.26	5.2307	7674
	5	552	2.25	5.2965	7967
	10	555	2.23	5.3643	8278
	20	557	2.22	5.4106	8493

It is seen that from the table the exciton energy at first peak absorption of CdSe/ZnS NCs decreased with increasing time and temperatures whereas the values particle size and particle number increased with increasing time and temperatures as shown in fig 2.

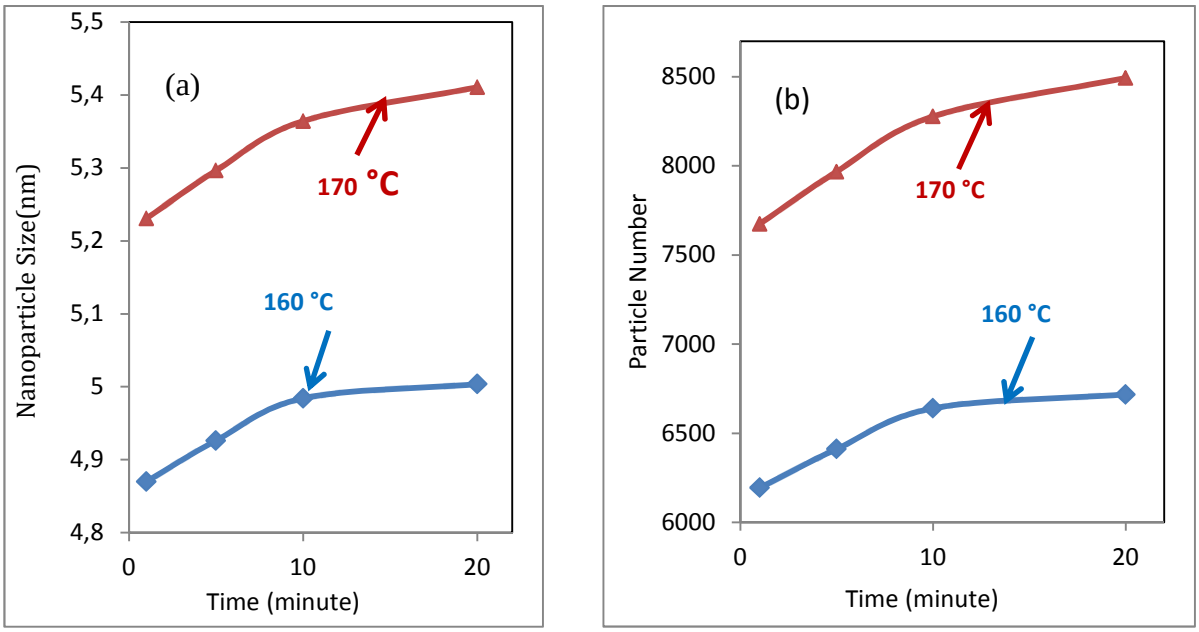


Fig. 2. (a) Nanoparticle size and (b) Particle number at the first peak absorption of CdSe/ZnS Nanocrystals for different times.

The shape and size of CdSe NCs were also observed by TEM as shown in fig.3. TEM Average size sizes of NCs were found to be 4.5-5.5 nm, which accords well with UV-Vis spectrum results [15,16].

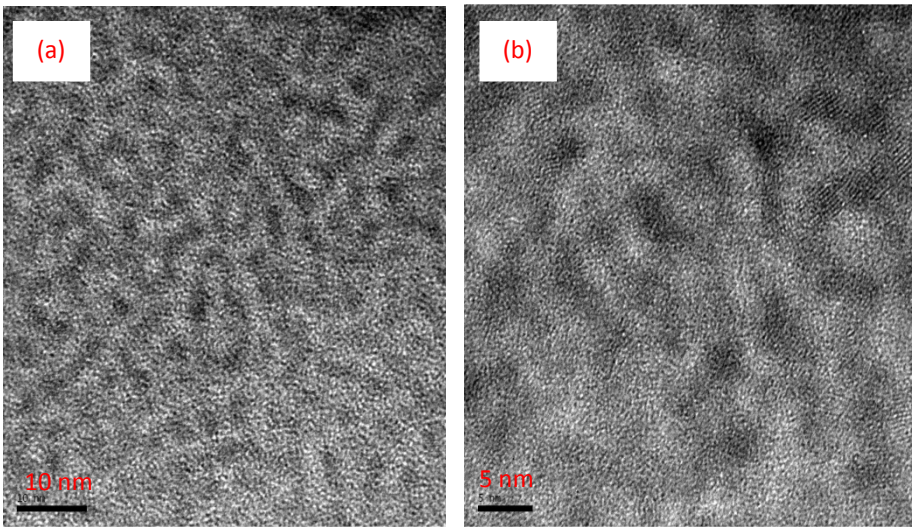


Fig. 3. TEM images of CdSe/ZnS nanocrystals at 20 minutes for (a) 160^{0}C at 10 nm scale bar and (b) 170^{0}C at 5 nm scale bar.

Fluorescence (FL) emission spectra of all the samples are shown in Fig. 3(a). From these spectra, it can be observed that the FL output wavelengths corresponding to the peaks are 560 to 570 nm for the samples of CdSe/ZnS NCs at 170^0 C for 1-20 min.

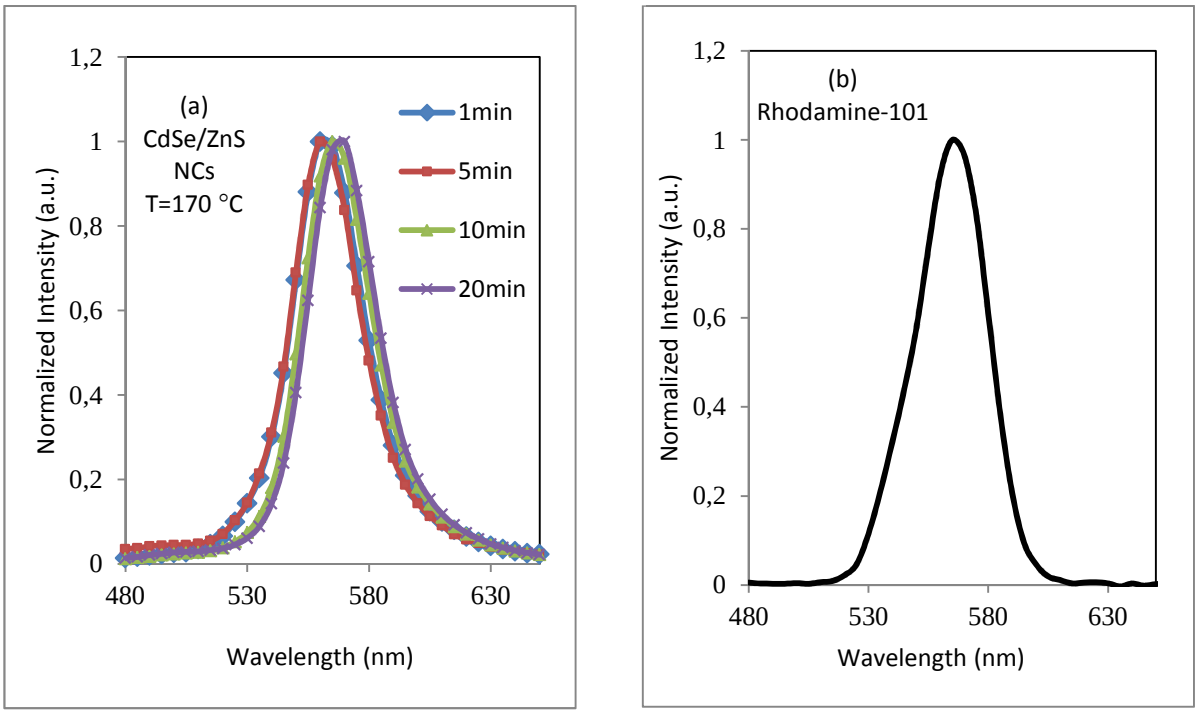


Fig. 4. Normalized fluorescence emission spectra vs wavelength of (a) CdSe/ZnS Nanocrystals at 170^0 C for different times and (b) Rhodamine-101

The overall values of those samples the fluorescence intensity and the emission peaks increase with increasing time and temperatures to the particle size. The band-edge emission of CdSe/ZnS NCs is 560 nm and the corresponding full width at half-maximum (FWHM) of the band-edge luminescence is around 32 nm. The emission peaks of CdSe/ZnS NCs range from 560 to 570 nm, and the corresponding full width at half-maximum (FWHM) of the band-edge luminescence was maintained between 32- 36 nm. The reason for the fluorescence of CdSe/ZnS NCs is the recombination of electrons and holes due to surface-trapped electrons and holes by quantum confinement.

Fig. 4 shows the emission spectra (normalized to the first emission maximum) of CdSe NCs taken at different time intervals and Rhodamine-101. This experiment used the change in fluorescence quantum yield (QY) due to coating CdSe NCs with ZnS as comparison with Rhodamine-101 in ethanol. The room temperature QY of CdSe/ZnS NCs are 27%-45%. The Values of Peak intensity, FWHM and quantum yield (QY) of CdSe/ZnS NCs for various time and temperatures obtained from the plots of Fig. 4 are included in Table 2.

Table 2: Values of Peak intensity, FWHM and quantum yield (QY) of CdSe/ZnS NCs for various time and temperatures.

Reaction Temp. (^{o}C)	Reaction Time (Min)	Peak Intensity Wavelength (nm)	Quantum Dots Size (nm)	FWHM (nm)	QY (%)
160	1	550	5.25	32	27
	5	553	5.32	33	41
	10	554	5.34	32	45
	20	556	5.39	36	36
170	1	560	5.48	35	28
	5	563	5.56	34	40
	10	565	5.61	33	44
	20	570	5.74	33	42

5 CONCLUSION

In conclusion, with increasing time and temperatures the nanoparticles become slowly disordered hence the exciton energy decreases whereas the nanoparticle size increases slowly. It is due to size effect which depends on the

thermodynamic properties of nanoparticles. From UV-Vis absorption spectra the diameters of resulting CdSe/ZnS NCs are about 4.47 - 5.41 nm with narrow size distribution. TEM images show that the nanoparticles are close to spherical and the size of nanoparticles measured from the image in good agreement with the calculation of UV-Vis absorption spectrum of our study. The fluorescence emission peak increases with increasing times and temperatures due to the particle size. Results show that nearly monodispersed and different size nanocrystals are obtained efficiently. FWHM of the fluorescence spectrum does not change more than ±2 nm (34±2 nm), indicating that a narrow, symmetric emission spectrum and small size dispersion can be maintained. The high fluorescence quantum yield is achieved for size of CdSe/ZnS NCs. The synthesized CdSe/ZnS NCs core-shell with high QYs will find potential applications.

ACKNOWLEDGMENT

The authors would like to acknowledge Istanbul Technical University Research Foundation (ITU-BAP Project no. 34537) and Research and Extension Project, DUET, Gazipur for their financial support.

REFERENCES

[1] Zhu, H., Prakash, A., Benoit, D. N., Jones, C. J., & Colvin, V. L., "Low temperature synthesis of ZnS and CdZnS shells on CdSe quantum dots." Nanotechnology, **21**(25), 255604, 2010.

[2] Nadarajah, A., Smith, T., &Könenkamp, R., "Improved performance of nanowire-quantum-dot-polymer solar cells by chemical treatment of the quantum dot with ligand and solvent materials." (2012).*Nanotechnology*, ***23***(48), 485403.

[3] C. Y. Huang, Y. K. Su, T. C. Wen, T. F. Guo and M. L. Tu, "Single-layered hybrid DBPPV-CdSe-ZnS quantum-dot light-emitting diodes", IEEE Photonics Technology Letters **20**, 282–284, 2008

[4] Deng, L., Han, L., Xi, Y., Li, X., & Huang, W. "Design Optimization for High-Performance Self-Assembled Quantum Dot Lasers With Fabry–Perot Cavity." IEEE Photonics Journal, **4**(5), 1600-1609, 2012.

[5] L. E. Brus, ``A Simple Model for the Ionization Potential, Electron Affinity, and Aqueous Redox Potentials of Small Semiconductor Crystallites,'' J. Chem. Phys. ***79***, 5566, 1983.

[6] W. Luan, H. Yang and N Fan, "Synthesis of efficiently green luminescent CdSe/ZnS nanocrystals via micro fluidic reaction", Nanoscale Res. Lett., **3**, 134-139. 2008.

[7] Neeleshwar, S., Chen, C. L. & Tsai, C. B., Chen, Y. Y. Size-dependent properties of CdSe quantum dots. *Physical Review B* **71**, 201307, 1-4. 2005.

[8] Dey, S. C., Nath, S. S. & Bhattacherjee R. "Optical Properties of Colloidal CdSe Quantum Dots", *Micro & Nano Letters* **6**, Iss. 3, pp 113-115, 2011.

[9] M. Grabolle, M. Spieles, V. Lesnyak, N. Gaponik, A. Eychmuller and U. Resch-Genger, Anal. Chem. **81**, pp 6285-6294. 2009.

[10] Wang Q, Pan DC, Jiang SC, Ji XL*, An LJ, Jiang BZ, "A New Two-phase Route to High-Quality CdS Nanocrystals.", Chemistry-A European Journal, **11**, 3843-3848, 2005.

[11] R. He, H. Gu, "Synthesis and Characterization of monodispersed CdSe nanocrystals at lower temperature", Colloids and Surfaces A: Physicochem. Eng. Aspects, **272** 111-116. 2006.

[12] S.L. Cumberhand, K.M. Hanif, A. Javier, G.A. Khitrov, G.F. Strouse, S.M. Woessner, C.S. Yun, "Inorganic Clusters as Single-Source Precursors for Preparation of CdSe, ZnSe, and CdSe/ZnS Nanomaterials.", Chem. Mater. **14**, 1576, 2002.

[13] Chang-Qing Zhu, Peng Wang and Xin Wang, "Facile phosphine-free synthesis of CdSe/ZnS core/shell nanocrystals without precursor injection", Nanoscale Res. Lett., **3**, pp 213-220. 2008.

[14] Z.T. Deng, L. Cao, F.Q. Tang, B.S. Zou, "A new route to zinc-blende CdSe nanocrystals : mechanism and synthesis." J. Phys. Chem. B **109**, pp 16671, 2005.

[15] M.R. Karim, A. Baysal, H.H.Gürel, O. Akinci, A.K. Türkoğlu, H. Ünlü, "Temperature Dependent Size Calculations of CdSe Quantum Dots." NanoTr5 Proc. pp, **197,** 2009.

[16] P. Srivastava and K. Singh, "Synthesis of CdSe nanoparticles by solvothermal route: Structural, optical and spectroscopic properties." Adv. Mat. Lett **3**(4) pp. 340-344, 2012.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 433-438
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Effect of SiCp addition on the indentation hardness of as-cast Al metal matrix composites

Tawsif Ahmed Siddique, Md. Tanjidul Islam, Mohammad Sharear Kabir, and Md. Nasrul Haque

Dept of Materials and Metallurgical Engineering,
Bangladesh University of Engineering and Technology, Dhaka-1000, Bangladesh

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The indentation hardness of Al-SiCp metal-matrix composites synthesized by stir casting process was investigated. Stir casting method was selected as the casting method due to its simplicity, flexibility and applicability. This method allows a conventional metal processing route to be used which minimizes the cost of the product. The silicon carbide particles to be used were first ball milled for size reduction. These particles were then sieved in a mechanical shaker to obtain different particle sizes. SiC particles of size 74µm corresponding to mesh 200 were selected for addition to the Al matrix. The composite was prepared by adding preheated SiC particles to the Aluminium melt via stir casting. Test specimens were prepared by varying the wt% of SiC (1%, 3%, 5%, 7% and 9%). As the SiCp additions were increased, the hardness of the composite increased to a large extent. This can be attributed to the uniform distribution of the SiC particles in the Al matrix via stir casting method.

KEYWORDS: SiCp, indentation hardness, as-cast Al metal matrix composites.

1 INTRODUCTION

The mechanical properties that can be obtained with metal matrix composites (MMCs) in combination with their relatively low cost processing methods have made them attractive for numerous applications in various fields including aerospace, automotive and sports industries [1, 2]. More specifically, particulate MMCs (PMMCs) have been shown to offer improvements in strength, wear resistance, structural efficiency, reliability and control of physical properties such as density and coefficient of thermal expansion, thereby providing improved engineering performance in comparison to the unreinforced matrix [1-7]. PMMCs are attractive not only for their aforementioned mechanical properties, but also because of the low cost availability of reinforcements.

Furthermore, problems associated with the continuously reinforced MMCs, such as microstructural non-uniformity, fibre-to fibre contact and extensive interfacial reactions can be avoided [5]. PMMCs have attracted considerable attention on account of the use of discontinuous reinforcements. This minimizes problems associated with fabrication of continuously reinforced metal-matrix composites such as fiber damage, fiber mismatch and inter-facial reactions. For applications subjected to severe loads or extreme thermal fluctuations such as in automotive components, discontinuously-reinforced metal matrix composites have been shown to offer near isotropic properties with substantial improvements in strength and stiffness, relative to those available with monolithic materials [6].

One of the major challenges when processing MMCs is achieving a homogeneous distribution of reinforcement in the matrix as it has a strong impact on the properties and the quality of the material [1-8]. To obtain a specific mechanical/physical property, ideally, the MMC should consist of fine particles distributed uniformly in a ductile matrix and with clean interfaces between particle and matrix. However, the current processing methods often produce agglomerated particles in the ductile matrix and as a result they exhibit extremely low ductility [9,10]. Clustering leads to a non-homogeneous response and lower macroscopic mechanical properties. Particle clusters act as crack or de-cohesion nucleation sites at stresses lower than the matrix yield strength, causing the MMC to fail at unpredictable low stress levels

Corresponding Author: Md. Tanjidul Islam

[11,12]. Possible reasons resulting in particle clustering are chemical binding, surface energy reduction or particle segregation [13].

Stir casting technique is currently the most common practiced commercial method for processing MMCs. This approach involves mechanical mixing of the reinforcement particulates/particles into a molten metal bath. A simplified apparatus is shown in Fig. 1, and typically is comprised of a heated crucible containing molten aluminum metal, with a motor that drives a paddle, or mixing impeller, that is submerged into the melt. The reinforcement is poured into the crucible above the melt surface and at a controlled rate, to ensure a smooth and continuous feed. As the impeller rotates at moderate speeds, it generates a vortex that draws the reinforcement particles into the melt from the surface. The impeller is designed to create a high level of shear, which helps strip adsorbed gases from the surface of the particles. The high shear also engulfs the particles in molten aluminum, which promotes wetting. Proper mixing techniques and optimized impeller design are required to produce adequate melt circulation and homogeneous distribution of the reinforcement.

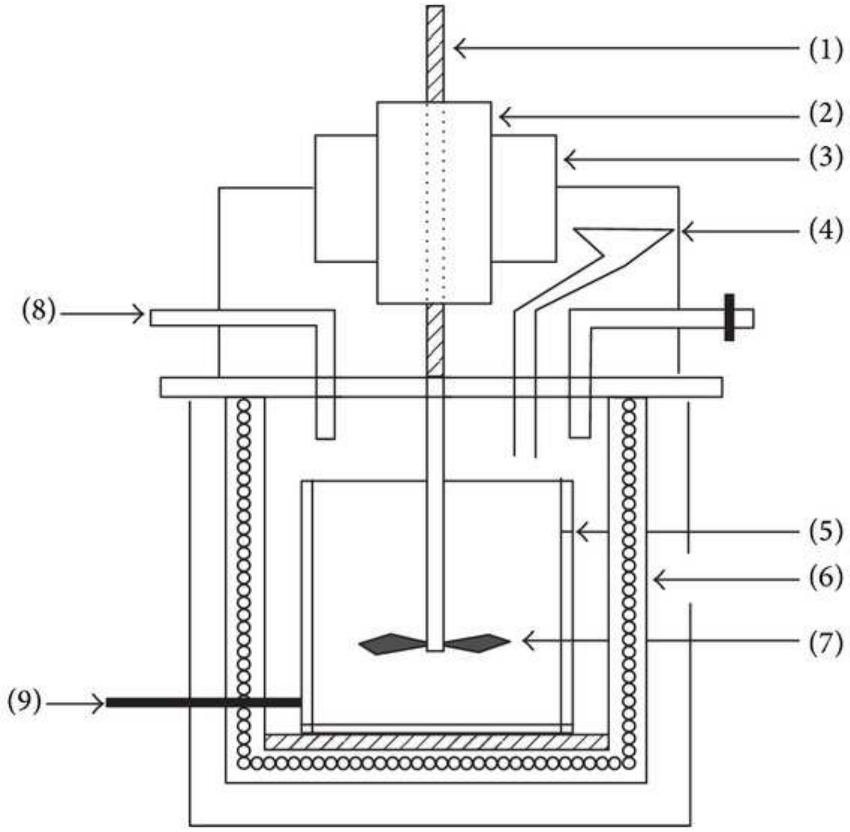


Fig. 1: Schematic of stir casting setup. (1) Stirrer spindle, (2) sliding mechanism with impeller position control unit, (3) electric motor, (4) sprue, (5) crucible, (6) electric furnace, (7) impeller, (8) argon gas inlet, and (9) thermocouple; [14]

In the present work, Al-SiCp PMMC was produced by stir casting process, whereby the SiC particulates were introduced into the molten metal through a vortex introduced by mechanical agitation. SiCp additions were varied for each castings i.e. 1 wt%, 3 wt%, 5 wt%, 7 wt% and 9 wt%. After casting the microstructure of the composite was studied by scanning electron microscope. The distribution of the SiC particles in the Al matrix was observed and the wear behaviour of the composite was studied under dry sliding conditions.

2 MATERIALS AND METHODS

2.1 PREPARATION OF SiC PARTICULATES

The coarse SiC particulates were ball milled to finer size in a ball mill containing cast iron balls as the grinding medium. The procedure was carried out for eight hours. After size reduction, the SiC particulates were then poured into the top sieve of a nested column of sieves with wire mesh cloth to perform sieve analysis by a mechanical shaker. After sieving was

complete, SiC particle size of 74µm corresponding to mesh size 200 was separated and weighed. The 74µm SiC particles were then used for the production of the composites.

2.2 PREPARATION OF STIRRER

For the agitation of the molten metal, a graphite stirrer was constructed out of a cylindrical graphite block. The stirrer was made into graphite shaft of 2 inch diameter and a feet length as shown in Fig. 2 (a).

2.3 SELECTED PRODUCTION TECHNIQUE

Stir casting process was used as a production technique to produce aluminum based silicon carbide particulate metal matrix composites. Stir casting is a primary process of composite production whereby the reinforcement ingredient material is incorporated into the molten metal by stirring. Its advantages lie in its simplicity, flexibility and applicability to large quantity production. It is also attractive because, in principle, it allows a conventional metal processing route to be used, and hence minimizes the final cost of the product. This liquid metallurgy technique is the most economical of all the available routes for metal matrix composite production [4]. The setup is shown in Fig. 2 (c).

2.4 SPECIMEN PREPARATION

Commercially pure (99.99%) aluminium was melted in a crucible placed in a muffle furnace and superheated to 850^{0}C. Meanwhile SiC particles were preheated in a furnace for 3 hours at a temperature of 1000^{0}C. The preheating of SiC particles was carried out to oxidize the surfaces of the particles and to improve their wettability with the aluminum matrix. The molten metal was then stirred by a graphite stirrer at 650 rpm and preheated SiC particles were then added to the melt as a vortex formed due to stirring as shown in Fig. 2 (b). Stirring was carried out for 2 minutes in the furnace for each casting. The melt was then poured into cylindrical metal molds and cooled to room temperature.

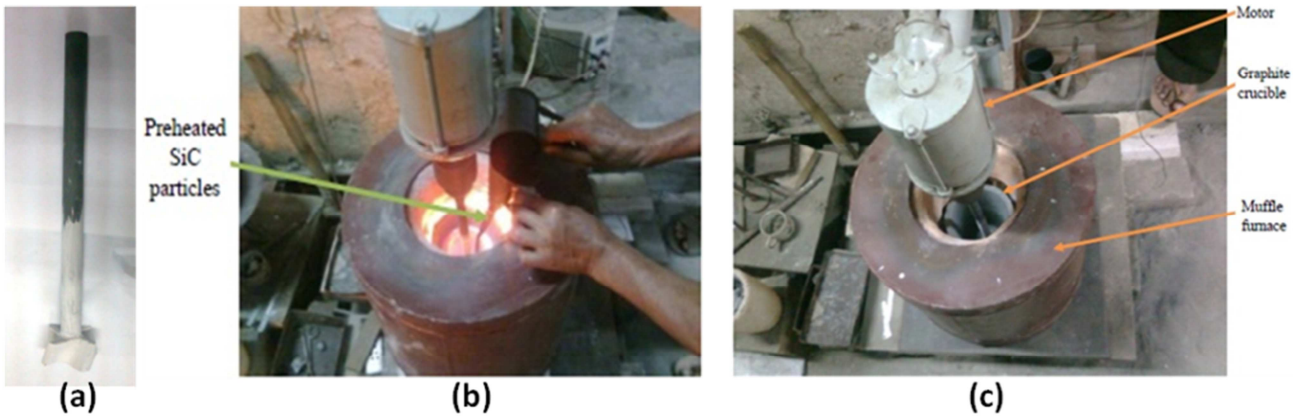


Fig. 2 (a) Graphite stirrer, (b) Addition of SiC particles into the melt, (c) Stir casting setup

2.5 MICROSTRUCTURAL ANALYSIS

The test specimens required for analysis were machined to cylindrical specimens and were then ground in successive steps using silicon carbide abrasive papers of various grit sizes. The ground specimens were then finely polished on a velvet cloth using a suspension of alumina (Al_2O_3) powder in acetone. The specimens were then washed and dried with acetone before mounting. The microstructures of the specimens were studied using a metallurgical microscope.

2.6 HARDNESS TEST

The hardness values of the samples were determined (ASTM-E10) using the Brinell hardness tester. The **Brinell hardness test** was conducted by applying 500 kg load **(L)** for 15 seconds with a ball of 10 mm diameter **(D)** on the surface of the sample of the different cast product of aluminium based SiC metal matrix composites. Then the diameter of the impression **(d)** has been measured by the scale. Then the hardness was calculated by the equation (1) given below:

$$\mathbf{HB} = \frac{2L}{\Pi D(D-\sqrt{D2}-d2)} \quad (1)$$

3 RESULTS AND DISCUSSIONS

3.1 MICROSTRUCTURE EVALUATION

Fig. 3 shows the microstructures of the composites in the unetched condition with varying SiC additions. As the SiC wt% is increased the volume fraction of SiC in the matrix increases. The particle shape of the SiC particles as noticed in Fig. 3 is not similar. There is a mixture of elliptical and irregular shaped particles as seen in the microstructures of the composite in Fig. 3. From the SEM micrographs it is evident that the distribution of the SiC particles in the Al matrix has been successful. There is slight agglomeration of SiC particles in composite with 7 wt% SiC addition as shown in Fig. 3 (d). A massive agglomerated mass of SiC particles can be seen in composite with 9 wt% SiC addition as seen in Fig. 3(e). This problem could arise due to poor wettability of the particle due to reasons like non-uniform preheating of the SiC particles, buoyancy of the particles due to trapped gases in the molten metal. The problem could also arise due to early solidification of the melt before the distribution of the SiC particles. It can be said that as SiC particle additions are increased there is a tendency towards agglomeration, which could be minimized by uniform preheating.

3.2 HARDNESS EVALUATION

The hardness values of the composites increases to a large extent with an increasing percentage of SiC additions as shown in Table 1. The hardness value of pure Al and that of composite with 1 wt% SiC addition is almost same. This is noteworthy that the hardness value of the composite increased from 15.5 HB in case of composite with 1 wt% SiC to 34 HB for 9 wt% SiC additions to the composite, which is about twice that of the composite with 1 wt% SiC. This is certainly due to the increase in SiC additions to the composite which acts as a reinforcement for the aluminium matrix. A problem was encountered while measuring the hardness of the globular phases as it was difficult to locate the indentation exactly on the SiC particles. That is why hardness values are averages of five to six measurements. While the accuracy of the measurements may not be very high, it nevertheless suggests that upon SiC additions the metal matrix composites have higher hardness than pure Al.

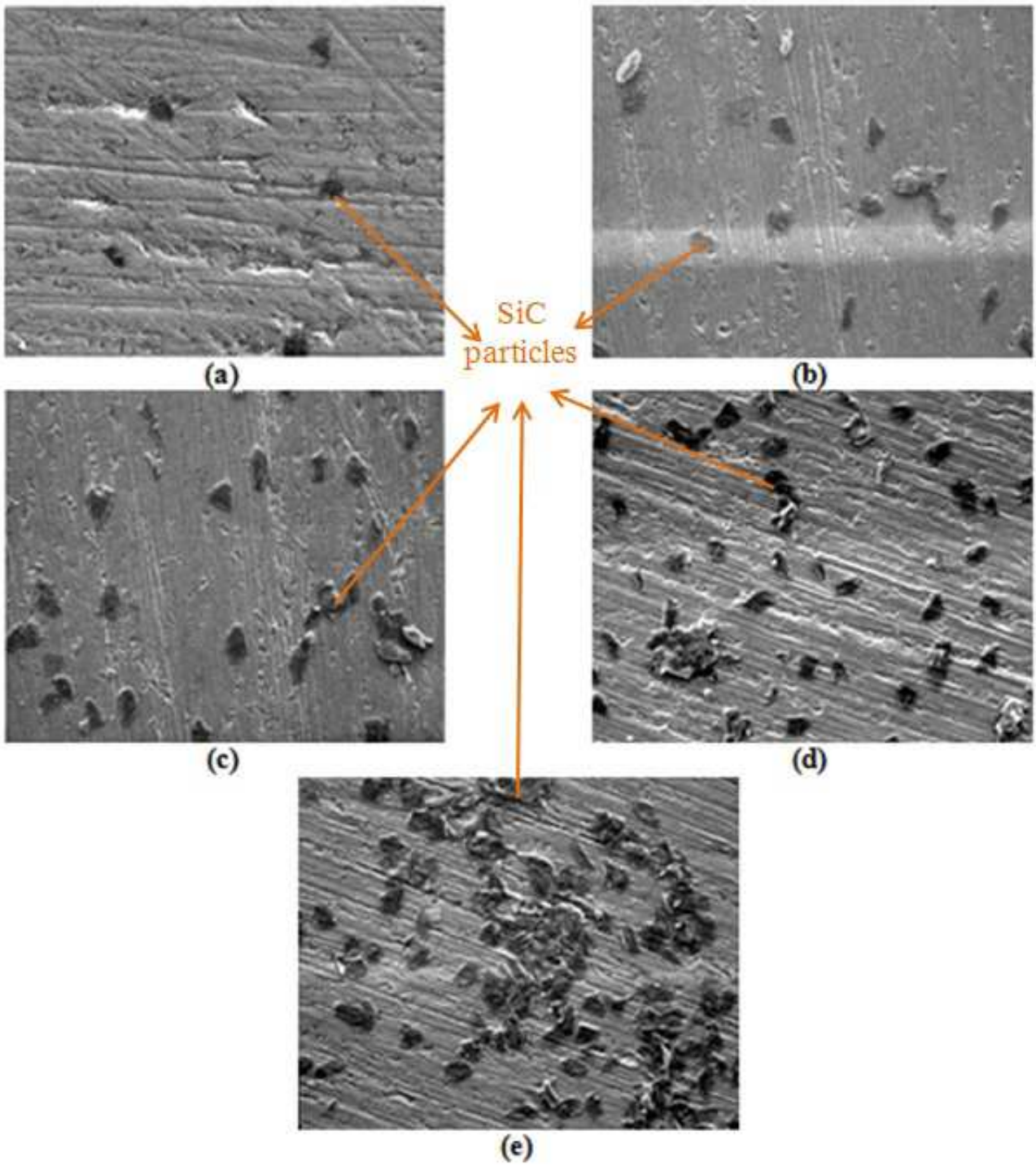


Fig. 3 Microstructure [Magnification : 250X] of composite with (a) 1 wt% SiC, (b) 3 wt% SiC, (c) 5 wt% SiC, (d) 7 wt% SiC and (e) 9 wt% SiC in the unetched condition.

Table 1 Brinell hardness values

Composite	Pure Al	Al + 1 wt% SiC	Al + 3 wt% SiC	Al + 5 wt% SiC	Al + 7 wt% SiC	Al + 9 wt% SiC
Brinell hardness (HBN)	15	15.5	19	25	28	32

4 CONCLUSIONS

The microstructure of the composite with varying SiC additions was studied in relation to the stir casting method. It can be said that stir casting method is a viable option for low cost production of particulate metal matrix composites. This method yields a composite with uniform particle distribution. Although problems may arise due to poor wettability of particles and buoyancy due to trapped gases, the casting method can be optimized to yield better results. The quality of the composite improves in terms of hardness and wear resistance by increasing reinforcement. The addition of 9 wt% SiC increases the hardness of the composite by two times.

REFERENCES

[1] S.J. HARRIS, Materials Science and Technology, “Cast metal matrix composites”, 1988, vol. 4, pp 231-239

[2] Young-Hwan Kim, Sunghak Lee and Nack J. Kım, “Fracture Mechanisms of a 2124 Aluminum Matrix Composite Reinforced with SiC Whiskers”, Metallurgical and Materials Transactions A 1991, Vol23A, 2589-2596

[3] B.R.Henriksen, T.E. Johnsen, Materials Science and Technology, “Influence of microstructure of fiber/matrix interface on mechanical properties of Al/SiC composites”, 1990, vol. 6, pp 857-863

[4] Y.H. KIm, C.S.Lee and K.S. Han; “Fabrication and Mechanical Properties of Aluminum Matrix Composite Materials”, Journal of Composite Materials 1992, Vol.26, pp 1062-1086

[5] T.S. Srivatsan, I.A. Ibrahim, F.A.Mohamed, E.J.Lavernia, “Processing techniques for particulate-reinforced metal aluminum matrix composites”, Journal of Materials Science, 1991, vol. 26, pp 5965-5978

[6] P.A. Karnezis, G.Durrant and B.Cantor, “Characterization of reinforcement distribution in cast Al-alloy/SiCp composites”, Materials Characterization, 1998, vol 40, pp 97-109

[7] Kon Bae Lee and Hoon Kwon, “Strength of Al-Zn-Mg-Cu Matrix Composite Reinforced with SiC Particles”, Metallurgical and Materials Transactions A Vol. 33A, February 2002 pp 455-465

[8] X.Xia, H.J. McQueen, H.Zhu, “Fracture Behavior of Particle Reinforced Metal Matrix Composites”, Applied Composite Materials, 2002, pp.17-31

[9] J.E. Schoutens and D.A. Zarate, “Structural indices in design optimization with meta lmatrix composites”, Composites, 1986, vol17, pp 188-204

[10] A. McLean, H.Soda, Q.XIa, A.K. ParamanIck, A. Ohno, T.ShImIzu, S.A.Gedeon and T.North; “SiC Particulate-reinforced, Aluminum-Matrix Composite Rods and Wires Produced by a New Continuous Casting Route”, Composites Part A 1996, Vol. 28, pp. 153-162

[11] L.Geng, C.K.Yao, “SiC-Al interface bonding mechanism in a squeeze casting SiCw/Al composite”, Journal of Materials Science Letters, 1995, vol. 14, pp 606-608

[12] M.I. Pech-Canul, R.N. Katz, M.M. Makhlouf, “Optimum Parameters for Wetting Silicon Carbide by Aluminum Alloys”, Metallurgical and Materials Transactions A, vol. 31 A, February 2000, pp. 565-573

[13] B. Wang, G.M.JanowskI and B.R.Patterson, “SiC Particle Cracking in Powder Metallurgy Processed Aluminum Matrix Composite Materials”, Metallurgical and Materials Transactions A 1995, vol.26 (9), pp 2457-2467

[14] P. Shanmughasundaram and R. Subramanian, “Wear Behaviour of Eutectic Al-Si Alloy-Graphite Composites Fabricated by Combined Modified Two-Stage Stir Casting and Squeeze Casting Methods,” Advances in Materials Science and Engineering, vol. 2013, Article ID 216536, 8 pages, 2013. doi:10.1155/2013/216536

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 439-444
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Data Security for Cloud Computing Using RSA with Magic Square Algorithm

A. Dharini, R.M. Saranya Devi, and I. Chandrasekar

Assistant Professor, Department of Computer Science,
Sri Vijay Vidayala College of Arts & Science,
Dharmapuri, Tamil Nadu, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Cloud computing is an up-and-coming technology and shared information, resources, software and hosting to customer on a pay-as-you-use basis. The major issues in cloud computing is the data protection security and it reduce the growth of the cloud computing. The security needs during the transmission of sensitive data and critical application to shared cloud environment. For secure communication over public network data can be protected by the method of encryption. So the proposed encryption techniques for secure data transmission, SSL over RSA with magic square provide add-on security to cryptosystem. To provide the confidentiality and integrity of data-in-transmission to and from cloud providers In this paper cryptographic methods RSA are discussed and combine Magic Square algorithm with RSA when implementing on data security in cloud computing.

KEYWORDS: Cryptography, Encryption, Decryption, Magic Square, RSA, Cloud computing.

1 INTRODUCTION

Cloud computing is used for group of virtualized and scalable resources and also competent of hosting application and providing required services to the users with the "pay only for use" basis. Using the internet cloud, users can access these services without having any previous knowledge on managing the resources involved. Cloud computing provides the ability to shared resources and common infrastructure, offering services on demand over the network to perform operations that meet changing business needs.

Cloud providers typically center on one type of cloud functionality provisioning: infrastructure, Platform of Software [1][2]. Cloud Infrastructure as a service provides processing, storage network bandwidth and other fundamental computing resources which allow customers to deploy and run operating systems or applications. For safe communication over public network data can be protected by the method of encryption. Encryption exchanges that data by any encryption algorithm using the key in twisted form. Only user can access the key used to decrypt the encrypted data [3]. The purpose of encryption is used to preventing leak or secrecy in communications [4]. Encryption algorithms play a huge role in providing data security against malicious attacks.

To encrypt the plaintext characters to cipher, their ASCII values are taken and if a character occurs in several places in a plaintext there is a possibility of same cipher text is produced. To overcome the problem, taking ASCII values for the characters to encrypt, preferably different numerals representing the position of ASCII values are taken from magic square and encryption is performed using RSA cryptosystem. This proposed research work provides the security using public key algorithm that ensures the security is improved and also compare these two algorithms and analysis which one is best for encryption in Cloud Computing.

The paper begins with a note on the related technology required in section 2. The detailed features of Cloud security is found in section 3. The Performance of two algorithms is in section 4. The result analysis of the two algorithms is in Section 5. Section 6 deals with the findings and future work of the paper.

Corresponding Author: A. Dharini

2 BACKGROUND

Many works are carried out to implement data security in the Cloud Computing. Some of the earlier works are presented in this section.

In 2009 Dai Yuefa, Wu Bo, Gu Yaqiang, Zhang Quan, Tang Chaojing analysed the basic problem of cloud computing data security. With the analysis of Hadoop Distributed File System (HDFS) architecture, they get the data security requirement of cloud computing and set up a mathematical data model for cloud computing. Finally they build a data security model for cloud computing [5].

In 2009 *Gopinath Ganapathy, and K. Mani* proposed another layer of security to any public key algorithms such as RSA, ElGamal etc., Since, this model is acting as a wrapper to a public key algorithm, it ensures that the security is enhanced. Further, this approach is experimented in a simulated environment with 2, 4, 8, and 16 processor model using Maui scheduler which is based on back filling philosophy [6].

In 2010 Amir Mohamed Talib Rodziah Atan, Rusli Abdullah & Masrah Azrifah Azmi Murad described on the theoretical concept and approach of a security framework as well as a Multi-Agent System (MAS)and architecture that could be implemented in cloud platform in order to facilitate security of Cloud Data Storage(CDS) [7].

In 2011, G. Jai Arul Jose, C. Sajeev Propose a model system in which cloud computing system is combined with Cluster Load balancing, Secure Socket Layer (SSL) over AES and secure session In this model, some important security services, including authentication, confidentiality and integrity, are provided in cloud computing system. Here cost is greatly reduced, Maintenance cost is reduced. The data is secured through SSL; AES based Cryptography, Server clustering and Server Load balancing [8].

In 2011 S. Praveen Kumar, K. Naveen Kumar, S. Sreenadh, B. Aravind, K. Hemnath Kumar proposed a work provides another layer of security to any public key algorithms such as RSA, Elgamal etc., Since, this model is acting as a wrapper to a public key algorithm, and it ensures that the security is enhanced. It attempts to augment the efficiency by providing add-on security to the cryptosystem [9].

3 SECURITY IN CLOUD

Cryptography is the study of mathematical techniques related to characteristic of information security such as confidentiality, data integrity, entity authentication, and data origin authentication. Modern encryption techniques such as RSA are discussed in brief in this section.

3.1 RSA

In the asymmetric method, private key and public key are used. Both the sender and receiver know the public key and it is used to encrypt the data. The owner of the private key can only decrypt the message. The public and private keys are always in pairs, it is difficult to derive at the private key from the public key which is shared. That is why this method is considered to be more secure than the symmetric method. RSA adopted public key cryptography algorithm [10]. RSA algorithm is developed by Rivest, Shamir and Adleman.

The encryption process can be done either at the customer's end or at the service provider's or at the vendor's end. The customer can do the encryption process and it will increase the computation time and usage which in turn increases the cost. Furthermore there may be no guarantee for the proper implementation of the encryption process. Because of these, it is appropriate to do the encryption process at the Client's end.

3.2 MAGIC SQUARE

A magic square is a square array of numbers consisting of the distinct positive integers 1, 2, …, $n2$ arranged such that the sum of the n numbers in any horizontal, vertical, or main diagonal line is always the same number. Given an n×n matrix of the integer 1 to n^2 such that the sum of every row, column and diagonal is the same. Then n rows the sum of all the numbers in the magic square must be n.M. But the numbers being added are 1, 2, 3, ... n2 , and so 1 + 2 + 3 + ... + n2 = n.M. In summation notation $\sum_{i=1}^{n^2} i = n.M$. Using the formula for this sum, $\mathrm{n.M} = \frac{n^2(n^2+1)}{2}$, and then solving for M gives $\mathrm{M} = \frac{n(n^2+1)}{2}$. Thus, a $^{3\times3}$ normal magic square must have its rows, columns and diagonals adding to $\mathrm{M} = \frac{3(3^2+1)}{2} = \frac{30}{2} = 15$ a $^{4\times4}$ to M = 34.The magic sum for an n×n normal magic square can be found by filling the n×n square with the numbers 1,

2, 3, ... n2 first going across the top row, then the second row, and so on and then adding the numbers along either of the diagonals. There are three types of magic squares:

- The odd order magic square are referred to M is an odd number M=2n+1 where n=0,1,2,3….
- The even order magic square are referred to M is an even number divisible by both 2 and 4 M=4(n+1) where n=0,1,2,3…
- The singly even order order magic square are referred to M is an even number divisible by 2 but not by 4 M=2(n+3) where n=0,1,2,3..

Method of Proposed Add-On Security Model

- Construct different doubly even Magic Square of order 16 as far as possible and each magic square corresponds to one ASCII set.
- To encrypt the character, use the ASCII value of the character to determine the *numeral in the magic square* by considering the position in it. Let NP and NC denote the numeral of the plaintext and cipher text respectively. Based on NP and NC values, all plaintext and cipher text characters are encrypted and decrypted respectively.

DATA SECURITY PROCESS

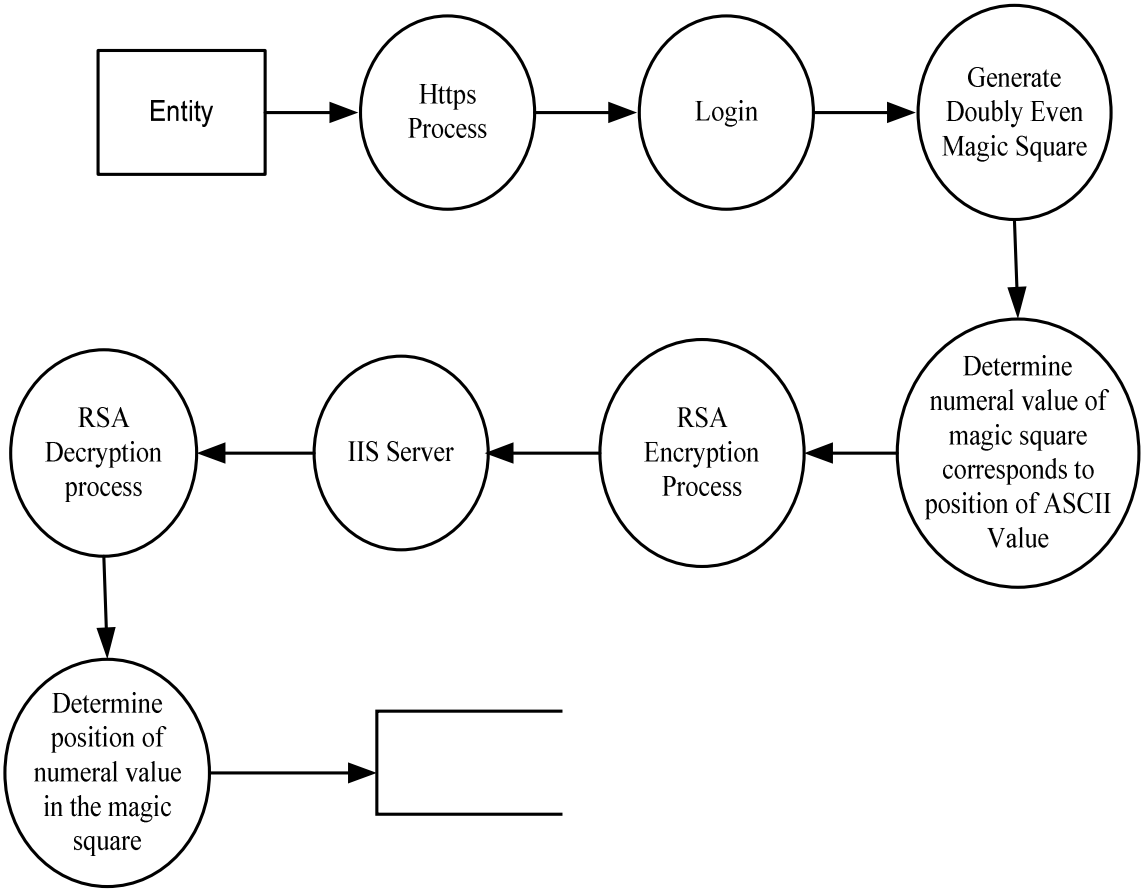


Fig.1. Data security Process

In data security process, the authenticated client has to login and the doubly even magic square has been generate the sequence of number that corresponds to ASCII value. By using that value RSA algorithm are used to encrypt the data. Afterwards the decryption of data has been done.

CONTEXT LEVEL DIAGRAM

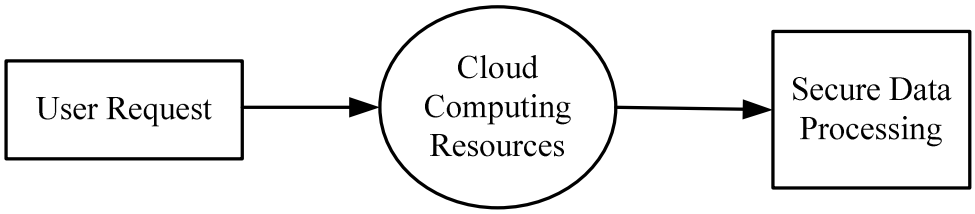


Fig.2. Context Level Diagram

ARCHITECTURAL DIAGRAM

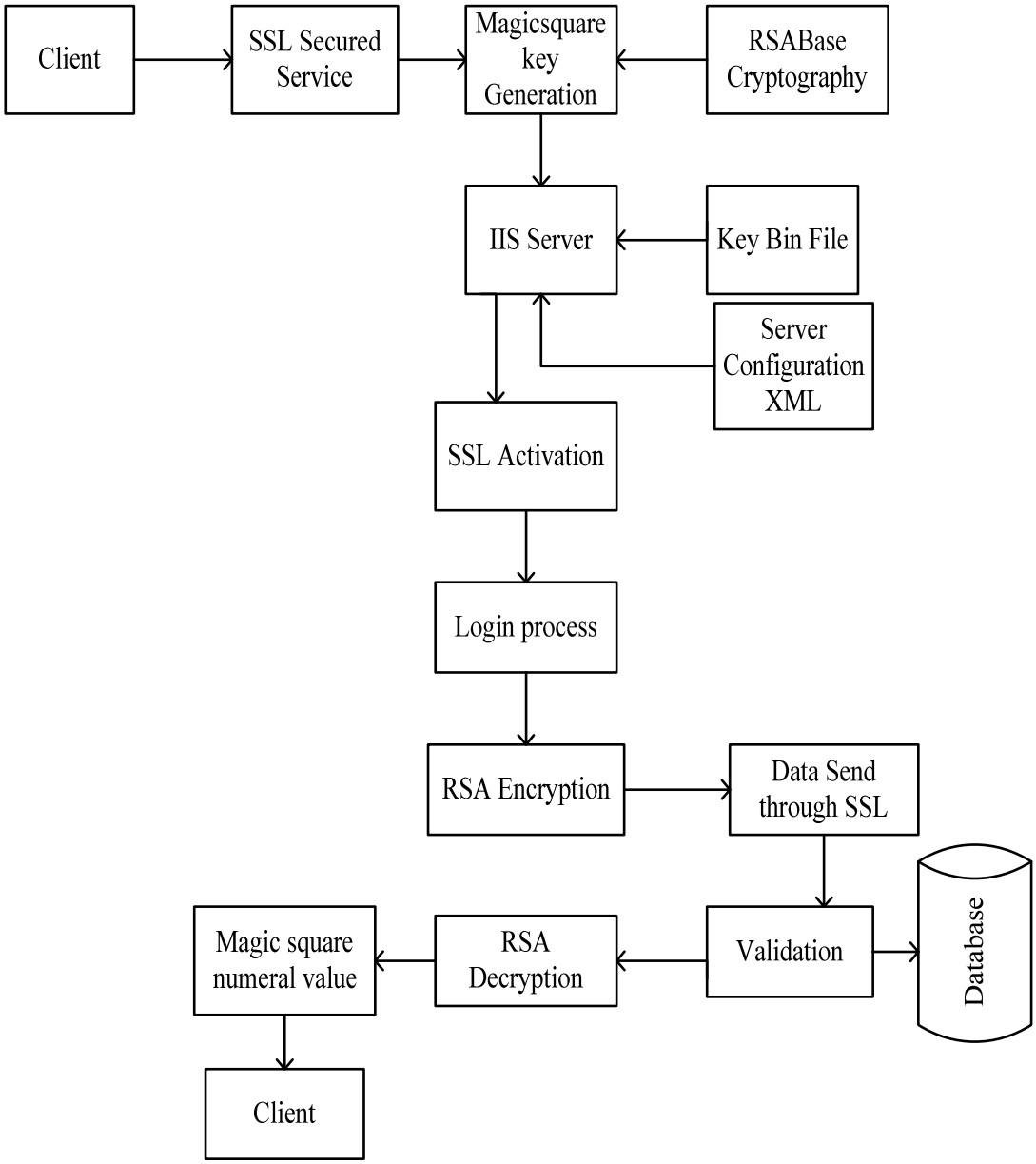


Fig.3. Architectural Diagrams

4 RESULT ANALYSIS

The security analysis consists of analyzing various security properties such as Data Confidentiality, Authentication and Integrity of the data.

4.1 SECURITY ANALYSIS

- *Data Confidentiality* is analyzed by comparing it with various data Encryption algorithms such Advanced Encryption Standard or Data Encryption Standard which uses the symmetric key for encrypting the data. In our proposed scheme as the data is encrypted, hence the cloud service provider do not have any access to the data as the user do not know the key, and is only known to the data owner which ensures the Data Confidentiality.
- *Authentication: A* new user is added or it tries to access the data over a cloud, authentication is performed with the help of the password set by the user during registration.
- *Integrity:* Ensures that the data integrity is maintained and the data over the cloud is secured.

4.2 ALGORITHM ANALYSIS

4.2.1 RSA ALGORITHM

In Table 1 is used to evaluate the RSA algorithm with the local and cloud environment analysis with different input file sizes. The algorithm RSA- an asymmetric encryption algorithm, is on an average the most time consuming. This is true in a local environment as well as cloud environment.

Table.1. Comparison of Mean Processing Time on the Cloud and on Local

Input file	RSA (Local)	RSA (Cloud)
2kb	678.4	380.2
5kb	747.3	309.2
10kb	796.8	400.9
20kb	853.4	429

4.2.2 RSA WITH MAGIC SQUARE

The time taken for encryption and encryption of various file sized message in simulated parallel environment using RSA public key crypto system with magic square, illustrated in Table 2. In earlier system these algorithms are implemented on the single processor system but because of the availability of the fast and parallel computing resources, the better encryption and decryption techniques can be implemented by using these security algorithms in cloud network. The Maui Scheduler with back filling techniques are used to calculate encryption and decryption time.

Table.2.Encryption and Decryption time using RSA

File Size(MB)	Encryption Time(ms)	Decryption Time(ms)	Total Time
1	231	265	496
2	452	480	932
4	910	940	1850
8	1867	1888	3755

5 CONCLUSION

Finally conclude the RSA algorithm is very secure with the help of the magic square. The magic square boosts the add-on security to system. It will increase the Computational speed. It provides security to the files while transmitting the files. The efficiency of algorithm is based on the time take of the encryption and decryption produce the cipher text to clear text so the

extensively RSA with magic square is handling ASCII character in the cryptosystem. Magic square deals with complexity in encryption and boosts the security in the cloud environment.

In the future work, at present a small data requires large amount of memory space for data so in future this can be further developed so that the memory space would be minimized into small area. Existing RSA allows only text content to be encrypted whereas further it can be enhanced so that image file and audio files shall also be encrypted.

ACKNOWLEDGEMENT

We would like to thank my respected research supervisor **Dr. S. SAGAYARAJ,** for the support of this research work. It is our privilege to thank my parents and friends for their encouragement and support in carrying out my research work well.

REFERENCES

[1] L. M. Vaquero, L. Rodero-Merino, J. Caceres, and M. Lindner. A break in the clouds: towards a cloud dentition. SIGCOMM Comput. Commun. Rev.,39:50{55, December 2008.
[2] Srinivasa Rao V, Nageswara Rao N K, E Kusuma Kumari. Cloud Computing: An Overview, Journal Of Theoretical And Applied Information Technology-2005 - 2009 Jatit.
[3] Cloud Security Alliance (2010). Top threats to cloud computing, version 1.0. http://www.cloudsecurityalliance.org/topthreats/csathreats.v1.0.pdf
[4] Anoop MS, "Public key Cryptography (Applications Algorithm and Mathematical Explanations)".
[5] Dai Yuefa, Wu Bo, Gu Yaqiang, Zhang Quan, Tang Chaojing. Data Security Model for Cloud Computing. Proceedings of the 2009 International Workshop on Information Security and Application (IWISA 2009) *Qingdao, China, November 21-22, 2009.*
[6] Gopinanadh Ganapathi, and K.Mani, "Add on security model for public key Cryptosystem based on magic square implementation", India, 2009.
[7] Amir Mohamed Talib Faculty of Computer Science & IT, University Putra Malaysia. Security Framework of Cloud Data Storage Based on Multi Agent System Architecture: Semantic Literature Review. Vol. 3, No. 4; November 2010, www.ccsenet.org/cis.
[8] G. Jai Arul Jose1, C. Sajeev2. Implementation of Data Security in Cloud Computing*. International Journal of P2P Network Trends and Technology- July to Aug Issue 2011.*
[9] S. Praveen Kumar, K. Naveen Kumar, S. Sreenadh, B. Aravind, K. Hemnath Kumar. Novel Advent for Add-On Security by Magic Square Intrication. Global Journal of computer science and technology. volume 11, issue 21, December 2011.
[10] R. Rivest, A. Shamir, L. Adleman. "A method for obtaining digital signatures and public-key cryptosystems" z. Communications of the ACM, Feb 1978.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 445-449
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Design a Phase Interleaving PFC Buck Boost Converter to Improve the Power Factor

Preti Tyagi and Sunder Singh

R&D Department,
Vivitar Electronics,
Mumbai, Maharashtra, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: In this paper we describe the design of a phase interleaving buck boost converter and simulation of the same by using PSIM software. The important specification of IC UCC28063, which is used for controlling and regulating of buck boost converter is also discussed. The input range is (170-270) VAC and the output voltage is controlled to 216 VDC. This AC-DC buck boost converter operated at high frequency i.e. 25KHZ and maintains the power factor approximately unity. PSIM proved the feasibility of the design and we also used this PFC converter in a 5kva Online UPS system.

KEYWORDS: Phase interleaving, Buck boost, PFC, PWM, AC-DC Converter.

1 INTRODUCTION

The power factor correction is a key area of research in the field of power electronics. The low power factor and high pulsating current in the AC main are the main disadvantage for diode rectifiers and controlled rectifiers. They generate pollution in the power transmission line. The pollutants are current harmonic and reactive power which result in line voltage distortion, heating the core of the transformer etc. Normally a passive filter is used to improve the power quality because of its simple circuit design. The bulky size of the passive component, fixed compensation characteristic and its series and parallel resonance are main drawback of this approach to power factor correction. Another approach is active power filter which eliminates the current harmonics and improve the power factor. The PFC circuit is typically added at the front end of system. Solid state ac-dc conversion is used in adjustable speed drives, switch mode power supplies (SMPS), uninterrupted power supplies (UPS), solar PV, battery chargers, power supplies for telecommunication systems, test equipments etc. Power factor correction (PFC) is necessary for ac-to-dc converters in order to comply with the requirements of international standards, such as IEC 61000–3–2 and IEEE-519. PFC can reduce the harmonics in the line current, increase the efficiency and capacity of power systems. The Active Power Factor Correction (APFC) is a method to improve the power factor near to unity, reduces harmonics distortion noticeably and automatically corrects the distorted line current [2]. The PFC boost converter with continuous conduction mode is highly used for medium and high power application because the continuous current nature of the boost converter is conducting less electromagnetic interference compared to the other topologies like boost and buck boost. The phase interleaving topology of the converter is also one of the best topology for high power application. The main advantages of interleaving topology are sharing the input current due to paralleling of the two phases [5]. Hence our topology is interleaving buck boost topology using the IC UCC28063. The combined capability of power factor correction, active filter and AC-DC converter makes the new technique using PFC buck boost converter to simultaneously, reduce the harmonics current produced from the non-linear load regulate. The dc power supply to the non-linear load and draw nearly sinusoidal current from the supply. This approach does not require any special power device to reduce the current harmonics and power factor correction.

Corresponding Author: Preti Tyagi

2 TOPOLOGY

It is a two phase interleaving topology of buck boost converter. The main advantage of phase interleaving topology is that the total input current are divided into two phase, resulting in the current rating reduced the current rating of the switching devices. We can use any numbers of switching device as per the requirement of the application in each phase.

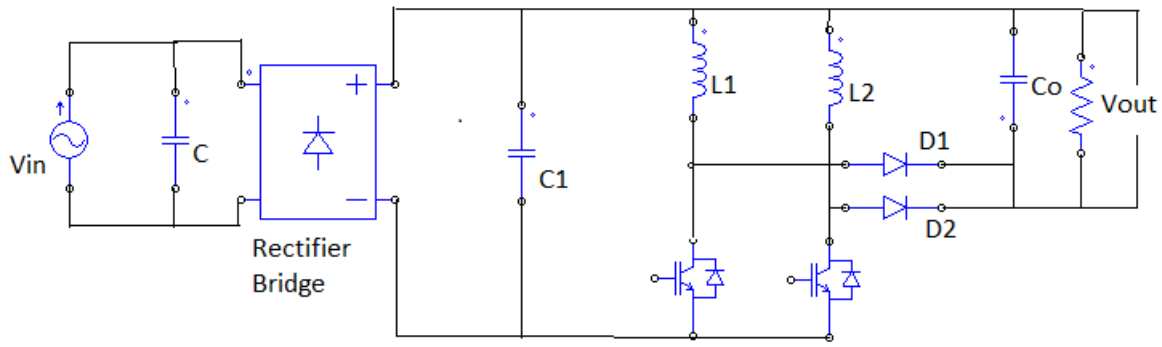


Fig 1: AC-DC Buck boost converter topology

We design the ac-dc buck boost converter of 5Kva capacity. Here we used for switching device in each phase for current sharing purpose,

3 DESIGN ANALYSIS

Here the design of the ac-dc buck boost converter of 4.5kw capacity is describing. In this input range is 170V to 270Vac and output is constant 216Vdc voltage, so that 192v lead acid battery can be connected.

Minimum input voltage = 170Vac

Output power =5KVA = 4.5KW

Output voltage = 216 V dc

Output current = $\frac{output\ power}{output\ voltage}$ = 4500/216 = 20.8A

Load resistance (RL) = $\frac{output\ voltage}{output\ current}$ = $\frac{216V}{20.8A}$ = 10.3Ω

Input current = 4500/170 = 26.4A

Input rms peak current (I p) = 37. 3A = 38A.

Total I p =160A

Operating frequency = 25 KHz

Time period T =1/F =1/25 kHz= 40µs,

Duty cycle D = $\frac{240}{240+216}$ = 0.47

We know that the duty cycle (D) = $\frac{Ton}{T}$

Ton = T * D = 40µs * 0.47 = 19µs.

Calculate the inductance using the following formula:

L = $\frac{Vdt}{di}$ = $\frac{240*19\mu s}{160/8}$ = 228µH

So inductance L = 228µH. (with EE-65 core)

Output capacitor = 4700µf/450V,

The selection of switching device (IGBT) is done on the bases of peak current, collector voltage and operating frequency. According to this requirement we selected the IGBT- K40H1203 whose rating is 40A/1200V and operating at high frequency.

4 SIMULATION RESULT

After fixing all these parameters we have simulated the circuit in PSIM software and the results are given below:

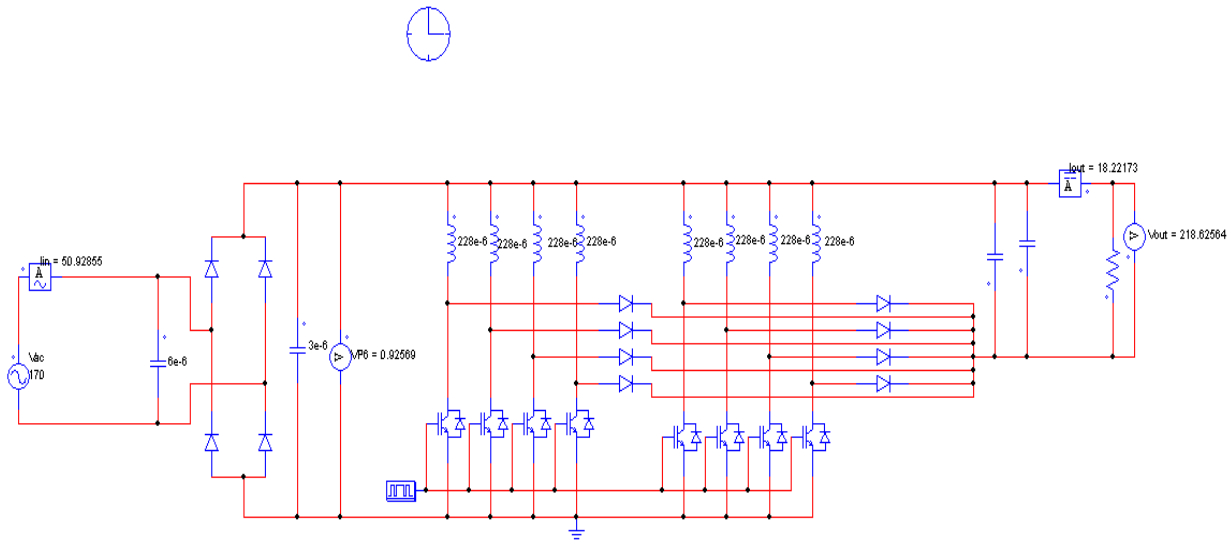


Fig 2: simulated circuit of PFC buck boost converter

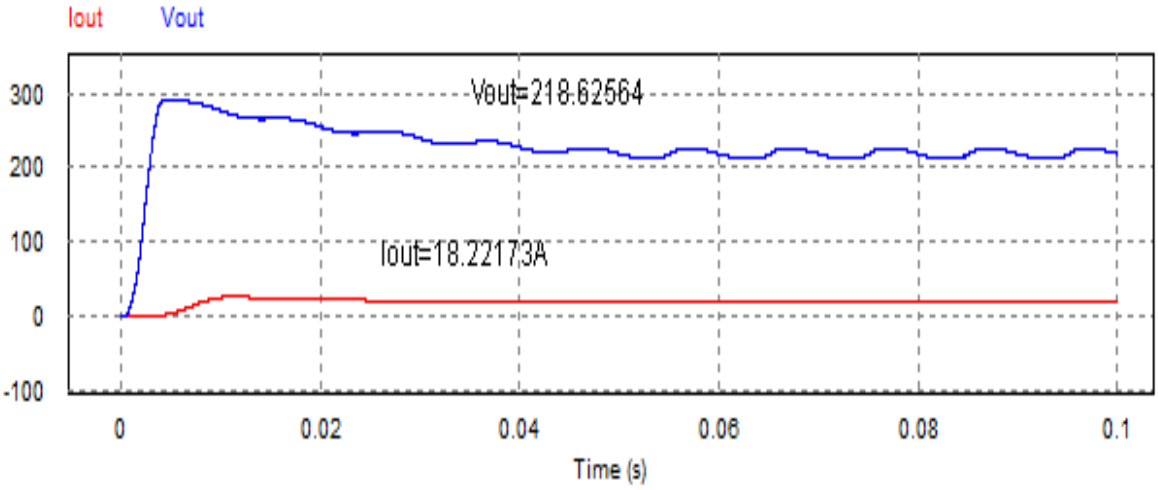


Fig 3: Waveform of Output voltage and output current

5 APPLICATION

We got satisfactory results from the simulation of the PFC converter circuit. Then we have decided to implement the 4.5kw UPS system with the same. We used this PFC buck boost converter at front end, and the dc output is given to the inverter input. A battery bank of (16 battery) is also connected at the output of ac-dc buck boost converter. The power diagram of the full system is given below:

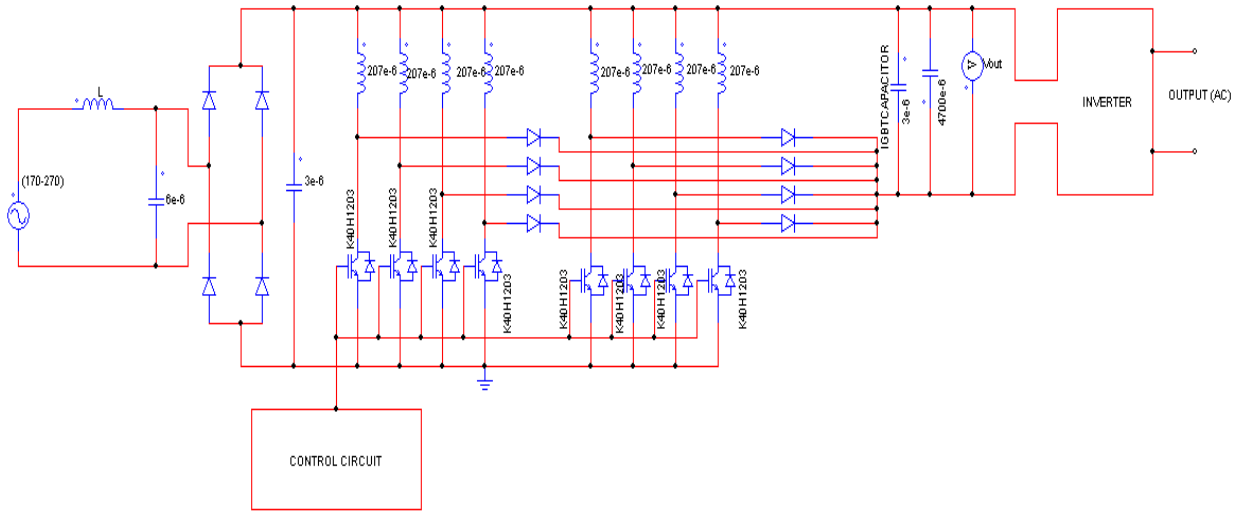


Fig 4: circuit diagram of online UPS system with PFC buck boost converter

According to this diagram we made the hardware and results are giving later. Here we used IC UCC2063 for controlling the PFC and regulate the output voltage, whose diagram is show in figure.5.

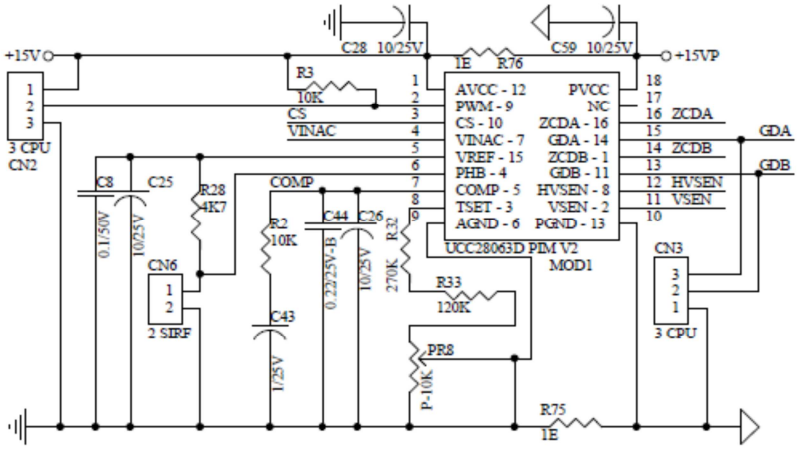


Fig 5: Buck Boost PFC Pre Regulator

6 PRACTICAL RESULT OF PFC CONVERTER

The following reading are taken to check the performance of the system, and got the maximum efficiency is 93% at almost full load condition. Power factor of system is 0.98 and total harmonic distortion is 7% according to the following reading.

Sr. No.	INPUT (AC)		PFC OUTPUT(DC)		PFC EFFICIENCY
	Current	Voltage	Current	Voltage	
1.	11.9	228.9	11.2	220.5	92.40%
2.	18.2	227	17.2	220.3	91.70%
3.	22.4	223	21	220.3	93%

7 CONCLUSION

In this topology we achieved a power factor 0.98 and total harmonics is 7% with good efficiency. Its performance is better than any other conventional topology. One other advantage is that we did not require separate charger to charge to the

battery bank, because we connect the battery bank at the output of the PFC buck boost converter. It provides the regulated dc output even if input voltage varies from 170v to 270 ac. Thus it's an optimal converter in terms of performance, efficiency and provides unidirectional (dc) power.

REFERENCES

[1] Jugnu Patel, Swapnil Arya, "Power Factor Corrector for AC to DC Boost Converter" National Conference on Recent Trends in Engineering & Technology 13-14 May 2011.

[2] P.L. Gawade, A.N. Jadhav "Harmonic analysis of Input Current of Single-Phase PFC Buck Converter" *International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726.*

[3] Ningliang Mi, Boris Sasic, Jon Marshall and Steve Tomasiewicz "A Novel Economical Single Stage Battery Charger with Power Factor Correction 0-7803-7769-9/03/$17.00 (C) 2003 IEEE.

[4] V. D. Rajaji, Dr. P. Siddaiah "Power Factor Correction Using PFC Boost Converter" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 4, April - 2013 ISSN: 2278-0181.

[5] "Power factor correction handbook" HBD853/D Rev-5 April 2014.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 450-456
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Behind The Eco Innovation Efforts: A Review of Dynamic Capabilities Theory

Lizwa Rashid, Juhaini Jabar, and Samer Shami

Faculty of Technology Management & Technopreneurship, Universiti Teknikal Malaysia Melaka, Malaysia

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: In the new millennium, scholars and business personal are actively searching a secret recipe on how to support the ability of current generations to meet their needs without compromising the ability of future generations to meet theirs. As many research discovered that eco innovation echoes to the sustainability development, research opportunity knocked the door for knowledge discovery as limited information reveals under this domain. Therefore, the purpose of this paper is to shed light on the role of eco innovation efforts towards sustainable development particularly in the automotive industries. There are five types of eco innovation that highly discussed in the literature namely eco product, process, marketing, organization and institutional. However, the technical eco innovation in forms of product and process relatively embrace by automotive industries as this industry received global forces in order to reduce pollution and waste creation. Furthermore, many scholars acknowledge that the automotive industries behave as a driver to improve sustainability performance. Secondly, this paper will discuss the secret weapons behind the eco innovation efforts underlines product and process innovation by reviewing dynamic capabilities theory. Last but not least, at the end of this paper, new paradigm for new research opportunities in automotive industries will be discussed.

KEYWORDS: Eco Innovation, Dynamic eco innovation practices, sustainability, automotive industry

1 INTRODUCTION

Eco innovation approved as a bridge to achieve sustainability [1]–[3] and manufacturing industries are the perfect medium to achieve the mission [4]. The growing attention of global concerned on sustainability and green practices acquire attention of both institutes and academic to discover the phenomenon. In one hand, more insight into best practices in manufacturing activities developed by OECD as guidance to leverage sustainability development as in [5], while [6][7] reported that, a total of 8516 publications related to green, ecology, environment and sustainability domain released from 1990 to 2010, which 62.6% of the scholar dominated in Business, administrations, finance and economics (BAFE) relatives to other fields. However, the central topics under the umbrella of eco innovation is unbalance as widen knowledge determine at macro and meso level in describing industry and national policy as in [8], [9] compared to micro level explicitly in green innovation management [7], [10], [11] and eco product development [12], [13].

The automotives industry acknowledged as the main contributor for the 20% of CO2 emission [6] and other source of air pollution such as particulates, sulphur dioxide, nitrogen dioxide, carbon monoxide and hydrocarbons mainly in urban areas [14]. On top of that, the auto industry related on the increasing number of waste by 25,000 tons/day, exploitation of natural resources along the product life cycle (PLC) and indirectly effects to social life; noise pollution, losses from accident and traffic congestion [15]. Therefore, the current trends for the competitive advantage in global automotive industries rest on effective and efficient implementation of green manufacturing throughout introduction of cleaner technology, improves fuel efficiency, and developing green vehicles as the demand of green market increase globally mainly in Europe and United States [16]. Therefore, this paper provides a meaningful review to clarify several questions listed as below:

a) What are the types of eco innovation efforts in manufacturing activities?
b) What are the antecedents of eco innovation efforts?
c) What is the research paradigm of eco innovation in new millennium?

2 THE DIMENSION OF ECO INNOVATION EFFORTS

Eco innovation terminology refers as an ecological, environmental, green and sustainable innovation initiate in most previous publications [2], [7] and the terms have resemblance in the objective to reduce the environmental impacts [7]. As reported in the [17] eco-innovation practices outline its target or object (products, processes, marketing methods, organizational and institutions); which contrary in report by [18], eco target includes product, process, organizational, social and institutional. Meanwhile [19] defines eco target falls as the four categories such as environmental technologies, organizational innovation, product and service innovation and green system innovation. Broad definition of eco innovation can be found in [1], yet, eco innovation definition in OECD manual is a pertinent to organization as useful guidelines ([19], because the innovation definition acceptance worldwide and the innovation information ahead compared to others institution. OECD report in eco innovation in manufacturing industry promoted that eco innovation typology rest on ***target***; technical (product and process) and non technical (marketing, organizational and institution) innovation***, mechanism*** or methods of changes (modification, redesign, alternatives and creation); and level of ***environmental impact*** (product life cycle). However, as mentioned by [20], the impact of sustainability development depending on the level of eco innovation implementation. The main dimension of eco innovation practices that acknowledges word wide can be trace in figure 1. Both product and process eco innovation is crucial in order to reduce environmental pollution mainly for the manufacturing industries.

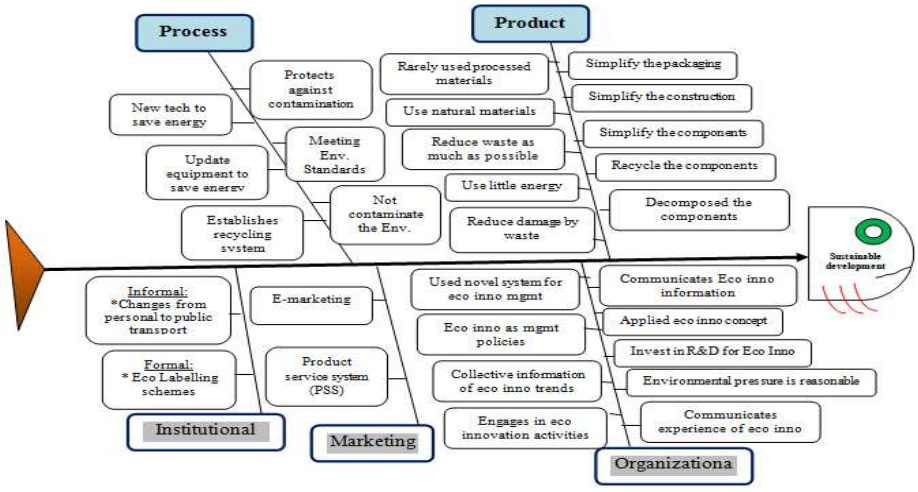


Figure 1: Eco innovations: the backbone of sustainable development

3 ANTECEDENTS OF ECO INNOVATION EFFORTS: THE EVOLUTION OF DYNAMIC CAPABILITIES THEORY

The accurate approach of competitive advantage was highly debated in the strategic management literature since a decade as a firm required a bullet weapon for competitive edge. Therefore, scholars have developed theoretical model as guidance on a right way to win a rival. In one hand, some authors were emphasized on producing the unique product to success in market[21]. Meanwhile, others are referring on utilizing internal resources. One of the prominent theory that has been developed and extensively discuss on resources as a vehicles for business sustainable was proposed by [22] and [23]. Both of them agreed that by exploiting the resource base in firm is useful as a bridge to sustain a competitive edge. [23] In his articles, accentuated the needs of exploiting current resource and building new resources as ones of the firm strategic advantages.

Consequently, [22] has concluded that firm's resource in forms of physical, human and organizational capital correlate as source of competitive advantage if they possess in four basic requirement namely valuable, rare, imitable and non substitute or renown as VRIN attributes. In the similar vein, [24] explored that's resource in forms of tangible resources (financial or physical) or intangible (employees knowledge, experience and skills) embedded in firm that's is crucial on developing and manufacturing a product. However, in the academician words, scholars used interchangeable terms between resources and capabilities when there are clear boundaries between these two terms. Resources can be referred as an assets, competencies, organizational process, information and knowledge that rooted in firm and enable the organization to perform its activities, while capabilities much related on the continuous process management to build the valuable resources base.

Therefore, to provide insight on differencing between two terms, dynamic capabilities theory arises latter on to complement resource base theory (RBV). [25] discovered that dynamic capabilities theories is the extension of the RBV theory because the core of theory is discussing on how to achieve sustainable advantage through valuable, rare, imitable and non substitute resource and renew it associated with high demand of velocity market. The RBV theory can best describe on how firm respond in stable and predictable market while a dynamic capability approaches highly relevant in the volatile environment. Dynamics capabilities approaches purely described how firm managers utilized resources in attempts to win the battles in high technology industries and grounded by the creative destruction.

By referring to [26], dynamic defines as firm capacity to renew its own competence in order to adapt the rapid changing in internal and external environment. Capabilities describe as a key role of firm strategic management in adapting, integrating and reconfiguring internal and external skills, resources and competencies to achieve sustainable advantage. Other than that, dynamic capabilities as well defines in many way; [27] has acknowledge capabilities as "core capabilities" to represent the firm's strategic activities, while "organizational capabilities" from point of view [28] and "organization competencies" by [29] to address firm capabilities.

The initial proposal on describing firm dynamic capabilities in market conditions can be undertaken in both strategies; established in the environment or vibrant environment [30]. However, [25] and [31] discovered that dynamic capabilities approaches are prudent in three market conditions as; (i) incremental dynamic capabilities (ii) renewing dynamic capabilities (iii) regenerative dynamic capabilities. On one hand, in the managerial perceptions, both in incremental and renewing dynamic capabilities market, relies on improving current resource base and extending of resource mix respectively. On the other, in the regenerative dynamic capabilities, firm strategy rest on renewing the recent resource that's no longer applicable and not meeting the requirement of new resource composition. [31] in articles stress out that's to deal with the dynamics environment, the capabilities is not solely building inside the firm but also need to configure with the external resources, so that firm could attain sustainable advantage. In the conclusion, for firm to attain sustainable advantages it is much dependent on how firm manipulating its internal or external resources.

As reported by [32] in the special issues of dynamic capabilities; current debates and future directions reveals that there was little evidence of framework development in dynamic capabilities in diverse industries and national setting. Furthermore, [31] highlighted the important to study dynamic capability for the new comings research agendas to help managers improved the source of firm sustainability by answering "what dynamic capabilities look like in organizations, how they are deployed, and how context may impact upon them?"[25]. As referring to the [32] argument, dynamic capabilities is much related to the innovation adoption and how the organization react to complement the turbulent market changes, thus, dynamic innovation capabilities model have been proposed by authors [33]–[36] to complete the puzzle of core competencies required to successfully manage technical eco innovation.

4 THE LINKAGES OF ECO INNOVATION WITH DYNAMIC CAPABILITIES: A NEW RESEARCH OPPORTUNITIES

[37] mentioned a formula to success in market positioning; firm are encourages to stop depending on producing a superior product, but relies on exploiting firm core competencies in knowledge, skills, management process and routines[29].The literatures of firm's core competencies or called dynamic capabilities provide a fertile ground to bloom since the introduction of RBV theory by Jay Barney in 1991. Dynamic capabilities approached answering how firm generates new "value creation activities" through efficient resource management by having specific strategy and organizational process [30] supported that the theory is representing the organizational behavior on how renewing their assets and stock resource for the sustainability advantage [26].

As opposed to the traditional dynamic capabilities that's relies on the organizational routine [26], [27], new concept of dynamic capabilities is referring as an organizational specific process or "firm best practice" [30], [38] in effectively managing activities. According to [30], dynamic capabilities reside in the managerial levels in return is not promising sustainable advantage, therefore firm required to effectively organize their resource base with the "synergistic activities". Thus, there were three authors describing the process of building dynamic capabilities reside the firm which is [30] and [25] who are following [26] works. Based on their conceptual model, the "synergistic activities" comprise of creative integration assets and resource, reconfiguration the knowledge base, gain and release research through knowledge creation routines, leveraging knowledge by replicating a process and lastly, learning activities.

Researchers under the umbrella of dynamic capabilities believes that this theory is pertinent to represent organization specific strategies and management [30] to enables innovation, new product and process development, alliances, manufacturing, human resources and organizational learning to overcome internal and external changes of environment [26].The preliminary framework developed were discussing on firm capabilities to manage new product development based

on firm core capabilities was discover by [27], [39] and [28]. Research performed by [27] was underline the important of utilization the organization core capabilities as it perform as a mirror of knowledge collection embedded in employee's knowledge & skills, technical systems, managerial system and values and norms. Meanwhile, [39] in their holistic research view of product development strategy concluded that effective product development routine involved different functions or expertise such as team members, project leader, senior managers, customers and suppliers as a result for higher firm performance [30]. In a similar vein, [28] has highlighted the important of varies functional and integrative capabilities in terms of internal-external integration and technological-marketing capabilities to advance new product and process efficiency. However, as per se, the resources based theory is full with novel variables, yet organization capabilities in return obligate an exploratory research in particular business and industry specific settings.

[40] Uncovered ten factors forced firm to transform their business model for their own survival. One of the most significant forces in the 21st century is much related on the environmental concern. The ideas to be environmental friendly were representing through introducing of the green product and implementing green manufacturing. Therefore, rapid growing of authors in the area of technical eco innovation is emerging and they are aggressively proposing theoretical model and empirical research to support the argument on how firm could produced an eco product innovation and influence green manufacturing practices to the entire stakeholders.

[41] captured that firm performed sustainable competitive advantage in forms of pollution prevention, product stewardship and sustainable development [42]. As the pollution prevention and product stewardship creating values on lowering cost and firm base competition respectively, sustainable development served as a market positioning in the future. According to [41], the mentioned triple environmental approached needed a different strategy for effective management and implementation. Thus, [43] and [44] conducted an empirical and conceptual research to shed light on core capabilities that's crucial to effectively implemented technical eco innovation efforts. Both authors proposed a conceptual framework based on resource based perspective and [44] extended the model initiated by [39]. The summary of core capabilities encounter in literature review can be assess in the table 1. In table 1, the main construct for dynamic capabilities drawing from three main perspectives derives by pioneers authors from each domains namely new product development [27], [28], [39], innovation management [34]–[36] and eco design [43], [44].Amass findings from the previous researchers echo to the establishment of dedicated construct for dynamic eco innovation practices in four main pillars listed as below:

(A) Technology Collaboration

Technology collaboration can be defines as one of elements reside firm dynamic capabilities which is describing inter firm relations and enables tacit knowledge sharing between a buying and supplying organization in strategic areas likes product development, process re engineering and technical training. The integration scope occupied in both structural changes also infrastructural aspects related to methods and managerial systems [45] and [46].

(B) Green Human Resources

Green Human resource is part of firm's best practices in managing companies' resources related to the human or called employees to drive sustainability initiatives. At the heart of literature under GHRM, training is primarily linked towards environmental innovations relatives to others factors [47]–[49] and another relies on the performance base rewards [48], [50] and green team formation [27], [31], [34], [39], [43], [44].

(C) Eco Innovation Culture

"Eco innovation cultures" defines as shared values and beliefs of the organization and providing guidance to the employee's perceptions, attitude and behavior in their daily work [36], [51], [48]. To ensure the success of eco innovation efforts, supervisory behavior en route to increase employee's environmental initiatives [52].

(D) Environmental Management System Strategy

Environmental management system Strategy acknowledge as the heart of firm best practice and described as company's specific planning and vision to be realized [53]. With heavy commitment of the environmental management system by the entire system to the environment reduction lead to the sustainability development [54][55][56].

5 CONCLUSION: OPPORTUNITIES FOR NEW RESEARCH AGENDA

The automotive industry considered as a dynamic sector which is dealing with an upgrading technology capability, customer preferences, and managing suppliers for the auto components. According to [57], automotive industry approved as ones of rich stream of industries as its promising an economy growth mainly in developing countries in terms of opening room for employment[58] and social development through knowledge transfer with foreign firm[59].In South East Asian

region, the competition to win the domestic market is between Malaysia, Thailand and Indonesia [57]. Even though Thailand remains as a "Detroit of Asia" as a results from the successful implementation of industrial cluster policy[60], but Malaysian performance is par as Thailand and hold the top three positions in the ASEAN car market due to the strong dominance of the domestic market in Malaysia [61].

However, in the 21st century, due to environmental issues arose due to industrialization activities resulted on creation a green vehicles and green manufacturing. According to the YAB Dato Seri Mustafa Mohammad in the NAP 2014 launching ceremony, he emphasized the new trend of challenged for the global automotive industry is on 'how to reduce the Green House Gas as well as the CO2 emissions', as the on the road vehicles play a role as a main contributor for the 23% of global CO2 emission. Therefore, the governments around the world have implemented various incentives to encourage the implementation of both eco product and eco process that is significantly reduced environmental pollution. Besides that, one of the government's initiatives is building a competitive and sustainable domestic automotive industry. Thus, it is meaningful to study the antecedents of technical eco innovation efforts as the outcomes will provides an insight on building sustainable automotive industry central at the developing countries [20].

Table 1: Main construct of dynamic capabilities

Main Construct for dynamic capabilities / Authors		New product development			Innovation management			Eco/green innovation	
		[27]	[39]	[28]	[35]	[36]	[34]	[43]	[44]
Technological capabilities	**R&D capabilities** (Scientific expertise/employees skills)	X	X	X	X	X	X	X	X
	Manufacturing capabilities (Physical assets enables process Innovation)	X		X	X	X		X	X
	Specific set of design capabilities	X		X				X	X
	Technological complementarities (knowledge)			X					
External capabilities	**Managerial process** (external communication, socialization)	X	X	X	X	X	X	X	X
	Managerial system (empowerment, incentive, recruiting)	X	X	X	X				X
	Absorptive structures (network of collaboration)	X	X	X	X	X	X	X	X
	Culture and values for external absorption	X	X	X	X	X	X	X	X
Internal capabilities	**Managerial process** (internal communication, integrative strategies, political and financial support, subtle control)	X	X	X	X	X	X	X	X
	Managerial systems (job training, collective brainstorming, incentive**)**	X	X	X	X	X	X	X	X
	Integrative structure (process integration, organization reengineering)	X	X	X	X	X	X	X	X
	Culture and values for internal integration	X	X	X	X	X	X	X	X
Marketing capabilities	**Market research tools (**empathic design)	X	X	X	X				
	Strategic marketing management			X	X			X	X
	Marketing mix policies (4Ps)			X				X	
	Marketing complementariness			X					

REFERENCES

[1] J. Carrillo-Hermosilla, P. Del Río, And T. Könnölä, "Diversity Of Eco-Innovations: Reflections From Selected Case Studies," *J. Clean. Prod.*, Vol. 18, No. 10–11, Pp. 1073–1083, Jul. 2010.

[2] F. D. Angelo, C. J. C. Jabbour, And S. V. Galina, "Environmental Innovation: In Search Of A Meaning," *World J. Entrep. Manag. Sustain. Dev.*, Vol. 8, No. 2/3, Pp. 113–121, 2012.

[3] T. Kijek And A. Kasztelan, "Eco-Innovation As A Factor Of Sustainable Development," *Probl. Sustain. Dev.*, Vol. 8, No. 2, Pp. 103–112, 2013.

[4] B. Sezen And S. Y. Çankaya, "Effects Of Green Manufacturing And Eco-Innovation On Sustainability Performance," In *Procedia - Social And Behavioral Sciences*, 2013, Vol. 99, Pp. 154–163.

[5] Oecd, "Sustainable Manufacturing And Eco-Innovation," 2009.

[6] T. Machiba, *Framing Eco Innovation: The Concept And The Evolution Of Sustainable Manufacturing*. Oecd Publishing, 2009, Pp. 22–22.

[7] T. Schiederig, F. Tietze, And C. Herstatt, "Green Innovation In Technology And Innovation Management - An Exploratory Literature Review," *R&D Manag.*, Vol. 42, No. 2, Pp. 180–192, Mar. 2012.

[8] M. . Porter, "Towards A Dynamic Theory Of Strategy," *Stategic Manag. J.*, Vol. 12, No. S2, Pp. 95–117, 1991.

[9] K. Rennings And C. Rammer, "The Impact Of Regulation-Driven Environmental Innovation On Innovation Success And Firm Performance," *Cent. Eur. Econ. Reserach*, Vol. 065, No. 10, 2010.

[10] P. H. Driessen, B. Hillebrand, A. W. . Kok, And M. M. . Verhallen, "Green New Product Development: The Pivotal Role Of Product Grenness," *Ieee Trans. Eng. Manag.*, Vol. 60, No. 2, Pp. 315–326, 2013.

[11] F. Halila, "The Adoption And Diffusion Of Environmental Innovations," 2007.

[12] D. Pujari, "Eco-Innovation And New Product Development: Understanding The Influences On Market Performance," *Technovation*, Vol. 26, No. 1, Pp. 76–85, Jan. 2006.

[13] R. M. Dangelico And D. Pujari, "Mainstreaming Green Product Innovation: Why And How Companies Integrate Environmental Sustainability," *J. Bus. Ethics*, Vol. 95, No. 3, Pp. 471–486, Feb. 2010.

[14] B. Nunes And D. Bennett, *Case Studies Green Innovation Management In The Automotive Industry Case Studies*. 2006, Pp. 1–8.

[15] N. Ariffin, "Revisiting Malaysia ' S Technology And R & D-Related Policy Studies And Findings From 1990-2012 - Review Of Effectiveness Towards The Technological Capabilities Of Companies And Industrial Development," In *International Symposium On Accelerating Innovation In Developing Countries*, 2012.

[16] F. Kari And R. Rajah, "Automobiles Emisiions And The Environment," Canada, 2008.

[17] S. Manufacturing, "Eco-Innovation: Framework, Practices And Measurement," Paris, 2009.

[18] K. Rennings, "Redefining Innovation — Eco-Innovation Research And The Contribution From Ecological Economics," *Ecol. Econ.*, Vol. 32, No. 2, Pp. 319–332, Feb. 2000.

[19] A. Arundel And R. Kemp, "Measuring Eco Innovation," Netherlands, 2009.

[20] L. Rashid, S. Yahya, S. A. Shamee, J. Jabar, M. Sedek, And S. Halim, "Eco Product Innovation In Search Of Meaning: Incremental And Radical Practice For Sustainability Development," *Asian Soc. Sci.*, Vol. 10, No. 13, Pp. 78–88, Jun. 2014.

[21] M. Porter, "What Is Strategy?," *Harv. Bus. Rev.*, Vol. November-Dec, Pp. 62–78, 1996.

[22] J. Barney, "Firm Resources And Sustained Competitive Advantage," *J. Manage.*, Vol. 17, No. 1, Pp. 99–120, Mar. 1991.

[23] B. Wernerfelt, "A Resource-Based View Of The Firm," *Strateg. J.*, Vol. 5, No. 2, Pp. 171–180, 1984.

[24] G. P. Kostopoulos, K. C., Spanos, Y. E., & Prastacos, "The Resource – Based View Of The Firm And Innovation: Identification Of Critical Linkages," In *European Academy Of Management Conference*, 2002, Pp. 1–19.

[25] V. Ambrosini And C. Bowman, "What Are Dynamic Capabilities And Are They A Useful Construct In Strategic Management?," *Int. J. Manag. Rev.*, Vol. 11, No. 1, Pp. 29–49, 2009.

[26] D. J. Teece, G. Pisano, And A. Shuen, "Dynamic Capabilities And Strategic Management," *Strateg. Manag. J.*, Vol. 18, No. 7, Pp. 509–533, 1997.

[27] D. Leonard-Barton, "Core Capabilities And Core Rigidities : A Paradox In Managing New Product Dev," *Strateg. Manag. J.*, Vol. 13, No. Special Issue, Pp. 111–125, 1992.

[28] Verona, "A Resource Based View Of Product Development," *Acad. Manag. Rev.*, Vol. 24, No. 1, Pp. 132–142, 1999.

[29] C. K. Prahalad And G. Hamel, "The Core Competence Of The Corporation," 1990.

[30] K. M. Eisenhardt And J. A. Martin, "Dynamic Capabilities: What Are They?," *Strateg. Manag. J.*, Vol. 21, No. 10–11, Pp. 1105–1121, Oct. 2000.

[31] V. Ambrosini, V. Browman, And N. Collier, " 'Dynamic Capabilities: An Exploration Of How Firms Renew Their Resource Base," *Br. J. Manag.*, Vol. 20, No. S1, Pp. 9–24, 2009.

[32] M. Easterby-Smith, M. A. Lyles, And M. A. Peteraf, "Dynamic Capabilities: Current Debates And Future Directions," *Br. J. Manag.*, Vol. 20, Pp. S1–S8, Mar. 2008.

[33] R. Balachandra And J. H. Friar, "Factors For Success In R&D Projects And New Product Innovation: A Contextual Framework," *Ieee Trans. Eng. Manag.*, Vol. 44, No. 3, Pp. 276–287, 1997.

[34] M. M. Crossan And M. Apaydin, "A Multi-Dimensional Framework Of Organizational Innovation: A Systematic Review Of The Literature," *J. Manag. Stud.*, Vol. 47, No. 6, Pp. 1154–1191, Sep. 2010.

[35] B. Lawson And D. Samson, "Developing Innovation Capability In Organisations: A Dynamic Capabilities Approach," *Int. J. Innov. Manag.*, Vol. 05, No. 03, Pp. 377–400, Sep. 2001.

[36] M. Smith, J. W. Building, M. Busi, H. House, D. B. Park, P. Ball, S. Lecturer, And R. Van Der Meer, "Factors Influencing An Organisations Ability To Manage Innovation : A Structured Literature Review And Conceptual Model," *Int. J. Innov. Manag.*, Vol. 12, No. 4, Pp. 655–676, 2008.

[37] P. Trott, *Innovation Management And New Product Development*. London: Pearson Education Limited, 2008, Pp. 1–567.

[38] C. Bowman And V. Ambrosini, "How The Resource Based And The Dynamic Capability Views Of The Firm Inform Corporate Level Strategy," *Br. J. Manag.*, Vol. 14, No. 4, Pp. 289–303, 2003.

[39] S. Brown And K. Eisenhardt, "Product Development: Past Research, Present Findings And Future Directions," *Acad. Manag. Rev.*, Vol. 20, No. 2, Pp. 343–378, 1995.
[40] C. K. Prahalad And G. Hamel, "Strategy As A Field Of Study: Why Search For A New Paradigm," *Strateg. Mana*, Vol. 15, No. Special Issue, Pp. 5–16, 1994.
[41] S. L. Hart, "A Natural-Resource-Based View Of The Firm," *Acad. Manag. Rev.*, Vol. 20, No. 4, P. 986, Oct. 1995.
[42] T. Butler, "'Leveraging Sustainability: How Companies Enhance Their Eco-Innovation Success,'" Rensealaer Polytechnic Institute, New York, 2004.
[43] M. V. Russo And P. A. Fouts, "A Resource-Based Perspective On Corporate Environmental Performance And Profitability.," *Acad. Manag. J.*, Vol. 40, No. 3, Pp. 534–559, Jun. 1997.
[44] G. Johansson, "Success Factors For Integration Of Ecodesign In Product Development: A Review Of State Of The Art," *Environ. Manag. Heal.*, Vol. 13, No. 1, Pp. 98–107, 2002.
[45] K. H. Hofmann, G. Theyel, And C. H. Wood, "Identifying Firm Capabilities As Drivers Of Environmental Management And Sustainability Practices - Evidence From Small And Medium-Sized Manufacturers," *Bus. Strateg. Environ.*, Vol. 21, No. 8, Pp. 530–545, Dec. 2012.
[46] S. Vachon And R. D. Klassen, "Extending Green Practices Across The Supply Chain: The Impact Of Upstream And Downstream Integration," *Int. J. Oper. Prod. Manag.*, Vol. 26, No. 7, Pp. 795–821, 2006.
[47] C. Jos And C. Jabbour, "Environmental Training In Organisations : A Literature Review," In *The Clute Institute International Academic Conference*, 2013.
[48] N. Govindarajulu And B. F. Daily, "Motivating Employees For Environmental Improvement," *Ind. Manag. Data Syst.*, Vol. 104, No. 4, Pp. 364–372, 2004.
[49] T. C. Ling, "Human Resource Management Practices," *J. Appl. Bus. Res.*, Vol. 26, No. 4, Pp. 105–116, 2010.
[50] D. W. S. Renwick, T. Redman, And S. Maguire, "Green Human Resource Management: A Review And Research Agenda," *Int. J. Manag. Rev.*, Vol. 15, No. 1, Pp. 1–14, Jan. 2013.
[51] R. M. Shatouri, R. Omar, K. Igusa, And D. S. P. Filho, "Embracing Green Technology Innovation Through Strategic Human Resource Management : A Case Of An Automotive Company," *Am. J. Econ. Bus. Adm.*, Vol. 5, No. 2, Pp. 65–73, 2013.
[52] C. Ramus And U. Steger, "The Roles Of Supervisory Support Behaviors And Environmental Policy In Employee ' Ecoinitiatives ' At Leading-Edge European Companies," *Acad. Manag. J.*, Vol. 43, No. 4, Pp. 605–626, 2000.
[53] G. Barczak And K. B. Kahn, "Identifying New Product Development Best Practice," *Bus. Horiz.*, Vol. 55, No. 3, Pp. 293–305, May 2012.
[54] R. Sroufe, "Effects Of Environmental Management Systems On Environmental Management Practices And Operations," *Prod. Oper. Manag.*, Vol. 12, No. 3, Pp. 416–431, Jan. 2003.
[55] S. J. Wu, S. A. Melnyk, And R. J. Calantone, "Assessing The Core Resources In The Environmental Management System From The Resource Perspective And The Contingency Perspective," *Ieee Trans. Eng. Manag.*, Vol. 55, No. 2, Pp. 304–315, May 2008.
[56] K. Rehfeld, K. Rennings, And A. Ziegler, "Integrated Product Policy And Environmental Product Innovations: An Empirical Analysis," *Ecol. Econ.*, Vol. 61, No. 1, Pp. 91–100, 2007.
[57] M. Rosli, "The Automobile Industry And Performance Of Malaysian Auto Production," *J. Econ.*, Vol. 27, No. 1, Pp. 89–114, 2006.
[58] Nurulizwa, S. Yahya, And S. Samer, "Advance Product Quality Planning: A Guide To Effective Implementation For Organizations," In *Managing Business Dynamic And Changes*, M. Hassan, W. F. Yee, And Z. D. Mansor, Eds. Selangor: Mc Graw Hill Publication, 2013, Pp. 77–91.
[59] S. Samer, I. Majid, Nurulizwa, And Fasasi, "Inter-Firm Knowledge Transfer To The Capability Of Local Parts Firms In The Malaysian Automobile Industry," *Eur. J. Innov. Manag.*, Vol. 4, No. 18, Pp. 156–163, 2012.
[60] A. Kuchiki, "A Flowchart Approach To Malaysia ' S Automobile Industry Cluster Policy," 2007.
[61] P. Wad And V. G. R. Chandran Govindaraju, "Automotive Industry In Malaysia : An Assessment Of Its Development," *Int. J. Automot. Technol. Manag.*, Vol. 11, No. 2, Pp. 152–171, 2011.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 457-470
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Modélisation et simulation des écoulements de surface dans le bassin versant du Bandama blanc : utilisation d'un modèle distribué (HYDROTEL)

[Modeling and simulation of surface runoff in the watershed of the White Bandama: using a distributed model (HYDROTEL)]

Matta Amessan, Fernad Kouamé, Théophile Lasm, Bi V. H. N'guessan, Kouamé Aka, and Jean Biémi

UFR des Sciences de la Terre et des Ressources Minières (STRM),
Université Felix Houphouet Boigny, Côte d'Ivoire

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The objective of this study is to better understand the functioning of a river system in the context of sustainable management of water resources. To better understand this functioning, hydrogeological modelling of the watershed of White Bandama is necessary. The methodological approach is derived from a process comprising two steps. The results are derived from a process comprising two steps. The first step consists in the mapping of the physical descriptors of the watershed that affect hydrological processes, such as topography, drainage patterns, land cover and soil type. Using PHYSITEL and a Digital Elevation Model (DEM), slope and orientation maps of the facets are derived and then coupled to the water system for the characterization of the internal hydrographic structure of the watershed. Supervised classification of Landsat TM dating from 1987 to 1993 led to the mapping of land use. The second step consists in combination of established thematic maps. The combination of these thematic maps is used to determine with HYDROTEL the dominant type of soil and land use by Relatively Homogeneous Hydrological Units (RHHU) representing small sub-watersheds.

KEYWORDS: Hydrotel, White Bandama River, Remote sensing, Physitel.

RESUME: L'objectif de cette étude est de mieux comprendre le fonctionnement d'un hydrosystème dans le contexte d'une gestion durable des ressources en eau. Pour mieux comprendre le fonctionnement d'un hydrosystème et dans le contexte d'une gestion durable des ressources en eau la modélisation hydrogéologique du bassin versant du Bandama Blanc s'avère nécessaire. L'approche méthodologique dérive d'une démarche comportant 2 étapes. La première étape consiste en la cartographie des descripteurs physiques du bassin qui influencent les processus hydrologiques tels que la topographie, le réseau hydrographique, la couverture végétale et le type de sol. A partir du modèle PHYSITEL et d'un Modèle Numérique d'Altitude (MNA), les cartes des pentes et des orientations des facettes sont dérivées et ensuite couplées au réseau hydrographique pour la caractérisation de la structure interne d'écoulement du bassin. La classification supervisée des images satellitaires Landsat TM datant de 1987 à 1993 ans permet de produire des cartes d'occupation du sol. La deuxième étape consiste au croisement des cartes thématiques établies. La combinaison de ces cartes thématiques permet de déterminer le type de sol dominant et les occupations du sol par Unités Hydrologiques Relativement Homogènes (UHRH) représentant de petits sous bassins versants, utilisés comme unités de simulations des processus hydrologiques sous HYDROTEL.

MOTS-CLEFS: Hydrotel, Bandama Blanc, télédétection, Physitel.

Corresponding Author: Bi V. H. N'guessan

1 INTRODUCTION

L'évaluation et la gestion efficace des ressources en eau d'un territoire requièrent une connaissance approfondie des processus hydrologiques mis en jeu ainsi que de leurs échelles de temps et d'espace particulières [29]. L'utilisation des outils numériques d'aide à la décision est devenue incontournable car ils permettent d'intégrer des données multi-sources et de faire des analyses pouvant tenir compte de contraintes très diversifiées pour une optimisation de la gestion des eaux [7]. Parmi ces outils, les modèles hydrologiques occupent une place de choix dans la compréhension des processus et des interactions dynamiques entre les paramètres environnementaux et physiographiques qui interviennent dans un hydrosystème.

Au cours de ces dernières décennies, l'usage des modèles mathématiques est devenu courant dans le développement et la gestion des ressources en eau. Ces modèles informatisés étaient essentiellement globaux, en ce sens que les bassins pour lesquels les débits étaient simulés étaient considérés comme un tout non subdivisé. Ces derniers présentent l'avantage de pouvoir prendre en compte la répartition des caractéristiques du milieu (topographie, catégorie d'occupation des terres, textures des sols, etc.). En effet, les processus hydrologiques sont fonction des états de surface ainsi que du climat et ils évoluent aussi bien dans l'espace que dans le temps. Pour décrire le milieu, l'intégration des données géospatiales provenant de la télédétection et des systèmes d'information géographique (SIG) a contribué au développement de certains modèles hydrologiques et à l'adaptation de modèles préexistants par l'exploitation efficiente des informations dérivées.

Les SIG permettent le traitement, l'analyse des données et la production de cartes thématiques permettant de décrire les caractéristiques physiographiques, comme la topographie, les sols, la lithologie etc. Ces informations géospatiales permettent de faire une représentation réaliste des hydrosystèmes. L'intérêt évident des techniques spatiales (télédétection et SIG) pour l'amélioration de la capacité des modèles hydrologiques distribués justifie leur utilisation en synergie dans ce travail. Cependant, le choix du modèle dépend des données d'entrée disponibles, des composantes représentées et de l'échelle spatio-temporelle de modélisation. De plus, les processus hydrologiques sont modélisés par des équations qui assurent la conservation de la masse, de la quantité de mouvement et de l'énergie. Ces modèles qui font appel à un nombre important de variables, sont généralement applicables à des bassins bien instrumentés ayant des données d'entrée à grande échelle.

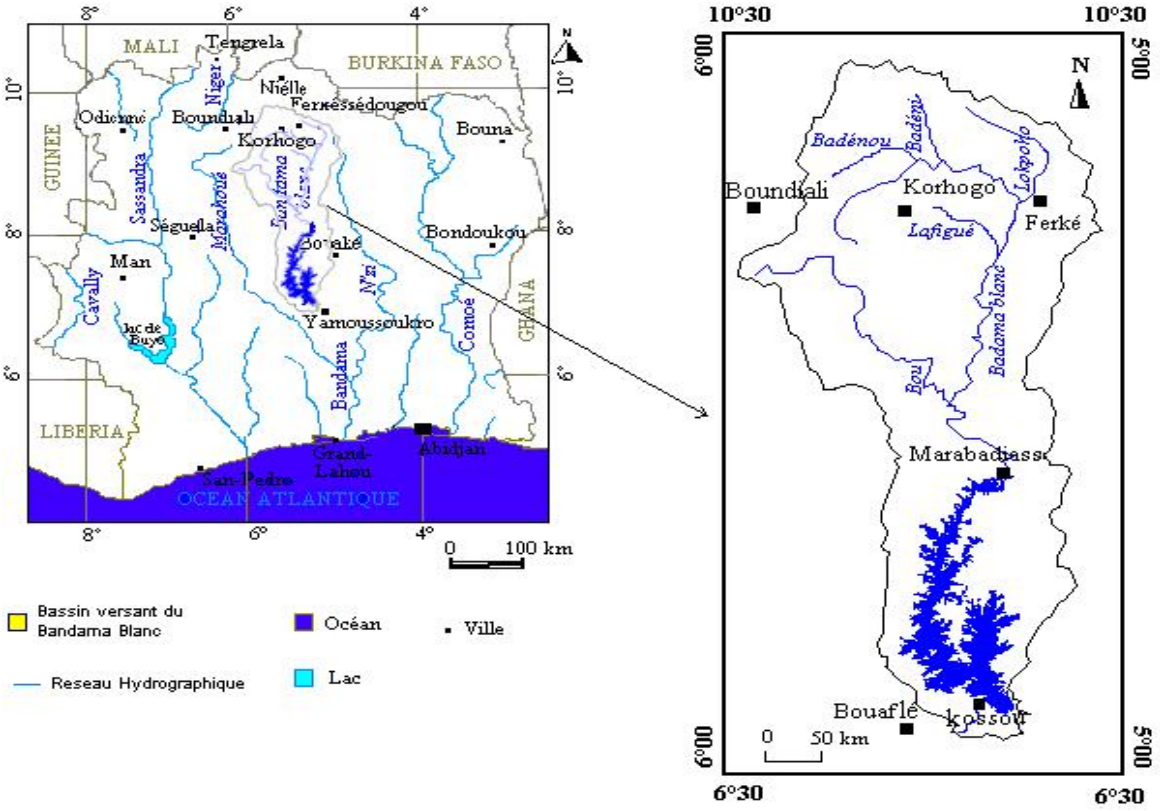
Les modèles hydrologiques distribués comme ANSWERS [6], TOPMODEL [3], CEQUEAU [22] et HYDROTEL [8], [10] offrent un bon compromis pour l'exploitation des données disponibles et présentent la particularité de pouvoir s'appliquer à une gamme variée de bassins. Dans cet article, on présente la modélisation hydrologique du bassin versant du Bandama Blanc à l'Ouest de la Côte d'Ivoire. Cet hydrosystème a un climat de type tropical humide.

À l'instar des régions d'Afrique de l'Ouest et Centrale [16], [25], [19], la Côte d'Ivoire a été affectée par la sécheresse persistante et sévère de 1970 à 1990 [28], [2]. Cette sécheresse sans équivalent dans le monde, qui s'est prolongée jusqu'en 2002 au Sahel [20], a eu un impact sur les ressources en eau [27], [17], [11] et influencé les modifications environnementales [5], [4] dans l'Ouest de la Côte d'Ivoire. Dans ce contexte de variabilité climatique et de mutation environnementale, une évaluation du potentiel hydrique s'avère nécessaire dans l'optique d'une Gestion Intégrée des Ressources en Eau (GIRE). L'intégration des techniques spatiales (télédétection et SIG) permet une représentation et une description des processus hydrologiques. Aussi, la prise en compte des variables hydrométéorologiques permettent la simulation des écoulements des eaux dans l'hydrosystème du Bandama Blanc. Le modèle hydrologique HYDROTEL, qui a montré son potentiel en simulation et en prévision hydrologiques sur des bassins versants au Canada [10] en France, et dans les bassins du N'zo [18], [1] pourrait être adapté pour la modélisation du bassin versant du Bandama Blanc afin :

1) de tester son applicabilité en milieu tropical humide ;
2) d'établir une base de données physiographique du bassin ;
3) de simuler les écoulements superficiels des eaux.

2 PRESENTATION DE LA ZONE D'ETUDE

Le bassin du Bandama blanc (figure 1), objet de cette étude, s'étend du Nord au Centre de la Côte d'Ivoire entre les latitudes 6°30 et 10°30 Nord et les longitudes 5°00 et 6°00 Ouest. Il a une forme rectangulaire et une superficie de 34059 Km². Ce bassin est un affluent du Bandama qui a une longueur de 1050 km. Le Bandama est le seul parmi tous les grands fleuves de la Côte d'Ivoire dont le bassin versant est entièrement en territoire ivoirien. Le Bassin du Bandama Blanc prend sa source à une altitude de 480 m entre Korhogo et Boundiali. Après une orientation E-W de son cours supérieur jusqu'à Ferkéssédougou, il prend une direction N-S. De Ferkéssédougou à sa confluence avec le Bou, le Bandama décrit une succession de nombreux méandres. Au droit de Kossou, la vallée se resserre notablement. C'est à cet endroit qu'est construit depuis 1971 le barrage de Kossou (le plus important barrage hydroélectrique du pays).



3 DONNÉES ET MATÉRIELS

3.1 DONNÉES

3.1.1 DONNÉES GÉOSPATIALES

- **Modèle Numérique d'Altitude (MNA)**

Le Modèle Numérique d'Altitude (MNA) du bassin versant du Bandama blanc est fourni par le site américain « **ftp://e0srp01u.ecs.nasa.gov/srtm/version2/SRTM3/Africa** ». Ces données ont été recueillies par la navette spatiale américaine Endeavour, au cours d'une mission d'une dizaine de jours (11/02/2000 – 22/02/2000), en format Shuttle Radar Topography Mission (SRTM). Le traitement des données par interférométrie radar a permis de générer les MNA de résolution spatiale de 90 m, avec une précision altimétrique de 16 m/10 m (absolu/relatif). La couverture du bassin versant a nécessité douze (12) fichiers SRTM allant du 5° au 6° longitude Ouest, et du 6°30 au 10°30 latitude Nord.

- **Images satellitaires**

Les images MOD13A3 « Indice de végétation » ont servi à l'élaboration de ce travail. Les caractéristiques de ces images sont présentées dans le tableau II.

Tableau II: Produit MOD13A3 (http://edcdaac.usgs.gov/modis/mod13.html)

Bandes	Nom	Résolution spatiale (m)	Résolution temporelle (mois)
1	NDVI	1000	1
2	EVI	1000	1
3	Qualité de NDVI	1000	1
4	Qualité d'EVI	1000	1
5	Réflectance du rouge	1000	1
6	Réflectance de PIR	1000	1
7	Réflectance du bleu	1000	1
8	Réflectance du MIR	1000	1
9	Angle moyen de vue au zénith	1000	1
10	Angle moyen du soleil au zénith	1000	1
11	Angle moyen de l'azimut relatif	1000	1

Pour la détermination des classes d'occupation du sol, des images MODIS-NDVI (MOD13A3) de Février 2006 fournies par un site Internet américain (**http://modarch.gsfc.nasa.gov/MODIS/RESULTS/DATAPROD/**) ont été utilisées. Ces images sont issues des scènes MOD13A3 h17v07 (Nord de la Côte d'Ivoire) et MOD13A3 h17v08 (Sud de la Côte d'Ivoire). Elles ont déjà subies des prétraitements, c'est-à-dire des corrections radiométriques et géométriques.

- **Données de texture du sol**

Pour l'établissement de la carte texturale du sol du bassin versant du Bandama Blanc nous avons utilisé les cartes pédologiques aux 1/500 000 du Nord-Est, du Nord-Ouest, du Sud-Est et du Sud-Ouest de la Côte d'Ivoire réalisées par [24].

- **Réseau hydrographique**

Pour la numérisation du réseau hydrographique de la zone d'étude nous avons utilisé des cartes topographiques du Sud-Est, Sud-Ouest, Nord-Est, et du Nord-Ouest de la Côte d'Ivoire à l'échelle 1/200 000 réalisées par le Centre de Cartographie et de Télédétection (CCT) en 1995.

3.1.2 DONNÉES HYDROMÉTÉOROLOGIQUES

Pour prendre en compte les variabilités spatiale et temporelle du climat, les données hydrométéorologiques, au pas de temps journalier, recueillies *in situ* de 1996 à 2000 sont utilisées :

- Les données météorologiques (pluies, températures), sont mises à notre disposition par La SODEXAM. Ces données pluviométriques concernent les précipitations mesurées aux différentes stations de jaugeage (figure 2) ;
- Les données Hydrométriques utilisées dans le cadre de ce travail, concernant les débits Journaliers mesurés aux différentes stations de jaugeage (figure 2) au cours de la période 1996-2000. Les données peuvent être utilisées pour mener une bonne étude puisqu'elles sont continues et couvrent l'ensemble du bassin, d'amont en aval.

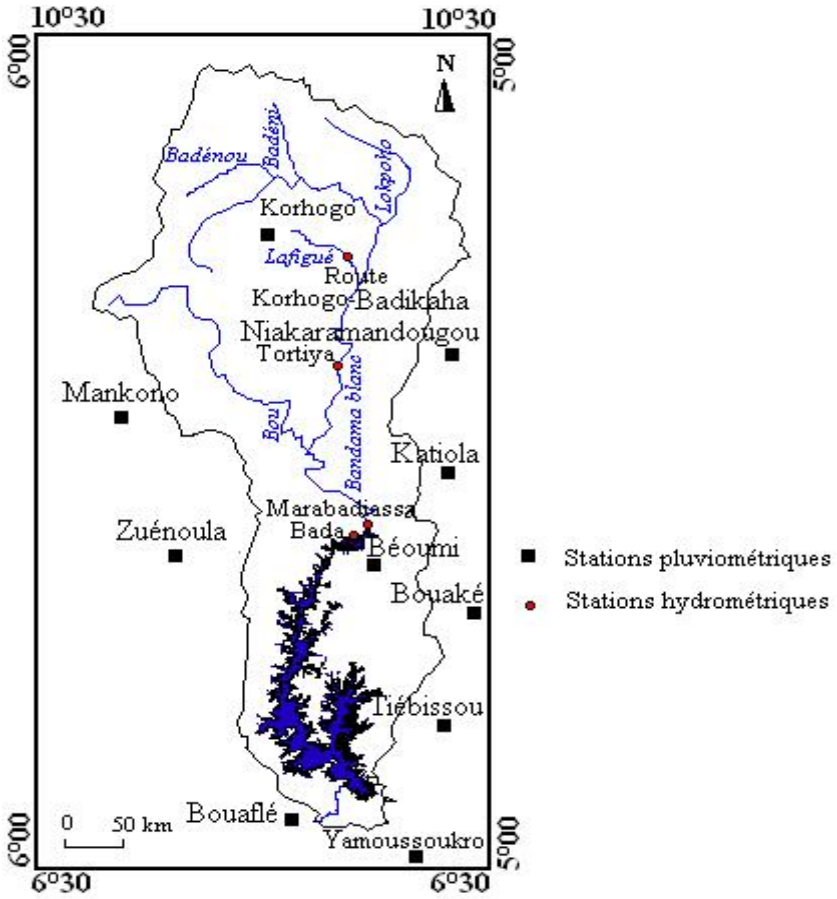


Fig 2. Carte de répartition des stations pluviométriques et hydrométriques du bassin versant du Bandama Blanc

3.2 MATÉRIELS INFORMATIQUES ET LOGICIELS

Les matériels informatiques concernent principalement :

- **Le logiciel MapInfo professionnel 7.5** a servi à la cartographie des types de sol, la numérisation et la correction du réseau hydrographique.
- **Le logiciel ENVI 4.3** a été utilisé pour effectuer la mosaïque des fichiers MNA et le traitement de l'mage Landsat TM.
- **Le logiciel PCI Works V7.0** a servi à convertir des fichiers (MNA, Carte d'occupation du sol) en format compatible à PHYSITEL.
- **Le logiciel PHYSITEL (Version 3.0)** a servi à déterminer la structure d'écoulement du bassin versant, à structurer les données d'occupation du sol et des types de sol, et à construire les fichiers relatifs à la base de données descriptives du bassin pour HYDROTEL.
- **Le logiciel HYDROTEL** permet de simuler les écoulements des eaux en mode continu.

3.3 CALAGE ET VALIDATION D'UN MODELE HYDROLOGIQUE

Le calage consiste à ajuster les valeurs numériques attribuées aux paramètres du modèle pour reproduire au mieux la réponse observée. C'est le processus de choix de jeux de valeurs des paramètres. Cette opération peut se faire par une procédure essai et erreur, ou automatiquement par une procédure d'optimisation en cherchant la valeur optimale d'un critère donné (communément appelé fonction objective) qui améliore la cohérence entre la réponse observée et simulée du bassin. Une fois un modèle hydrologique distribué implanté sur un bassin versant donné, se pose ensuite la question de savoir quelle est la capacité du modèle à simuler le présent ou le futur ? C'est l'étape de la validation qui doit répondre à cette question. Cette étape consiste à vérifier la reproductibilité des résultats par le modèle et la représentativité des paramètres calés. Son principe est de tester le modèle sur une série de données non utilisées dans la phase de calage.

4 RÉSULTATS

4.1 CALAGE

L'analyse numérique du degré d'ajustement entre les valeurs observées et simulées pendant le calage et la validation du modèle s'est effectuée à travers le critère de Nash, la RCEQM et l'Ecart en Volume.

4.1.1 RÉSULTATS DU CALAGE (ANNÉE 1996)

- **Station de Korhogo/Badikaha**

Les résultats du calage à la station de Korhogo/Badikaha (figure 3a) montrent que les débits journaliers simulés concordent assez bien avec les débits journaliers observés. Le critère de Nash qui est de 0,92 indique que le calage est satisfaisant. Les périodes de crue (août-octobre) et de décrue (novembre) sont bien simulées à l'exception de la crue observée à la mi Novembre et qui n'a pu être représentée. A la période d'étiage (juin juillet) on note une surestimation des débits simulés qui s'explique à travers le critère de l'EV qui est de -4,7%. Enfin, le critère de la RCEQM (0,25) donne une évaluation globale des processus modélisés.

- **Station de Tortiya**

Les résultats du calage à la station de Tortiya (figure 3b) montrent que les débits journaliers simulés concordent assez bien avec les débits journaliers observés. Le critère de Nash (0,78) indique que le calage est satisfaisant. Ce dernier a été amélioré par les calages effectués sur la station effectuée en amont (Korhogo/Badikaha). Ainsi, les paramètres de modélisation utilisés (BV3C, Interpolation des données météorologiques…) peuvent être retenus pour expliquer le fonctionnement global de l'Hydrosystème du Bandama blanc. Toutefois on note une surestimation des débits en période d'étiage (avril à Mars) se traduisant par la supériorité des lames d'eau simulées (337,93 mm) sur les lames d'eau observées (285,52mm). Enfin les critères de la RCEQM et de l'EV sont respectivement de 2,54 et de -4,9%.

- **Station de Marabadiassa**

Au niveau de la station de Marabadiassa (figure 3c), on a une bonne concordance des courbes simulées et observées, avec une légère surestimation des pics. Le critère de Nash est de 0,81 preuve d'un calage satisfaisant. La grande différence entre les lames d'eau observées et simulées est due à la surestimation des débits en période d'étiage et de décrue. Le critère de Nash a été amélioré par les calages effectués sur les stations situées en amont. Le critère de l'EV donne -8,35% preuve d'une légère surestimation des débits en période d'étiage enfin le critère de la RCEQM est de 4,1.

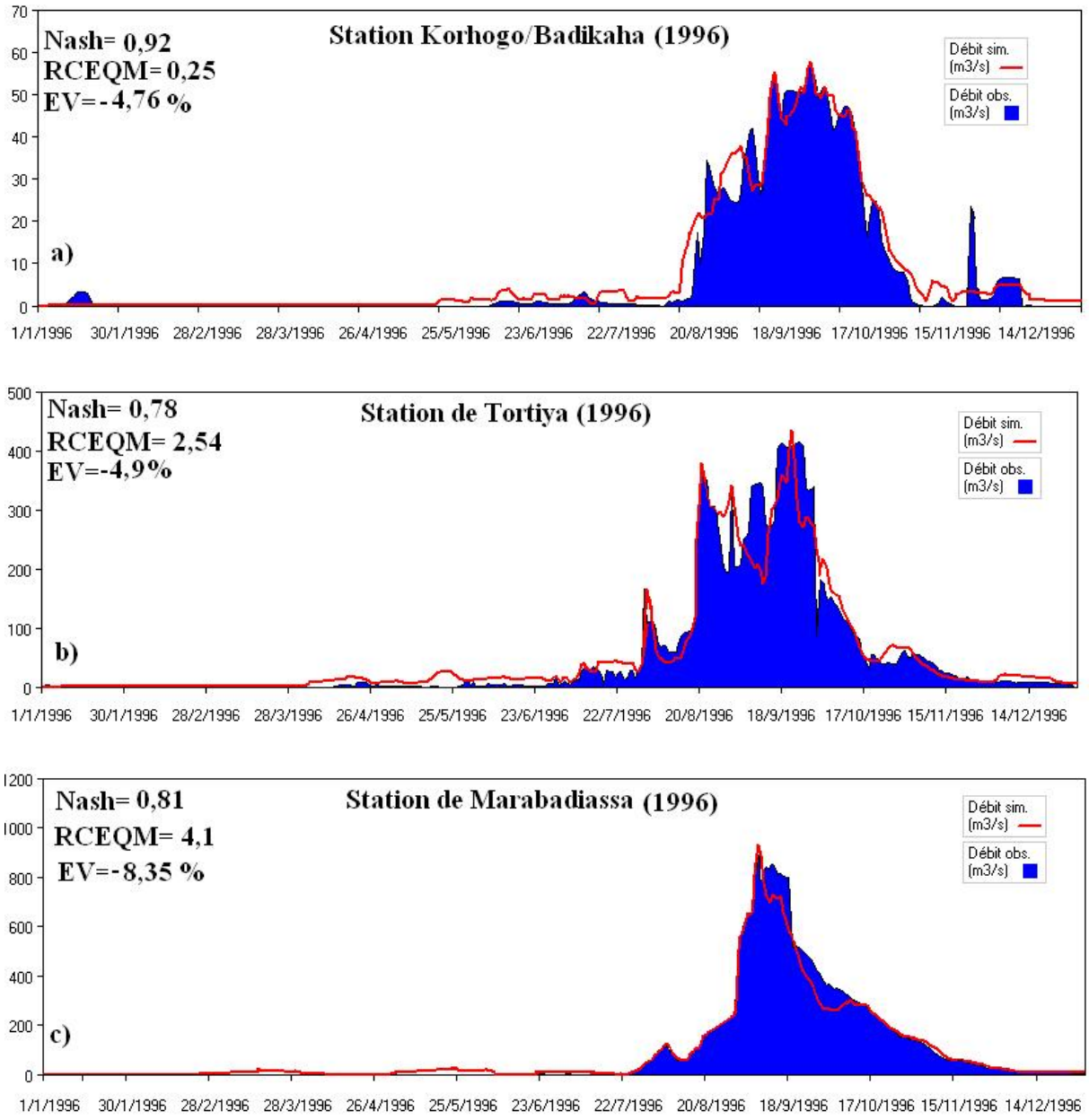


Fig 3. Débits simulés et observés pour le calage du modèle (1996) ; a) station de Korhogo/Badikaha, b) station de Tortiya c) station de Marabadiassa

L'analyse numérique et graphique des résultats du calage du modèle HYDROTEL pour l'année 1996 montre que les débits journaliers simulés concordent assez bien avec les débits journaliers observés aux stations de calage. Le synchronisme entre débits observés et simulés est respecté. Cependant, on note une surestimation ou une sous estimation des débits simulés en période d'étiage et de décrue, qui s'explique par la supériorité des lames d'eau simulées par rapport aux lames d'eau observées. Le critère de Nash indique que le calage est satisfaisant avec des valeurs qui oscillent entre 0,78 et 0,90. Ainsi, les paramètres de modélisation utilisés peuvent être retenus pour expliquer le fonctionnement global de l'hydrosystème du Banadama Blanc.

4.2 RESULTATS DE LA VALIDATION TEMPORELLE (ANNEES 1997 ET 1999)

La validation temporelle est faite sur deux périodes (années 1997et 1999) selon les mêmes jeux de paramètres utilisés pour la calibration du modèle en 1996.

- **Validation temporelle pour l'année 1997**

L'analyse graphique de la station de Korhogo/Badikaha (figure 4a) nous montre que les allures des courbes simulée et observée sont assez synchrones avec un critère de Nash égal à 0,88. On note cependant une surestimation des débits sur une partie du cycle (juin à juillet). La crue qui est observée dans le mois de décembre n'est pas représentée. Ces écarts semblent être dus à un problème d'extrapolation des paramètres de calages (BV3C, Interpolation des données météorologiques…). Ils peuvent aussi révéler l'incapacité du réseau de mesure de précipitation à suivre leur répartition temporelle sur ce sous bassin. Les critères de la RCEQM et de l'EV sont respectivement de 0,36 et de -6,77% preuve d'une assez bonne simulation.

La station de Tortiya (figure 4b) présente une simulation moyennement satisfaisante avec un Nash de 0,80. L'analyse du graphique de cette station fait apparaître une période d'étiage (mai à Juin) Caractérisée par une surestimation des débits simulés. Cette surestimation est due à l'évolution dans le temps des caractéristiques internes du bassin, notamment l'humidité dans les différentes couches du sol et la saturation après un épisode pluvieux comme ce fut le cas dans le bassin du N'zo. Les critères de la RCEQM et de l'EV sont respectivement de 3,98 et de -5,44%.

La station de Marabadiassa (figure 4c) montre un léger décalage entre les débits observés et simulés: les pics simulés apparaissent après les pics observés. La période d'étiage (mai à juin) est caractérisée par une surestimation des débits.

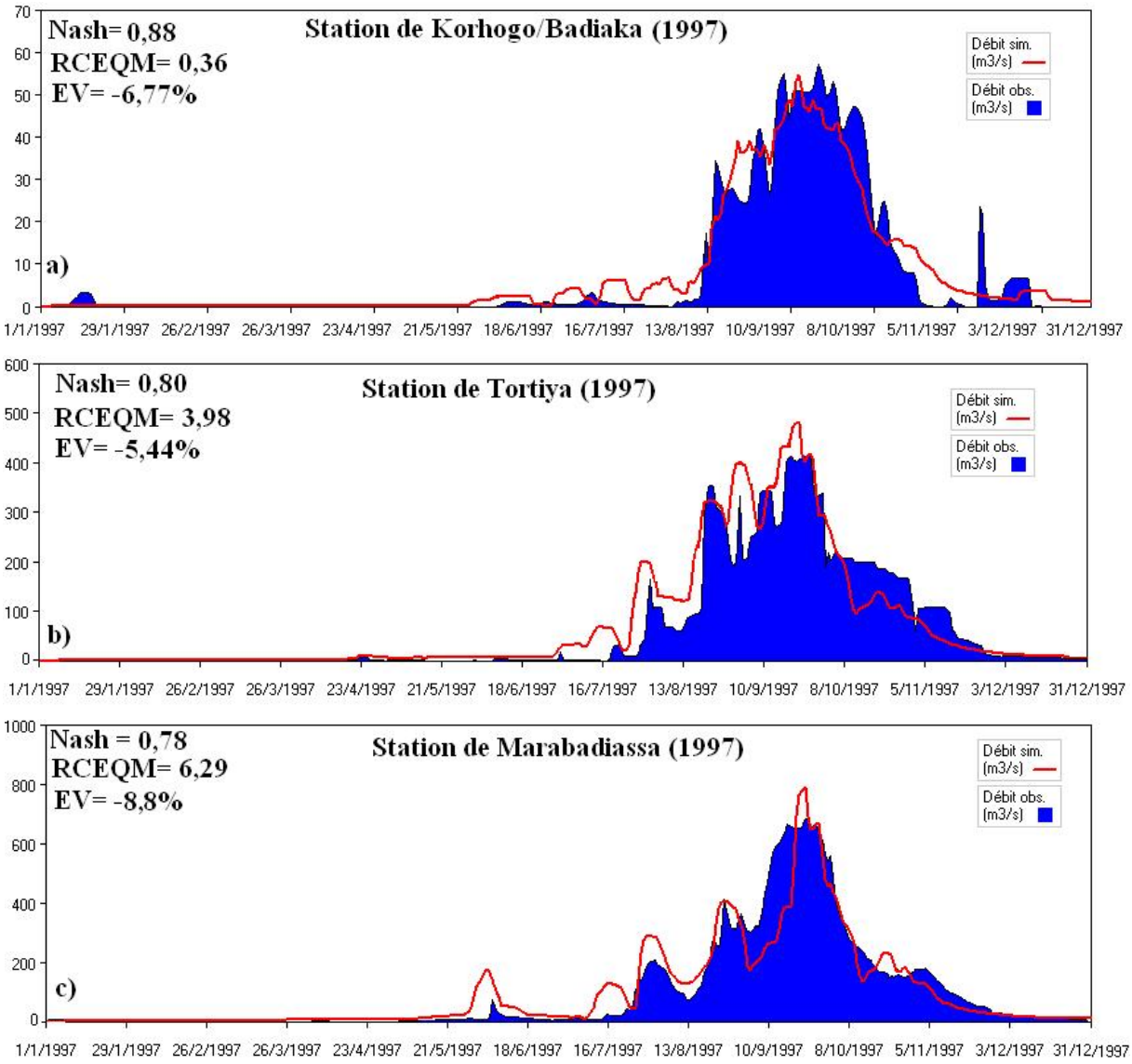


Fig. 4 Débits simulés et observés pour la validation (1997) ; a) station de Korhogo/Badikaha, b) station de Marabadiassa, c) station de Tortiya

- **Validation temporelle pour l'année 1999**

La validation temporelle du modèle pour l'année 1999, donne un meilleur résultat de simulation pour la station de Korhogo/Badikaha (figure 5a) avec un critère de Nash de 0,80.

On observe une bonne reproduction des hydrogrammes. La simulation des écoulements à la station de Korhogo/Badikaha permet de reproduire de façon satisfaisante l'écoulement de l'eau et de suivre le fonctionnement du bassin à long terme. Il apparaît donc que le modèle HYDROTEL produit des simulations satisfaisantes malgré les écarts observés au début de la saison pluvieuse (Juin).

La station de Tortiya (figure 5b) a un Nash égale à 0,76. On note un bon synchronisme entre les débits simulés et observés, toute fois, en période d'étiage (mars et mai) il y'a une surestimation des débits simulés. Le problème de cette station réside en période de décrue (novembre) où l'on note une mauvaise simulation de l'écoulement.

A la station de Marabadiassa (figure 5c) on note un assez bon synchronisme entre les débits simulés et observés avec un critère de Nash égale à 0,76. En période d'étiage (février à avril), on note une surestimation des débits simulés.

Les tableaux VI et VII présentent respectivement les valeurs des différents paramètres calés au niveau des stations hydrométriques du Bandama Blanc et les critères de Nash, les EV et les RCEQM des différentes années de simulation. Ces paramètres du modèle utilisé lors du calage peuvent être retenus pour expliquer le fonctionnement global de l'hydrosystème du Bandama Blanc. Ainsi, l'un des atouts de la modélisation mathématique des bassins versants est sans nul doute la possibilité de comprendre le fonctionnement des hydrosystèmes ([8],[9]).

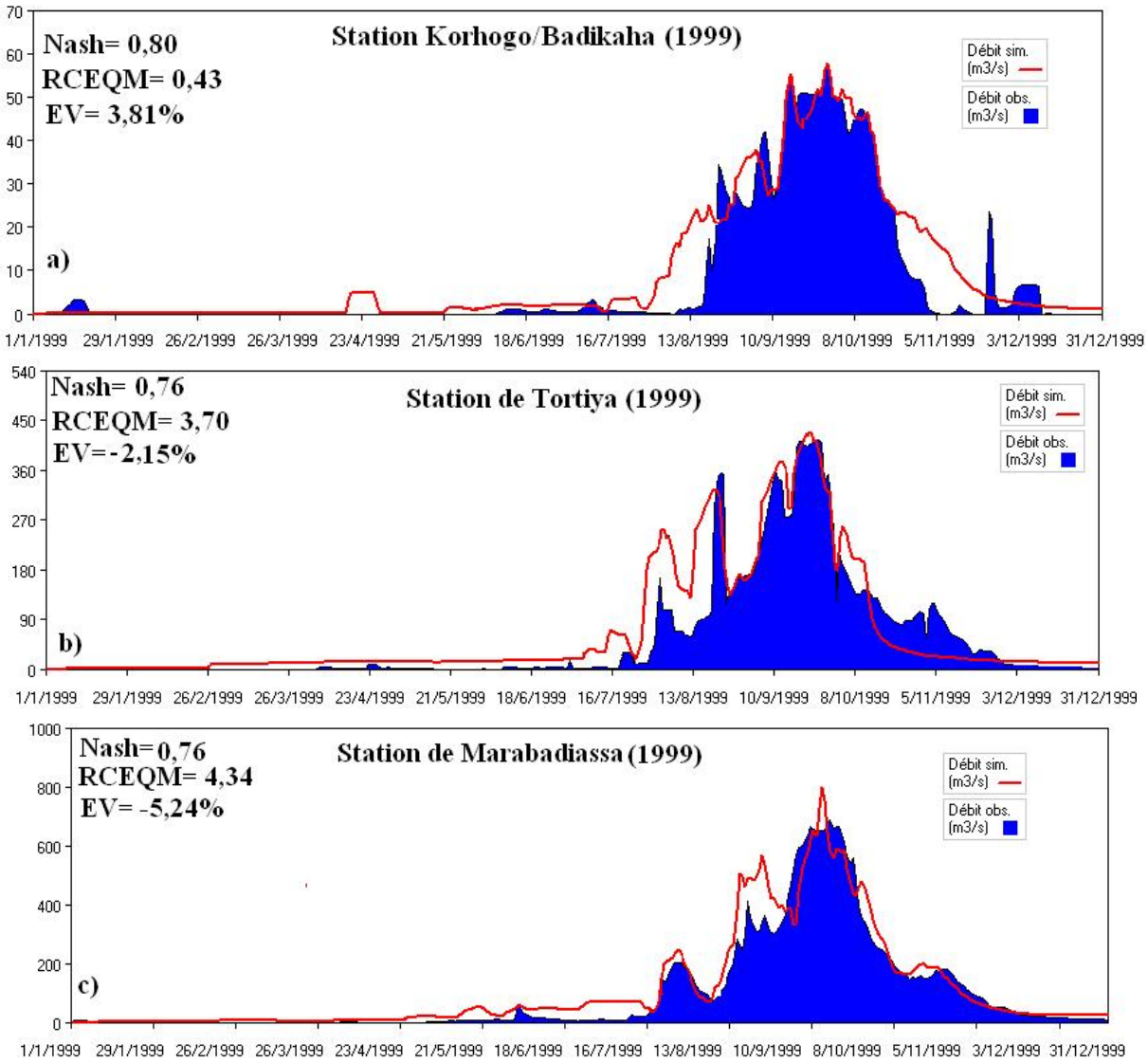


Fig. 5. Débits simulés et observés pour la validation (1999) ; a) station de Korhogo/Badikaha, b) station de Tortiya, c) station de Marabadiassa

Tableau 1. Valeurs principales des paramètres calés des sous-bassins du Bandama Blanc

Paramètres à caler	Korhogo/ Badikaha	Tortiya	Marabadiassa
Paramètres du Bilan Vertical à 3 Couches (BV3C)			
Humidité relative initiale			
- Couche 1 (%)	0,1	0,1	0,1
- Couche 2 (%)	0,2	0,2	0,2
- Couche 3 (%)	0,4	0,4	0,4
Profondeur de couche			
- Couche 1 (m)	0,75	1,25	1,25
- Couche 2 (m)	1,25	2,75	3
- Couche 3 (m)	1,75	5	4
Coefficient de récession (m/h)	$2{,}5.10^{-7}$	$2{,}5.10^{-7}$	$2{,}5.10^{-7}$
Hydrogramme GéoMorphologique (HGM)			
- Lame référence (m)	0,000002	0,000002	0,000002
Coefficient de Manning			
- Milieux forestiers	0,2	0,2	0,2
- Eau	0,01	0,01	0,01
- Autres milieux	0,15	0,15	0,15

Tableau 2. Résultats du calage et de la validation du modèle

	Korhogo/ Badikaha	Tortiya	Marabadiassa
Critère de Nash (1996)	**0,92**	**0,78**	**0,81**
Critère de Nash (1997)	**0,88**	**0,80**	**0,78**
Critère de Nash (1999)	**0,80**	**0,76**	**0,76**
Critère de RCEQM (1996)	**0,25**	**2,54**	**4,1**
Critère de RCEQM (1997)	**0,36**	**3,98**	**3,70**
Critère de RCEQM (1999)	**0,43**	**3,70**	**4,34**
Critère d'EV (%) (1996)	**-4,76**	**-32,49**	**-18,35**
Critère d'EV (%) (1997)	**-16,77**	**-35,44**	**-12,88**
Critère d'EV (%) (1999)	**3,81**	**-29,15**	**-5,24**

4.3 INTERPRETATIONS DES RESULTATS DE LA SIMULATION DES ECOULEMENTS

L'analyse des résultats de simulations (calage et validation) nous donne matière à réflexion sur différents points, à savoir : les causes d'une mauvaise estimation (surestimation et/ou sous estimation) des pics et d'une surestimation des débits en périodes d'étiages qui s'observent sur les différentes stations hydrométriques du Bandama Blanc ; mais aussi des problèmes de simulation dans le temps pour les stations de Marabadiassa, de Tortiya et Korhogo/Badikaha (1997 et 1999).

Selon une étude réalisée par [15], sur les sources d'incertitudes concernant l'application de modèles hydrologiques, celle-ci indique qu'elles peuvent provenir de :

- la conception du modèle ;
- l'imprécision des données d'entrées du modèle ;
- l'imprécision sur les données observées, du calage du modèle, et de la représentativité des années de calage [21].

La donnée de précipitation est la source dominante de l'incertitude liée aux données qui influence la fiabilité de simulation dans le modèle. Idéalement, pour avoir la meilleure estimation du débit, la connaissance de l'intensité de la pluie à chaque point du bassin et à chaque pas de temps est nécessaire (mesure continue de la pluie en fonction du temps).

- **Mauvaise estimation (surestimation et/ou sous estimation) des pics**

La connaissance de la distribution temporelle de la pluie est essentielle pour la modélisation du processus hydrologique. En référence aux problèmes de l'échelle et de l'échantillonnage [12], on peut dire que dans la pratique de modélisation, les données pour décrire la variabilité temporelle de la pluie sont souvent limitées. À l'échelle temporelle, elle est limitée par la longueur de la chronique et la discrétisation de la pluie à l'échelle du temps choisi. Notons que le bassin versant du Bandama Blanc compte 10 postes pluviométriques pour un bassin versant de 34059 km² soit 3405,9 km²/poste pluviométrique. Cette

répartition assez large et non uniforme du réseau météorologique est à l'origine de la mauvaise interpolation de la précipitation et la cause principale des mauvaises estimations des débits.

Les sous-bassins emboîtés de Korhogo/Badikaha possède une station pluviométrique à l'intérieur de son sous-bassin (stations de Korhogo). Ce qui explique une assez bonne interpolation des précipitations. Le sous-bassin emboîté de Tortiya ne possèdent pas de stations pluviométriques à l'intérieur de son sous-bassin, ce qui entraîne une mauvaise estimation des précipitations de faible extension, cause d'une mauvaise simulation des pics. Le sous-bassin de Marabadiassa quant à lui possède une station pluviométrique à proximité de son sous-bassin (station de Katiola) ce qui explique une interpolation assez passable des précipitations, ajouté à cela, le manque de station pluviométriques pour une bonne interpolation des précipitations surtout en période d'étiage.

- **Surestimation des débits en période d'étiage**

La surestimation des débits simulés en période d'étiage pour toutes les stations hydrométriques, pourrait être liée aux différentes incertitudes citées précédemment. Cependant, l'analyse des travaux [18], [1] qui ont appliqué ce même modèle respectivement dans le bassin versant du N'zo et du N'zi (milieu tropical humide), nous permet d'affirmer que cette surestimation n'est pas principalement due à la structure du modèle. Une analyse de notre zone d'étude permet de constater que le bassin du Bandama Blanc ne dispose pas d'assez de stations pluviométriques, ce qui explique une grande perturbation de son régime hydrologique. Ces analyses sont corroborées par les résultats de simulation au niveau de la station de Marabadiassa qui a les critères de Nash les moins satisfaisants de l'étude. Ainsi les surestimations des débits sont principalement dues au manque de stations pluviométriques dont les effets sont plus perceptibles en période d'étiage et durant les années sèches.

Cette surestimation des débits pourrait être aussi rattachée en l'occurrence à des précipitations de faible extension spatiale en saison sèche. Ces pluies sont généralement mal mesurées à cause de la faible densité du réseau météorologique. Leur extrapolation spatiale n'est pas parfaitement bien prise en compte dans le modèle HYDROTEL. D'autre part, l'évolution dans le temps des caractéristiques internes du bassin, notamment l'humidité dans les différentes couches du sol et la saturation après un épisode pluvieux, pourrait aussi être à la base de cette surestimation.

4.4 DISCUSSION

La modélisation mathématique est un outil indispensable dans la compréhension des processus et des interactions dynamiques entre les paramètres environnementaux et physiographiques mis en jeu dans un hydrosystème [29]. L'exploitation en synergie des données de télédétection et des SIG, avec le modèle hydrologique distribué HYDROTEL [20], a permis de constituer une base de données géospatiales et d'entreprendre la modélisation des écoulements dans le bassin versant du Bandama Blanc. La structure interne d'écoulement a permis la discrétisation du bassin versant du Bandama Blanc en des unités hydrologiques relativement homogène (UHRH) qui sont de petits sous bassins homogènes vis-à-vis du devenir des ruissellements dans le cours. Les UHRH se caractérisent du point de vue topographique par le même sens d'écoulement. Ce découpage du bassin est essentiellement basé sur la topographie et ne tient pas compte des états de surfaces (végétation, types de sol…) qui peuvent influencer les processus hydrologiques. Les états de surface ont été utilisés pour l'estimation des débits dans plusieurs bassins dans les régions sahéliennes et soudano-sahéliennes [26]. Les états de surface de même que la topographie apparaissent donc comme un élément moteur et déterminant des écoulements. Pour la connaissance des états de surface de notre bassin, nous avons utilisé une image landsat TM datant de 1990 +/- 3 ans qui nous a permis de décrire le paysage naturel de notre bassin et une carte pédologique renseignant sur les types de sol rencontrés. La cartographie par télédétection des états de surface a été abordée par différents auteurs. La télédétection permet ici de produire un document cartographique homogène pour différents sites.

Les résultats des simulations (calage et vérification) à la station de Korhogo/Badikaha, qui est la plus en aval, montrent un bon synchronisme entre les débits simulés et observés. Cependant, à la station de Marabadiassa (station la plus en amont), l'allure des courbes n'est pas synchrone à certains endroits. On observe une surestimation sur une partie du cycle hydrologique. Ces écarts semblent être dus à un problème d'extrapolation des paramètres de calage, mais révèlent aussi l'incapacité du réseau de mesure des précipitations à suivre leur répartition spatio-temporelle sur ce sous-bassin. Par ailleurs, lorsque les pluies sont isolées et de faible extension, leur extrapolation conduit à des résultats comportant des écarts entre les simulations. La simulation de l'écoulement par le modèle HYDROTEL est moins performante en période d'étiage, cela est confirmé par les travaux [14] dans le bassin versant l'Orb (France) et [18] dans le N'zo (Côte d'Ivoire) et [1] dans le N'zi (Côte d'Ivoire).

Les résultats des simulations (calage et vérification) ont des coefficients de Nash qui varient entre 0,76 - 0,92 tandis que les simulations réalisées dans le N'zo ([18] et [1] avec le même modèle ont des coefficients de Nash compris entre 0,78 - 0,91 pour le N'zo et entre 0,56 - 0,91 pour le N'zi. La densité des postes pluviométriques pourrait expliquer ce déséquilibre à

savoir 490 km²/poste pour le N'zo, et 3060,8 km²/poste pour le N'zi 3060,8 km²/poste tandis que le Bandama Blanc compte 3405,59 km²/poste (Tableau VIII). L'applicabilité de ces types de modèles à des bassins de grande taille ne disposant pas de données à haute résolution spatiale est, par conséquent, difficile et pose le problème d'équifinalité dans l'estimation des paramètres, plus précisément lorsque les données pour la validation interne sont rares [13]. Outre le renforcement du réseau de mesures des variables météorologiques, les images radar peuvent constituer une bonne source de données pour la spatialisation des événements pluvieux. Les simulations à long terme ont permis de mettre en évidence la variabilité des écoulements, corroborant les travaux antérieurs en Afrique de l'Ouest et Centrale depuis 1970 [2], [23].

5 CONCLUSION

L'intégration des données géospatiales dans le modèle distribuée HYDROTEL a permis de modéliser le fonctionnement du bassin versant du Bandama blanc. À partir des images satellitaires TM de Landsat (date ?) et des données provenant des SIG (réseau hydrographique, carte de type de sol et limite du bassin), la base de données géospatiales a été constituée pour pouvoir représenter les caractéristiques physiographiques du bassin du Bandama Blanc. Le découpage spatial du bassin a abouti à des unités de simulation hydrologiques (508 UHRH). Ces UHRH sur lesquelles l'hétérogénéité spatiale des caractéristiques du bassin (topographie, occupation du sol, textures des sols) est prise en compte servent de base à la simulation des processus hydrologiques. Les données hydrométéorologiques (10 stations pluviométriques et 4 stations hydrométriques) recueillies in situ de 1996 à 2000, sont également prises en compte au niveau de chaque UHRH. La simulation des écoulements est réalisée de 1996 à 2000. Le calage et la validation des paramètres du modèle sur le bassin du Bandama Blanc, est fait à travers 4 sous-bassins emboîtés, qui découlent d'un regroupement des UHRH en fonction des stations hydrométriques. Les résultats obtenus par la simulation indiquent que les données provenant de la télédétection et de SIG peuvent être utilisées en vue d'une modélisation distribuée. Le critère de Nash varie de 0,76 à 0,92 pour les calages et les validations. En saison sèche, le fort taux de prélèvement des eaux pour les différentes activités socio-économiques en période d'étiage a donnée une forte surestimation du modèle hydrologique. En revanche, le modèle reproduit assez bien les processus hydrologiques au cours de la saison pluvieuse.

On peut retenir que les données géospatiales provenant de la télédétection et des SIG ont montré leur aptitude à caractériser la structure physiographique du bassin du Bandama Blanc en vue d'une modélisation hydrologique distribuée, le modèle HYDROTEL a montré son applicabilité en milieu tropical, au niveau d'un bassin de grande taille à vocation agricole, disposant de données hydrométéorologiques limitées dans le temps et dans l'espace (3405,9 km²/poste pluviométrique) et la simulation des écoulements a mis en évidence la perturbation du régime hydrologique par les ouvrages de stockages d'eau (barrages), en période d'étiage pour la plupart des stations, et en période de crue pour des stations spécifiques.

Ainsi, cette étude effectuée au sein du bassin versant du Bandama Blanc peut servir d'outil d'aide à la décision pour les populations rurales pour l'élaboration d'une carte à vocation agricole du bassin versant sur la base des caractéristiques physiographiques et météorologique, l'identification des zones vulnérables à l'inondation et enfin l'implantation et le dimensionnement des ouvrages de stockages pour une gestion rationnelle et durable des ressources en eau.

Pour améliorer les résultats de cette étude, nous recommandons l'intégration des images satellitaires multi-dates pour évaluer la dynamique de l'occupation des terres, une étude plus approfondie des caractéristiques du sol pour déterminer les propriétés hydrodynamiques propres, le renforcement du réseau météorologique pour une meilleure interpolation de la précipitation et/ou l'utilisation de données radar et enfin le calage du modèle sur une période de deux années et sa validation sur une chronique de 10 années au minimum.

En perspective, nous souhaitons dans un premier temps modéliser le bilan hydrologique avec HYDROTEL en intégrant les aménagements potentiels existants dans le bassin versant du Bandama Blanc, ensuite étudier l'impact de la variabilité climatique et du changement de l'occupation du sol sur le fonctionnement hydrologique à l'aide du modèle et enfin faire une étude de la sensibilité du modèle HYDROTEL en milieu tropical.

REFERENCES

[1] Adon G.C.R,"Modélisation hydrologique spatialisée du bassin versant du N'zi :Apports de données géospatiales et du modèle distribué (Hydrotel"). DEA d'Hydrogéologie Université de Cocody Abidjan, 77 p,2008.

[2] Ardoin, B.S ",Variabilité hydroclimatique et impacts sur les ressources en eau de grands bassins hydrographiques en zone soudano-sahélienne". Thèse de doctorat, Université de Montpellier II, Montpellier, 330 p,2004.

[3] Beven K. J. and Kirkby M. J.," A Physically based, variable contributing area model of basin hydrology". Hydrol. Sci. pp. 43-69,1979.

[4] Bigot S., Brou Y.T., Oszwald J. et Diédhiou A, Facteurs de la variabilité pluviométrique en Côte d'Ivoire et relations avec certaines modifications environnementales. Sécheresse, vol. 16, n° 1, p. 5-13,2005.

[5] Brou Y. T.,Climat, mutations socio-économiques et paysages en Côte d'Ivoire. Mémoire d'Habilitation à Diriger des Recherches, Université des Sciences et Techniques de Lille, 212p, 2005.

[6] Connolly R.D., Silburn D.M. and Ciesiolka C.A.A., Distributed parameter hydrology model (ANSWERS) applied to arange of catchment scales using simulator data. III. Application to a spatially complex catchment. Journal of Hydrology, vol. 193,p. 183-203,1997.

[7] Dupont J., Smitz J., Rousseau A.N., Mailhot A. et Gangbazo G.,Utilisation des outils numériques d'aide à la décision pour la gestion de l'eau. Revue des sciences de l'eau, numéro spécial, p. 5-18,1988.

[8] Fortin J.-P., Villeneuve J.-P., Guilbot A. and Seguin B.,Development of a modular hydrological forecasting model based on remotely sensed data for interactive utilization on a microcomputer. International Association of Hydrological Sciences Publication, n° 160, p. 307-319,1986.

[9] Fortin J.P., Villeneuve J.P., Bocquillon C.,Hydrotel, Physitel, and Imatel: and Integrated Application of Remote Sensing and GIS to Hydrological Modeling, on Microcomputer. Proc. International Symposium of Remote Sensing and Water Resources, Enschede, Hollande, 20-24 août: 793-804, 1990.

[10] Fortin J.P., Turcotte R., Massicotte S., Moussa R., Fitzback J. and Villeneuve J.P., A distributed watershed model compatible with remote sensing and GIS data: Application to Chaudière watershed. Journal of hydrologic Engineering, Vol 6 n° 2, pp100-108, 2001.

[11] Goula B.T.A., Savané I., Konan B., Fadika V. et Kouadio G.B.,Étude comparative de l'impact de la variabilité climatique sur les ressources en eau des bassins du N'zo et du N'zi en Côte d'Ivoire. Sciences et Nature, vol. 2, n° 2, p. 107-120,2005,

[12] Grayson R. and Blöschl G., Spatial modelling of catchments dynamics. Cambridge University Press, pp 51-81,2000.

[13] Grayson R., Moore I., Mc Mahon T.,Physically based hydrological modelling. 1. A terrain based model for investigative purposes. Water Resources Research 28(10): 2639-2658,1992.

[14] Indarto K.,Découpages spatiaux et conséquences sur le bilan hydrologique : application au bassin de l'Orb à travers une démarche de modélisation hydrologique distribuée. Thèse de Doctorat, ENGREF Montpellier, 220p,2002.

[15] Institut National de Recherche Scientifiques (INRS) – Eau ,« Rationalisation du réseau hydrométrique du Québec » - Gouvernement du Canada, Ministère de l'Environnement, p.331,1971,

[16] Janicot S. et Fontaine B. (1993) L'évolution des idées sur la variabilité interannuelle récente des précipitations en Afrique de l'Ouest. La Météorologie, série 8, n° 1, p. 28-41,1993.

[17] Kouamé K.F. et Biémi J., Évaluation des ressources en eau des aquifères de socle fissuré par télédétection et SIG de la région semi montagneuse à l'Ouest de la Côte d'Ivoire. P. 807-812, in C. R. Duguay & M. Bernier (réd.) Compte rendu du 23e Symposium canadien de télédétection/10e Congrès de l'Association québécoise de télédétection, 21-24 août 2001, Sainte-Foy (Québec), Volume 2, Société canadienne de télédétection, Ottawa, 900p,2001.

[18] Kouamé F., Bernier M., Goné D., Saley B., Lefèbvre R., Soro N. et Koudou A.,Intégration de données géospatiales dans un modèle hydrologique distribué pour la simulation des écoulements des eaux en milieu tropical humide de Côte d'Ivoire (Afrique de l'ouest). Télédétection vol. 7, n° 1-4, pp.217-235,2007.

[19] Le Barbé L., Lebel T. and Tapsoba D. (2002) Rainfall variability in West Africa during the years 1950–1990. Journal of Climate, vol. 15, p. 187-202.

[20] Lebel T. and Vischel T.,Climate and water cycle in the tropical zone: a problem of scale. Comptes Rendus Geoscience, n° 337, p. 29-37,2005.

[21] Melching C.S.,Reliability Estimation In : V. P. Shing, (ed.), Computers models of watersheds hydrology, Waters Resources Publication, Baton R, USA, pp. 69 – 118,1995.

[22] Morin G., Fortin J.-P., Lardeau J.-P., Sochanska W. et Paquette S., Le Modèle CEQUEAU : manuel d'utilisation. INRS-Eau, Sainte-Foy, Rapport n° 93, 78 p,1981.

[23] Olivry J.C.,Long term effects of rain shortage : the ill rivers of western and central Africa. International Association of Hydrological Sciences Publication, n° 252, p. 158-162,1998.

[24] Perraud A. (1971) Les Sols. In : Le milieu naturel de la Côte d'Ivoire. Mémoire ORSTOM n° 50, pp. 265-374.

[25] Paturel J.E., Servat E. et Delattre M.O.,Analyse de séries pluviométriques de longue durée en Afrique de l'Ouest et Centrale non sahélienne dans un contexte de variabilité climatique. Journal des Sciences Hydrologiques, vol. 43, n° 3, p. 937-945,1998.

[26] Puech C.,Détermination des états de surface par télédétection pour caractériser les écoulements des petits bassins versants. Application à des bassins en zone méditerranéenne et en zone tropicale sèche. Thèse de doctorat, Université Joseph Fourier, 214 p,1993.

[27] Savané I., Coulibaly K.M. et Gioan, P.,Variabilité climatique et ressources en eaux souterraines dans la région semi-montagneuse de Man. Sécheresse, vol. 12, n°4, p. 231-237,2001.

[28] Servat E., Paturel J.E., Kouamé B., Travaglio M., Ouédraogo M., Boyer J.F., Lubès-Niel H., Fritsch J.M., Masson J.M. et Marieu B., Identification, caractérisation et conséquences d'une variabilité hydrologique en Afrique de l'Ouest et centrale. International Association of Hydrological Sciences Publication, n° 252, p. 323-337,1998.

[29] Singh V.P., Effect of spatial and temporal variability in rainfall and watershed characteristics on streamflow hydrograph. Hydrological Processes, vol. 11, p. 1649-1669,1997.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 471-476
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

KINETICS AND EQUILIBRIUM STUDY OF ADSORPTION OF PHENOL RED ON TEFF (*Eragrostis teff*) HUSK ACTIVATED CARBON

Jemal Yimer Damte[1], O. P. Yadav[2], Tesfahun Kebede[2], and Jemal Mohammed[3]

[1]Chemistry, Jigjiga University,
Jigjiga, P.O. Box 1020, Ethiopia

[2]Chemistry, Haramaya University,
Haramaya, P.O. Box 138, Ethiopia

[3]Chemistry, Debra Birhan University,
Debra Birhan, Ethiopia

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: It has been widely recognized that dye removal by activated carbon adsorption is due to the surface action between the dye and the functional groups present in the surface of the carbon. This work presents a systematic experimental study on kinetics and equilibrium of adsorption of phenol red (PR) on teff (*Eragrostis*) husk activated carbon (THAC) and husk powder (HP). The adsorbents were characterized by using X-ray diffraction and Fourier transform infrared spectrometric techniques to understand the effect of surface properties on the adsorption of phenol red. The adsorption process was optimized with respect to pH, adsorbate initial concentrations, adsorbent dosage and contact time. Based on the results obtained, it was shown that teff husk activated carbon was more effective adsorbent than teff husk powder. The maximum adsorption of PR dye on THAC and HP occurred at pH of 5.2 and 5.0, respectively. Kinetic parameters of adsorption such as the Lagergren rate constant and the intraparticle diffusion rate constant were also determined. The calculated values of the amount of dye adsorbed per gram of adsorbent at equilibrium (qe) using pseudo second order equation were in good agreement with the corresponding experimental values. The observed negative value of Gibbs free energy of adsorption (ΔG_{ads}) indicates that the adsorption process is spontaneous and the positive enthalpy of adsorption (ΔHads) as well as entropy of adsorption (ΔS) show that entropy gain is the driving force rather than the energy change for the adsorption of phenol red on the THAC and HP.

KEYWORDS: Adsorption, Activated Carbon, Equilibrium, Isotherm, Thermodynamic.

1 INTODUCTION

Industrial effluents are one of the major causes of environmental pollution. Effluents discharged from dyeing industries are highly coloured with a large amount of suspended organic solids. Untreated disposal of this coloured water into the receiving water body causes damage to aquatic life as well as to human beings by their mutagenic and carcinogenic effects. The discharge of such effluents is worrying for both toxicological and environmental reasons [1].

Activated carbon is the most popular adsorbent for the adsorption process since it has high adsorption capacity. The adsorption capacity of activated carbon depends not only on its surface area, but also on its internal pore structure, surface characteristic and the presence of functional groups on pore surface. Internal pore structure and surface characteristic play an important role in adsorption processes and depend both on the precursor used and method of preparation. Different methods such as small angle X-ray, mercury porosimetry, scanning electron microscopy and gas as well as liquid phase adsorption are available for characterizing the pore structure (surface area, pore volume, pore size distribution, etc.) of

Corresponding Author: Jemal Yimer Damte

activated carbon [2]. The characteristics of adsorption behaviour of activated carbons are generally inferred in terms of both adsorption kinetics and equilibrium isotherm. Though most widely used adsorbent for this purpose is activated carbon, yet commercially available activated carbons are expensive and may not be economical for large scale wastewater treatment [3]. Other untreated low-cost adsorbents often have low adsorption capacities; therefore, their adsorbate removal efficiencies are poor. If an activated carbon with high adsorption capacity for wastewater treatment can be produced from low cost or waste materials, such as an adsorbent then the adsorption process may be economical as well as a means to minimize its waste disposal problem [4]. Thus, the present study was designed on the assumption that teff husk can be used as a potential low cost adsorbent if investigated, for its dye removal capacity from waste water both as an activated carbon form and as its non activated form.

2 METHODS

Teff husk was collected from local markets. The husk was washed with distilled water and sun dried for a day followed by drying at 100 ^{0}C to a constant weight for 24 hours. The dried material was mixed with equal amount of conc. H_2SO_4 and kept at room temperature, overnight. Excess of the acid was removed by washing the solid residue with distilled water till it attained neutral pH, and then soaked in 2 % $NaHCO_3$ solution overnight in order to remove excess acid present if any and the product was air-dried at room temperature. The material thus prepared was kept in hot air oven at 120 ^{0}C for 10 hours and then transferred to a muffle furnace kept at 500 ^{0}C for an hour. The dry product thus obtained was crushed in to granules and fractionated into different mesh sizes and then preserved in desiccators for further use.

2.1 PREPARATION OF PHENOL RED (PR) SOLUTIONS

A 0.01 M stock solution of phenol red was prepared by dissolving its appropriate amount in 250 mL distilled water. Different concentrations of PR ranged from 0.003 – 0.007 M were prepared from the stock solution. Double distilled water was used for preparing different solutions and reagents. All the adsorption experiments were carried out at room temperature.

2.2 ADSORPTION STUDIES

250 mL of phenol red dye solution was mixed with fixed amount of adsorbent (0.01 g) in a 500 mL conical flask. It was shaken at room temperature. Five mL each sample was collected at a regular interval of time centrifuged and filtered. Absorbance of filtrated was recorded on UV/Visible spectrometer, and concentration of dye was obtained from Absorbance *versus* Concentration curve. The amount of dye adsorbed per gram of adsorbent (qe) was calculated using the following equation:

$$qe = \frac{C_o - C_e}{W} V \qquad (1)$$

Where, Co and Ce are the initial and equilibrium concentrations of the adsorbate (phenol red dye), respectively; V = volume of dye solution and W = weight of adsorbent.

2.3 ADSORPTION ISOTHERMS

Batch adsorption experiments were carried out using rotary shaker at 150 rpm in 200 mL shaking flasks at room temperature for 50 min. The adsorbent was thoroughly mixed with 250 mL of PR solution. The isotherm studies were performed by varying the initial PR concentrations as 0.003, 0.004, 0.005, 0.006 and 0.007 M at pH 2.5, which was adjusted using 0.1M HCl or 0.1 M NaOH before addition of the adsorbent. After shaking the reaction mixture, it was analysed for the residual PR concentration.

2.4 SPECIFIC SURFACE AREA OF CARBON

Surface area per gram of the activated teff husk carbon was obtained using Sears method [5]. A 1.5 g of carbon sample was mixed with 100 mL of water and 30 g NaCl. The mixture was stirred for five minutes. To this 0.1 N HCl was added to make a final volume of 150 mL and final pH of 4.0. It was then titrated against 0.1 N NaOH. The volume of 0.1 N NaOH required to raise the pH from 4.0 to 9.0 was noted. The specific area (i.e. area per gram) was obtained using the formula:

$$A = 32.V - 25 \qquad (2)$$

Where A= surface area of adsorbent (activated carbon) per gram (in m^2/g); V = volume of 0.1 N NaOH required to raise the pH from 4.0 to 9.0.

3 RESULTS AND DISCUSSIONS

Physico-Chemical Parameters of Adsorbents

Table 1. Physico-chemical parameters of teff husk powder and its activated carbon.

Property	Husk powder	Activated carbon
Bulk density (g/cm^3)	0.4225	0.5416
Moisture content (%)	9.89%	2.04 %
Ash content (%)	7 %	9.12 %
pH	7.41	10.5
Pzc	7.1	8.71
Specific Surface area (m^2/g)	263	295

Physico-chemical parameters of activated carbon and husk powder are recorded in Table 1. Low moisture content of activated carbon ensures availability of more active sites on it and better adsorption efficiency. Carbon with higher moisture content demands the use of additional weight of carbon during treatment processes [6]. Ash content levels of activated carbon were higher than the husk powder, suggesting higher inorganic constituent in the former. The carbon having little amount of ash content may remove the inorganic contaminants effectively [7].

Activated carbon with higher bulk density is more suitable for the adsorption treatment process compared to low density carbon that suspends on water. Thus, providing poorer adsorbate - adsorbent contact. Also the lower bulk density values illustrates that the carbon samples are highly branched and porous with more void space [8]. Activated carbon which has higher specific surface area than husk powder, therefore the activated carbon can remove the phenol red dye from aqueous solution more effectively. Activated carbon has higher pH than husk powder because when a substance carbonized its basicity increase when treated with $NaHCO_3$ solution.

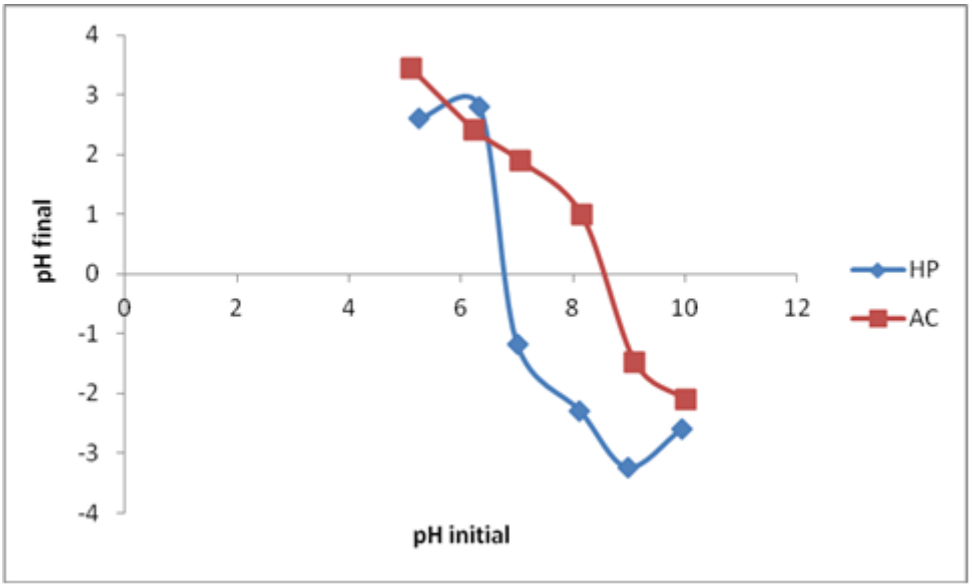


Figure 1. Determination of point of zero charge of the sorbents.

The zero point charge implies that the prepared carbon is free from surface charges nearby neutral pH. Hence the carbon samples are suitable for the treatment of water even at the neutral medium. The value of pH affected a net zero charge on a solid, in the absence of specific biosorption, is called the pHpzc. When the pH of the aqueous solution is below the pHpzc, the surface of the adsorbent will become positively charged. Meanwhile, the surface of the adsorbent will become negatively

charged when the solution pH is greater than pHpzc [9]. pHpzc for husk powder and activated carbon are 7.1 and 8.71, respectively.

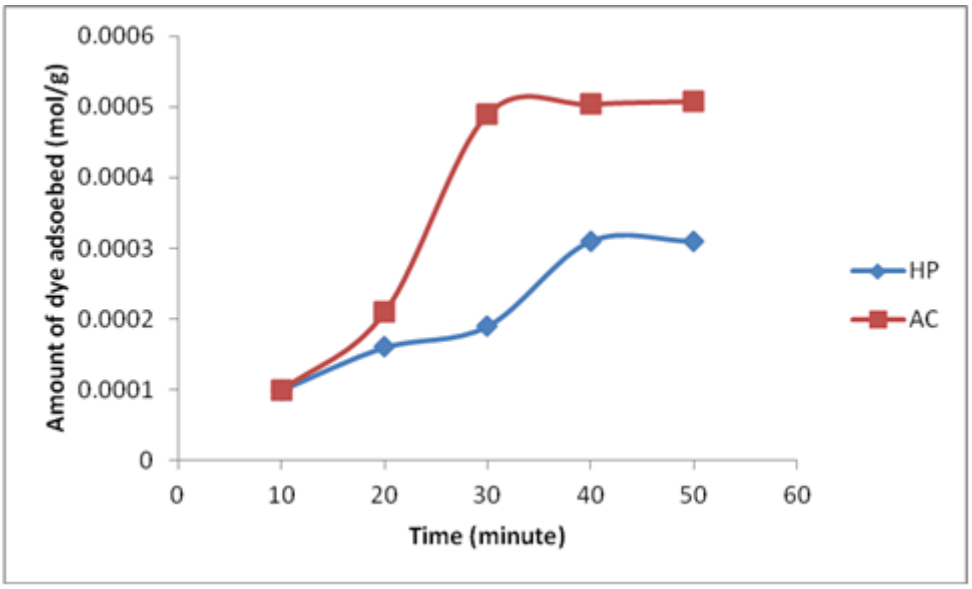


Figure 2. Plot of amount of phenol red adsorbed per gram of adsorbent (mol/g) as a function of time

It can be seen that sorption efficiency of phenol red increases with the increase of time up to 30 min using activated carbon but in husk powder increases up to 40 min. In activated carbon, after definite time equilibrium between the rate of adsorption and rate of desorption become equal and there is no further net adsorption of the adsorbate [10].

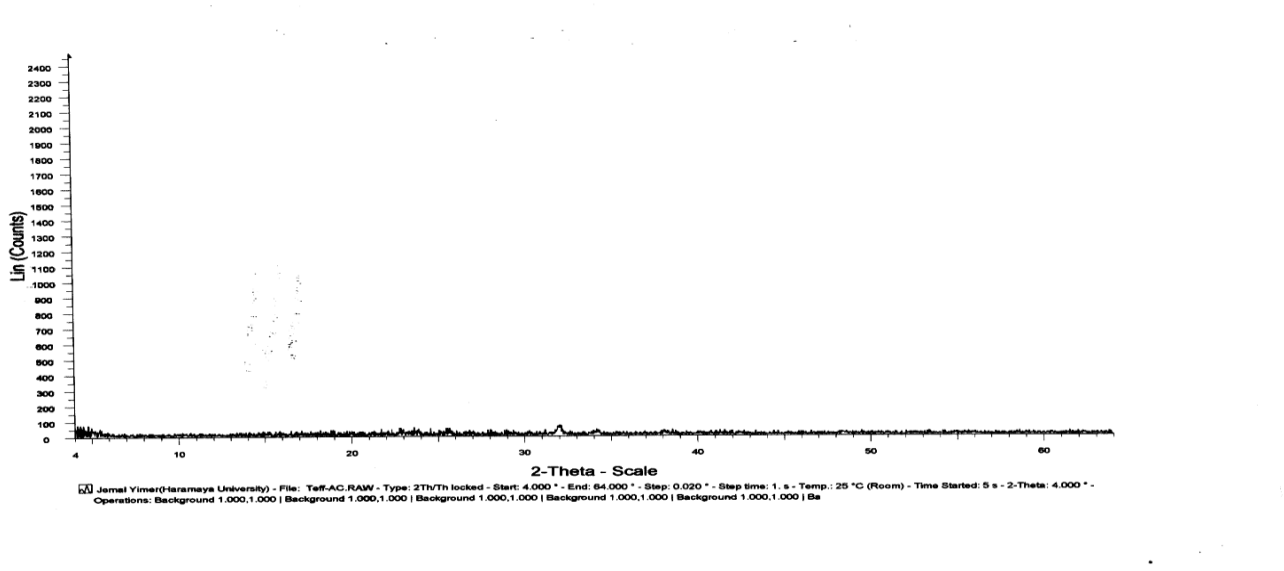


Figure 3. XRD of teff husk activated carbon (THAC)

The obtained XRD spectra (Figure 3) of teff husk activated carbon exhibited no diffraction peaks. It suggests an amorphous structure of the synthesized teff husk carbon. The small peaks indicate the contaminants which are present in the activated carbon.

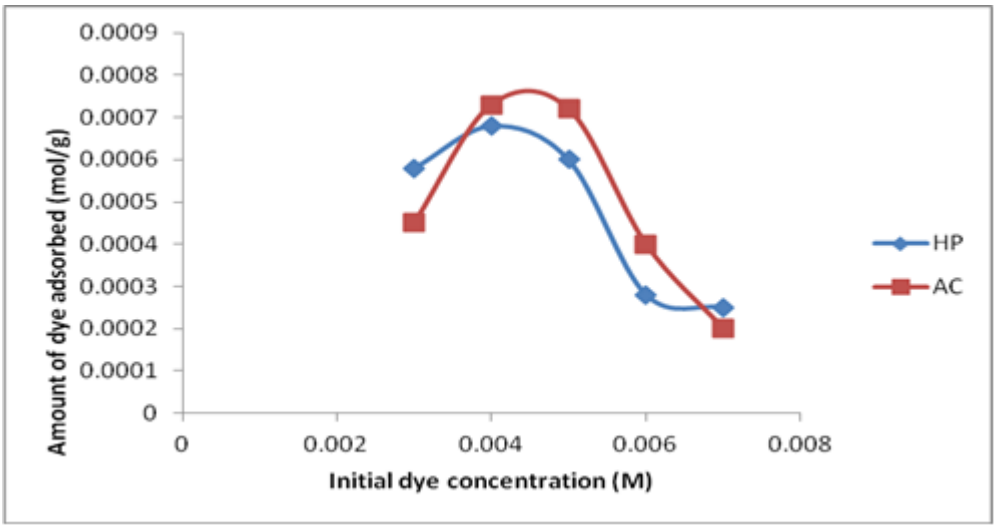


Figure 4. Plot of amount of phenol red adsorbed per gram of adsorbent (mol/g) on to THAC and HP (adsorbent dose = 0.01 g/L, pH = 7, and Agitation speed = 140 rpm).

Initially the removal of dye increased with the increase of dye initial concentration, and maximum removal of dye was using its initial concentration 0.005 M. This may be due to availability of more active sites per dye molecule [11]. In case of low concentrations, the ratio of the initial number of moles of solutes to the available surface area of adsorbent is large and subsequently the fractional adsorption becomes independent and consequently higher adsorption yields were obtained. However, at higher concentration, most of the adsorption sites could be occupied by phenol red and the available sites of adsorption would become fewer, hence the removal of dyes which depends up on the initial concentration decrease [12]. The maxima of such plot shift to higher dye initial concentration in case of activated carbon as adsorbent.

4 CONCLUSIONS

In this study, activated carbon prepared from teff husk has been used successfully, as an efficient adsorbing agent for the removal of phenol red dye from aqueous solutions. Effects of operational parameters such as solution pH, adsorbent concentration, dye initial concentration, and contact time that governs the overall process of adsorption, have been investigated, X-ray diffraction pattern indicated that the synthesized adsorbent has amorphous structure. The amount of dye sorbed was found to vary with initial pH, adsorbent dose, phenol red concentration and contact time. The phenol red dye sorption decreased at high pH values in accordance with a presupposed ion-exchange mechanism of the adsorption. Since teff husk is freely, abundantly and locally available, it can be used as an economical sorbent for treating real industrial effluent against dyes pollutants.

ACKNOWLEDGMENT

The author is thankful to the Ethiopian Ministry of Education for providing the research fund. I am also grateful to the School of Graduate Studies, Haramaya University and all members of the Department of Chemistry, for hosting me and for their nice services during the study period. It is also my pleasure to extend my gratitude to Jijiga University for giving me a chance to pursue my post graduate studies.

REFERENCES

[1] Crini, G., Non-conventional low cost adsorbents for dye removal a review, *Bio resource Techno*l. 97(9): 1061-1085, 2006.
[2] Z. Eren and F.N. Acar, Equilibrium and kinetic mechanism for reactive black sorption onto high lime soma fly ash, *J. Hazard Matter*. 143: 230, 2007.
[3] Y.S. Ho and G. Mckay, The kinetic of sorption of divalent metal ions, *Chemical Engineering Journal*, 12: 45-52, 2000.
[4] A. Ozcan, E.M. Oncu and A.S. ozcan, Adsorption of acid blue 193 from aqueous solution onto DEDMA-sepiolite, *J. Hazard Matter*. 129: 244, 2006.
[5] Sears, G., Determination of specific surface area of colloidal silica by titration with sodium hydroxide, *Anal. Chem*. 28: 1981-1983, 1956.

[6] A.C. Bansal, J.B. Donnet and F. Stoeckli, Removal of dyes from aqueous solution, *Am. J. Applied Sci*. 2 (11): 1499-1503, 1988.
[7] Pereira, F., Soaras, S., Jose Orfao, J.M., and Figueiredo, Adsorption of dyes on activated carbons and influence of surface chemical groups**.** 41: 811, 2003**.**
[8] R.S. Summers and P.V. Roberts, Investigating nonlinearity in aniline sorption to montmorillonite, *J. Colloid Interface Sci*. 122: 367, 1988.
[9] A. Shukla, Y. H. Zhang, J.L. Margrave, and S. S. Shukla, The role of sawdust in the removal of unwanted materials from water, *Journal of Hazardous Materials.* B 95, 137–152, 2002.
[10] Gode, F., Pehlivan, E., Adsorption of Cr (III) ions by Turkish brown coals, Fuel Processing Technology, 86, 875-884, 2005.
[11] Sourja, C., Sirshendu, D., Sunando, D., and Jayanta, K.B., Adsorption study for the removal of basic dye, *Experimental and Modelling* Chemosphere. 58: 1079–1086, 2005.
[12] M. Nassar and Y. H. Magdy, Removal of different basic dyes from aqueous solution by adsorption on palm-fruit bunch particles, *J. Chem. Eng.* 66, 223–229, 1997.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 477-493
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Détection localisée des zones dégradées de végétation par télédétection: application à la zone de transition entre le bassin sédimentaire et le socle cristallin (Centre – Bénin)

[Localize detection of degraded vegetation zone by remote sensing: application to the transition zone between the sedimentary basin and the crystalline basement (Centre – Benin)]

E.A. Tchibozo[1] and O.P. Toundoh[2]

[1]Maître assistant (CAMES), Département de géographie et aménagement du territoire,
FLASH, Université d'Abomey Calavi, Benin

[2]Etudiant de Master, Cartographie et sciences de la géoinformation,
RECTAS, Université Obafemi Owolowo
Ilé Ifè, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This paper aims to assess the degradation of vegetation in the transition zone between the sedimentary and crystalline in central Benin. The method used is the geomatics and includes the photo - interpretation assisted image classification, the calculation of vegetation indices and spatial analysis. The results show that despite its high coverage (75.21%), unevenly distributed among the dense forest (40, 50%), open forest (15.03%), woodland (16.47%) and tree and shrub savannah (28.00%), large bare surfaces indicate a risk of desertification and loss of vegetation. Image processing from vegetation indices showed that the degraded vegetation is characterized by low coverage containing low biomass and having a healthy and low density. The highest rate of degradation of vegetation varies. The sharp deterioration represents 8.89% of the dense forest, 76.83% of the woodland, 72.89% of woodland and 100% of the tree and shrub savannah. Degradation of vegetation is related to the importance of human pressure in the south and center of the study area, the sedimentary basin, and insufficient water in the North, on the crystalline basement.

KEYWORDS: degradation, Centre-Benin, vegetation indices, image processing, coverage, desertification.

RESUME: La présente contribution vise à évaluer la dégradation de la végétation dans la zone de transition entre le sédimentaire et le cristallin au centre Bénin. La méthode utilisée relève de la géomatique et regroupe la photo – interprétation par classification assistée d'image, le calcul des indices de végétation et l'analyse spatiale. Les résultats obtenus montrent que malgré son taux de couverture élevé (75,21%), inégalement réparti entre la forêt dense (40, 50%), la forêt claire (15,03%), la savane boisée (16,47%) et la savane arborée et arbustive (28,00%), de vastes surfaces dénudées indiquent un risque de désertification et la perte de végétation. Le traitement d'image à partir des indices de végétation a montré que la végétation dégradée est caractérisée par une faible couverture contenant une faible biomasse et présentant une santé et une densité faibles. Le taux le plus élevé de la dégradation des formations végétales est variable. La forte dégradation représente 8,89% de la forêt dense, 76,83% de la forêt claire, 72,89% de la savane boisée et 100% de la savane arborée et arbustive. La dégradation de la végétation est liée à l'importance de la pression anthropique au sud et au centre de la zone d'étude, sur le bassin sédimentaire, et l'insuffisance d'eau au Nord, sur le socle cristallin.

MOTS-CLEFS: dégradation, Centre –Bénin, indices de végétation, traitement d'image, taux de couverture, désertification

Corresponding Author: E.A. Tchibozo

1 INTRODUCTION

Selon [1], la dégradation des forêts se réfère à la réduction de la capacité d'une forêt de produire des biens et services liés au maintien de la structure et des fonctions d'écosystèmes. Actuellement, ce phénomène est devenu un problème grave, en particulier dans les pays en développement. Parmi ses impacts négatifs, le gaz à effet de serre constitue une part significative avec 12% à 15% des émissions mondiales de CO_2 [2].

La déforestation s'accompagne généralement d'une réduction du couvert végétal, et en particulier arboré [3]. Au Bénin, le couvert végétal se dégrade progressivement et l'on estime qu'environ 70.000 ha de forêt sont défrichés chaque année entre 1990 et 2000 du fait des agressions de l'agriculture, de l'élevage, de l'exploitation forestière incontrôlée et des feux de brousse. Avec un taux d'accroissement de la population de l'ordre de 3,2 % et ses corollaires d'augmentation en besoins de tous genres à satisfaire, les formations forestières sont sous la pression de plus en plus forte de l'agriculture, de l'élevage, de l'exploitation forestière et de l'urbanisation [4]. Cette tendance à la dégradation des ressources forestières est confirmée par plusieurs travaux [5], [6],…

Le centre – Bénin est particulièrement concerné. Il accueille de nombreux colons agricoles dont les pratiques culturales et les formes d'utilisation des ressources naturelles sont peu respectueuses de l'environnement. Les terres fertiles se font ainsi rares et se limitent actuellement aux zones hydromorphes, notamment les bas-fonds. Ces changements paysagers deviennent une préoccupation majeure tant pour les institutions scientifiques que pour les gestionnaires des ressources naturelles au Bénin. Le présent travail s'inscrit dans ce cadre où les besoins en informations spatiales sont de plus en plus insatisfaits dans un contexte de dynamique de l'environnement. Pour régler ce problème, il faut un outil adapté pour l'observation répétitive (saisons et climats) de grandes surfaces parfois inaccessibles par les travaux de terrain : la télédétection

L'une des principales applications de la télédétection dans la gestion des ressources de l'environnement et la prise de décision est la détection et l'évaluation quantitative de la végétation verte. Plusieurs auteurs ont utilisé les indices de végétation pour analyser le changement de l'environnement global, en particulier dans le contexte de la sécheresse et de l'évaluation des risques de dégradation des terres [7]. Au cours des 30 dernières années les indices de végétation (VI) ont été largement utilisés pour le traçage et la surveillance des conditions de végétation, telles que la santé, le taux de croissance et de production, de l'eau et des nutriments stress, etc. Dans cet article, les indices de végétation calculés à partir des images satellites seront utilisés pour localiser et cartographier les zones de végétation dégradée.

L'objectif principal de la présente étude est d'évaluer la dégradation de la végétation dans la zone de transition entre le sédimentaire et le cristallin au centre Bénin. De manière spécifique, il s'agira de cartographier et d'analyser l'occupation du sol, de cartographier les indices de végétation et détecter des zones dégradées de végétation, d'évaluer la dégradation et identification de ses facteurs.

Pour atteindre ces objectifs, les hypothèses suivantes sont retenues: la végétation est inégalement répartie dans la zone de transition entre le bassin sédimentaire côtier et le socle cristallin; la dégradation de cette végétation est perçue à partir des indices de végétation ; la dégradation de la végétation est localisée et inégalement répartie ; la pression anthropique et le contenu en eau de la végétation participent à sa dégradation.

La zone d'étude est située au Centre – Bénin entre 6°43'55,3'' et 7°41'04,3''de latitude nord, 1°59'17,2'' et 2°47'51'' de longitude est. D'une superficie de 869799,92 ha, elle constitue une zone de transition soudano - guinéenne, traversée par le « Dahomey gap », c'est-à-dire la zone d'interruption de la ceinture forestière équato-guinéenne devant relier les blocs forestiers d'Afrique centrale et occidentale. Sur le plan géomorphologique, elle chevauche la ligne de contact entre le bassin sédimentaire côtier et le socle cristallin. On y rencontre des mosaïques de forêts claires (*isoberlinia spp.*, *pterocarpus erinaceus*, *combretums*), éventuellement de forêts denses sèches (*isoberlinia doka*, *monotes kerstingii*, *daniellia oliveri*, *khaya senegalensis*), parsemées de savanes arborées et arbustives et traversées par des galeries forestières dont les grandes superficies sont localisées au - delà de 7°N (figure 1a, 1b, 1c et tableau 1). Les types de sol qui couvrent la zone d'étude sont les sols hydromorphes, ferralitiques, ferrugineux et les vertisols.

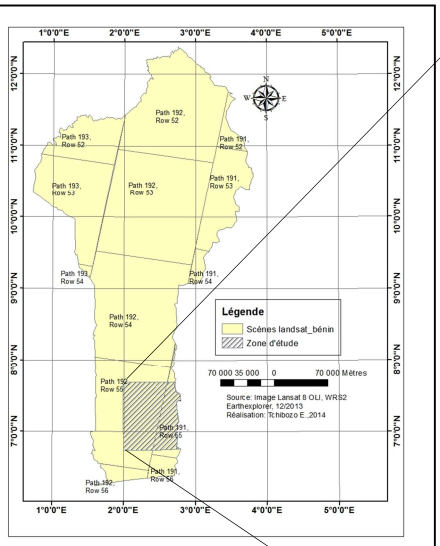


Figure 1a : Scènes Landsat couvrant le Bénin

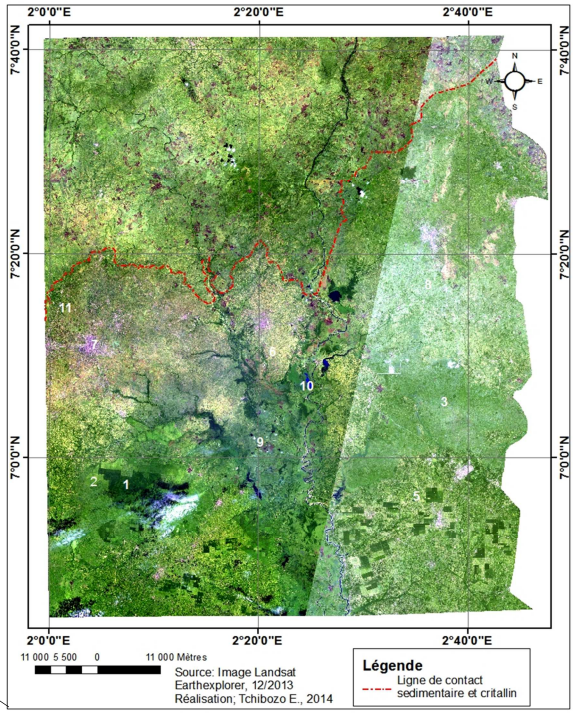


Figure 1b: Image de la zone d'étude

Source : Extrait de mosaïque d'image Landsat WRS2, Earthexplorer, 12/2013

Tableau1 : clé d'interprétation des images

N°	Unités d'occupation du sol
1	Forêt dense
2	Forêt claire
3	Savane arborée et arbustive
4	Savane boisée
5	Plantations
6	Mosaïque de cultures et jachères
7	Agglomérations
8	Sols dénudés
9	Zone inondable
10	Eau de surface

Source : Images traitées, Tchibozo, 2014

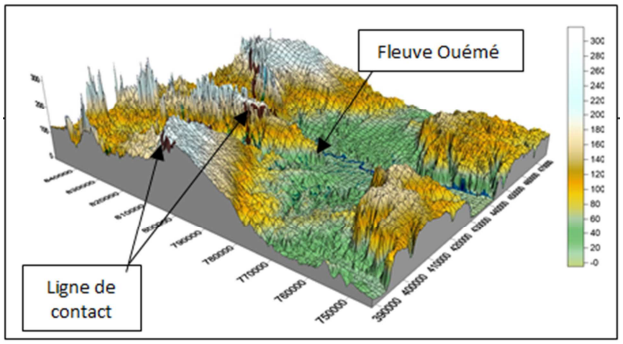


Figure 1c: Relief de la zone d'étude

2 MATÉRIEL ET MÉTHODES

2.1 MATÉRIEL

Dans ce travail, le matériel est composé d'un GPS, un ordinateur, des logiciels de télédétection et SIG (Envi 4.8, Envi- Ex 4.8, Erdas 9.2, ILWIS 3.7, Excel 2013, SPSS 21,0 et Surfer11), un scanner, une imprimante, des clés USB et une calculatrice. Les données utilisées proviennent de la télédétection, de la cartographie et des travaux publiés antérieurement sur la zone d'étude. Les caractéristiques de ces données sont présentées dans le tableau 2.

Tableau 2 : principales caractéristiques des données collectées

N°	Données	Principales caractéristiques	Échelle/ Résolution	Source et année
1	Image Landsat 8, Radiomètre LDCM/ OLI	0,43-0,45 µm ; 0,45-0,51 µm 0,52-0,60 µm ; 0,63-0,68 µm 0,85-0,89 µm ; 1,56-1,66 µm 1,36-1,39 µm ; 2,1-2,3 µm 0,52-0,9 µm (panchromatique)	30 mètres 15 mètres	USGS, Earthexplorer09/2013
2	Shuttle Radar Topography Mission (SRTM3)	Digital Elevation Model	90 meters	2000
3	Carte hydrogéologique du Bénin	scannée raster avec 200 dpi	1/500 000	
4	Carte topographique du Bénin	scannée raster avec 200 dpi	Echelle:1/600000,	IGN - Bénin, 1982, 2ème édition

Source: CENATEL, Bénin 2013, adapté

2.2 MÉTHODES

La méthodologie utilisée dans la présente étude constitue une approche géomatique de l'extraction de l'information géographique utile. Elle est basée sur la photo – interprétation numérique par classification supervisée d'image, le calcul des indices de végétation et l'analyse spatiale [8].

La photo – interprétation par classification supervisée d'image est appliquée pour obtenir une carte de l'occupation du sol. Cette dernière, plus récente, est indispensable pour la mise à jour les données existantes, la reconnaissance des zones de végétation sur le terrain et la superposition des unités d'occupation du sol avec les cartes des indices de végétation. La classification supervisée est réalisée par le critère de maximum de vraisemblance. Les résultats obtenus sont évalués avec la matrice de confusion et l'indice Kappa [9].

Les indices de végétation fournissent des informations sur le taux de couverture de la végétation, différencient les zones couvertes de végétation de celles des sols nus, mesurent le contenu en eau des feuilles, réduisent les effets atmosphériques et topographiques sur les images [10]. Dans la présente étude, ils sont utilisés pour détecter la dégradation localisée de la végétation. En général, les bandes spectrales utilisées pour calculer les indices de végétation dépendent des propriétés spectrales des plantes et des phénomènes contribuant à leur dégradation. Malgré les nombreuses études réalisées, il est parfois difficile de choisir avec précision l'indice de végétation approprié. La réflectance dans la bande R et celle dans le PIR, et en conséquence dans le spectre visible, varient suivant plusieurs facteurs [11]. Les valeurs de ces indices, calculées à l'échelle du pixel, ont été mises en relation avec des types d'états de surface et des taux de végétation estimés à partir de la littérature existante et sur le terrain pour identifier les zones dégradées de végétation. Ceux utilisés dans la présente étude sont décrits ci-dessous et présentés dans le diagramme méthodologique (figure 2).

- **Difference Vegetation Index (DVI) = PIR-R**,

  Où, PIR est la bande proche infrarouge du spectre et R, la bande rouge du spectre [12].

Cet indice est sensible à la présence de la végétation et n'est pas influencé par l'atmosphère et l'ombre des unités d'occupation du sol. Les valeurs égales à 0 indiquent les sols nus, celles inférieures à 0 l'eau et les supérieures à 0, la végétation ;

- **Normalyze Vegetation Index (NDVI) = (PIR-R) / (PIR+R)**,

  Où PIR est la bande proche infrarouge et R, la bande rouge du spectre [13].

Cet indice permet d'éliminer les effets de la topographie et la variation de l'angle d'éclairage solaire sur l'image, ainsi que d'autres éléments atmosphériques tels que la brume... Il se prête au traitement statistique à cause de la distribution normale de ses valeurs comprises entre –1 et +1. Mais, le NDVI est souvent affecté par la rétrodiffusion du sol nu à travers la couverture végétale. En effet, lorsque la végétation ne couvre que partiellement le sol, le signal du sol se mélange avec celui du couvert [14].

Pour suppléer à cette insuffisance du NDVI, d'autres indices permettant de minimiser l'influence du sol comme le MSAVI et le PVI ont été calculés. Toutefois, notons que pour une région de forte densité, le MSAVI peut souffrir de saturation.

- **Modified Soil Adjusted Vegetation Index ($MSAVI_2$) = 2 PIR + 1 – $[(2\ PIR + 1)^2 – 8(PIR - R)]^{0.5}$ / 2**, [15]

  Où, PIR est la bande proche infrarouge et R, la bande rouge du spectre.

- **Perpendicular Vegetation Index (PVI_2)** = $(PIR\text{-}a*R\text{-}b) / (1+a^2)^{0,5}$,

  Où PIR est la bande proche infrarouge ; R, la bande rouge ; a, la pente de la droite du sol, b, l'ordonnée à l'origine de la droite du sol [16];

Le PVI_2 est un indice prend en considération, les effets du sol nu et est défini comme la distance orthogonale entre un point qui représente le couvert végétal dans la bande rouge et proche infrarouge et la droite au sol.

Pour identifier les causes probables de la dégradation de la végétation, d'autres indices spécifiques à la pression anthropique et au contenu en eau de la végétation sont calculés : l'indice de brillance (IB) et l'indice du stress hydrique (NDWI). Ils sont identifiés à cause de la pression anthropique liée à l'évolution démographique du sud et les difficultés d'accès à l'eau sur le socle cristallin (granito gneissique).

- **Indice de brillance (IB)= $(PIR^2+R^2)^{0,5}$** où PIR est la bande proche infrarouge ; R, la bande rouge ;
- **l'Indice normalisé de différence en eau (NDWI) = (PIR-MIR) / (PIR+MIR)**, où**,** PIR est la bande proche infrarouge ; MIR, la bande moyen rouge.

L'analyse spatiale est réalisée par superposition de la carte de l'occupation du sol avec les cartes d'indices de végétation et des requêtes spatiales. La ligne de contact a été dessinée à partir de la carte hydrogéologique.

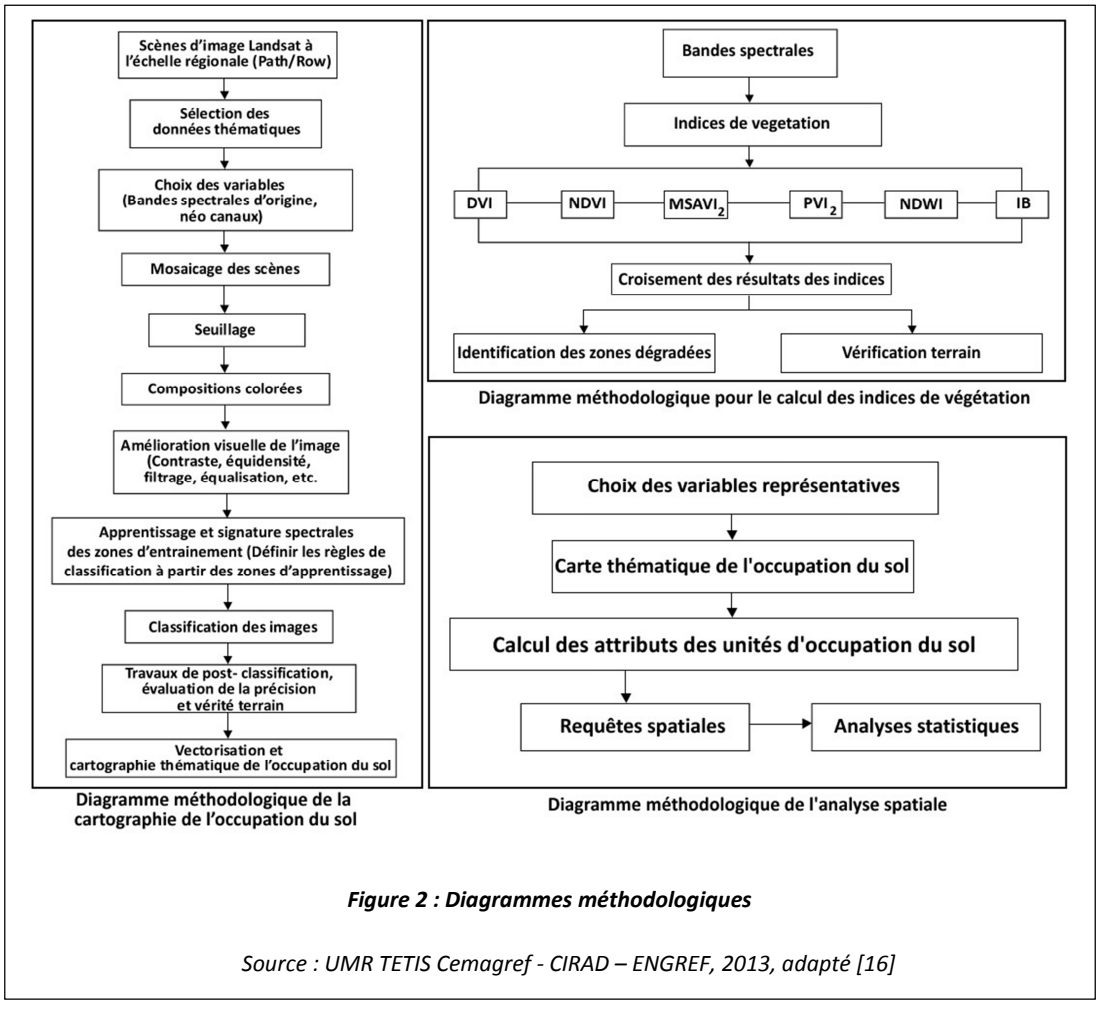


Figure 2 : Diagrammes méthodologiques

Source : UMR TETIS Cemagref - CIRAD – ENGREF, 2013, adapté [16]

3 RÉSULTATS

3.1 ÉVALUATION DE LA CLASSIFICATION ASSISTEE D'IMAGE

La cartographie de l'occupation du sol est réalisée par classification assistée d'image. Son évaluation montre que sur un total de 2237 pixels que contiennent les zones d'entrainement de l'image, renseignées par la signature spectrale, 2123 pixels ont été bien classifiés, soit une précision globale de 94,90% avec un indice Kappa de 0,94 (tableau 3). Selon [9], cet indice est excellent quand sa valeur ≥ 0,81; bon lorsqu'il est compris entre 0,80 ≤ Kappa ≤ 0,61; cet indice est modéré quand son chiffre se situe entre 0,60 et 0,21; il est mauvais avec une valeur comprise entre 0,20 et 0,0 et très mauvais avec un chiffre inférieur à 0,0. De ce qui précède, on peut dire que la classification réalisée sur l'image de la zone d'étude est valide. Les unités présentant les plus grandes précisions de classification sont la savane arborée et arbustive (100%) et la mosaïque de cultures et jachères (99,58%). Celles les moins précises dans la classification sont la forêt claire (70,37%) et la savane boisée (87,69%), tableau 4. Les plus importantes erreurs de commission (28,97%) et d'omission (29,63%) sont remarquées sur la forêt claire alors que les plus faibles se retrouvent sur l'eau et la savane arborée et arbustive.

Tableau 3 : Matrice de confusion

N°	Classes d'occupation du sol	Eau de Surface	Agglomé-rations	Forêt dense	Forêt claire	Savane boisée	Savane arborée et arbustive	Mosaïque de_cultures et jachères	Sols dénudés	Zone Inon-dable	Total
0	Unités non classées	0	0	0	0	0	0	0	0	0	0
1	Eau de surface	712	0	0	0	0	0	0	0	713	713
2	Agglomérations	4	335	0	0	0	0	1	4	344	344
3	Forêt dense	0	0	267	29	0	0	0	0	296	296
4	Forêt claire	0	1	28	76	2	0	0	0	107	107
5	Savane boisée	0	0	2	3	57	0	0	0	62	62
6	Savane arborée et arbustive	0	2	2	0	4	61	0	0	69	69
7	Mosaïque de_cultures et jachères	0	0	0	0	2	0	238	3	243	243
8	Sols dénudés	0	21	0	0	0	0	0	276	297	297
9	Zone inondable	4	0	1	0	0	0	0	0	106	106
10	Total	720	359	300	108	65	61	239	283	2237	2237

Source : Photo- interprétation par classification assistée d'image

Tableau 4 : Pourcentage des précisons obtenues sur chaque unité d'occupation du sol

N°	Classes d'occupation du sol	Eau de Surface	Agglomé - rations	Forêt dense	Forêt claire	Savane boisée	Savane arborée et arbustive	Mosaïque de_cultures et jachères	Sols dénudés	Zone Inon-dable	Total
0	Unités non classées	0,00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	Eau de surface	98,89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	31.87
2	Agglomérations	0,56	93.31	0.00	0.00	0.00	0.00	0.42	1.41	0.00	15.38
3	Forêt dense	0,00	0.00	89.00	26.85	0.00	0.00	0.00	0.00	0.00	13.23
4	Forêt claire	000	0.28	9.33	70.37	3.08	0.00	0.00	0.00	0.00	4.78
5	Savane boisée	0,00	0.00	0.67	2.78	87.69	0.00	0.00	0.00	0.00	2.77
6	Savane arborée et arbustive	0,00	0.56	0.67	0.00	6.15	100.00	0.00	0.00	0.00	3.08
7	Mosaïque de cultures et jachères	0,00	0.00	0.00	0.00	3.08	0.00	99.58	1.06	0.00	10.86
8	Sols dénudés	0,00	5.85	0.00	0.00	0.00	0.00	0.00	97.53	0.00	13.28
9	Zone inondable	0,56	0.00	0.33	0.00	0.00	0.00	0.00	0.00	99.02	4.74
10	Total	100,00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100

Source : Photo- interprétation par classification assistée d'image

3.2 CARTOGRAPHIE ET ANALYSE DE L'OCCUPATION DU SOL

La classification réalisée a été vectorisée, soumise à la vérité terrain et éditée pour obtenir une carte (figure 3). L'analyse de la carte permet de retenir ce qui suit :

Dans la zone d'étude, l'occupation du sol est composée de forêt dense (30,46%), de forêt claire (11,31%), de savane boisée (12,39%), de savane arborée et arbustive (21,06%), d'eau (0,31%), d'agglomérations (1,36%), de mosaïque de cultures et jachères (9,24%), de sols dénudés (10,59%) et de zone inondable (3,29%). Le taux global de couverture de la végétation est évalué à 75, 21%. Il est inégalement réparti entre la forêt dense qui représente 40, 50% de cette valeur, la forêt claire 15,03%, savane arborée et arbustive 28,00% et la savane boisée 16,47%.

Au Sud, la continuité de la végétation est interrompue par des poches de sols dénudés, de mosaïque de cultures et jachères, d'agglomérations et de plantations. Cette dernière formation présente des formes régulières visibles au sud – est et au sud-ouest sur les berges de la vallée de l'Ouémé. Au centre, un polygone de zone inondable se distingue aisément dans le paysage plus humide de la vallée de l'Ouémé. Les sols dénudés et les champs de cultures et jachères occupent une partie des forêts classées et de la forêt-galerie, particulièrement au sud-ouest entre les villages de Massi et Houegbo et dans la forêt classée de la Lama. Une zone de plantations riveraine de la forêt de Djigbé a déjà franchi les limites établies par son classement.

Au Centre, de vastes espaces dénudés structurent le paysage. Certains sont occupés par une mosaïque de cultures et jachères qui se développent autour des agglomérations de Bohicon, de Cove et de Kétou. Au Centre – ouest, à proximité du village de Dan et au centre, au-dessus de Cove, une ceinture de végétation qui chevauche la ligne de contact entre le bassin sédimentaire et le socle cristallin contraste avec les sols dénudés. Cette situation laisse place à une végétation clairsemée sous une faible pression des plantations, mais importante des cultures et jachères au Nord – est de la ligne de contact. Dans cette région, les forêts classées sont menacées par des campements de colons agricoles et de Peuls.

Au nord – ouest, autour du village de Paouignan, la végétation ne présente que des reliques de forêt dense et de forêt claire. Les forêts classées de Dan et d'Atchérigbé, riveraines de la Route Nationale Inter – État N°2 (RNIE2) sont presque des sols nus.

Ainsi, de l'analyse de l'occupation du sol, il ressort qu'au centre de la zone d'étude, sur le bassin sédimentaire à proximité de la ligne de contact avec le socle, et au Nord - ouest sur le socle cristallin à proximité des forêts classées d'Atchérigbé et de Dan, les surfaces dénudées sont relativement importantes. Le risque de désertification et la perte de végétation sont plus visibles. Cette situation inquiétante doit être étudiée pour évaluer l'état de la végétation afin de caractériser les zones dégradées.

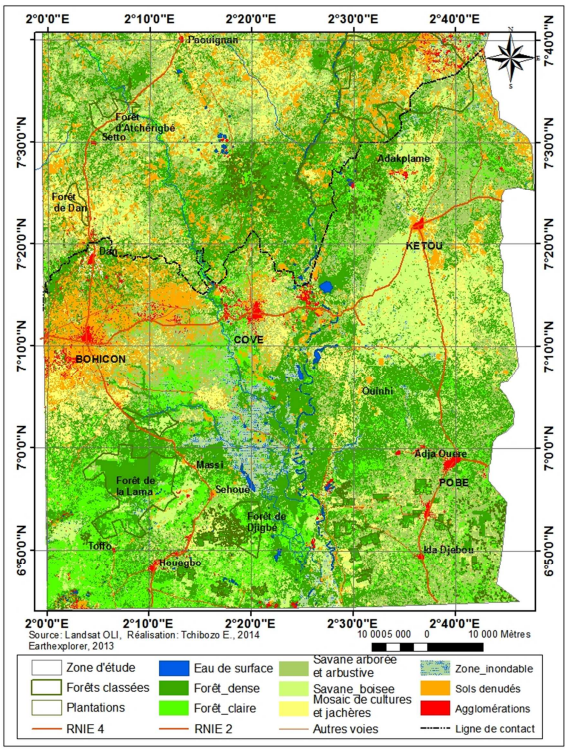


Figure 3: Carte de l'occupation du sol

Source: Image Landsat OLI, Earthexplorer, décembre 2013, traitée

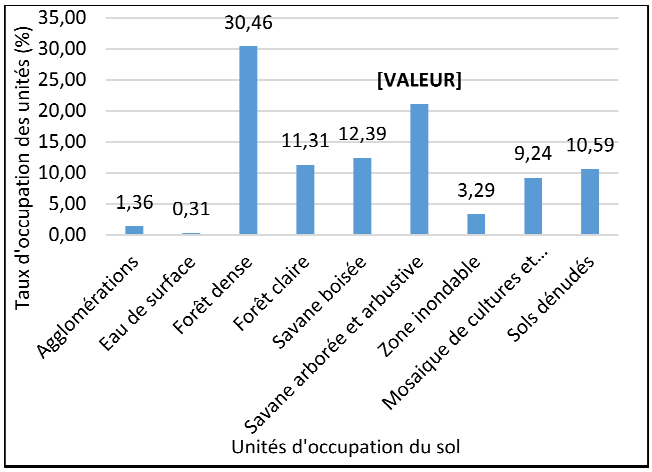


Figure 4: Histogramme montrant la répartition des unités dans l'occupation du sol

Source : Source: Image Landsat OLI, Earthexplorer, décembre 2013, traitée

3.3 CARTOGRAPHIE DES INDICES DE VEGETATION ET DETECTION DES ZONES DEGRADEES DE VEGETATION

Les indices de végétation mesurent essentiellement la différence de réponse spectrale de la végétation et des sols dans la bande rouge (R) qui est liée à l'absorption de la lumière par la chlorophylle et la bande proche infrarouge (PIR) qui représente la densité de la végétation verte. Dans le présent travail, plusieurs indices sont calculés pour identifier les zones dégradées de végétation. Les résultats obtenus sont présentés sur les figures ci-dessous.

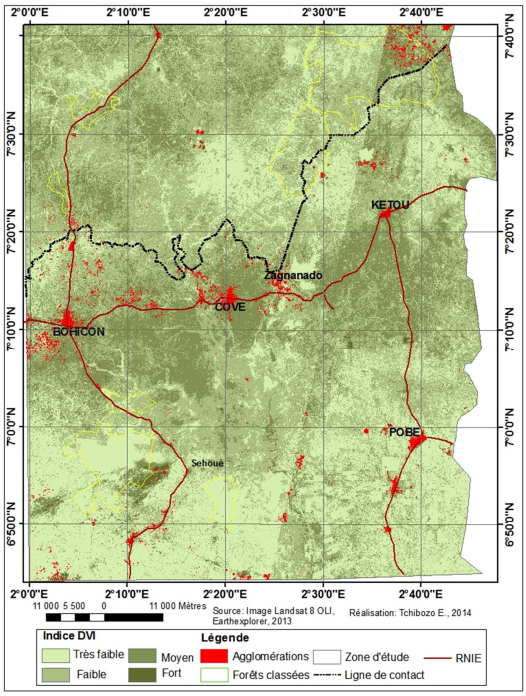


Figure 5 a: Carte de la répartition de l'indice DVI

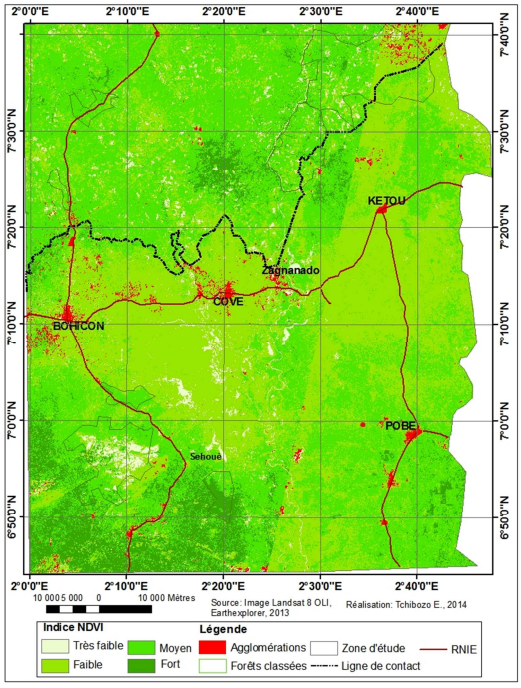


Figure 6 a : Carte de la répartition de l'indice NDVI

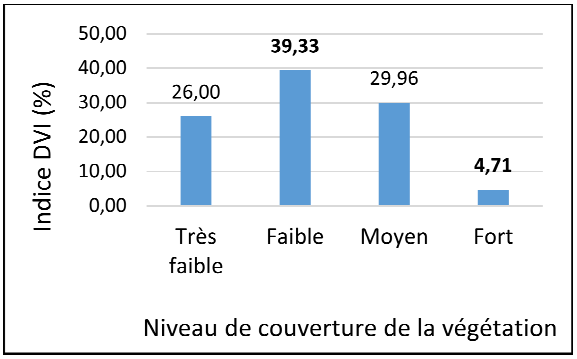


Figure 5 b: Niveau de couverture selon l'indice DVI

Source : Traitement d'image

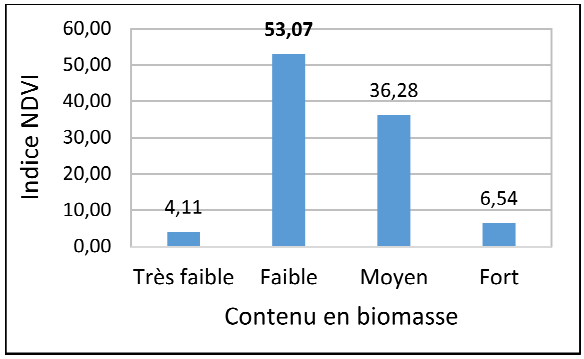


Figure 6b: Contenu en biomasse

Source : Traitement d'image

La figure 5a présente la carte de l'indice DVI. Il montre les différents niveaux de couverture de la végétation. L'analyse de sa répartition spatiale indique que les couvertures très faibles occupent 26,00% de la zone d'étude. Sur la carte de l'occupation du sol et sur le terrain, elles correspondent aux cultures et jachères, aux plantations des berges de la vallée de l'Ouémé et celles à proximité de la forêt classée de la Lama, au sud-ouest de la zone d'étude. Au centre, ce sont les savanes autour de la ligne de contact entre le bassin sédimentaire et le socle cristallin, et plus particulièrement la savane arborée et arbustive et la savane boisée au Nord – ouest, au-dessus de la forêt classée d'Atchérigbé qui sont concernées. Les faibles couvertures de végétation dominent la zone d'étude avec 39,33% d'occupation (figure 5b). Elles représentent la forêt dense et la forêt claire dégradées autour et à l'intérieur de la forêt classée de la Lama et à Houegbo, de même que la forêt-galerie au sud des vallées zou et de l'Ouémé. Cette faible couverture est également présente au centre de la zone d'étude, avec une ceinture de la forêt dense, la forêt claire et la savane arborée et arbustive autour de la ligne de contact entre le sédimentaire et le cristallin. On la remarque également au Nord-ouest, autour de la forêt classée d'Atchérigbé et au Nord – est autour du village d'Atakplamè et à l'intérieur des forêts classées de Dogo et Kétou. Les couvertures moyennes représentent 29,96% de

l'occupation. Elles correspondent à la forêt claire et aux savanes autour de Bohicon, Cove et Kétou. Ce niveau de couverture chevauche également la ligne de contact entre le bassin sédimentaire et le socle cristallin, et est inégalement réparti autour des forêts classées de Dan et d'Atchérigbé au Nord –ouest et dans les forêts classées de Dogo et Kétou au Nord – est. Les fortes couvertures de végétation ne représentent seulement que 4,71% dans l'occupation. Sur le terrain, elles caractérisent la forêt dense à l'intérieur de la forêt classée de la Lama au Sud –est, celle de Bohicon, Cove et Kétou au centre et dans la vallée du zou au Nord – ouest. Les forêts galerie du Sud-ouest et du Sud – est de la zone d'étude sont également couvertes par cette forêt dense.

Sur la figure 6a, l'indice normalisé de végétation (NDVI) confirme l'importance relative du faible taux de couverture de la zone d'étude et apporte une précision par rapport à la végétation verte c'est-à-dire, le contenu en biomasse. La biomasse très faible qui indique une mauvaise santé de la végétation représente 4,11% de l'occupation. Sur le terrain, elle correspond à la forêt dense, la forêt claire et les savanes très dégradées à l'intérieur de la forêt classée de la Lama au Sud-ouest et dans les vallées du zou et de l'Ouémé ainsi qu'à Zagnanado au Centre. La faible biomasse suit la même tendance que la faible couverture (figure 5b) et représente le plus important taux de l'occupation (53,07%), graphique 6b. Sur la carte de l'occupation du sol, elle représente la forêt dense dégradée, identifiée sur les limites de la forêt classée de la Lama au Sud – ouest, et la forêt claire au Sud-est sur la berge de la vallée de l'Ouémé. Ce faible niveau de biomasse est également remarqué au centre de la zone d'étude, sur le bassin sédimentaire en dessous de la ligne de contact entre le sédimentaire et le cristallin, et au Nord –est autour des forêts classées de Dan et d'Atchérigbé. La biomasse moyenne représente 36,28% dans l'occupation, caractérise une végétation moyennement dégradée. Elle est localisée au Sud, autour des forêts classées de la Lama et de Djigbé, au sud –est autour de Pobè et d'Adja - Ouerè, à l'est de Bohicon au Centre et sur le socle au-dessus de la ligne de contact entre le sédimentaire et le cristallin au nord de la zone d'étude. La biomasse la plus élevée qui indique une végétation verte en bonne santé, n'occupe seulement que (6,54%). On la trouve plus au Sud –ouest de la zone d'étude dans les agglomérations de Toffo et Houegbo, au Centre-ouest sur et au-dessus de la ligne de contact entre le bassin sédimentaire et le socle cristallin et à l'ouest du village d'Atakplamè. Ce niveau de couverture est moins visible au Nord-ouest, au-dessus de la forêt classée d'Atchérigbé et au Nord – est à l'intérieur des forêts classées du Dogo et de Kétou.

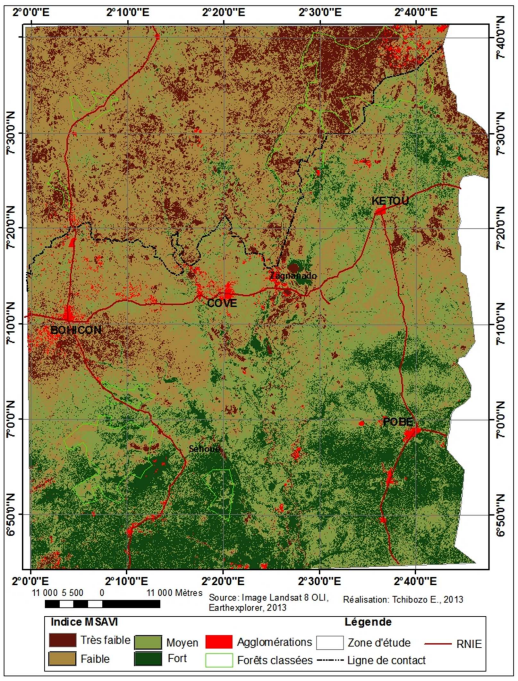


Figure 7 a : Carte de la répartition de l'indice $MSAVI_2$

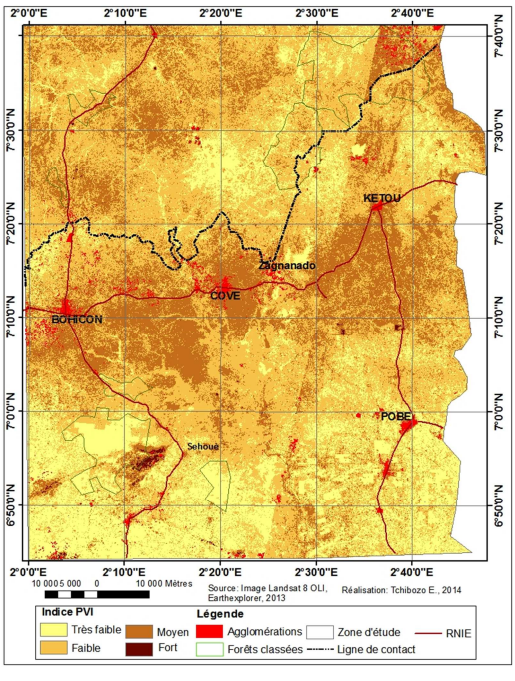


Figure 8 a : Carte de la répartition de l'indice PVI_2

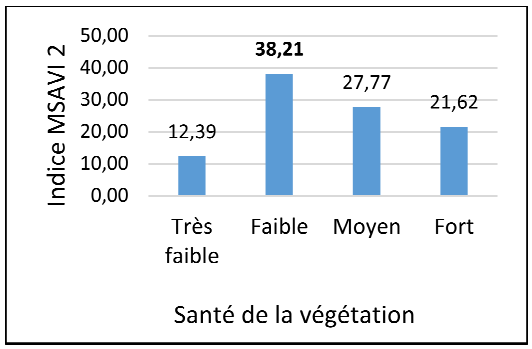


Figure 7b: Histogramme montrant les niveaux de santé de la végétation selon MSAVI

Source: Traitement d'image

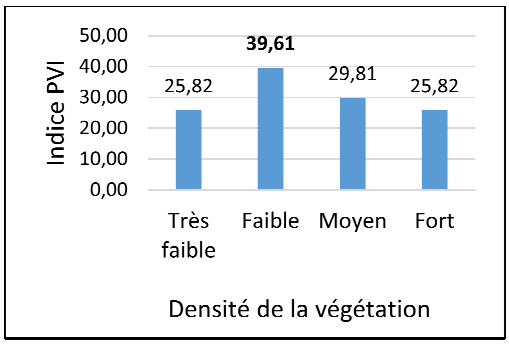


Figure 8b: Histogramme montrant les densités de de la végétation selon PVI

Source: Traitement d'image

La figure 7a présente la carte de du MSAVI. Cet indice permet d'apprécier la santé de la végétation. La santé très faible de la végétation représente 12,39% de l'occupation et indique une végétation très dégradée empreinte d'importantes surfaces de sols dénudés (figure 7b). Sur la carte d'occupation du sol, elle correspond à la savane arborée et arbustive, les cultures et plantations et la forêt claire à l'intérieur de la forêt classée de la Lama au Sud – ouest de la zone d'étude, au centre à Bohicon, Zagnanado et Kétou. On la retrouve également sur le socle cristallin, au centre autour et au-dessus de la ligne de contact entre le sédimentaire et le cristallin et au Nord – est, autour des forêts classées de Dogo et Kétou. La santé faible caractérise une végétation dégradée qui occupe 38,21% de la zone d'étude. Elle est relativement moins localisée et domine le paysage. Sur le terrain, elle correspond à la forêt claire, la savane arborée et arbustive, les cultures et plantations sur le bassin sédimentaire au Sud, et aux savanes, au Nord sur le socle cristallin. La santé moyenne de la végétation représente 27,77% et indique une végétation clairsemée et moyennement dégradée. Au centre de la zone d'étude, sur le bassin sédimentaire, autour de Bohicon, Zagnanado et Kétou, elle est constituée de la forêt dense et de la forêt claire. Les plus fortes valeurs du MVAVI occupent 21,62% de de la zone d'étude et caractérisent, une végétation dense verdoyante et en bonne santé. Elle est composée de la forêt dense, la forêt claire au sud – ouest, et celles autour des forêts classées de la Lama et de Djigbé, au sud-est à Pobè. On la trouve également au Centre de la zone d'étude, autour de Kétou sur le bassin sédimentaire et dans les zones humides au sud des vallées du zou et de l'Ouémé.

La figure 8a expose la carte du PVI. L'analyse de la répartition spatiale de cet indice montre que la très faible densité de la végétation représente 25,82% dans l'occupation (figure 8b). Sur la carte d'occupation du sol et le terrain, elle correspond aux cultures et jachères, à la forêt claire dégradées et aux savanes qui sont à l'intérieur des forêts classées de la Lama et celle de Djigbé, autour des villages de Toffo, Houegbo et Sehouè, au sud-ouest. Cette très faible densité est également visible autour des plantations de Pobè et Ouinhi et sur les savanes au centre – ouest, réparties de part et d'autre de la ligne de contact, au nord – est de Kétou et dans la vallée de l'Ouémé. La végétation de faible densité occupe 39,61% de l'occupation. Elle domine la zone d'étude et correspond surtout à la savane arborée et arbustive, au sud de la vallée de l'Ouémé, autour de la forêt classée de la Lama et au Sud - est autour du village de Ouinhi. Sur le socle, particulièrement au centre – ouest de la zone d'étude, au-dessus de Bohicon et au Nord – est autour des forêts classées de Dan et d'Atchérigbé, la faible densité est également remarquée. La densité moyenne de la végétation représente 29,81% de l'occupation et correspond à la savane boisée au centre de la zone d'étude. Ces formations sont plus visibles autour de Bohicon, Cove, Zagnanado et Kétou et au Nord – ouest, autour des forêts classées de Dan et d'Atchérigbé. Au nord – est, la densité moyenne est visible autour du village d'Atakplamè et à l'intérieur de la forêt classée de Dogo. La forte densité quant à elle, représente 25,82% dans l'occupation et correspond à la forêt dense et la claire , concentrée au Sud à l'est de la forêt classée de la Lama et à Adja – Ouerè, dans les zones inondables de la vallée de l'Ouémé, la foresterie urbaine de Bohicon, Cove, Kétou et les formations saxicoles du Nord – ouest autour de la forêt classée de Dan et de la forêt classée d'Atchérigbé, dans les villages de Paouignan et aussi au Nord-est dans la forêt classée du Dogo et à d'Atakplamè.

Ainsi, la zone de transition entre le bassin sédimentaire et le socle cristallin est caractérisée par une faible couverture de la végétation contenant une biomasse, une santé et une densité faibles. Cette végétation inégalement répartie montre une

faible couverture des cultures et jachères, des plantations et de la savane boisée et une très faible couverture de, la forêt claire et de la savane arborée et arbustive. Ces formations sont caractérisées par une biomasse et une densité très faible remarquées à l'intérieur de la forêt classée de la Lama et dans les vallées du zou et de l'Ouémé au Sud, à Zagnanado au Centre et sur le socle autour des forêts classées de Dan et d'Atchérigbé, au Nord – est de la de la zone d'étude. Cette situation demande une appréciation des niveaux de dégradation de la végétation.

3.4 ÉVALUATION DE LA DEGRADATION LOCALISEE DE LA VEGETATION ET IDENTIFICATION DE SES FACTEURS

La dégradation de la végétation est localisée. Plusieurs facteurs sont à la base de cette situation.

3.4.1 ÉVALUATION DE LA DEGRADATION LOCALISEE DE LA VEGETATION

La figure 9a et 10 a montrent respectivement les niveaux de dégradation dans la zone d'étude et la végétation très dégradée. La lecture de ces cartes permet de retenir les informations suivantes :

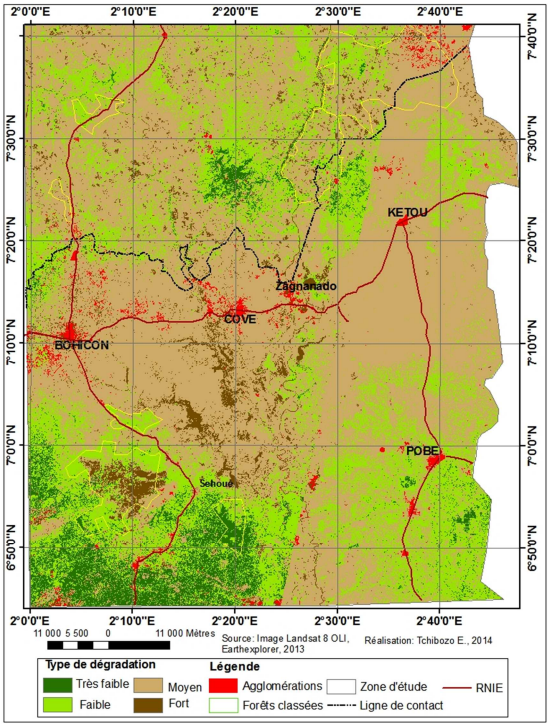


Figure 9a : Carte des niveaux de dégradations

Source : Traitement d'image

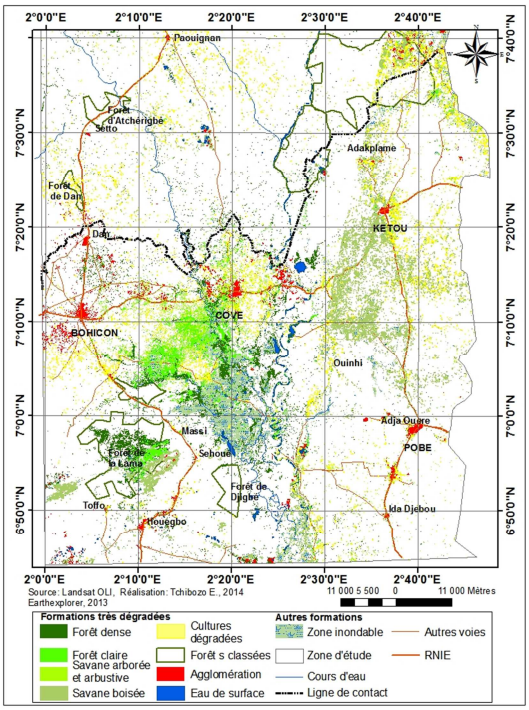


Figure 10 a: Carte de la végétation dégradée

Source : Traitement d'image

La dégradation occupe la zone d'étude à des niveaux variés. On distingue les zones de dégradation forte, moyenne, faible et très faible. La zone de dégradation moyenne est la plus importante de l'occupation (63,98%), figure 9b. Le taux le plus élevé de la dégradation des formations végétales est variable (figure 10a). La forte dégradation représente 8,89% de la forêt dense, 76,83% de la forêt claire, 72,89% de la savane boisée et 100% de la savane arborée et arbustive (figure 10b).

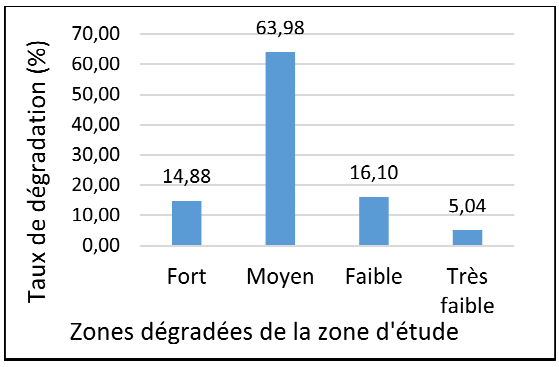


Figure 9b: Histogramme montrant les zones dégradées de la zone d'étude

Source : Traitement d'image

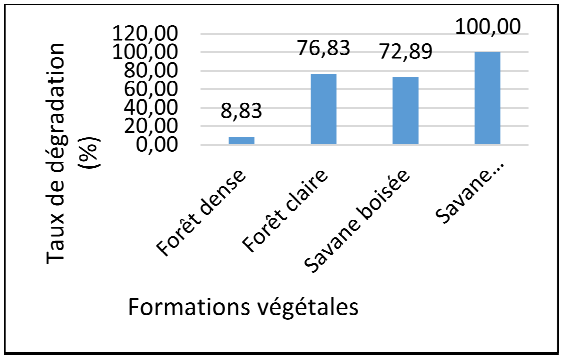


Figure 10b: Histogramme montrant les taux de dégradation de la végétation

Source : Traitement d'image

3.4.2 IDENTIFICATION DES FACTEURS DE DÉGRADATION

Dans le présent travail, la pression anthropique et le contenu en eau de la végétation seront étudiés à travers des indices spécifiques. Les résultats obtenus sur l'indice de brillance et l'eau sont présentés ci-dessous.

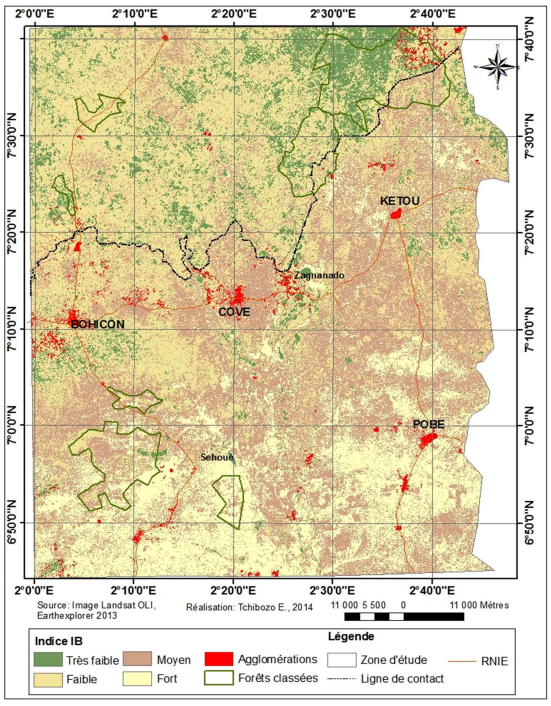


Figure 11a : Carte de la répartition de l'indice IB

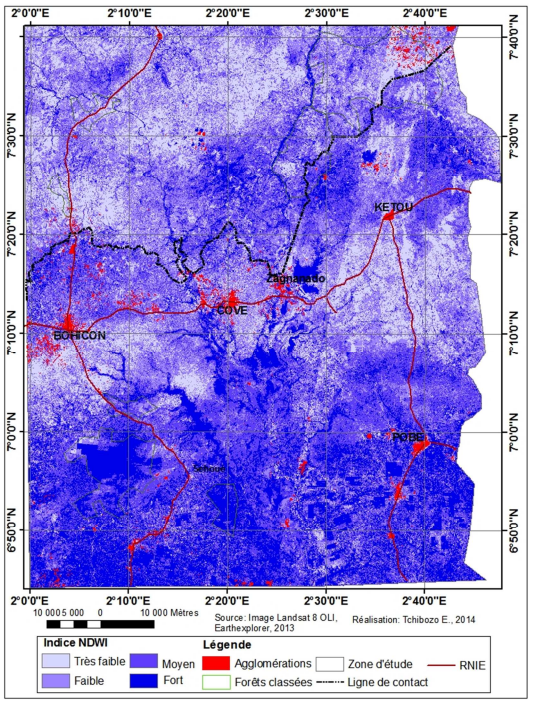


Figure 12a : Carte de la répartition de l'indice NDWI

La figure 11a représente la carte de l'indice de brillance. Elle montre les niveaux de pression anthropique sur le paysage. L'analyse de sa répartition spatiale indique que la forte pression n'occupe que 11,89% de la zone d'étude (figure 10b). Elle correspond aux zones de forte pression anthropique, identifiées au Sud-ouest de la zone d'étude, autour des forêts classées de la Lama et celle de Djigbé, au Sud-est, autour de Pobè et au centre autour de Zagnanado. La forte pression pourrait

s'expliquer par les multiples villages et agglomérations autour des forêts classées. La pression moyenne occupe 35,56% de la zone d'étude. Elle est perçue au Sud – est, au-dessus de la forêt classée de la Lama et celle d'Agrimè, et au centre de la zone d'étude, autour de Cove et Kétou, ainsi qu'au Nord à Paouignan. La pression faible constitue 10,39% et est remarquée au Centre de la zone d'étude sur le bassin sédimentaire à Bohicon et au Nord, sur le socle cristallin au-dessus de la ligne de contact. La très faible pression est identifiée au centre de la zone d'étude, sur le bassin sédimentaire à Bohicon et Zagnanado, et au Nord, sur le socle à l'est des forêts classées de Dogo et Kétou.

La figure 12a représente le NDWI. Cet indice mesure le contenu en eau de la végétation et donc le stress hydrique. La végétation qui contient une forte quantité d'eau occupe 23,78% de la zone d'étude (figure 11 b). Elle est localisée dans les forêts classées et forêt-galerie et les plantations du sud. Au Sud –ouest, elle est répartie autour et à l'intérieur des forêts classées de la Lama et de Djigbé, dans les vallées du zou et de l'Ouémé sur les plantations et au Sud – est, à Zagnanado. Sur le socle, cette végétation humide est remarquée au-dessus de la ligne de contact et plus particulièrement, au Nord – est à l'intérieur des forêts classées de Dogo et Kétou. La végétation qui contient une quantité moyenne d'eau domine le paysage avec 32,79% d'occupation. On la trouve au Sud –est autour des plantations, autour des agglomérations de Bohicon, Cove et Kétou au Centre et au Nord –ouest, autour de la Route Nationale Inter États (RNIE). La végétation contenant une faible quantité d'eau représente 27,84% de l'occupation. Elle est relativement distribuée au centre sur le bassin sédimentaire à Bohicon, Cove et Kétou et au nord de la zone d'étude sur le socle cristallin. La très faible quantité d'eau constitue 15,58% de la zone d'étude. On la trouve au Centre sur le bassin sédimentaire et au Nord-est sur le socle.

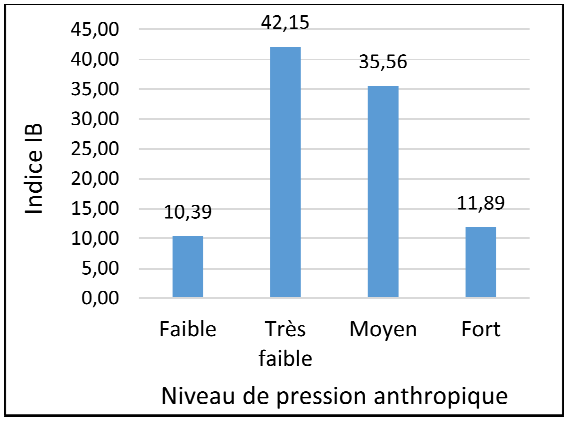


Figure 11b: Histogramme montrant les niveaux de pression anthropique

Source : Traitement d'image

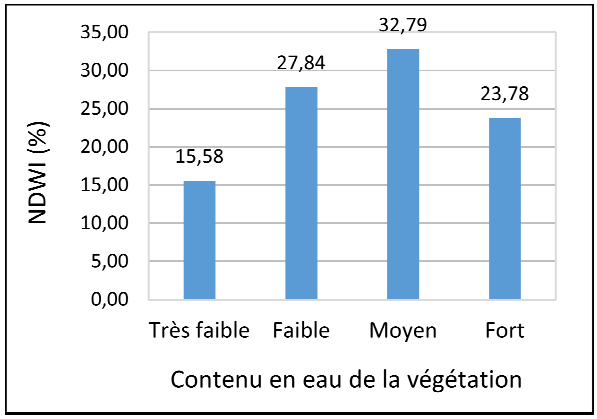


Figure 12b: Figure 10b: Histogramme montrant le contenu en eau de la végétation

Source : Traitement d'image

4 DISCUSSIONS

Le présent travail vise comme objectif, d'évaluer la dégradation de la végétation dans la zone de transition entre le sédimentaire et le cristallin, au centre Bénin. Les résultats obtenus montrent que la zone d'étude est caractérisée par un taux global de couverture de la végétation relativement élevé (75, 21%), inégalement réparti entre la forêt dense (40, 50%), la forêt claire (15,03%), savane arborée et arbustive (28,00%) et la savane boisée (16,47%). Malgré cela, de vastes surfaces dénudées (10,59%) sont remarquées au centre, sur le bassin sédimentaire à proximité de la ligne de contact avec le socle cristallin, au Nord – ouest, sur le socle autour des forêts classées d'Atchérigbé et de Dan. Le risque de désertification et la perte de végétation sont plus visibles. De ce qui précède, on peut affirmer que la végétation est inégalement répartie dans la zone d'étude et que la première hypothèse de travail est vérifiée.

La végétation est dégradée à des niveaux variés. Le traitement d'image à partir des indices de végétation a montré qu'elle est caractérisée par une faible couverture contenant une faible biomasse et présentant une santé et une densité faibles. Cette situation est particulièrement constatée sur les cultures et jachères, les plantations, la savane boisée, la forêt dense dégradée, la forêt claire, la savane arborée et arbustive et la savane boisée. Ce résultat permet d'affirmer que la dégradation de végétation est perçue à partir des indices de végétation et que la deuxième hypothèse est aussi vérifiée.

La forte dégradation de la végétation est identifiée au sud de la zone d'étude dans la forêt classée de la Lama, dans la forêt-galerie du zou, de l'Ouémé et à Zagnanado. Au Nord, sur le socle cristallin, au-dessus de la ligne de contact, elle est plus localisée sur les formations saxicoles et constitue un nuage de point qui est relativement concentré au Nord – est à proximité des forêts classées de Dogo et Kétou. Il correspond aux sols dénudés, aux reliques de forêt dense et forêt claire dégradées et à la savane boisée. La forte pression sur la végétation est non seulement au Sud, mais aussi au centre de la zone d'étude. À partir de ce qui précède, on peut confirmer la troisième hypothèse selon laquelle, la dégradation localisée de la végétation est inégalement répartie.

Les facteurs de la dégradation de la végétation sont variés. La pression anthropique et le contenu en eau de la végétation occupent une place importante. La forte pression anthropique est identifiée au sud-ouest de la zone d'étude, alors que la très faible pression est au centre, sur le bassin sédimentaire et au Nord, sur le socle. La végétation contenant une forte quantité d'eau se trouve dans les forêts classées, la forêt-galerie et les plantations du sud. La très faible quantité d'eau est au centre sur le bassin sédimentaire et au Nord-est, sur le socle. De ce qui précède, on peut dire que la quatrième hypothèse du travail est aussi vérifiée.

Les résultats ci-dessus présentés corroborent les travaux de plusieurs auteurs. En effet, selon Oloukoi, 2012, L'exploitation abusive des habitats et de la diversité biologique…, constituent les principales causes de la structure actuelle des paysages en zone soudano-guinéenne de l'Afrique de l'Ouest. En 2010, le rapport du Programme de Gestion des Forêts et Terroirs Riverains (PGFTR) avait montré que la forêt classée d'Abomey (au centre du Bénin) est marquée par une forte emprise humaine et présente des signes de dégradation du couvert forestier. En 2012, une analyse prospective sur la dynamique de l'occupation du sol à l'échéance 2050, réalisée par l'analyse spatiale et le SIG, a montré une régression effrénée des formations naturelles forestières du Bénin au profit des unités anthropisées. En 2013, dans sa thèse sur l'Anthropisation des paysages au Bénin: dynamique, fragmentation et développement agricole, [6] affirmé que dans la zone soudano - guinéenne du Bénin, les mosaïques de forêts sont soumises à de multiples formes de dégradation.

Il est important de noter que malgré son efficacité pour identifier les zones dégradées de végétation, même normalisé, l'indice NDVI reste sensible à la géométrie de vue et d'illumination, plus spécialement dans les régions où la densité de végétation est faible et où la présence de sol est importante [17]. Le NDVI souffre aussi d'une rapide saturation en milieu de végétation dense et la contribution du sol en région de faible densité de végétation peut compliquer son interprétation. C'est pourquoi, en plus du NDVI, il faut rechercher d'autres indices permettant de minimiser l'effet du sol nu sur la réponse spectrale de la végétation. Dans le présent travail, ce sont les indices MSAVI et PVI qui sont utilisés.

Le SAVI modifié (MSAVI - Modified SAVI)) permet de minimiser l'effet des sols nus. Il est plus sensible à la présence de végétation verte que le SAVI et autres indices de végétation [15]. Mais son résultat ne permet pas de supprimer complètement la saturation en région de végétation dense. C'est pourquoi l'indice PVI a été aussi calculé. Plusieurs études sur l'indice PVI ont montré que les isolignes de recouvrement générées par cet indice se «ramassent» sur elles-mêmes pour les plus hauts taux de recouvrement, au point de définir un «point de convergence» des trajectoires radiométriques dans les canaux rouge et proche infrarouge [18]. Ces trajectoires radiométriques décrivent l'accroissement de pourcentage de recouvrement du couvert végétal pour un type donné de sol en arrière-plan. C'est pourquoi dans la présente étude, la moyenne (MSAVI +PVI)/2 est utilisée dans pour évaluer la dégradation localisée de la végétation.

5 CONCLUSION

Le présent travail a permis d'identifier les zones dégradées de végétation à partir des indices de végétation. Les résultats obtenus montrent une forte couverture de la végétation (75, 21%), inégalement réparti entre la forêt dense (40, 50%), la forêt claire (15,03%), savane arborée et arbustive (28,00%) et la savane boisée (16,47%).

La très faible couverture de végétation occupe 26,00% de la zone d'étude et la forte, 4,71%. Sur le terrain, la très faible couverture est remarquée au sud-ouest de la zone d'étude, sur les cultures et jachères, les plantations des berges de la vallée de l'Ouémé et celles à proximité de la forêt classée de la Lama. Au centre et au nord – ouest, ce sont les savanes autour de la ligne de contact entre le bassin sédimentaire et le socle cristallin, et plus particulièrement la savane arborée et arbustive et la savane boisée au-dessus de la forêt classée d'Atchérigbé, qui sont concernées. La forte couverture caractérise la forêt dense à l'intérieur de la forêt classée de la Lama au Sud –est, celle de Bohicon, Cove et Kétou au centre et dans la vallée du zou au Nord – ouest. Les forêts galerie du Sud-ouest et du Sud – est de la zone d'étude sont également couvertes par cette forêt dense.

L'occupation du sol est composée de plusieurs unités à des taux variés : la forêt dense (30,46%), la forêt claire (11,31%), la savane boisée (12,39%), la savane arborée et arbustive (21,06%), l'eau (0,31%), les agglomérations (1,36%), la mosaïque de cultures et jachères (9,24%), les sols dénudés (10,59%) et la zone inondable (3,29%). Au centre de la zone d'étude, sur le

bassin sédimentaire à proximité de la ligne de contact avec le socle, et au Nord - ouest sur le socle cristallin à autour des forêts classées d'Atchérigbé et de Dan, les surfaces dénudées sont relativement importantes. Le risque de désertification et la perte de végétation sont plus visibles. La forte dégradation occupe 14,88% de la zone d'étude. Elle est identifiée au Sud dans la forêt classée de la Lama, dans la forêt- galerie du zou, de l'Ouémé et à Zagnanado. Au Nord, sur le socle cristallin, au-dessus de la ligne de contact la forte dégradation plus localisée sur les formations saxicoles, constitue un nuage de point qui est relativement concentré au Nord –est à proximité des forêts classées de Dogo et Kétou. Il correspond aux sols dénudés, aux reliques de forêt dense et forêts claires dégradées et à la savane boisée. La très faible dégradation représente seulement 5,04% de l'occupation. On la trouve au Sud-ouest, sur la forêt dense autour de la forêt classée de Djigbé, à Houegbo et à Toffo et au Nord-est sur les formations saxicoles de la vallée de l'Ouémé et d'Atakplamè. Les facteurs de la dégradation de la végétation sont variés. La pression anthropique est plus forte au sud-ouest de la zone d'étude, alors qu'elle est relativement très faible au centre, sur le bassin sédimentaire et au Nord, sur le socle. Le contenu en eau de la végétation est relativement important dans les forêts classées, la forêt-galerie et les plantations du sud, et très faible dans les formations du centre sur le bassin sédimentaire et au Nord-est sur le socle cristallin.

Les résultats obtenus par ce travail constituent une contribution à la localisation des zones dégradées de végétation. Ils permettront de donner une alerte précoce à la désertification afin d'améliorer la gestion des écosystèmes forestiers. Compte tenu de la surface considérée, des études de terrain plus localisées doivent être entreprises pour mieux maîtriser la dégradation localisée de la végétation.

REFERENCES

[1] OIBT, Critères et indicateurs révisés de l'OIBT pour l'aménagement durable des forêts tropicales, Modèle de rapport sur les C&I inclus, Série OIBT: Politique forestière n° 15. Yokohama, 2005.

[2] G. P. ASNER, D.E KNAPP, E.P. Broadbent, P. Oliviera, M. Keller, and J. Silva, "Selective logging in the Brazilian Amazon". Science 310: 480-482, 2005.

[3] LUND, H.G., What Is a Degraded Forest, Forest Information Services. Gainesville, VA, USA, 2009. http://home.comcast.net/~gyde/2009forestdegrade.doc.

[4] FAO, Actes de la Troisième réunion d'experts sur l'harmonisation des définitions forestières à l'usage des différentes parties prenantes, 17-19 janvier 2005. OMM//GIEC/CIFOR/FAO/IUFRO /PNUE. Rome, 2005. ftp://ftp.fao.org/docrep/fao/008/j4959e/j4959e.pdf

[5] PGFTR, Etude de la diversité biologique dans les périmètres de reboisement de Kilir et d'Abomey, appartenant à l'aire d'intervention du PGFTR au Bénin, Rapport final, Laboratoire d'écologie appliquée, Bénin, 2010,110p.

[6] MAMA A., Anthropisation des paysages au Bénin: dynamique, fragmentation et développement agricole, Thèse de l'Université Libre de Bruxelles, Université d'Europe, Bruxelles, 2013,198p.

[7] W.T. LIU, and F.N. KOGAN, "Monitoring Regional Drought Using the Vegetation Condition Index", International Journal of Remote Sensing, vol.17(14): 2761-2782pp, 1996.

[8] P. VINÉ, "Remote Sensing and Geographic Information Systems for Design and Operation of Water Resources Systems", Proceedings of Rabat Symposium S3, IAHS Publ. no. 242, April 1997, pp.

[9] J.R. LANDIS, G.G. KOCH, "The Measurement of Observer Agreement for Categorical DATA", Biometrics, n°33, 159-174pp, 1974.

[10] D. J RAY and A.R. HUETE, "Interpreting vegetation indices, Preventive veterinary medicine", n°11, 185-200 pp, Elsevier Sciences Publishers, B.V, Amsterdam, 1991.

[11] J.E. COLWELL, "Grass canopy bidirectional spectral reflectance", Proceedings of the 9th Int. Symposium on remote sensing of environment, 1974, 1061-1085pp. 1974

[12] A.J. RICHARDSON and WIEGAND C.L.," Distinguishing vegetation from soil background in formation", Photogramm. ENG. Remote sensing, vol. 43: 1541-1552pp, 1977.

[13] ROUSE, J.W. Jr., HAAS, R.H., DEERING, D.W., SCHELL, J.A. and HARLAN J.C., Monitoring the Vernal Advancement and Retrogradation (Green Wave Effect) of Natural Vegetation, NASA/GSFC Type III Final Report, Greenbelt, MD., 1974, 371p.

[14] F. BARET, G. GUYOT and D. MAJOR, "TSAVI: a vegetation index which minimizes soil brightness effects on LAI and APAR estimation", 12 th Canadian Symposium on Remote Sensing and IGARSS'90, pp.4, Vancouver, Canada, 10- 14 July 1989. Cited in BARET and GUYOT, 1991.

[15] J. Qi, A. CHEHBOUNI, A. R.HUETE and Y. H. KERR, "A Modified Soil Adjusted Vegetation Index", Journal Remote Sensing of Environment, vol.48: 119-126pp, 1994.

[16] CEMAGREF, Aide méthodologique à la caractérisation et la cartographie des interfaces habitat –forêt, 15p, 2012.

[17] A. BANNARI, A.R. HUETE, D. MORIN and F. ZAGOLSKI, "Effets de la Couleur et de la Brillance du sol sur les Indices de végétation, International Journal of Remote Sensing, n°17(10): 1885 -1906 pp, 1996.

[18] A.R. HUETE, "A soil adjusted vegetation index (SAVI)". Remote Sensing of Environment, n°25: 121–136pp, 1988.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 494-502
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Evaluation of Habitual Rice (*Oryza sativa* L.) Landraces of Bangladesh through Different Genetic Parameters

M. S. Alam[1], L. Hassan[1], M. M. Islam[2], S. N. Begum[3], and S. N. Islam[1]

[1]Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh, Bangladesh

[2]Biotechnology Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh

[3]Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The study was carried out with an objective to evaluate the agronomic performance of 76 rice genotypes and to learn the variability, heritability and genetic advance of yield and its components. The genotypes differed significantly for all the characters *viz.,* days to 50% flowering, days of maturity, number of tillers plant^{-1}, number of effective tillers plant^{-1}, plant height, panicle length, number of filled grain panicle^{-1}, number of unfilled grain panicle^{-1}, 1000-seed weight and yield plant^{-1}. The phenotypic co-efficient of variation (PCV) were higher than genotypic co-efficient of variation (GCV) for all the characters studied indicating that they all interacted with the environment to some extent. All the characters studied in the present investigation expressed high heritability estimates ranging from 78.38 to 99.14 percent. High heritability values indicate that the characters under study are less influenced by environment in their expression. High heritability along with high genetic advance was noticed for the traits, number of filled grains panicle^{-1} and number of unfilled grains panicle^{-1}. Other characters showed high heritability along with moderate or low genetic advance which can be improved by intermating superior genotypes of segregating population developed from combination breeding.

KEYWORDS: Genetic variability, Heterogeneous, Gene pool, Stress-tolerance, Cultivars, Additive gene.

1 INTRODUCTION

Rice, the staple food of about 160 million people in Bangladesh, belongs to the family of Gramineae and the genus *Oryza*. *Oryza* contains about 20 different species, of which only two are cultivated: *Oryza sativa* L. ('Asian rice') and *Oryza glaberrima* Steud ('African rice'). The species *O. sativa*, of Asian origin, comprises of two main types: indica and japonica. The indica type is from tropical and japonica is from temperate and subtropical Asia. *Oryza glaberrima* originates from inland delta of the Niger River. Nowadays, the Asian species (*O. sativa*) is cultivated far more than the African species (*O. glaberrima*), mainly for its higher yield potential [1].

Landraces are widespread and popular among farmers, and are an important part of agriculture because their diverse array in a crop creates genetic diversity in agriculture [2]. The genetic variability is a key component of breeding programs aimed at broadening the gene pool of rice and other crops. Landraces are known to be heterogeneous mixtures of genotypes carrying a range of stress-tolerance genes [3]. Landraces also possess traits that are most preferred by farmers and can be used to produce new cultivars or to incorporate desirable traits into varieties.

In rice, as in many other crops, landraces have not been bred as varieties, but have become adapted to the local conditions of environment and inputs where they are cultivated. Landraces have been the mainstay of agricultural systems in many developing countries. Recently, however, the diversity of gene pool has become depleted, mainly on account of extension of modern high-yielding varieties. Over many years, farmers and breeders have selected rice varieties for improved grain yield, quality, disease and pest resistance, and other traits that favor productivity for farmers. The process of

Corresponding Author: M. S. Alam

domestication narrowed the range of genetic variation that was available in wild populations, causing a genetic bottle neck as a result of the selection pressure imposed by humans. Natural habitats of wild rice are also threatened by various development projects of the farmland. The number of landraces began to decline in 1970's when high-yielding varieties were introduced. Most of the old landraces are now available in certain gene banks only.

Bangladesh constitutes a large part of the South Asian centre of genetic diversity, sharing with India and Myanmar. It has rich genetic diversity of landraces and wild rice. In recent years, these traditional varieties have been replaced by modern improved varieties associated with new cultural practices. Several workers have found and reported genetic variability of landraces for higher yield, for tolerance to various stresses and for improved grain quality. Gomez *et al.* [4] evaluated rice landraces in India and found variability for quality traits such as milled rice percentage and kernel length. Irie *et al.* [5] reported great diversity for photoperiod sensitivity, based on number of days to heading, among 1240 rice landraces of Myanmar. Significant variation for physiological and economic traits was recorded among 11 landraces grown in the Tamil Nadu region of India by Gomez and Kalami [6]. Despite the research already done, the role of landraces in contributing germplasm to breeding programs has not been fully appreciated. This has been due to inadequate testing or lack of genetic information about the landraces. Information from genetic studies could be useful in designing breeding programs that will best exploit economically important grain quality and yield related traits when developing new varieties. To meet the continuously expanding needs of varietal improvement, the assemblage, evaluation and preservation of the entire existing landraces are essential to more rewarding breeding efforts. The specific objectives of the study were as follows:

- to evaluate the agronomic performance of collected landraces
- to study the variability, heritability and genetic advance of yield and its components

2 MATERIALS AND METHODS

The experiment was conducted at the experimental farm of Bangladesh Institute of Nuclear Agriculture, Mymensingh, during July 2011 to January 2012. Geographically the experimental area is located at $24^0$75 N latitude and $90^0$5 E longitudes at the elevation of 18 m above the sea level. Fifty four rice landraces (i.e. Dudh kalam, Hati bajore, Malagoti, Kuchra, Enghi, Kajol shail, Hogla, Jamai naru, Hari, Dakh shail, Moina moti, Marish shail, Patnai, Bhute shallot, Kute patnai, Mohini shallot, Moghai balam, Sada gotal, Khak shail, Mohime, Holde gotal, Jota balam, Tilek kuchi, Rani Shalot, Kathi goccha, Bashful balam, Bazra muri, Durga bhog, Kumra ghor, Khainol, Ghunshi, Chinikani, Dhar shail, Khejur chori, Shaheb kachi, Raja shail, Hamai, Mura bajal, Lal gotal, Kalmilata, Volanath, Rupessor, Sylhet balam, Karengal, Kalo mota, Mota aman, Ghochi, Chap shail, Mondeshor, Nona kochi, Ghocca, Tal mugur, Ghigoj and Tor balam) were collected from the farmer's field of southern Bangladesh. Rest of the rice genotypes (21 landraces i.e. Fulkainja, Piarjat, Koicha binni, Lal biroi, Lalanamia, Golapi, Asam binni, Kakua binni, Nona bokhra, Jongli boro, Kashrail, Ledra binni, Nunnia, Rotisail, Genggeng binni, Chinisail, Jolkumri, Ponkhiraj, Mowbinni, Bogi, Kali boro and Binadhan-8) was collected from Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The experimental field was divided into three blocks each representing one replication. Each block was then sub-divided in to seventy six plots. The seventy six rice genotypes were placed in each plot. The size of the unit plot was one square meter in size. Row to row and plant to plant distances were 20 cm and 20 cm, respectively in each plot. Analysis of variance was performed using the plant breeding statistical program (PLBSTAT, Version 2N, Utz 2007). The replicates were considered as random variable. Multiple mean comparisons were made with Fisher's least significant difference (LSD) procedure using Stat Graphics Plus for Windows 3.0 (Statistical Graphics Crop. Rockville, USA). Genotypic and phenotypic variances were estimated according to the formula given by Johnson *et al.* [7]. Heritability in broad sense (h^2_b) was estimated according to the formula suggested by Johnson *et al.* [7] and Hanson *et al.* [8]. Genotypic and phenotypic co-efficient of variations were estimated according to Burton [9] and Singh and Chaudhary [10]. Estimation of genetic advance was done following formula given by Johnson *et al.* [7] and Allard [11]. Genetic advance in percent of mean was calculated by the formula of Comstock and Robinson [12].

3 RESULTS AND DISCUSSION

3.1 EVALUATION OF PERFORMANCE OF RICE LANDRACES

The analyses of variance of different genotypes for quantitative characters are shown in Table 1. It was observed that genotypic effects were highly significant for all characters *viz.,* days to 50% flowering, days to maturity, tillers plant^{-1}, effective tillers plant^{-1}, plant height, panicle length, filled grain panicle^{-1}, unfilled grain panicle^{-1}, 1000-grain weight and yield plant^{-1}. This indicates that there is a genotypic variation among the genotypes for the characters. Yaqoob *et al.* [13] observed

significant variation among genotypes for days to maturity, tillers plant^{-1}, effective tillers plant^{-1}, plant height, panicle length, 100-grain weight and yield plant^{-1}. Tiwari *et al.* [14] also observed significant variation among genotypes for days to 50% flowering, effective tillers plant^{-1}, panicle length, number of spikelets panicle^{-1}, number of fertile spikelets and grain yield plant^{-1}.

The mean performances of the 76 rice genotypes for their characters are shown in Table 2. From the tabular results it was observed that Ghunshi was the highest in plant height (173.8 cm) followed by Malagoti and Bazra muri (172.8 and 172.6 cm, respectively) and Binadhan-8 was the lowest (84.40cm) for plant height. Bhute shalot had the highest (30.50 cm) panicle length followed by Genggeng binni (30.30 cm) and Ghigoj had the lowest (20.62 cm) panicle length. Binadhan-8 took the lowest days to 50% of flowering (88 days) and Jamainaru took the highest (140 days) days to 50% of flowering which was not significantly different from Kuchra (139 days). Binadhan-8 was early maturing (130 days) and Kuchra was late maturing (175 days) which was not significantly different from Hati bajore and Mondeshor (174 and 173 days, respectively). Moina moti and Nunnia had the highest and same number of tillers plant^{-1} (22.60) and Genggeng binni had the lowest number of tillers plant^{-1} (9.20). Nunnia had the highest number of effective tillers plant^{-1} (22.40) which was not significantly different from Moina moti (21.80) and Genggeng binni had the lowest number of effective tillers plant^{-1} (9.03). Kakua binni had the highest number of filled grain panicle $^{-1}$ (236.8) and Kumra ghor and Karengal had the lowest (59.60) number of filled grain panicle $^{-1}$. Koicha binni had the highest (85.40) number of unfilled grain panicle^{-1} and Mota aman had the lowest (8.40) number of unfilled grain panicle^{-1}. Highest 1000-grain weight (31.93g) was present in Mota aman followed by Hati bajore (31.23 g) and the lowest in Chinishail (11.28 g) followed by Kakua binni (11.75 g). Among 76 rice genotypes for yield plant^{-1} Bogi yielded the highest (67.80 g) while Ghunshi yielded the lowest yield plant^{-1} (10.20 g).

Table 1. Analysis of variance for plant characters of 76 rice genotypes

Items	d.f	Plant height (cm)	Panicle length (cm)	Days to 50% flowering	Days to maturity	Number of tillers plant^{-1}	Number of effective tillers plant^{-1}	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	1000 seed weight (g)	Grain yield plant^{-1} (g)
Replication	2	130.92	0.372	67.561	204.34	2.453	3.195	125.65	6.92	0.639	5.995
Genotypes	75	651.70**	12.894**	546.827**	515.62**	23.969**	23.168**	4448.18**	563.04**	66.183**	427.840**
Error	150	30.67	1.086	17.235	33.99	0.652	0.691	18.13	1.62	0.968	1.760

*** indicates significant at 0.01 probability*

Table 2. Mean performance of 76 rice genotypes based on different morphological traits related to yield

Genotypes	Plant height (cm)	Panicle length (cm)	Days to 50% flowering	Days to maturity	Number of tillers plant^{-1}
Dudh kalam	148.40	27.32	102.00	140.00	13.40
Hati bajore	154.00	27.80	138.00	174.00	13.80
Malagoti	172.80	25.52	99.00	139.00	13.20
Kuchra	153.40	24.60	139.00	175.00	16.20
Enghi	152.40	28.50	118.00	156.00	12.80
Kajol shail	127.80	25.70	114.00	155.00	12.80
Hogla	154.20	27.70	125.00	170.00	12.80
Jamai naru	144.20	28.20	140.00	171.00	18.00
Hari	116.00	27.13	119.00	155.00	15.00
Dakh shail	145.40	28.52	117.00	155.00	15.40
Moina moti	133.40	25.20	103.00	138.00	22.60
Marish shail	146.20	25.90	129.00	172.00	17.00
Patnai	164.00	24.10	115.00	155.00	12.60
Bhute shalot	141.00	30.50	133.00	171.00	15.40
Kute patnai	152.40	24.74	121.00	155.00	10.80
Mohini shalot	139.40	23.58	129.00	166.00	15.20
Moghai balam	123.60	26.24	120.00	156.00	13.60
Sada gotal	143.00	25.48	125.00	167.00	12.60
Khak shail	142.80	27.20	95.00	137.00	14.80
Mohime	152.40	24.50	120.00	167.00	13.80
Holde gotal	139.20	23.34	121.00	166.00	13.00
Jota balam	138.60	26.40	118.00	155.00	20.80
Tilek kuchi	133.20	26.74	120.00	166.00	11.60
Rani shalot	148.80	25.65	135.00	172.00	14.60
Kathi goccha	148.60	22.84	110.00	147.00	10.60
Bashful balam	148.20	26.60	125.00	155.00	12.40
Bazra muri	172.60	25.86	131.00	169.00	11.20
Durga bhog	143.80	23.40	95.00	138.00	15.40
Kumra ghor	147.40	21.14	132.00	172.00	11.80
Khainol	152.80	28.10	97.00	137.00	16.40
Ghunshi	173.80	21.64	130.00	171.00	10.00
Chinikani	143.00	23.48	116.00	156.00	14.80
Dhar shail	141.00	24.41	110.00	150.00	11.60
Khejur chori	147.40	25.62	133.00	172.00	15.40
Shaheb kachi	138.00	25.78	134.00	171.00	11.80
Raja shail	143.20	24.00	110.00	152.00	12.00
Hamai	153.00	25.12	109.00	151.00	12.60
Mura bajal	149.40	23.62	129.00	171.00	11.60
Lal gotal	142.40	24.50	133.00	172.00	12.40
Kalmilata	147.40	24.62	118.00	155.00	11.80
Volanath	129.00	25.32	128.00	169.00	12.40
Rupessor	116.00	23.16	111.00	147.00	15.40
Sylhet balam	116.20	26.90	100.00	140.00	13.00
Karengal	131.40	23.51	130.00	171.00	11.20
Kalo mota	142.40	24.02	132.00	172.00	10.60
Mota aman	120.60	22.74	126.00	166.00	15.20
Ghochi	155.60	22.60	97.00	137.00	16.00
Chap shail	148.80	25.80	118.00	158.00	11.80
Mondeshor	138.40	26.70	133.00	173.00	10.20
Nona kochi	148.20	26.64	132.00	172.00	11.60
Ghocca	143.60	26.90	105.00	145.00	12.60
Tal mugur	161.80	27.22	100.00	138.00	11.60
Ghigoj	141.60	20.62	110.00	150.00	13.80
Tor balam	156.26	26.26	107.00	147.00	13.40
Fulkainja	118.40	29.54	101.00	137.00	16.40
Piarjat	134.20	29.48	104.00	146.00	14.20
Koicha binni	138.80	28.94	102.00	142.00	13.40
Lal Biroi	143.60	24.88	103.00	143.00	17.20
Lalanamia	123.20	25.62	109.00	145.00	11.00

Genotypes	Plant height (cm)	Panicle length (cm)	Days to 50% flowering	Days to maturity	Number of tillers plant^{-1}
Golapi	143.40	23.30	107.00	146.00	18.20
Asam binni	148.40	26.74	107.00	143.00	14.00
Kakua binni	138.80	27.96	110.00	145.00	18.40
Nona bokhra	141.40	24.20	95.00	139.00	11.60
Jongli boro	136.60	25.00	93.00	137.00	13.00
Kashrail	126.80	27.05	96.00	138.00	10.40
Ledra binni	128.00	27.16	106.00	146.00	20.80
Nunnia	113.00	27.26	103.00	147.00	22.60
Rotisail	109.00	27.28	103.00	147.00	12.60
Genggeng binni	137.80	30.30	105.00	147.00	9.20
Chinisail	124.20	25.06	110.00	146.00	14.40
Jolkumri	138.80	25.72	100.00	136.00	11.60
Ponkhiraj	139.60	24.22	103.00	139.00	11.00
Mowbinni	133.20	22.44	113.00	148.00	10.40
Bogi	144.20	23.60	110.00	147.00	16.20
Kali boro	153.00	24.34	93.00	137.00	11.13
Binadhan-8	84.40	25.40	88.00	130.00	16.20
CV%	3.93	4.07	3.63	3.79	5.86
Minimum	84.40	20.62	88.00	130.00	9.20
Maximum	173.80	30.50	140.00	175.00	22.60
Mean	140.89	25.59	114.43	153.79	13.77
LSD (0.05)	8.94	1.68	6.69	9.40	1.30

Table 2. Continued

Genotypes	Number of effective tillers plant^{-1}	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	1000 seed weight (g)	Grain yield plant^{-1} (g)
Dudh kalam	12.00	115.80	55.80	28.15	28.94
Hati bajore	13.00	100.60	15.00	31.23	32.68
Malagoti	12.86	167.26	45.20	20.93	36.70
Kuchra	15.60	100.60	15.20	28.67	36.48
Enghi	12.60	144.80	20.80	20.59	38.32
Kajol shail	12.40	91.60	21.20	29.27	29.34
Hogla	12.60	80.60	24.20	27.84	18.55
Jamai naru	16.80	112.20	19.26	25.52	35.93
Hari	14.60	153.80	39.60	21.64	42.25
Dakh shail	15.00	181.26	30.60	19.40	44.75
Moina moti	21.80	141.80	22.40	21.60	51.60
Marish shail	15.80	128.40	25.60	24.79	33.76
Patnai	12.20	143.20	19.20	27.11	47.72
Bhute shalot	14.40	95.00	33.60	28.14	36.83
Kute patnai	10.00	164.80	21.60	27.40	40.26
Mohini shalot	14.86	78.26	22.00	29.06	23.41
Moghai balam	12.60	148.20	20.20	26.32	36.99
Sada gotal	11.00	98.80	26.20	30.06	30.27
Khak shail	13.60	133.80	34.60	28.61	42.57
Mohime	13.00	109.20	25.60	28.44	29.95
Holde gotal	12.40	80.80	27.80	26.80	21.27
Jota balam	19.60	113.40	13.40	31.04	49.95
Tilek kuchi	11.00	128.25	25.25	24.58	28.63
Rani shalot	14.20	88.60	10.80	28.91	25.31
Kathi goccha	10.00	141.80	23.00	25.09	25.71
Bashful balam	12.00	117.20	55.20	23.76	28.80
Bazra muri	10.00	106.20	16.40	21.31	19.52
Durga bhog	14.20	118.40	36.00	21.12	24.20
Kumra ghor	11.40	59.60	13.60	25.05	17.03
Khainol	15.80	113.00	38.40	28.31	39.47
Ghunshi	9.40	63.50	13.25	17.84	10.20
Chinikani	13.80	151.00	16.80	12.35	15.67
Dhar shail	10.80	117.60	45.00	14.13	18.11
Khejur chori	15.00	93.00	19.60	27.49	29.16
Shaheb kachi	10.80	82.20	17.40	26.27	17.40
Raja shail	11.60	93.80	28.40	28.27	28.06
Hamai	12.20	99.20	43.60	27.92	30.27
Mura bajal	10.20	112.20	54.40	23.94	28.29
Lal gotal	11.60	91.40	20.00	27.80	23.73
Kalmilata	11.20	111.80	13.80	26.14	25.97
Volanath	10.40	111.36	53.00	24.76	27.85
Rupessor	15.00	90.60	12.80	25.44	29.20
Sylhet balam	12.40	160.60	37.60	21.17	31.47
Karengal	10.80	59.60	21.20	24.02	15.22
Kalo mota	10.00	84.80	24.40	24.80	12.75
Mota aman	14.60	89.86	8.40	31.93	34.65
Ghochi	14.40	179.60	16.40	21.22	21.90
Chap shail	10.80	97.40	22.00	28.72	27.98
Mondeshor	10.00	113.40	22.00	29.50	27.02
Nona kochi	11.40	89.80	14.00	28.50	28.14
Ghocca	11.60	60.60	20.80	24.64	17.18
Tal mugur	10.60	120.60	39.60	27.84	27.30
Ghigoj	13.60	116.20	18.80	27.17	32.41
Tor balam	13.00	81.80	38.20	27.65	26.11
Fulkainja	15.00	115.80	57.60	17.14	24.49
Piarjat	14.00	163.33	23.20	18.08	31.26
Koicha binni	13.00	144.80	85.40	16.95	23.39
Lal biroi	16.80	188.00	34.60	16.01	33.37

Genotypes	Number of effective tillers plant^{-1}	Number of filled grains panicle^{-1}	Number of unfilled grains panicle^{-1}	1000 seed weight (g)	Grain yield plant^{-1} (g)
Lalanamia	10.80	215.60	29.80	24.53	59.47
Golapi	17.60	201.20	25.40	19.81	58.74
Asam binni	13.60	171.00	14.80	24.51	48.50
Kakua binni	18.20	236.80	24.33	11.75	45.21
Nona bokhra	11.20	138.20	18.20	28.22	53.73
Jongli boro	12.60	96.80	14.80	18.36	16.38
Kashrail	10.00	101.60	37.40	27.36	25.39
Ledra binni	19.20	139.00	12.40	21.66	55.90
Nunnia	22.40	113.00	25.60	16.11	24.69
Rotisail	12.40	190.80	26.60	23.40	52.19
Genggeng binni	9.03	182.00	23.00	22.33	38.96
Chinisail	13.80	125.40	27.00	11.28	18.27
Jolkumri	11.40	158.00	12.20	22.71	35.10
Ponkhiraj	10.40	102.13	9.20	22.57	22.58
Mowbinni	10.20	162.66	36.20	25.18	42.92
Bogi	16.00	206.20	20.20	25.34	67.80
Kali boro	9.60	117.20	9.80	22.55	19.31
Binadhan-8	11.80	119.40	34.26	25.51	29.80
CV%	6.37	3.44	4.79	4.06	4.18
Minimum	9.03	59.60	8.40	11.28	10.20
Maximum	22.40	236.80	85.40	31.93	67.80
Mean	13.05	123.92	26.59	24.23	31.72
LSD (0.05)	1.34	6.87	2.06	1.58	2.14

3.2 ESTIMATION OF GENETIC PARAMETERS OF RICE LANDRACES

Genotypic variances, phenotypic variances, heritability, genotypic co-efficient of variation (GCV), phenotypic co-efficient of variation (PCV), genetic advance and genetic advance in percentage of mean, GA (%) for all the quantitative characters are presented in Table 3.

3.2.1 VARIABILITY PARAMETERS

Greater variability in the initial breeding material ensures better chances of producing desired forms of a crop plant. Thus, the primary objective of germplasm conservation is to collect and preserve the genetic variability in indigenous collection of crop species to make it available to present and future generations. The results of analysis of genotypic and phenotypic variance are presented in Table 3. The phenotypic co-efficient of variation (PCV) were higher than genotypic co-efficient of variation (GCV) for all the characters studied indicating that they all interacted with the environment to some extent. Bhadru *et al.* [15] also mentioned the same result. The characters studied in the present investigation exhibited low, moderate and high PCV and GCV values. Among the characters, highest PCV and GCV values were recorded for number of unfilled grains panicle^{-1}, followed by grain yield plant^{-1} (g) and the lowest PCV and GCV values were recorded for days to maturity. Tiwari *et al.* [14] also observed the higher magnitude of PCV and GCV for grain yield plant^{-1}, number of fertile spikelets, effective tillers plant^{-1}, panicle length, and number of spikelets panicle^{-1}.

3.2.2 HERITABILITY

The estimates of heritability act as predictive instrument in expressing the reliability of phenotypic value. Therefore, high heritability helps in effective selection for a particular character. Heritability is classified as low (below 50%), medium (50-70%) and high (above 70%). All the characters studied in the present investigation expressed high heritability estimates ranging from 78.38% to 99.14%. Among the characters, highest heritability was recorded for number of unfilled grains panicle^{-1} followed by number of filled grains panicle^{-1} and panicle length (cm) recorded lowest heritability value (Table 3). High heritability values indicate that the characters under study are less influenced by environment in their expression. The plant breeder, therefore, may make his selection safely on the basis of phenotypic expression of these characters in the individual plant by adopting simple selection methods. High heritability indicates the scope of genetic improvement of these characters through selection. Patel *et al.* [16] observed highest heritability for days to 50% flowering, plant height, total

tillers, panicle length, total number of spikelets panicle^{-1}, number of filled spikelets panicle^{-1}, number of unfilled spikelets panicle^{-1} and grain yield m^{-2}.

3.2.3 GENETIC ADVANCE

The genetic advance is a useful indicator of the progress that can be expected as result of exercising selection on the pertinent population. Heritability in conjunction with genetic advance would give a more reliable index of selection value. Genetic advance was highest for number of filled grains panicle^{-1} and lowest for panicle length (cm). The genetic advance as per cent of mean was highest in case of number of unfilled grains panicle^{-1}, while lowest recorded by panicle length (cm). The information on genetic variation, heritability and genetic advance helps to predict the genetic gain that could be obtained in later generations, if selection is made for improving the particular trait under study. In general, the characters that show high heritability with high genetic advance are controlled by additive gene action and can be improved through simple or progeny selection methods. Selection for the traits having high heritability coupled with high genetic advance is likely to accumulate more additive genes leading to further improvement of their performance. In the present study, high heritability along with high genetic advance was noticed for the traits, number of filled grains panicle^{-1} and number of unfilled grains panicle^{-1}. Other characters showed high heritability along with moderate or low genetic advance which can be improved by intermating superior genotypes of segregating population developed from combination breeding. Babu *et al.* [17] estimated highest genetic advance for number of filled grains panicle^{-1}.

Table 3. Estimation of genetic parameters of 76 rice genotypes based on different morphological traits related to yield

Characters	Phenotypic variance	Genotypic variance	PCV (%)	GCV (%)	Heritability (%)	GA	GA (%)
Plant height (cm)	237.69	207.01	10.94	10.21	87.09	27.66	19.63
Panicle length (cm)	5.02	3.94	8.76	7.75	78.38	3.62	14.14
Days to 50% Flowering	193.77	176.53	12.16	11.61	91.11	26.12	22.83
Days to maturity	194.54	160.54	9.07	8.24	82.53	23.71	15.42
Number of tillers plant^{-1}	8.42	7.77	21.08	20.25	92.26	5.52	40.07
Number of effective tillers plant^{-1}	8.18	7.49	21.93	20.98	91.56	5.40	41.35
Number of filled grains panicle^{-1}	1494.82	1476.68	31.20	31.01	98.79	78.68	63.49
Number of unfilled grains panicle^{-1}	188.76	187.14	51.66	51.44	99.14	28.06	105.51
1000 seed weight (g)	22.71	21.74	19.66	19.24	95.74	9.40	38.78
Grain yield plant^{-1} (g)	143.79	142.03	37.80	37.57	98.78	24.40	76.92

4 CONCLUSION

The results clearly showing that that there were significant variations for all the characters studied among the genotypes. Binadhan-8 was early maturing and Kuchra was late maturing. Among 76 rice genotypes for yield plant^{-1} Bogi yielded the highest while Ghunshi yielded the lowest yield plant^{-1}. The characters studied in the present investigation exhibited low, moderate and high PCV and GCV values. High heritability values indicate that the characters under study are less influenced by environment in their expression. The characters that show high heritability with high genetic advance are controlled by additive gene action and can be improved through simple or progeny selection methods and other characters can be improved by intermating superior genotypes of segregating population developed from combination breeding.

REFERENCES

[1] Wopereis, M.C.S., Defoer, T., Idinoba, P., Diack, S., and Dugué, M.J., *Participatory Learning and Action Research (PLAR) for Integrated Rice Management (IRM) in Inland Valleys of Sub-Saharan Africa: Technical Manua,* WARDA Training Series, Cotonou, Benin: Africa Rice Center, pp. 26 -32, 2008.

[2] A. T. Modi, "Short-term preservation of maize landrace seed and taro propagules using indigenous storage methods", *South African Journal of Botany*, 70(1): 16-23, 2004.

[3] S. Kohli, T. Mohapatra, S. R. Das, A. K. Singh, V. Tandon, and R. P. Sharma, "Composite genetic structure of landraces revealed by STMS markers", *Current Science*, 86(6):850-854, 2004.

[4] S. M. Gomez, P. Rangasamy, and A. Kalami, "Assessment of quality parameters of rice crosses under drought condition", *Plant Archives*, 3:295-297, 2003.

[5] K. Irie, K. Aye, T. Nagamine, H. Fujimaki, and F. Kikuchi, "Varietal variations of heading time among rice landraces in Myanmar", *Japanese Journal of Tropical Agriculture*, 47(3):198-205, 2003.

[6] S. M. Gomez, and A. Kalami, "Scope of landraces for future drought tolerance breeding programme in rice (Oryza sativa L.)", *Plant Archives*, 3:77-79, 2003.
[7] H. W. Johnson, H. F. Robinson, and R. E. Comstock, "Estimates of genetic and environmental variability in soybean", *Agronomy Journal*, 47(7): 314-318, 1955.
[8] G. Hanson, H. F. Robinson, and R. E. Comstock, "Biometrical studies on yield in segregating population of Korean Lespedeza", *Agronomy Journal*, 48(6):268-272, 1956.
[9] G. W. Burton, *Quantitative inheritance in grasses*, *Proc Sixth International Grassland Congress*, **1**, 297–283, Pa. State College, Aug. 17–23, National Publishing Company, Washington, D.C., 1952.
[10] R. K. Singh, and B. D. Choudhury, *Biometrical method in quantitative genetic analysis*, Kalyani Publishers, Ludhiana, New Delhi, pp. 54-57, 1985.
[11] R.W. Allard, *Principles of Plant Breeding*, John Wiley and Sons. Inc., NewYork, 1960.
[12] R. E. Comstock, and H. F. Robinson, *Genetic parameters, their estimate and significance*, *Proc Sixth International Grassland Congress*, 1: 284-291, Pa. State College, Aug. 17–23, National Publishing Company, Washington, D.C., 1952.
[13] M. Yaqoob, N. Hussain, and A. Rashid, "Assessment of genetic variability in rice (Oryza sativa L.) genotypes under rainfed conditions", *Journal of Agricultural Research*, 50(3): 311-319, 2012.
[14] D. K. Tiwari, P. Pandey, S. Tripathi, S. P. Giri, and J. L. Dwivedi, "Studies on genetic variability for yield components in rice (Oryza sativa L.)", *Advances in Agriculture & Botanics*, 3(1): 76-81, 2011.
[15] D. Bhadru, V. T. Rao, Y. C. Mohan, and D. Bharathi, "Genetic variability and diversity studies in yield and its component traits in rice (Oryza sativa L.)" *SABRAO Journal of Breeding & Genetics*, 44(1): 129-137, 2012.
[16] A. Patel, P. R. Chaudhari, and S. B. Verulkar, "Analysis of genetic variability, heritability and genetic advance for yield and yield components in rice (Oryza sativa L.) under different water regimes", *Plant Archives*, 12(1): 425-435, 2012.
[17] V. R. Babu, K. Shreya, K. S. Dangi, G. Usharani, and P. Nagesh, "Genetic variability studies for qualitative and quantitative traits in popular rice (Oryza sativa L.) hybrids of India", *International Journal of Scientific and Research Publications*, 2(6): 1-5, 2012.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 503-510
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Electronic retailing: Exploring relationship among product quality and delivery services role in customer's commitment and loyalty in China

Muhammad Ziaullah, Yi Feng, and Shumaila Naz Akhter

School of Management and Economics,
University of Electronic Science and Technology of China,
Qingshuihe Campus: No. 2006, Xiyuan Ave, West Hi-Tech Zone, 611731,
Chengdu, Sichuan, China

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The purpose of the study is to investigate the relationships among product quality & delivery services, commitment and e-loyalty in the context of e-tailing. The stated variables have considerable importance on firm's performance. The data were collected from a sample of 383 students at universities in China during the first quarter of 2014. Confirmatory factor analysis (CFA) and structural equation modeling (SEM) were used to investigate the hypotheses about relationship among model constructs. The study hypotheses developed were positively confirmed. The study reveals implications in product quality & delivery services, commitment and e-loyalty that are helpful to both academics and practitioners.

KEYWORDS: Product quality, Delivery services, e-tailing, e-loyalty, commitment

1 INTRODUCTION

In response to the increasingly diverse competition, e-retailers are consistently seeking strategies to insulate and increase profit. These strategies concentrate on improving product quality and delivery services, commitment and e-loyalty. A product quality and delivery services has gained tremendous attention from managers and academics due to its considerable influence on affective and continuance commitment and e-loyalty. Generally quality has been considered as an investment for organization, but the efforts for its improvement result in improve clientele, increased purchasing volume from existing customers and rise in firm's profit [1].

Substantially, in the exchange relationship a product quality has critical value and it must exist, therefore a business relationship can be built around it. Therefore product does not meet the customer's standard and expectations, and then they do not have motivation to continue the relationship [2]. Similarly delivery services are vital for developing relationship in the context of e-tailing. Therefore, it is essential that delivery of right product within the promised time frame, with accurate product information available on e-tailer website and customers receive what they are expected to receive from e-tailers [3]. In online shopping product quality and delivery services has vital role for customer's satisfaction, commitment and loyalty. For instance, the express delivery companies have chartered aircraft to optimizing their high volume areas services of e-tailing in mainland China. Therefore, to fulfill this objective more than 100 cargo jets have been leased by major couriers i.e. SF Express (Group) Co Ltd (private courier service in China) have its own air fleet and although deployed 31 cargo planes at the delivery peak period during november 2013. Similary, YTO Express (logistics) Co Ltd has run two Boeining 737 cargo planes on the Beijing-Shenzhen route to facilitate delivery. Although, State Post Bureau EMS, express delivery unit has been leased 26 freighters making deals with Air China Cargo Co Ltd and PEMPCO international. Chinese e-commerce focused on fast speed by a few hours [4].

In the context of relationship marketing commitment has great recognition and importance. The commitment is a key precursor to achievement of valuable outcomes such as future intentions [5] and profitability [6]. Perhaps, customer

Corresponding Author: Muhammad Ziaullah

commitment refers as an attitude that reflects the desire to maintain a valued relationship [7]. E-loyalty is widely refers as customer's favorable attitude and commitment towards the e-tailer that results in repeat purchase behavior [8]. Subsequently, e-loyal customers have increased profitability to the e-tailer based on long term customer commitment and reduced costs of acquiring new customers. E-loyal customers are willing to pay premium prices, which are not the ones seeking the lower prices. Particularly, they also provide rich enough source of profit as referring new customers to e-tailer [9].

The purpose of this study is to propose and test a model of product quality and delivery services, commitment and e-loyalty. This study focuses on development of commitment and e-loyalty through improving product quality and delivery services of e-tailing. This paper begins with the proposed model and hypotheses. We explain research design and methodology, hypotheses testing results, conclusion, implications and limitations and suggestions for future research with conclusion.

2 THEORETICAL FRAMEWORK DEVELOPMENT AND RESEARCH HYPOTHESES

2.1 PRODUCT QUALITY

Product quality refers as customer's perceptions of all non-price attributes of an organization's goods and services [10]. Especially this definition comprises both intrinsic characteristics and associated all services. The various kinds of products have been traded by online retailers. Thus online product quality concept is similar with the conventional traded products [11]. Particularly in online shopping there are two most influential factors have been considered quite critical and important while making decisions such as product quality and product variety [12]. As customer's expectation has been met online in this manner they tend to continue to visit that specific e-tailor. Keenely (1999) argues that online firm's fundamental objective is to maximize product quality for online buyers. Similarly it is argues that cost minimization and quality maximization are the critical success factor of e-commerce [13].

2.2 DELIVERY SERVICES

In the context of online shopping environment reliable, safe and timely delivery is fundamental and integral objective e-tailing. E-tailing customers are interested to buy products at home and they required safe, reliable and quick delivery of desired product at their desired destinations. In online shopping environment timely and reliable delivery play critical role to meeting customer's expectations and make them satisfied. Online customers can switch very easy form one web to another web page just a single click away or even customer moved towards conventional click and mortar retailers due to the late, unsafe and undesirable products delivery.

Online customers pay much more concentration and considered product delivery as an important factor as they have paid for it. However, reliable delivery is "means objective" while timely delivery is "fundamental objective" of online retailers in the e-commerce [13]. Particularly it has been considered three aspects critical for delivery performance of the firms and it encompasses that suppliers of product should be able to meet delivery schedule (Timely delivery), adjust and accommodate certain changes in delivery schedule (flexibility) and consistently deliver right products (accurate) in the hand of customers [3].It is found that delivery performance has positive influence on customer's satisfaction [14], and it is the antecedent of satisfaction [15]. Liu et al. (2008) argues that delayed delivery of product can make customers dissatisfied [16].

2.3 COMMITMENT

The researchers have used different definitions and perspective to characterize two components of commitment such as affective and continuance commitment [17]. The effective commitment is based on the "affective or emotional attachment to the organization such that the strongly committed individual identifies with, is involved in, and enjoys membership in the organization" [18]. Thus the essence of effective commitment is that customers indulge to acquire an emotional attachment to their partner in a consumption relationship. As customer like to any specific brand or service providers (e-tailers), at that movement they are experiencing the psychological state of affective commitment [19]. Thus, continuance commitment in exchange relationship is built on the side bets, switching costs and scarcity of alternatives [18].

2.4 E-LOYALTY

Loyalty refers as the repeated purchase behavior presented over a period of time driven by a favorable attitude toward the subject [20]. A true loyal customer has strong commitment and attachment towards retailer. It is quite difficult to distracted customer towards slightly more attractive alternatives. Substantially, a true loyalty shows higher purchase intention, willingness to pay more and resistance to switch toward alternative [21]. Lim and Razzaque (1997) have classified four main categories of loyalty i.e. brand loyalty, vendor loyalty retailer loyalty and service loyalty [22]. Therefore, customer loyalty requires that there is a strong desire by the customers for products and that they have several vendors to choose products based on their preferences [23]. Based on the previous research and literature review following hypotheses were proposed. Theoretical framework stated in Fig.1.

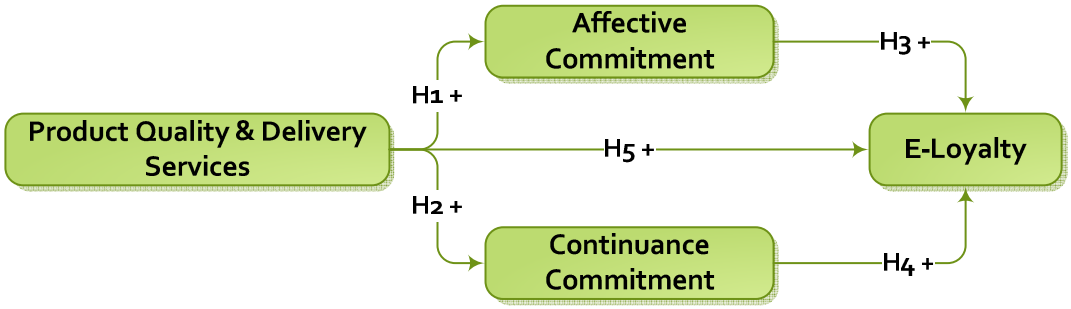


Fig. 1 Theoretical Framework

H1: E-tailing product quality and delivery services positively influences affective commitment
H2: E-tailing product quality and delivery services positively influences continuance commitment
H3: Affective commitment positively influences e-loyalty
H4: Continuance commitment positively influences e-loyalty
H5: E-tailing product quality and delivery services positively influences e-loyalty

3 RESEARCH METHODOLOGY

3.1 QUESTIONNAIRE DESIGN

We reviewed the literature to explore valid measures for this study related constructs and adapted existing scales to measure online shopping offline aspects such as, i.e. product quality and delivery services[24], commitment [19] and e-loyalty [8]. Firstly, scales from literature were explored in English, therefore initial questionnaire was developed in English. Then, English version questionnaire were translated into Chinese by two Chinese Master and Ph. D students. Further, Chinese version questionnaire were translated back into English, hence this version of questionnaire was counter checked against the original English version for discrepancies and their rectification. This approach has been adopted to facilitate appropriate measurement development and to confirm meaning consistency, to improve understandability of the survey and proper use of terminology in Chinese. In this study all the indicators in the questionnaire were measured using a 7-Point Likert scale ranging from strongly disagree to strongly agree (1= strongly disagree; 7= strongly agree).

3.2 SAMPLING AND DATA COLLECTION

According to Fung Business Intelligence Center Chinese online customers are young people and over 60% were aged 30 or below in 2012. It is highlighted that middle aged customers preferred to buy online due to more buying power [25]. Particularly, it is recommended that universities students are likely to be the first and more attractive potential consumers segment of e-commerce due to their high education level and income [26]. Therefore, in this study we used convenience sampling and paper survey approach to collect data from universities different locations such as libraries, research labs, canteens and mini markets in mainland China. In our study 430 respondents have completed the survey, after sorting and removing errors 383 valid and usable questionnaires left for data analysis. The response rate was 89 percent. The profile of respondents and their characteristics are stated in Table 1.

Table 1: Respondent profile (n=383)

Demographics Variable	Category Sample Percentage		
Gender	Male	222	58.0
	Female	161	42.0
Age (Years)	Below-20	79	20.6
	20-29	299	78.1
	30-39	5	1.3
Education Level	High School	3	0.8
	Bachelor	218	56.9
	Master	147	38.4
	Ph. D	15	3.9
Profession	Students	383	100
Shopping Experience (Years)	Under 1	48	12.5
	1-4	239	62.4
	Over 4	96	25.1

3.3 CONSTRUCT DEVELOPMENT

In this study we used Kaiser-Meyer-Olkin (KMO) to measure sampling adequacy and the Bartlett test of sphericity. The results that showed KMO value of 0.874 with the significance of Bartlett's test at 0.000 level, indicates the data for exploratory factor analysis (EFA) fitting. We used maximum likelihood analysis for data reduction and promax rotation with Kaiser Normalizations for clarifying the factors. Hence EFA was conducted with specifying four numbers of factors. The cumulative variance explanation reaches 62%. All the items have strong loadings on the construct in the pattern matrix which are >0.30 [27]. The results of EFA are shown in Table 2.

The internal consistency reliability of all items was examined by Cronbach alpha and item to total correlations. Therefore, the alpha coefficients and item to total correlations for each construct are shown in Table 3. The Cronbach's alpha of all measurement constructs ranges from 0.89 to 0.83. A Cronbach's alpha of value 0.7 or higher is commonly considered as a cut off for reliability [28, 29]. Convergent validity has been examined based on measurement items standardized factor loadings, composite reliability and the variance extracted measures. The results of convergent validity test are also presented in Table 3. Standardized factor loadings of all items in each construct range from i.e. product quality and delivery services (0.983-0.675), affective commitment (0873-0.688) and Continuance commitment (0.883-0.663) and e-loyalty (0.852-0.657) that exceed the recommended level of 0.60 [27]. The composite reliabilities (CR) range from 0.91 (product quality and delivery services) to 0.87 (continuance commitment) which exceed the recommended level of 0.70. The average variance extracted (AVE) measure ranges from 0.65 (affective commitment) to 0.58 (e-loyalty) which is better than recommended value of 0.50 [27]. The higher value of AVE, CR and factor loadings results, therefore adequately demonstrates the convergent validity of the measurement items.

Table 2. Results of exploratory factor analysis (EFA)

Items	Product Quality and Delivery Services	Affective Commitment	Continuance Commitment	E-Loyalty
PQ	0.987			
PA	0.950			
TD	0.737			
PS	0.695			
RD	0.687			
PV	0.418			
AF1		0.777		
AF2		0.944		
AF3		0.742		
AF4		0.673		
CC1			0.518	
CC2			0.945	
CC3			0.859	
CC4			0.432	
L1				0.735
L2				0.739
L3				0.846
L4				0.888
L5				0.640
L6				0.432

*Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization. a. Rotation converged in 6 iterations. *(PA: Product availability, PQ: Product quality, PV: Product variety, RD: Reliable delivery, TD: Timely Devlivery, PS: Pakage safety, AC: Affective Commitment, CC: Continuance Commitment, L: e-Loyalty)*

Table 3. Results of internal reliability and convergent validity tests

Internal Reliability			Convergent Validity		
	items	Cronbach α	Item Total Correlation	Standardized Factor Loadings	Composite Reliability	Variance Extracted
P.Q & Del. Services	PQ	0.89	0.864	0.983	0.91	0.63
	PA		0.808	0.922		
	TD		0.726	0.743		
	PS		0.729	0.678		
	RD		0.752	0.675		
	PV		0.804	0.687		
AFF. Commit.	AF1	0.85	0.680	0.688	0.88	0.65
	AF2		0.818	0.822		
	AF3		0.765	0.873		
	AF4		0.743	0.830		
Cont. Commit	CC1	0.83	0.648	0.813	0.87	0.64
	CC2		0.751	0.832		
	CC3		0.756	0.883		
	CC4		0.526	0.663		
E-Loyalty	L1	0.87	0.678	0.698	0.89	0.58
	L2		0.731	0.779		
	L3		0.735	0.778		
	L4		0.776	0.852		
	L5		0.648	0.792		
	L6		0.417	0.657		

4 ANALYSIS AND RESULTS

We used SPSS AMOS-IBM version 21 to analyze the data and demonstrate structural equation modeling (SEM) of this study. It is a powerful multivariate analysis technique used to measure latent variables and investigate causal relationship among proposed model variable. Specifically, SEM allows conducting confirmatory analysis (CFA) for theory development and testing. The overall model fit indices are x2 =293.40, df=154 (p-values=0.00), GFI=0.93, AGFI=0.90, NFI=0.94, CFI=0.97, RMSEA=0.049 indicating that model is acceptable with no substantive differences. Moreover, fit indices of structural model are presented in Table 4. The path between product quality and delivery services and affective commitment (B=0.118), product quality and delivery services and continuance commitment (B=0.103), affective commitment and e-loyalty (B=0.44), continuance and e-loyalty (B=0.158), product quality and delivery services and e-loyalty (B=0.195) are found significant and support H1, H2, H3,H4, and H5. In this way product quality and delivery services has direct significant influence on e-satisfaction and indirect impact via e-trust. This evidence shows that e-tailing should design effective mechanism of information management to improve their product quality, variety, availability by significantly considering e-tailing delivery services in the context of reliability, package safety and timely perspective in order to develop and sustainable relationship with online customers. The standardized parameter estimates of hypothesized paths are presented in Table 5.

Table 4. Fit indices for structural model

Fit Index	Scores	Recommended cut-off values
Absolute fit Measures		
Minimum fit function chi-square (x2)	293.40 (p=0.00)	The lower, the better
Degree of freedom (d.f)	154	
(x2)/d.f	1.905	<5
Goodness-of-fit index (GFI)	0.93	>0.80
Root mean square residual (RMSR)	0.049	<0.05
Incremental fit measures		
Adjusted goodness-of-fit index (AGFI)	0.90	>0.80
Tucker-Lewis index (TLI)	0.96	>0.90
Normal fit index (NFI)	0.94	>0.90
Comparative fit index (CFI)	0.97	>0.90
Parsimonious fit measures		
Parsimonious normed fit index (PNFI)	0.762	The higher, the better
Parsimonious goodness-of-fit index (PGFI)	0.680	The higher, the better

Table 5. Standardized parameter estimates of hypothesized paths

Hypotheses	Path	Coefficient (t-value)	Result
H1	Product quality & Delivery services → affective commitment	0.118 (3.06)*	Supported
H2	Product quality & Delivery services → continuance commitment	0.103 (3.09)**	Supported
H3	affective commitment→ e-loyalty	0.44 (5.30)	Supported
H4	continuance commitment→ e-loyalty	0.158 (7.61)**	Supported
H5	Product quality & Delivery services→ e-loyalty	0.195 (5.51)	Supported

*p<.001 & **p<0.05

H1: E-tailing product quality and delivery services positively influences affective commitment (γ=0.118; p<0.001). This finding of result confirms the belief that the higher the product quality and delivery services online customers receive from a e-tailers. It significantly increased customers' affective commitment with e-tailing.

H2: E-tailing product quality and delivery services positively influences continuance commitment (γ=0.103; p<0.005). This study result confirms the belief that the higher the product quality and delivery services online customers receive from a e-tailers. It significantly increased customers' continuance commitment towards e-tailing.

H3: Affective commitment positively influences e-loyalty (γ=0.44; p<0.001). In the context of e-tailing affective commitment of online customers towards e-tailers also enhanced e-loyalty that ultimately influences on e-tailers profitability.

H4: Continuance commitment positively influences e-loyalty (γ=0.158; p<0.005). In the context of e-tailing affective commitment of online customers towards e-tailers also enhanced e-loyalty that ultimately influences on e-tailers profitability. It is also identified that continuance commitment has weak relationship comparative to affective commitment with e-loyalty.

H5: E-tailing product quality and delivery services positively influences e-loyalty (γ=0.195; p<0.001. It is investigated that e-tailers product quality and delivery services has indirectly via commitment and also directly influences on e-loyalty.

5 MANAGERIAL IMPLICATIONS

This study finding provides several managerial implications. The basic premise of the proposed theoretical model was that e-tailers should understand comprehensively the factors that are necessary to achieve high product quality and delivery services that will positively impact on customer's commitment and loyalty, and use them as diagnostic information. Perhaps, by recognizing and analyzing such diagnostic indicators, e-tailers will be better able to formulate and implement their policies and strategies. The explanation of the research model has the potential to help e-tailers better understand how e-tailing customers assess product quality and delivery services as well as their influence on commitment and loyalty. Learning the unexplored relationship between e-tailing product quality and delivery services, commitment and e-loyalty, e-tailers can effectively allocate their resources and develop a rational plan to improve their product quality/delivery services under specific business circumstances.

6 CONCLUSION, LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While several authors have focused on multidimensional aspect of e-tailers product quality & delivery services and the relationship between customer satisfaction, e-trust and customer loyalty. This research sought to establish the bridges between product quality & delivery services, commitment and loyalty of e-tailing. Empirical tests of the model, using a sample of young e-tailing customers, were conducted to support the proposed hypotheses.

Empirical tests of the model, using a sample of young retail customers, were conducted to support the proposed hypotheses. Specifically, this research contributes to the progress of establishing and measuring the constructs of product quality & delivery services, commitment and e-loyalty. This study reveals several limitations. Firstly, sampling frame includes universities students that may lead to loss of generalizability of results. Secondly, dependent variable in the hypothesized model, commitment and e-loyalty are likely to be influenced by some other variables other than product quality & delivery services of e-tailing, which were not the specific object of this study. Therefore, future studies might be conducted to the specific product quality & delivery services of particular brands, category influence on e-loyalty in the context of e-tailing.

REFERENCES

[1] Rust, R. T., Zahorik, A. J. & Keiningham, T. L. (1995). Return on quality (ROQ): Making service quality financially accountable. *Journal of Marketing*, 59(2), 58-70.

[2] Ulaga, W., & Eggert, A. (2006). Relationship value and relationship quality: Broadening the nomological network of business-to-business relationships. *European Journal of marketing*, *40* (3/4), 311-327.

[3] Wolfinbarger, M., & Gilly, M. C. (2003). eTailQ: dimensionalizing, measuring and predicting etail quality. *Journal of Retailing*, *79* (3), 183-198.

[4] Wei He (2013) Couriers preparing battle plan for Nov 11. Online < http://usa.chinadaily.com.cn/epaper/2013-10/30/content_17069637.htm>

[5] Kim, W. G., Leong, J. K., & Lee, Y. K. (2005). Effect of service orientation on job satisfaction, organizational commitment, and intention of leaving in a casual dining chain restaurant. *International Journal of Hospitality Management*, *24*(2), 171-193.

[6] Anderson, E., & Weitz, B. (1992). The use of pledges to build and sustain commitment in distribution channels. *Journal of Marketing Research*, 18-34.

[7] Moorman, C., Zaltman, G., & Deshpande, R. (1992). Relationships between providers and users of market research: The dynamics of trust. *Journal of Marketing Research*, *29*(3), 314-328.
[8] Srinivasan SS, Anderson R, Ponnavolu K (2002) Customer loyalty in e-commerce: an exploration of its antecedents and consequences. *Journal of Retailing*, 78(1), 41-50.
[9] Markey, R. G., & Hopton, C. (2000). E-customer loyalty–applying the traditional rules of business for online success. *European Business Journal*, *12*(4), 173-79.
[10] Buzzell, R. D., & Gale, B. T. (1987). *The PIMS principles: Linking strategy to performance*. Simon and Schuster.
[11] Cowherd, D. M., & Levine, D. I. (1992). Product quality and pay equity between lower-level employees and top management: An investigation of distributive justice theory. *Administrative Science Quarterly*, 302-320.
[12] Jarvenpaa, S. L., & Todd, P. A. (1996). Consumer reactions to electronic shopping on the World Wide Web. *International Journal of Electronic Commerce*, *1*(2), 59-88.
[13] Keeney, R. L. (1999). The value of Internet commerce to the customer. *Management Science*, *45*(4), 533-542.
[14] Chakraborty, G., Srivastava, P., & Marshall, F. (2007). Are drivers of customer satisfaction different for buyers/users from different functional areas? *Journal of Business & Industrial Marketing*, *22*(1), 20-28.
[15] Ulaga, W. (2003). Capturing value creation in business relationships: a customer perspective. *Industrial Marketing Management*, *32*(8), 677-693.
[16] Liu, X., He, M., Gao, F., & Xie, P. (2008). An empirical study of online shopping customer satisfaction in China: a holistic perspective. *International Journal of Retail & Distribution Management*, *36*(11), 919-940.
[17] Gundlach, G. T., Achrol, R. S., & Mentzer, J. T. (1995). The structure of commitment in exchange. *The Journal of Marketing*, 78-92.
[18] Allen, N. J., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. *Journal of Occupational Psychology*, *63*(1), 1-18.
[19] Fullerton, G. (2003). When does commitment lead to loyalty? *Journal of Service Research*, *5*(4), 333-344.
[20] Keller, K. L. (1993). Conceptualizing, measuring, and managing customer-based brand equity. *The Journal of Marketing*, 1-22.
[21] Shankar, V., Smith, A. K., & Rangaswamy, A. (2003). Customer satisfaction and loyalty in online and offline environments. *International Journal of Research in Marketing*, *20*(2), 153-175.
[22] Lim, K. S., & Razzaque, M. A. (1997). Brand loyalty and situational effects: an interactionist perspective. *Journal of International Consumer Marketing*, *9*(4), 95-115.
[23] Otim, S., & Grover, V. (2006). An empirical study on web-based services and customer loyalty. *European Journal of Information Systems*, 15(6), 527-541.
[24] Ahn, T., Ryu, S., & Han, I. (2005). The impact of the online and offline features on the user acceptance of Internet shopping malls. *Electronic Commerce Research and Applications*, 3(4), 405-420.
[25] Fung Business Intelligence Center (2013) Online retailing in China 2013. Online: <http://www.funggroup.com/eng/knowledge/research/china_dis_issue111.pdf >
[26] Lightner NJ, Yenisey MM, Ozok AA, Salvendy G (2002) Shopping behaviour and preferences in e-commerce of Turkish and American university students: implications from cross-cultural design. Behaviour & Information Technology, 21(6), 373-385.
[27] Hair JF, Tatham RL, Anderson RE and Black W (1998) Multivariate data analysis. (Fifth Ed.) Prentice-Hall:London.
[28] Nunnally JC (1978) Psychometric Theory (2) McGraw-Hill. New York.
[29] Hair JF, Black WC, Babin BJ, Anderson RE Tatham RL (2006) Multivariate Data Analysis. NJ: Pearson Prentice Hall.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 511-514
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Democracy and Ethno-Nationalism in Nigeria

Stephen Ayodeji Akinnimi

Department of Political Science and Public Administration,
Adekunle Ajasin University,
Akungba-Akoko, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Nigeria is an amalgam of rival ethnic groups pitched against each other in a contest for power and resources that have reflected in the political processes, sometimes threatening the corporate existence of the country. Right from the constitutional conferences organized during the colonial era down to the ones organized after independence, the question of an acceptable system of co-existence has been contentious. However, the intervention of the military in the political affairs of the country and their long duration in governance succeeded in abating the full manifestation of ethno-nationalism. But the return of the country to democracy in 1999 has enabled the suppressed ethno-nationalism grievances to explode, throwing up issues beyond the capacities of democratic institutions. Ethno-nationalism has become a threat to the survival of the nation's nascent democracy and its existence. As a result, the democratic government has resorted to the tactics of military administration in the management of these challenges. This paper examines the state's response to an emboldened ethno-nationalism and its implications on the process of democratization. It adopted both descriptive and analytical methods, using the theory of instrumentalism to explain the factors responsible for ethno-nationalism.

KEYWORDS: Democracy, ethnicity, nationalism, conflict, violence.

1 INTRODUCTION

Nigeria is the fourth largest and most populous country in Africa with around 170 million people, comprises about 300 ethnic groups. It has the largest Muslim population in Africa. The dominant ethnic-national groups (ethnic groups with a political agenda) in the northern two-thirds of the country are the Hausa and the Fulani (29 percent of the total population) most of who are Muslims. Other ethnic-national groups in the north are Nupe, Tiv and Kanuri. The Yoruba people (21 percent) about half of whom are Christians and half Muslims predominate in Nigeria's south-west. The largest ethnic-national group in the south-east is the Igbo or Ibo (18 percent) who are majorly Catholics. Conflict among these ethnic-national groups is not surprising insofar as they represent a huge diversity of culture and ways of life, and they occupy different types of cities and terrain.

The situation in a polity such as Nigeria becomes more problematic when the politics of who get what, when and how gravitate towards ethnic clashes and antagonism. These contentious ethnic national groups are governed by a federal system like the United States, India and Brazil. Nigeria is faced with the challenging goal of rebuilding a petroleum based economy and trying to make democratic governance work. Unfortunately, the revenues from its resource rich economy have been squandered by corruption and mismanagement. Despite the unequal sharing of oil revenues and tremendous difficulty in institutionalizing democracy, Nigeria held presidential elections in 2007, 2011 and looking forward to conducting the 2015 elections, which demonstrates successful transferring of government between civilian administrations. Though, the previous elections were blemished by chaos, violence and fraud.

Consequently, with the dawn of a democratic era in 1999, the expression of suppressed ethnic demands and religious conflicts bottled up by years of repressive military rule has been opened up. Some of these ethno-nationalist sentiments have manifested insurgencies in the Niger-delta region under the auspices of the Movement for the Emancipation of Niger-d-

Delta (MEND), the renewed demand of Biafra spearheaded by the Movement for the Actualization of sovereign State of Biafra (MASSOB), the incessant ethnic clashes in the Middle belt region, sharia instigated riots in the North, the notoriety of the Oodua People's Congress (OPC) can't be overlooked, and frequent religious disturbances cum Boko Haram terrorist activities in the Northeastern part of the country and the Federal Capital Territory (FCT).

2 CONCEPTUALIZING "DEMOCRACY"

Democracy varies in different places and historical periods. The current position is that democracy like human right should go beyond voting, it should encompass the right to make economic decisions in government chosen by the citizens. However, many associate democracy at first thought with one true United States president, Abraham Lincoln (1861-1865) when during the Gettysburg address, which was made to mourn those who have fallen during the great battle of Gettysburg, gave a speech which was been considered as one of the most eloquent statement of the democratic fight ever made. He coined "democracy as the government of the people, by the people and for the people" (Ogunboyede, 2014).

Schumpeter (1997) defines democracy as" institutional arrangement for arriving at political decisions in which individuals acquire the power to decide by means of competitive struggle for people's votes" cited in Abdulhamed (2004). Thus democracy can be seen as the system of governance under which people exercise their governing power directly or indirectly through their representatives periodically elected by themselves. Indeed, a democratic government is invariably a government that is founded on the principle of the rule of law, accountability and transparency devoid of arbitrariness, highhandedness and dictatorship.

3 CONCEPTUALIZING "ETHNICITY"

The concept of ethnicity refers to a social identity formation that rests upon culturally specific practices and a unique set of symbols and cosmology. Ethnic culture is one of the important ways people conceive of themselves, and culture and identity are closely intertwined (IDEA 2001).

According to Osaghae (1994), ethnicity refers to a social formation resting upon culturally specific practices and a unique set of symbols and cosmology. To understand ethnicity and its potency in an ethnically segmented society such as Nigeria, there must be a proper grasp of the meaning of an ethnic group. Ethnic groups may be defined as categories of people characterized by cultural criteria of symbols including language, value system and normative behaviours and whose members are anchored in a particular part of the new state territory (Otite, 2000). In similar vein, ethnicity can be concerned as an interaction or relationship that exist among people of different ethnic groups who decides to base their relationship on the difference, such exist when two or more ethnic groups relate with one another which normally brings about competition on issues like power or wealth.

4 CONCEPTUALIZING "NATIONALISM"

Nationalism is an ideology that creates and sustains a nation as a concept of a common identity for groups of humans (joireman, 2003). Nationalism is intensified by politics of exclusion and occurs when an ethnic group is politically mobilized. Therefore, nationalism is politicized ethnicity and manifests whenever a group of people particularly targeted for ill treatment or oppression especially in a heterogeneous political system (joireman 2003).

Nationalism is a belief, creed or political ideology that involves an individual identifying with, or becoming attached to one's nation. Nationalism involves national identity, by contrast with the related construct of patriotism, which involves the social conditioning and personal behaviours that support a state's decisions and actions (Wikipedia, the free encyclopedia, 2014). This is based on two perspectives; the primordialist and modernist perspective. The former describes nationalism as a reflection of the ancient and perceived evolutionary tendency of humans to organize into groupings based on affinity of birth. While the modernist perspective describes it as a recent phenomenon that requires the structural conditions of modern society order to exist.

5 THEORETICAL FRAMEWORK

In this research study, the theory of instrumentalism as an approach would be employed for the analysis of democracy and ethno-nationalism in Nigeria. The theory of instrumentalism which views ethnic identity as manipulated to achieve a defined political or economic gain for the elites is the appropriate explanatory tool for the manifestation of ethno-nationalism in Nigerian democracy. The role of the elites in mobilizing ethnic sentiments is vital because these individuals

who participate in group action in the name of ethnicity has a choice to make and this is only done when they perceive that benefits outweighs costs of the choice. The theory also stipulates that these sentiments and the actions it brings, disappear when it is no longer politically expectant. The understanding is obvious because the notion of inclusivity that underlies state formation process does not apply to Nigeria because of the country's politicized identity based politics.

The Nigerian state has limited autonomy and is incapable of arbitrating among competing ethnic groups, this basically makes the state the core terrain for contestation by the desperate groups over its control and by extension its vast resources (Ake, 1996). Given its arsenal of patronage positions and public finance, elites bereft of crosscutting ideology, resort to ethnicity as a force to ascend the ladder of power and superintend over disbursement of the available resources (Obi, 2002). But the question that arises is, why are people inclined to participate in ethnically oriented programmes that are often risky to their lives? The answer is not farfetched; the people in Nigeria have persistent impoverishment and socio-economic insecurity that alienates them from the state, thus threatening the tenets of true democracy. Some of the past violent ethnic clashes are the Jos riots of 1945, the Kano riots of 1953, the Tiv uprisings of 1959-1960 and 1964, the Biafra war of 1967-1970 (also known as the civil war) was rooted in ethnic secession of the Igbo people, the 2011 post-election violence which took its toll in the northern part of the country, among others. While the present ethno-religious violence has the Boko Haram insurgent activities top on the list.

The tainted history of inter-ethnic relations in Nigeria which has been quite discordant has always been reinforced whenever the situation requires it. The elites capitalized on these situations to advance parochial interests by recalling mistrust, betrayal and acrimony that occurred in the past. Additionally, developments in the global political economy have had implications by reinforcing the undemocratic character of the Nigerian state with consequences for ethnic politics. This is because globalization needed authoritarian regimes that are ethnocentric in order to repress resistance involving those anchored on genuine ethnic grievance.

6 ETHNO-NATIONALISM IN NIGERIA: IMPLICATIONS FOR THE SURVIVAL OF DEMOCRACY

Clearly indicate who is willing to handle correspondence at all stages of refereeing, publication and also post-publication The effort made so far in the research study has been able to show that the inter-ethnic relations in Nigeria has been one of the conflicts largely caused by ethnic chauvinism, which manifests in form of ethno-nationalism. A survey of the political scenario in Nigeria since independence will show the extent to which ethnic loyalty has affected the nation's dream to have true democratic governance. When Nigeria attained independence in 1960, she had a federal structure that was made up of three regions, namely: the North, the East and the West. The difference among the three regions became clear and amplified by the emergence of three regionally based and tribally/ethnically sustained political parties. They were the northern People's Congress (NPC), the National Convention of Nigerian Citizens (NCNC) and the Action Group (AG). It was against this seemingly simple background that the problem of Nigeria's first attempt at democracy started. Between 1960 and 1965 the ethnically loaded political arrangement described above coupled with other factors threatened the continued existence of Nigeria as a nation. In the bid to win the most political power by these ethnic leaders, the situation degenerated into political riots, arsons, killings and other acts of vandalism, especially in the west.

There is problem with power relations in Nigerian politics. As events and reactions in the ongoing democratic dispensation have shown, the northerners are not comfortable that power is not in their hands. The propaganda of the northern oligarchy is that the south has always being in control of economic power. Since the inception of the fourth republic, the northern elites have begun to rock the boat. This is accompanied by cries of marginalization all the time. The fact that power has often been monopolized by the three dominant ethnic nationalities has also meant that the minority groups have been marginalized in the rat race for power. Again, power at the centre and the resources that comes with it in Nigeria is too attractive. This thus makes the competition for power so fierce, because if an ethnic group loses at the centre, it has lost all. The way power is obtained and used in Nigeria is usually in terms of what the various ethnic nationalities can benefit. But in many instances in the past, power has been used to pursue sectional or parochial interests. Marginalizations of some groups with inevitably arouse consciousness and then sensitize such groups for action, resistance, apathy and other related negative vices.

Consequently, the predominance of the spirit of ethnic-nationalism also gave rise to the emergence of ethnic militias all over the country in the first quarter of the fourth republic, the common ones are: Oodua Peoples Congress (OPC) for the Yoruba nationality, Arewa Peoples Congress (APC) for the Hausa/Fulani nationality and Bakassi Boys for the Igbo nationality, also Egbesu Boys for the Ijaw nationality. The emergence of these ethnic militias mounted an increase in the level of political violence, riots and conflicts in the country. Though for sometime now, their activities have not been expressed.

The interplay of ethnic nationalism has also divided and fragmented the civil society in Nigeria. Oyedare (1994) posits that the problem in Nigeria is traceable to the heterogeneity and the adversarial nature of the civil society itself. The civil society in Nigeria is relatively weak, parochial in outlook and divided most especially along ethnic, religious and linguistics lines. If the civil society is divided, it is obvious that it will have adverse effects on the nascent democracy in place (Aluko and Ajani 2009).

7 CONCLUSION AND RECOMMENDATIONS

This paper has been able to discuss evidently that the sustainability is on shaky grounds as long as the problem of ethno-nationalism remain in place. That in spite nationwide increase in violence revolving around ethno-nationalist identities, Nigerian government is still treating them as "residue of the past and are therefore reluctant to recognize the inevitability of the ethnic identities that divide the population of the overwhelming majority of the people in Nigeria. In words of Sindjoun (2000), "plural societies are not only places where we identify clash, they also include dynamics of overlapping and crossbreeding, multiple positions and multiple allegiances.

In view of the above, this paper recommends that some form of power rotation or sharing must be institutionalized and entrenched in the constitution. It is absolutely ridiculous for any section in the country to have sole control of power while the other so called ethnic nationalities remain servitude (Olasebikan, 2002). It is however sad to note that the northern oligarchy have come to see power as their own inalienable birth right. Power must be made to rotate among the various ethnic nationalities using the six geo-political zones. Again some form of power sharing among the various ethnic nationalities so that no section of the country will be marginalized at any point in time must accompany this.

REFERENCES

[1] Ake Claude (1996): The Political Question in oyeleye oyediran (Eds). Governance and development in Nigeria. Ibadan, Nigeria: consult international

[2] Aluko and Ajani (2009): "Ethnic nationalism and The Nigerian Democratic Experience in The Fourth Republic. African research review, Vol 3. No. 1 ISSN No: 0083.

[3] IDEA (2000): Democracy in Nigeria; continuing dialogue for nation building capacity. Stockholm international, number 10.

[4] Joireman Sandra (2003): Federalism and political identity. London/New York, continuum.

[5] Kola Ogunboyede (2014): Terrorism and Democratic governance in Nigeria. International journal of Innovation and Scientific Research, Vol 10. No 1 ISSN: 2351-8014.

[6] Obi Cyril (2002): "Oil and the politics of transition in Nigeria" in Onuoha, B.M. Fakunle (Eds) Transition politics in Nigeria 1970-1990. Lagos, Malthouse press.

[7] Olasebikan Dapo (2002): Democracy in action: The southwest experience. Lagos, Nigeria; wepcom publishers.

[8] Osaghae, E. (1994): Ethnicity and its management in Africa: The democratization link. Lagos, Malthouse press limited.

[9] Otite Onigu (2000): Community conflicts in Nigeria: Management resolution and transformation. Ibadan, Nigeria: Spectrum books.

[10] Oyedare, B.A (2002): The Nigerian political class: Threat to Post Transition Democracy in Omo Omoruyi, Dirk Bery Sch losser.

[11] Schumpeter, A. (1997): The role of civil society in democratic governance. Oxford, Oxford university press.

[12] Sindjoun Luc (2000): On Democracy in Plural Societies: Coalition Politics and Power Sharing. Senegal, Codesria Bulletin Numbers 2, 4 and 4.

[13] Wikipedia, free encyclopedia (2014): Definition and conceptualization of nationalism. (Online). Available: www.googlesearch.com.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 515-519
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Phytochemical screening and health potentials of *Morinda lucida* Benth

T.O.A. Adeyemi, R.O. Ogboru, O.D. Idowu, E.A. Owoeye, and M.O. Isese

Moist Forest Research Station, Forestry Research Institute of Nigeria, Benin-city, Edo State, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: *Morinda lucida* Benth have been used over the years by rural communities across the tropical region for its medicinal potentials. Phytochemicals are bioactive plant constituents produced via secondary metabolism in relatively small amounts. Their presence span across several plant species of which *Morida lucida* is worthy of note. To ascertain the phytochemical constituents responsible for the ethno-medical properties of Morinda, a qualitative and quantitative screening of the phytochemical constituents was conducted on some sampled leaves. The result of the screening showed that the leaf of Morinda contains alkaloids, tannins, anthraquinones and steroids. The implication of these finding is that the presence of anthraquinone in Morinda leaves makes it a potential laxative; while the presence of steroid, alkaloid and tannins explains its ability to treat heart ailments, malaria and diarrhea respectively among other ailments.

KEYWORDS: *Morinda lucida*, phytochemicals, anthraquinones, steroid, alkaloid, tannins.

1 INTRODUCTION

Morinda lucida Benth., belonging to the family Rubiaceae is a tropical rainforest tree with the English name "Brimstone tree". It is also known as Sangogo or Bondoukou alongua (in Cote d'Ivoire), Twi, Kon kroma or Ewe amake (in Ghana), Ewe amake or Atak ake (in Togo) and Oruwo or Ruwo amongst the Yoruba tribe (South-west Nigeria) and Huka or Eze-ogu amongst the Igbo speaking tribe of South-east Nigeria [1]. It is a medium size tree about 15m tall with scaly grey bark, short crooked branches and shining foliage. In West Africa, *Morinda lucida* is an important plant in traditional medicine. In Nigeria, *Morinda lucida* is one of the four most used plants in the preparation of traditional medicines against fever [12]. The leaves are used as "oral teas", which are usually taken orally for the traditional treatment of malaria, and as a general febrifuge, analgesic, laxative and anti-infections [14]. The major constituents of *M. lucida* extract are the various types of alkaloids, anthraquinones and anthraquinols [2]. Two compounds (oruwalol and oruwal) and anthraquinones have been isolated and characterized from the stem of the plant [3]. In South-West Nigeria, fresh leaves of the plant are macerated in fresh palm wine and the filtrate taken orally for blood sugar control in suspected diabetic patients [1]. The leaves have also been reported to possess strong hypoglycemia, trypanocidal and aortic vasorelaxant activities [6], [21]. Further studies have shown that leaf and stem bark of *M. lucida* posses anticancer [20], hepatoprotective [17], antispermatogenic [19], and antidiabetic [7] activity.

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients. They protect plants from disease and damage, and contribute to the plant's colour, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are known as phytochemicals. These compounds are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism and anticancer property. There are more than a thousand known and many unknown phytochemicals. It is well-known that plants produce these chemicals to protect themselves, but recent researches demonstrate that many phytochemicals can also protect human against diseases [8]. It is against this backdrop that this study tends to ascertain the bioactive components responsible for the therapeutic properties of *M.lucida.*

Corresponding Author: T.O.A. Adeyemi



Fig. 1. A leaf sample of Morinda licida

2 MATERIALS AND METHODS

Collection of plant samples

Morinda lucida leaves were harvested from the premises of Idia college in Benin-City (6.3176^0 N 5.6145^0 E), Edo State, Nigeria. Benin-City is within the tropical rainforest agro-ecological zone of Nigeria. Stems and branches were cut from the Morinda tree, the leaves were removed and properly washed in tap water and air-dried at room temperature at the Moist Forest Research Station, Benin-City until constant weight was attained. They were kept away from high temperatures and direct sun light to avoid destroying active compounds.

Processing of plant samples

The dried leaves of the plant were pulverized, using a ceramic mortar and pestle to obtain a powdered form. The powdered form of the plant were then stored in airtight container.

Preparation of aqueous extract of plant samples

The aqueous extract of Morinda plant sample was prepared by soaking 10 g of powdered samples in 200 ml of distilled water for 12 h. The extract was then filtered using filter paper or Whatman filter paper.

Phytochemical analysis

Chemical tests are conducted on the aqueous extract of each plant sample and also of the powdered form of the plant samples using standard methods [10].

Qualitative analysis on phytochemical constituents

Test for tannins

0.5 g of powdered sample of each plant was boiled in 20 ml of distilled water in a test tube and then filtered. The filtration method used here is the normal method, which includes a conical flask and filter paper. 0.1% $FeCl_3$ was added to the filtered samples and observed for brownish green or a blue black colouration, which shows the presence of tannins.

Test for saponins

2 g of powdered samples of each plant was boiled together with 20 ml of distilled water in a water bath and filtered. 10 ml of the filtered sample was mixed with 5 ml of distilled water in a test tube and shaken vigorously to obtain a stable persistent froth. The frothing was then mixed with 3 drops of olive oil and observed for the formation of emulsion, which indicates the presence of saponins.

Test for flavonoids

A few drops of 1% NH_3 solution was added to the aqueous extract of each plant sample in a test tube. A yellow coloration was observed if flavonoid compounds are present.

Test for cardiac glycosides

1 ml of concentrated H_2SO_4 was prepared in a test tube. 5 ml of aqueous extract from each plant sample was mixed with 2 ml of glacial CH_3CO_2H containing 1 drop of $FeCl_3$.The above mixture was carefully added to the 1 ml of concentrated H_2SO_4 so that the concentrated H_2SO_4 was underneath the mixture. If cardiac glycoside is present in the sample, a brown ring will appear, indicating the presence of the cardiac glycoside constituent.

Quantitative analysis on phytochemical constituents

Phenols

The quantity of phenols is determined using the spectrophotometer method. The fat free plant sample was boiled with 50 ml of Ether $[(CH_3CH_2)_2O]$ for 15min. 5 ml of the boiled sample was then pipetted into 50 ml flask, and 10 ml of distilled water was added. After the addition of distilled water, 2 ml of NH_4OH solution and 5 ml of concentrated CH_3 $(CH_2)_3CH_2OH$ is added to the mixture. The sample is made up to the mark and left for 30 min to react for colour development and measured at 505 nm wavelength using a spectrophotometer.

Alkaloids

5 g of the plant sample is prepared in a beaker and 200 ml of 10% CH_3CO_2H in C_2H_5OH is added to the plant sample. The mixture is covered and allowed to stand for 4 h. The mixture then filtered and the extract is allowed to become concentrated in a water bath until it reaches 1/4 of the original volume. Concentrated NH_4OH is added until the precipitation is complete. The whole solution is allowed to settle and the precipitate is collected and washed with dilute NH_4OH and then filtered. The residue is alkaloid, which is then dried and weighed.

Tannins

Quantity of tannins is determined by using the spectrophotometer method. 0.5 g of plant sample is weighed into a 50 ml plastic bottle. 50 ml of distilled is added and stirred for 1 h. The sample is filtered into a 50 ml volumetric flask and made up to mark. 5 ml of the filtered sample is then pipetted out into test tube and mixed with 2ml of 0.1 M $FeCl_3$ in 0.1 M HCl and 0.008 M $K_4Fe(CN)_6.3H_2O$. The absorbance is measured with a spectrophotometer at 395 nm wavelength within 10 min.

Saponins

The samples were ground and 20 g of each plant sample is put into a conical flask and 100 ml of 20% C_2H_5OH is added to the plant sample. The sample is heated over a hot water bath for 4 h with continuous stirring at about 55^0C. The mixture is then filtered and the residue re-extracted with another 200 ml of 20% C_2H_5OH. The combined extracts are reduced to 40 ml over a water bath at about 90oC. The concentrated is then transferred into a 250 ml separator funnel and 20 ml of $(CH_3CH_2)_2O$ is added to the extract and shaken vigorously. The aqueous layer is recovered while the $(CH_3CH_2)_2O$ layer is discarded and the purification process is repeated. 60 ml of n-C_4H9OH is added and the combined n-C_4H 9OH extracts is washed twice with 10 ml of 5% NaCl. The remaining solution is then heated in a water bath and after evaporation; the samples are dried in the oven to a constant weight.

Flavonoids

10 g of plant sample is repeatedly extracted with 100 ml of 80% aqueous methanol at room temperature. The whole solution is then filtered through filter paper and the filtrate is later on transferred into a water bath and solution is evaporated into dryness. The sample is then weighed until a constant weight.

Table 1. Qualitative and quantitative analysis of phytochemical constituents of Morinda lucida in Benin-city, Nigeria.

Phytochemicals	Qualitative remarks	Quantitative remarks (%)
Flavonoid	-	-
Phenols	-	-
Alkaloid	+	2.166
Tannin	+	1.087
Cardiac Glycoside	-	-
Saponin	-	-
Anthraquinones	+	2.008
Steroids	+	1.004

Key: - Not present
+ Present

3 RESULTS AND DISCUSSION

From the Table 1 above, *Morinda lucida* leaf sample sourced from Benin-city, Nigeria was found to contain alkaloid (2.166%), tannin (1.087%), anthraquinone (2.008%) and steroids (1.004%). This result corroborates some previous studies on the phtyochemical screening of *Morinda lucida* which also revealed the presence of alkaloids and flavonoids (Ebilomo *et al.,* 2011), anthraquinones and anthraquinols (Nweze *et al.,* 2004; Akinyemi *et al.,* 2005), tannins, alkaloids, flavonoids and glycosides components (Ajayeoba *et al.*, 2006), although flavonoid was not detected in this study.

Doughari (2012) reported that plant-derived alkaloids in clinical use include the analgesics morphine and codeine, the muscle relaxant (+)-tubocurarine, the antibiotics sanguinafine and berberine, the anticancer agent vinblastine, the antiarrythmic ajmaline, the pupil dilator atropine, and the sedative scopolamine. Other important alkaloids of plant origin include the addictive stimulants caffeine, nicotine, codeine, atropine, morphine, ergotamine, cocaine, nicotine and ephedrine.

Tannin rich medicinal plants are used as healing agents in a number of diseases. In Ayurveda, formulations based on tannin-rich plants have been used for the treatment of diseases like leucorrhoea, rhinnorhoea and diarrhea (Doughari, 2012).

Steroids and anthraquinone presence lends credence to its usage in the treatment of therapeutic applications as arrow poisons or cardiac drugs (Firn, 2010) and as laxatives respectively. Steroids (anabolic steroids) have been observed to promote nitrogen retention in osteoporosis and in animals with wasting illness (Maurya *et al.,* 2008; Madziga *et al.,* 2010). Ebiloma *et al.* (2011) also proved that *M. lucida* aqueous leaf extract posses potent antimalarial effects and may therefore offer a potential drug lead for development of a safe, effective and affordable antimalarial. Olajide *et al* (2010) submitted that methanol extracts of the leaves of *Morinda lucida* have a strong glucose lowering property when administered to streptozotocin-treated rats.

4 CONCLUSION

The phytochemical screening of *Morinda lucida* Benth revealed the significant presence of alkaloids, tannins, steroid and anthraquinone. These research finding has been able to lend further credence to the ethno-botanical potentials of *Morinda lucida* especially in the rural communities where orthodox medicine are unavailable and in the promotion of phytomedicine. Its high concentrations of alkaloids explain why the leaves can be used in the treatment of headache, malaria and other forms of fever, while the presence of tannin explains why it is used in the treatment of diarrhea. However, there is need to carry out pharmacological studies as regards the synergy of Morinda lucida with other ethno-medicinal plants with similar properties and activities towards the formulation of high quality herbal products.

ACKNOWLEDGMENT

The authors wish to acknowledge Mr Aghogho, the Chief Laboratory Technologist of the Department of Chemistry, Delta State University, Abraka for his technical assistance in the area of phytochemical analysis.

REFERENCES

[1] Adeneye, A.A. (2013). Profile of *Morinda lucida* leaf fractions on blood glucose and lipids in normal and alloxan-induced Hyperglycaemic rats. Journal of Pharmacogolia 4 (5): 408-413.

[2] Adesogan, E.K., (1973): Anthraquinones and anthraquinols from *Morinda lucida*: The biogenic significance of Oruwal and Oruwalol. *Tetrahedron*, 29: 4099-102.

[3] Adewunmi, C.O. and Adesogan, E.K. (1984). Anthraquinones and oruwacin from Morinda lucida as possible agents in fascioliasis and schistosomasis. Fitoterapia, 55:259-263

[4] Ajayeoba, F.O., Abiodun, O.O., Falade, M.O., Ogbole, N.O., Ashidi, J.S., Happi, C.T., and Akinboye, D. O. (2006). *In vitro* cytotoxicity studies of twenty plants used in Nigerian antimalarial ethnomedicine. *Phytomedicine* 13(4): 295-298.

[5] Akinyemi, K. O., Mendie, V. E., Smith, S. T., Oyefolu, A. O., and Coker, A. O. (2005). Screening of some medicinal plants used in southwest Nigerian traditional medicine for anti-*Salmonella typhi* activity. *Journal of Herbal Pharmacothgrary* 5 (1): 45-60

[6] Asuzu, I.U., Chineme, C.N., (1990): Effects of *Morinda lucida* leaf extract on *Trypanosoma brucei* infection in mice. J. Ethnopharmacol., 30:307-313.

[7] Daziel, J.M., (1973): The useful plants of West Africa. 1st ed. London: Crown Agents; pp. 403-404.

[8] Doughari, J.H. (2012). Phytochemicals: Extraction Methods, Basic Structures and Mode of action as Potential Chemotherapeutic Agents, Phytochemicals - A Global Perspective of Their Role in Nutrition and Health, Dr Venketeshwer Rao (Ed.), ISBN: 978-953-51-0296-0, InTech, Available from: http://www.intechopen.com/books/phytochemicals-a-global-perspective-of-their-role-in-nutrition-andhealth/phytochemicals-extraction-methods-basic-structures-and-mode-of-action-as-potentialchemotherapeutic

[9] Ebiloma, G.U., Omale, J., Aminu, R.O (2011). Suppressive, Curative and Prophylactic Potentials of *Morinda lucida* (Benth) against Erythrocytic Stage of Mice Infective Chloroquine Sensitive *Plasmodium berghei* NK-65 *British Journal of Applied Science & Technology 1(3): 131-140, 201.*

[10] Edeoga, H.O, Okwu, D.E, Mbaebie, B.O (2005). Phytochemical constituents of some Nigerian medicinal plants. Afri. J. Biotechnol. 4 (7): 685-688

[11] Firn, R. (2010). *Nature's Chemicals.* Oxford University Press, Oxford. Pp 74-75.

[12] Lawal H.O, Etatuvie, S.o and Fawehinmi, A.B (2011). Ethnomedicinal and pharmacological properties of Morinda lucida. Journal of Natural products, Vol. 5(2012): 93-99

[13] Madziga HA, Sanni S and Sandabe UK. (2010). Phytochemical and Elemental Analysis of *Acalypha wilkesiana* Leaf. *Journal of American Science.* 6(11): 510-514.

[14] Makinde, J.M., Obih, P.O., (1985): Screening of *Morinda lucida* leaf extract for antimalaria action on *Plasmodium berghei* in mice. *African J. Medical Science*, 14: 59 – 63

[15] Maurya, R.; Singh G. & Yadav, P.P. (2008). *Antiosteoporotic agents from Natural sources.* In: Atta-ur-Rahman (Ed.) *Studies in Natural Products Chemistry*, Vol. 35. Elsevier. Pp 517-545.

[16] Nweze, E. I., Okafor, J. I., and Njoku, O. (2004). Antimicrobial activities of methanolic extracts of *Trema guineensus* (schunm and Thorn) *Morinda lucida* (Benth) used in Nigeria. *Bio-research* 2(1): 39-46.

[17] Oduola, T., Bello. I., Adeosun G., Ademosun A., Raheem, G., Avwioro, G., (2010): Hepatotoxicity and nephrotoxicity evaluation in Wistar albino rats exposed to *Morinda lucida* leaf extract. *NAJ. Med. Sci*, 2: 230-233

[18] Olajide O.A., Awe S.O., Makinde J.M., Morebise, O. (2010). Evaluation of the Anti-diabetic property of *Morinda lucida* leaves in Streptozotocin-diabetic rats. Journal of Pharmacy and Pharmacology Pp 45-48.

[19] Raji, Y., Akinsomisoye, O.S., Salman, T.M., (2005): Antispermatogenic activity of *Morinda lucida* extract in male rats. *Asian Journal of Androl*., 2: 405-410.

[20] Sowemimo, A.A., Fakoya, F.A., Awopetu, I., Omobuwajo. O.R., Adesanya, S.A., (2007): Toxicity and mutagenic activity of some selected Nigerian plants. *J. Ethnopharmacol*., 113:427-432.

[21] Taofeeq, O, Ibrahim, B., Ganiyu, A., Abdul-Waheed, A., Gassal, R., Godwin, A. (2010). Hepatotoxicity and nephrotoxicity evaluation in Wistar albino rats exposed to *Morinda lucida* leaf extract. North Am. J. Med. Sci., 2, 230-233.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 520-526
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Detection of Sybil Attack using Received Signal Strength and Masquerade Attack using Mutual Guarding

A. Amalorpava Preethi[1] and R. Boopathiraj[2]

[1]Research Scholar,
Department of computer science,
Dr. G R Damodaran College of Science,
Coimbatore-641014, India

[2]Assistant Professor of computer science,
Dr. G R Damodaran College of Science,
Coimbatore-641014, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Mobile Adhoc Networks is one of the complex systems and it is used in many applications and management operations. Due to the difficulties in MANET, it is essential to check the respective node and their security for each, because each node is affected by various attacks and it produces the threats in the network. These threats create more than one identity and it takes the other node's information. The main objective of the proposed work is to detect and eliminate the serious attacks such as Sybil and Masquerade simultaneously.

KEYWORDS: MANET, Sybil, Masquerade, SSC.

1 INTRODUCTION

Nowadays Mobile Adhoc Networks is one of the important researches for challenging the protocol fields. It is the most advanced techniques that are able to communicate without any physical infrastructure and it is one of the fastest, cheapest growing networks with powerful devices [1].

Basically vulnerability of the network is the lack of secure boundaries, limited resources, Cooperativeness, dynamic topology and wireless links. Sometime vulnerability is created by the attackers in the network. The hackers misuse MANET by using the node or changing the identity of the existing nodes. This type of attack is called Sybil Attack and it is the impersonation attack [2, 3].

Sybil attack creates some of the misconception number of nodes present in the networks. These are the malicious nodes. To gain the network of many IP addresses, these attacks are prevented using two approaches. Namely Lightweight Sybil attack detection and robust Sybil attack detection [4].

Some of the goals used to detect these attacks are authentication, availability, integrity, confidentiality and non-repudiation [5].

2 RELATED WORKS

In [6], the implementation of the enhanced property for mobility, that the traffic in the networks is monitored and the results shown the number of networks are detected by Sybil attacks. Here the author extends the protocol to monitor the collision at the media access network of a single attacker.

In [7], the proposed work exploited mobility to enhance security in MANETs. In a fully self-organized MANETs where there is no central authority, nodes establish security associations purely by mutual agreement. Users can activate a point-to point secure side channel (SSC) using infrared or wired media between their personal devices to authenticate each other and set up shared keys when they are in close proximity to each other. The author attempts to solve the problem of impersonation and Sybil attacks by binding a user's face and identity using these SSCs. However, SSCs are based on the assumption that nodes are connected through wired or infrared connections.

In [8], a mathematical approach is proposed to detect the Sybil attack. Here the author implemented the framework to detect the vulnerability of ad-hoc routing protocol and this approach is used to analyze the threats in the Sybil attackers by extended strand space mode.

In [9] resources testing are used to identify the Sybil attack through various tasks in the each node of the network.

3 SYBIL ATTACK

Sybil attack provides a lot of damage and creates problem to the networks. Sybil the name comes from that multiple identities and it is named after the famous multiple disorder patient whose name is "Sybil" (Shirley Ardell Mason). This attacker also creates and provides the fake information among the nodes in the whole network and sends the duplicate information among the nodes. Two types of Sybil attack detection is lightweight Sybil attack and robust Sybil attack detection. In both the cases that using parameters are different that first one is based on speed, RSS and cheapest. Second one is based on time, location and expensive.

The Sybil attack is one of the serious problems in MANET and some other application oriented network. So it is important to remove, reduce or eliminate from the network. Usually Sybil attacks are reduced, using cryptographic-based authentication [10 and 11]. But this technique is used in wireless ad hoc network, but for MANET this technique is very difficult to eliminate the Sybil attack. So in this paper, Received Signal Strength is used to protect the network from Sybil attack

4 SIGNAL STRENGTH BASED ANALYSIS

In the proposed implementation, Signal strength analysis is used to find out the distinction between a new legitimate node and a new Sybil identity node. Suppose, if one of the node from the new legitimate is enter into other node means then the first RSS at the receiver node is low. In the Sybil attack that the node creates new identity then the signal strength of this node is high.

It is important to study how each node collects and maintains the RSS values of the neighbouring nodes.

Table 1: Neighboring list based on RSS

Node ID	RSS-List
1	R1-T1---R2-T2---R3-T3---RnTn
2	
3	: : :
N	

The above table provides the list of neighbours in the form, such as <Address, RSS-List <time, rss>. Using protocol such as RTS, CTS, DATA and ACK are used to record the RSS values. Signal strength of the transmission capturing and storing is based on the receiving neighbouring nodes. This can be performed in direct communication that it acts as a source or destination to other nodes or not. Each RSS signal strength has the address R_n RSS and send the data with time period T_n, where n is the number of element in the RSS.

Some of the experiments are used to determine the behaviour of the legitimate node and the Sybil attackers.

Suppose, let us take two nodes, node A and node B. If a new node B enters into the A's neighbourhood or their respective radio range, then the node B takes overtime. It is one of the natural behaviours of the nodes. If node A stays in static position

then the node B enters into their radio range, then B's RSS observes continuously by node A. If it is happened continuously means then the node B is out range and communicates with other nodes.

In this paper based on the threshold the Sybil attack is identified. This type of threshold is depending on the maximum network speed. To identify the speed split the node into two zones that are gray and white node. These partitions are also divided based on the speed based detection. Higher speed thresholds produce the wider gray zones. First node of the gray zones indicates that it is the normal entry of the node in the radio range.

Suppose for example take 12m/s for a normal speed. If any new creation is created of formed in white zone it is denoted as Sybil identity. Smaller speed threshold will work better than the larger ones because they will produce high true positives.

For example, the maximum speed of nodes is 2 m/s in a network, then detection accuracy will be improved only when the detection threshold based on this speed produces narrower gray zone.

Step 1: addNewRss (Address, rss, time−recv)
Step 2: BEGIN SUB:
Step 3: IF: Address is not in the Table
Step 4: THEN:
Step 5: IF: rss >= UB−THRESHOLD
Step 6: THEN: add−to−Malicious−list (Address)
Step 7: Bcast−Detection−Update (Address)
Step 8: ELSE: Add−to−Table (Address)
Step 9: END−IF
Step 10: Create−Record (Address)
Step 11: Push−back (rss, time−recv)
Step 12: IF: list−Size > LIST−SIZE
Step 13: THEN: Pop−front ()
Step 14: END SUB:

The above steps from 1 to 14 is used to detect the Sybil attack, by using addNewsRss function it checks the RSS received signal and the signal time and address. If the address is not present, then it indicates the node is not present in the table and it not communicates or interacts with other before nodes.

UB_THRESHOLD is used to check out whether the RSS transmitter in white zone or not. If it is greater than or equal to the threshold, it denotes the new node in a malicious list. Finally the size of the link is checked with the LIST_SIZE. If it is greater than the LIST_SIZE means that the oldest RSS is removed from the list.

Step 1: IF: RSS−TIMEOUT
Step 2: THEN: rssTableCheck( )
Step 3: rssTableCheck( )
Step 4: BEGIN SUB:
Step 5: FOR: for each Address in the Table
Step 6: DO:
Step 7: Pop−element()
Step 8: IF: (Current−Time—getTime ()) >
Step 9:TIME−THRESHOLD
//Indicating that we did not hear from this Address since the TIME−THRESHOLD
Step 10: THEN:
Step 11: IF: getRss() > UB−THRESHOLD
Step 12: THEN: Add−to−Malicious−List
(Address)
//Indicates previous ID of a Whitewasher
Step 13: ELSE: Print "Normal out of Range"
Step 14: END FOR:
Step 15: END SUB:

The above step is used to control the size and global time called RSS_Timeout. If the time expires then the rssTableCheck is used to check the time for every address and it checks the last received time against the TIME_THRESHOLD. If the time is greater than the threshold it denotes that the respective time is past enough since it has not heard from this node. Now to

check the reason for the perished nodes, the strength of the last RSS is checked against the UB−THRESHOLD. If it is greater, then it indicates the previous identity of a whitewasher; otherwise it is concluded as a normal out of range scenario.

5 MASQUERADE ATTACK

Setting in which an adversary is added to the network and it assumes the id of one of the nodes from 1 to N. In this paper to prevent this attack, two techniques of mutual guarding is used that is sending and receiving of node verification.

5.1 MUTUAL GUARDING

In earlier, nodes are stationary and new nodes are added securely to the network. The immediate neighbour receiving of some packets from someone is called as anomaly. For example two nodes are taken which are s and d and both are communicate in the same area and both are sent packets and received it, these are called mutually guarded.

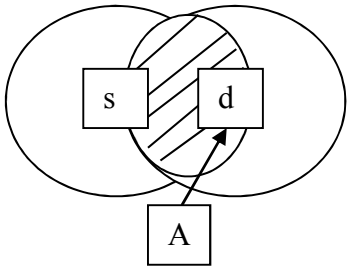


Figure 1: s overhears A masquerading as s

When an adversary A sends a packet to d by setting source id to s, s also receives the packet. S detects the presence of the attacker that masquerades as it. When an adversary is located in the same area then it cannot masquerade as s or d without getting detected. If the node s can transmit, at this time s neighbours are present in the transmission area then the attackers cannot masquerade. Receiving a packet sent by A by changing the source id to s, is an anomaly for a node that has never received a packet from s. id of a node is not neighbour means then it is called as anomaly and can be easily detected.

5.2 VERIFICATION OF THE NUMBER OF PACKETS SENT AND RECEIVED FOR MASQUERADE DETECTION

Using RF, masquerade attack can be detected. The collision is detected if the id of node s transmission data in the time allocated period, then it is an anomaly.

Let us take d be node and s_i denotes the i^{th} neighbor, where i>0 for every T iterations. Then this s_i is used to track the number of sending packets S_{s1d} with the time period for every T iterations. Then d broadcasts a single packet containing the number of packets it received from its neighbours$(R_{s1d}, R_{s2d}, R_{s3d}, \dots)$. If $R_{s1d} > S_{s1d}$, the rule is obtained then the attack of masquerades is present.

6 IMPLEMENTATION WORK

In this paper, implementation of the techniques RSS and mutual guarding is done with the use of Ns2. This tool runs on Linux. It is a simulator tool which has the finest granularity and supports the metropolitan mobility. Ns2 Code contains two sets of languages namely C++ and OTcl (Object Tool Command Language). C++ is used for the creation of objects because of its speed and efficiency whereas OTcl is used as a front end to setup the simulator, configure objects and schedule events. It is easy to use.

The current experiments and simulation results are collected using the Ns2 simulator tool with the backend of C++. AODV (Adhoc On demand Distance Vector routing protocol) defines the coding files such as .h, .cc, and other similar files. The input is given by Tool Command Language and the graph value of animation is extracted using the trace file.

The proposed work shows that the communication between the nodes is secured with the avoidance of Sybil and masquerade attacks.

6.1 EXPERIMENTS AND RESULT

The network consists of 50 nodes.

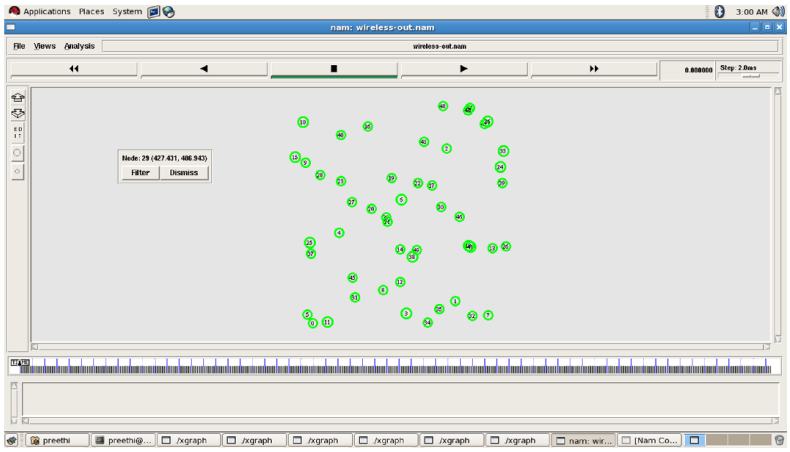


Figure 2: Simulation network

Figure-2 shows the simulation result of nodes communicated from a particular range to another. Out of these fifty nodes, two Sybil nodes and two masquerade nodes has been detected.

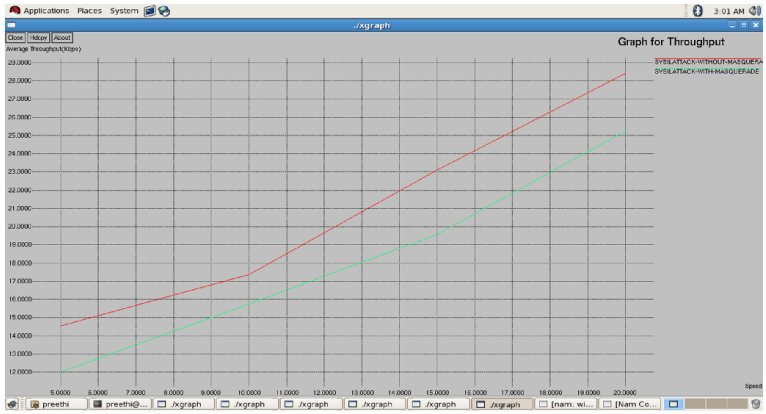


Figure 3: Throughput graph

The number of successful packets delivered through the communication channel is called throughput. The above graph shows the throughput of Sybil without masquerade.

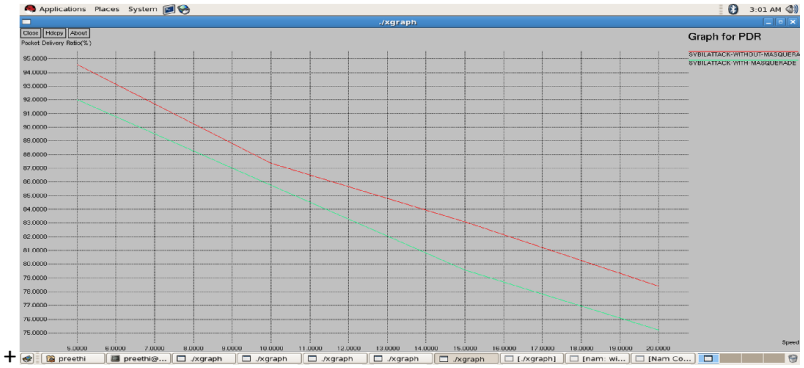


Figure 4: Packet delivery ratio graph

Packet transfer delay is a concept in packet switching technology. The figure-4 shows that the packet delivered is high at the place of Sybil detection without masquerade.

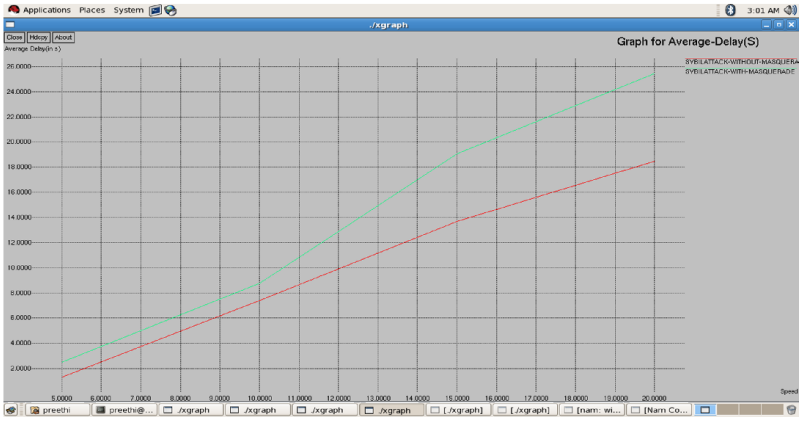


Figure 5: Packet Average delay graph

The above figure shows the delay of packets at the time of sending either due to the link failure or any other defects. Average delay of the packet is high in Sybil without masquerade.

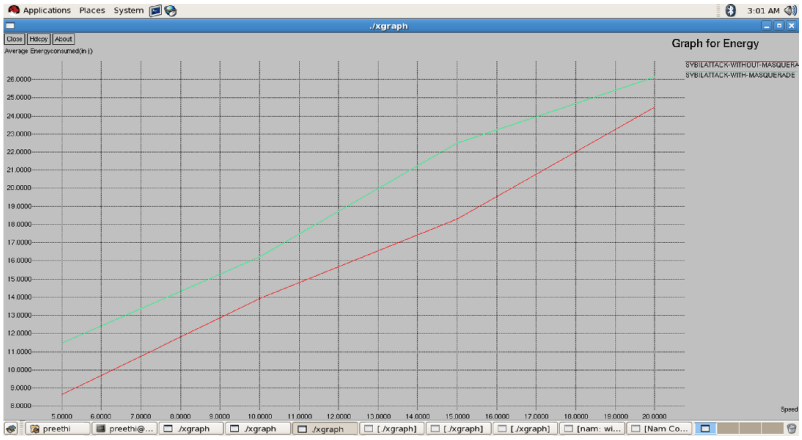


Figure 6: Energy Consumption graph

The energy consumption graph shows that the performance of energy level is low at the detection of both the nodes and it is high in Sybil without masquerade detection.

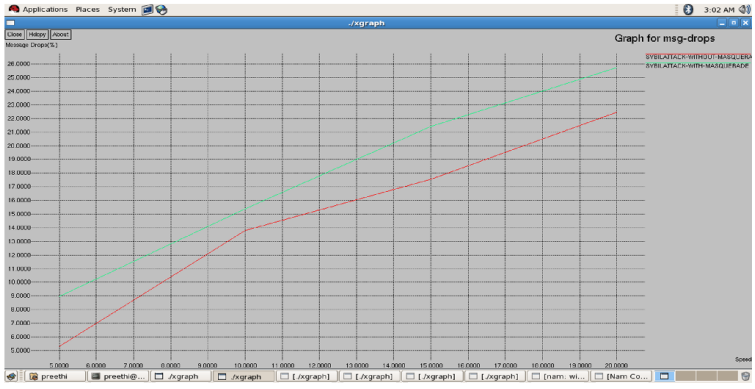


Figure 7: Message drop graph

Figure-7 shows the amount of message drops is detected to be high in Sybil without masquerade.

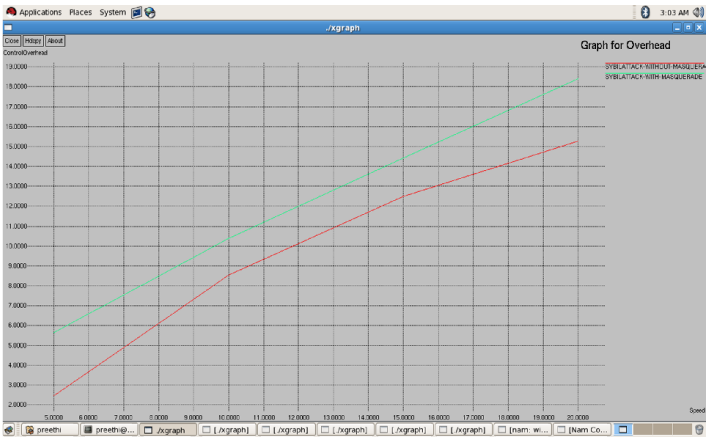


Figure 8: Overhead graph

Figure-8 shows the overhead graph comparison and it shows that the Sybil without masquerade is high.

In figure 3, 4,5,6,7,8 shows that Throughput, Packet delivery ratio, Packet Average delay, Energy Consumption, Message drop and overhead in graph representation. It clearly shows that proposed work is better than previous work.

7 CONCLUSIONS

In this paper, RSS-based detection mechanism and Mutual Guarding techniques are proposed to effectively maintain the network against Sybil attacks and masquerading attack in MANET. The performance level is high while detecting Sybil attacks whereas it is low when both the Sybil and masquerade nodes are detected. Through various experiments that a detection threshold exists for the distinction of legitimate new nodes and new malicious identities is shown. The simulation results showed that the proposed work is better than the existing work even in mobile environments. These detects eliminate the total intrusions over the communication channel of the data link layer.

REFERENCES

[1] Priyanka Goyal, Vinti Parmar and ,Rahul Rishi, “MANET: Vulnerabilities, Challenges, Attacks, Application”, IJCEM International Journal of Computational Engineering & Management, Vol. 11, January 2011.

[2] Nirmal Patel and Pratik Modi, “ Detecting Sybil attack using AODV in MANET”, International Journal of Advance Engineering and Research Development (IJAERD) Volume 1,Issue 5,May 2014.

[3] Diogo Miguel da Costa, “Thwarting the Sybil Attack in Wireless Ad Hoc Networks”, Instituto Superior Tecnico.

[4] RoopaliGarg and Himika Sharma, “Comparison between Sybil Attack Detection Techniques: Lightweight and Robust”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3, Issue 2, February 2014.

[5] LoayAbusalah, Ashfaq Khokar, and Mohsen Guizani, ``A Survey of Secure Mobile Ad Hoc Routing Protocols,'' IEEE Communication Surveys & Tutorials, Vol.10, No.4, pp.78-93, 2008.

[6] Piro, C, Shields, C and Levine, B.N, "Detecting the Sybil Attack in Mobile Ad hoc Networks," Securecomm and Workshops, 2006 , vol., no., pp.1,11, Aug. 28 2006.

[7] S. Capkun, J. P. Hubaux, and L. Buttyan, “Mobility helps peer-to-peer security,” IEEE Trans. Mobile Comput., vol. 5, no. 1, pp. 43–51, Jan.2006.

[8] Gui Jing-jing; Tao Zhang; Zhang Yu-sen, "Modeling and Analyzing the Sybil Attack to Ad-Hoc Routing Protocols," Multimedia Technology (ICMT), 2010 International Conference on , vol., no., pp.1,5, 29-31 Oct. 2010.

[9] D. Monica, J. Leitao, L. Rodrigues, and C. Ribeiro, “On the use of radio resource tests in wireless ad hoc networks,” in Proc. 3rd WRAITS, 2009,pp 21-26.

[10] K. Hoeper and G. Gong, “Bootstrapping security in mobile ad hoc networks using identity-based schemes,” in Security in Distributed and Networking Systems (Computer and Network Security). Singapore: World Scientific, 2007.

[11] S. Hashmi and J. Brooke, “Toward Sybil resistant authentication in mobile ad hoc networks,” in Proc. 4th Int. Conf. Emerging Security Inform., Syst. Technol., 2010, pp. 17–24.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 527-532
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

A comparative study of the Morphometric Analysis of High land sub-watersheds of Meenachil and Pamba Rivers of Kerala, Western Ghats, South India

E. K. Manju and A. V. George

School of Environmental Science,
Mahatma Gandhi University,
Kottayam, Kerala, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Morphometric analysis helps to understand the fluvial and structural control of the terrain and the geological and geomorphic aspects of a drainage basin. It is inevitable in developmental and management plan of a watershed. A critical evaluation and assessment of morphometric parameters of Vagamon and Peermade sub-watersheds have been achieved through measurement of linear, aerial and relief aspects of sub-watersheds by using Remote Sensing and Geographic Information System techniques. Detailed drainage map is prepared for both the sub-watersheds using ArcGIS 9.2. The analysis reveals that Vagamon a typical high land sub-watershed of Meenachil river basin is characterized by trellis pattern. Stream order varies from 1 to 3 with total number of stream segments as 43, out of which the 83.72% is by 1^{st} order streams with a minimum 2.33% as 3^{rd} order whereas Peermade sub-watershed, which forms a part of Pamba river basin is characterized by the dominance of dendritic pattern. However the eastern region shows trellis pattern. Out of the 100 stream segments identified, 79.00% (79) is 1^{st} order with only 1.00% i.e., one number is 4^{th} order stream. Vagamon sub-watershed shows typically trellis drainage pattern and structural complexity. Morphometric analysis results reveals that Vagamon sub-watershed has high values of Ruggedness Number (Rn), Length of Overland Flow (Lof), Bifurcation Ratio (Rb) and Constant Channel Maintenance (C) and low values of Elongation Ratio (Re), Circularity Ratio(Rc), and Form Factor (Rf). This indicates the highly elongated shape and the structural complexity which further emphasized by the typical trellis pattern of the of Vagamon sub-watershed. High basin relief and relief ratio of the Vagamon sub-watershed compared to that of Peermade sub-watershed is an expression of the more steep nature of the slopes compared to Peermade, as is evident from field verification. High drainage density (Dd), stream frequency (Fs) and texture ratio (T) of Peermade sub-watershed reveals its low infiltration capacity and impermeable subsurface material.

KEYWORDS: Peermade, Vagamon, dendritic pattern; trellis pattern; structural complexity.

1 INTRODUCTION

Morphometric analysis provides quantitative description of the basin or sub-watersheds and fluvial geometry, structural controls, geological and geomorphic aspect of a drainage basin [1]. The quantitative analysis of morphometric parameters is of much significance in river basin evaluation, watershed prioritization, soil and water conservation, and natural resources management at micro level. It is of great significance in understanding the hydrologic scenario of an area, because a strong mutual relationship exists between morphological variables and hydrological characteristics. Geographical Information System (GIS) is an efficient tool in delineation of drainage patterns, morphometric analysis and water resource management and its planning. Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of its landforms [2]. This analysis can be achieved through measurement of linear, aerial and relief aspects of basins by using Remote Sensing and GIS techniques which has an ability to provide a synoptic view of a large area. The outcome of morphometric analysis is useful in applying proper catchment management practices [3],[4],[5],[6],[7],[8],[9],[10]. The present study is an attempt to critically evaluate and assess various

Corresponding Author: E. K. Manju

morphometric parameters of Vagamon and Peermade sub-watersheds of the Meenachil and Pamba river basins of Western Ghats South India.

2 STUDY AREA

The areas selected for the present investigation belongs to typical highland sub-watersheds, of Idukki district. Vagamon sub-watershed lies between 9°38'35" to 9°41'42" N latitude and 76°53'9" to 76°55'37" E longitude. In general the area has altitude above 620m of MSL. Peermade sub-watershed lies between 76°56'1"E to 76°59'57" E longitude and 9°34'8"N to 9°36'59" N latitude and the area is characterized by an altitude above 1000m of MSL. Vazhikkadavu Ar, an important tributary of Meenachil river, having stream order varying from 1 to 3 originates from Vagamon sub-watershed. The Vagamon sub-watershed area is characterized by typical trellis pattern, which reveals the strong structural control that prevails in Vagamon sub-watershed.

Azhutha Puzha, an important tributary of the sacred river Pamb having stream order from 1 to 4, arises from Peermade sub-watershed. Unlike Vagamon sub-watershed which is characterized by a typical trellis pattern, the Peermade sub-watershed is characterized by predominance of dendritic pattern. However a less pronounced trellis pattern is observed towards the eastern region. Morphometric parameters such as linear, relief and aerial aspects are vital in understanding of drainage basin, its development and management. Morphometric analysis necessitates preparation of the detailed drainage map, ordering of various streams, measurement of catchment area, its perimeter etc.

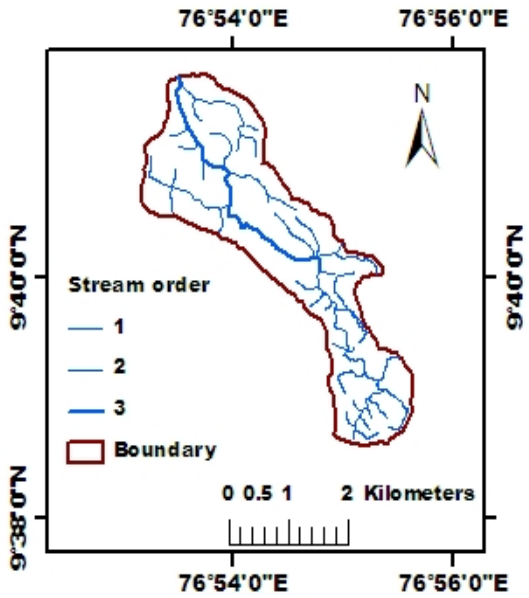


Fig.1 .Drainage pattern of Vagamon sub-watershed

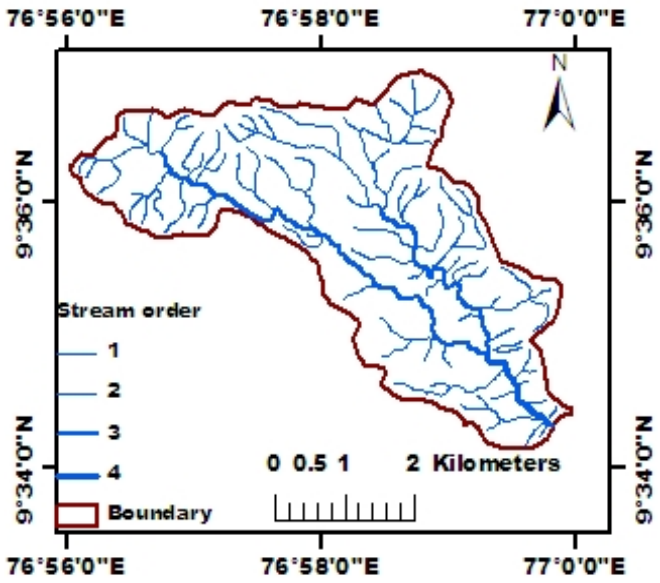


Fig.2.Drainage pattern of Peermade sub-watershed

3 METHODOLOGY

Vagamon and Peermade sub-watersheds and its associated drainage networks (Fig. 1 and Fig.2) were delineated from SOI topographical maps 58 C/14 in 1:50000 scale and were digitized using Arc GIS 9.2 software.

Morphometric analysis has been carried out for the following parameters: stream order(U), stream length (Lu), mean stream length (Lsm), bifurcation ratio (Rb), stream length ratio (Rl) (linear parameters), drainage density (Dd), stream frequency (Fs), elongation ratio (Re), Circulatory ratio (Rc), form factor (Rf), texture ratio (T), length of overland flow (lof), constant channel maintenance(C) (aerial parameters), basin relief (Bh), relief ratio (Rh), ruggedness number (Rn) (relief parameters). The methods adopted for calculating morphometric parameters are given in Table 1.

Table 1. Methods of calculating morphometric parameters

Morphometric Parameters		Methods
LINEAR	Stream Order (U)	Hierarchical order
	Stream Length (Lu)	Length of the stream
	Mean Stream Length (Lsm)	Lsm=Lu/Nu, where ,Lu=Stream length of order 'U' Nu=Total number of stream segments of order 'U'
	Stream Length Ratio (Rl)	Rl=Lu/ Lu-1; where, Lu=total Stream length of order 'U'; Lu-1=Stream length of next lower order
	Bifurcation Ratio (Rb)	Rb= Nu/ Nu+1; where, Nu=Total number of stream segments of order 'U'; Nu+1=Number of stream segments of next higher order
RELIEF	Basin Relief (Bh)	Vertical distance between the lowest and highest points of watershed
	Relief Ratio (Rh)	Rh=Bh/Lb; where, Bh=Basin Relief; Lb= Basin Length
	Ruggedness Number (Rn)	Rn=Bh×Dd; where, Bh=Basin Relief; Dd=Drainage density
ARIAL	Drainage Density (Dd)	Dd=L/A; where, L=Total length of streams; A=Area of watershed
	Stream Frequency (Fs)	Fs=N/A; where, N=Total number of streams; A=Area of watershed
	Texture Ratio (T)	T=N1/P; where, N1= Total number of first order streams; P=Perimeter of watershed
	Form Factor (Rf)	$Rf=A/(Lb)^2$; where, A=Area of watershed; Lb=Basin Length
	Circularity Ratio(Rc)	$Rc=4\pi A/P^2$; where, A=Area of watershed; P=Perimeter of watershed; π=3.14
	Elongation Ratio (Re)	$Re=2\sqrt{(A/\pi)}/Lb$; where, A=Area of watershed; Lb=Basin Length; π=3.14
	Length of Overland Flow (Lof)	Lof=1/2Dd; where, Dd=Drainage density
	Constant Channel Maintenance (C)	C=1/Dd; where, Dd=Drainage density

4 MORPHOMETRIC ANALYSIS

Vagamon sub-watershed covers an area of 8.71 Km^2 and Peermade sub-watershed 16.42 Km^2. The basin length of Vagamon sub-watershed is 6.73 Km and that of Peermade sub-watershed is 8.01 Km, and perimeter of 17.42Km and 22.64 Km respectively. In both the subwatersheds, channel segments have been ranked according to Strahler's stream ordering system [1]. Altogether 43 stream segments were recognized in Vagamon sub-watershed. Out of this 83.72% (36 numbers) are 1^{st} orders, 13.95% (6 numbers) are 2^{nd} orders and 2.33% (1) 3^{rd} order.

In Peermade sub-watershed, out of the total 100 stream segments, 79.00% (79) are 1^{st} orders, 18.00% (18) are 2^{nd} orders, 2.00% (2) is 3^{rd} order and 1.00% (1) is 4^{th} order (Table 2). Horton's law of stream numbers [11] states that the number of stream segments of each order forms an inverse geometric sequence with order number. In the present study also, the number of streams decreases in geometric progression as the stream order increases.

Table 2. Mean stream length (Lsm) of Vagamon and Peermade sub-watershed

Name of the sub-watershed	Stream order	Lu(km)	Nu	Lsm
Vagamon	1.00	16.67	36.00	0.46
	2.00	7.75	6.00	1.29
	3.00	4.70	1.00	4.70
Peermade	1.00	37.59	79.00	0.48
	2.00	13.45	18.00	0.75
	3.00	9.88	2.00	4.94
	4.00	1.51	1.00	1.51

Results of the morphometric analysis are represented in Table 2 and Table3. Stream length reveals the surface run off characteristics. The lengths of streams of various orders are measured from their mouth to drainage divide. In both the sub-watersheds, total lengths of stream segments are maximum in first order streams and it decreases as the stream order increases. The mean stream length (Lsm) is a characteristic property related to the drainage and its associated surfaces. This

has been calculated by dividing the total stream length of order 'U' by the number of stream segments of order 'U'. Generally Lsm is greater than that of the lower order and less than that of its next higher order. Variation of this may be due to the difference in slope and topography [12]. In Vagamon sub-watershed Lsm varies from 0.46 to 4.70 and in Peermade from 0.48 to 4.94 (Table 2). Lsm of the 3rd and 4th order streams of Peermade show variation from normal pattern. This may be due to the difference in slope and topography. Bifurcation ratio (Rb) is the ratio of the number of stream segments of a given order to the number of segments of the next higher order [13]. Characteristically it ranges between 3.0 and 5.0 for basins in which the geologic structures do not distort the drainage pattern [1]. The Rb is not the same from one order to its next order. These irregularities are dependent on geological and lithological development of the drainage basin [1]. In the present study, Vagamon sub-watershed has higher Rb value (6.00) than Peermade sub-watershed (5.13). This indicates high structural complexity and low permeability of the Vagamon terrain. The trellis drainage pattern of the Vagamon sub-watershed also supports this structural complexity. Stream length ratio (Rl) has an important relationship with the surface flow discharge and erosion status of the drainage basin [14]. It is the ratio of length of a particular order stream to that of next lower orders of stream segment. Both the sub-watersheds of the present study show variation in stream length ratio between streams of different orders. This indicates their late youth stage of geomorphic development [15].

Table 3. Result of morphometric analysis ofVagamon and Peermade sub-watershed

Sub-watershed	Vagamon	Peermade
Area (km^2)	8.71	16.42
Perimeter (km)	17.42	22.64
Basin order	3.00	4.00
Basin length(Lb)(km)	6.73	8.01
Relief ratio (Rh)	0.09	0.06
Basin relief (Bh)(km)	0.58	0.45
Ruggedness number(Rn)	1.92	1.72
Bifurcation ratio(Rb)	6.00	5.13
Drainage density(Dd) (km^2)	3.35	3.80
Stream frequency(Fs) (km^2)	4.94	6.09
Texture ratio(T) (km)	2.07	3.49
Form factor (Rf)	0.19	0.26
Circulatory ratio (Rc)	0.36	0.40
Elongation ratio (Re)	0.49	0.57
Length of overland flow (Lof) (km)	0.15	0.13
Constant channel maintenance(C) (km)	0.30	0.26

Among the aerial parameters analyzed the measurement of drainage density provides a numerical measurement of the landscape dissection and runoff potential. Drainage density is defined as the length of streams per unit of drainage area. Higher this number means closer together are the channels. In the present study Peermade sub-watershed has drainage density 3.80 and Vagamon has 3.35. High drainage density of Peermade sub-watershed may be due to the weak or impermeable subsurface material, sparse vegetation and mountainous relief. Stream frequency (Fs) is related to permeability, infiltration capacity and relief of a sub-watershed. It is the total number of stream segments of all orders per unit area [16]. The calculated value of stream frequency (Fs) of Vagamon and Peermade drainage basins are 4.94 and 6.09 respectively. Fs is higher in Peermade sub-watershed, which can be attributed to high relief and low infiltration capacity. The texture ratio (T) depends on underlying lithology, infiltration capacity and relief aspect of the terrain [17]. It is the ratio between the first order streams and perimeter of the basin. Peermade sub-watershed has higher T value (3.49) than Vagamon sub-watershed (2.07). High texture ratio can be attributed to the presence of high relief of Peermade sub-watershed. Form factor (Rf) is defined as the ratio of mean basin width and the maximum basin length. Generally, Rf is less than 1 because the maximum basin length is longer than the mean basin width. In the present study, the low Rf value (0.19) of the Vagamon sub-watershed reveals that it is more elongated than the Peermade sub-watershed (0.26). Circulatory ratio (Rc) is defined as the ratio of the area of the basin to the area of the circle having the same circumference as the perimeter of the basin. According to Miller, circularity ratios are ranging from 0.4 to 0.5 that indicates strongly elongated and highly permeable homogenous geologic materials [18]. Circulatory ratio values of Vagamon and Peermade sub-watersheds are 0.36 and 0.40 respectively .Low value of the Vagamon sub-watershed reveals the highly elongated shape and highly permeable geological materials. Elongation ratio (Re) is a very significant index in the analysis of the hydrological character of a drainage

basin. It is an index which indicates how the shape of the basin deviates from a circle [13]. Analysis reveals that Peermade sub-watershed has high Re value 0.57, while Vagamon sub-watershed has low Re value 0.49. Low Re values of the Vagamon sub-watershed of the present study indicate the highly elongated shape of the drainage basin. Length of the overland flow (Lof) is the length of water flow over the ground before it gets concentrated in to definite stream channels. Length of overland flow was calculated as the half of the reciprocal of the drainage density (Dd). In the present study Vagamon sub-watershed has high Lof (0.15) compared to and Peermade has low Lof (0.13). This indicates the structural complexity of Vagamon sub-watershed. The constant of channel maintenance(C), indicates the minimum area required for the development and maintenance of a unit length of channel [13]. It is the inverse of drainage density. Constant channel maintenance of Peermade sub-watershed is 0.26 which is less than Vagamon sub-watershed (0.30). This reveals the weak or impermeable subsurface material, sparse vegetation and mountainous relief of Peermade sub-watershed.

Relief parameters such as basin relief (Bh), relief ratio (Rh) and ruggedness number (Rn) of Vagamon, and Peermade sub-watersheds are evaluated. Basin relief (Bh) is the maximum vertical distance between the lowest and highest elevation in a basin. The maximum and minimum height of the Vagamon sub-watershed is 1195m and 620m, whereas in Peermade sub-watershed maximum height is 1453m and minimum height is 1000m. Thus the Bh of Vagamon sub-watershed is 0.58km and Peermade 0.45km. Relief ratio (Rh) indicates the overall steepness of the basin, which Includes factors of gradient and elevation. The high Rh values of Vagamon (0.09) is due to steep slope and high relief, while the lower values of Peermade (0.06) may indicate the presence of basement rocks that are exposed in the form of small ridges and mounds with lower degree of slope. Ruggedness number (Rn) is the product of the basin relief and its drainage density. Vagamon has high ruggedness number (1.92). This indicates the structural complexity of the terrain in association with relief and drainage density. It also implies that the area is susceptible to soil erosion

5 CONCLUSIONS

The outcome of morphometric analysis is very much useful in applying proper watershed management practices. The application of various morphometric techniques is a major advance in the quantitative and qualitative description of geometry and network of drainage basins. GIS has proved to be an efficient tool in morphometric analysis. Vagamon sub-watershed shows typical trellis drainage pattern indicating the more structural complex nature. High values of Rn, Lof, Rb and C for Vagamon sub-watershed further emphasis the structural complexity of the sub-watershed. The low values of the morphometric parameters such as Re, Rc, and Rf indicates the highly elongated shape of the Vagamondrainage basin. High values of Bh and Rh for Vagamon reveals the steep slope whereas the low values of Peermade sub-watershed indicates presence of small ridges and mounts. Further the morphometric parameters evaluated using GIS have helped us to understand various terrain parameters such as nature of bedrock, infiltration capacity, surface runoff, etc. The outcome of the present study will help a lot in watershed development and management.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the Director, School of environmental Science, M.G. University, Kottayam and Faculty in charge, Dr.R Satheesh Centre for Remote sensing and GIS, School of Environmental Science, M.G. University, Kottayam, for the support extended and facilities provided during the course of study.

REFERENCES

[1] A. N. Strahler, Quantitative Geomorphology of Drainage Basins and Channel Networks; Handbook of Applied Hydrology, McGraw Hill Book Company, New York, pp. 4-76, 1964.

[2] J. I. Clarke, Morphometry from Maps. Essays in Geomorphology, Elsevier Publications, NewYork, pp. 235-274, 1996.

[3] K. P. G. W. Senadeera, S. Piyasiri and K. D. W. Nandalal, “The evaluation of morphmetric characteristics of Kotmale Reservoir catchment using GIS as a tool, Sri Lanka,” The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. 34, pp. 30, 2001.

[4] O. O. Ogunkoya, J. O. Adejuwon and L. K. Jeje, “Run off response to basin parameters in south western Nigeria,” Journal of Hydrology, vol. 72, pp. 67-84, 1984.

[5] R. N. C. Aryadike and P. O. Phil-Eze, “Run off response to basin parameters in Southeastern Nigeria,” Geografiska Annaler. Series A. vol. 71A, pp. 75-84, 1989.

[6] S. Biswas, S. Sudhakar and V. R. Desai, “Prioritisation of subwatersheds based on morphometric analysis of drainage basin: A remote sensing and GIS approach,” Journal of the Indian Society of Remote Sensing. vol. 27, no. 3, pp. 155-166, 1999.

[7] G. Lazarus Ndatuwong and G. S. Yadav, "Morphometric analysis to infer the hydrogeological behavior in part of Sonebhadra District, Uttar Pradesh, India, using Remote Sensing and GIS technique". International Journal of Remote sensing and GIS. vol.3, no. 1, pp. 1-7, 2014.

[8] D. Lakshmamma Nagaraju, G. Mahadevaswamy, S. Siddalingamurthy and S. Manjunatha, "Morphometric analysis of Gundal watershed, Gundlupet Taluk, Chamarajanagar District, Karnataka, India," International Journal of Geomatics and Geosciences, vol. 1, no. 4, pp. 758, 2011.

[9] K. Nageswara Rao, P. Swarna Latha, P. Arun Kumar and R. Hari Krishna, "Morphometric analysis of Gostani river basin in Andhra Pradesh State, India using Spatial Information Technology," International Journal of Geomatics and Geosciences, vol. 1, no. 2, pp. 179-187, 2010.

[10] V. K. Srivastava and D. Mitra, "Study of drainage pattern of Raniganj coalfield (Burdwan District) as observed on Landsat-TM/IRS LISS II Imagery," Journal Indian Society of Remote Sensing," vol. 23, no. 4, pp. 225-235, 1995.

[11] R. E. Horton, "Erosional development of streams and their drainage basins: Hydrophysical approach to quantitative morphology". Geological Society of America, Bulletin, vol. 56, pp.275-370, 1945.

[12] S. Srinivasa Vittala, S. Govindaiah, and H. Honne Gowda, "Morphometric analysis of sub-watersheds in the Pavagada area of Tumkur District, South India, using Remote Sensing and GIS techniques," Journal of Indian Society of Remote Sensing, vol. 32, no. 4, pp. 351-362, 2004.

[13] S. A. Schumm, "Evolution of drainage systems and slopes in badlands at Perth Amboy, New Jersey," Geological Society of America, Bulletin, vol. 67, pp. 597-646, 1956.

[14] P. D. Sreedevi, K. Subramayam, and A. Shakeel, "The significance of morphometric analysis for obtaining groundwater potential zones in structurally controlled terrain," Environmental Geology, vol. 47, no. 3, pp. 412-420, 2005.

[15] S. Singh and M. C. Singh, "Morphometric analysis of Kantar River Basin," National Geographical Journal, India, vol. 43, no. 1, pp. 31-43, 1997.

[16] R. E. Horton, "Drainage basin characteristics," Transaction of American Geological Union, vol. 13, pp. 350-361, 1932.

[17] H. Vijith, and R. Satheesh, "GIS Based Morphometric Analysis of two Major Upland Sub-watersheds of Meenachil River in Kerala," Journal of the Indian Society of Remote Sensing, vol. 34, no. 2, pp. 181-185, 2006.

[18] V. C. Miller, "A quantitative geomorphic study of drainage basin characteristics in the Clinch Mountain area, Virginia and Tennessee", Department of Geology Columbia University, New York, pp. 389-402, 1953.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 533-542
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

PERCEPTION AND PRACTICE OF INTERMITTENT PREVENTION TREATMENT OF MALARIA AMONG PREGNANT WOMEN ATTENDING ANTE-NATAL CLINICS IN IBADAN NORTH EAST LOCAL GOVERNMENT AREA

Oluwakemi I. Adeniji[1] and Foluso C. Odesola[2]

[1]Public Health Nursing Department, University College Hospital, Ibadan, Oyo State, Nigeria

[2]CHO Training Program, University College Hospital, Ibadan, Oyo State, Nigeria

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Malaria contributes to 11% of maternal deaths in Nigeria (McGregor, 1984). These women are infected with *Plasmodium falciparum*, the most virulent Plasmodium with serious health consequences.
This study therefore was designed to assess the perception and practice of Intermittent Prevention Treatment of malaria among pregnant women attending ante-natal clinics in Ibadan North East Local Government Area.
The study was a cross sectional surveys in which 99 respondents were interviewed. Data on demography, perception, practice, knowledge and barriers to the use of IPT were collected and were analyzed using descriptive statistics.
Thirty three (33.3%) of the respondent are between the ages of 31-35 years, while 25(25.3%) are within the age range of 26-30 years. Perception of pregnant women receiving IPT for malaria shows that IPT is very effective 32 (32.3%), while 60(60.6%) agrees that IPT drugs are readily available for pregnant women. Also, the study shows that71 (71.7%) had benefited from the program of IPT before, and 39 (39.4%) often attends seminars on malaria. On knowledge of pregnant women on IPT for malaria, 56(56.6%) reveals reliability of IPT materials, 61(61.6%) agreed that SP-drugs has no side effect on them, and 58(58.6%) said low birth weight, still birth are effects of malaria in pregnancy. Moreover, the barriers to the use of IPT for malaria among pregnant women include inadequate information about its use 30(30.6%), inadequate storage facility 43(43.4%), abuse of SP-drugs 51(51.5%), and, hoarding of IPT materials by medical staff 25(25.3%).
The study therefore recommends that government should ensure that IPT program for malaria is properly monitored and adequate supplies should be made.

KEYWORDS: Antenatal clinic, Malaria, Intermittent preventive therapy, Sulphadoxine-Pyrimethamine.

1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Malaria in pregnancy (MiP) is a major health concern in Nigeria. Malaria infection is more dangerous during pregnancy, and adverse effects are more serious for the pregnant woman as well as the foetus and newborn. In endemic areas such as Nigeria, women have high levels of immunity and so may not experience fever or other malaria symptoms (Ndyomugyenyia et al., 2009). During pregnancy, however, their immunity is altered and they are more vulnerable to complicated and severe malaria. Meta-analysis of intervention trials in Sub-Saharan Africa suggests that in endemic areas, MiP is largely undetected and untreated, and this leads to 100,000 infant deaths per year due to malaria-associated, low birth weight (Breman et al., 2004; Shulman et al., 1996; Steketee et al., 1996). Malaria-related anaemia may cause up to 10,000 maternal deaths per year. In Nigeria, a large proportion of pregnant women do not go to a health facility even when they have malaria symptoms (Marchesini and Crawley, 2004). This is especially true in States where many Muslim women are in seclusion and do not make their own decisions about attending a health facility.

Intermittent treatment of malaria in pregnancy is a strategy where all pregnant women are given full dose of sulphadoxine-pyrimethamine (SP) at least twice during pregnancy, regardless of whether they have malaria. Starting as early as possible in the second trimester, IPT-SP is recommended by the World Health Organization (WHO) for all pregnant women at each scheduled antenatal care (ANC) visit until the time of delivery, provided that the doses are given at least one month apart (Parise et al, 1998; Shulman et al., 1999). Sulphadoxine-pyrimethamine should not be given during the first trimester of pregnancy; however, the last dose of IPT-SP can be administered up to the time of delivery without safety concerns (Schultz et al., 1994; Verhoeff et al., 1998). The effectiveness of IPT-SP in improving birth weight and reducing prevalence of pre-term deliveries and maternal anaemia in Nigeria has been documented (Verhoeff et al., 1998; Hill and Kazembe, 2006).

1.2 MAIN OBJECTIVE

The main objective is to assess, document and establish the perception and practice of intermittent prevention treatment of malaria among pregnant women attending ante natal clinics in Ibadan north east local government area.

2 LITERATURE REVIEW

Based on WHO's fact sheet it has been established that pregnancy quadruples a woman's risk to malaria illness and doubles her risk of death (Vallely L, Ahmed Y, Murray SF (2005).. Malaria alone increases the risk of maternal anemia up to 15%, increases the risk of preterm up to 36%, intrauterine growth retardation up to 70%, low birth weight up to 14% and infant death up to 8% (Tranbarger G (2003). Maternal anemia contributes significantly to maternal mortality causing an estimated 10,000 deaths per year (Marchesini and Crawley, 2004). In areas of high or moderate transmission, most malaria infections in pregnant women are asymptomatic and infected women do not present for treatment. In such areas, the World Health Organization recommended a combination of interventions to prevent malaria in pregnancy including insecticide-treated nets (ITNs), intermittent preventive treatment in pregnancy (IPT) and effective case management and treatment (Nahlen, 2000; WHO, 2004).

Intermittent Preventive Treatment of Malaria in pregnancy (IPT) provides significant protection against maternal anemia and low birth weight, and reduces significantly the risk of abortion, still birth, pre-term deliveries and maternal mortality. Studies in Kenya on intermittent prevention treatment of malaria among pregnant women. (Parise et al, 1998; Shulman et al., 1999) and Malawi on intermittent prevention treatment of malaria among pregnant women. (Schultz et al., 1994; Verhoeff et al., 1998) have shown that IPT using SP when delivered as part of antenatal care significantly reduces the prevalence of maternal anemia, placental parasitemia and the incidence of low birth weight. Many countries in sub-Saharan Africa including Nigeria have introduced SP-IPTp into national malaria control programmes (Verhoeff et al., 1998; Hill and Kazembe, 2006).

The Federal Government of Nigeria through the Federal Ministry of Health demonstrated a strong political will and commitment in adopting IPT with SP as the National strategy for malaria control in pregnancy (Federal Ministry of Health, 2005). Following the National Guidelines and Strategies for Malaria Prevention and Control (2005) during pregnancy promulgated by the Federal Ministry of Health, there has been inadequate documentation on the implementation of IPT as part of this strategy. In order to successfully prevent malaria in pregnancy there is a need to monitor the implementation of the three-pronged approach (of which Intermittent Preventive Treatment is an essential part) in preventing malaria in pregnancy.

In May 2000, African leaders in Abuja under the Roll Back Malaria (RBM) partnership set the target that by 2005 at least 60% of all pregnant women who are at risk of malaria, especially those in their first pregnancies should have access to chemoprophylaxis or IPT. The WHO (2010) reports that at the end of 2008, 35 out of 45 sub-Saharan African countries had adopted IPT as national policy. However, coverage has remained far from the target in many countries including Nigeria. (WHO 2010)

In 2001, Nigeria instituted intermittent preventive treatment using SP for pregnant women in the second and third trimesters of pregnancy. However, both first and second dose coverage remains low being 8.0% and 4.6% respectively in Nigeria and 9.9% and 5.4% in south-east Nigeria (Nwogu, 2009). The use of IPT in Nigeria involves the administration of at least two of SP during pregnancy, regardless of whether the woman is infected. The first dose is taken after quickening and there should be at least one month between the two doses, (WHO 2004). However, although the WHO guideline allows the administration of IPT all through the third trimester, the policy in Nigeria recommends otherwise, stating that *'the last dose should be given not later than one month before the expected date of delivery'*. (Vander, H. W.2005) Direct observed treatment (DOT) by a qualified health worker was also incorporated to ensure compliance by pregnant women. Compliance is further enhanced by the single dose treatment of SP.

Successful use of IPT is dependent on the utilization rates of antenatal care (ANC) services amongst pregnant women. Attendance at ANC is high in most Sub-Saharan African countries, but up to 25% of pregnant women pay the first visit in the 3rd trimester (Akinleye S.O 2009). This may affect the impact of ANC and IPT related services as delivery of the second dose of SP is substantially reduced and envisaged protection for mother and foetus is lost (Falade C.O, Ajayi I.O 2009)

A woman that attends ANC needs to do so at appropriate times for delivery of IPT, which is best given when the growth of the foetus is occurring at its highest velocity (16th - 24th week) as this helps to reduce placental parasitaemia, foetal growth reduction and the resultant low birth weight. Whether a woman starts early or late, each visit should count so that opportunities created by her attendance to ANC are not missed for the delivery of relevant interventions.

2.1 INCIDENCE OF MALARIA

Incidence of malaria varies by weather, which affects the ability of the main carrier of malaria parasites, Anopheles mosquitoes, to survive or otherwise (Mwangagia et al., 2007). Tropical areas including Nigeria have the best combination of adequate rainfall, temperature and humidity allowing for breeding and survival of anopheline mosquitoes (Okwa et al., 2009; Onyabe and Conn, 2001). in the south but is more seasonal in the northern regions (WHO, 2010). Malaria transmission, based on climatic parameters occurred between April and October in Anambra state (Ayanlade et al., 2010), which shows that rainfall plays an important role in the distribution Malaria transmission in Nigeria takes place all year round of breeding sites for the mosquito vector thereby influencing malaria transmission (Okwa et al., 2009). In Nigeria, the peak malaria transmission coincides with the appearance of stagnant water collections just after the rainy season (Okwa et al., 2009).

Although malaria is one of the most climate-sensitive vector-borne diseases (Morse, 1995), several other factors have been identified as contributing to its emergence and spread. These include environmental and socio-economic changes, deterioration of health care and food production systems, and the modification of microbial/vector adaptation (McMichael et al., 1998; Morse, 1995). In malaria endemic areas, factors such as poverty, poor socioeconomic status, poor education, lack of enlightenment and poor environmental sanitation have been attributed to availability of mosquito-friendly environment- conditions which allow for survival and proliferation of the vector and pathogenic parasite (McMichael et al., 1998).

Increase in population density led to an increase in human exposure and more pressure on limited productive land (Lindsay and Martens, 1998). Pressures on productive land, force farmers to clear forests and reclaim swamps. Puddles and elevated temperatures result from lost tree and ground cover, providing ideal breeding sites for mosquitoes (Walsh et al., 1993). According to Warsame et al., (1995), increased flooding could facilitate the breeding of malaria carriers in formerly arid areas. Small geographical changes in the distribution of malaria may expose large numbers of people to infection (Warsame et al., 1995).

3 METHODOLOGY

3.1 STUDY DESIGN

The study is a descriptive one which involves the administration of questionnaire to determine the perception and practice of intermittent prevention treatment of malaria among pregnant women attending antenatal clinics in Ibadan North East Local Government Area of Oyo State.

3.2 SAMPLING PROCEDURE

A systemic and random sampling technique was used in selecting the respondent in the three (3) Primary Health Centre's in the Local Government Area in the ratio of 2:1:1.

3.3 SAMPLE SIZE

The sample size for the study was 100 pregnant women attending antenatal clinics in the Local Government Area in the ratio of 2:1:1.

3.4 DATA COLLECTION INSTRUMENT

A structured questionnaire that comprised of close ended questions was used for data collection.

3.4.1 DATA MANAGEMENT AND ANALYSIS

Completed questionnaires were collected, coded and entered into the computer using the Statistical Packaged for Social Science (SPSS) version 15.0. The results were presented in frequencies, percentages and charts.

4 RESULTS

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Table 1 shows that 33(33.3%) of the respondent are between the ages of 31-35 years, while 25(25.3%) are within the age range of 26-30 years. Also 21(21.2%) of them fall within the age range of 36-40 years and 15(15.2%) are within 20-25 years. The remaining 5(5.1%) of them fall within the age range of 41years and above.

It also shows that 60(60.6%) of the respondent are Muslim, while the remaining 39(39.4%) are Christian. It further reveals that 32(32.3%) are civil servant, while 31(31.3%) are as petty traders and 25(25.3%) are business women. The remaining (11.1%) are either religious worker or engage in one activity or the other.

Moreover, the result shows that 55(55.6%) has 3-5 children, while 26(26.3%) has 1-2 children and the remaining 18(18.2%) have 6-8 children. Also, 57(57.6%) of the respondent are 4-6 months pregnant, while 24(24.2%) of the respondent are 7-9 months pregnant. Also 16(16.2%) of the respondent are 1-3 months pregnant.

In addition, the result shows that 40(40.4%) of the respondent are graduate, while 21(21.2%) post graduate degrees and 20(20.2%) are secondary school certificate holders. Also, 12(12.1%) has primary school certificates. The remaining 6(6.1%) of the respondent has no formal education.

Table 1: Demographic characteristics of the respondents

Personal characteristic of the respondent	Frequency	Percentage (%)
Age		
20-25 years	15	15.2
26-30 years	25	25.3
31-35 years	33	33.3
36-40 years	21	21.2
41 and above	5	5.1
Religion		
Christianity	39	39.4
Muslim	60	60.6
traditional	-	-
Occupation		
Civil servant	32	32.3
Business	25	25.3
Petty traders	31	31.3
Others	11	11.1
No of children		
1-2	26	26.3
3-5	55	55.6
6-8	18	18.2
Month of Pregnancy		
1-3 month	16	16.2
4-6 month	57	57.6
7-9 month	24	24.2
Educational status		
Primary school	12	12.1
Secondary school	20	20.2
Tertiary	40	40.4
Post graduate	21	21.2
Others	6	6.1

4.2 PERCEPTION OF IPT OF MALARIA AMONG PREGNANT WOMEN

The result in table 2 shows the perception of IPT of malaria among pregnant women, thirty two respondent (32.3%) strongly agree that IPT is very effective, while 60(60.6%) agrees that IPT drugs are readily available for pregnant women and 46(46.5%) strongly disagree that malaria can be transferred from mother to fetus during pregnancy. Also 43(43.4%) disagree that all pregnant women respond negatively to intermittent preventive treatment for malaria.

Table 2: Perception of IPT of malaria among pregnant women

Perceptions	**SA Freq(%)**	**A Freq(%)**	**SD Freq(%)**	**D Freq(%)**
IPT is very effective during pregnancy	32(32.3)	59(59.6)	3(3.0)	5(5.1)
IPT drugs are readily available for Pregnant women	16(16.2)	60(60.6)	14(14.1)	9(9.1)
Doses of drugs given are usually taking as prescribed	11(11.1)	43(43.4)	21(21.2)	24(24.2)
Malaria is endemic in this region	26(26.3)	52(52.5)	15(15.2)	6(6.1)
Federal government provides adequate Sulphadoxine-Pyrimethamine (SP) supplies	9(9.1)	43(43.4)	38(38.4)	9(9.1)
All pregnant women respond positively to Intermittent Preventive Treatment (IPT) for malaria	8(8.1)	48(48.5)	29(29.3)	14(14.1)
SP are given in all antenatal clinics	3(3.0)	34(34.3)	26(26.3)	36(36.4)
All pregnant women respond negatively to Intermittent Preventive Treatment (IPT) for malaria	4(4.0)	22(22.2)	30(30.3)	43(43.4)
Other methods of IPT of malaria such as bed net, use of propellant are more useful than using SP-drugs	13(13.1)	50(50.5)	18(18.2)	18(18.2)
Malaria is the only severe sickness during pregnancy	5(5.1)	49(49.5)	23(23.2)	22(22.2)
Malaria can be transferred from mother to foetus during pregnancy	1(1.0)	23(23.2)	46(46.5)	29(29.3)
Malaria causes death of most pregnant women during pregnancy and delivery	10(10.1)	23(23.2)	43(43.4)	23(23.2)
All pregnant women attend antenatal clinics for IPT of malaria.	1(1.0)	24(24.2)	36(36.4)	38(38.4)
Malaria contribute to maternal death	24(24.2)	49(49.5)	13(13.1)	13(13.1)
The physiological changes of pregnancy and pathological changes due to malaria have a synergetic effect.	11(11.1)	46(46.5)	31(31.3)	11(11.1)
Maternal malaria often result in maternal aneamia, still birth, low birth weight, premature delivery etc.	18(18.2)	47(47.5)	27(27.3)	7(7.1)
Women develop increasing resistance to malaria infection over successive pregnancies.	40(40.4)	-	32(32.3)	27(27.3)
Malaria transmission in Nigeria takes place all year round.	9(9.1)	57(57.6)	17(17.2)	16(16.2)
Human malaria is not transmitted by female mosquitoes of the genus Anopheles from human to human.	11(11.1)	39(39.4)	35(35.4)	14(14.1)
Premature birth results only from symptomatic malaria and is usual in severe malaria.	16(16.2)	38(38.4)	22(22.2)	23(23.2)

4.3 PRACTICE OF PREGNANT WOMEN IN USING IPT FOR MALARIA

Table 3 shows result on the practice of pregnant women in using IPT for malaria. Thirty nine respondent (39.4%) attend seminar on malaria, 71(71.7%) of them said they benefited from the program and 53(53.1%) said it was effective, out of the respondents, 35(35.4%) preferred the use of repellant to prevent mosquito bites and 28(28.3%) know how to control mosquitoes in their surroundings.

Table 3: Practice of pregnant women in using IPT for malaria

Practice of pregnant women in using IPT for malaria	Frequency	Percentage(%)
Attendance of seminar on malaria		
Often	39	39.4
Frequently	33	33.3
Seldom	27	27.3
Benefit from IPT program for malaria		
Yes	71	71.7
No	28	28.3
Effectiveness IPT program for malaria		
Very effective	37	37.4
Partially effective	53	53.5
Not effective	9	9.1
Preference of method of IPT for malaria		
SP-drugs	33	33.3
Insecticide-treated nets (ITNs)	35	35.4
Repellant	31	31.3
Control of mosquitoes in your surroundings		
Insecticide	16	22.5
Bed nettings	20	28.2
Repellant	13	18.3
Cleaning of surroundings	9	12.7
Use of drugs	13	18.3

4.4 KNOWLEDGE OF PREGNANT WOMEN IN USING IPT FOR MALARIA

The result in table 4 shows knowledge of pregnant women in using IPT for malaria. Eighty two (82.8%) respondents agreed that IPT is effective, 43(43.4%)said the drugs is easily available and 72(72.7%) said the health workers has good interpersonal relationship with them. Also,56(56.6%) of the respondents said IPT is reliable, 62(62.6%) agreed that introduction by the government is good and that all health centres practice IPT – 39(39.4%).

Moreover, 61(61.6%) respondents said SP-drugs has no side effects and 45(45.4%) opined that ITNs is more effective than SP-drugs. Out of the respondent, 34(34.3%) said anaemia is present in all pregnant women with malaria, and 58(58.6%) opined that low birth weight, still births are some of the side effects of malaria in pregnant.

Table 4: Knowledge of pregnant women in using IPT for malaria

Pregnant women knowledge on IPT	Frequency	Percentage(%)
Effective of IPT for Malaria		
Yes	82	82.8
No	17	17.2
Availability of drugs for malaria		
Yes	43	43.4
No	56	56.6
Attitudes of health workers in counseling on use of IPT drugs		
Yes	72	72.7
No	27	27.3
Reliability of prevention of malaria		
Yes	56	56.6
No	43	43.4
Benefit of government introducing IPT for malaria		
Yes	62	62.6
No	37	37.4
Practice of health centres on IPT for malaria		
Yes	39	39.4
No	69	60.6
Any side effect of SP on pregnant women		
Yes	61	61.6
No	38	38.4
Effectiveness of ITNs over SP		
Yes	45	45.5
No	54	54.5
Presence of anemia in all pregnant women with malaria		
Yes	34	34.3
No	65	65.7
Any side effects of malaria in pregnancy		
Yes	58	58.6
No	41	41.4

4.5 BARRIERS TO THE USE OF IPT FOR MALARIA AMONG PREGNANT WOMEN

The result in Table 5 shows the barriers to the use of IPT for malaria among pregnant women. Fifty three (53.5%) of the respondents agreed that government does not provide adequate assistance to the use of IPT for malaria, 62(62.6%) also strongly disagrees that the medical personnel's are not always available. Moreover, 38(38.4%) strongly disagree that SP-drugs is not always sufficient in health centres, also 36(36.7%) strongly disagree that there is inadequate information about the use of IPT for malaria among pregnant women. In addition, 51(51.5%) agree to the abuse of SP-drugs by pregnant women and 46(46.5%) strongly disagree that inadequate storage system for the IPT material is a barrier to the use of IPT for malaria. Also, 36(36.4%) strongly disagree that incompetency of personnel in handling IPT materials is a barrier and 31(31.3%) strongly agree that hoarding of IPT material such as ITNs, SP-drugs, repellant by medical staff is a barrier to the use of IPT for malaria.

Table 5: Barriers to the use of IPT for malaria among pregnant women

Barriers to the use of IPT for malaria	SA Freq(%)	A Freq(%)	SD Freq(%)	D Freq(%)	Mean	Standard deviation	Rank
Government does not provide adequate assistance to the use of IPT for malaria	12(12.1)	53(53.5)	21(21.2)	13(13.1)	2.35	0.86	7
Medical personnel are always not available	3(3.0)	26(26.3)	62(62.6)	8(8.1)	2.76	0.64	3
SP-drugs is not always sufficient in health centres	5(5.1)	37(37.4)	38(38.4)	19(19.2)	2.72	0.83	4
Inadequate information about the use of IPT for malaria among pregnant women	1(1.0)	30(30.6)	36(36.7)	31(31.6)	2.98	0.82	1
Abuse of SP-drugs by pregnant women	2(2.0)	51(51.5)	31(31.3)	15(15.2)	2.60	0.77	6
Inadequate storage systems for the IPT materials	2(2.0)	43(43.4)	46(46.5)	8(8.1)	2.61	0.67	5
Incompetency of personnel in handling IPT materials	4(4.0)	29(29.3)	36(36.4)	30(30.3)	2.93	0.87	2
Hoarding of IPT material such as ITNs, SP-drugs Repellant, etc. by medical staffs	31(31.3)	25(25.3)	28(28.3)	15(15.2)	2.27	1.07	8

5 CONCLUSION

The study reveals that majority of the respondent (33.3%) were between the ages of 31-35 years, showing that most are in their 30's. Higher percentage of the respondent (60.6%) were Muslim, most of the respondent (32.3%) were civil servant having number of children most frequent (55.6%) between 3-5 children. It was also discovered that more of the respondent (57.6%) are in their 4-6 months of pregnancy and most predominant educational status (40.4%) is graduate which makes them value the use of IPT for malaria

Also, the result shows that perception of the pregnant women receiving IPT for malaria agree that IPT is very effective, IPT drugs are readily available, moreover it was shown that majority of the pregnant women had benefitted from the IPT program for malaria and often attend seminar on malaria, also they agree that the method used are good.

In addition, the study reveals various knowledge of pregnant women about IPT for malaria. This include reliability of IPT material, SP-drugs has no side effect and also that ITNs is more effective than SP-drugs, and that low birth weight, still birth are effect of malaria in pregnancy. However the respondent believes /agrees that the barriers to the use of IPT for malaria among pregnant women include; hoarding of IPT materials such as ITNs, Repellant etc. by medical staffs and inadequate provision of assistance by the government to the use of IPT for malaria.

REFERENCES

[1] Aribodor, D. N., Nwaorgu, C. O., Eneanya, C. I., Okoli, I., Worley, R. P., and Etaga, H. O. (2009). Association of low birth weight and placental malarial infection in Nigeria. J. Infect. Dev. Ctries., 3(8):620-623.

[2] Ashworth, A. (1998). Effects of intrauterine growth retardation on mortality and morbidity in infants and young children. Eur. J. Clin. Nutr., 52(suppl 1):34–42.

[3] Ayanda, O. (2009). Relative abundance of adult female anophelines mosquitoes in Ugah, Nasarawa State, Nigeria. Journal of Parasitology and Vector Biology, Vol. 1 (1) pp. 005-008.

[4] Breman JG, Alilio MS, Mills A (2004). Conquering the intolerable burden of malaria: what's new, what's needed: a summary. Am. J. Trop. Med. Hyg. 7(Suppl 2):1-15.

[5] Brabin, B. J. (1996). An analysis of malaria and immunity in pregnancy. Bull world health organ., 61(6): 1005-1016.

[6] Deressa, W., Ali, A., and Hailemariam, D. (2008). Malaria-related health-seeking behaviour and challenges for care providers in rural Ethiopia: implications for control. J. Biosoc. Sci. 40: 115–35.

[7] Dicko, A., Mantel, C., Thera, M., Doumbia, S., and Diallo, M. (2003). Risk factors for malaria infection and anaemia for pregnant women in the Sahel area of Bandiagara, Mali. Acta. Trop., 89: 17–23.

[8] Dolan, G., Terkuile, F. O., and Jacoutot, V. (1993). Association of malaria in pregnancy with low birth weight. Trans. R. Soc. Trop. Med. Hyg., 87:620–6.
[9] Gerritsen AAM, Kruger P, van der Loeff FS, Grobusch MP (2008). Malaria incidence in Limpopo Province, South Africa, 1998–2007. Malar. J., 7: 162.
[10] Goodman, C. A., Coleman, P. G., and Mills, A. J. (1999). Cost- effectiveness of malaria control in sub-Saharan Africa. Lancet, 354: 378–385.
[11] Hill J, Kazembe P (2006). Reaching the Abuja target for intermittent preventive treatment of malaria in pregnancy in African women: a review of progress and operational challenges. Trop. Med. Int. Health. 11(4):409-418.
[12] Luxemburger, C., McGready, R., and Kham, A. (2001). Effects of malaria during pregnancy on infant mortality in an area of low malaria transmission. AMJ Epidemiol., 154(5):459-465.
[13] Marchesini P, Crawley J (2004). Reducing the burden of malaria in pregnancy. Mera 2004, Roll Back Malaria Department, WHO, Geneva.
[14] McGregor, L. A. (1984). Epidemiology, malaria and pregnancy. Amer. J. Trop. Med. Hygiene, 33:517-525.
[15] Menendez, C., Ordi, J., Ismail, M., and Ventura, P. (2000). The impact of placental malaria on gestational age and birth weight. J. Infect., 181:1740-1745.
[16] Menon, R. (1972). Pregnancy and malaria. Medical Journal of Malaya, 27(2):115-119.
[17] Minakaw, N., Sonye, G., Mogi, M., Githeko, A., and Yan, G. (2002). The effects of climate factors on the distribution and abundance of malaria vectors in Kenya. J. Med. Entomol., 39: 833-841.
[18] Mockenhaupt, F.P., B. Rong, M. Gunther, S. Beck, H. Till, E. Kohn, W.N. Thompson and U. Bienzle, (2000). Anaemia in Pregnant Ghanaian women: Importance of Malaria, iron deficiency and haemoglobinopathies. Trans. R. Soc. Trop. Med. Hyg., 94: 477-483.
[19] Ndyomugyenyia R, Tukesigab E, Katamanywac J (2009**).** Intermittent preventive treatment of malaria in pregnancy (IPTPp): participation of community-directed distributors of ivermectin for onchocerciasis improves IPTPp access in Ugandan rural communities. Trans. R. Soc. Trop. Med. Hyg. 103, 1221—1228.
[20] Nosten, F., ter Kuile, F., and Malankiri, L. (1991). Malaria in pregnancy in an area of unstable endemicity. Trans Royal Soc. Trop. Med. Hyg., 48: 154-160.
[21] Nwogu, E. C. (2009). Utilization of maternity care in Nigeria. Global Journal of Pure and Applied Sciences, Vol. 15, No. 3, pp: 439-437.
[22] Obiajunwa, P. O., Owa, J. A., and Adeodu, O. O. (2005). Prevalence of congenital malaria in Ile-Ife, Nigeria. Journal of Tropical Pediatrics, Vol. 51, No. 4, pp. 219–222.
[23] Oduwole, O. A., Ejezie, G. C., and Meremekwu, M. (2011). "Congenital Malaria," American Journal of Tropical Medicine and Hygiene, Vol. 84, pp. 386–389
[24] Ogbonnaya, L. U., Adeoye, S., Umeorah, O., and Asiegbu, O. (2005). Concurrent use of multiple antenatal care providers by women utilizing free antenatal care at Ebonyi State
[25] Parise ME, Ayisi JG, Nahlen BL, Schultz LJ, Roberts JM, Misore A, Muga R, Oloo AJ, Steketee RW (1998). Efficacy of sulfadoxine pyrimethamine for prevention of placental malaria in an area of Kenya with a high prevalence of malaria and human immunodeficiency virus infection. Am. J. Trop. Med. Hyg. 59(5):813-822.
[26] Perlmann, P., and Troye-Blomberg, M. (2000). Immunity to malaria. Am. J. Immunology, 80: 229-242.
[27] Plebanski, M., and Hill, A.V. (2000). The Immunology of Malaria Infection. Curr. Opin. Immunol., 12(4): 437-441.
[28] Schultz LJ, Steketee RW, Macheso A, Kazembe P, Chitsulo L, and Wirima JJ (1994). The efficacy of antimalarial regimens containing sulfadoxine-pyrimethamine and/or chloroquine in preventing peripheral and placental Plasmodium falciparum infection among pregnant women in Malawi. Am. J. Trop. Med. Hyg. 51(5):515-522
[29] Shulman CE, Graham WJ, Jilo H, Lowe BS, New L, Obiero J, Snow RW, Marsh K (1996). Malaria as an important cause of anemia in primigravidae: evidence from a district hospital in coastal Kenya. Trans. R. Soc. Trop. Med. Hyg. 90:535-539.
[30] Shulman CE, Dorman EK, Cutts F, Kawuondo K. Bulmer JN, Peshu N, Marsh K (1999). Intermittent sulphadoxine-pyrimethamine to prevent severe anaemia secondary to malaria in pregnancy: a randomised placebo-controlled trial. Lancet . 353:632-636.
[31] Steketee RW, Wirima JJ, Slutsker L, Khoromana CO, Heymann DL, Breman JG (1996). Malaria treatment and prevention in pregnancy: indications for use and adverse events associated with use of chloroquine or mefloquine. Am. J. Trop. Med. Hyg. 55(1Suppl):50-56.
[32] Steketee, R. W., Nahlen, B. L., Parise, M. E., and Menendez, C. (2001). The burden of malaria in pregnancy in malaria-endemic areas. Am J. Trop. Med. Hyg., 64: 28–35.
[33] Sule-Odu, A. O. (2000). Maternal deaths in Sagamu Nigeria. Int. J. Gynaecol Obset., 69(1): 47-49.
[34] Uko, E. K., Emeribe, A. O., and Ejezie, G. C. (1998). Malaria Infection of the Placenta and Neo-Natal Low Birth Weight in Calabar. J. Med. Lab. Sci., 7: 7-10.

[35] Uneke CJ (2007)**.** Impact of Placental Plasmodium falciparum Malaria on Pregnancy and Perinatal Outcome in Sub-Saharan Africa: I: Introduction to Placental Malaria. Yale J. Biol. Med., 80 (2): 39–50.

[36] Verhoeff FH, Brabin BJ, Chimsuku L, Kazembe P, Russel WB, Broadhead RL (1998). An evaluation of intermittent sulfadoxine- pyrimethamine treatment in pregnancy on parasite clearance and risk of low birth weight in rural Malawi. Ann. Trop. Med. Parasitol. 92:141-150.

[37] Wang S, Lengeler C, Smith TA, Vounatsou P, Akogbeto M, Tanner M (2006). Rapid Urban Malaria Appraisal (RUMA) IV: Epidemiology of urban malaria in Cotonou (Benin). Malar. J., 5: 45.

[38] World Health Organisation. (2010). World Malaria Report 2010. www.cdc/malariaepidemiology.com

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 543-550
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Assessment of Heavy Metals and Antibiotic Resistance in Rhizobacteria Isolated from Rhizosphere Soils Contaminated with Tannery Effluents in Bahir Dar, Ethiopia

Melkamu Tamiru[1], Yosef Hamba[2], and Munees Ahemad[3]

[1]Collage of Natural and Computational Science, Stream of Microbial, Molecular and Cellular Debra Birhan University, P.O. Box 455, Debra Birhan, Ethiopia

[2]Department of Molecular Biology and Biotechnology, Pan African University Institute of Basic Science, Technology and Innovation at Jomo Kenyatta University of Agriculture and Technology, P.O. Box 62000-00200, Nairobi, Kenya

[3]Department of Agricultural Microbiology, Aligarh Muslim University, Aligarh-202002, U.P., India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: *Aims:* Pollution of the environment with toxic heavy metals is spreading throughout the world with industrial progress. Metal pollution in industrial areas is of serious environmental concern as these metals like chromium (Cr), nickel (Ni), mercury (Hg), cadmium (Cd), lead (Pb) and cupper (Cu) are known to cause damage to living organisms including human beings. The study investigated the level of heavy metals and antibiotics resistance in bacteria isolated from rhizosphere soils contaminated with tannery effluents.
Methodology and Results: Soil samples were collected from three selected rhizosphere soils of the Tannery effluent contaminated environments and heavy metals resistant rhizobacteria were isolated from soil. A total of twenty one rhizobacteria were isolated from Potassium dichromate supplemented nutrient agar. These isolates were categorized under *Pseudomonas species, Staphylococcus, Clostridium, Klebsiella species, Bacillus species, Listeria species, and Streptococcus species* after biochemical tests. Further, these isolates were assessed for resistance to other heavy metals and antibiotic resistance. Most of these isolate exhibiting maximum resistance against both metals and antibiotics.
Conclusion, Significance and Impact of study: These heavy metal resistant bacteria can be useful for the bioremediation of heavy metal contaminated environment including industrial effluents.

KEYWORDS: Antibiotics, Bacterial resistance, Heavy metals, Soil, Tannery effluents

1 INTRODUCTION

Heavy metal soil contamination is a significant environmental problem because of their toxicity, persistent and non-degradable conditions in the environment (Tam and Wong, 2000; Yuan *et al*., 2004). According to Altaf *et al*., (2008) tannery effluents are ranked as the highest pollutants among all industrial wastes. They are especially large contributors of chromium pollution. Unregulated disposal of chromium-containing effluent in both developing and developed countries has led to the contamination of soil, sediments, surface and groundwater (Altaf *et al*., 2008). Moreover, copper, chromium, cadmium and nickel are known to be the most common heavy metals used and the more widespread contaminants of the environment (Doenmez and Aksu, 1999).

The aim of this study was to investigate heavy metals and antibiotics resistant *rhizobacteria* isolated from tannery effluent contaminated soils. The identification of resistance against different metals may provide a useful tool for the simultaneous monitoring of several toxic metal pollutants in the environment.

Corresponding Author: Yosef Hamba

2 MATERIALS AND METHODS

2.1 STUDY AREA

This study was conducted in Bahir Dar tannery. Bahir Dar is the capital city of the Amahara Region, located in the North-west of Ethiopia on the southern shores of Lake Tana, the source of Abay River (Blue Nile). It is 578 KM (360 miles) south of Addis Ababa, having $11^0$36'N latitude and $37^0$23'E longtude with an elevation of 1840 meters above sea level (Adem and Lamma, 2012). Soil samples were collected from three places at depth of 20cm in plant rhizosphere in sterilized polyethylene bags with the help of a sterilized spatula (Tamer Akkan *et al*., 2013). Equal amount of soils from three sites were mixed well and these composite samples were used for further isolation.

2.2 ISOLATION AND IDENTIFICATION OF CHROMIUM RESISTANT RHIZOBACTERIA

For isolation of chromium resistant rhizobacteria, serial dilution of the soil sample was done. Ten gram soil from composite soil sample was added into 90 ml of distilled water and mixed well (Kasra *et al*., 2007). A serial dilution was made up to 10^{-6} from the soil sample. The concentration of $K_2Cr_2O_7$ was maintained in the stock solution. Nutrient agar plates were prepared and the medium was autoclaved at 121^0C for 15 min. The soil samples were spread plated on media supplemented with $K_2Cr_2O_7$ (100 µg ml^{-1}) and incubated at 28^oC for 3 days. The growth of the bacterial colonies was observed after 48hrs of incubation at 28°C. It was sub-cultured on nutrient agar plate containing 100 µg of potassium dichromate (K2Cr2O7). After incubation, rhizobacterial growth on the media was observed. To obtain pure culture of the isolates serial streaking of single colony was done on Nutrient Agar and preserved for further test. The bacterial isolates were screened on Nutrient Agar (NA) plates supplemented with various concentration of each metal one time by the standard spread plate method *(*Shrivastava *et al*, 2013). Identification of the isolates was done following standard biochemical tests. Biochemical tests like Gram staining, Thyoglycolate test, catalase activity were done for identification of isolates (Holt *et al*., 1994).

2.3 DETERMINATION OF MINIMUM INHIBITORY CONCENTRATION (MIC) OF THE HEAVY METALS

The MIC of the metal for each bacterial isolate was determined on nutrient agar plate supplemented with heavy metals. The heavy metals: Cu^+, Zn^+, Cr^+, Cr^{+3}, Ni^+, Cd^+, Hg^{+2} and Pb^+ were used in the form of ($CuSO_4.5H_2O$, $ZnSO_4.7H_2O$, $K_2Cr_2O_7$, $CrCl_3$, $NiSO_4.6H_2O$, $(CH_3COO)_2Cd.H_2O$, $HgCl_2$ and $(CH_3COO)_2Pb.3H_2O$), respectively; in varying concentration. Stock solutions of the metal salts were prepared by mixing 100ml of distilled water with 10g of metal salt and were added to the respective media in varying concentrations. The concentration of heavy metals gradually increased in nutrient agar until the isolate failed to grow on the metal amended plate. The concentrations varied from 50 to 2000 µg/ml. The MIC was recorded when the isolates failed to show growth on the plates (Shakoori, 1998).

2.4 ANTIBIOTIC SUSCEPTIBILITY TEST

The antibiotic sensitivity of isolated rhizobacterial strains was conducted using the conventional Kirby Bauer disk diffusion method (CLSI, 2007). The rhizobacterial colonies were taken from an agar plate cultures. The plates were incubated at 37 ^{o}C for 24 hours. Then the inoculum were transferred into a tube containing 5 ml of sterile nutrient broth medium and mixed gently to form homogeneous suspension. The broth culture was incubated at 37°C until it achieves or exceeds the turbidity of the test suspension. The broth culture was incubated at 37^oC to examine the zone of growth inhibition. Finally the turbidity was adjusted to 0.5 Mac Farland standards (CLSI, 2007). The results were classified as resistant or sensitive (CLSI, 2007).

2.5 GROWTH PATTERN OF THE MOST PROMISING BACTERIA

The most promising rhizobacterial isolate exhibiting maximum resistance to both metals and antibiotics was selected for growth study under chromium stress. To assess the growth pattern of the rhizobacterial isolate, exponentially grown culture was inoculated into nutrient broth treated with different concentration of chromium (Cr^{3+} and Cr^{6+}) and incubated at 28 ^{o}C. Growth was determined turbid-metrically after interval of 6 hours by measuring optical density at wavelength 540nm (Ahemad and Malik, 2011).

3 RESULTS AND DISCUSSIONS

In the present study, soil samples were collected from the rhizosphere region of the plants grown, Mango (*Mengifera indica*) and Cabbage (*Brassica oleracea*), in chromium contaminated soils in Bahir Dar tannery. Soil sample was taken 6 times from each selected plant rhizosphere. The soil samples collected from the rhizosphere of plants grown in metal polluted environment contain heavy metals resistant bacteria (Soumitra Nath, 2012). Further, a total of 21 rhizobacterial isolates different in colony morphology and pigmentation were picked up randomly from nutrient agar plates. All the isolates further tested for their morphological, cultural and biochemical characteristics.

Rhizobacterial isolates were tested for resistance to heavy metals, Hg^{2+}, Cd^{2+}, Cu^{2+}, Cr^{3+}, Zn^{2+}, Ni^{2+}, Pb^{2+} and Cr^{6+} [in the form of ($HgCl_2$, $(CH_3COO)_2Cd.H_2O$, $CuSO_4.5H_2O$, $CrCl_3$, $ZnSO_4.7H_2O$, $NiSO_4.6H_2O$, $(CH_3COO)_2Pb.3H_2O$, and $K_2Cr_2O_7$), respectively. The rhizobacterial resistance at each concentration of heavy metal was depicted by growth on agar plate containing heavy metals. There was a decline in the growth of the rhizobacteria with increasing concentrations of the heavy metals in the media in contrast to the situation in the control i.e., 0.0 µg ml^{-1} of the metals where there was a profuse/heavy growth by all the organisms. The rhizobacterial load decreased with the increase in concentration of heavy metals indicating toxic effect of the heavy metals on the growth of rhizobacterial isolates (Table3).

Many previous studies reported that many bacterial species isolated from industrial zones had been shown to develop resistance to heavy metals (Osborn *et al*., 1997; Ansari and Malik, 2007). The study by Valentina, (2006) reported that there was considerable contents of Ag, Au, Cr, Cu, Ni, Pb, Zn, As, Bi, Cd, Co, Hg, Mo and Sn were present in industrial soil and bacteria from such soil are frequently tolerant to higher levels of metals than those isolated from unpolluted areas. Also, Ersoy *et al*. (2011) reported that high levels of Ni, Cr, Cu, Co, and Zn were present in the industrial soils as compared with the levels of those metals in forest soil and Cr and Ni values in these locations were 5 times higher than the legal limits. Heavy metals could be spread to these locations in different probable ways. For example, high concentrations of Cr and Ni might be due to the application of waste waters from factories to soil for irrigation purposes, because the drainage channels are so close to the open storage zone of the solid wastes of the chromium factory. Second, the heavy metals might be transferred from the open metallic waste storage zone to the soils by means of the wind (Ersoy *et al*., 2011). In the present study, the total viable count of rhizobacteria was found to be 11.1 x 10^6 in the rhezosphere soils. In a study reported by Abou-Shanab (2007), the number of culturable bacteria in the rhizosphere were 6.6 x 10^6CFU, 14.2- and 9-fold higher than that in the sediment and water, respectively. In the present study, the bacteria count on nutrient agar supplemented with chromium decreased from 11.1 x 10^6 $CFUg^{-1}$ of soil with increasing concentration of chromium from 0 to 100 µg ml^{-1} (Table 1).

Table 1. Bacterial count on chromium supplemented media† from tannery effluent contaminated Rhizosphere soil

Concentration of chromium (µg ml^{-1})	Total viable count (CFU g^{-1} of soil)
0	11.10 x 10^6
50	8.75 x 10^6
100	5.00 x 10^6

Twenty one rhizobacterial isolates which differed in colony morphology and color were selected from potassium dichromate supplemented nutrient agar plates randomly. All the isolates further tested for their morphological, cultural and biochemical characteristics. Further, the rhizobacterial isolates were identified as five *Pseudomonas* Spp., three *Staphylococcus* Spp., four *Clostridium* Spp., three *Klebsiella* spp., two *Bacillus* Spp., two *Listeria* Spp., and two *Streptococcus* spp., (13 gram-positive and 8 Gram- negative), following *Bergey's Manual of Determinative Bacteriology* (Holt *et al.,* 1994).

The isolated bacteria were showed very high degree of resistance to all heavy metals as, MIC values of rhizobacterial isolates varied from 50 to 2000 µg ml^{-1} (table 2). Responses of rhizobacterial isolates to heavy metals were very heterogeneous. The resistance levels in the form of MIC indicated that among the eight selected heavy metals, lead was a less toxic heavy metal showing the growth of rhizobacterial isolates up to 2000 µg ml^{-1}, followed by nickel on which the isolates grew up to 1600 µg ml^{-1}. In contrast to these results previous study by Mohd *et al*., (2012) reported that most of the bacterial isolates showed high resistance to zinc and iron compared to lead. On the other hand, in this study among all the eight heavy metals selected mercury and cadmium were the most toxic inhibiting the growth of isolates in lower concentration, showing no growth above 800 µg ml^{-1} (Table 3).

Table 2. MIC of rhizobacteria in µg ml^{-1} for eight heavy metals

Rhizobacterial isolates	Hg^{+}	Cd^{+}	Cu^{+}	Zn^{+}	Ni^{+}	Pb^{+}	$Cr3^{+}$	$Cr6^{+}$
***Klebsiella* sp. MB1**	400	1000	1400	1200	1600	1400	1200	1200
***Klebsiella* sp. MB2**	500	200	1200	500	1000	1600	1600	600
***Klebsiella* sp. MB3**	600	600	400	400	600	1400	600	600
***Staphylococcus* sp. MB4**	800	600	800	600	1400	1000	600	600
***Staphylococcus* sp. MB5**	100	300	400	200	1000	1800	600	500
***Staphylococcus* sp. MB6**	500	600	800	50	300	1400	600	1200
***Pseudomonas* sp. MB7**	50	50	600	50	1000	1800	1600	500
***Pseudomonas* sp. MB8**	800	1000	800	400	1600	2000	1000	1200
***Pseudomonas* sp. MB9**	200	100	800	1000	1000	1600	600	1000
***Pseudomonas* sp. MB10**	500	500	300	600	1000	1400	1000	1400
***Pseudomonas* sp. MB11**	100	50	800	100	100	1600	600	600
***Clostridium sp*. MB12**	500	1000	800	600	1000	1000	600	1400
***Clostridium sp*. MB13**	800	600	1200	1000	1200	1600	1000	1400
***Clostridium sp*. MB14**	300	400	1200	500	1200	1600	800	800
***Clostridium sp*. MB15**	100	300	500	400	1000	1800	1600	500
***Streptococcus* sp. MB16**	50	100	800	1000	1600	1200	1000	500
***Streptococcus* sp. MB17**	600	500	100	100	1200	1600	600	500
***Listeria* sp. MB18**	300	400	800	1000	1200	1800	1000	1000
***Listeria* sp. MB19**	600	1000	800	1200	1200	1400	600	600
***Bacillus* sp. MB20**	50	400	1200	500	1200	1600	1000	1000
***Bacillus* sp. MB21**	600	100	800	400	1000	600	800	1000

Table 3. Pattern of metal resistance in bacterial isolates from tannery effluent contaminated rhizosphere soil

Metal	Sensitive range				Resistant range				
Mercury	MIC(µg ml^{-1})	50	100	200	300	400	500	600	800
	No. of isolates inhibited	3(14.3)	3(14.3)	1(4.8)	2(9.5)	1(4.8)	4(19.0)	4(19.0)	3(14.3)
Cadmium	MIC(µg ml^{-1})	50	100	200	300	400	500	600	100
	No. of isolates inhibited	2(9.5)	3(14.3)	1(4.8)	2(9.5)	3(14.3)	2(9.5)	4(19.0)	4(19.0)
Copper	MIC(µg ml^{-1})	100	300	400	500	600	800	1200	1400
	No. of isolates inhibited	1(4.8)	1(4.8)	2(9.5)	1(4.8)	1(4.8)	10(47.6)	4(19.0)	1(4.8)
Zink	MIC(µg ml^{-1})	50	100	200	400	500	600	1000	1200
	No. of isolates inhibited	2(9.5)	2(9.5)	1(4.8)	4(19.0)	3(14.3)	3(14.3)	4(19.0)	2(9.5)
Nickel	MIC(µg ml^{-1})	100	300	600	1000	1200	1400	1600	
	No. of isolates inhibited	1(4.8)	1(4.8)	1(4.8)	8(38.1)	6(28.6)	1(4.8)	3(14.3)	
Lead	MIC(µg ml^{-1})	600	1000	1200	1400	1600	1800	2000	
	No. of isolates Inhibited	1(4.8)	2(9.5)	1(4.8)	5(23.6)	7(33.3)	4(19.0)	1(4.8)	
Chromium (Cr^{3+})	MIC(µg ml^{-1})	600	800	1000	1600				
	No. of isolates inhibited	9(42.8)	2(9.5)	7(33.3)	3(14.3)				
Chromium (Cr^{6+})	MIC(µg ml^{-1})	500	600	800	1000	1200	1400		
	No. of isolates inhibited	5(23.6)	5(23.6)	1(4.8)	4(19.0)	3(14.3)	3(14.3)		

†Total number of isolates = 21; Values in parenthesis indicate percentage of the total isolates; MIC = minimum inhibitory concentration

Previous study by Hassen *et al*., (2006), found that copper and chromium were tolerated heavy metals whilst mercury was the most toxic heavy metal for the bacteria. In the same manner, a study by Abou-Shanab *et al.*, (2007) reported that Mercury was the most toxic heavy metals inhibiting bacterial isolates at 0.01 mM followed by cadmium. Also the same results were reported by Laur-Dorina *et al.* (2011) as mercury had the highest toxicity on the bacteria as no colonies developed on 3 mM Hg. In contrast to this finding, Tamer *et al*., (2013), reported that heavy metal resistance of Cd and Cu in isolates was 100% that is less toxic than Mn and Pb in which 90.7% and 67.7% of isolates respectively where resistant.

Most of the bacterial isolates grew well in the presence of low concentrations of the heavy metals, while no bacteria could grow at higher concentrations. Moreover 95.2% of the isolates showed growth when the concentration of Pb^{2+} was above 1000 µg ml^{-1} and for Ni^{2+}, 85.7% of the isolates were resistant, while no isolates could tolerate Hg^{+} above 800 µg ml^{-1}

and for Cd^{+} 4(19.0) were grown on 1000 µg ml^{-1} (Table:4). Further, all the rhizobacterial isolates were also tested for antibiotic susceptibility to nine different antibiotics (vancomycin, co-trimoxazole, ciprofloxacin, nalidixic acid, erythromycine, tetracyclin, cefoxitin, chloramphenicol and gentamicin). In this study, most of the rhizobacterial isolates showed resistance to the antibiotics. Metal resistance has been reported to be associated with antibiotic resistance (Verma *et al*., 2001).The present study indicated that 80.9% of the isolates were resistant to nalidixic acid while 71.4% of the isolates showed resistance to cefoxitin. In contrast, the bacterial sensitivity was maximum to chloramphenicol (19.0%) rhizobacterial isolates were resistant and erythromycin (28.6%) isolates were resistant (Table 5). In the study by Nath *et al*., it was reported that the isolates having high MIC values for a set of metals exhibits high resistance pattern towards a group of antibiotics (Nath *et al*., 2012). A study in India by Tamil *et al*., (2012) reported that the bacterial isolates from tannery showed highest resistance to both heavy metals and antibiotics.

Table 4. Number and Percentage of bacterial isolates resistant to heavy metal at concentration 1000 µg ml^{-1} and above

Heavy metals	No. of bacteria
Pb^{+}	20 (95.2)
Ni^{+}	18 (85.7)
Cr^{3+}	10 (47.6)
Cr^{6+}	10 (47.6)
Zn^{+}	6 (28.6)
Cu^{+}	5 (23.6)
Cd^{+}	4 (19.0)
Hg^{2+}	0 (0.0)

Total number of isolates = 21

Table 5. Percent resistance to antibiotics in rhizobacterial isolates† from tannery effluent contaminated rhizosphere soil

Antibiotics	Number of isolates	Percent resistance
Nalidixic acid (NA)	17	80.9
Cefoxitin (CX)	15	71.4
Co-trimoxazole (COT)	12	57.1
Tetracycline (TE)	6	28.6
Chloramphenicol (C)	4	19.0
Ciprofloxacin (Cip)	9	42.9
Erythromycin (E)	6	28.6
Vancomycin (Va)	11	52.4
Gentamycin (Gen)	10	47.6

†Total number of isolates = 21.

Hundred percent of the bacteria isolates were resistant to at least one of 9 antibiotics tested. In the same manner, Mohd *et al*., 2012, reported that 100% of 24 isolated bacteria were resistant to at least one of 10 antibiotics tested. Multi-resistance was observed in 9.5% of the isolates, for up to 8 antibiotics. The observed multi-resistance pattern to 7 antibiotics agents was 9.5 %, followed by 4.8% and 23.8% respectively to 6 and 5 antibiotics, 19.0% to 4 antibiotics, 9.5 % to 3 antibiotics, 9.5% to 2 antibiotics and 14.3% to 1 antibiotic. In general, a total of eight combinations of the selected antibiotic resistant patterns were observed. For example, 23.8% of the isolates were resistant to five antibiotics in four different combinations where as 19.0% of the isolates exhibited resistance to four antibiotics in four different combinations. In this study among 21 rhizobacterial isolates only 9.5% of the isolates were resistant to eight antibiotics and no isolate showed resistance to all the nine antibiotics (Table 6).

Table 6. Multiple resistant pattern in rhizobacterial isolates to antibiotics † from tannery effluent contaminated rhizosphere soil

Number of antibiotics	Number of resistant isolates (%)	Resistance pattern
2	2 (9.5)	NA, VA (1)
		NA,CIP (1)
3	2 (9.5)	NA,CIP,C (1)
		COT,CX,Gen(1)
4	4 (19.0)	NA, VA, CIP, Gen (1)
		NA,Cip,CX,C (1)
		NA,COT,CX,C (1)
		NA,COT,Cip,CX (1)
5	5 (23.8)	VA,TE,COT,CX,Gen(2)
		NA, VA,COT,E,CX (1)
		NA,COT,CiP,CX,GEN(1)
		NA,VA,Cip,CX,Gen(1)
6	1 (4.8)	NA,VA,COT,Cip,CX,E(1)
7	2 (9.5)	NA,VA,COT,TE,CX,E,Gen(2)
8	2 (9.5)	NA,VA,COT,Cip,TE,CX,E,Gen(1)
		NA,VA,COT,TE,CX,C,E,Gen(1)

†Total number of isolates = 21; Values in parenthesis indicate percentage of the total isolates.
Note: NA = Nalidixic acid, CX = Cefoxitin, COT = Co-trimoxazole, TE = Tetracycline, C =Chloramphenicol, E = Erythromycin, Cip = Ciprofloxacin, VA = Vancomycin, Gen = Gentamycin

In agreement of these findings, many authors have reported extensive metal resistant traits in rhizobacterial isolates belonging to diverse genera and evidenced their implications in bioremediation processes (Wani *et al*., 2007; May *et al*., 2009). Bacterial isolate, *Klebsiella* sp. MB1 was selected for further study due to exhibiting highest resistance to antibiotics and most of the selected heavy metals including Cr^{6+} and Cr^{3+}. A growth pattern study of the *Klebsiella* sp. MB1 with respect to controls was carried out in NB medium supplemented with $K_2Cr_2O_7$ (Cr^{6+}) and $CrCl_3$ (Cr^{3+}) in three different concentrations. The growth of the isolate in nutrient broth was determined by measuring the optical density at 540nm with uninoculated broth as control after interval of each 6 hours by measuring optical density at 540 nm. It was observed that the growth was declined with increasing concentration of both Cr^{6+} and Cr^{3+}. The growth pattern of bacterial isolate MB1 at different time intervals in the presence of 0, 50, 100 and 200(µg ml^{-1}) of $K_2Cr_2O_7$ and $CrCl_3$ are shown in fig. 1 and 2 respectively.

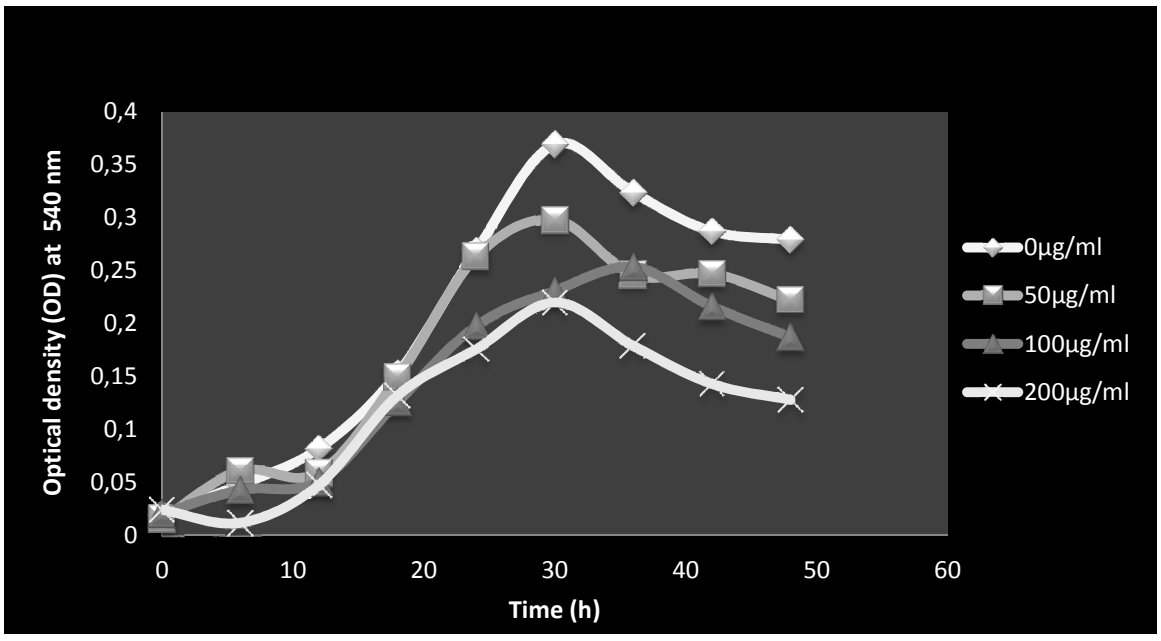


Fig. 1. Growth pattern of Klebsiella sp.MB1 at different concentration of Cr^{6+} ($K_2Cr_2O_7$).

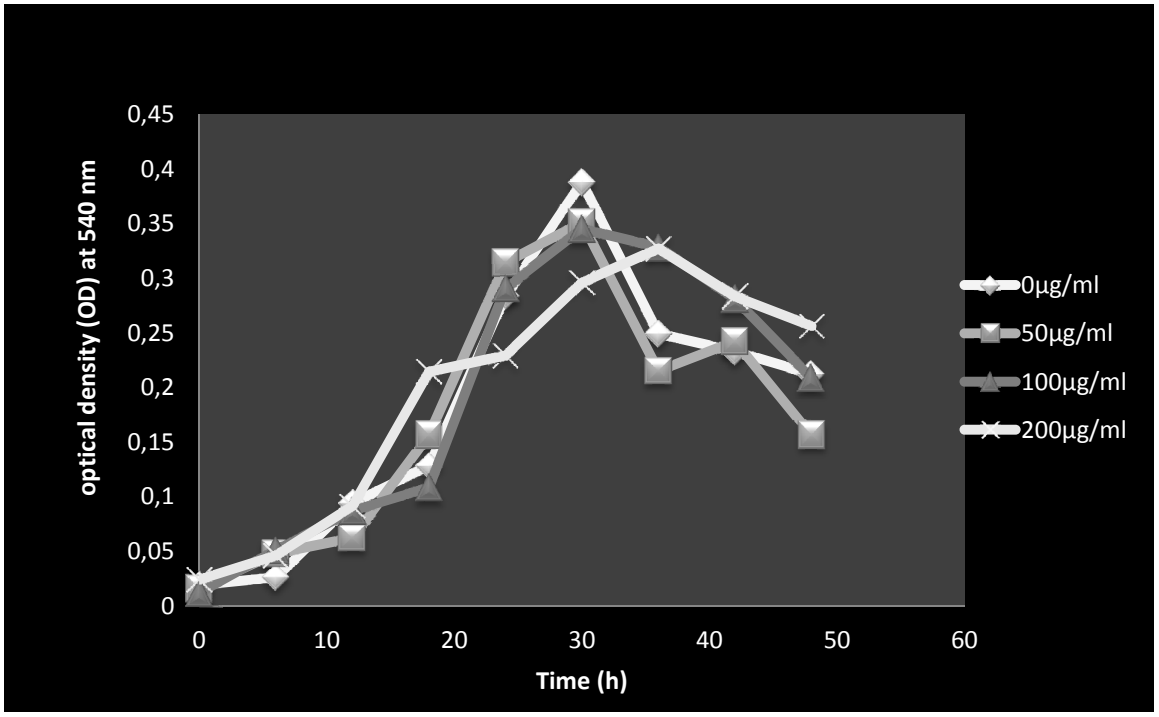


Fig. 2. Growth pattern of Klebsiella sp. MB1 at different concentration of Cr^{3+} ($CrCl_3$).

4 CONCLUSIONS

The industrial effluents are enriched media to grow and spread microbial population, which may be resistant to different metals. The identification of resistance against different metals may provide a useful tool for the simultaneous monitoring of several toxic pollutants in the environment. The present study revealed that the most resistant bacteria towards selected heavy metals and different antibiotics were isolated from tannery effluent contaminated rhizosphere soils. Microbes have adapted to tolerate the presence of metals or can even use them to grow. This study showed that the rhizobacteria isolated from rhizosphere soils contaminated with tannery effluents had considerable resistance to chromium in addition to other metals. Along with heavy metal resistance, bacterial isolates also possessed significant resistance to various antibiotics along with heavy metal resistance. From the results, it could be concluded that the bacterial strains isolated from industrial effluent possessed potential to be used in bioremediation activities. The identification of resistance against different metals in bacterial isolates may provide a useful tool to assess the extent of metal pollution in the environment.

REFERENCES

[1] Abou-Shanab, (2007). Chromate-tolerant bacteria for enhanced metal up take by E/CHHORN/A CROSS/PES(MART.). *International Journal of Phytoremediation,* **9**:91-105

[2] Adem C., and Lamma k., (2012), Analysis of approaches of communication in the fight against HIV/AIDs in higher education institution; *Online Journal of communication and media technology*, **2**

[3] Ahemad M., and Malik A., [2011]; Bioaccumulation of heavy metals by zinc resistant bacteria isolated from agricultural soils irrigated with wastewater*. Bacteriol J DOI*: **10**:3923

[4] Altaf, Masood and Malik, (2008); "Impact of long-term application of treated tannery effluent on the emergence of resistance traits in rhizobium sp. isolated from *trifolium alexandrinum*," *Turkish Journal Biology*, **32**:1-8

[5] Ansari and Malik, (2007). Biosorption of nickel and cadmium by metal resistant bacterial isolates from agricultural soil irrigated with industrial wastewater. *Bioresourse Technology*, **98**: 3149-3153

[6] CLSI, 2007. Performance Standards for Antimicrobial Susceptibility Testing. CLSI Approved Standard M100-S17. *Clinical and Laboratory Standard Institute*, Wayne, PA.

[7] Doenmez and Aksu, (1999). The effect of copper (II) ions on the growth and bioaccumulation properties of some yeasts. *Process Biochemical*, **35**:135-142

[8] Ersoy, Gökhan, Murat and Kemal, (2010). Investigation of heavy metal resistance in some bacterial strains isolated from industrial soil, **34**:423-431

[9] Hassen, Saidi, Cherif and Boudabous, (2006). Resistance of environmental bacteria to heavy metals. *Bioresource Technology*, **64**:7-15

[10] Holt, Krieg, Sneath, Staley and Willams, (1994). *Bergey's Manual of Determinative Bacteriol*. Williams and Wilkins, USA.

[11] Kasra, Ghazifard and Tavakol, (2007). Identification of bacteria resistant to heavy metals in the soils of Isahan provice. *Iranian Journal Science and Technology*, **31**:122.129

[12] Laura-Dorina, Anghel and Jurcoane, (2011). Isolation of heavy metal resistant bacterial strains from the battery manufactured polluted environment, **16**:102-106

[13] May, Rajkumar and Freitas, (2009), Isolation and characterization of Ni mobilizing PGPB repertine soils and their potential in promoting plant growth and Ni accumulation in *Brassica* spp. *Chemosphere*, **75**:719-725

[14] Mohd, Saari, Sung and Danish-Daniel, (2012). Heavy Metals Tolerance and Antibiotics Resistance of Bacteria Isolated from Wild Marsh Clam, *Polymesoda expansa*

[15] Nath, Deb and Sharma, (2012). Isolation and Characterization of Cadmium and Lead Resistant Bacteria. *Global Advanced Research Journal of Microbiology*, **1**:194-198

[16] Osborn, Bruce, Strike, Ritchie, Strike and Ritchie (1997). Distribution, diversity and evolution of the bacterial mercury resistance (mer) operon. *FEMS*. *Microbiology Review*, **19**:239-262

[17] Shakoori, A.R., K.S. Zaidi, and Haq, (1998). Cadmium resistant Enterobacter clacae and Klebsiella sp isolated from industrial effluents and their possible role in cadmium detoxification. *World Journal of Microbiology and biotechnology*, **15**: 249-254.

[18] Shrivastava, Jadon, Singh, and Bhadauria, (2013). Heavy metal tolerance of three different bacteria isolated from industrial effluents. *International journal of pharmaceutical research and bio-science*, **2**:137-147

[19] Soumitra, Nath, Bibhas Deb and Indu Sharma, (2012). Isolation and Characterization of Cadmium and Lead Resistant Bacteria, **1**:194-198

[20] Tam and Wong, (2000). Spatial variation of heavy metals in surface sediments of Hong Kong mangrove swamps. *Environmental Pollute*, **100**:195-205

[21] Tamer Akkan, Ayşenur Kaya and Sadık Dincer, (2013).Antibiotic Levels and heavy metal resistance in gram-negative bacteria isolated from seawater, Iskenderun Organized Industrial Zone. *Journal of Applied Biological Science*, **7**:10-14

[22] Tamil, Anjugam, Archana Devi, Madhan, Kannappan and Chandrasekaran (2012). Isolation and characterization of bacteria from Tannery effluent treatment plant and their tolerance to heavy metals and antibiotics, *Asian Journal experiment of Biological Science*, **3**:34-41

[23] Verma, Srinath, Gadpayle, Ramtake, Hans, and Garg, (2001):nChromate tolerant bacteria isolated from tannery effluent. *Bioresource Technology*, **78**:31-35

[24] Wani, Kahn and Zaidi, (2007). Chromium redaction, plant growth promoting potentials and metal solubilization by Bacillus sp. Isolated from alluvial soil. *Current microbiology*, **54**:237- 243

[25] Yuan, Shi, He, Liu and Jiang, (2004). Speciation of heavy metals in marine sediments from the East China sea by ICPMS with sequential extraction. *Environment*, **30**:769-783

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 551-557
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Classification Based On Stone Inscription Image

Mie Mie Tin[1] and Mie Mie Khin[2]

[1]Informatin Science Department,
University of Computer Studies, Mandalay,
Mandalay, Myanmar

[2]Ministry of Science and Technology,
Department of Advanced Science and Technology,
Naypyitaw, Myanmar

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This paper is intended to develop the Decision Support System of Myanmar Literature shown by Myanmar Stone Inscriptions using Image segmentation and Zernike Moment Magnitudes (ZMM) approach for similarity measure. Myanmar nationals have Myanmar Language, religion and culture. The origin of Myanmar Language and writing is searched stone inscriptions is found. Myanmar alphabets are sculptured on stones through five eras. In this paper, we present Zernike Moment Magnitudes (ZMM) approach based on script feature having the objective of classifying ancient era with the uncertainty that may occur in a classification problem. Describing some methods to classify ancient era using Myanmar alphabets sculptured on stones and getting classification methods are based on Zernike moment magnitudes (ZMM) approach. This paper wants to support automatic classification for Myanmar ancient stone inscription character. It's also providing decision support for Myanmar history. We also use image of Myanmar stone script data.

KEYWORDS: Zernike moment magnitudes (ZMM), Stone-Script, Image segmentation, Decision Support system, Machine Learning, Sensitively Analysis

1 INTRODUCTION

All researchers who have studied the origin and development of the Myanmar script accept that its source was the Brahmi script which flourished in India from about 500 B.C to over 300 A.D. Myanmar are members of Tibet-Myanmar nationalities. The origin of Myanmar is Kan Su Province form north-western part of China.

Myanmar written script is developing Bagan era that is around AD 1110. Earlest script was described by Myasadi stone script or rajakumara stone script. Movement of Myanmar script is written on stone, tuddy /leaf and paper.

In Myanmar Thinbongyi (primer), there are thirty-three consonants. They are named according to their form and nature. In the Myanmar Thinbongyi (primer), there are thirty-eight Thinbons, consonants and vowels.

Consonants are not clear when recited only by themselves. Consonant sounds become clear when they combine with vowel sounds. Consonants are sounds produced by partially or completely blocking air in its passage from the lungs through the vocal tract. Vowels are sounds produced not by blocking air in its passage from the lungs through the vocal tract. In the original Thinbongyi, there are twenty-two vowels. It is necessary to be correct in place of articulation, means of articulation and manner of articulation in reciting Myanmar Language [1].

In this way, consonants have also changed their types by eras. Therefore this paper takes places of itemizing and maintaining records of Myanmar Stone Inscriptions through eras. An organization can have its exact report in time by using the package and it is a great improvement to store data by computerization. Decision analysis is concerned with decisions

under uncertainty and where there are multiple objectives. Decision analysis tackles a problem by decomposing it into more manageable parts. A unique feature of Decision Analysis is how this decomposition is carried out.

This paper used Image segmentation process to get character from stone inscription sheet. We also use OCR recongnization in digital image of stone inscription. ZMM is a method for approximating discrete-valued functions that is robust to noisy data and capable of learning disjunctive expressions. This method can search a completely expressive hypothesis space and thus avoid the difficulties of restricted hypothesis spaces. [2] Decision trees are one of the most widely used classification techniques especially in artificial intelligent. A decision tree is composed of decision points, alternatives, chance point state of nature and payoff. At a decision point, usually designated by a square, the decision maker must select one alternative course of action from a finite number of available ones. These are shown as branches emerging out of the right side of the decision point. A chance point, designated by a circle, indicates that a chance event is expected at this point in the process. That is one of a finite number of states of nature is expected to occur. The assumed probabilities of the states are nature rewritten above the branches. Each state of nature may be followed a payoff, a decision point, or by another chance point. Decision analysis terminology refers to the outcome resulting from making a certain decision and the occurrence of a particular state of nature as the payoff.

2 RELATED WORK

Zied klouedi et.al presented an algorithm for building decision trees in an uncertain environment. The theory of belief functions is used in this algorithm in order to represent the uncertainty about the parameters of the classification problem [3]. Kent e.Holisinger proposed the quantitative approach to decision making. He briefly described the Statistical Decision theory and the decision tree, the most basic technique in decision theory. He concluded that Decision theory provides a useful framework to explore alternatives and quantitative analyses which must be viewed as explorations of possibilities [4].

P.Vannoorenberghe et.al investigates the induction of decision trees based on belief functions theory. They described decision tree for multiple classes. This method consists in combining trees obtained from various two classes [5].

Mie Mie Khin et.al described the methods to classify ancient ear. They considered getting classification methods are based on bays classifier. They conclude that Native Baysin method is accurate in probability decision theory [6].

3 THEORICAL BACKGROUND

Decisions may be categorized as being either pro-grammed or non-programmed. In a programmed decision, the rules for making the decision are explicit. That is, given a certain set of actions will be taken. Programmed decisions are given often incorporated into transaction processing systems, and thus computer systems can make those decisions without human intervention [7]. In designing information system is very important to isolate decisions that can be programmed, thereby relieving human beings of the necessity of making those routine day-to-day decisions.

Non-programmed decisions deal with non-repetitive and ill-defined problems, and require human decision making [8]. Non-programmed decisions are made at all levels within an organization, including operational, technical, and strategic levels. However, as one moves to higher levels of decision making, a greater percentage of decisions made are non-programmed.

Programmed decisions require timely, accurate, and reliable information, whereas non- programmed decisions require a great deal of flexibility with the information system to gain information to make a non-programmed decision [9].

Decision trees classify instances by sorting them down the tree from the root to some leaf node, which provides the classification of the instance. Each node in the tree specifies a test of some *attribute* of the instance, and each branch descending [10].

3.1 BASIC ALGORITHM

Most algorithms that have been developed for learning decision trees are variations as on a core algorithm that employs a top-down, greedy search through the space of possible decision trees. This algorithm, ID3, learns decision trees by constructing them top-down; each instance attribute is evaluated using a statistical test to determine how well it alone classifies the training examples. The best attribute is selected and used as the test at the root node of the tree. A descendant of the root node is then created for each possible value of this attribute.

In many decision-making situations, it is possible to obtain probability estimates for each of the possible states of nature. When such probabilities are available, the expected value approach can be used to identify the best decision alternative. The expected value approach evaluates each decision alternative in terms of its expected value. The decision alternative that is recommended is the one that provides the best expected value. Let us first define the expected value of a decision alternative and then show how it can be used for the decision problem.

4 DATASET

This paper uses stone inscription from Bagan era. It was discovered at the foot of Myazedi Pagoda near Myinkaba Village to the south of old Bagan. A similar stone inscription was found in an old building near Myazedi Pagoda. It is now set up at the southeast corner of the precinct of Myazedi Pagoda. Both stone pillars have each four faces on which are inscribed in Pali, Pyu, Mon and Myanmar languages recording the same subject. The Myazedi stone inscription was one of the earliest writings discovered so far in the history of Myanmar literature.



Fig. 1. Input Form of Stone Inscription

5 RESULTS

In this system, input data is scanning data and one sentence or one sheet of stone inscription. This stone inscription includes vowels, consonants and original vowels. To classify this stone inscription, decision maker needs to know the relevant character of different eras. When one character is chosen, era relevant characters are viewed and decision maker chooses appropriate era and it is counted increase one time. We also use image segmentation method and fine image similarity results. We get the counting results for each character.

Myanmar stone inscriptions developed step by step in AD 11 to AD 20. It is showed in Fig 2.

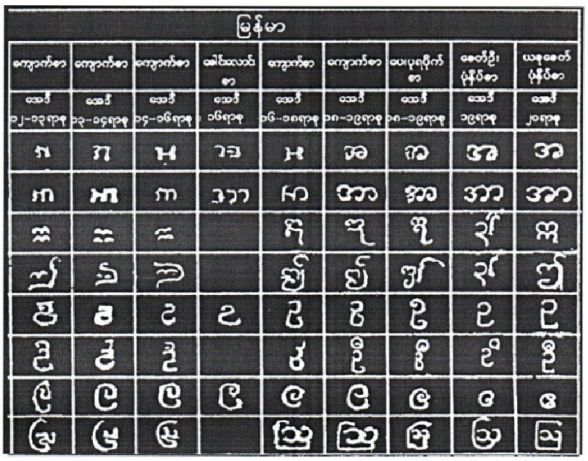
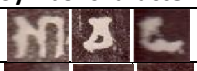


Fig.2. Development Hand Writing Character between Eras

Table 1 shows the development of Myanmar alphabets and Myanmar alphabets sculptured on stones through six eras.

Table 1. Difference Character form Between Eras

Eras	Symbol character
Bagan era	
Pinya era	
Innwa era	
Taunggo era	
Nyanungyan era	
Konbaung era	

This simple, data is one sheet stone inscription and total count number is 24 characters. The results of state nature shows in table 2.

Table 2. State of Nature

Decision Alternatives	Possible Counting		
	Consonants(S1)	Basic Vowels(S2)	Original Vowels(S3)
Bagan era (d1)	3	3	4
Pinya era (d2)	2	2	1
Innwa era (d3)	0	5	0
Taunggo era (d4)	1	1	1
Nyaungyan era (d5)	0	0	0
KonBaung era (d6)	1	0	0

Let N = the number of possible states of nature

$P(s_j)$ = the probability of state of nature s_j

$P(s_j) \geq 0$ for all states of nature

$$\sum_{j=1}^{N} P(s_j) = 1 \qquad (1)$$

The expected value (EV) of decision alternative d_j is defined as follows;

$$EV(d_i) = \sum_{j=1}^{N} P(S_j) V(d_i, S_j) \qquad (2)$$

V (*di,S j*) = payoff values

The expected value of a decision alternative is the sum of weighted payoffs for the alternative. The weight for a payoff is the probability of the associated state of nature and therefore the probability that the payoff occurs.

Suppose Stone Inscription Department management believe that s_1,s_2 and s_3 are state of nature, have 0.29 probability of occurrence and that s_2, state of nature, has a 0.46 probability and that s_3, state of nature, has a 0.25 probability and P(s1) = 0.29 , P(s2) = 0.46 and P(s3)=0.25 .Using the payoff values $V(d_i, s_j)$ shown in equation (2), expected values for the three decision alternatives can be calculated. We consider that stone inscription is Bagan era.

$EV(d_1)$ =3.25, $EV(d_2)$=1.75,

$EV(d_3)$ =2.30, $EV(d_4)$ = 1,

$EV(d_5)$ = 0, $EV(d_6)$ = 0.29

Thus, according to the expected value approach, since d_1 has the highest expected value (3.25), d_1 is the recommended decision. The calculations required to identify the decision alternative with the best expected value can be conveniently carried out on a decision tree.

This system is tested with different form of Myanmar Stone Inscription. This experiment is more than ten time and all answers are right. Probability theory is exactly classify these tests and easily classified their related ears. In this case, decision maker must be experience skills and knowledge.

6 SENSITIVELY ANALYSIS

One approach to sensitively analysis is to consider different probabilities for the state of nature and then recomputed the expected value for each of the decision alternatives repeating several times [11].

Obviously, we could continue to modify the probabilities of the state of nature and begin to learn more about how search changes affect the recommended decision. The only drawback to this approach is that there will be numerous calculations required to evaluate the effect of several possible changes in the state of nature probabilities.

For the special case of decision analysis with two state of nature, the sensitivity analysis computations can be eased substantially through the use of a graphical procedure. Let us demonstrate this procedure by further analyzing the stone Inscriptions Decision problem. In this section begin by denoting the probability of state of nature consonants (s_1) and vowels (basic vowels and original vowels - s_2). That is,

$p(s_1) = p$

Thus,

$p(s_2) = 1 - p(s_1) = 1-p$

The expected value for Decision alternative d_1 can then be written as a function of p.

$EV(d_1) = -4p+7$, $EV(d_2) = -p+3$,

$EV(d_3) = -5p+5$, $EV(d_4) = -p+2$,

$EV(d_5) = 0$, $EV(d_6) = p$

Thus, this section have developed two set of three linear equations that express the expected value of the six decisions alternatives as a function of the probability of state of nature s_1.

In equation,

Thus $-p+3 = -5p-5$,

$p = 0.5$

Whenever, $p = 0.5$, each decision alternatives will provide the same expected value in this section can now conclude that for $p<0.5$, decision alternatives d_1 provides the largest expected value, and that for $p>0.5$, decision alternatives d_1 provides the largest expected value. Since p is simply the probability of state of nature s_1 and $(1-p)$ is the probability of state of nature s_2. In this section, how changes in the state of nature probabilities affect the recommended decision alternatives can be found. With a different sensitivity analysis graph, d_1 could be the best decision alternative for certain value of p.

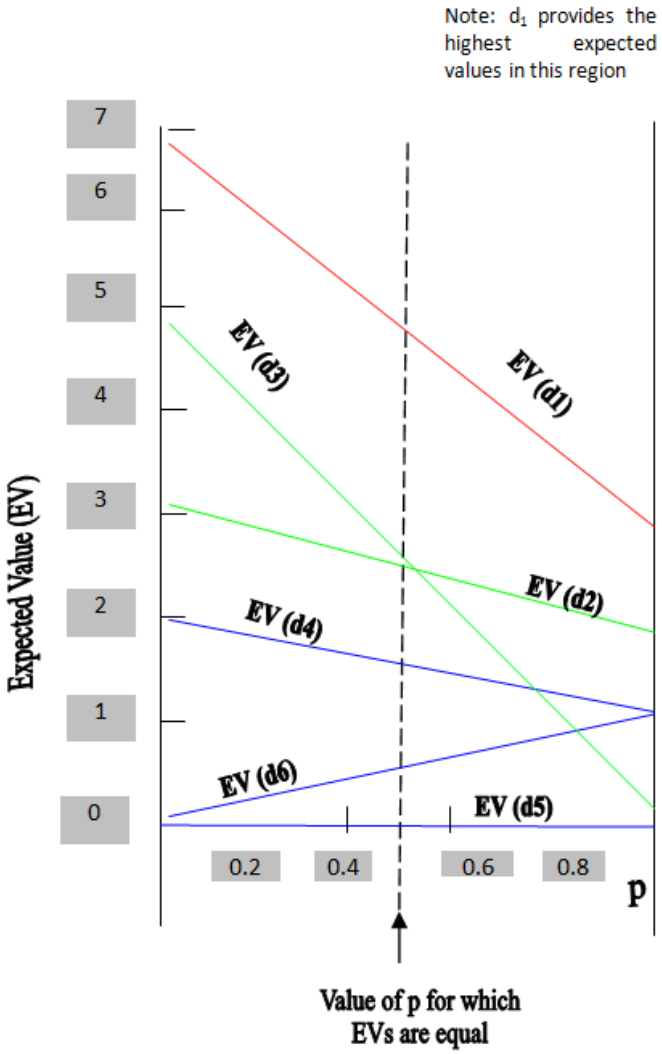


Fig 3. Expected value as a function of p

7 CONCLUSION

In this paper, we describe the method of probabilistic approach and show the expected value results. In our result, probability decision theory makes the uncertainty problem accurate. But, this case depends on the amount of dataset. This decision will support the study of historical and cultural significances of the inscription. Further studies are to classify the result using other machine learning technique.

REFERENCES

[1] Aye Maung: *Selected Bagan Stone Inscriptions*.1st Ed.

[2] Danial Md Nor**,** Rosli Omar , M. Zarar M.Jenu and Jean-Marc Ogier, "Image Segmentation And Text Extraction: Application To The Extraction Of Textual Information In Scene Images", *International Seminar on Application of Science Mathematics(ISASM2011) ,2011.*

[3] Zied Elouedi, khaked mellouli and philippe Semets: *Decision trees using the belief functional theory*, 2000.

[4] Kent E.Holisinger :*Decision Making Under Uncertainty: Statistical Decision Theory*, 2001.

[5] P.Vannoorenbenbrghe and T. Denoeux :*Handling uncertain labels in multiclass problems using belief decision trees*,2002.

[6] Mie Mie Khin, Chit Su Haling and Saw Thanda Myint . *"*Classification Method to support decision making stone inscriptions" ,*ICCA, 2006.*

[7] T. Biswas:*Decision Making Under Uncertainty,* Macmillan, 1997.

[8] C.A Holloway: *Decision Making Under Uncertain. Models and choice*, Prentice-Hall, 1979.

[9] PG Moore, ,H- Thomas, DW.Bunn and J.Hampton :*Case Studies in Decision Analysis*, penguin,1976.

[10] H. Raifa and R.Schlaifer: *Applied statistical Decision Theory, Harvard University Press*, 1961.

[11] Ban croft, G and G.O' Sullivan:*Quantative methods for Accounting and Business studies*, MC Graw-Hill 1993.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 558-565
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Influence of TV Dramas on the Dressing Style and Way of Talking of Women in Pakistan: A Case Study of Karor Lal Eason, Pakistan

Faisal Azeez[1], Muhammad Mukhdum Ali[2], Malik Muhammad Sher Ali Juni[2], Ch. Aqeel Ashraf[3], Salman Amin[2], Irfan Haider[4], Atif Umair[5], and Javeria Kareem[2]

[1]Lecturer Department of Communication Studies, University of Sargodha, Pakistan

[2]Department of Communication Studies, University of Sargodha, Pakistan

[3]Teaching Assistant; Department of Communication Studies, University of Sargodha, Pakistan

[4]Department of Business Administration, University of Sargodha, Pakistan

[5]Research Assistant Department of Communication Studies, University of Sargodha, Pakistan

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: This study indicates the "Influence of TV Dramas on the Dressing Style and Way of Taking of Women in Tehsil Karor Lal Eason District Layyah". In this way data was collected from one hundred women who belong to 16 to 30 years age group and have access to cable network. The present study documented the time spending, watching habits, favorite channels .Analysis show that Indian entertainment channels are most popular among the respondents and they are much impressed from the Indian dramas and they sometimes use Hindi words in their daily life conversation with their family members and relatives. Results further indicated that Indian culture is penetrating in our society due the popularity of Indian dramas and film industry in our society.

KEYWORDS: females, Indian dramas, language, dressing, interaction, cultivation, impact of dramas.

1 INTRODUCTION

Media is the representative of society and is playing influential role in the society. Media is playing very important role in our society, due to alien media; Pakistani society is in danger zone. Cable television viewership is no more restricted to the upper-middle class only; with the availability of low-priced television and cable connection, it has become a common household facility for the lower class as well. Viewers have access to a variety of channels from local to foreign, which provide them an opportunity to watch all types of programmers. Zia (2003) stated that the reasons for this rapid growth of cable television to include easy access, low cost, access to satellite channels and a huge television viewer-ship interested in entertainment only. The Muslims were highly affected by the Hindu‟s culture because of living with them together for a longer period in Sub-Continent. In this way, now we are facing cultural conflict and identity crisis at a large scale (Murtaza, 2007). Culture or civilization is a complex whole which includes knowledge, belief, art, law, customs and other capabilities and habits acquired by man as a member of society (Lane and Ersson, 2007).

People like Indian films, dramas and even ads and they learn a lot of things from the foreign media. Culture is a backbone of any society; it is the identification of a nation. Satellite transmission is putting a great influence on Pakistani society, but after the cable transmission the power of influence is increasing. Pakistan is a Muslim country and Pakistani culture is the unique pattern of belief, ideas, values highly influenced by the religion of Islam. Islam in Pakistan sets the code of ethics in the cultural life for the people of Pakistan. But People gained western and Indian culture due to acculturations modernization

and westernization. Pakistan has an impact of Indian dressing culture as well. Now, people like to wear Sarhi, Patiala Shalwar, Chori Pajama, sleeveless dress, short shirts and less use of chadar (veil) etc. (Batool, 2007).

In Pakistan, our drama industry made a sudden impact on minds of peoples. Our Pakistani drama channels such as Indus Vision, ARY digital, Hum TV and Geo entertainment, etc., Are highly influenced by Indian and western channels and trying to compete with these channels to serve as the translator for our society. They are losing its cultural identity by showing off, glamour, romance, etc. The Indian dramas &films have frequent and intensive negative impact on our social, cultural, religious beliefs and values of Pakistani youth. We all are accepting it. The effects are clearly visible on lifestyles, food, dressing, language, traditional celebrations and religion. When we look around us, find fashion everywhere, girls or boys wearing fashionable clothes, sitting together, full makeup, stylish haircuts etc. Teenagers are fond of burgers, coke and hotling thus; we can say that the media is now introducing new trends, behaviors, attitudes and standards for a modern life which greatly affected the society.

Today media play an important role in the promotion of Hindi language in Pakistan. Because people, mostly watch Indian programs and they adopt many Hindi words. They use Hindi words in daily routine e.g. didi (sister) “jeej” (brother in law) “shanty”(sakoon) “vishwas” (trust) “pati” (husband). Indian television shows have contributed heavily to the Sanskritisation of Urdu in Pakistan, and it has been reported that many Hindi words such as Namaste , maharani and chinta , which have been an inherent part of Sanskritized Hindi, have entered standard usage in Pakistan due to the influence of these soaps and Bollywood movies and Indian dramas. Media present the modernization and westernization and it has a negative impact on the original culture, gifted by Islam, but we are not denying the bad effects of the Indian style of dressing that we have adapted. The examples are wearing off Sarhi, Sleeveless, dressing, short shirts, less use of cheddars, etc.… On special occasions ladies use to wear Indian culture to show off. People have learned these things through Indian dramas and movies. Therefore, objectives of this study are following.

- To explore how viewing the Indian dramas affect the viewers.
- To check either the Indian media trying to cultivate their culture in our society.
- To check, how much Indian dramas lead to adoption of Indian language.
- To check, how much Indian dramas lead to adoption of Indian dresses.

2 HYPOTHESIS

- Greater the exposure to cable television greater the effect on the language and dressing of females in village Wara Sehran Tehsil Karor Lal Eason.
- There is no impact of Indian dramas on language and dressing of females of village Wara Sehran Tehsil Karor Lal Eason.
- Most of the Starplus viewers use Hindi words in their daily life.
- Indian dressing is the most influencing variable in Pakistani society. S

3 LITERATURE REVIEW

The focal point of this study is to evaluate the effects of on women‟s life patterns in respect of language and dressing style in village Wara Sehran Tehsil Karor Lal Eason. Joshi (1985) has surveyed the participation of women in decision making at Indian television (Door Darshan). A survey of women viewers in Madras city indicates the superficiality of women‟s programs. But my study focuses on the impact of Indian dramas on females regarding the dressing and language. (Krishnaswamy, 1986 as cited in Tamakuwala, 2011). A study conducted by Saleem (1994) “Cultural Imperialism: A case study of the impact of dish antenna on Pakistani society” concluded that dish antenna‟s programmers are successfully influencing the socio-cultural and religious beliefs and values of Pakistani viewers. An alarming issue came to light that projection of other cultures and values has compelled 36 percent respondents from all to think that Islam is a conservative religion and they appreciated socioeconomic and religious values of western societies.

A survey conducted by Rahim (1994) indicated the change in the lifestyle of women in Hyderabad. He reports the changes in the behavior of typical housewives in many ways. The interaction with husband and children rejoiced. Time spend in socialism also decreased. Cooking pattern changed, resulting in the introduction of new dishes. Dress, outlook and appearance were disturbed along with language. The effect of dish antenna on PTV dramas by Noreen Shafiq (1995) concluded that the number of private satellite channels was increasing. PTV was not producing new and interesting programmers, for the public. The standard of programmers was falling. With the arrival of dish antenna people liked to watch

Zee TV and enjoyed BBC. Now there were ten channels in Urdu language at the same time, so one could judge the position of PTV.

Shahbaz (2004) emphasizes on the influence or impact of daily night transmission of Star Plus family dramas on social and cultural values and norms of Pakistani youth of the middle class. The survey research concludes that the social-cultural thinking of Pakistani youth is under the foreign cultural values through these Star Plus dramas. They are also affecting the language, fashion, food and architect, social behavior and daily life style of Pakistani society. These dramas have increased the generation gap. And through these dramas, Pakistani youths have become more money oriented. They have created an impact on the “lifestyle” of middle class Pakistani youth and influenced the thoughts of modernist and traditionalist thinkers. Star plus is actually interred mingling the eastern and western culture resulting in the formation of an „International Culture‟ and promoting more liberalism and modernism in Pakistani society and youth. They have an impact on social interactions and on norms and values of youngsters and have increased the desires, demands and idealism in Pakistani youth. These Star Plus dramas have frequent and intensive negative impact of Pakistani youth‟s social and cultural norms and values.

The Cultivation Theory asserts that heavy viewers' attitudes are cultivated primarily by what they watch on television. Gerbner views this television world as "not a window on or a reflection of the world, but a world in itself" (McQuail, 1993: 100). Cultivation Theory, in its most basic form, suggests that television is responsible for shaping or „cultivating‟ viewers‟ conceptions of social reality. The combined effect of massive television exposure by viewers over time subtly shapes the perception of social reality for individuals and, ultimately, for our culture as a whole. Thus, cultivation research is in the effects tradition. Cultivation theorists argue that television has long-term effects which are small, gradual, indirect but cumulative and significant. Nonetheless, the Gerbner‟s work presents a Social Psychology Theory on communication effect on persuasion as related mass media. He argues that the mass media cultivate attitudes and values which are already present in the culture. Media maintains and propagates these values amongst members of a culture, thus binding it together. The Cultivation Theory got its start with the cultivation hypothesis, created by George Gerbner, which attempts to understand how "heavy exposure to cultural imagery will shape a viewer's concept of reality" (Pierce, 2007).

4 METHODOLOGY

Researchers used a survey method to investigate the impact of Indian dramas on language and dressing of females. The target population is the females of village Wara sehran and 100 sample sizes are taken to investigate this study. Cluster sampling was used in the research in which researchers defined different groups of female according to age. The age groups are 16 to 20, 21 to 24 and from 24 to 30. The unit of analysis of the present study is females of different age groups. Researchers measured the effect of Indian dramas on language and dressing.

ANALYSIS

Table 1		Age		Total	
16-20		21-24		25-30	
Do you like to watch cable television?	Alone	Count	17	15	6	38
% of Total	17.0%	15.0%	6.0%	38.0%		
Along with someone	Count	27	22	11	60	
% of Total	27.0%	22.0%	11.0%	60.0%		
Total	Count	45	38	17	100	
% of Total	45.0%	38.0%	17.0%	100.0%		

Table 1 shows that 60% Respondents like to watch cable television along with someone between them 27% belongs to 16-20 age groups, 22% belong to 21-24 age groups and 11% belongs to 26-30 age groups. 38% Respondent like to watch cable television along between them 17% belongs to 16-20 age groups, 15% belong to 21-24 age groups and 6% belong to 25-30 age groups.

Table 2		Age		Total	
16-20		21-24		25-30	
Since when do you have a cable connection at home?	1 year	Count	14	13	5	32
	% of Total	14.0%	13.0%	5.0%	32.0%	
	2 years	Count	10	7	5	22
	% of Total	10.0%	7.0%	5.0%	22.0%	
	3 years	Count	12	7	4	23
	% of Total	12.0%	7.0%	4.0%	23.0%	
	More than 3 years	Count	9	11	3	23
	% of Total	9.0%	11.0%	3.0%	23.0%	
	Total	Count	45	38	17	100
	% of Total	45.0%	38.0%	17.0%	100.0%	

Table 2 shows that 32% Respondents have a cable connection at their home from one year between them 14% belongs to 16-20 age group, 13% belongs to 21-24 age group, and 5% belongs to 25-30 age group. 23% Respondents have cable connection at their home from 3 and more than 3 year between them 12% belongs to 16-20 age group, 7% belongs to 21-24 age group, 4% belongs to 25-30 age group. 22% Respondents have cable connection at their home from 2 years between them 10% belongs to 16-20 age group, 7% belongs to 21-24 age group, 5% belongs to 25-30 age group.

Table 3		Age		Total	
16-20		21-24		25-30	
How many hours you daily watch cable television?	1 to 2 hours	Count	19	15	8	42
	% of Total	19.0%	15.0%	8.0%	42.0%	
	2 to 4 hours	Count	12	12	4	28
	% of Total	12.0%	12.0%	4.0%	28.0%	
	More than 4 hours	Count	14	11	4	29
	% of Total	14.0%	11.0%	4.0%	29.0%	
	Total	Count	45	38	17	100
	% of Total	45.0%	38.0%	17.0%	100.0%	

Table 3 shows that 42% Respondents watch daily cable television from 1 to 2 hours between them 19% belongs to 16-20 age groups, 15% belongs to 21-24 age groups, 8% belongs to 25-30 age groups. 29% Respondents daily watch cable television more than 4 hours between them 14% belongs to 16-20 age group, 11% belongs to 21-24 age group, 4% belongs to 25-30 age group. 28% Respondents daily watch cable television from 2 to 4 hours between which 12% belongs to (16-20) and (21-24) age group and 4% belong to 25-30 age groups.

Table 4		16-20	21-24	25-30	
Which cable television channel do you usually watch?	star plus	Count	19	17	14	50
% of Total	19.0%	17.0%	14.0%	50.0%	
Colors	Count	6	5	0	11
% of Total	6.0%	5.0%	.0%	11.0%	
zee TV	Count	16	15	3	34
% of Total	16.0%	15.0%	3.0%	34.0%	
Life ok	Count	4	1	0	5
% of Total	4.0%	1.0%	.0%	5.0%	
Total	Count	45	38	17	100
% of Total	45.0%	38.0%	17.0%	100.0%	

Table 4 shows that 50% Respondents mostly watch Star plus between them 19% belongs to 16-20 age groups, 17% belongs to 21-24 age groups and 14% belong to 25-30 age groups. 34% Respondents watch Zee TV between them 16% belongs to 16-20 age groups, 15% belongs to 21-24 age group and 3% belongs to 25-30 age groups. 11% Respondents watch colors between them 6% belongs to 16-20 age groups, 5% belongs to 21-24 age group and 0% belong to 25-30 age groups. 5 % Respondents watch Life ok between them 4% belongs to 16-20 age groups, 1% belongs to 21-24 age groups and 0% belong to 25-30 age groups.

Table 5		16-20	21-24	25-30	
Do you prefer Indian dramas are to be the best source of information on new designs and fashion trends?	Agree	Count	8	6	5	19
% of Total	8.0%	6.0%	5.0%	19.0%	
Strongly agree	Count	22	20	8	50
% of Total	22.0%	20.0%	8.0%	50.0%	
Disagree	Count	9	8	4	21
% of Total	9.0%	8.0%	4.0%	21.0%	
Strongly disagree	Count	6	4	0	10
% of Total	6.0%	4.0%	.0%	10.0%	
Total	Count	45	38	17	100
% of Total	45.0%	38.0%	17.0%	100.0%	

Table 5 shows that 50% Respondents are strongly agreed that Indian dramas are the best source of information on new design and fashion trends between them 22% belongs to 16-20 age, 20% belongs to 21-24 age group and 8% belong to 25-30 age groups. 21% Respondents are disagreed that Indian dramas are the best source of information on new design and fashion trends between them 9% belongs to 16-20 age, 8% belongs to 21-24 age group and 4% belong to 25-30 age groups. 19% Respondents are agreed between them 8% belongs to 16-20 age, 6% belongs to 21-24 age group and 5% belong to 25-

30 age groups. 10% Respondents are strongly disagreed between them 6% belongs to 16-20 age, 4% belongs to 21-24 age groups.

Age			Total			
Table 6		16-20	21-24	25-30		
I like to wear Indian dress formally?	Agree	Count	11	9	2	22
% of Total		11.0%	9.0%	2.0%		22.0%
Strongly agree	Count	12	9	3		24
% of Total		12.0%	9.0%	3.0%		24.0%
Disagree	Count	10	6	3		19

Table 6 shows that 35% Respondents are strongly disagreed to wear Indian dresses formally between them 12% belong to 16-20 age, 14% belong to 21-24 age and 9% belong to 25-30 age. 24% Respondents are strongly agreed to wear Indian dresses formally between them 12% belong to 16-20 age, 9% belong to 21-24 age and 3% belong to 25-30 age . 22% Respondents agreed to wear Indian dresses formally between them 11% belong to 16-20 age, 9% belong to 21-24 age and 2% belong to 25-30 age. 19% Respondents are strongly disagreed to wear Indian dresses formally between them 10% belong to 16-20 age, 6% belong to 21-24 age and 3% belong to 25-30 age.

Age			Total			
Table 7		16-20	21-24	25-30		
I have learned Hindi words evidently from Indian dramas?	Agree	Count	17	11	4	32
% of Total		17.0%	11.0%	4.0%		32.0%
Strongly agree	Count	23	17	11		51
% of Total		23.0%	17.0%	11.0%		51.0%
Disagree	Count	4	5	1		10
% of Total		4.0%	5.0%	1.0%		10.0%
Strongly disagree	Count	1	5	1		7
% of Total		1.0%	5.0%	1.0%		7.0%
Total	Count	45	38	17		100
% of Total		45.0%	38.0%	17.0%		100.0%

Table 7 shows that 51% Respondent are strongly agreed that they have learned Hindi words evidently from Indian dramas among them 23% belongs to 16-20 age group, 17% belongs to 21-24 age groups and 11% belongs to 25-30 age groups. 32% Respondents are agreed between them 17% belongs to 16-20 age group, 11% belongs to 21-24 age groups and 4% belong to 25-30 age groups. 10% Respondents are disagreed that they have not learned Hindi words evidently from Indian dramas among them 4% belongs to 16-20 age group, 5% belongs to 21-24 age groups and 1% belongs to 25-30 age groups. 7% Respondents are strongly disagreed between them 1% belongs to 16-20 age group, 5% belongs to 21-24 age groups and 1% belong to 25-30 age groups.

Age			Total		
Table 8		16-20	21-24	25-30	
I use to speak Hindi words during my conversation with others usually?	Agree	Count	4	5	1	10
	% of Total	4.0%	5.0%	1.0%	10.0%	
	Strongly agree	Count	6	5	2	13
	% of Total	6.0%	5.0%	2.0%	13.0%	
	Disagree	Count	18	11	5	34
	% of Total	18.0%	11.0%	5.0%	34.0%	
	Strongly disagree	Count	17	17	9	43
	% of Total	17.0%	17.0%	9.0%	43.0%	
	Total	Count	45	38	17	100
	% of Total	45.0%	38.0%	17.0%	100.0%	

Table 8 shows that 43% Respondents are strongly disagreed that they do not use to speak Hindi words during their conversation with others, usually among them 17% belongs to 16-20 age group, 17% belongs to 21-24 age and 9% belongs25-30 age. 34% Respondents are disagreed that they do not use to speak Hindi words during their conversation with others, usually among them 18% belongs to 16-20 age group, 11% belongs to 21-24 age and 5% belongs25-30 age. 13% Respondents are strongly agreed that they use to speak Hindi words during their conversation with others, usually among them 6% belongs to 16-20 age group, 5% belongs to 21-24 age and 2% belongs25-30 age. 10% Respondents are agreed between them 4% belongs to 16-20 age group, 5% belongs to 21-24 age and 1% belongs25-30 age.

5 DISCUSSION

H1 states that greater the exposure of cable television greater the effect on the language and dressing on the females of village Wara Sehran. This hypothesis 29% proved females of age group from 16 to 20 and 21 to 24 mostly spend more than 4 hours in watching Indian dramas and the impact of these dramas languages and dressing on the females respectively. But it's 42% not proved females spend 1 to 2 hours in watching Indian dramas.

H2 states there is no impact of Indian dramas language and dressing on the females of village Wara Sehran this hypothesis disapproved because there is an impact of these dramas on social cultural aspects on the Pakistani society.

H3 states "That most of the star plus viewers use Hindi words in their life". H3 is proving more the 42% people use different Hindi words in their daily life some people use these words consciously and some unconsciously use to them. 51% Respondent agreed that they learned the words of Hindi language evidently from Indian dramas.

H4 states that "Dressing is the most influencing variable in Pakistani society." H4 is disproved because 57% Respondent strongly disagreed to wear Indian dresses casually and 35% formally. 24% people said yes we are victim of star plus dressing even they know that this kind of dressing like sari and sleeveless shirts are not according to the Islam but they like to wear it proudly.

The general findings revealed that the majority respondents had cable connection at their home from one year. Majority respondent preferred to watch star plus and their favorite watching time are after 7.p.m. According to the results majority of respondent themselves have control over the remote. So we should create awareness among people about the importance of language and about the bad impacts of other language on our identification. Ali (2001) and Shahbaz (2004) conducted studies on the "Impact of satellite television channels on the people living in Lahore" and the "Impact of Star Plus dramas on youth in Pakistan" respectively, also emphasizes on the influence of Star Plus family dramas on social and cultural values and norms of Pakistani youth of the middle class. The survey research concludes that social-cultural thinking of Pakistani youth is under the influence of foreign cultural values. They are also affecting language, fashion, food and Architecture, social

behavior and daily lifestyle of Pakistani society. The eastern and western cultures are intermingled in these dramas, resulting in an „international culture‟ and promoting liberalism and modernism in Pakistani society.

6 CONCLUSION

This study explored the "impact of Indian drama‟s on language and dressing of females of village Wara Sehran tehsil Karor lal Eason, Pakistan." Many people use different words in their routine life the major source of their learning is Indian dramas. One thing is good that the majority of people dislike Indian dressing and avoids to wear it. But we should take steps about prevailing Indian dressing in Pakistani society and media campaign might be beneficial for it. Use Hindi words and Indian dressing is a biggest hurdle in the way of our success by and by we are going far away from our identification. The country which we got on the name of Islam today is following these kinds of un-Islamic things merging into Pakistani society. The time is passing speedily if we fail to block the way of these un-Islamic things the day is not far away when we lose our dignity. This research concluded that it is the responsibility of PEMRA that there must be broadcast those types of programs which are related to the ethics and values of our culture as well as presenting the real ideology of Pakistan.

REFERENCES

[1] Ali,D (2001), impact of satellite TV channels on the people living in Lahore. Master thesis, Department of Sociology, university of Punjab, Lahore.

[2] Batool, U. (2007). What are impacts of Indian dressing in Pakistan? Society and politics. Available at this source: http://www.blurtit.com/q459730.html. [Accessed October 2010].

[3] Joshi, P. C. (1985). An Indian personality for television: Report of the working group on Software for Doordarshan, New Delhi: Government of India.

[4] Lane, J., and S. Erison. (2007). Culture and politics. 2nd Edition. England: Ashgate publishing limited. pp (16-17).

[5] McQuail, D.,&Windahl, S. (1993). Communication models for the study of mass communication. (P. 100). London: Longman.

[6] Murtaza, G. (2007). The impact of culture conflict on identity with an emphasis on Pakistan. Thesis, (PhD). Department of social science, University of the Punjab, Lahore.

[7] Pierce., Terry. An overview of the Cultivation Theory. March 4, 2007 from Qamar, M., Asim, M., Shawar, D.and Zafar, M. I. (2012) ¡°The Impacts Assessment of Indian Culture on Pakistani Society in Faisalabad¡± International Journal of Research in Social Sciences And Humanities, Vol. 1, No. V, pp. 53-62

[8] Rahim, A. (1994). Impact of cable TV on television and video viewing in Hyderabad: A survey. Media Asia: an Asian mass communication quarterly, 21 (1), 15-20.

[9] Shafiq, N. (1995). The effect of the dish antenna on PTV dramas. Unpublished master.s thesis, Department of Mass Communication, BahauddinZakariya University, Multan. Pakistan.

[10] Shahbaz, Z.(2004). Impact of cable TV channels Star Plus soap operas on social and cultural norms and values of Pakistani youth. (P.123) Unpublished master.s thesis, Department of Mass Communication, Lahore College for Women University, Lahore.

[11] Saleem N (1994), Impact on dish antenna on Pakistani society: a case study of Lahore. (pp. 5253) Unpublished Master.s thesis, department of mass communication, university of the Punjab, Pakistan.182 [12]. Tamakuwala, S.J. (2011) retrieved: http://shodhganga.inflibnet.ac.in/bitstream/10603/2563/9/09_chapter%203.pdf

[13] Zia, A. (2003) Consumption of cable television, a research report published in: cable television, A vision of the future. (pp. 56-61). Pakistan Electronic Media Regulatory Authority Islamabad, Pakistan.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 566-576
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Investigating The Challenges In Revenue Collection Process: The case study of Ghana AMA property rate collection

Fati Tahiru[1], Samuel Agbesi[1], and Alexander Osei-Owusu[2]

[1]Information Technology Masters Student,
Kwame Nkrumah University of Science and Technology,
Kumasi, Ghana

[2]Research Coordinator, Graduate School,
Ghana Technology University College,
Accra, Ghana

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The paper focused on the challenges that exist on the process of revenue collection in the Accra Metropolitan Assembly. Like all metropolitan and municipal authorities, the AMA faces several challenges ranging for the efficient provision of service to revenue collection.

The study attempt to eliminate or reduce to minimum the challenges in the process of revenue collection, the problems associated with revenue administration, the tax base coverage and challenges in identifying property owners. Other objectives are to proposed and design a database solution for effective management of property ownership and revenue collection and also to propose a network solution for connecting the assembly's and the land sector agencies.

The study used the interpretative case study approach to obtain study individuals in their natural settings and also obtain deeper understanding of the event. Data was obtained from written narrative, observation and semi structured interviews of 20 participants.

In this study the researcher investigated the challenges associated with the collection of property rate in the AMA. It was discovered that revenue trend has not been stable in revenue collection. It was discovered that the AMA does not have a full or comprehensive register of all taxable activities or levies in their jurisdiction. There exist no system to track invoices and payments. Data on services, facilities, levies etc. are handled manually and consequently subject to fraud, abuse and significant revenue loss.

The research therefore recommends ways of minimizing the revenue leakage associated with property rate administration by the AMA; The proposed database system for collecting property rate stores detailed information of individual customer's and their property (land and building), these details would be stored with land or property coordinates from Google map for easy site identification. The system is designed to generate invoices and send it via mail to the appropriate customers and also keep payment records as well as summary reports of all services.

KEYWORDS: AMA, ICT, VPN, DACF, WLAN.

1 INTRODUCTION

The local assemblies play a vital role in the economic development in the country. Most of these authorities depend or rely on manual file based information storage with little or no means of obtaining feedback from the public. Due to the manual nature of information storage not more than one person can access data at the same time and this makes it impossible for information sharing within or outside the assemblies. These Local Authorities are faced with challenges of collection, storage and dissemination of information.

However, information Communication Technology facilitates the creation of dynamic base of information and communication capacity in perspective needs and interest of various public sectors. The availability of ICT training, internet, email access services is limited at the public sectors in Ghana. An overview of the local authorities reveals a high demand for information services for their processes. The file based information storage used by most local authorities is often not up to date and not properly structured.

The revenue service and the local authorities are not collecting all revenue due from companies and individuals in Ghana. Revenue is lost because there are no proper ICT systems in place, to assist in identification of properties and their owners, to keep up to date record on tax rolls, to verify payment done by property owners. Due to the manual process involve in the revenue collection, management does not detect all short paid, mispricing and unpaid items.

Ghana has been implementing a local government decentralization program with the objective of promoting grass root democracy and ensuring that local government services and development programs are informed by and reflect local needs. The Municipal, Metropolitan and Districts Assemblies (MMDA's) were established to meet this objective. For the decentralization program to be successful, these assemblies most operate as an autonomous institution and have adequate funds to cater for their operations. The central Government funds cannot meet the needs of the Assemblies and therefore the need to mobilize revenue for their own operation but the issue here is the assemblies revenue collection processes are mainly manual, which is cumbersome, less efficient and fraught with fraud.

The decentralization process granted the District Assemblies the following functions according to (Act 2008):

a. The formulation and execution of plans, programs and strategies for the effective mobilization of the resources necessary for the overall development of the district.
b. The levying and collection of taxes, rates, duties and fees.

Major revenue sources of the assemblies include:

a. Basic rate – Fixed rate levied on adult population
b. Property rate – levied on immovable properties(annually)
c. License – charged on economic activities in the district
d. Fees – charged on tolls, lorry park etc.

The assemblies work in collaboration with the Lands Valuation Board on rates collection related to landed properties. The Lands valuation board, a division of the Lands Commission (Act 2008) is responsible for:

a. Inventory of state acquired Lands
b. Revaluation of properties within the District Assemblies.
c. Preparation and maintenance of valuation list for rating purposes.

The effects of poor monitoring and enforcement are reflected in the performance of revenue collection. Presently, the assembly collects about 70% of their total estimated revenue. This implies that about 30% of estimated revenues are bad liability at the end of the fiscal year (dormaa.ghanadistricts.gov.gh).

1.1 MOTIVATION

Despite the decentralization of the district assemblies operations and their function to collect taxes, rates, duties and fees, they still face a number of problems. The process of collecting revenue is mainly manual and cumbersome, inefficient and prone to fraud. The assembly has limited data on properties and their owners, defaulting property owners, and proper payment record.

It is anticipated that the introduction of an ICT system for the local assemblies will help manage revenue collection properly. Building a database for the district assemblies to capture all land registration document and permits issued at the land valuation board will enable the assembly have access to primary information on all properties and their owners in the country. In this way there will be a synergy and network between the land sector and the assembly, which will aid in easy information sharing. This will ensure accurate billing, monitoring and control of the revenue collection process and also guarantee that revenue is not lost.

This research acknowledges the fact that there are other ICT research priorities in Ghana. However, this study is intended to explore how ICT system can help manage the collection of property rate in the Accra Metropolitan Assembly. The Public sector is faced with the issue of revenue leakage from the, land sector agencies through to the local authorities who are in charge of rate collection; this is because most of the operations in the assemblies are manually based and therefore there is

limited control, no transparency and no accountability. This limitation has resulted in unpaid land rates and bills, and also led to exploitation of consumers by some officials. It has further attracted corrupt practices as officials (rate collectors) and consumers conspire to distort bills and other fees that need to be settled.

In most operations humans serve as an interface between the business entities and customers, and these human resources are responsible for revenue collection, facilitation of mispricing, inappropriate accountability and the wrong invoicing; in this view this study assumes that replacing humans with computer systems would be a better solution to revenue management.

1.2 AIMS AND OBJECTIVES

The main objectives of this research include the following:

1. To eliminate or reduce to minimum revenue leakage in the process of revenue collection.

1.3 SPECIFIC OBJECTIVES

1. To Identify the main source of revenue
2. To investigate the challenges and constraint to property rate collection.
3. To propose and develop database solution for effective management of property ownership and revenue collection.
4. To propose a Network solution for improved synergy between the assemblies and land sector agencies.

2 METHODOLOGY

The research methodology suitable for the study has been assessed to be qualitative because the subject under research is of social nature and there is the need to obtain an in depth opinion from participant through methods such as interviews or focus group. Considering the nature of the research, qualitative research is appropriate in gaining understanding in the research environment. The use of qualitative approach in a study brings the researcher closer to reality thus, there is close interactions between researcher and respondent (Sarantakos, 1998). Strauss and Corbin (1990) as cited in Sanders (1997) claim that qualitative methods can be used to better understand any phenomenon about which little is yet known. In view of the context of this study the Interpretative case study approach is adopted to bring out understanding of a complex issue and also extend experience or strength to what is already known through previous research (spring, 1997). Interpretative case study was adopted to obtain understanding of words from an individual perspective since the research focused on a specific phenomenon. Yin defines case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 1984, p. 23, spring1997). This work investigates the challenges of revenue collection process in the Accra Metropolitan Assembly and whether ICT will help eliminate revenue leakage in the process. A single case is adopted for this study to explore and gain an initial, in-depth understanding of what method is used in revenue collection, the challenges associated with the method and evaluate how ICT can be used as tool to remedy the challenge. In line with this McMillan and Schumacher (1997) also stated that case studies can provide a detailed description and analysis or processes or themes voiced by participants in a particular situation.

Case studies, adopts an interpretive approach to data, studies `things' within their context and considers the subjective meanings that people bring to their situation. The case study approach is an explanatory method which makes it easy to ask and seek answers for the necessary 'how', 'when' and ,'why' questions associated with the study. Again, the intimacy of fieldwork relationships associated with case studies can be the greatest advantage (David and Sutton, 2004, Darison 2012). Given the sensitive nature of the topic as well as the in-depth data the researcher is interested the best way to gather this kind of data is directly from the population who are interested and associated with the phenomena.

The data collection instruments that were employed for the study include the use of semi structured institutional questionnaires, observation, interviews, and pocket notebook. These tools were employed to facilitate the data collection process as and when the use of any one of them became necessary. These tools were employed to ensure a complete assessment and understanding of the phenomenon under investigation. The semi structured interviews allow the researcher to construct a series of open ended questions to identify the challenges or problems in revenue collection and how effective the introduction or application of ICT can eliminate or reduce revenue leakage. The researcher resorted to this type of interview because it enable her to probe the interviewee to elaborate more on issues discussed in order to obtain more information. Face –to-face interview was used to establish rapport with potential participant in order to gain their cooperation. This method was used to gain information from the AMA budget, financial and MIS department about available

information and documentation of properties in the metropolis. This method became necessary because it enables the researcher to obtain clarification to ambiguous answers and follow-up on information when appropriate. Observation aid the researcher to obtained good description of the functions of both institutions (AMA and LC).Information was gathered from the composite budget of the AMA and block directorate of the rating division under the land valuation division in the Lands Commission. Drawing understanding from this, Observation can lead to deeper understandings than interviews alone, because it provides knowledge of the context in which events occur, and may enable the researcher to see things that participants themselves are not aware of, or that they are unwilling to discuss (Patton, 1990, Sander, 1997).

The target population is the management and staff of Accra Metropolitan Assembly and Lands Commission. A sample of 20 staff members were purposively selected from each institute. A cross section of property owners were randomly selected for this exercise. The staff of AMA comprised of Budget Office, Metropolitan Finance Office and Internal Audit Unit, MIS Department and the divisions of the Lands Commission comprise of the Land Valuation unit and the land registry.

In carrying out the study, the purposive sampling method was employed in the selection of the of the 12 staff from the Accra Metropolitan Assembly and 8 staff from the Lands commission(valuation division).Purposeful sampling seeks information-rich cases which can be studied in depth (Patton, 1990, Sander, 1917). The Accra Metropolitan Assembly was selected for the study due to the evidence of the usage of the ICT system in revenue collection. The Lands commission was also selected due to the data obtained by the valuation unit which is turn to be necessary for the assembly's revenue collection. The purposive sampling technique was used to sample the officers that were interviewed at the assembly and the Lands commission.

3 RESULTS AND DISCUSSIONS

Having established the theoretical background and methodology adopted for the study as well as the study area profile, the purpose of this section is to narrow the discussion down by analyzing the empirical data from the study area and investigate if the theoretical issues discussed in the preceding chapter pertaining to challenges in local government revenue collection exist in the Accra Metropolitan Assembly. This chapter thus seeks to analyze the data obtained from the field survey and interviews conducted in the research area.

1. Objective 1 - To identify the main source of revenue

In response to a question asked about the main source of revenue for AMA all respondents listed the following:

- Rate
- Land
- Fees and fine
- Rent
- Licenses
- Miscellaneous

The following data the revenue statistics was obtained from the directorate of budget provided as shown in the Table 1.1

TABLE 1 – Revenue statistics from budget office (Source: Field Survey, July, 2013)

	2005	2006	2007	2008	2009	2010
RATE	1,194,603.90	1,535,100.19	1,174,484.13	2,701,497.26	2,131,138.62	2,512,990.91
LAND	38,009.74	15,159	22,885.92	24,700.73	26,164.00	54,324
FEES/FINES	1,833,912.04	2,545,379.87	3,128,134.06	2,987,479.91	2,716,386.55	5,952,299.40
LINCENSE	939,018.91	2,113,691.73	3,402,988.78	4,288,814.66	2,539,116.12	4,330,034.37
RENT	318454.14	10116034	1,097,141.70	703,123.60	697,678.28	1,343,962.32
INVESTMENT	3,228.22	3,044.07	12,083.68	5,421.74	-	18,389.06
MISCELLANEUOS	666,098.47	210,883.59	234,529.32	130,822.31	29,085.33	109,430.97
GOVERNMENT GRANDS	3,244,125.46	7,389,736.87	12,959,379.9	9,053,942.95	5,072,291.66	11,702,451.91

From table 1 above and figure 1 below, it can be observed that grants from Government represent the highest source of revenue, it represent 43.61% of the total revenue generated for the six year period, this is followed by Fees and fines (16.9%).The third source of revenue contribution with 15.54% is revenues generated from license, whiles revenue generated

from rents represent 12.6%. Rates represents the fifth with 9.93%, the sixth is miscellaneous with a contribution of 1.22%. The seventh and eighth are land and investment and with 0.16% and 0.04 % respectively.

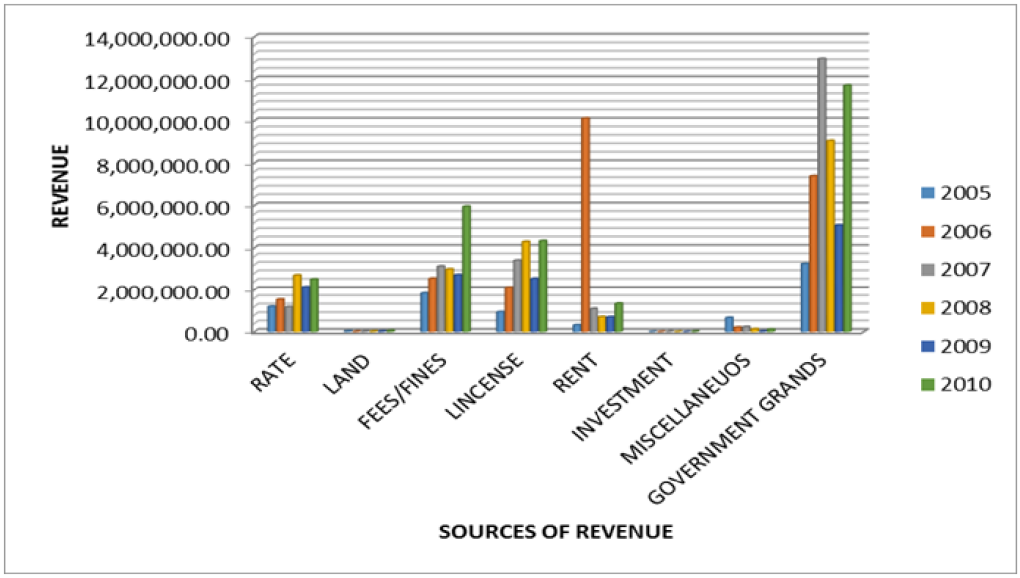


Figure 1 -Revenue statistics from budget office (Source: Field Survey, July, 2013)

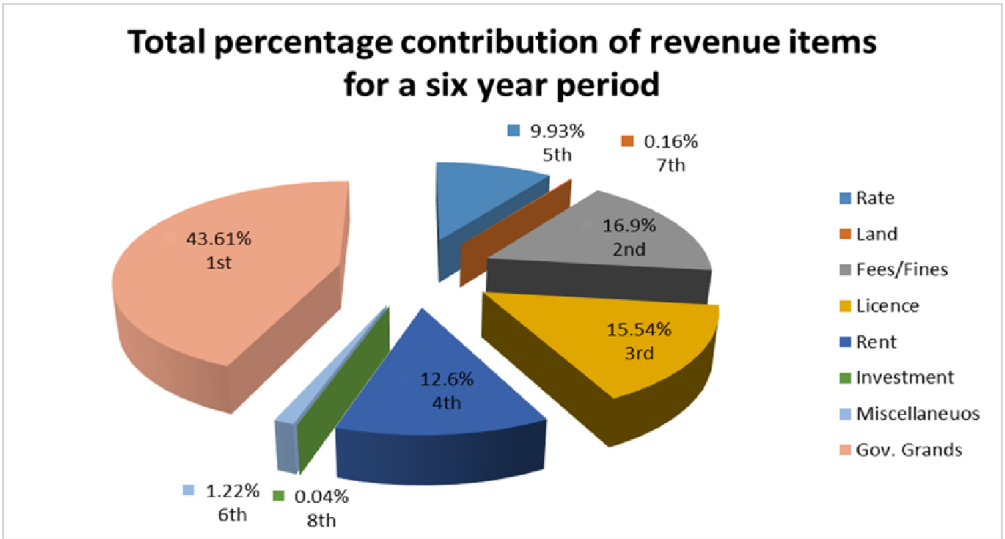


Figure 2 - Ranking of the revenue items (Source: Field Survey, July, 2013)

The study of the main revenue component of the Accra Metropolitan Assembly indicated that taxes in the form of rates and nontax such fines, lands, rents, investment among others contribute 59.1% and 40.9% respectively of the internally generated revenue of the assembly. The survey made it clear that even though there are several revenue instruments available to the Accra Metropolitan Area, the assemblies greatly depend on grants from the central government and this contribute about 63% of the total revenue of the assembly.

Objective 2 - To investigate the challenges and constraint to property rate collection

When participants were asked about the challenges they encounter in the revenue collection process. The following responses were gathered:

Difficulty in identifying properties and their owners

The study discovered that due to inadequate ownership information from the land commission is on registered properties, it becomes difficult identify properties; It lacks personal identification numbers and sometimes the owner's full name and address are not complete. There are instances where owners refused to pay bills because their ownership information is not correct for instance a misspelled name. Also, there are cases where the legitimate owner of the property is deceased and the new owner or successor had not been reported.

- **Unauthorized Building**

The study unearthed that there are numerous building within the AMA's jurisdiction that are built outside the boundaries of a parcel. This may be due to the fact that the parcel was not surveyed or the building does not have permit. Unauthorized building is considered one of the major problems in Ghana. This in a way decreases the revenue obtained from permit fees and property rates

- **Non Update Valuation Roll**

The valuation roll prepared by the rating unit at the lands valuation division, contain information about properties and their values. What the metropolis has realized is that not all rateable buildings are valued .This can be as a result of an oversight by the land sector agency during the valuation process or sometimes there are new building that had not been updated in the property register and therefore not valued. These errors attributes to the revenue loss from property rates.

- **Use of manual procedures and minimum controls**

The study pointed out that the computerized system at the Metropolis is independent or autonomous in nature. In this sense data is not shared or linked to other divisions that need or depend on this information. Property rate are printed and distributed manually to owners, some payments are carried out the manually at the sub metro offices and later recorded or transferred in the billing and payment system at the head office. This gives rise to the misappropriation of funds since it's difficult to map payment against invoices and the agent who received it.

- Fraudulent practices on the part of the revenue collectors and the difficulty in obtaining the needed data.
- Relying on land valuation division for valuation rolls which is not forth coming.
- Inadequate street naming and house numbering

How the challenges affect revenue generation in the Metropolis

Table 2 Revenue 2012 (Source: Field Survey, July, 2013)

N	ITEMS	BUDGETED GH¢	ACTUAL GH¢	% ACTUAL
1	RATES	4,938,005.00	3,311,116.98	15.69
2	LANDS	400,000.00	604,219.43	2.9
3	FEES, CHARGES AND FINES	6,842,199.00	3,202,325.79	15.17
4	LICENCES	7,877,080.00	3,982,160.59	18.87
5	RENT	3,238,850.00	890,708.96	4.22
6	GRANT	126,107,467.00	8,927,510.87	42.3
7	INVESTMENT	76,500.00	9,051.00	0.04
8.	MISCELLANEOUS		179,386.59	0.85
	TOTAL	149,480,101.00	21,106,480.21	100

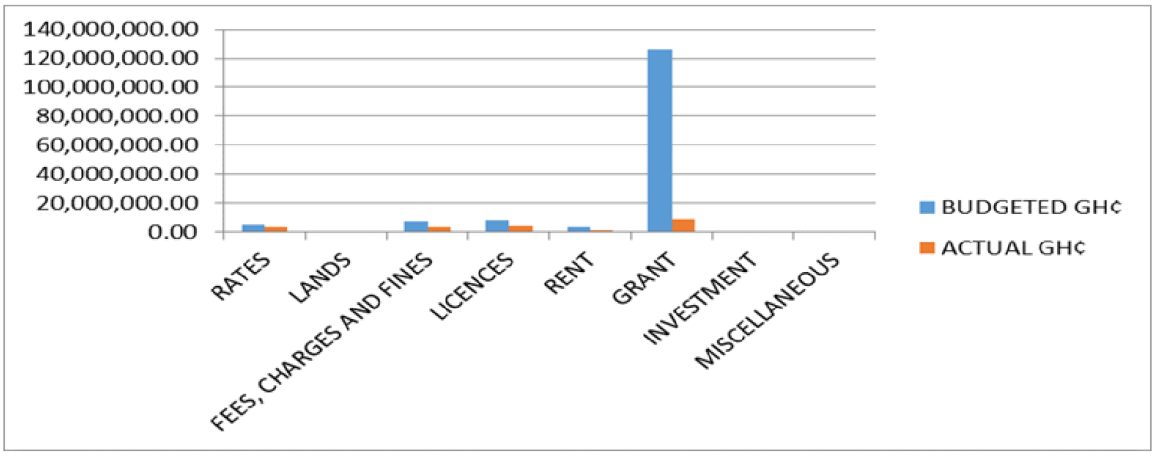


Figure 3 - Revenue as at June 2012 (Source: Field Survey, July, 2013)

With the table 2 and figure 3 above the estimated budget for property rate for the AMA was GH¢4,938,005.00 in percentage terms it is 15.69 percent but the actual revenue released from the rate was GH¢3,311,116.98 which gives a variance of GH¢1,626,888.02. Though it appears as the second highest actual revenue collected by the assembly, the assembly is not able to attain its target revenue, in other words target are not met. The assembly relies mostly on grant which is GH¢8,927,510.87

Table 3–Budgeted and Actual Revenue as at June 2011 (Source: Field Survey, July, 2013)

NO	ITEM	2011 Revenue **BUDGETED(GH¢)**	**ACTUAL(GH ¢)**	**ESTIMATED% ACTUAL**
1	RATES	6,585,000.00	2,665,779.02	40.48
2	LANDS	270,000.00	156,529.19	57.97
3	FEES, CHARGES&FINES	6,641,340.00	2,627,805.98	39.57
4	LICENCES	9,023,960.00	3,250,277.16	36.01
5	RENT	8,172,230.00	569,511.98	8.97
6	GRANT	23,225,400.00	8,494,694.87	36.58
7	INVESTMENT	76,500.00	8,631.00	11.28
8.	MISCELLANEOUS	-	2,264,928.79	-
	TOTAL	**53,994,430.00**	**20,038,157.99**	**37.11**

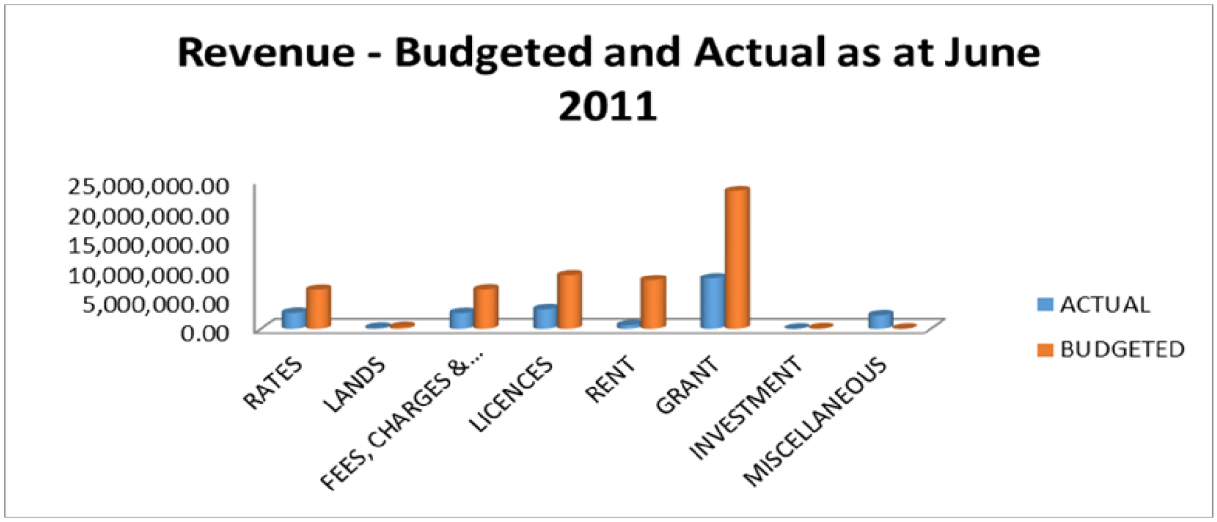


Figure 4 – Budgeted and Actual Revenue as at June 2011 (Source: Field Survey, July, 2013)

With the table 3 and figure 4 above the estimated budget for property rate for the AMA was GH¢6,585,000.00 in percentage terms it is 40.48 percent but the actual revenue released from the rate was GH¢2,665,779.02 which gives a variance of GH¢3,919,220.98.Though it appears as the highest actual revenue collected by the assembly, the assembly is not able to attain its target revenue, in other words target are not met. The assembly relies mostly on grant which is GH¢8,494,694.87.

Objective 3 - To propose a Network solution for improved synergy between the assemblies and land sector agencies.

This section presents the proposed network solution for improved synergy between connecting the assembly's and the land sector agencies. The VPN connection is considered as a viable solution for the implementation. A VPN is a Virtual Private Network that uses public infrastructure (usually internet) to connect remote network or users (NetGear VPN Basics).It uses virtual connections routed through the internet from the business private network to the remote site or remote employee. This technology can be applied to both LAN and WLAN.

The VPN technology uses different methods for connecting individual sites. The site-to- site VPN allows multiple offices in fixed locations to establish secure connections with each other over a public network such as the internet. On the other hand the remote access VPN allows individual users with a remote computer network. Some of the common protocols used by VPN for the safe transfer of data from one point to another are PPTP, L2TP/IPSec and SSTP.

The researcher proposed the L2TP/IPSec VPN technology. The L2TP allows multiprotocol traffic to be encrypted and then sent over any medium that supports point-to-point datagram delivery, such as IP or asynchronous transfer mode (ATM).In terms of security L2TP has no major vulnerabilities. It is considered the safest VPN protocol next to the Open VPN and SSTP. L2TP is encrypted using the standardized IPSec protocol with 256bit encryption system.

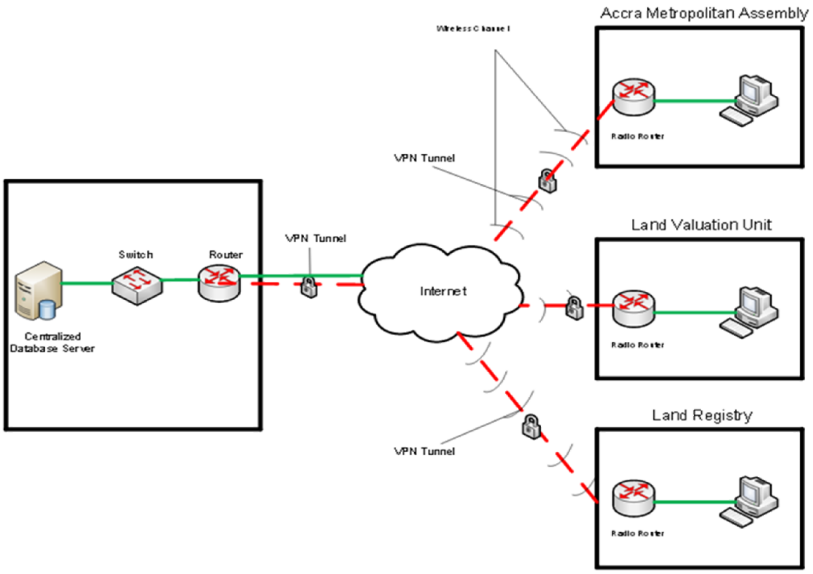


Figure 5 -VPN tunnel

4 MAJOR FINDINGS

The study adopted the interpretative case study approach to investigate the challenges in property rate collection in the Accra Metropolitan Assembly. The study aims at minimizing revenue loss or revenue leakage associated the administration of property rates in the Metropolis. Accra Metropolitan Assembly was chosen for the study because of its readily available internet infrastructure that can be adopted in the areas of revenue collection to increase the internally generated revenue of the Metropolis. Particular attention was directed to the challenges involve in the property rate collection, the ICT system that can be used to minimize the loss of revenue, identify the revenue sources available and as well as the revenue performance. The study emphasized on the following objectives; to Investigate problems associated with administration of revenue collection, investigate the tax base coverage and the challenges in identifying property owners, to propose and develop database solution for the effective management of property ownership and revenue collection and finally to propose a network solution for improved synergy between connecting the assemblies and the land sector agencies.

Findings from the study indicated that the administration of property tax which forms about 40.48% of the IGF, is placed in the hands of the Accra Metropolitan Assembly, mandated by the local Government, section 90 of Act 462, 1993. They are responsible for the assessment, collection and accounting for other taxes, rates and licenses such as license, lands and rents etc. in their jurisdiction. It was observed that these sources of revenue were found to be less administered and others were not administered at all by the AMA.

Based on the findings, the revenue base information is mostly incomplete, collections are usually low and enforcement is virtually non-existent.

From the study the tax base coverage for AMA is mostly inadequate for them to realize the projected revenues. This is as a result of un-updated tax registers coupled with exemption for some institutions such as churches, Government bungalows and institutions, Schools etc.

The study also revealed the challenges that impede the property tax administration in the AMA. These were identified as difficulty in identifying property and their owners due to incomplete owner information and lack of proper addressing system and nonexistence of maps, also unauthorized building due to constructions without permit from the AMA. Un-updated valuation rolls which the AMA depends on to collect property rate, some owners end up not paying anything because their information is not in the register. The use of manual procedure in obtaining data and collecting revenue in AMA is prone to fraud.

5 CONCLUSIONS

Although the government of Ghana has launched couple of policies for the effective and efficient use of ICT in public organizations, most of these sectors are engage in the use of manual processes or partial use of ICT. The situation in Accra Metropolitan Assembly is not an exception.

The Administration of property rate is a major challenge facing developing countries; in their effort to raise higher amount to constitute their IGF. In recent studies and in most Government assessment, on District assembly or the local authority it had been noticed that the district assemblies are not able to raise enough revenue from property rates resulting in overdependence on the DACF.

Moreover, these issues can be related to lack of information sharing between the land sector agencies (registry and valuation unit) and the local authorities. It appears that there is no centralized database connecting the land registry and the land valuation division to assist them in developing the valuation list. Also, the local authorities who issue permits such as the building permit does not make use of the readily available information or database on the property owners information at the land registry .However, information to update the property register at the metropolis is not readily available. These processes of keeping autonomous information for each sector that have related job function or operations give rise to fraudulent activities which in a way encourage revenue leakage.

For the district, there is the need for continuous monitoring and update of the tax register to widen the tax coverage, a computerized system for billing (invoicing and payment); thus a system that allow them to track all invoices sent and their recorded payment, provide summary reports on debtors and also projects revenue based on the assemblies client based. A further study with in-depth analysis on the success of a complete ICT usage in revenue collection in the Accra Metropolitan assembly is required.

6 RECOMMENDATIONS

Detailed information about property owners should be captured at the land registry division of the lands commission and also transfer of lands should be detailed and captured in a database which must also be readily available to other sectors that require information on landed properties.

An aerial photography should be carried out every five years in order to keep the map up to date; since this approach can be expensive an alternate approach can be regular field verification to observe unauthorized structures.

There should be a centralized database system connecting both the metropolis and sub metros for efficient management of revenue and its collection. There should also be the establishment of a wide Area Network (WAN) to enable the metropolis, sub metro and the land sector to share information, and also have access to up to date information. This will intend facilitate efficient revenue collection and reduce corruption.

Also, there is the need for public awareness of property rates based on the metropolis, municipal and district levels. The study unearthed that some property owners are not aware of their obligation to pay property rates. This issue can be mitigated with mass education and awareness campaign using electronic media and print. The use of television and radio to educate the public about the need of paying property rates and taxes and the significance of these rates to the development of our society and its contribution to the nation as a whole.

REFERENCES

[1] Adenike A. Adedokum Local Government Tax Mobilization and Utilization in Nigeria: Problems and Prospects. Department of Public Admin & Local Government studies. Polytechnic, Ibandan, Nigeria.

[2] Alan F. Macdonald (2012), Reality Executive challenge in Edmonton, Alberta [online] Available on: http/www.gimme-shelter.com/term2/property-tax-50019 [accessed: December, 2012].

[3] Almy (2004) a survey of property tax systems in Europe: Report prepared for the department of taxes and customs, ministry of finance, Republic of Slovenia.

[4] Al-hassan Baba Darison (2011), Enhancing local government Revenue mobilization through the use of Information Communication Technology.

[5] Aryee J. A (2003) Decentralization for local development in Ghana.

[6] Assibey-Mensah (2000), Decentralization on trial: The case of Ghana's district assemblies.

[7] Bardhan, Pranab, Mookherjee Dilip (2002), Capture and Governance at Local and National Levels, American Economic Review, Vol. 90, No.2.

[8] Baxter (2008), The qualitative Report. Volume 13 No. 4. Available online: http:www.edu/sss/QR/OR13-4/baxter.pdf. Accessed on [15th August, 2013].

[9] Bird R. M (2001), User charges in Local Government Finance in M. Freire & R. Stren, The challenges of urban Government: Policies and practices. Washington, DC: The World Bank Institute.

[10] Chailer Proofer (2012). Some advantages and Disadvantages of Descriptive Research. [Online] Available at: http://www.blurtit.com/q950778.html and http://www.ehow.com/info_7822756_research-study-design-types.html. Accessed on: 3rd February, 2013.

[11] Cooper, D. R., & Schindler, P. S. (2006). Business Research Methods (9th edition).USA: McGraw-Hill.

[12] David, M. and Sutton, C.D. (2004) Social Research: the basics, Sage Publications, London.

[13] Dr. Gordon Crawford (2004), Democratic decentralization in Ghana: Issues and prospects. POLIS working paper. No. 9.

[14] Dr. Munawwar Alam and Dr. Roger Koranteng (2010), Decentralization in Ghana. [Online] Available at: [http://www.the common wealth.org/files/236880/FileName/Decentralisation in Ghana.pdf].

[15] Dr Catherine Dawson (2002) .Practical Research Methods: A user-friendly guide to mastering research techniques and projects.

[16] Dellinger W (1994), Decentralization and its implication for urban service delivery.

[17] Dormaa Disrtict assembly website. Available at: www.dormaa.ghanadistricts.gov.gh .[Accessed on: 12th July, 2012].

[18] Enid Slack (2010), The property tax in theory and Practice. Institute of Municipal Finance and Governance Munk School of Global Affairs, University of Toronto.

[19] Ferhat Baskan OZGEN and Aykut Hamit TURAN (2007).Usage and Adoption of online tax filing and payment system in tax management: An empirical assessment with technology Acceptance (TAM) Model in Turkey.

[20] Fosu Mark Agyapong (2012) An Evaluation Of Effectiveness Of Revenue Mobilization Strategies Of Metropolitan, Municipal And District Assemblies (MMDAs) In Ghana, A Case Study Of Kumasi Metropolitan Assembly (KMA).

[21] Ghana Statistical Service Department

[22] Hans Bjorn Olsen (2007).Decentralization and local Governance. Module1: Definition and Concepts

[23] John Norregaard (2013).Taxing Immovable property: Revenue potential and implementation challenges.

[24] Katrina Connolly and Dr. Michael Bell. Financing Urban Government in Transition Countries: Assessment Uniformity and the Property Tax.

[25] Kokor, J.Y. (2001) Local Governance of development in Ghana: (Dortmond University printing press).

[26] Kwame Badu Antwi-Boasiako (2010) Public administration: Local Government and Decentralization in Ghana.

[27] Lands Commission Bill, Act 2008, section 22.

[28] Mathew Lee Difference between Research design and research method. [Online] Available at: http://www.ehow.com/facts_7329595_difference-research-design-research-method.html#ixzz2e7J4d5Bu [Accessed on: 18 September, 2013].

[29] McMillan, J. H., & Schumacher, S. S. (1997). Research in Education: A Conceptual Introduction. New York: Longman.

[30] Merriam, S. B., et al. (2002) Qualitative research in practice: Examples for discussion and analysis. (San Francisco, CA: Jossey-Bass.

[31] Ministry of local Government rural development and Environment (2009).Strategy for Efficient Revenue Mobilization. Vol. 1 Issue 1/08.
[32] Nachmias, C.F. (1992); Research Methods in Social Sciences. Edward Arnold Ltd, London.
[33] Net Gear VPN Basics [Online] Available at: www.documentation.netgear.com/reference/esp/vpn/ VPNBasics-3-05.html [Accessed on: 15 August, 2013].
[34] Nkrumah S.A (2000), Decentralization for good Governance and Development. The Ghanaian Experience in Regional Development dialogue Vol.21.
[35] Orlikowski, W.J. and Robey, D.(1991) "Information Technology and the Structuring of Organizations," Information Systems Research (2).
[36] Patton, M. Q. (2005). Qualitative Research. Encyclopedia of Statistics in Behavioral Science.
[37] P.N. Reddy and P .C. Tripathi (2007) Principles of Management 4E, chapter 8. [www.preservearticles.com/201101143290/decentralization].
[38] Revenue, 2012, [online] Available at : en.wikipedia /wiki/revenue [accessed on:1st April,2012]
[39] Revenue Leakage, 2012 [online] Available at: www.scmgroup.co.nz/article/jargon-buster. [Accessed on: 3rd June, 2012].
[40] Roy Kelly (2000).Property taxation in East Africa: The tale Of three reforms: Lincoln Institute of land policy.
[41] Roy W. Bahl and Richard M. Bird (2008), Tax policy in developing Countries: Looking back and forward. National Tax journal Vol. LXI, No.2.
[42] Roy Bahl & Sally Wallace (2008), Reforming the property tax in developing countries: A new approach, International center for public policy working paper series, at AYSPS,GSU paper 0819International center for public policy, Andrew Young school of policy studies, Georgia state University.
[43] Richard M. Bird and Enid Slack (2002), Land and Property Taxation. A Review, mimeo, University of Toronto.
[44] Richard M. Bird and Enid Slack,(1978) Residential Property Tax Relief in Ontario (Toronto: University of Toronto Press).
[45] Sanders, M. (1997) Journal of Technology Education: Choosing Qualitative Research: A Primer for Technology Education Researchers [Online] Available at: http://scholar.lib.vt.edu/ejournals/JTE/v9n1/hoepfl.html [Accessed on:10 August, 2013].
[46] Somarathne, D. (2010) The Wire Frame: Research methodology and methods. [Online] Available at: http://www.thewireframecommunity.com/node/196 [Accessed on: 7August 2013].
[47] Strauss, A., & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage Publications, Inc.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 577-584
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

Study on Antimicrobial Activity of *Barringtonia acutangula* and *Premna corymbosa,* two widely distributed Shrubs of the Sundarbans

Md. Jalal Uddin[1] and Rony Kumar Banik[2]

[1]Biotechnology and Genetic Engineering Discipline, Khulna University, Khulna-9208, Bangladesh

[2]Department of Pharmacy, University of Science and Technology Chittagong, Chittagong-4202, Bangladesh

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: Use of plant based drugs and chemicals for curing various ailments and personal adornment is as old as human civilization. Plants and plant-based medicaments are the basis of many of the modern pharmaceuticals we use today for our various ailments. The aim of the study was to evaluate the antimicrobial activity of Barringtonia acutangula (Family: Lecythidaceae) and Premna corymbosa (Family: Verbenaceae), two widely distributed shrubs of the Sundarbans mangrove forest by disc diffusion assay. The in vitro antimicrobial activity was tested against E. coli, S. flexneri, S. dysenteriae, V. cholerae , S. paratyphi, Proteus spp, S. aureus and S. epidermis using disc diffusion assay where the chloroformic extract of bark of B. acutangula showed excellent performance against E. coli and the zone of inhibition was recorded as 10mm and 13mm for 500µg and 1000µg consistently. The chloroformic extracts of bark of P. corymbosa also showed significant activity against V. cholera, S. dysenteriae and E. coli respectively. In this investigation Kanamycin (30 µg / disc) standard disc were used as the reference.

KEYWORDS: Shrubs, Antimicrobial Activity, Zone of Inhibition, Disc Diffusion, Barringtonia acutangula and Premna corymbosa.

1 INTRODUCTION

Medicine is the wonder of the world and blessings for mankind. From the very ancient time men used various plant parts as their wound healing. Medicinal Plants have been used for centuries as a popular remedy against several health disorders. In the field of natural product biology, ethnopharmacology, as well as bioprospecting approaches, have received renewed attention in recent years (Bremner, P.*et al*., 2002; Geetha *et al*., 2002). Natural products and herbal remedies used in traditional folk medicine have been the source of many medically beneficial drugs (Battle *et al*., 2005) as many of the medicinal plants have been shown to present interesting biological and pharmacological activities and are used as therapeutic agents (Gertsch *et al*., 2003). Natural products and related drugs are used to treat 87% of all categorized human diseases including bacterial infection, cancer and immunological disorders (Newman, D. J. *et al.,* 2007). About 25% of prescribed drugs in the world originate from plants (Rates, S.M. K. 2001) and over 3000 species of plants have been reported to have anticancer properties (Graham, J. G. *et al*; 2000). About 80% of the populations in developing countries rely on traditional plant based medicines for their primary health care needs (FAO, 2004). Bangladesh has a rich and prestigious heritage of herbal medicines among the South Asian countries. More than 500 species of medicinal plants are estimated as growing in Bangladesh and about 250 species of them are used for the preparation of traditional medicines (Ghani, A. 2003). However, the majority of these plants have not yet undergone chemical, pharmacological and toxicological studies to investigate their bioactive compound(s) (Ghani, A. 2003). Thus, this research work was designed to evaluate the antimicrobial activity of *B. acutangula and P. corymbosa* by disc diffusion assay for further exploration of their bioactive constituents. In vitro antibacterial activity of plants can be detected by observing the growth response of various microorganisms to those plant extracts or their solvent fractions that are placed in contact with them. This can be done in three ways (diffusion, dilution, and bioautographic methods) and a great number of factors viz. the extraction method (Nadir *et al*., 1986), inoculate volume, culture medium composition (Bauer *et al,* 1966), pH (Leven *et al.,* 1979), and incubation temperature (Lorian, 1991)

Corresponding Author: Md. Jalal Uddin

can influence the results. There is no standardized method for expressing the result of antibacterial screening (Ayafor *et al.,* 1982). Diameter of zone of inhibition is used sometimes to measure the inhibition of growth of microorganism. Disc diffusion technique is widely acceptable for the preliminary screening of antibacterial activity. The leaves and barks extract of *B. acutangula and P. corymbosa* were tested with eight species of pathogenic bacteria to investigate whether they have any antibacterial activity or not and the result is reported in this chapter.

2 MATERIALS AND METHOD

Test Materials

Selected *Barringtonia acutangula and Premna corymbosa* were collected on 25th March, 2011 and collected plants samples were identified by the experts of Bangladesh National Herbarium, Mirpur, Dhaka. This research work was carried out from 26th March to 15th September, 2011 in Molecular Biology and Animal Cell Culture Laboratory of Khulna University, Khulna, Bangladesh.

Experimental Materials

Filter paper discs, Nutrient agar medium, Petri dishes, Inoculating loop, Sterile cloth, Sterileforceps ,Sterile scissors, Tissue paper, Micropipette, Chloroform / Dimethyl sulfoxide, 70% ethanol, Test tubes, Beaker, Nose masks and hand gloves, Standard antibiotic discs (Kanamycin 30µg/disc), Laminar air flow, UV lamp, 10 ml volumetric flask, Incubator Autoclave, Water Bath, Digital Balance and Refrigerator.

Preparation of Materials

Collected plant samples were washed by distilled water (DW) to remove undesirable materials and excess of water was drained off. The leaves and stems were separated from each other and they were sliced into small pieces. The sliced materials were weighed by balance. The sliced leaves and stems were dried for few days under sunlight with shadow. After that the dried samples were powdered separately by grinding machine and then 5.4 gm powdered leaf of *B. acutangula* was taken into clean flat-bottomed glass container and soaked in 200 ml of 95% ethanol, 5.4 gm powdered leaf of *B. acutangula* and 12.8 gm powdered bark of *P. corymbosa* was taken into clean flat-bottomed glass container and soaked in 200 ml of absolute methanol and 5.4 gm powdered leaf and 10.72 gm powdered bark of *B. acutangula* and 12.8 gm powdered bark of *P. corymbosa* was taken into clean flat-bottomed glass container and soaked in 200 ml of absolute chloroform. The containers with its contents were sealed and kept for a period of 7 days accompanying occasional shaking and stirring. The whole mixture then underwent a coarse filtration by a piece of clean, white cotton material. Then it was filtered through Whatman filter paper. The filtrates obtained were evaporated under ceiling fan and in a water- bath until dried. It rendered concentrates of greenish, brownish, reddish and sometimes blackish in color. The concentrates were designated as crude extract of 95% ethanol, methanol and chloroform of *B. acutangula and P. corymbosa*. Then 50mg of each ethanolic, methanolic and chloroformic extract of leaves and chloroformic extract of bark of *B. acutangula*, methanolic and chloroformic extract of barks of *P. corymbosa* were dissolved in 2ml of ethanol, methanol and chloroform respectively to produce final concentration of 25µg/µl.

Preparation of Media

Nutrient agar media were prepared by adding water to a dehydrated product, which contains all the ingredients. Practically all media are available commercially in powdered form (Pelczar *et al,* 1986).

Table 1. Composition of nutrient agar media

Ingredients	Amounts (gram/liter)
Peptone A	5.0
Beef extract	3.0
Sodium chloride	8.0
Agar A	15
Distilled water	1L
pH	7.3 (approximately)

Preparation of the Seeded Test Plates

With the help of an inoculating loop, the test organisms from the pure cultures were transferred to the agar slants in an aseptic condition using laminar air hood. The inoculated slants were then incubated at 37°C for 18-24 hours (for bacteria) to assure the growth of test organisms. This culture was used within two days. Each of the test organisms were transferred from the subculture to the test tube containing 16 ml autoclaved media with the help of the sterilized inoculating loop at 45°C under laminar air follow. The test tubes were shaken by rotation to get a uniform suspension of organism. The bacterial suspensions were immediately transferred to the sterile Petri dishes aseptically. The Petri dishes were rotated several times, first clockwise and then anticlockwise, to assure homogeneous distribution of the test organisms.

Table 2. List of Microorganisms used in this study

Gram positive(+ve)	Gram negative(-ve)
	Shigella flexneri
	Shigella dysenteriae
Staphylococcus aureus	*Vibrio cholerae*
Staphylococcus epidermis	*Salmonella paratyphi*
	Escherichia coli
	Proteus spp.

Preparation of Discs

Sterile filter paper discs (5 mm in diameter) were taken in a blank Petri dish. Sample solution of the desired concentration (500/1000µg) was applied on the discs with the help of a micropipette in an aseptic condition. These discs were left for few minutes in aseptic condition for complete removal of solvent. Kanamycin (30 µg / disc) standard disc were used as positive control and blank disc were used as negative control which ensure the residual solvents (left over the discs even after air drying) and the filter paper were not activated themselves.

Procedure

Sample impregnated discs (500/1000µg), standard antibiotic discs (Kanamycin) and negative control discs were placed gently on the solidified agar plates, freshly seeded with the test organisms with the help of a sterile forceps to assure complete contact with medium surface. The spatial arrangement of the discs was such that the discs were not closer than 15mm to the edge of the plate and far enough apart to prevent overlapping the zones of inhibition. The plates were then inverted and kept in refrigeration for about 24 hours at 4°C. This was sufficient for the material to diffuse into a considerable area of the medium. Finally the plates were incubated upside down at 37°C for 12-18 hours. After incubation, the antibacterial activity of the test agent was determined by measuring the diameter of zone of inhibition in term of millimeter with a transparent scale.

3 RESULTS AND DISCUSSIONS

Antibacterial activity of ethanolic, methanolic and chloroformic extracts of bark and leaf of *Barringtonia acutangula* and *Premna corymbosa* were examined and found to exhibit activities against the test bacteria. In this regard, disk diffusion method was applied in a dose dependent manner. Commercial kanamycin discs were used to compare the extract of test sample. The result of the antibacterial activity of the ethanolic, methanolic and chloroformic extracts were measured in terms of diameter of zone of inhibition in millimeter and shown in Table 3, 4, 5, 6, 7, 8, 9 and 10.

Table 3. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against S. aureus

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			250 (µg/disc)	500 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	__	__	37	__
	Leaf	Ethanol	8	11	35	__
	Leaf	Chloroform	9	12	37	__
	Bark	Chloroform	9	10	32	__
Premna corymbosa	Bark	Methanol	11	14	34	__
	Bark	Chloroform	12	16	33	__

Table 4. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against Proteus spp.

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	__	3	30	__
	Leaf	Ethanol	6	8	28	__
	Leaf	Chloroform	4	7	30	__
	Bark	Chloroform	5	7	30	__
Premna corymbosa	Bark	Methanol	__	5	27	__
	Bark	Chloroform	12	15	29	__

Table 5. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against S. dysenteriae

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	__	__	17	__
	Leaf	Ethanol	__	__	17	__
	Leaf	Chloroform	8	9	18	__
	Bark	Chloroform	9	11	17	__
Premna corymbosa	Bark	Methanol	6	8	19	__
	Bark	Chloroform	10	14	17	__

Table 6. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against V. cholerae

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	4	7	28	__
	Leaf	Ethanol	__	5	31	__
	Leaf	Chloroform	9	12	30	__
	Bark	Chloroform	8	11	29	__
Premna corymbosa	Bark	Methanol	6	10	30	__
	Bark	Chloroform	14	18	28	__

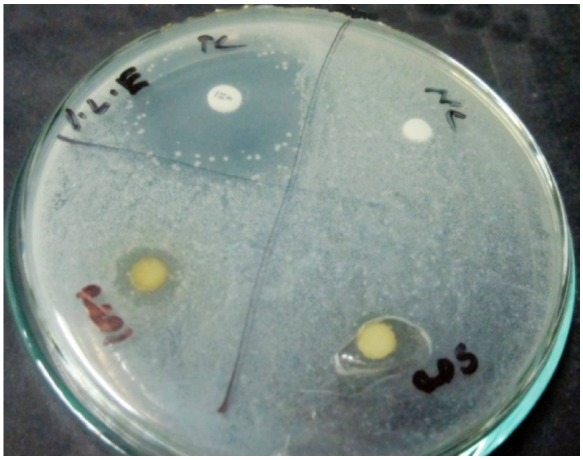


Figure 1. Zone of Inhibition of Barringtonia acutangula leaf against S. aureus

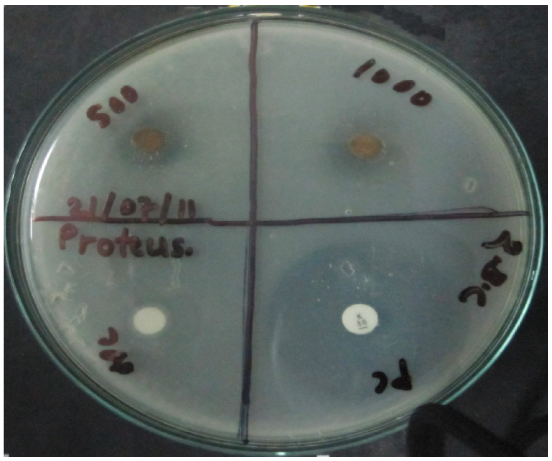


Figure 2. Zone of Inhibition of Premna corymbosa bark against V. cholerae

Table 7. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against S. paratyphi

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	8	11	32	__
	Leaf	Ethanol	16	8	30	7
	Leaf	Chloroform	12	14	30	13
	Bark	Chloroform	8	11	29	8
Premna corymbosa	Bark	Methanol	7	10	28	__
	Bark	Chloroform	11	14	30	__

Table 8. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against E. coli

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	8.5	11	13	__
	Leaf	Ethanol	8	10	14	__
	Leaf	Chloroform	7	10	13	__
	Bark	Chloroform	10	13	12	__
Premna corymbosa	Bark	Methanol	7	9.5	13	__
	Bark	Chloroform	7	12	12	__

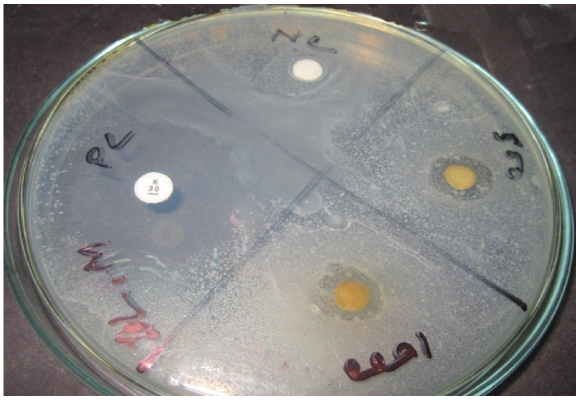


Figure 3. Zone of Inhibition of Barringtonia acutangula leaf against S. paratyphi

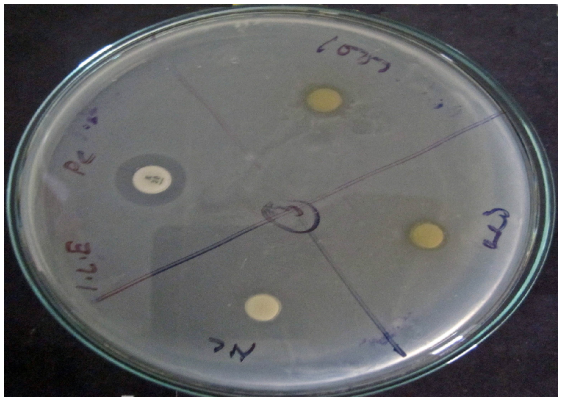


Figure 4. Zone of Inhibition of Barringtonia acutangula leaf against E. coli.

Table 9. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against S. flexneri

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	10	14	28	__
	Leaf	Ethanol	10	12	30	__
	Leaf	Chloroform	12	15	31	__
	Bark	Chloroform	9	__	29	__
Premna corymbosa	Bark	Methanol	__	7	27	__
	Bark	Chloroform	9	14	27	__

Table 10. Study on antimicrobial activity of B. acutangula and P. corymbosa extracts against S. epidermis

Name of the plant	Type of extract	Solvent	Diameter of zone of inhibition in mm			
			Test Sample		Kanamycin	
			500 (µg/disc)	1000 (µg/disc)	Positive Control	Negative Control
Barringtonia acutangula	Leaf	Methanol	8	15	30	__
	Leaf	Ethanol	7	10	29	__
	Leaf	Chloroform	7	9	30	__
	Bark	Chloroform	8	11	31	__
Premna corymbosa	Bark	Methanol	10	12	31	__
	Bark	Chloroform	12	14	30	__

From these tabulated vales it is seen that the chloroformic extracts of bark of *Premna corymbosa* has significant antimicrobial activity against *S. dysenteriae* (Table 5) and gave zone of inhibition of 14 mm for 1000 µg/disc and 10 mm for 500 µg/disc*,* where commercial antibiotic disc kanamycin gave zone of inhibition of 17 mm. On the other hand, chloroformic extract of bark of *Barringtonia acutangula* shows an outstanding performance against *E. coli* (Table 8) and gave zone of inhibition of 10 mm for 500 µg/disc and 13 mm for 1000 µg/disc, where kanamycin gave 12 mm. Besides these, the methanolic, ethanolic and chloroformic extracts of barks and leaves of *B. acutangula and P. corymbosa* shows significant antimicrobial activity especially against *E. coli* and a mild response against *S.paratyphi*, *S.flexneri* and *S.epidermis.* But in case of other bacterial strains no satisfactory results are found especially on *S.aureus*, *Proteus Spp.* and *V. cholera.*

4 CONCLUSION

Barringtonia acutangula and *Premna corymbosa* traditionally been used as therapeutic agents to treat piles. tumors, eye infection, fever, flu, skin rash, womb cleaning, rheumatic disorders and arthritis, diarrhea, dysentery and colitis. This study proved that the ethanolic, methanolic, and chloroformic extracts of *B. acutangula and P. corymbosa* exert potent antibacterial activity against *E. coli, S. flexneri, S. dysenteriae, V. cholerae, S. paratyphi, Proteus spp, S. aureus* and *S. epidermis* where chloroformic extract of bark of *Barringtonia acutangula* showed an outstanding performance against *E. coli*.

ACKNOWLEDGMENTS

I am very much grateful to all of the teachers of Biotechnology and Genetic Engineering Discipline, Khulna University, Khulna, Bangladesh, for their assistance and encouragement to perform this research.

REFERENCES

[1] Abraham, Z. 1981. Glimpses of Indian Ethno botany, Oxford & Publishing Co., New Delhi, pp 308-320.
[2] Battle, T.E., Arbiser, J. & Frank, D.A. 2005. The natural product honokiol induces caspase dependent apoptosis in B-cell chronic lymphocytic leukemia (BCLL) cells. Blood 106, 690–697.
[3] Bauer A.W., Kirby W.M.M., Sherris J.C. & Turck M.1966. Antibiotic susceptibility testing by a standardized single disc method. Am. J Clin Pathol 45: 493-496.
[4] Bremner, P. & Heinrich, M. 2002. Natural products as targeted modulators of the nuclear factor kappaB pathway. Journal of Pharmacy and Pharmacology 54, 453–472.
[5] Berghe D.A.V. & Vlietinck A.J.1991. Screening methods for antibacterial and antiviral agents from higher plants. In: Methods in Plant Biochemistry (ed.) Dey PM, Harborne JB. London: Academic Press. pp. 47- 67.
[6] Claus E.P. & Tyler, V.E. 1993. Pharmacognosy 5th edition. Lea & Febiger Publisher, Philadelphia, pp. 1-3.
[7] Davison, G.W. H. & Chew, H. H. 2008. The Singapore Red Data Book: Threatened plants and animals of Singapore. Nature Society (Singapore). 285 pp.
[8] FAO, 2004. Trade in Medicinal Plants, Economic and Social Department, Food and Agriculture Organization of the United Nations, Rome, Italy.

[9] Geetha, S., Sai Ram, M., Singh, V., Ilavazhagan, G. & Sawhney, R.C. 2002. Anti-oxidant and immunomodulatory properties of seabuckthorn (*Hippophae rhamnoides*)—an in vitro study. Journal of Ethnopharmacology 79, 373–378.

[10] Gertsch, J., Sticher, O., Schmidt, T. & Heilmann, J. 2003. Influence of helenanolide-type sesquiterpene lactones on gene transcription profiles in Jurkat T cells and human peripheral blood cells: anti-inflammatory and cytotoxic effects. Biochemical Pharmacology 66, 2141 2153.

[11] Ghani, A. 2003. Medicinal Plants of Bangladesh with Chemical Constituents and Uses, Asiatic Society of Bangladesh, Dhaka, Bangladesh.

[12] Graham, J. G., Quinn, M. L., Fabricant, D. S. & Farnsworth, N. R. 2000. Plants used against cancer—an extension of the work of Jonathan Hartwell, Journal of Ethnopharmacology, vol. 73, no. 3, pp. 347–377.

[13] Hsuan Keng, S.C. Chin & H. T. W. Tan. 1990. The Concise Flora of Singapore: Gymnosperms and Dicotyledons. Singapore University Press. 222 pp.

[14] Jayalakshmi, B., Raveesha, K. A. & Amruthesh, K. N. 2011. Phytochemical investigations and antibacterial activity of some medicinal plants against pathogenic bacteria.

[15] Koehn, F.E. & Carter, G.T. 2005. The evolving role of natural products in drug discovery. Nature Reviews. Drug Discovery 4, 206–220.

[16] Michael J. Pelczar, JR. E.C.S.Chan & Noel R. Krieg, 1986. Microbiology, pp-38, 39, 99, 103 106

[17] Newman, D. J. & Cragg, G. M. 2007. Natural products as sources of new drugs over the last 25 years, Journal of Natural Products, vol. 70, no. 3, pp. 461–477.

[18] Pandey R, Verma, R.K., Singh S.C. & Gupta M.M. 2003. 4α-methyl-24β -ethyl- 5α-cholesta-14,25-dien-3β-ol and 24β -ethylcholesta-5, 9(11), 22e-trien-3β - ol, sterols from Clerodendrum inerme. Phytochemistry 63, 415-420

[19] Rates, S.M. K. 2001. Plants as source of drugs, Toxicon, vol. 39, no. 5, pp. 603–613.

[20] Schultes R.F. 1978. The kingdom of plants. In: Thomson WAR(ed.), Medicines from the Earth. McGraw-Hill Book Co., NY. p. 208.

[21] Turner, R.J. Jr. & Wasson, E. 1997. Botanica. Mynah, USA.

[22] Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. Manual of the Flowering Plants of Hawai. 2nd vols. Bishop Museum Special Publication 83, University of Hawai and Bishop Museum Press, Honolulu, HI.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 585-597
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

An Empirical Evolution Framework of ICT in Education Sector of Pakistan

Arbab Kanwal[1], Mr. Fahad Jan[2], and Mr. Zubair Azhar[3]

[1]Computer Sciences,
University of Agriculture Faisalabad,
Punjab, Pakistan

[2]Computer Sciences,
Lecturer, CS Department University of Agriculture Faisalabad,
Punjab, Pakistan

[3]Computer Sciences,
Senior IT Manager and Administration at Faisalabad Industrial Estate of Development and Management Company,
Punjab, Pakistan

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: In a current era, needs of IT resources are common to achieve the target goals. These segments can be a government, research institutes, industry, telecommunication and education. Today technologies are essential tools for any sector to perform daily activities in this competitive world. The businesses must have the ability to exploit the role of these technologies such as Information and Communication Technology (ICT). To use these technologies effectively, proper measures and planning is required. ICT has the potential to enable any sector to perform efficient activities and utilize the resources for better performance. Studies have shown that ICT has the capacity to dramatically improve the results in any sector. In this research we did conduct the analysis and comparison of private and government education sector in Pakistan to study the representation of ICT. The investigation of analysis we did discuss the effectiveness of ICT being utilized education further more we did suggest what measures can be taken to improve the effective role of ICT in the less beneficiary sector. The study established that the availability of ICT resources in schools is still very much wanting and very inadequate for the students to use. Because of the limited number of functional computers and the computer laboratory, accessibility is timetabled. It was found out that training was mainly limited to introduction to basic concepts of information technology, some application programs notably MS office suit and internet; contextual training of students on how to use ICT in learning was not in practice.

KEYWORDS: Information and Communication Technology, long-last learning, Diffusion of innovations, ICT Tools and Applications.

1 INTRODUCTION

Information and Communication technology is playing a very integral role in field of education. ICT is used to enhancing the quality of education, effectiveness and their impact on education has been discussed all over the world for many years. ICT gives education more effective and responsive. In the world, there are many countries, information and communication technology (ICT) has very well beneficial results on the development of educational curriculum. That era is the Information Communication Technology then it's the time to improve the our education system, with the using of Information Communication and Technology tools and also using modern and advance education methodology to enhance our education system. The students and teachers, school staff, administrator department, examination department can also enhance their learning skills with the help of ICT tools [1].

Corresponding Author: Arbab Kanwal

There are many hurdles exist to the synthesis of ICTs both in developed and developing countries. Pakistan is a developing country and facing a numerous problems in education sector, far away from the race of progress in education. The overall impact of this study lies in how the results and recommendations have the potential to improve the ICT learning environment of the Faculty of Education teachers who teach in a government schools. Mostly studies now support the demand that technology has much possibility to provide new classifications of instructional happenings and to upgrade the knowledge and learning experiences of both the teachers and students. ICT is delivering better results in some industries and have optimized efficient usage of resources between them but in some of the industries ICT is still playing less effective role.

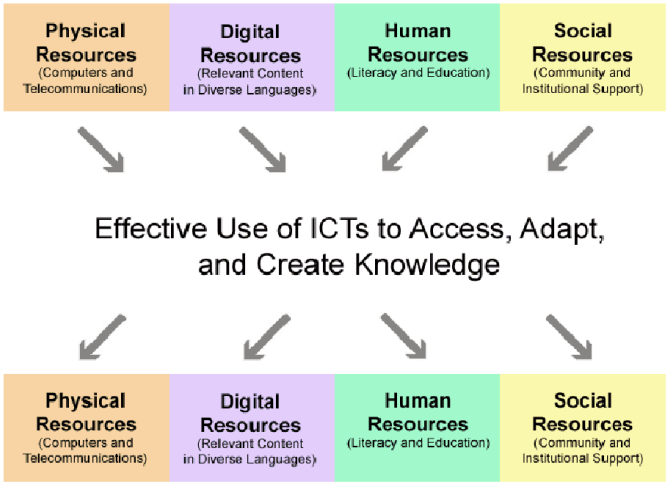


Fig 1: Role of ICT in education for innovative learning

Information and communication technology has very significant role every country in the world. In this modern era, extensive knowledge of Information and Communication technology is required to spread online and collaborative education system. There is much need to enhance our government schools education then the government schools get the better knowledge of education like other high impact private schools. It is also necessary to enhance the new creative thinking of students in collaborative environment. Our main focus on especially primary level schools to enhance long-lasting learning [2].

Its main important features of Information and Communication technology are time and space and their capability performance. Capability performance has the high impact on our government education system. It increases the efficiency of knowledge, step by step easy learning process for the primary, middle, and also for secondary students. It's a very time saving process if we using the online collaborative environment in our education system. In 24 hours and 7 days in the week, in every corner of the world, anytime we can download the course contents and other study materials [3].

The purpose of this research is to study the detailed education situation in Faisalabad. I would like to know, whether it is beneficial to apply ICT concept in education system and will it improve the education system. For this research, Faisalabad district has been selected and it has been selected because it is underdeveloped district in Punjab, Pakistan. Provide the online learning system to all children and teachers of public primary schools and free access to computers in order to minimize the lack of ICT tools uses in different government tools.

This research aims at evaluating the current level of lack of communication bents between the government schools of Faisalabad district. No IT competition held with the use of ICT tools in different schools. No IT activities between other schools of District Punjab and also no virtual events held. It's a huge drawback of our society government schools. In which, No result sharing between schools and other departments of government education like professional development of teachers, EDO's and special development and content development. No real time reporting performance among the schools for EDO's. It's a very necessary centralize sharing between schools [5].

This paper addressed the importance of ICT and role of ICT in poverty type poor countries. In these countries, past effort was not introduced the importance of ICT in education sector. In which, researcher was examined the many short comings in education and various under development education projects and also examined and review the strategies of education in poor countries and provided the beneficial solution of these shortcomings. It developed the Global ICT strategy in education to improve the quality of education and also revised the ICT new tools in education [6].

Researcher stated that many countries developed the valuable ICT tools in education sector to get more benefits of ICT tools in education sector. It also developed the resource development tools that were used in education fields. They developed the national strategy for education, other policy issues and other development resources for this purpose to integrating the ICT in education. Their development was totally emphasized on the extended research and suggested the well planned processes. This education was developed for the lithuanian country [7].

1.1 HISTORICAL PERSPECTIVE

Teaching is explode into one all told the foremost troublesome professions in our society, currently daily where knowledge is increasing therefore speedily that trendy technologies demand the employment of data and communication technology (ICT). ICT has become among a short time one all told the essential building blocks of an up to date society. Many countries presently regard understanding ICT and mastering its basic plan as a section of the core of education. In Uganda, Government established a fully-fledged ICT Ministry since 2006 to stress the importance of ICT in promoting process and development. Observers and proponents of ICT counsel that our use of more and more refined and enabling technologies will continue, to the extent that technological ability will become a basic sensible demand for our work, social and personal lives. The National Council for syllabus and Assessment notes that because the pace of technological development continues to grow, kids in our faculties nowadays can sleep in a world wherever ICT are going to be progressively embedded in their daily lives.

The use of computers in education isn't a brand new development. Within the 1970‟s, its promoters claimed that it might remodel and save education [8]. The late 1980‟s saw a growing shift towards laptop integration that stressed the syllabus and not the tool. Its proponents felt that students would learn new skills as they required them so as to create the pc work for them. The PC might currently be viewed a lot of as a partner as against a contestant and will be treated during a lot of natural [8]. The 1990‟s saw a heightened target increasing the utilization of engineering within the schoolroom, and not simply by the evangelists. Growing attention and pressure to implement technology in education is coming back from several directions, together with group and therefore the sector, not simply departments of education. One in all the foremost important options of the technological or digital era of a lot of connection to education is that the net. [9] Defines the net technically and functionally as a worldwide network of computers and groups interacting along.

1.2 THEORETICAL PERSPECTIVE

The study used the idea of psychological feature flexibility [12], emphasized by four levels of analysis [13]. The idea of psychological feature flexibility suggests that learners grasp the character of complexness a lot of pronto by being bestowed with multiple representations of an equivalent data in numerous contexts. It emphasizes the power to impromptu structure one's data in some ways, in reconciling response to radically ever-changing situational demands. The idea mostly issues itself with transfer of data and skills on the far side their initial learning state of affairs. Skills transfer is delineate as learners want to use the data and skills perfect within the educational program on the work [14] and [15]. Behavioral amendment would possible occur for learners World Health Organization learn the fabric bestowed in coaching and want to use that new data or skills to figure activities.

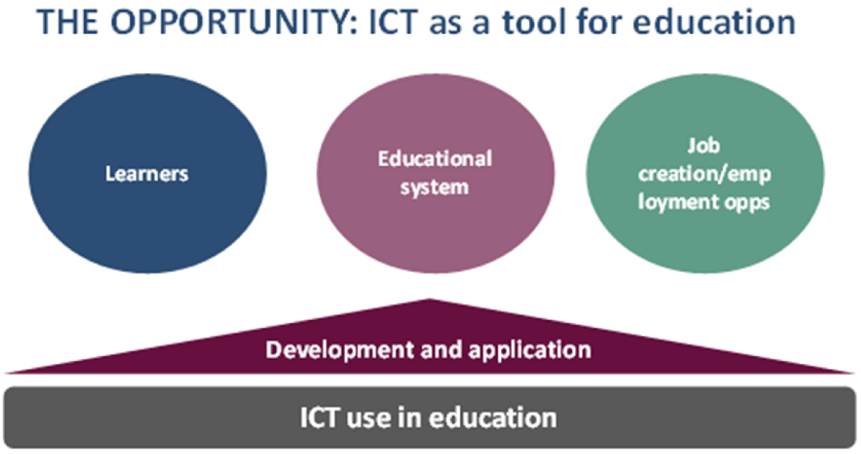


Fig 2: Long-Lasting Tools of ICT in education for students learning

For the lecturers and students to use and develop ICT materials that facilitate teaching and learning they ought to be in position to demonstrate high psychological feature flexibility [16]. This puts stress on transfer of learning. Transfer of learning refers to the extent to that performance in one state of affairs like multimedia system lesson is mirrored during another state of affairs like acting on the work or in a sequent lesson [17]. So teaching is usually a precursor to use or use that data within the planet for college students within the school rooms.

1.3 CONTEXTUAL PERSPECTIVE

Government schools, being a young and established, was came upon within the year 2002 to function a launch pad for just development in Punjab schools by providing information, skills and stimulating innovations in education, technology, economic advancement and social development [11]. However, the school faces several challenges with reference to the teaching and learning processes. Classical tutorial strategies are and still are utilized in the teaching and learning method with their limitations in numerous circumstances variable reckoning on student and teacher desires. Very little stress is being placed on the embracement of academic technology, nonetheless if properly used, ICT will give associate degree array of powerful tools which will facilitate in remodeling the current isolated teacher-centered and text sure schoolroom into made, students targeted interactive information setting. If not well self-addressed, investment in development of ICT within the University are going to be wasteful and therefore the teaching and learning method shall still be terribly slow limiting the University from achieving the event it's hoped to acquire the mission.

1.4 IMPLICATION OF THE STUDY

The study ought to be of nice importance to the policy manufacturers and directors of faculties serving to them to understand the quality of ICT in learning thus on come back up with policies that promote ICT in learning. The findings and suggestions of the study ought to be of importance to high school lecturers and alternative lecturers of upper establishment of learning on the utilization of ICT to help learning.

The investigator hopes that results of the study are also helpful to future researchers with interest in examining any the results of ICT on students learning. This could cause the generation of latest ideas for the higher implementation of ICT into learning method. The comprehensive implication of this study lies in however the results and suggestions have the potential to boost the ICT learning atmosphere of the school of Education professors World Health Organization teach during a portable computer program.

This successively might improve the educational atmosphere of the preserved lecturers World Health Organization might model their professors in teaching students within the room. These results conjointly are also useful for alternative schools of Education that have or square measure considering present computing. This study contributes to the body of analysis of present computing in schools of Education yet as diffusion of innovation analysis.

Two approaches are unit taken to look at however this study fits into the literature, from a 'micro' approach in however it fills a distinct segment or a spot within the literature and from the 'macro' approach in however it contributes to education and society. There are unit valuable previous studies of ICT integration as well as [12] World Health Organization completed a groundwork synthesis of thirty studies of laptop computer implementation and also the effects of 1 to 1 initiatives in faculties [13] World Health Organization completed a scientific review of ninety four analysis studies in faculties. However, these were school settings that have less relevance to post-secondary contexts. Similarly, [14] completed a meta-analysis on methods of desegregation technology into pre service education; however the sixty eight studies analyzed were additionally not specific to omnipresent laptop computer teacher education schemes.

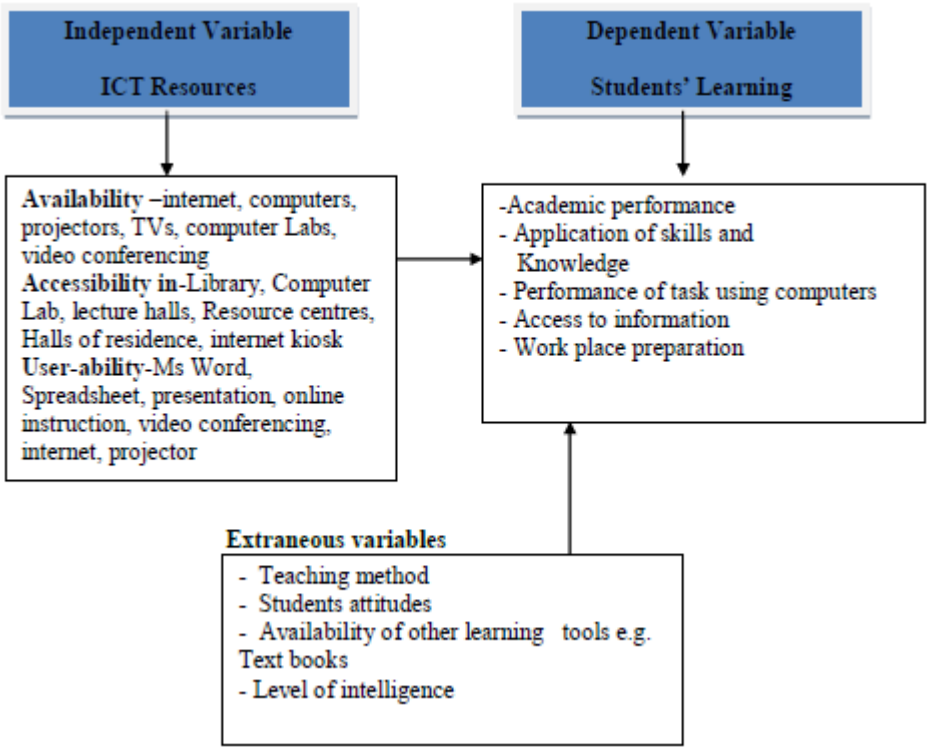


Fig 3: Conceptual Framework that shows the relationship between students learning and ICT tools

There are unit varieties of studies on the implementation of laptop computer universities that are living since Actor University started the primary laptop computer establishment in 1988, [29]. If however, there's a school of Education utilized in the studies, it's not forever specifically known. Studies of present computing in schools of Education represent a smaller set of analysis and are unit represented in additional detail within the literature review.

Given that many of the Education faculty members in the institution under study have not had the experience of teaching in a laptop environment, this study focuses on how the professors are learning about ICT and how to integrate it into their teaching in a laptop education program. As faculty turnover is a common occurrence at many universities, this study includes the learning experience of new faculty members who have had to quickly learn about the organizational culture as well as teaching in a ubiquitous laptop program. There are many external and internal factors influencing the process of how professors learn ICT in an educational environment and this study includes data gathered from preserve teachers, technical assistants and administrators as all are interdependent in the education process.

The study examines however the college members area unit group action technology in a very portable computer setting, listing the types and purpose of ICT used, what ICT is integrated into pre service teacher assignments and numerous ICT teaching ways. It additionally examines the technology skills that they had at first and the way they need improved, however perceived learning happens, World Health Organization they speak to after they study ICT, the number of interactions with colleagues and others within the community, and therefore the quantity of school development received.

2 RELATED WORK

[13] Examined that the knowledge and Communication Technology (ICT) acquirement among the library professionals of Calicut University. The study includes solely the library professionals within the central library and division libraries of Calicut University. A structured form was wont to collect information. The study reveals that the skilled Assistants area unit a lot of ICT adept in ICT skills than the Junior Librarians and Assistant Librarians. The employment of ICT-based resources and services, library automation computer code, and general purpose application computer code is high among the junior professionals than the senior library workers. The employment of digital library and institutional repository computer code is incredibly low among the library professionals. Majority of the professionals had confidence in routine ICT and net tasks, and wish coaching or orientation in library automation, digital library and institutional repository computer code.

[14] Reported a survey of the ICT skills among librarians in engineering academic establishments in Madras. The most objective was to spot the kinds of ICT skills possessed by the librarians, assess the level/extent of various sorts of ICT skills, the means that of exploit ICT skills, and determine the constraints in exploit ICT skills by the librarians. The data in ICT relates to operative systems, packages and programming languages, library automation software system, internet awareness, data of on-line facilities/services, and conjointly technical skills and social control skills. The results show that the librarians of those establishments area unit exploit sizable basic skills in ICT. However, they have to concentrate a lot of on network-based services and digital library services.

[15] Said that the overall laptop computer sales worldwide square measure increasing and should overtake desktop computers within the close to future abundant of this market has been fuelled by academic establishments requiring students to get laptops . The utilization of ICT has been increasing in education and can probably continue and, as technology becomes cheaper, laptops in an exceedingly wireless surroundings have become established because the tool of selection. Many schools square measure adopting present computing. Wherever each student has an exact grade includes a laptop computer. For instance, the Anytime Anyplace Learning Foundation (AALF) includes a self-reporting information of one to one laptop computer faculties from round the world. As of Gregorian calendar month 2008, there have been eighty nine registered faculties from Canada, Australia, and Bharat AALF different countries, together with South American country, Argentina, Brazil and African nation will be providing a laptop computer for each faculty age kid through the one laptop computer Per kid program [36]. The state of Pine Tree State is providing a laptop computer for each kid in grade seven. At present, there square measure several faculty boards or districts providing laptops for college kids.

[16] Was designed that the ICT framework program for the network and multimedia organization. It mentioned the two main drivers of the ICT framework program. First one internet of the future, in which included the unlimited broadband, wireless access anywhere in specific organization. Second one includes the internet basic parts or infrastructure that transmits the video demands and visualizing improving the overall performance of the video conferencing.

[17] Described that Information & Communication Technology tools and application played a very important role in education fields to improve and enhanced the students and teachers' critical and innovative thinking. They try level best to design such an ICT application that fulfilled the education requirements of students, teachers, staffs, knowledge management department, and also administrative departments.

[18] Developed the U-training (Ubiquitous-training) model. Basically U-training model is a higher education portal for students and teachers to learn their ICT skills. Learners can be used this model with high technological infrastructures like PDA's mobiles, laptops and instant messages. It's like a self-training portal, in which included ICT tools related courses, courses management tools, create online syllabus system. Totally emphasized on collaboration learning, pedagogical strategy courses, problem based learning and also micro teaching.

[19] Explained that ICT give a positive impact on learning associate degreed student performance once it becomes an integrated component within the room and teaching. Bonnet (1997) argued that the provision of visual digital technology (such as animation, simulation and moving images) involves students and reinforces abstract understanding. ICT use conjointly encourages development from a teacher-focused or teacher-led model to an additional student-focused model within which students work along, build their own selections and take an energetic role in learning Swedish National Association for college Improvement (2008).

[2] Stated that the objective of this paper had included two parts. In first part, we used the scenario based application that facilitates the education technical and innovative learning and also sharing learning resources. Learning could be considered as the key capabilities in modern education, in which ICT tools were used. It developed the knowledge base models that facilitating the various education stakeholders and was changing the business environment.

[4] Described that the survey based research in Pakistan to find the savior factors of integrating the ICT tools in education web portal, cost effective infrastructure, and other government policy issues. The main emphasized was that to integrate the e-Governance in Pakistan education sector. For this purpose, it was used the activity diagrams, scatter diagrams, and statistics tools were also involved.

[1] Explained that developed the Multimedia Development Corporation (MDeC), this company were used for create the linkages between different education institutes. This application was only used for the Malaysian education sector. It supported the Multimedia Super Corridor (MSC). Their preliminary framework was Project Management Maturity Model (PMMM).

3 MATERIALS AND METHODS

Mixed method study uses both quantitative and qualitative measures including; interviews, focus groups, a faculty survey, and course outline documentation. We'll develop an education portal and also provides the facility of internet connectivity. Physical and technological infrastructure establishes the connectivity between schools through internet or wireless and save private net cost. Human resource development guides the staff, how to upload results or generate new event and also training materials.

The students face the many problems during the training of ICT tools and 42% are those students who cannot bear the cost of computers in this modern era. 37% are those students; they face the problem of bad internet connection. Some most important problems: lack of training of ICT tools, lack of collaboration between the students by using the ICT tools, insufficient knowledge and integration of ICT tools, lack of computer access, shortage of basic Information and Communication Technology skills, Shortage of costly infrastructure, lack of trainers and lack of applicable software's [42].

4 USER-ABILITY OF ICT SOURCES AND SCHOOL STUDENTS DISCOVERING

Respondents ended up asked for to level their awareness and techniqueswithin a variety of ICT equipment.

4.1 DISTRIBUTION OF RESPONDENTS BY RANKING OF SCHOLARS CAPABILITIESIN SEVERAL ICT EQUIPMENT'S

Table 1: Distribution of respondents by ranking of scholars capabilities

ICT Tools	Level of skills	Freq	Percent
Word processing	Very poor	11	6.3%
	Poor	10	5.7%
	Fair	39	22.3%
	Very Good	73	41.7%
	Good	42	24.0%
Total		**175**	**100.0%**
Spreadsheet	Very poor	13	7.4%
	Poor	14	8.0%
	Fair	59	33.7%
	Very Good	61	34.9%
	Good	28	16.0%
Total		**175**	**100.0%**
Presentation	Very poor	18	10.3%
	Poor	24	13.8%
	Fair	65	37.4%
	Very Good	41	23.6%
	Good	26	14.9
Total		**174**	**100.0%**
Online Instruction Blackboard	Very poor	41	23.6%
	Poor	39	22.4%
	Fair	52	29.9%
	Very Good	30	17.2%
	Good	12	6.9%
Total		**174**	**100.0%**
Video Conferencing	Very poor	52	30.1%
	Poor	58	34.1%
	Fair	38	22.0
	Very Good	15	8.7%
	Good	9	5.2%
Total		**173**	**100.0%**
Publication Software	Very poor	40	23.1%
	Poor	50	28.9%
	Fair	46	26.6%
	Very Good	27	15.6%
	Good	10	5.8
Total		**173**	**100.0%**
Projectors	Very poor	30	17.1%
	Poor	35	20.0%
	Fair	47	26.9%
	Very Good	42	24.0%
	Good	21	12.0%
Total		**175**	**100.0%**
Internet and Emails	Very poor	8	4.6%
	Poor	15	8.6%
	Fair	38	21.7%
	Very Good	51	29.1%
	Good	63	36.0%
Total		**175**	**100.0%**

It display that vast majority of your respondents (73, 41.7%) emphasized that their techniques to utilize MS term is great. While in the similar vein, 42 (24.0%) respondents claimed that their competencies have been excellent while 39 (22.3%) rated their expertise as honest. Though the 5.7% and 6.3% of respondents rated their competencies as becoming weak and really lousy respectively in applying MS term. The acquiring reveals the students' abilities to make use of MS Term for his or her educational objective like preparing obviously get the job done is comparatively superior which counsel that ICT can impact mastering.

The recorded only 28 (16.0%) respondents who envisaged their competencies to work with spreadsheets as great along with 59 (33.7%) who rated their techniques as honest. Greater part from the respondents (61, 34.9%) rated their techniques of employing spreadsheets pretty much as good. Though 14 (8.0%) rated their competencies as very poor and 13 (7.4%) rated as extremely very poor. In the course of a dialogue along with the researcher, some learners uncovered which the content material taught to them is incredibly shallow and perhaps a single lecturer consented that "The researcher prepare them only primary components" which was an extra evidence of your shallowness from the contents taught.

The conclusions acquired, exhibit that only 26 (14.9%) of every one of the respondents agreed that learners capabilities to make use of presentation application in accomplishing discovering responsibilities had been excellent.

A complete of forty one (23.6%) respondents agreed that their techniques ended up only great. Then again a giant quantity of the respondents totaling to 65 (37.4%) thought that their expertise to make use of presentation program in doing mastering jobs were being reasonable. About 24 (13.8 %) rated their expertise as very poor and 18 (10.3%) rated their techniques as pretty lousy in making use of presentation computer software. The above mentioned results recommend which the learners had been quite able and qualified in applying presentation program like PowerPoint to current their system resources all through conversations and classes.

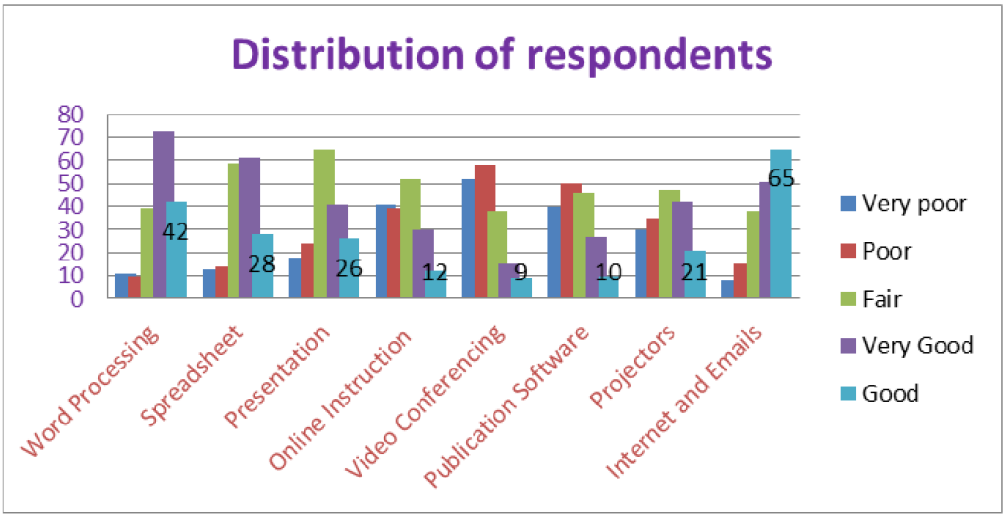


Fig 4: Distribution of respondents by ranking of scholars

End result demonstrates that only 12 (6.9%) respondents rated their competencies in on-line instruction to generally be great. About thirty (17.2%) respondents explained that their abilities in applying on the net instruction are sweet though the totality on the respondents (52, 29.9%) rated their competencies as truthful. A complete of 39 (22.4%) rated their capabilities as very poor and 40 (23.6%) agreed that their expertise in applying on the web instruction may be very lousy. The above mentioned results expose that learners usually are not very well outfitted to implement on the internet instruction like blackboard to share discovering components. Aside from, dialogue using the learners also reveals that no lively on the internet instruction technique was set up given that the faculties hasn't experienced web link for just a extended time period of your time.

It Spells out quite several respondents (5.2%) who approved they experienced great competencies of online video conferencing. Yet again a little variety (15, 8.7%) of respondents approved their competencies to get excellent. No less than 38 (22.0%) on the respondents rated their expertise as reasonable. Vast majority of respondents (fifty nine, 34.1%) acknowledged which they experienced very poor abilities of online video conferencing. 52 (30.1%) of your respondents agreed that their abilities were being incredibly very poor. Through the conversations together with the directors all of them agreed which the ICT means for video clip conferencing weren't set up the rationale why this kind of technological innovation

wasn't applied inside the school. It known as for even bigger community band widths which the faculties couldn't pay for mentioned dean school of Instruction and Humanities.

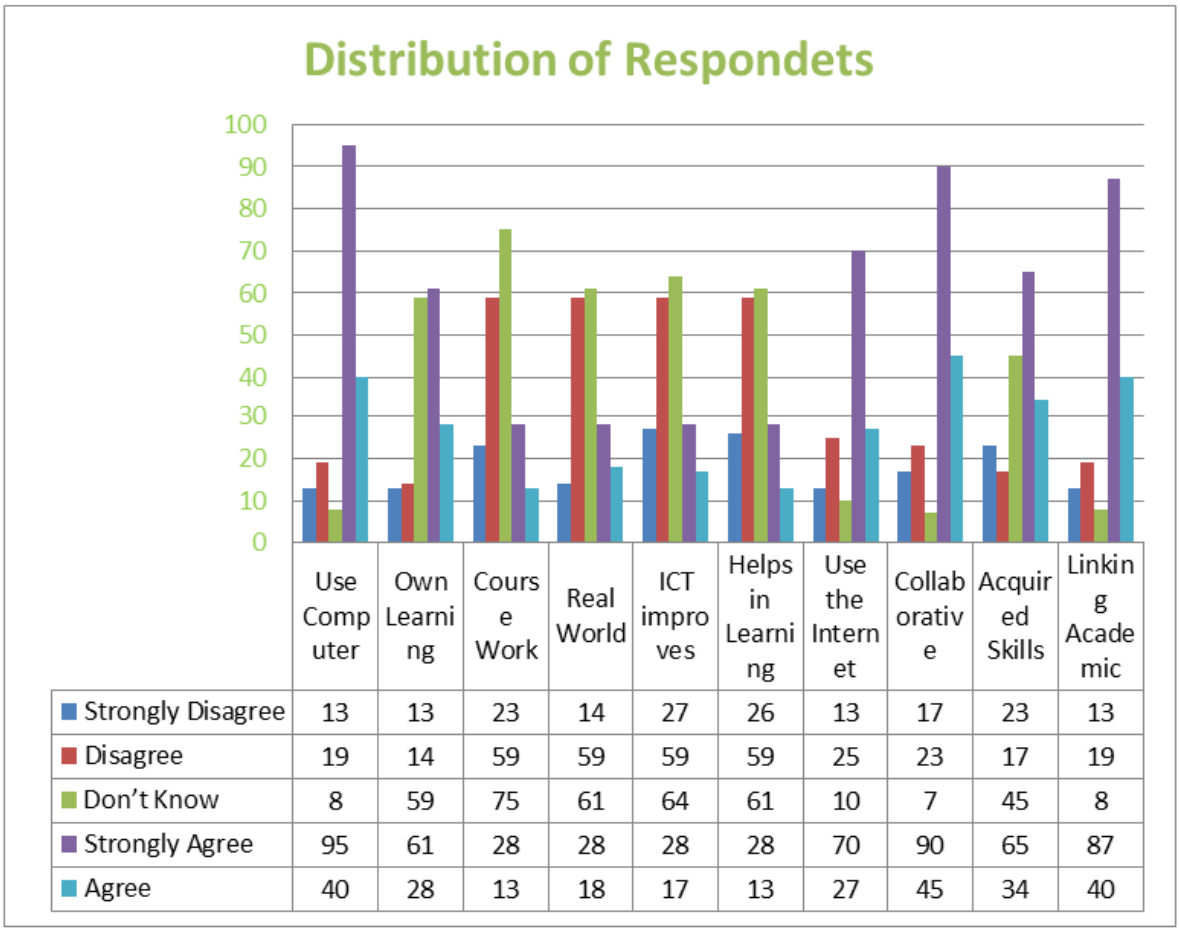
Benefits present that only ten (5.8%) with the full respondents claimed learners techniques to work with publication program had been great. About 27 (15.6%) respondents consented that their competencies ended up very good. 46 (26.6%) rated their competencies as honest, nonetheless greater part (50, 28.9%) mentioned their expertise ended up inadequate. A complete of 40 (23.1%) respondents claimed their abilities ended up really very poor .Conversations along with the directors verified that educating learners how you can create paperwork employing PageMaker and publisher like banners, adverts and so forth. weren't in position. A lecturer in the school of personal computer science reported that point and monetary methods does not make it possible for this plan as a result students are usually not supplied with the know-how and expertise on this offers which influences their studying with this details age.

Outcomes even more expose that 47 (26.1%) on the school students experienced reasonable expertise to make use of a projector in presenting their perform. A minimum of 35 (20.0%) respondents reported their competencies to work with projectors had been extremely weak and about 30 (17.1%) rated their abilities as weak. Around the optimistic aspect a complete of 42 (24.0%) respondents consented getting fantastic techniques when a little range of respondents (21, 12.0%) mentioned that they had superb competencies to employ projectors. Respondents who agreed of getting very good, honest and really fantastic expertise to make use of projectors are genuine due to the fact through the scientists details selection he noticed numerous students of knowledge Technological innovation utilizing it to existing their study course performs. Apart from, dialogue while using the students discovered which the course coordinators are liable for selecting and connecting the projector both equally for academics and school students use which evidently advise which the students have been reasonably professional and qualified during the utilization of projectors for studying needs.

The recorded only 8 (4.6%) respondents who agreed that their expertise to make use of World-wide-web and on line know-how had been incredibly bad. The vast majority with the respondents (63, 36.0%) agreed that their capabilities to make use of world-wide-web and on the web means have been great. The above mentioned acquiring is indicative the learners amount their expertise in applying online and on the internet means hugely and so need to be able of collaborating with fellow S students, downloading tutorial methods like on the web journals amid some others.

4.2 RESPONSES ON STUDENTS' FINDING OUT

It exhibits that students possess a quite constructive angle to information and facts technologies. The respondents use personal computers to accomplish class functions, tasks and experiences to which the vast majority (54.3%) agreed, though about forty (22.9%) respondents strongly agreed they use computer systems to accomplish program will work. A complete of 19 (10.9%) and about 13 (7.4%) respondents disagreed and strongly disagreed respectively on their own utilization of desktops to finish program functions and assignments. A little amount (4.6%) of respondents weren't certain. The getting indicates that irrespective of the issue in accessing computer systems, learners had been placing plenty of energy to utilize personal computers of their mastering procedures.



	Use Computer	Own Learning	Course Work	Real World	ICT improves	Helps in Learning	Use the Internet	Collaborative	Acquired Skills	Linking Academic
Strongly Disagree	13	13	23	14	27	26	13	17	23	13
Disagree	19	14	59	59	59	59	25	23	17	19
Don't Know	8	59	75	61	64	61	10	7	45	8
Strongly Agree	95	61	28	28	28	28	70	90	65	87
Agree	40	28	13	18	17	13	27	45	34	40

Fig 5: Distribution of respondents by feeling on overall performance of studyingresponsibilities

It could be recognized additional that, not less than 41 (23.4%) respondent strongly agreed to possess mastering applying personal computer and World Wide Web. The vast majority (68, 38.9%) of respondents agreed to individual understanding applying computer systems. They can be prepared to utilize desktops like a nutritional supplement to other instructing routines. About 46 (26.3%) respondents disagreed as well as a modest quantity (13, 7.4%) of respondents strongly disagreed to employing personal computers and web for very own finding out. The above mentioned getting counsel that ICT presents instruments for pondering far more deeply, pursuing curiosity and checking out and growing intelligence as learners establish psychological products with which they're able to visualize connections involving tips on any subject. These getting is regular with who identified that pcs can be employed being a dietary supplement but cannot thoroughly substitute the teacher's position.

Table 2 even further reveals that totality (52%) from the respondents agreed that ICT make improvements to student's organizational abilities. About 24% strongly agreed although a little range (12%) disagreed. A complete of 5.1% strongly disagreed to IT increasing school student's corporation capabilities. The obtaining propose that interactive instructional systems enable students to understand to prepare sophisticated data, realize styles, attract inferences, converse results and find out far better organizational and difficulty fixing kills.

4.3 DISTRIBUTION OF RESPONDENTS BY FEELING ON COMPONENTSINFLUENCING STUDENT'S UTILIZATION OFA VARIETY OF ICT METHODS

Table 2: student's utilization ofa variety of ICT methods

Opinion	Freq	Percent
Inadequate power supply	13.00	8%
Limited time to access the lab	37.00	22%
Inadequate infrastructure	11.00	7%
Bureaucracy	4.00	22%
Limited ICT facilities	62.00	37%
Inadequate internet services	11.00	7%
Lack of hands on experience	25.00	15%
Mismanagement of lab equipment	2.00	1%

From Table 2, responses through the open up finished issues unveiled that totality (37%) of your respondent's emphasized minimal ICT methods inside the school college given that the important variable influencing student's usage of ICT applications. This was obvious where by students accessed the pc laboratory to review in a few distinctive shifts on distinct times not for comfort but to share the couple of desktops which were offered. School student laptop or computer ratios ended up also large nonetheless lots of pcs have been defective. This watch was additional supported by 37 (22%) with the respondents who pressured which they have restricted the perfect time to obtain the pc laboratory. The Dean school of Education and learning and Humanities elevated the difficulty of missing a school laptop laboratory.

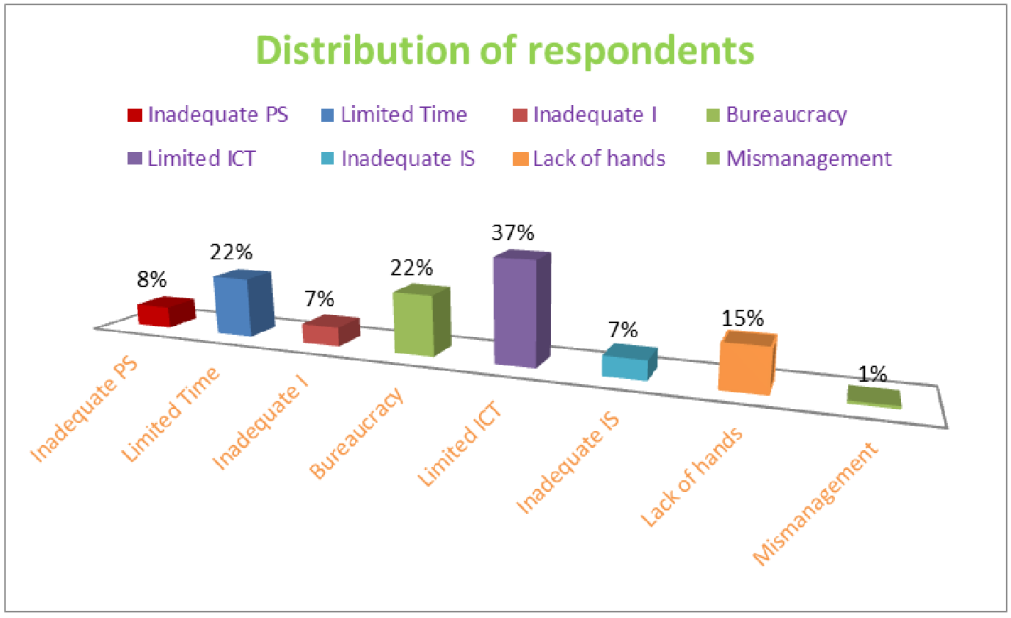


Fig 5:Student's utilization ofa variety of ICT methods

From Table 2, about 25 (15%) with the respondents indicated which they absence arms on expertise and many instruction were being theoretical together with the students getting little or no time for you to observe given that the pc laboratory is often competed for. This implies which the learners will not be outfitted along with the simple information and capabilities they may well much need through work.

About 13 (8%) respondents lifted insufficient electric power source, though at the very least 11 (7%) seemed at confined infrastructures along with the identical variety stressing insufficient world-wide-web connectivity as being the variable

influencing student's utilization of ICT methods. A smaller sized variety (2%) and (1%) of respondents pointed at paperwork and mismanagement of laboratory equipment's respectively as components influencing their utilization of the ICT instruments while in the school.

4.4 QUESTIONNAIRE RETURN LEVEL

Inside the review, a complete range of 249 school students and seventeen instructors ended up sampled offering a complete of 266 questionnaires which were dispersed. A complete of 175 (65.7%) totally accomplished questionnaires had been returned of which 164 (65.8%) and 11 (64.7%) had been stuffed by students and instructors respectively. This gave a reaction charge of 65.7% as illustrated in Table 3 under:

Table 3: Questionnaire returns level of students and teachers

Respondent Category	Number Issued Out	Number Returned	Percentage
Students	249	164	65.8 %
Teachers	17	11	64.7 %
Total	266	175	65.7 %

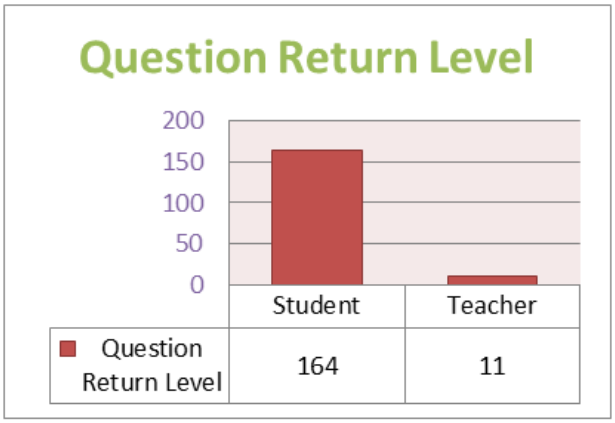


Fig 6: Questionnaire returns level

5 CONCLUSION

The ICT infrastructure in the school is improperly produced, erratically dispersed and insufficient. Having said that, some ICT methods like laptop lab, projectors and TV sets have been deemed being relatively offered. Even though not totally enough, the school acknowledges the necessity for ICT methods in its educational endeavors and therefore there may be by now anything to develop on. ICT accessibility during the various school sectors for both equally lecturers and students wasn't very well attended to. The most important obstacle nonetheless impacting easy accessibility to ICT services during the school continues to be the minimal amount of ICT methods which doesn't match using the at any time escalating scholar inhabitants. But there was a minimum of something set up to develop on nevertheless however was restricted to personal computers. To the huge extent, a scholar schooling in ICT from the school was generally restricted to MS Office environment fits although not ability acquisition that triggered ICT ability transfer to employ ICT both of those for studying as well as in other options.

6 FUTURE DIRECTIONS

This research work as a result suggests the next feasible investigate places. The connection among technologies and genuine understanding in increased establishments of finding out the Students motivation and utilization of the World Wide Web being a hub and also for understanding the influence of recent know-how on learner's performance

ACKNOWLEDGEMENT

Special and many thanks go to my parents, sisters and brothers, who support me in every moment of my life. I also thanks to my friends who motivate me and give enormous facilities during my study.

REFERENCES

[1] R. Jamaluddin, R. Chin, C. M. Moin and C. W. Lee, "Understanding the requirements for project management maturity models: Awareness of the ICT industry in Malaysia,"*IEEE International Conference on*, pp. 1573-1577, 2012.

[2] S. N. A. Kazmi, "Factors influencing e-Governance implementation: Issues and challenges in Pakistan," *(ICDIM), Fifth International Conference on,* pp. 326-331, 2010.

[3] P. Srivastava, "Educational informatics: An era in education,"*(ICTEE), IEEE International Conference on*, pp. 1-10, 2013.

[4] H. Mohamed and F. Shukoor, "Impact of Information Communication Technology (ICT) on professional development and educational needs of library professionals in the universities of Kerala," *Journal of Doctoral dissertation Cochin University of Science and Technology, vol.* 3, no. 1, pp. *256-260, 2010.*

[5] M. Capay and M. Magdin, "Lifelong learning of teachers at primary and secondary schools with the support of e-courses," *15th International Conference on,* vol. 4, no. 8, pp.16-26, 2012.

[6] G. Muhametjanova andK. Agiltay, "Students' and Instructors' Perceptions on Use of Information and Communication Technologies during Instruction in a Kyrgyzstan University," *IEEE 12th International Conference on*, pp. 500-502, 2013.

[7] S. Pouezevara, S. Mekhael, and N. Darcy, "Planning and Evaluating ICT in Education Programs Using the Four Dimensions of Sustainability: A Program Evaluation from Egypt," *International Journal of Education and Development using ICT*, vol. *10*, no. 2, pp. 120-141, 2014.

[8] M. A. Iniesta-Bonillo, R. S. Fernandez, and W. Schlesinger, "Investigating factors that influence on ICT usage in higher education: a descriptive analysis," *International Review on Public and Nonprofit Marketing*, vol. *10, no.* 2, pp. 163-174, 2013.

[9] P. Wastiau, R. Blamire, C. Kearney, and V. Quittre, E. V. Gaer, and C.Monseur, "The Use of ICT in Education: a survey of schools in Europe," *European Journal of Education*, vol. *48*, no. 1, pp. 11-27, 2013.

[10] M. Webb, and N. Reynolds, "Current and future research issues for ICT in education,"*Journal of Computer Assisted Learning*, vol. *29*, no. 1, pp. 106-108, 2013.

[11] B. Dumont, "Co-operation between Europe and some Southern and Eastern Mediterranean Countries on the use of ICT in Education: constrains and opportunities learnt from several European projects," *Journal of Agricultural Informatics*, vol. *4,* no. 1, 2013.

[12] A.K. Ray, "Imperatives of Access, Equity and Quality in Indian Technical Education System: Role of ICT. In *ICT in Education in Global Context," Journal of Springer Berlin Heidelberg,* pp. 143-162, 2014.

[13] S. Sarkar, "The role of information and communication technology (ICT) in higher education for the 21st century," *Science*, vol. *1,* no. 1, pp. 30-41, 2012.

[14] Spring, J. (2012). *Education Networks: Power, Wealth, Cyberspace, and the Digital Mind. Sociocultural, Political, and Historical Studies in Education*.Routledge, Taylor & Francis Group. 7625 Empire Drive, Florence, KY 41042.

[15] Wiseman, A. W., & Anderson, E. (2012). ICT-integrated education and national innovation systems in the Gulf Cooperation Council (GCC) countries.*Computers& Education*, *59*(2), 607-618.

[16] B. Dumont, "Co-operation between Europe and some Southern and Eastern Mediterranean Countries on the use of ICT in Education: constrains and opportunities learnt from several European projects," *Journal of Agricultural Informatics*, vol. *4*, no. 1, 2013.

[17] C. W. Fan, and K. K. Ho, "A tale of three cities: Review of the development of ICT in school education between Hong Kong, Macau and Singapore," *New Horizons in Education*, vol. *60*, no. 1, pp. 70-82, 2012.

[18] Z. A. Shaikh and S. A. Khoja, "Higher Education in Pakistan: An ICT Integration Viewpoint," *International Journal of Computer Theory and Engineering*, vol. *5*, no. 3, pp. 410-413, 2013.

[19] S. Rahim, A. Begum, and G. Sahar, "ICTs in Education for the Mountainous Area Development: An Application Based Study of Gilgit (Pakistan)," In *Education and Educational Technology Springer Berlin Heidelberg,* pp. 73-79, 2013.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 598-610
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

La certification qualité et la performance des organisations : Quelles convergences ? Etude de cas au sein de la Nouvelle Société AMADIR dans le grand Agadir

[The quality certification and the performance of organizations: what convergences? Case study within the New Company AMADIR in Agadir]

Lamia El Kahri[1], Ali Rachidi[2], Mostapha Amri[2]

[1]Doctorante En Sciences et Techniques de Gestion,
Equipe de recherche en économie de transport, technologies de l'information et logistique,
Université IBN ZOHR/ENCG, Agadir, Maroc

[2]Enseignant chercheur,
Université IBN ZOHR/ENCG, Agadir, Maroc

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The companies become increasingly conscious that their development and their competitiveness pass by the integration of the approach quality within their organization. In this direction, the certification seems a strategic action of the search for excellence. This article aims at studying the impact of certification on the performance of the companies while being based on a case study within the business AMADIR New Company in Agadir.

KEYWORDS: Approach quality, quality certification, performance, Agroalimentary Company, normalize ISO, TQM.

RESUME : Les entreprises deviennent de plus en plus conscientes que leur développement et leur compétitivité passent par l'intégration de la démarche qualité au sein de leur organisation. Dans ce sens, la certification apparait comme une action stratégique de la recherche d'excellence. Cet article vise à étudier l'impact de la certification sur la performance des entreprises en s'appuyant sur une étude de cas au sein de l'entreprise Nouvelle Société AMADIR dans le grand Agadir.

MOTS-CLEFS: Démarche qualité, certification qualité, performance, entreprise agroalimentaire, norme ISO, MQT.

1 INTRODUCTION

Le monde industriel a subi une évolution permanente de plus en plus marquée ces dernières années comme l'affirment Franchini et al « Le marché évolue et l'environnement économique se caractérise par un accroissement de la compétitivité économique et par une diversification accrue des produits »[1]. Ce rythme accéléré de changement impose un niveau de compétitivité aux entreprises marocaines et les obligent à s'engager dans un progrès permanent à tous les niveaux de

[1] Mohamed DHIAF, « Proposition d'un modèle de mesure de l'impact du Total Quality Management sur la performance globale : Cas des entreprises Tunisiennes de Textile- Habillement », Thèse de doctorat en sciences de l'ingénieur, soutenue en 2007, Ecole Nationale Supérieur d'Arts et Métiers, Tunisie, P.11.

Corresponding Author: Corresponding Author (email)

l'organisation afin de faire face à une concurrence exacerbée, dans le but d'améliorer leurs performances, rester compétitives, survivre et se développer.

Dans la même perspective, Mervellec signale que « Nous sommes dans une époque où le problème est de produire ce que l'on est capable de vendre et non plus de vendre ce que l'on est capable de produire »[2]. Pour ce faire, un nombre croissant d'entreprises se sont plongées dans une démarche de certification pour approfondir et progresser dans leurs démarches d'amélioration de compétitivité et de performance. En effet, l'intégration d'un système qualité permet à l'organisation de renforcer sa propre compétitivité et d'atteindre la qualité requise pour le produit et le service.

PROBLEMATIQUE, INTERET ET OBJECTIF DE L'ETUDE

Le recours à la certification qualité est une bonne approche pour faire le premier pas vers l'excellence. Malgré ses apports avérés, elle ne constitue pas un passeport suffisant vers l'excellence. En effet, les résultats des travaux portant sur la performance et la certification sont contradictoires et font que le lien entre ces deux variables est flou. Pour ce faire, Il nous a donc semblé utile d'engager un travail de recherche autour de cette thématique d'évaluation et de pilotage de la performance dans une logique de qualité, afin de répondre à une interrogation principale qui fait l'objet de notre problématique à savoir :

QUEL EST LE LIEN DE CORRÉLATION POUVANT EXISTER ENTRE LA CERTIFICATION QUALITÉ ET LA PERFORMANCE GLOBALE DES ENTREPRISES ?

Cette réflexion ne peut être appréhendée qu'à travers un questionnement qui prenne en compte les différents aspects de cette problématique.

QUESTIONS DE RECHERCHE

Outre l'interrogation principale, cette étude vise, de façon spécifique, à trouver des réponses concluantes aux questions suivantes:

- Existe-il une relation étroite entre la certification qualité et la performance des entreprises ?
- Comment les démarches qualité peuvent-elles améliorer la performance des entreprises?

La problématique du présent travail, consiste, surtout, à éclaircir dans un premier temps, les changements que connait l'entreprise lors de l'implantation d'une démarche qualité ainsi que leurs impacts sur sa performance. Dans cette optique, la mise en place d'une démarche qualité au sein d'une organisation apparait comme une action stratégique qui contribue à sa performance et son amélioration dans un contexte en pleine mutation.

Pour répondre à cette problématique, un certain nombre d'hypothèses ont été défini dont l'objet est de fournir un cadre de réflexion à notre recherche, la validation de toute ou partie de ces hypothèses énoncées nous permettra de répondre à notre question fondamentale.

LES HYPOTHESES DE LA RECHERCHE :

Hypothèse 1 : La démarche qualité attribue à l'entreprise une bonne image au niveau de ses partenaires (clients, fournisseurs, actionnaires, état, etc.….), améliore sa performance ce qui contribue à une augmentation des parts de marché.

Hypothèse 2 : L'implantation d'un système qualité augmente les ventes de l'entreprise et lui assure une meilleure performance.

Pour comprendre la complexité de la notion de qualité, il sera primordial que le lecteur ait une bonne compréhension du vocabulaire utilisé par les promoteurs de la qualité. Il conviendra de voir comment la notion de qualité fut appliquée dans le monde industriel. Pour cela, Une revue de la littérature sera déployée à ce propos afin de préciser ce concept.

[2] *Mohamed DHIAF, « Proposition d'un modèle de mesure de l'impact du Total Quality Management sur la performance globale : Cas des entreprises Tunisiennes de Textile- Habillement », Op.Cit.,P.12.*

2 QUELQUES CONCEPTS THÉORIQUES SUR LA NOTION DE LA QUALITÉ

L'environnement actuel pose continuellement de nouveaux défis compétitifs pour les entreprises. Ces dernières doivent être capables de comprendre leur environnement général, de satisfaire de façon très précise les besoins de ses clients, d'anticiper et de s'adapter de manière continue aux nouvelles règles de son environnement dans le but de garantir une survie à long terme en cherchant à aboutir une certaine performance. En effet, cela ne peut être réalisé qu'à travers l'intégration d'un système qualité digne de ce nom.

Le terme qualité est difficile à cerner du fait de la multitude des apports d'auteurs sur le quoi de ce concept comme le confirme Mintzberg « On ne peut pas définir la qualité, néanmoins on peut la reconnaitre ».[3]

D'après le dictionnaire Larousse «La qualité signifie notamment: la manière d'être, bonne ou mauvaise, de quelque chose, état caractéristique ou supériorité, excellence en quelque chose ». Christian DOUCET de sa part, définit simplement la qualité comme le travail bien fait, le bon produit, le client satisfait, le travailleur consciencieux. Plus spécialement la qualité est « la manière d'être » bonne ou mauvaise de quelque chose et s'oppose à la quantité qui n'a pas de notion de valeur.[4]

La norme ISO 9000 propose la définition suivante : « La qualité est l'aptitude d'un ensemble de caractéristiques intrinsèques à satisfaire des exigences».[5]

Pour l'AFNOR : « La qualité est l'ensemble des propriétés et caractéristiques d'un produit ou service qui lui confère son aptitude à satisfaire les besoins exprimés ou implicites».[6]

Différents auteurs définissent la notion de qualité ; il en résulte donc de nombreuses définitions. Nous avons choisi celles qui nous paraissaient les plus intéressantes à exploiter :

Pat Townsend estime : «La qualité, c'est ce que le client perçoit quand il sent que le produit ou le service rencontre ses besoins et correspond à ses attentes».[7]

De même Frédéric lukace considère que : « La qualité est la satisfaction extrême et durable du client et une réduction systématique de tous les coûts qui n'y contribuent pas, autrement, présenter à chaque client le bien ou le service qui correspond exactement à ses besoins ».[8]

Et pour Jacques Dove : « La qualité est la satisfaction des utilisateurs, la satisfaction de l'entreprise et la satisfaction de l'intérêt général ».[9]

D'après ces définitions, présentées à titre indicatif, nous pouvons déduire que l'objectif ultime de toute démarche qualité est la satisfaction exacte des besoins explicites et implicites du client pris dans le sens large. Alors qu'on est-il de la qualité dans le domaine agroalimentaire ?

3 LES SPÉCIFICITÉS DE LA NOTION DE LA QUALITÉ DANS LE DOMAINE AGROALIMENTAIRE

Ce travail portant sur une expérience au sein d'une entreprise agroalimentaire. Pour ce faire, il semble important de préciser les particularités que revêt la notion de la qualité dans ce secteur.

Le secteur agroalimentaire est l'un des secteurs moteurs de l'économie marocaine. En effet, il contribue à hauteur de 32% du PIB industriel et 12% [10]du taux de croissance de la production.

---

[3] Hanen FAKHFAKH, « Le management socio-économique et la mise en œuvre d'une démarche qualité intégrale dans un établissement d'enseignement supérieur », thèse de doctorat en sciences de gestion soutenue en 2012, Ecole doctorale « ABBE GREGOIRE », Tunisie, P.64.

[4] Yvan CHAPETEIX, « Les enjeux des signes d'identification de la qualité et de l'origine dans le secteur agroalimentaire français », mémoire de Master, Management en Hôtellerie et Restauration, Université de TOULOUSE II LE MIRAIL, 2012, P.10

[5] ISO 9000

[6]Imane RAJI, « Mise en place d'une démarche qualité dans un établissement de santé : cas de l'hôpital préfectoral d'inezgane », Mémoire en vue de l'obtention du dîplome de DESS en Management de la qualité, Université IBN ZOHR, ENSA D'AGADIR, 2007, P.17.

[7] Mohamed DAHDAH, «Satisfaction de la clientèle, cas Amendis Tanger », Thèse professionnelle ISCAE, Novembre 2007,p.30.

[8] Idem.

[9] Idem.

Depuis de nombreuses années, les industries agroalimentaires ont mis en place différents outils pour assurer la mise sur le marché de produits présentant une qualité hygiénique optimale : contrôle des matières premières à réception, des en-cours de fabrication, des produits finis, audits des fournisseurs, HACCP, bonnes pratiques d'hygiène, systèmes de traçabilité de plus en plus performants, etc.

En effet, les aliments sont des produits différents des autres produits industriels. Leurs particularités sont à l'origine de contraintes spécifiques du secteur de l'agro-alimentaire.

Il est ainsi possible de parler de « qualité alimentaire », c'est-à-dire « l'aptitude du produit à bien nourrir »[11]. L'aliment doit en effet fournir à son consommateur, « dans des conditions de sécurité complète, les nutriments et l'énergie nécessaires à son métabolisme vital ».

Les questions relatives à la qualité des produits agricoles et alimentaires ne sont pas nouvelles, c'est une préoccupation ancienne et récurrente qui reste toujours au cœur des inquiétudes des consommateurs. D'après Multon,[12] le terme qualité alimentaire peut se décliner en trois éléments : « la qualité hygiénique », « la qualité nutritionnelle » et « la qualité organoleptique (goût) ».

Mainguy[13] de son côté, résume ces différentes composantes de la qualité par ses « 4S » : la Satisfaction, qui correspond à l'organoleptique, la Santé, faisant référence à la mutation, la Sécurité et le Service. Multon ajoute à ces « 4S », le Symbolique véhiculé par l'aliment ainsi que le S de « Société » afin de souligner l'impact des évolutions sociales sur les mœurs alimentaires.

L'évaluation de la performance dans une logique qualité se traduit par une variété des critères touchant les objectifs de qualité. Mais avant d'entamer cette partie, il est souhaitable de préciser ce concept de performance et d'étudier son évolution à travers un panorama de la littérature, et sa mesure.

4 LA NOTION DE LA PERFORMANCE ORGANISATIONNELLE : REVUE DE LITTÉRATURE

La performance d'une entreprise est une question toujours d'actualité pour toute équipe dirigeante. C'est un concept omniprésent dans la littérature de gestion. En effet, l'objet de nombreuses recherches en gestion est l'identification de paramètres permettant d'expliquer la notion de la performance organisationnelle.[14]

La vision taylorisme de la performance industrielle était suffisante lorsque le contexte était stable et la vitesse d'évolution relativement lente. A la phase d'équilibre, la performance a acquis un aspect non financier exprimé par le couple coût-valeur.[15] Aujourd'hui suite aux changements rapides et à la concurrence exacerbée la performance est à caractère global, incluant des dimensions financières, techniques, sociales et environnementales.

Toutefois dans le domaine de la gestion plusieurs travaux inspirent une immense alternative de valorisation du terme de performance.[16] En effet, Plusieurs auteurs ont définit la performance et chacun a une dimension qui est souvent très flexible :

D'après Bourguignon :

- La performance est un terme dont la définition peut prendre des sens variables selon les auteurs. Le mot performance permet des interprétations variables et ne prend de sens que dans le contexte spécifique. Bourguignon[17] a identifié trois points pour définir la performance :

---

[10] Rapport annuel du ministère de commerce et d'industrie 2009

[11] François Nicolas,Egizio et alceschini, « Agro- alimentaire : une économie de la qualité » Edition Economica 1993, p.143.

[12] François Nicolas,Egizio et alceschini, op.cit.,p.144.

[13] Idem.

[14] Olivier de la Villarmois ; « Le concept de performance et sa mesure : un Etat de l'art » Maitre de conférences, GREMCO/CLAREE-IAE de Lille, p.1.

[15] Sofiane ahmed SAHRAOUI, op.cit., p.24.

[16] OUACH Thi Kim Oanh ; « Une perspective de recherche sur la performance dans l'organisation », 23ème colloque annuel du conseil canadien des PME et de l'entrepreneuriat, Trois- Rivières, sciences sociale, Université Toulouse, 2006, p.3.

[17] NDAO Assane, op.cit.,P.3.

- La performance est succès. La performance n'existe pas en soit ; elle est fonction des représentations de la réussite, variables selon les entreprises et selon les acteurs ;
- La performance est résultat de l'action. Traditionnellement, « la mesure des performances est entendue comme l'évaluation ex post des résultats obtenus »;[18]
- La performance est action. La performance est un processus et « non un résultat qui apparaît à un moment dans le temps ».[19]

- Le terme performance signifie « la réalisation des objectifs organisationnels quelles que soient la nature et la variété de ces objectifs. Cette réalisation peut se comprendre au sens strict (résultat, aboutissement) ou au sens large du processus ». Par extension, est considéré comme performant celui ou celle qui atteint ses objectifs[20] .
- Accomplir une action aborde à la fois l'exécution d'une œuvre, (le résultat de cette action) et ainsi, le record (résultat exceptionnel) d'une action[21] .

Dans le même ordre d'idées, H.Boisvert précise : « La performance désigne un résultat exceptionnel, hors du commun, optimal, elle relève d'attentes que l'on peut traduire en objectifs, si les attentes ne sont pas formellement exprimées sous forme d'objectifs, nous concluons la performance d'une personne lorsqu'elle comble ou même dépasse nos attentes, c'est-à-dire lorsqu'elle utilise quelque chose hors du commun, parfois intangible pour lequel nous n'avons pas établi de points de repère ou d'échelle de mesure ».[22]

De sa part, Lorino prétend que « … est performance dans l'entreprise tout ce qui, et seulement ce qui, contribue à améliorer le couple valeur-coût, c'est-à-dire à améliorer la création nette de la valeur (à contrario, n'est pas forcément performant ce qui contribue à diminuer le coût ou à augmenter la valeur, isolément, si cela n'améliore pas le solde valeur-coût ou le ratio valeur/coût) … est performance dans l'entreprise tout ce qui, et seulement ce qui, contribue à atteindre les objectifs stratégiques… »[23].

Louis Raymond[24] insiste sur l'aspect de mesure, en considérant que : « … la définition de la performance s'appuiera entre autres sur les systèmes de mesure de performance organisationnelle utilisés actuellement par les entreprises de classe mondiale (Exp : Le balanced scorecard).

D'après les recherches réalisées sur le terme performance nous pouvons constater que la performance organisationnelle est un concept difficile à cerner en raison des représentations abondantes et souvent contradictoires, mais aussi en raison de la multitude de disciplines qui s'y intéressent.

Après avoir défini les termes qualité et performance, il convient d'étudier le degré de corrélation entre ces deux variables. Dans le point suivant nous essayerons de présenter une revue de littérature de différents courants qui ont traité la relation Qualité et Performance.

5 LA RELATION QUALITE ET PERFORMANCE : REVUE DE LITTERATURE

Plusieurs conclusions ressortent à travers la revue de la littérature portant sur l'étude de la relation pouvant exister entre la qualité du produit et la performance des organisations. Toutefois, les études réalisées sur la relation qualité-performance sont contradictoires. Certaines, défendent en faveur d'une relation positive entre qualité-performance et d'autres d'une relation négative.

---

[18] Ibid, P.5.
[19] Idem.
[20] Malika ahmed zaid CHERTOUK ; "Contribution performance financière et performance sociale dans les enterprises publiques algériennes", Université M.Mammeri, Algérie, 2011, P.3.
[21] Idem.
[22] Sofiane ahmed SAHRAOUI, op.cit., P.25.
[23] Oivier DEVISE, Jean-Pierre VAUDELIN ; « Evaluation de la performance d'une PME : le cas d'une entreprise auvergnate », 4ème conférence Francophone de modélisation et simulation, « organisation et conduite d'activités dans l'industrie et les services », Université de Toulouse, Paris, MOSIM'03- du 23 au 25 avril 2003, P. 1
[24] OUACH Thi Kim Oanh, op.cit., p.3

5.1 LES AUTEURS QUI ONT POUR UNE RELATION FAVORABLE ENTRE LA QUALITÉ ET LA PERFORMANCE

Suite aux pressions exercées par l'environnement, les organisations sont amenées à améliorer de manière continue leurs produits et leurs processus afin de satisfaire ses clients. Pour ce faire, un bon nombre de travaux montrent que le succès de la mise en œuvre du TQM peut également engendrer des produits et services améliorés à des coûts inférieurs, avec plus de clients satisfaits et plus d'employés (Agus et Abullah ; Chin et al).[25]

Plusieurs recherches récentes se sont orientées vers l'étude de l'impact de la qualité sur la performance des organisations. En effet, une organisation qui applique les principes de l'assurance qualité garantit en permanence au client que la qualité visée du produit est atteinte à travers la définition d'un système qualité reposant notamment sur la définition et le respect de procédures de travail et la mise en place de mécanismes de détection, d'analyse et de correction des dysfonctionnements.[26]

Toutefois, La qualité totale, au travers même de sa définition et de la perception qu'en ont les entreprises, s'affirme comme un outil sur la voie de l'excellence, dans une vision stratégique, de management, d'organisation et de gestion du risque au service de la performance de l'entreprise.[27] Dans la même perspective Chong confirme, que le TQM fournit une manière fondamentale pour conduire les affaires, rendant l'entreprise plus concurrentielle et plus viable.[28]

Ainsi, la définition (ISO 9000 V 2000), évalue les résultats autant que les moyens mis en œuvre. Mais la nouvelle norme ISO 9001 introduit désormais les notions d'efficacité et d'efficience. L'efficience est liée à la maitrise des processus répétitifs (performance et productivité du geste) et l'efficacité est liée au management des processus (performance et productivité de l'intelligence).[29] Et si on se réfère à la définition de la performance, c'est une notion qui consiste à remplir la mission, en s'adaptant à son environnement et en profitant de ce qu'il a à offrir, à produire des résultats de qualité correspondant aux besoins des clients et répondant aux objectifs de l'organisation, de le faire de façon efficiente en produisant les résultats escomptés au meilleur coût, tout en respectant les conditions organisationnelles reliées à l'utilisation optimale des ressources et à la qualité du processus.[30]

D'après Henry Ollagnon, professeur de gestion du vivant et stratégies patrimoniales à l'institut agronomique Paris-Grognon[31] « La qualité totale est un outil contributeur aux résultats, un outil d'aide à la décision, de normalisation, de valorisation de la conformité et de management… un outil stratégique et patrimonial pour des problèmes intrinsèquement complexes et multi-acteurs ».

Selon Lorino la satisfaction des clients passe par l'amélioration de la maîtrise des processus de façon à ce que le produit ou le service offert soit effectivement produits de manière fiable et efficace.[32] De ce fait, la certification permet une meilleure identification et un suivi dans le temps des problèmes de coordination. Elle facilite le traitement des anomalies et valorise l'erreur. Elle entraine une professionnalisation du traitement des réclamations et systématise le recueil et le traitement des non-conformités internes.

Selon certains auteurs comme « Ghobadian, Gallear, Reed et al », la mise en place du management par la qualité totale (TQM) est une alternative permettant le succès à long terme d'une organisation et qu'elle génère un avantage compétitif. [33]

En traitant la relation qui existe entre la qualité et la performance financière plusieurs auteurs tels, Forker, al et Curkovic montrent dans leurs travaux l'existence d'une relation positive entre la qualité et la performance financière.[34] Cette idée est partagée par d'autres chercheurs comme Buzzel et Weirsema qui soutiennent une relation positive entre la qualité du

---

[25] Aziza Driss MEDDEB ; « Management par la qualité totale et performance de l'entreprise : Rôle médiateur de l'innovation, Revue de littérature et modèle conceptuel », IHEC Carthage, Tunisie, P.5.

[26] Zahir YANAT, Farid CHAOUKI ; « contribution de la certification (ISO 9001 v2000) à l'amélioration de la compétitivité des entreprises marocaines : cas du secteur agro-alimentaire », Université de Bordeaux IV et Faculté de droit et d'économie de Bni Mella, Maroc, P. 3.

[27] Sylvie Mayeur ; « Guide opérationnel de la qualité : faut-il tuer la qualité totale ? », Edition Maxima, 2003, p. 34.

[28] Ibid, P.36.

[29] Idem.

[30] Pierre Voyer ; « Tableaux de bord de gestion et indicateurs de performance », 2ème Edition presse de l'université de Québec, p.100.

[31] Pierre Voyer, op.cit., p.36.

[32] Zahir YANAT, Farid CHAOUKI, op.cit.,P. 4.

[33] Idem.

[34] Aziza Driss MEDDEB, op.cit., P.6.

produit et la performance financière dans le cadre du« profit Impact of Market Strategy (PIMS) » réalisé par le « Strategic Planning Institute ».[35]

D'autres recherches tels les travaux de Maani et al confirment dans le même sens de réflexion l'existence de relation faible, mais statiquement significative entre la qualité du produit et la performance financière.[36]

Afin d'étudier les approches d'amélioration de la qualité et leurs effets sur la performance des organisations, Adam et al. Ont mené une étude internationale auprès de 977 entreprises localisées en Asie, en Europe et en Amérique du nord. Les résultats montrent que les approches d'amélioration de la qualité ont un effet statistiquement significatif sur la performance financière.[37]

Dans la même perspective Nilsson et al. Ont mené une étude comparative sur l'impact des pratiques de management de la qualité sur la satisfaction des clients et la performance financière dans les entreprises industrielles et les entreprises de service. L'étude empirique qui a touché 482 entreprises montre que pour les entreprises industrielles, les pratiques de management de la qualité influencent la satisfaction des clients et la performance financière à travers une orientation organisationnelle pour la qualité.[38]

Dans le but d'analyser le lien entre processus de certification et l'apprentissage organisationnel et la transformation de ces connaissances en compétences susceptibles de faire évoluer l'organisation, certains chercheurs comme Bénézech et Loos-Baroin ont menés une recherche dans ce sens et démontrent que la façon dont les documents du système de management de la qualité (SMQ) sont conçus et perçus au sein de l'organisation va influencer la dynamique d'apprentissage et concluent par la suite que la certification est vue comme un dispositif d'apprentissage organisationnel. Dans le même ordre d'idée Lambert G. et Loos-Baroin J .présument que la certification est plus largement comme un outil de la gestion des connaissances.[39]

Buzzell et Gale voient que le facteur le plus important pouvant affecter la performance d'une unité d'affaires est la qualité du produit et des services offerts par rapport à la concurrence.[40]

Après avoir aborder les recherches qui soutiennent une relation positive entre la qualité et performance, nous allons voir dans un autre point les études qui critique cette relation.

5.2 LES ETUDES QUI PLAIDENT POUR UNE RELATION NEGATIVE ENTRE LA QUALITE ET LA PERFORMANCE

Paradoxalement, on trouve plusieurs recherches qui ont confirmé une relation négative entre la qualité et la performance telles celles de Mispelblom[41] qui perçoit dans la question de la certification un dispositif de rigidité pour l'organisation à travers le renforcement de la prescription du travail et la diminution de l'autonomie du personnel imputable à la codification du savoir-faire de l'entreprise dans les procédures de travail.

D'autres recherches voient en l'engagement dans une démarche qualité des dépenses énormes. Dans ce sens, Hendricks et singhal précisent que certaines entreprises qui ont gagné le prix Malcolm Baldrige de la qualité aux Etats- Unis ont souffert de difficultés financières énormes. [42]

Anderson et al. Soulignent que l'hétérogénéité des besoins des clients risque d'influencer négativement le chiffre d'affaires. En effet, si l'entreprise décide de satisfaire les besoins de plusieurs clients ou de plusieurs segments en même temps, elle risque une baisse de la qualité du service et par la suite une baisse du chiffre d'affaires.[43]

---

[35] Marcel ALAIN ; « Réussir la qualité de service : Plaidoyer pour la performance réalisée avec discipline et innovation », Edition Nouvelles, 1998, p.203.
[36] Ibid, P.210.
[37] Idem.
[38] Idem.
[39] Sylvie ROLLAND et Sébastien TRAIN, op.cit., p.9.
[40] Marcel ALAIN, op.cit., p.203.
[41] Zahir YANAT, Farid CHAOUKI, op.cit.,P.3.
[42]Hajer ZORGATI, Lassad LAKHAL ; « Qualité du produit et performance financière », Faculté de droit et des sciences Economiques et politiques de Sousse, Tunisie, p.6.

Dans le but d'étudier l'impact de la qualité sur la performance Iaquinto a réalisé une étude sur les entreprises japonaises ayant gagné le prix Deming de la qualité. Les résultats montrent pour la majorité des entreprises l'existence d'une association négative entre le gain d'un prix de la qualité et l'amélioration de la performance.[44]

Toutefois, selon certains auteurs comme Hendriks et Singhal; Iaquinto; Hansson et Eriksson[45], les avantages et le succès du TQM demeurent incertains. Selon Sousa et Voss, les échecs du TQM sont expliqués par la difficulté des méthodologies de recherche empiriques et par la présence de facteurs de contingence tels que la taille et la structure du marché ainsi que la concurrence qui influent sur la relation entre les pratiques de management par la qualité totale et la performance.[46]

En d'autres termes, les entreprises qui ont obtenu la certification n'ont pas, en moyenne, connu une amélioration de leur rendement absolu, mais ont vu leur rendement relatif s'améliorer substantiellement, par comparaison avec leurs homologues non certifiés. ISO 9000 étant un « standard » d'organisation, sa mise en place au sein d'une entreprise ne peut pas constituer à elle seule un atout concurrentiel durable. Une entreprise doit disposer d'autres ressources, plus difficiles à imiter et qui peuvent ainsi constituer un avantage concurrentiel différentiateur. Néanmoins, ces résultats suggèrent que le fait de ne pas rechercher une certification ISO 9000 contribue à une évolution défavorable graduelle du rendement.

La revue de la littérature souligne de consensus dans les travaux sur l'impact de la certification sur la performance des entreprises. Même si les études réalisées sur la relation qualité-performance soutiennent dans la majorité des cas une relation positive ils indiquent également que certains facteurs semblent nécessaires pour que le lien fonctionne. Toutefois, Cette divergence au niveau des résultats peut être expliquée par le fait que les deux termes qualité et performance ont a été définie et mesurée de manière variée d'un auteur à l'autre.

Le choix de se faire certifier ou pas peut être une fonction de différentes motivations internes ou externes à l'entreprise. Dans chacun des cas, le résultat final de la certification sur la performance diffère.

En synthèse des travaux académiques on peut déduire que, l'implantation d'un système qualité au sein de l'entreprise semble donc accroitre sa performance. Afin de confirmer cette évidence nous allons mener une étude de cas au sein d'une entreprise certifiée dans le Grand Agadir.

6 RÉSULTATS DE L'ÉTUDE

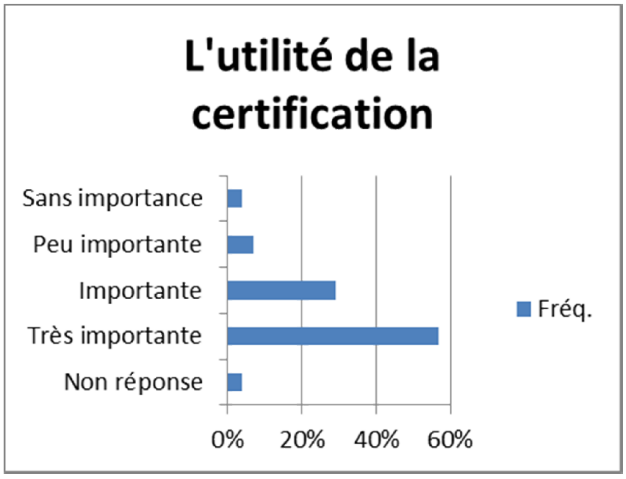
Différentes techniques peuvent être employées pour collecter des informations fiables (questionnaire, guides d'entretien etc). Dans le cadre de notre travail empirique, nous avons mené notre enquête par voie de questionnaire, auprès d'un échantillon de 36 personnes au sein de l'entreprise Nouvelle Société AMADIR dans le grand Agadir.

Nous présentons, ci-après, les principaux résultats de l'enquête : il s'agit de tester le lien de causalité c'est-à-dire montrer le degré de corrélation pouvant exister entre l'implantation d'un système qualité et la performance des organisations, avons pris une entreprise dans le secteur agroalimentaire. Ce choix n'est pas arbitraire, étant donnée son importance économique et stratégique dans l'économie marocaine.

[43] *Hajer ZORGATI, Lassad LAKHAL, op.cit., p.9.*
[44] *Ibid, P.10.*
[45] *Aziza Driss MEDDEB, op.cit., P.7.*
[46] *Ibid, p.8.*

ANALYSE DES RÉSULTATS

6.1 L'UTILITÉ DE LA CERTIFICATION

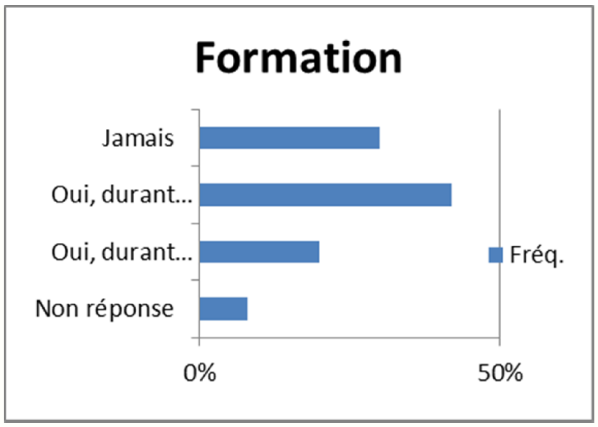


Les résultats montrent que 57 % des sondés jugent que la certification qualité est très importante pour la compétitivité de l'entreprise, contre 29 % qui qualifient l'éventuelle utilisation d'importante.

Le questionnement sur le degré d'utilité de l'intégration d'une démarche qualité au sein de l'entreprise permet de révéler une information très importante à savoir une bonne image de l'entreprise vis-à-vis de ses collaborateurs et de se différencier par rapport aux concurrents et ce à travers la définition d'un système qualité reposant notamment sur le respect des procédures de travail et la mise en place de mécanismes de détection, d'analyse et de correction des dysfonctionnements.

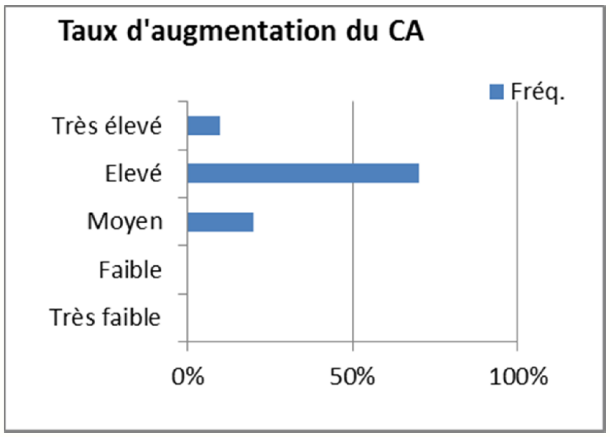
Quant aux réfractaires au changement, ils représentent 11 %. Nous estimons que ce recul par rapport à l'intégration de l'innovation est peut-être dû à leur méconnaissance totale de l'outil, ce qui induit la peur de l'inconnu et de tout ce qui est nouveau, ou bien à leur idéologie.

6.2 LA FORMATION



42% des interviewésont bénéficié d'une formation en démarches qualité « dans le cadre de la formation continue » et seuls 20% d'entre eux déclarent avoir bénéficié de la dite formation durant leur parcours professionnel initial. Or, le pourcentage des sondés qui n'ont jamais bénéficié d'une formation en qualité est de 30%. Ce constat nous amène à réfléchir sérieusement sur les objectifs des formations qui sont minorés au bénéfice des réflexions consacrées aux aspects liés aux contenus.

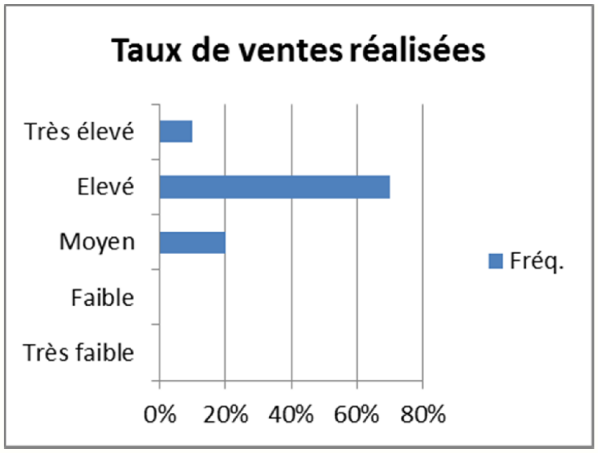
6.3 TAUX D'AUGMENTATION DU CA



A partir du diagramme ci-dessus nous déduisons les résultats suivants :

- 70% des sondés jugent que l'intégration d'une démarche qualité au sein de l'entreprise favorise un niveau élevé de CA ;
- 20% d'entre eux la qualifient d'un niveau moyen ;
- Uniquement 10% qui déclarent un niveau très élevé de CA.

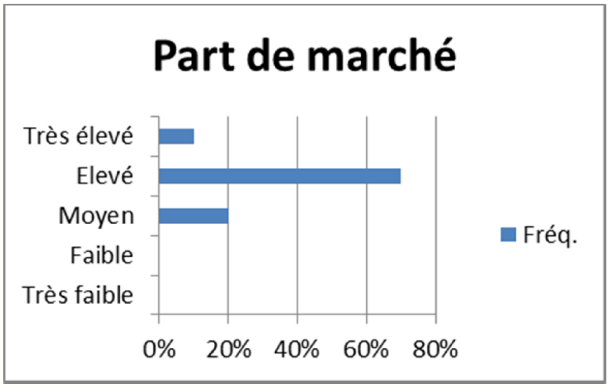
6.4 TAUX DES VENTES RÉALISÉES



-68% des interviewés ont témoigné un niveau élevé de taux de ventes réalisées par rapport à l'implantation du système qualité, l'intégration de cette dernière permet à l'entreprise de satisfaire ses clients en leur offrant un produit qui répond à leur besoins ce qui entraine une augmentation de ses ventes.

-30% des interviewés ont déclaré un niveau Moyen de taux de ventes réalisées et uniquement 12% qui ont jugé un niveau très élevé.

6.5 LA PART DE MARCHÉ

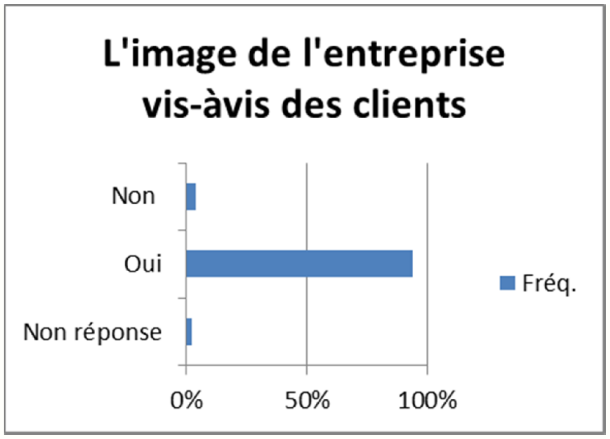


-70% des interviewés ont déclaré un taux élevé de part de marché par rapport à l'implantation d'un système qualité au sein de l'entreprise.

-20% qui ont déclaré un taux Moyen. Et seulement 10% qui ont été contre avec un taux faible.

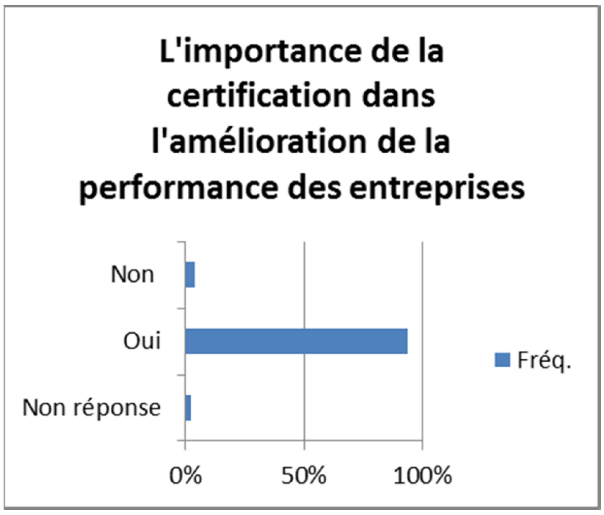
Cette différence remarquable d'avis s'explique par le fait que l'intégration d'un système qualité est une alternative permettant le succès à long terme de l'organisation. Selon eux, cela signifie que la certification peut constituer un avantage concurrentiel pour l'entreprise à travers la fidélisation de ses clients et par conséquent conquérir de nouveaux parts de marché.

6.6 L'IMAGE DE L'ENTREPRISE



La majorité des sondés voire un pourcentage de 90% ont favorisé le fait que la certification donne une bonne image à l'entreprise vis-à-vis de ses clients. Ceci s'explique par le fait que l'intégration d'un système qualité au sein de l'entreprise lui permet une maitrise des processus et une satisfaction de ses clients et ce à travers une meilleure identification et un suivi dans le temps des problèmes, ce qui facilite le traitement des anomalies de façon à ce que le produit soit effectivement efficace et conforme.

6.7 L'IMPORTANCE DE LA CERTIFICATION DANS L'AMELIORATION DE LA PERFORMANCE DES ORGANISATIONS



La majorité des interviewés (93 %), sont pour l'implantation d'un système qualité au sein de l'entreprise. Pour eux, la démarche qualité permet :

- Une meilleure maitrise des processus à travers les audites et contrôles périodiques réalisés et le principe de l'amélioration continue.
- De fidéliser leurs clients en leur offrant un produit correspond à leurs attentes, réaliser des ventes énormes et par la suite acquérir des parts de marché ;
- Une Définition précise des objectifs et d'éviter les pertes d'énergie ;
- De garantir le fonctionnement efficace de l'ensemble de l'organisation.

6% des sondés déclarent qu'ils sont contre l'intégration d'une démarche qualité au sein de l'entreprise, car d'après eux, c'est une source de rigidité pour l'entreprise à travers l'application des procédures et ca demande des dépenses énormes.

7 CONCLUSION

La qualité a donc traversé une longue période en subissant au fur et à mesure des évolutions. La mondialisation et l'extension des marchés ont fait apparaître la qualité comme un facteur de compétitivité pour l'entreprise, seulement pour jouer pleinement ce rôle qui lui est assigné, la qualité ne doit pas rester limiter au produit mais elle doit être perçue de façon beaucoup plus large englobant aussi bien le produit, le processus de production ainsi que toute l'organisation.

Toutefois, et en tenant compte des résultats dégagés dans le cadre de notre recherche et les propos théoriques étudiés, il ressort que le système qualité constitue une composante stratégique dans la mise en valeur des entreprises mais sous conditions de les soutenir par des mesures d'accompagnement appropriées. Parmi elles, on pourrait noter :

- L'importance de la sensibilisation du personnel et de la clientèle sur le rôle pilote que joue le système qualité pour la survie de l'entreprise ;
- L'adoption des plans de formation adéquats sur le management qualité au profit de tout le personnel de l'entreprise.

REFERENCES

[1] Barkia N (2001), « La certification des entreprises de services selon la norme ISO 9001 : Cas des cabinets d'Expertise comptable », Mémoire en vue de l'obtention du Diplôme d'Expertise Comptable, Faculté des Sciences Economiques et de Gestion de SFAX, 2001 ;

[2] Boérie D (2003), « Maîtriser la qualité : Tout sur la certification et la qualité totale- les nouvelles normes ISO 9001.V.2000 » 2ème Edition Maxima ; 315P ;

[3] Chertouk M (2011), « Contribution performance financière et performance sociale dans les entreprises publiques algérienne », Université M.Mammeri Algérie;

[4] Devise O, Vaudelin J.P (2003), « Evaluation de la performance d'une PME : le cas d'une entreprise auvergnate », 4ème conférence francophone de modélisation et simulation, du 23 au 25 Avril 2003, Université de TOULOUSE, France ;

[5] Donatien A « Contrôle de gestion et performance des services publics communaux des villes camerounaises », Université Montesquieu Bordeaux IV ;

[6] Hanen FAKHFAKH, « Le management socio-économique et la mise en œuvre d'une démarche qualité intégrale dans un établissement d'enseignement supérieur », Thèse de doctorat en sciences de gestion, Ecole doctorale « ABBE GREGOIRE », soutenue en 2012 ;

[7] Kabiri Kettani M (2006), « La certification qualité « la voie vers la performance », La Revue Marocaine de Commerce et de Gestion - N°2 – juin 2006, PP : 13-50 ; http://www.essor-magazine.com/pdf/dossier33.pdf; (date de consultation: le 11/12/2012) ;

[8] Lerat-Pytlak J (2002), « Le passage d'une certification ISO 9001 à un management par la qualité », Thèse en sciences et techniques de gestion, Université de TOULOUSE I ;

[9] Mohamed DHIAF « Proposition d'un modèle de mesure de l'impact du Total Quality Management sur la performance globale : Cas des entreprises Tunisiennes de Textile- Habillement », Thèse de doctorat en sciences de l'ingénieur, Ecole Nationale Supérieur d'Arts et Métiers, Tunisie, soutenue en 2007 ;

[10] Meddeb A D ; « Management par la qualité totale et performance de l'entreprise : Rôle médiateur de l'innovation, Revue de littérature et modèle conceptuel », IHEC Carthage, Tunisie ;

[11] Nguyen N(2009), « Gestion de la qualité » Edition, sylvain ménard, les etidions de la chenelière inc ; 525P ;

[12] Nicalas F, Valceschini E (1995), « Agroalimentaire : Une Economie de la qualité » Edition Economica; 431P ;

[13] Roux-Morin L (2006), " Administration électronique et qualité du service public, L'exemple des caisses d'Allocations familiales", Recherches et Prévisions, n° 86 - décembre 2006 ;

[14] Rolland S et Train S (2006), « La certification qualité est elle un facteur de compétitivité pour les entreprises. 5ème édition du colloque métamorphose des Organisations 23 et 24 Novembre 2006, Nancy ?« Nouvelles régulations, Normalisation et Dynamique des organisations » ;

[15] Yanat Z, Chaouki F « contribution de la certification (ISO 9001 v2000) à l'amélioration de la compétitivité des entreprises marocaines : cas du secteur agro-alimentaire », Université de Bordeaux IV et Faculté de droit et d'économie de Bni Mella, Maroc.

[16] Yvan CHAPETEIX, « Les enjeux des signes d'identification de la qualité et de l'origine dans le secteur agroalimentaire français », mémoire de Master, Management en Hôtellerie et Restauration, Université de TOULOUSE II LE MIRAIL, 2012 ;

[17] Zorgati H, Lakhal L ; « Qualité du produit et performance financière », Faculté de droit et des sciences Economiques et politiques de Sousse, Tunisie.

International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 11 No. 2 Nov. 2014, pp. 611-619
© 2014 Innovative Space of Scientific Research Journals
http://www.ijisr.issr-journals.org/

A Comparative Study on Heat Transfer in Straight Triangular Fin and Porous Pin Fin under Natural Convection

Jitamitra Swain[1], Kumar Gaurav[1], Dheerendra Singh[1], Prakash Kumar Sen[2], and Shailendra Kumar Bohidar[2]

[1]Student, Bachelor of Engineering (Mechanical Engineering),
Kirodimal Institute of Technology, Raigarh, Chhattisgarh, India

[2]Faculty, Department of Mechanical Engg.,
Kirodimal Institute of Technology Raigarh, Chhattisgarh, India

Copyright © 2014 ISSR Journals. This is an open access article distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT: The present work is a study on the efficiency and performance parameters of straight triangular fins and porous pin fins in natural convection. The study is based on a straight triangular fin and a general porous pin fin profile. To formulate heat transfer equation in straight triangular fin MODIFIED BESSEL'S EQUATION is used. Similarly to formulate heat transfer equation for porous fin ADOMIAN DECOMPOSITION METHOD (ADM) is used. General differential equations of different orders are used for formulation of both fins. On the basis of efficiency and effectiveness the two fins are compared and an approximate study is done.

KEYWORDS: Straight triangular fins, porous fins, pin fins.

1 INTRODUCTION

In this age of technology with need of small, intricate and light parts fins play an important role in heat exchanging. Variety of fins have been invented and studied so that they can be made immaculate and more efficient. Electronic gadgets and appliances are becoming smaller in size day by day and hence increasing the demand for small but efficient parts. Porous fins are compact and more efficient than other fins in case of heat transfer in electronic gadgets. Similarly straight triangular fin is more efficient than fin with rectangular cross section. These fins are also used widely for their varied use. They too transmit heat at a better rate as compared to straight fins. For the above discussed needs, research is going on for optimum use of material in fin for maximum heat transfer.

Corresponding Author: Jitamitra Swain

NOMENCLATURE

A	Adomian polynomials, i=0,1,2…
C_p	specific heat of the fluid passing through porous fin(J/kg-K)
Da	Darcy number
g	gravity constant(m/s2)
h	heat transfer coefficient over the fin surface(W/m2K)
k	thermal conductivity(W/mK)
kr	thermal conductivity ratio
K	permeability of the porous fin(m2)
M	mass flow rate of fluid passing through porous fin(kg/s)
Nu	Nusselt number
P	perimeter of the fin(m)
q	actual heat transfer rate per unit area of the porous fin(W/m2)
Q	dimensionless actual heat transfer rate per unit area(W/m2)
qi	ideal heat transfer rate per unit area(W/m2)
Qi	dimensionless ideal heat transfer rate per unit area(W/m2)
Ra	Rayleigh number
R	radius of the fin(m)
Ta	ambient temperature(K)
T_0	base temperature(K)
T	fin surface temperature(K)
v	average velocity of fluid passing through porous fin(m/s)
x	axial length measured from fin tip(m)
X	dimensionless axial distance

GREEK SYMBOLS

β	coefficient of thermal expansion(K-1)
ε	effectiveness of the fin
η	efficiency of the fin
ξ	porosity or void ratio
ψ	radius to length ratio
θ	dimensionless temperature
θ_0	dimensionless tip temperature
ϒ	kinematic viscosity(m2/s)
ρ	density of the fluid(kg/m3)

2 STRAIGHT TRIANGULAR FIN

It has been observed that straight fins with rectangular cross section transfers heat at a good rate. But it was also observed that the heat transfer rate decreases as the thickness increases which implies unnecessary use of thick material. For this reason straight triangular fins came into use. The tapered fin is of paramount practical importance since it yields the maximum heat flow per unit weight.

Let l=length of fin , b=width of the fin , y= thickness at base of the fin.It is assumed that the fin is sufficiently thin i.e. (y << l).

Applying energy balance on the small element dx, we have

$$Q_x = Q_{(x+dx)} + Q_{conv} \quad (1)$$

On further solving and writing the heat transfer equations in differential form we have

$$\frac{d^2\theta}{dx^2} + \frac{d\theta}{xdx} - \frac{2hl\theta}{xky} = 0 \quad (2)$$

Let, $B^2 = \frac{2hl}{ky}$

Then the equation (2) becomes

$$X^2\frac{d^2\theta}{dx^2} + X\frac{d\theta}{dx} - B^2X\theta = 0 \qquad (3)$$

Again assuming z to be new independent variable such that

$$Z = 2B\sqrt{x} \quad \text{then } \frac{dz}{dx} = BX^{-1/2} \qquad (4)$$

Thus after further calculation the equation (3) reduces to(in terms of z)

$$\frac{d^2\theta}{dz^2} + \frac{d\theta}{zdz} - \theta = 0 \qquad (5)$$

2.1 BESSEL'S EQUATION

The equation is perfectly identical to the modified Bessel's equation of zero order(n=0) and its general solution is given by

$$\theta = C_1 I_0(z) + C_2 K_0(z)$$

putting the value of z we have

$$\theta = C_1 I_0(2B\sqrt{x}) + C_2 K_0(2B\sqrt{x}) \qquad (6)$$

Where I_0 and k_0 are modified zero order Bessel's function of first and second kind respectively.[2]

The constants of integration C_1 and C_2 can be found out by applying boundary condition.

At $x=l$, $\theta=\theta_0$;

At $x=0$, θ=finite ; (7)

Solving the equation (6) we get

$$C_2 = 0 \text{ and } C_1 = \frac{\theta_0}{(2B\sqrt{l})I_0} \qquad (8)$$

Putting the value of C_1 and C_2 in the general equation we get the heat transfer in straight triangular fin as:

$$Q_{fin} = b\sqrt{2hky}\,.\,\theta_0.\frac{I_1(2B\sqrt{l})}{I_0(2B\sqrt{l})} \qquad (9)$$

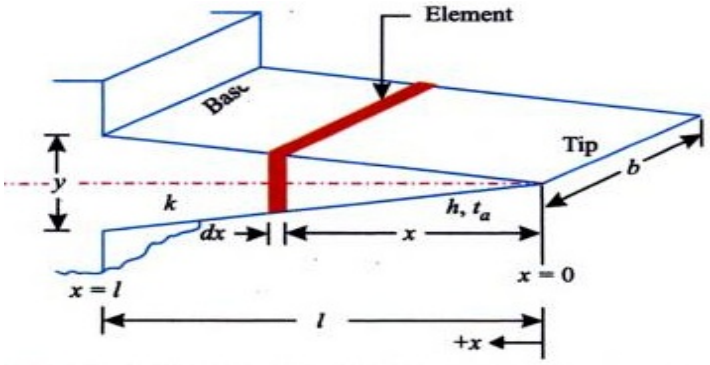


Fig. 2.1.1.Straight Triangular Fin

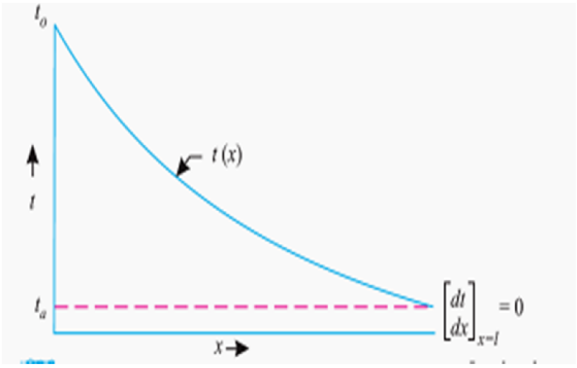


Fig 2.1.2 Temperature variation with distance

As discussed above, there are two Bessel's function I_0 and I_1 , which can be evaluated by using different values of 'z'. These values of some of the Bessel's function are mentioned in the table 2.1 below.[3]

Table 2.1 Typical values of Bessel's function

Z	$I_0(z)$	$I_1(z)$	$\frac{2}{\pi}K_0(z)$	$\frac{2}{\pi}K_1(z)$
0.0	*1.000*	*0.000*	∞	∞
0.2	*1.010*	*0.1005*	*1.116*	*3.040*
0.4	*1.040*	*0.02040*	*0.7095*	*1.391*
0.6	*1.092*	*0.314*	*0.4956*	*0.829*
0.8	*1.166*	*0.433*	*0.360*	*0.5486*
1.0	*1.266*	*0.565*	*0.2680*	*0.383*
2.0	*2.279*	*1.591*	*0.0725*	*0.0890*
3.0	*4.881*	*3.953*	*0.0221*	*0.0256*
4.0	*11.302*	*9.799*	*0.0071*	*0.00795*
5.0	*27.240*	*24.336*	*0.00235*	*0.00257*
6.0	*67.2348*	*61.342*	*0.00027*	*0.000688*
7.0	*168.6*	*156.04*	*0.000093*	*0.000289*
8.0	*427.6*	*399.9*	*0.000032*	*0.000099*
9.0	*1093.6*	*1040.9*	*0.000032*	*0.000034*
10.0	-	-	*0.000011*	*0.000011*

3 POROUS FINS

Although many innovative ideas have been used in heat transfer in electronic gadgets , porous fins have become an excellent passive means to provide high heat transfer rate for electronic components in a small, light weight, low maintenance and energy free package. Pop and Ingham [4], Nield and Bejan [5]. Enlightened the above discussion quite effectively. A simple method has developed by Kiwan [6] to analyze the performance of porous fins in a natural convection environment. Kiwan and Alnimr [7] numerically investigated the effect of using porous fins to enhance the heat transfer from a given surface.

Similarly Bhanja and Kundu [8] established an analytical model to analyse T shaped porous fins.

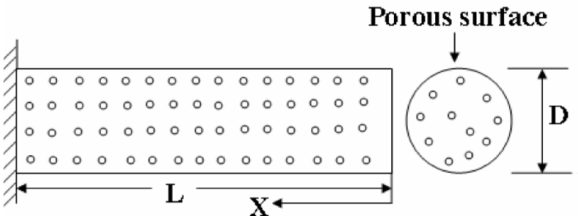


Figure 3: shows a porous fin of length L having pores in it.

Fin is attached to a vertical isothermal wall from which heat has to be dissipated through natural convection. As the fin is porous, it allows fluid to penetrate through it. The porous fin increases the effective surface area of the fin through which the fin convects heat to the working fluid. In order to simplify the solution, the following assumptions are made

- Porous medium is homogeneous, isotropic and saturated with a single phase fluid
- Physical properties of solid as well as fluid are considered as constant except density variation of liquid, which may affect the buoyancy term where Boussinesq approximation is employed.
- Darcy formulation is used to simulate the interaction between the porous medium and fluid.
- The temperature inside the fin is only function of x.
- There are no heat sources in the fin itself and no contact resistance at the fin base.
- The fin tip is adiabatic type.

The total convective heat transfer from the porous fin can be expressed as the sum of convection due to motion of the fluid passing through the fin pores and that from the solid surface. By energy balance considering only convection,

$$q(x) - q(x+dx) = mc_p(T-T_a)+hp(dx)(1-\xi)(T-T_a) \qquad (10)$$

where 'm' is the mass flow rate of the fluid passing through the pores i.e. $m=\rho v.dx.P$

The fluid velocity v can be estimated from Darcy's equation i.e. $v=gK\beta(T-T_a)/\Upsilon$ [4]

Using the above results the general Fourier's equation can be written as

$$\frac{d^2T}{dX^2} - \frac{4\rho c_p g K\beta(T-T_a)^2}{\gamma D k_{eff}} - \frac{4h(1-\xi)(T-T_a)}{Dk_{eff}} = 0 \qquad (11)$$

The dimensionless form of the equation can be written as

$$(X;\psi;k_r;\theta) = \left(\frac{X}{L};\frac{R}{L};\frac{k_s}{k_f};\frac{T-T_a}{T_b-T_a}\right);$$

$$(Nu;Ra;Da) = \left(\frac{hD}{k_f};\frac{\rho c_p g\beta(T_b-T_a)D^3}{k_f\gamma}\frac{K}{D^2}\right); \qquad (12)$$

$$(\omega_1;\omega_2) = \left(\frac{RaDa}{\Omega\psi^2};\frac{Nu(1-\xi)}{\Omega\psi^2}\right);$$

Where,

$$\Omega = \frac{k_{eff}}{k_f} = \xi + (1-\xi)k_r$$

So the equation reduces to

$$\frac{d^2\theta}{dX^2} = \omega_1\theta^2 + \omega_2\theta \qquad (13)$$

The above equation is a differential equation of second degree.

The boundary condition are as follows:

$$\frac{d\theta}{dX} = 0 \qquad \text{when X=0}$$

$$\theta = 1 \qquad \text{when X=I} \qquad (14)$$

The above equation cannot be solved by general analytical method and hence a method suggested by Adomian G. is used.

3.1 ADOMIAN DECOMPOSITION METHOD

The equation (13) with the boundary condition as in equation (14) is very complicated to solve using general analytical method. Hence, Adomian Decomposition Method is used to solve it as developed by Adomian.[9]

As per ADM the equation can be reduced to

$$L_x\theta = \omega_1\theta^2 + \omega_2\theta \qquad (15)$$

Where L_x is the second order differential. Assuming that inverse of the second order differential exists we can write

$$L_x^{-1}(.) = \iint_0^X (.)dXdX \qquad (16)$$

Applying this inverse operator to equation

$$\theta = \theta(0) + \frac{d\theta(0)}{dX} + \omega 1\, Lx - 1\,(\theta 2) + \omega_2 L_x^{-1}(\theta) \qquad (17)$$

$\theta(0)$ can be decomposed in terms of a new variable θ_i which is as below

$$\theta_0 = \sum_i^{\infty} \theta_i$$

Hence the equation can be written as

$$\sum_i^{\infty} \theta_i = \theta_0 + \frac{d\theta(0)}{dX} + \omega_1 L_x^{-1} \sum_0^{\infty} Ai + \omega_2 L_x^{1} \sum_i^{\infty} \theta \qquad (18)$$

Where A_i is the Adomian polynomial which corresponds to a nonlinear term θ_i.

This adomian polynomial can be expressed in matrix form as below:

$(A_0;A_1;A_2;A_3;.....)=(\theta_0^2;2\,\theta_1\,\theta_2\,;2\,\theta_2\,\theta_3\,;.....)$

Using the above equation we get the temperature excess expression as

$$\theta = \theta_0 + (\omega_1\,\theta_0^2 + \omega_2\,\theta_0)\frac{X^2}{2!} + (2\omega_1^2\,\theta_0^3 + 3\omega_1\,\omega_2\,\theta_0^2 + \omega_2\,\theta_0)\frac{x^4}{4!} + \ldots\ldots\ldots \qquad (19)$$

Applying the boundary condition we have the equation re written as below

$$1 - \theta_0 + (\omega_1\,\theta_0^2 + \omega_2\,\theta_0)\frac{1}{2!} + (2\omega_1^2\,\theta_0^3 + 3\omega_1\,\omega_2\,\theta_0^2 + \omega_2\,\theta_0)\frac{1}{4!} + \ldots\ldots\ldots \qquad (20)$$

Now expressing the expression as Fourier equation we have

$$Q = \frac{\frac{q}{k_{f(T0-Ta)}}}{R} = \Omega\,\psi\,(\frac{d\theta}{dx}) \qquad (21)$$

Also heat transfer rate per unit area in ideal porous fin can be expressed as

$$Q_i = Ra\ Da + Nu(1-\xi)/\psi$$

Similarly for porous unfinned we have

$$Q_w = 0.5\ Nu$$

Thus efficiency of the porous pin fin can be expressed as

$$\eta = Q / Q_i$$

The fin effectiveness can be expressed as

$$\varepsilon = Q / Q_w \qquad (22)$$

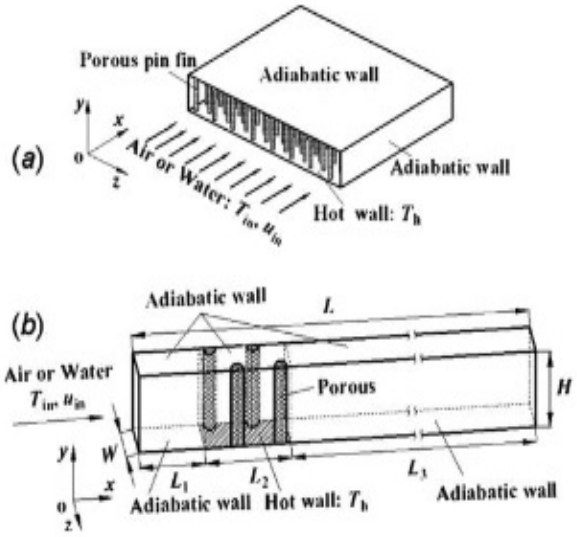


Fig 3.1.1 Porous pin fins as heat exchangers

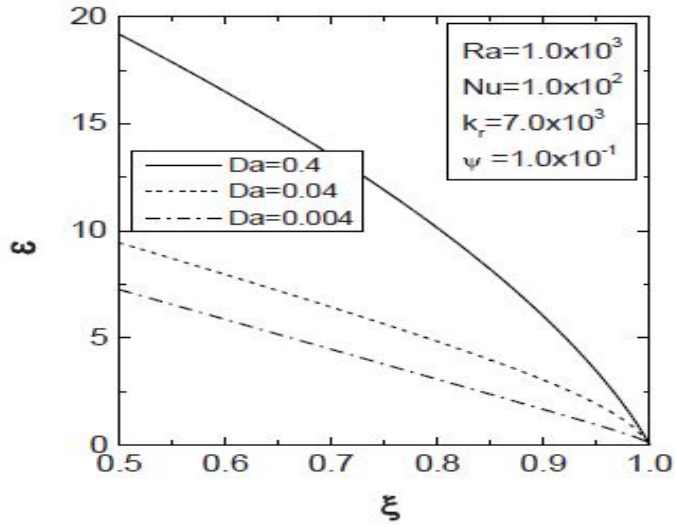


Fig.3.1.2 Plot showing effectiveness Vs void ratio

4 RESULTS AND CONCLUSION

As discussed earlier we observed that the electronic gadgets work much efficiently in lower temperature range. The electronic products are mainly composed of semiconductors which are very sensitive to temperature. Hence they are temperature sensitive. It was a common thinking among the human race that lowering the temperature increases the reliability to an approximate 10 degree celcius lower in temperature so as to double the reliability. A typical electronic gadget works well or near perfectly under 100 degree celcius.

With increase in technology gadgets are getting smaller and quicker. This throws light on the increasing workload on the electronic gadgets but small size; and hence increases in heat produced during operation in the gadgets. Alternatives for this problem were investigated on a wider scale and different types of cooling fans were introduced. But although these were invented porous pin fins emerged as a better option in heat transfer in electronics gadgets.

4.1 STRAIGHT TRIANGULAR FIN VERSUS POROUS PIN FIN

Straight triangular fins are fins which yields the maximum heat flow per unit weight. But porous fins yields maximum heat flow than straight triangular fin because of huge surface area as pores and outer surface. As the fluid pass through the numerous pores they transmit a much larger amount of heat than general profile of straight triangular fins.

As plotted in graph it can be seen that the porous fin has a wide range of variation in relation with Darcy number and distance from the tip. The analytical method or ADM or Adomian Decomposition Method is used because the general analytical method cannot be used for its study. Other than ADM numerical methods are also used. Numerical method use Gauss – Siedel iteration to find out the approximate values of heat transfer in porous pin fins.

Graphs have been plotted between Darcy number , Nusselt number,Rayleigh number and distance from tip of the porous fin.The graphs are plotted in Fig 3.1.2, Fig 4.1.1 and Fig 4.1.2.The value of I_0 and I_1 is shown in table 2.1 for different values of B.

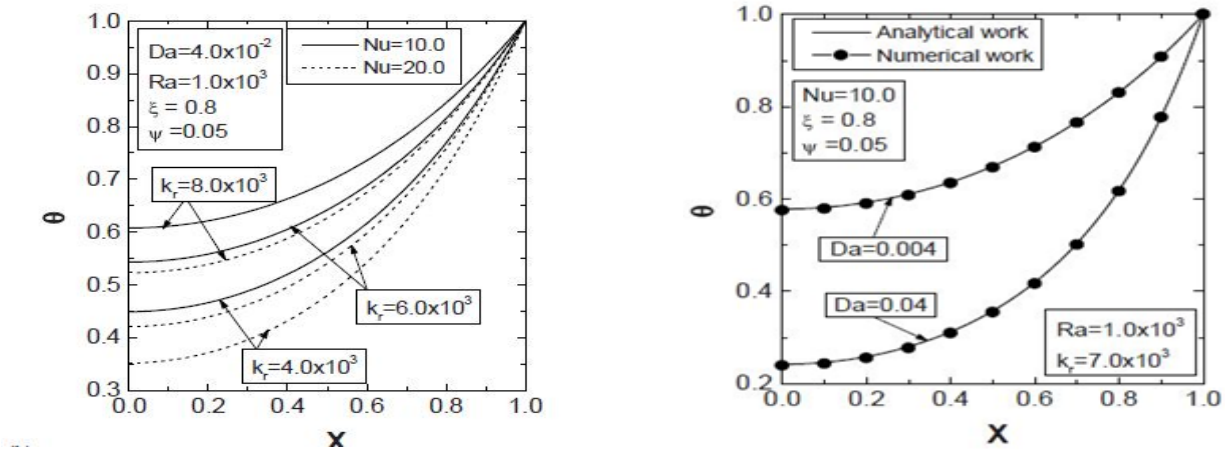


Fig.4.1.1 Plot showing variation of temperature excess to distance with constant darcy number and constant thermal conductivity

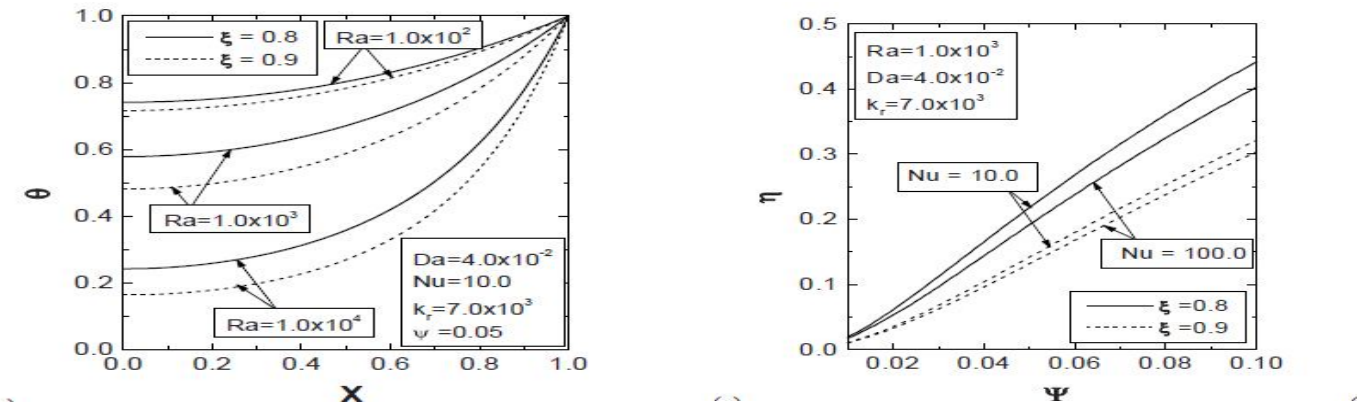


Fig.4.1.2 Variation of temperature excess to distance and efficiency to length to radius ratio

REFERENCES

[1] R.K. Rajput,Heat and Mass Transfer,5th Edition,p. 242

[2] R.K Rajput, Heat and Mass Transfer, 5th Edition, p. 244

[3] D.S Kumar , Heat and Mass Transfer , 3rd Edition p.274

[4] Pop, I., Ingham, D.B., 2001. Convective Heat Transfer: Mathematical and Computational Modeling of Viscous fluids and Porous Media, Pergamon, Oxford.

[5] Nield, D.A., Bejan, A., 1999. Convection in Porous Media, 2nd ed. Springer, New York.

[6] Kiwan, S., 2006. Thermal Analysis of Natural Convection in Porous Fins, Transport in porous media,

[7] Kiwan , S., 2007. Effects of Radiative Losses on the Heat Transfer from Porous Fins, International Journal of Thermal Science 46, p. 1046.

[8] Bhanja, D., Kundu, B., 2011. Thermal Analysis of a Constructal T-shaped Porous Fin with Radiation Effects, International Journal Of Refrigeration 34 p. 1483

[9] Adomian, G., 1988. Non-Linear Stochastic System Theory and Application to Physics, Kluwer Academic Publisher, Dordrecht.