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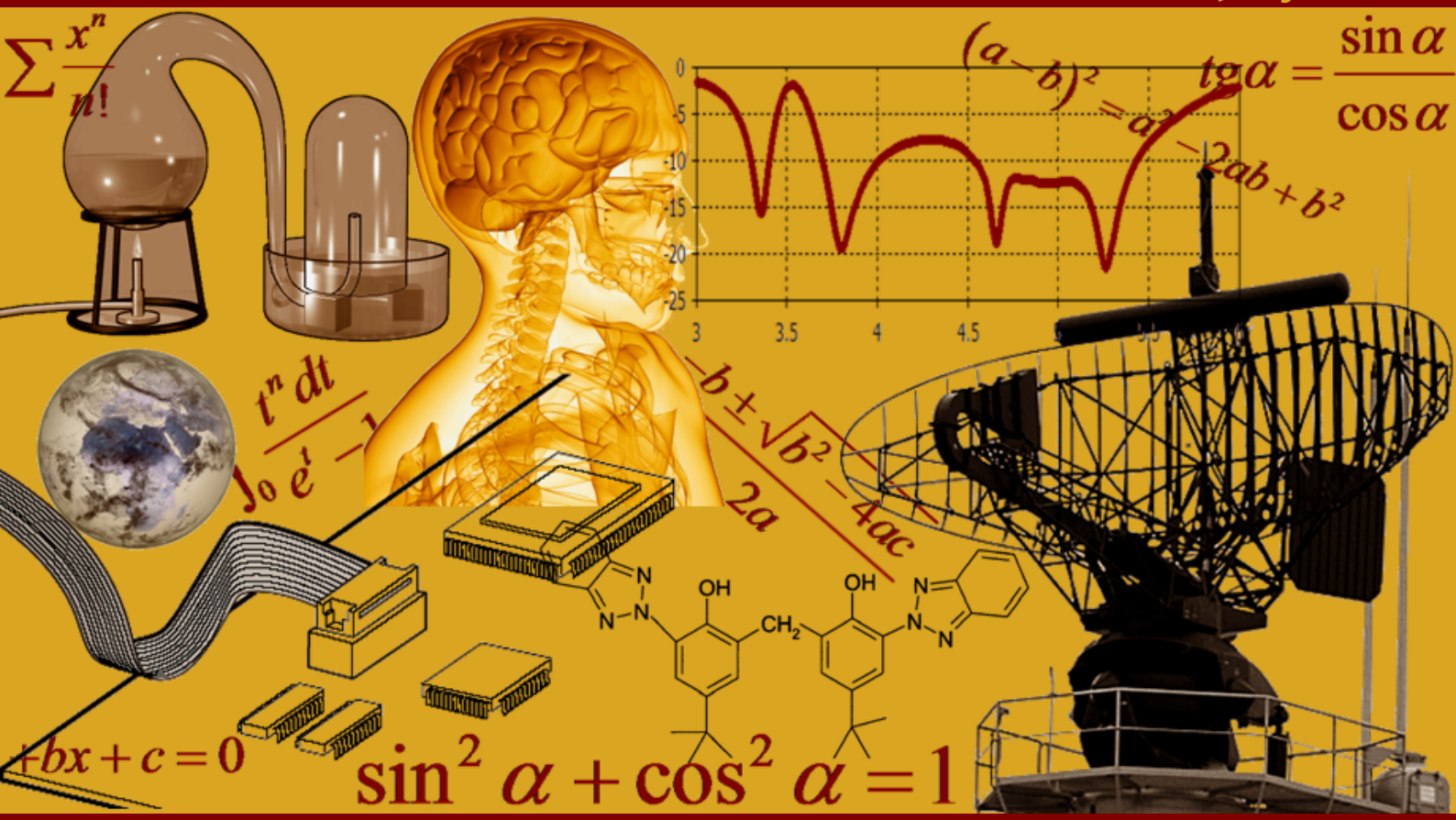

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Biomarker of Exposure: Alterations in GIT of Post Juvenile Africa Cat Fish (*Clarias gariepinus*) Exposed to sub-lethal concentrations of Glyphosate Herbicide (IPA 360g/L)

N. O. Erhunmwunse[1], E. E. Ewere[2], M. O. Ainerua[2], and F. I. Alohan[2]

[1]Physiology and Ecotoxicology Laboratory,
Animal and Environmental Biology, faculty of Life Sciences,
University of Benin, P.M.B 1154, Benin City, Nigeria

[2]Department of Animal and Environmental Biology, faculty of Life Sciences,
University of Benin, P.M.B 1154, Benin City, Nigeria

ABSTRACT: The study investigates the effect of a commonly and widely used herbicide 'IPA Glyphosate' on the histopathology of gastrointestinal tract of exposed post juvenile catfish (*Clarias gariepinus*) under laboratory condition. Results showed that alterations in GIT were both dose and time dependent and include: hyperplasia of gastric mucosa, necrotic hyperplasia, severe degenerative and necrotic changes in the intestinal mucosa and submucosa. The alterations further buttress the advantage of histopathological markers for detecting rapid response of organisms to toxins in its early stage. This study has shown that the use of glyphosate herbicide can act as a stressor on non-target organisms such as *C. gariepinus* and with the alterations observed can go a long way to affect the absorption of food in the intestine, hence, the growth of the fish.

KEYWORDS: Biomarker, GIT, Glyphosate, *Clarias gariepinus*.

1 BACKGROUND

The effects of toxicant on the gastro-intestinal tract of fish may ranged from slight changes in mortality, secretion and absorptive functions to more severe effects associated with mucosal integrity, blood flow or neuromuscular control. These effects could ultimately influence the ability of organism to thrive [1]. Some studies indicated that high levels of some metals in diet may cause increased apoptosis of intestinal cells [2]. Only a few studies have documented the histomorphological alterations of intestine in the fish exposed to heavy metals [1], [3]. Reference [4], [5] demonstrated some alterations in the gut of *Channa punctatus* and *Heteropneustes fossils* following mercury intoxication. Reference [6] observed that there was no histological alteration in the GIT of *Salvelinus ailpinus* exposed to dietary intake of inorganic and methyl mercury. In Nigeria today, farmland close to water bodies are constantly sprayed with herbicide. Experiments have documented how chemical herbicides are more cost effective and give better weed control than hand weeding include a study in which maize yields doubled and production costs fell by 61% when Nigerian farmers used atrazine [7]. More recently, chemical control decreased costs by as much as 50% and increased yields up to 55% on Nigerian cassava, yam, and soybean plots [8]. Constant spraying of farmland close to water bodies may pose a great risk to the aquatic fauna of such water bodies including fishes. In this investigation, glyphosate herbicide was considered alongside catfish as such fish farms are cited close to many farms in southern part of Nigeria.

Corresponding Author: N. O. Erhunmwunse (nosakhare.erhunmwunse@uniben.edu)

2 MATERIALS AND METHOD

2.1 EXPERIMENTAL FISH SPECIMEN AND CHEMICALS

One hundred and twenty normal post juvenile *Clarias gariepinus* of both sexes with a mean weight of 135.44±1.99 g and mean length of 28.32±0.844 cm were purchased from Osayi farms in Benin City, Edo state. They were kept in 60 L aquaria at 27.5±0.4 ◦C, pH 7.3, with 12:12 h photoperiod. They were left unfed in the first 2 days to adapt to a change in environment before feeding them with the fish diet. Laboratory aquaria were well aerated and provided with external filtration and a layer of gravel on the bottom. Fish were normally fed once a day with pelleted commercial food (Durante Aquaculture fish concentration-2mm). They were allowed to acclimate to captivity conditions for two month prior to taking the blood samples. Careful netting and handling was implemented to minimize stress. The commercial formulation of glyphosate (360 g/l-41 w.wt IPA) at five nominal concentrations 72, 54, 32 and 18 mg/L were used. These concentrations were defined taking into account: the result of the range finding test.

2.2 THE SUB-LETHAL TEST

The sub-lethal concentrations were used to perform the experiment according to reference [9] procedure for the static renewal technique. The tests consisted of a control and four concentration groups, three replicates per group, with ten fish in each replicate.

2.3 TISSUE PREPARATION

The GIT of the test animals (fish) were excised keeping the structure intact, rinsed in normal saline, fixed in 10% formalin for about 24 h at 4°C, dehydrated through series of graded alcohol, cleared in xylene, infiltrated with paraffin at 56°C, then embedded in paraffin wax [10]. Thin section of the selected gill tissues of about 6 – 7 Nμm) was cut by means of a rotatory microtone, dehydrated and stained with haematoxylin and eosin. The sections were examined and photomicrographs using an Olympus BH2 microscope fitted with photographic attachment were taken. The prepared slides were used to describe the histological structure observed under light microscopy.

3 RESULT AND DISCUSSION

Pathology has been a crucial and vigorous method in established routine toxicology studies carried out for the purpose of risk assessment. In aquatic toxicology, application of the histopathology techniques in assessing toxicological pathology of organisms has many advantages [11]. The gastro-intestinal tract is one of the main routes for the uptake of xenobiotics present in the diet or in the water that the fish inhabit [12], [13]. The effects of toxicant on the gastro-intestinal tract of fish may range from slight changes in motility, secretion and absorptive functions to more severe effects associated with mucosal integrity, blood flow or neuromuscular control. These effects could ultimately influence the ability of the organism to thrive [1]. The main changes reported in gastro-intestinal tract included hydropic degeneration of the digestive gland [14], proliferation of mucous cells, hyperaemia, atrophy and metaplasia. Some studies have indicated that high levels of some metals in diet may cause increased apoptosis of intestinal cells [2]. Only a few studies have documented the histomorphological alterations of intestine in the fish exposed to heavy metals [13], [3].

The GIT of *C. gariepinus* exposed to glyphosate herbicide in this current experiment showed severe degenerative and necrotic changes in the intestinal mucosa and submucosa, atrophy in the muscularis and submucosa and aggregations of inflammatory cells in the mucosa and submucosa with edema between them.

According to reference [15], the observed irritation and destruction of the mucosa membrane of the intestine, hampered absorption. The pathological alterations in the intestine of the studied fish are in agreement with those observed by many investigators about the effects of different toxicants on fish intestine [16], [17], [18]. Epithelial degeneration, inflammatory cells infiltration in the submucosa as well as submucosa edema was seen in the intestine of tilapia fish exposed to carbofuran [19]. Reference [19] investigated the histological alteration in the intestine of *Tilapia zilli* and *Solea vulgaris* obtained from Like Victoria and observed some lesions in the intestine, degenerative and necrotic changes in submucosa and mucosa with edema between them, dilation in the blood vessels of serosa and atrophy in the muscularis and sub mucosa.

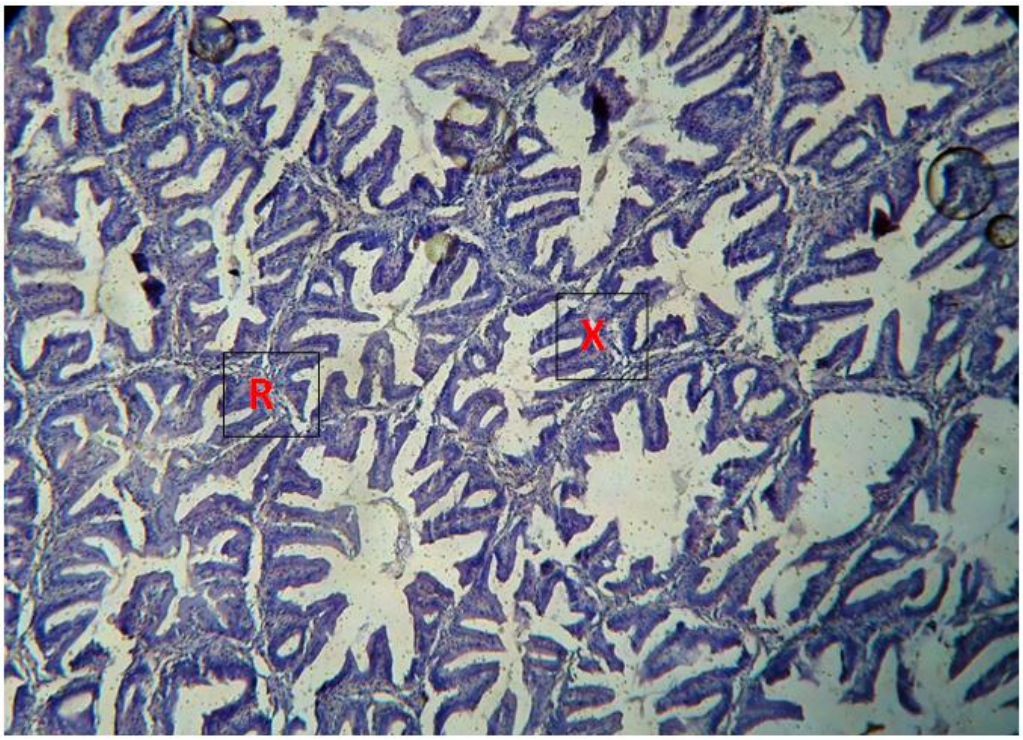

Plate 1a: Photomicrograph of C. gariepinus Gastrointestinal Tract (Control) showing the normal GIT structure. R and X (Muscularis) (H and E stain x100)

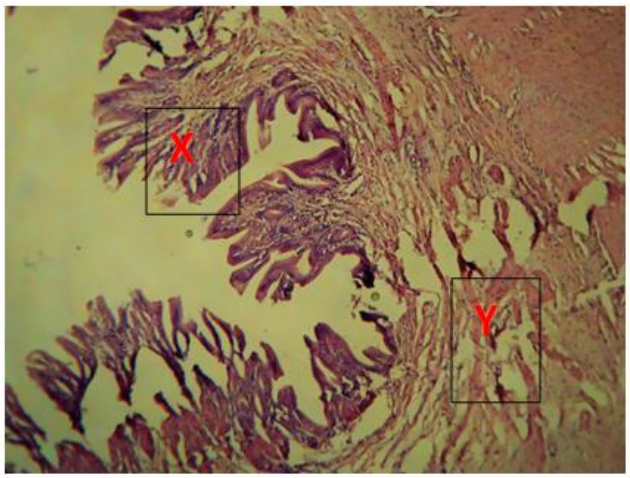

Plate 1b: Photomicrograph of GIT of C. gariepinus exposed to 72 mg/L glyphosate severe degenerative and necrotic changes in the intestinal mucosa and submucosa (X and Y) (H and E Stain x400).

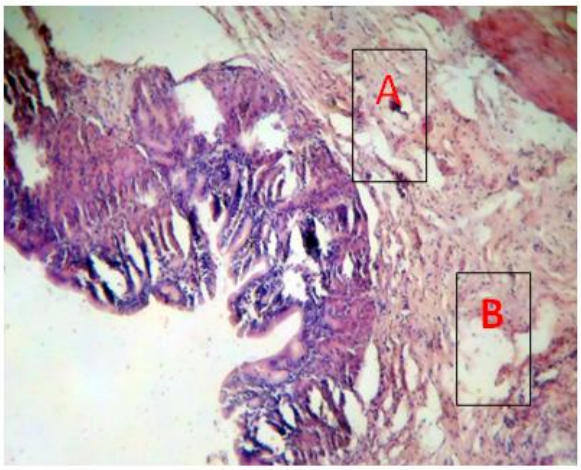

Plate 1c: Photomicrograph of GIT of C. gariepinus exposed to 54 mg/L glyphosate severe degenerative and necrotic changes in the intestinal mucosa and submucosa (A and B) (H and E Stain x400).

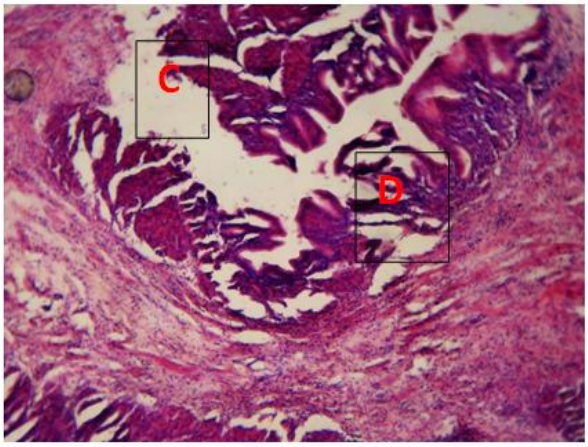

Plate 1d: Photomicrograph of GIT of C. gariepinus exposed to 32 mg/L glyphosate. Haemorrhage in the submucosa and aggregations of inflammatory cells in the mucosa and submucosa (C and D) (H and E Stain x400)

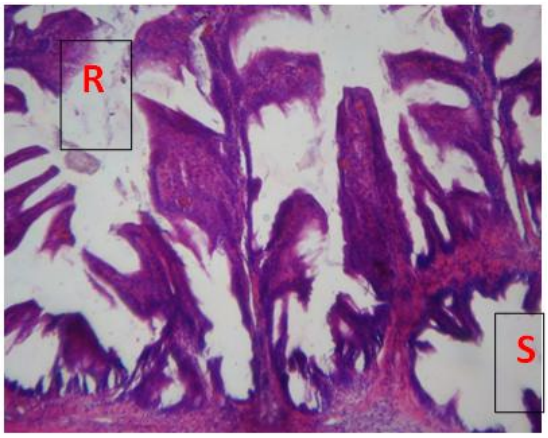

Plate 1e: Photomicrograph of GIT of C. gariepinus exposed to 18 mg/L glyphosate Severe degenerative and necrotic changes in the intestinal mucosa and submucosa (R and S) (H and E Stain x400)

4 CONCLUSION

In conclusion, pollution from pesticide usage has shown to cause damage to the health of organisms in water and indirectly on humans when they consume these fish due to the accumulation of toxic substances. This study has shown that the use of glyphosate herbicide can act as a stressor on non-target organisms such as *C. gariepinus* and with the alterations observed can go a long way to affect the absorption of food in the intestine, hence, the growth of the fish.

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Customer satisfaction

Swetha Krishna Pondichery

Department of Technology Management
University of Bridgeport,
Bridgeport, Connecticut, United States

ABSTRACT: In this study I have used a review centric research method for studying the various factors impacting on Social Marketing the Problems and challenges faced by social marketing. Post identifying the factors I have done a case study of major Effecting Customer Satisfaction in today's market world and for the factors impacting the Social marketing developing a conceptual model for the probable impacting factors and then later studying the same for confirming the same factors. In the conceptual model it was identified that Customer Satisfaction Identity is a major factor contributing to build a Customer image. The objective of the review centric research study is to find out the major facts.

KEYWORDS: Customer Satisfaction, Quality, Customer Service, Price Fairness and Tolerance.

1 INTRODUCTION

Both public and private sectors have given much attention to the concept of customer satisfaction in the past couple of decades. Naturally, administrators have requested their staff to do customer satisfaction studies for their own organizations.

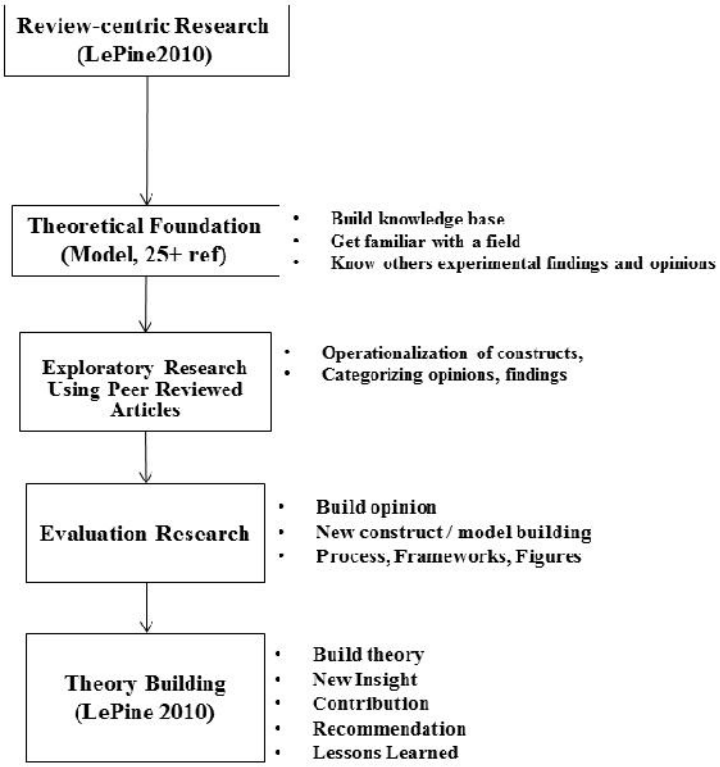
In this paper I tried to provide the analyst an over view of the model of Customer Satisfaction .These models come from a vast literature from the marketing research discipline. This pool; of research inclides models that interface the concept of Customer Satisfaction in a related concepts , such as price fairness , quality, customer service and technology In marketing literature Social Marketing has been identified as a name, term or object that identifies a seller, [1]. However the process of building a Social medium for marketing is a culture driven phenomenon and is long commitment and very similar to a lifestyle change , which takes time to nourish and flourish. There are several intangible factors which play greater roles in the bigger picture of creating brand and its image. Factors like Market segmentation, market analysis, product, promotion, price, sensitivity, a greater share of customer's service promotion, money, social, network, and a higher percentage of repeat business. [2]Customers value more than relationship they tend to form with the company and its people it could be in many forms like marketing or sales[3]. There have been lots and lots spoken about Social Marketing, but the term Social Market has made a specific meaning and could be clearly understood because of the Author or the guru Kotler and Zaltman who introduced the concept a decade ago. The literature given by the author has the extended definition about the term Social Marketing and how different science theories can be applied.[1] In this paper I have done little research from different journal papers written by different authors.

2 CUSTOMER SATISFACTION MEANING AND DEFINITION

A **customer satisfaction** evaluation can be quite specific in nature - a specific subset of experience such as a single transaction and/or particular attribute - but may also be cumulative, based on all previous experience with a good or service [4]Much has been written about **social marketing** since Kotler and Zaltman (1971) introduced the concept a decade ago. The literature has contained extended discussions about the definition of social marketing, the ethics of social marketing, the appropriateness of broadening the marketing discipline to include social marketing, and the potential of applying various social science theories in social marketing contexts. However, there have been few attempts (Rothschild 1979) [1]to move

Corresponding Author: Swetha Krishna Pondichery (spondich@my.bridgeport.edu)

beyond the reporting of case studies toward the development of general knowledge about social marketing, including knowledge about the problems most organizations tend to find in applying conventional marketing approaches in social programs the term social marketing is used throughout this article to mean "the design, implementation, and control of programs seeking to increase the acceptability of a social idea or practice in a target group(s)" (Kotler 1975, p. 283).[5] . An awareness of these problems should allow social agency administrators or their marketing advisors to formulate more workable and effective social marketing programs. While the authors believe strongly in the contribution marketing can make to social programs[6].



2.1 RESEARCH METHOD

Research methods in social marketing This chapter discusses the current and potential role of qualitative research methods in Customer Satisfaction. The major methodological approaches and the specific data collection and analysis methods that can be used to achieve social marketing objectives are outlined and examples are provided of diverse research projects that have used these methods to improve social welfare. Of note is that many of these studies are not explicitly described in the literature as social marketing projects broadly put, social marketing represents the strategic use of economic and social forces in order to change behaviors that lead to social problems (Kotler, Roberto, & Lee, 2002).

Social marketing is like commercial marketing in several ways. Both have a customer focus; i.e., the target of change is a market sector that is defined in terms of social exchange between the group in control of marketing and the group whose behavior is the focus of change. These sectors are segmented; the effectiveness of marketing depends on defining relevant sectors and then crafting a marketing format that reflects the sectors needs and interests. Customers of both efforts must perceive the benefits of partaking in the product or behavior exceeds the costs of engaging in a different behavior. In this study I identify the most important success factors that help in the current business or organizational situation to build our goal to accomplish a competitive advantage. My research approach incorporates the “interpretive paradigm” in which a rich description of each factor in our current organization context is established. 615

2.2 CUSTOMER SATISFACTION ITS GOAL AND AWARENESS

Many believe that **Customer Satisfaction** can have a major impact on society's myriad social problems. However, this impact can be seriously compromised if the technology is applied incorrectly or to areas in which it is not appropriate. [7]If practitioners misuse the concept, its effectiveness may be limited. If researchers and scholars assess its performance in areas

for which it should not be responsible, social marketing may be blamed for failures for which it should not be held accountable.[2] It is time, therefore, to introduce precision into the dialogue by establishing a clear consensus on what social marketing is and is not and what its "legitimate" domains are and are not. These definitions and distinctions have important implications for present and future practical applications, academic discussions, and field research.[1] The central premise of the article is that social marketing stands a significance chance of failure if existing issues of definition and domain are not adequately resolved

3 FACTOR IMPACTING CUSTOMER SERVICE

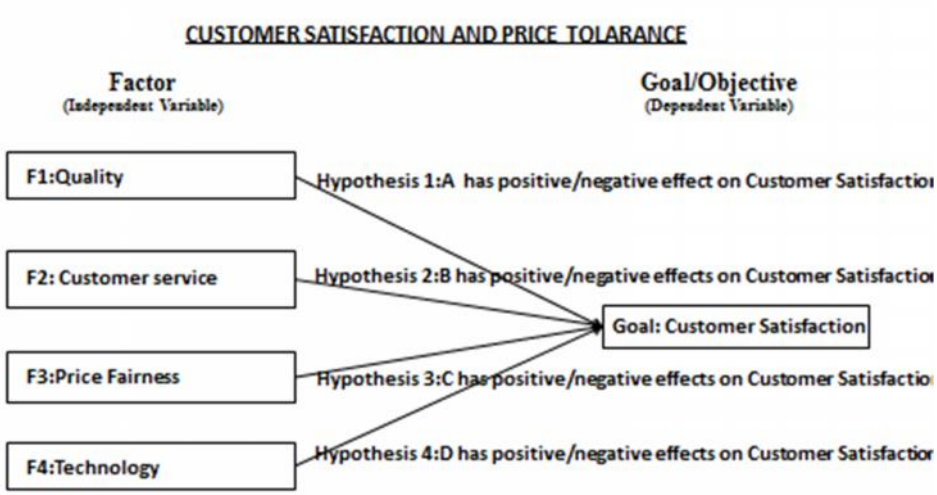
In the above goal section where Customer Satisfaction is my dependent variable and basically discussing the problems and challenges in social marketing and what each of the five authors have to say on the following goal As we know Social Marketing is a wide sea and there are many factors which have a positive and a negative effect and these authors above are trying to give a clear view point [2] As I agree with authors views and perspective and we know that Philph Kotler is the guru and he introduced the concept of social marketing with a very clear description saying social marketing can have a major impact in our society. When Kotler and Zaltam say that social marketing has a major impact in the society I completely agree with his saying because now days everything depends on social marketing I can even say the world runs on social marketing and here Kotler gives a clear evaluation and meaning of Social Marketing as the Design implementation and control of program In the second evaluation I would like to give my opinion and understandings about what [7]Andreasen when he says that the concept of social marketing should be used appropriately in the society and not miss use it or else its effectiveness will decrease and it may lead to bad impact in the society .To build a market its not only enough to know the market but we should know the wants need and the demands of the customers

This article discusses the meaning, power, and limitations of **social marketing** as an approach to planned social change. First, this will require delineating the generic nature of marketing phenomena and some recent conceptual developments in the marketing field. This will be followed by a definition of (Fox & Kotler, 1980) social marketing and an examination of the conditions under which it may be carried out effectively. The instruments of social marketing are defined, followed by a systems view of the application of marketing logic to social objectives. Marketing management is the analysis, planning, implementation, and control of programs designed to bring about desired .exchanges with target audiences for the purpose of personal or mutual gain. It relies heavily on the adaptation and coordination of product, price, promotion, and place for achieving effective response.[8]

Social marketing faces distinctive ethical challenges, which are not faced by commercial marketing, with regard to the ends it seeks, the rationale it offers for achieving those ends, and the effects it may have on its targets. The more social marketing attempts to address these ethical challenges, the more its nature as a form of social activism becomes apparent. Nevertheless, these are special ethical challenges social marketing needs to confront temporary society faces a vast number of social problems, which are both extremely complex and divers Social marketing has clear relations to commercial marketing. Still, social marketing is distinct from commercial marketing in that social marketing focuses on resolving social problems, whereas commercial marketing focuses on producing various goods or services for a profit. The "customer" of social marketing is not expected "to pay a price equal to the cost of providing the service," whereas the customer of commercial marketing is expected to do so[5]

3.1 FIGURE: THE MODEL FOR SOCIAL MARKETING WITH ITS GOAL AND ITS FACTORS

Based on the literature review and review centric research, I have tried to come up with a conceptual model for brand building in competitive markets, below mentioned are the five key factors of the model.



3.2 QUALITY INDEPENDENT VARIABLE

Quality is probably undervalued by firms because there is little consensus about appropriate measures and methods to research quality Firms are always in a rush to bring new products to market. This attitude is probably driven by several factors, such as capturing market share rewards to new products; shaping consumer preferences; exploiting economies of experience; or preempting lucrative

Supplies , market positions, distribution outlets, and shelf space [9] Market analysis depends on available data .Inter market linkages are commonly modeled as spatial equilibrium in which transaction costs and demand and supply in district markets jointly determine prices and trade flows Only prices, trade flows, and transaction costs and imperfectly observable. The available of these data establishes a hierarchy of methods. Study of the methodology of market analysis is a necessary part of the development of a science of marketing.

A case study in market analysis is presented to illustrate the actual problem-solving process, rather than just the rationalized reconstruction of the process often reported [10]. Market analysis reveals when demand is defined as the demand for jobs, on the part of people who want to get a job, and supply refers to the supply of jobs by employers who want to get a job done."' I will reserve until later the justification for this reversal, in which the accepted upward sloping labor supply curve gives way to the familiar downward sloping demand curve- that of people for jobs[3]. There seem to be several good reasons why social **market analysis** should be handled in special courses separate from marketing organization.

Furthermore, the general subject of marketing lends itself to being divided on this basis. The market price analysis is concerned with the actual prices prevailing in the market, and the manner of their determination and the reasons for their fluctuations. The marketing organization analysis is concerned with the structure of the market, the internal organization of the numerous types of business units operating in the various markets, and the interrelations of these various business units, and division of functions between them[11]

3.3 TECHNOLOGY INDEPENDENT VARIABLE

A **technology**, in our model, is a group of production methods that is used to produce an inter- mediate good or service. Each production method is embodied in a differentiated capital good. A potential producer of a capital good decides whether to incur a fixed cost of adopting the new production method. If he does, he will be the monopolist supplying the capital good that embod- ies the specific production method. This decision determines whether or not a production method is used, which is the extensive margin of adoption insert quote here [12] The process of dividing up the market into homogeneous segments and then developing unique marketing programs for individual target segments (while perhaps ignoring certain

segments) is fundamental to modern marketing. Market segmentation is generally viewed as being more productive than treating the entire market in an undifferentiated manner. Although market segmentation is widely utilized and accepted by most profit making and many nonprofit (e.g., universities, hospitals) marketers, social marketers find that predisposed to their offerings. Social marketers often segment on the basis of risk to the consumer.[13].

This article deals with the overall relationship between product liability and market segmentation. The legal concepts of foresee ability and notice are related to market segmentation in the context of disadvantaged consumer segments. In addition, the role of marketing research in supporting or defending a liability allegation is discussed. This article focuses on the legal considerations relevant to the fundamental marketing strategy of segmentation, primarily from the standpoint of disadvantaged segments.[14]

The theme of the article is that, beyond attracting consumers from potentially profitable segments, companies should take steps to minimize their product liability vulnerability in these and other segments. The discussion is based on facts taken from an actual product liability case (using disguised names, places, and products); in addition, other corroborative cases and substantive law examples are presented[15].

3.4 CUSTOMER INDEPENDENT VARIABLE

Customer service is the provision of service to customers before, during and after a purchase. According to Turban et al. (2002), "Customer service is a series of activities designed to enhance the level of customer satisfaction – that is, the feeling that a product or service has met the customer expectation. "The importance of customer service may vary by product or service, industry and customer. The perception of success of such interactions will be dependent on employees "who can adjust themselves to the personality of the guest,"[2] according to Micah Solomon. From the point of view of an overall sales process engineering effort, customer service plays an important role in an organization's ability to generate income and revenue.[3] From that perspective, customer service should be included as part of an overall approach to systematic improvement. A customer service experience can change the entire perception a customer has of the organization. [16]Once the marketer has analyzed the market and determined target segments, he or she should then develop an offering that conforms closely to the desires of the target segments. Conventional marketers will typically adjust product characteristics, packaging, the product name, the product concept, and the product position to increase the likelihood of a sale to the target segments. [17]However, social marketers find: Social marketers find that the development of a pricing strategy primarily involves trying to reduce the monetary, psychic, energy, and time costs incurred by consumers when engaging in a desired social behavior. Social marketers generally have much more complex objective functions than commercial marketers.[1].

The notion of **product strategy**-structure congruence within multi-product firms, however, is a complex one since diversity in product strategies implies a requirement for diversity in formal structure. Some writers have suggested that strong countervailing forces or constraints may exist which mitigate against achieving a theoretically satisfying fit between strategy and structure at lower organization levels (Bettis, 1979; Haspeslagh, 1982; Lorsch and Allen, 1973).Nevertheless, given the generally recognized importance and contribution of formal structure to the achievement of strategy, the suggestion of constraints raises some particularly important questions[18].

What is product?

In marketing term a product is anything that can a be offered to a market to satisfy a want or need .In other words a product is the item or service that you are offering your customers. A product can be physical object or a service and may refer to a single item or unit a group or equivalent or a group of goods or services [19]

3.5 PROMOTION INDEPENDENT VARIABLE

In many industries, promotions represent a significant percentage of the marketing mix budget. Nondurable goods manufacturers now spend more money on promotions than on advertising[20]. This study addresses a problem commonly encountered by marketers who attempt to assess the impact of their sales **promotion** response models in the literature either have ignored competitive promotions, focusing instead on the focal firm's promotions and sales response, or have considered the ideal situation in which the analyst has access to full information about each firm's sales and promotion activity.[10] The authors propose a random coefficients hidden Markov promotion response model, which takes the competitor's unobserved promotion level as a latent variable driven by a Markov process to be estimated simultaneously with the promotion response model[21] This article studies the nature, determinants, and impact of "negative" activities in organizations. In competing for **promotion**, the members in organizations can work not only to enhance their own performances, but also to "sabotage" their opponent's performances. It is worthwhile for them to engage in negative

activities because promotion is generally based on relative, rather than absolute, performance, and its nature is winner take all.[22].

3.6 BRANDING INDEPENDENT VARIABLE

Branding Social Marketing -Approaches to solving any problem, whether commercial or social, gain favor when they are widely perceived as superior to alternatives. [23]This applies to innovations in software, cooking, health care, and golf. [20]The fundamental problem for social marketing, noted previously, is that it is neither widely known nor perceived to be plainly superior to its competition in a clearly defined set of situations. I believe that the solution is found in the marketing discipline itself. I propose that social marketing should be considered a brand in the marketplace of social change approaches-and one that needs better marketing[21]

4 CONTRIBUTIONS AND NEW INSIGHTS

I feel Customer Satisfaction is a business is big era and it can be further enhanced by the by strong research and solving the factors effecting it and introducing latest approach and techniques prepared to handle the obstacles encountered during the process. A smoother strategic process process will enable not only better commercial success in the Market but also make the next upcoming social marketing strategy and research on the horizon that much better A social marketing program has as its core the wants and needs of its consumers. These are determined through market research methods that aim to learn as much about the target audience and how it thinks, feels and behaves in relation to the issue the program is addressing. These methods include quantitative research, such as a knowledge, attitude and behavior (KAB) survey, which reveals how many people think or do something. Qualitative research, on the other hand, provides insight into why people think or do what they do, through techniques such as focus groups and individual interviews.

There are many things that social marketing can do for business. Developing a strategy for using it means that the firms need to think about what they want to accomplish this year and determine how social media fits into the plan. One of the benefits of a social marketing strategy is the fact that the available tools can customized for their particular needs. The firms can choose to concentrate their efforts on the sites that seem to offer the best return on investment, while taking a “wait and see” stand on the other

Explanation and Discussion

In the needs standard, consumers evaluate whether a consumption experience gave them what they need. Of course, need can be defined in different ways, with Maslow’s hierarchy of needs being just one typology for needs. The standard of excellence refers to technical perfection, that is, some objective, widely recognized criteria. The standard of regret refers basically to the “what might have been” scenario for a consumer. This commonly occurs when a consumer realizes that what she/he got in one encounter could well have been improved if she/he had chosen a different provider. Finally, the nothing standard denotes the situation where consumers form a dissatisfaction feeling without cognition.

The factors clearly explain the different view of different authors in total there are about 30 references and more than 30 authors talking about different factors affecting customer satisfaction. I can clearly explain what each author has spoke about in both exploratory and evaluator research method under each factors that is both the goal which being the Customer Satisfaction and the independents factors which are ,Customer service, Technology, Price tolerance and Quality.

If we are looking to boost customer satisfaction which is the mail goal and the dependent factor one of the most promising places to start of in the social Market is the Customer Service , but unfortunately it’s also a place where long-term goals tend to buckle under short term financial pressures and many companies try to meet Wall Street’s immediate demands by cutting costs through automotive and outsourcing despite a growing body of research conclusively showing that customers are fed up with lousy service and that increased satisfaction has a positive impact on consumer spending, cash flow and business performances. There by in my discussion I can clearly

5 CONCLUSION

Market Analysis Market Segmentation Product Strategy and Promotion, is the factor affecting the Social Marketing which are the problems and challenges in my research paper. We cannot proceed without these independent facts without giving a clear approach on how and why they affect Social Marketing. There is no escaping social media these days, either for individuals or for businesses. Today, it is impossible to separate social media from the online world.

The social marketing conversation is no longer considered an issue it is taking place in homes, small businesses and corporate boardrooms, and extending its reach into the nonprofit, education and health sectors. From feeling excitement, novelty, bewilderment, and overwhelmed, a growing number of people now speak of social media as simply another channel or tactic. Blogging can have a very positive effect on your Company's branding & growth. As per the Hub spot report, Customers with blogs gathered 68% more leads than customers without blogs. It is imperative to understand that today, social media have exponential potential. They are part of an ever-growing online network of people who discuss, comment, participate, share and create.

Whether you are an individual, a startup, small business or a large corporation, an online presence and an ongoing conversation with your constituents is a baseline requirement and will take time and expertise. Companies are diverting resources and rethinking their traditional outreach strategies. And as the social media wave dissipates into the vast ocean of connected experiences, the term itself will become an entry in dictionaries and encyclopedias and we will embark on a new era of knowledge, accessibility and experiences unbound by distance, time or physical walls. It is high time that every business adopts social marketing and make use of it in an appropriate way and try to make positive use of it and takes it seriously then I am sure we can deal with any problem and challenges we face in Social Marketing

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The Impact of Land Information Management Systems on Environmental Planning in Informal Settlements in Nairobi, Kenya

Emmanuel Siakilo, Grephas Pancras Opata, and Leonard Simiyu Mulongo

University of Eldoret, Kenya

ABSTRACT: For a city to grow and develop in the long term, it cannot disregard its environment. An ad hoc approach to environmental issues is fragmentary, expensive and inefficient. For a city to be effective and efficient it must consciously integrate the environment particularly on the urban fringes into its planning and management mechanisms. This paper describes the impact that land ownership information management systems as applied by the various stakeholders have on the general environmental planning based on a study of informal settlements in Nairobi, Kenya. First, a survey was conducted using a questionnaire to get an insight into the current situation of the informal land development sector in the study area. Structured interviews were used at the settlement level to gain knowledge on the operations of land management and their impacts on environmental planning in the study area. Finally, focus group discussions were conducted with the village elders and headmen at the settlements to gain more insights on land ownership systems. Data for the study was analyzed descriptively using descriptive statistics. From the study, it was established that there is poor security of land information due to lack of back-ups in these settlements and information on land registration, registration of rights and rights holders is in itself insufficient and does not address environmental planning. It was thus recommended that Nairobi's Informal Settlements Coordinating Committee should be remodeled into a more effective and participatory framework with regard to collection and management of land information for environmental planning in informal settlements.

KEYWORDS: Impact, Land Information Management Systems, Environmental Planning, Informal Settlements, Nairobi Kenya.

1 BACKGROUND

Urban Environmental Planning is the process of facilitating decision-making to carry out development with due consideration given to the natural environmental, social, political, economic and governance factors and provides a holistic frame work to achieve sustainable outcomes. Environmental Planning concerns itself with the decision-making processes where they are required for managing relationships that exist within and between natural systems and human systems.

Environmental Planning endeavours to manage these processes in an effective, orderly, transparent and equitable manner for the benefit of all constituents within such systems for the present and for the future. Present day environmental planning practices are the result of continuous refinement and expansion of the scope of such decision making processes. Some of the main elements of present day environmental planning are: social and economic development, urban development, regional development, natural resource management, integrated land use infrastructure systems and governance frameworks [1].

LAND INFORMATION

Policy-makers, land administrators and individual citizens all have a need for land information and make significant use of spatial data on a day by day basis (Dale & McLaughlin, 1988). In both the public and private sector, land information is a prime requisite for decision-making. This assertion relies on the premise that information reduces

Corresponding Author: Emmanuel Siakilo (esiakilo@gmail.com)

uncertainty. The quality of information (i.e. completeness, accuracy, currency and fitness for use) is directly related to its value and the effectiveness of the decision-making process where it is used.

Land information comprises attribute, spatial and temporal information about land objects, land/property rights and the people who hold those rights. Attribute information may refer either to personal information about the legal subject(s) or the rights they hold, e.g. name, date of birth, address, personal/corporate identity number, group membership, marital/corporate status, description of rights, among others.

Spatial information refers to geographical information about land objects, e.g. area (size), boundary coordinates, elevation, land use/cover, among others. Temporal information may include information about the duration of rights in land, seasonal changes in permitted land use, and spatial changes over time, et cetera. Land information may be produced in form of paper or digital maps, databases, digital models (e.g. digital terrain models), written documents (e.g. certificates of ownership, lease, occupation, among others), images (e.g. satellite images, aerial photographs, among others).

The provision of land information is the responsibility of the land management administration organizations. Apart from the use of land information for decision making at the policy and/or management level, land information is also used in routine land administration activities e.g. dispute resolution and land transfer.

LAND INFORMATION SYSTEMS

An information system may be defined as a combination of human and technical resources, together with a set of organizing procedures, which produces information in support of some managerial requirements [2]. Such a system has mechanisms for collecting, storing, maintaining, processing data and retrieving and disseminating information that can be used for decision-making.

Land information systems (LIS) are the interaction between people, data, technology and procedures that controls the flow of land-related information in organizations to support production and service delivery. The purpose of a land administration system (e.g. improving tenure security, basis for land taxation, implementing land use control, among others) will determine the type, format, amount and quality of land information that the system will collect, maintain and distribute, i.e. the design of the land information system.

The intended function of the LIS (strategic planning, management control, operational control) will also determine the focus and the type of the information system. Figure 1 shows the elements of a land information system.

Land information systems may be manual or computerized. The advantages of computerized systems are:

- Less storage of data due to physical compaction of data
- Easier and quicker access and manipulation of data
- Easier analyses (e.g. Layering) using geo-referencing tools
- Data integration (e.g. Merging attribute and graphical datasets)
- Data sharing using networks between distributed databases

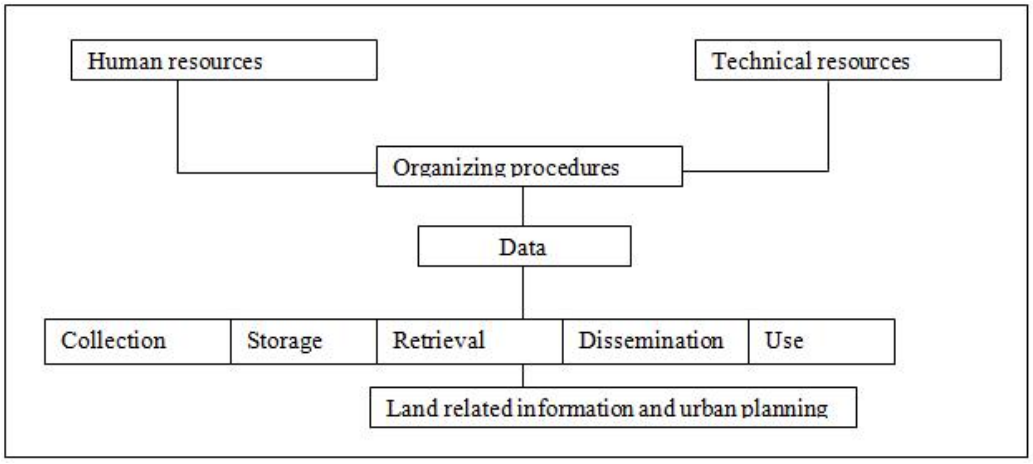

Figure 1. Elements of a land information system [2]

The design of a land information system will determine its effectiveness. Some of the important considerations for the design of a LIS are:

- The requirements of the users and stakeholders
- Flexibility to accommodate anticipated future developments
- Data sharing mechanisms, i.e. Using standardized data models and software formats

A land information system can be evaluated according to various criteria:

- User satisfaction
- Affordability of products and services
- Responsiveness to the information needs of its users
- System accessibility and availability
- Information dissemination (mode and reliability)
- Data usability and relevance
- Efficiency of data capture, maintenance and processing
- Data completeness, currency, consistency and accuracy (integrity)
- Quality of data protection, e.g. Legal rights of access, intellectual property rights
- Physical safety of data, i.e. Data back-up, warehousing, storage/archiving
- Availability of both data and service metadata e.g. Data quality labelling
- SDI readiness
- Level of data conversion (including availability of conversion information)
- Standardization of database structure and contents
- Administrative issues
- Data redundancy, e.g. Through duplication of data collection
- Sustainability, e.g. Capacity building in technical expertise, change management on restructuring/re-engineering

LAND INFORMATION MANAGEMENT

Land information is a public good. It needs to be properly managed just like other resources. Land information management strategies are concerned with the effective management of the land information resource to achieve specific objectives and to improve decision making. These objectives may include improvements in cadastral coverage, data content, data reliability, data access, integration of data, among others. These improvements can, in turn, contribute to the achievement of cadastre and land registration goals, e.g. better cadastral coverage, improved security of tenure, among others. Land information management tasks at any level include:

- Determining the internal and external requirements of land-related information products and services
- Examining how the land information is actually used in decision making
- Strategic planning (priorities, goals, strategies, action, performance evaluation and monitoring) institutional aspects
- Continuously improving the land information system (e.g. Re-engineering)

STATEMENT OF THE PROBLEM

Urban areas throughout the developing world are experiencing a problem in the provision of adequate and serviced land to meet the demands of their rapidly expanding urban populations. As a result, low income groups who are mostly unable to afford land are forced to crowd in already existing congested settlements, creating slum conditions.

These informal settlements are home to increasingly large proportions of the urban population in the city of Nairobi in Kenya. As embraced in Kenya vision 2030 document of October 2007 [3], Kenya needs to strengthen her institutional capacity to collect data on land use, not just for urban and physical planning but also for environmental analysis and policy making. Only three urban centers (50 per cent of Nairobi, Kisumu and Kitale), according to this document, have land use data and the study site is not part of the 50 per cent mentioned in Nairobi.

The capacity to undertake land cover mapping is weak and therefore assessment and monitoring of strategic environmental resources remains a challenge. A general lack of land information and inappropriate land information

management are major constraints to the achievement of effective urban land management in both formal and informal areas in Kenya. There are gaps in land-related data and information collected by a wide range of government and non-government agencies and the difficulty in maintaining it and distributing it to stakeholders.

Besides, there is little effort to understand existing informal land ownership systems and their potential role in the environmental planning of these settlements in Kenya. The mandates of the actors in the informal land development sector have not been clarified and they do not use the land information that they collect and maintain to integrate informal settlement in the formal urban planning process.

In Kenya, the ever increasing poor state in informal settlements arises not from the annual population explosion that is exacerbated by high rural-urban migration every year, but majorly from the ineffective handling of land ownership information and information on infrastructural services in such areas. Without effective land information management based on accurate survey in these settlements that are keenly monitored and evaluated by planners on land issues, acceptable conducive living conditions will be so elusive a concept in these settlements in Kenya.

2 MATERIALS AND METHODS

A survey of the current situation of informal settlements in Nairobi was carried out during the fieldwork period. A questionnaire was the main tool used for this survey. The key informants for the purposes of the survey were drawn from the Directorate of City Planning, Ministry of Lands and Housing, NEMA headquarters office, NCC, Shelter Forum – a consortium of civil society organizations involved in land and shelter policy research and advocacy, Amani Housing Trust – a trust set up by the Catholic Archdiocese of Nairobi to implement and operate a slum upgrading programme, Kazi na Jasho Self Help Group – a Community-Based Organization (CBO) working under the provincial administration to offer voluntary services in environmental conservation, security and social advocacy, Pamoja Trust – a Non-Governmental Organization (NGO) working with Community-Based Organizations to find solutions to land tenure and shelter problems for the urban poor, Kibra Land Committee and EMS Associates – private planning land consultants.

The distribution of the questionnaires was done by hand to the respective offices and respondents given two weeks to complete them. From the survey, 15 stakeholder organizations involved in the collection of land information were identified and questionnaires issued. Out of the 15 questionnaires distributed to key informants, 9 were completed and received back from the following individuals.

Interviews were used as the main method of data collection at settlement level. The interviews were used to gain in-depth insights into the operations of the land information management system in the individual settlements. The interview method was effective. It had a high response rate and follow-up questions and verification of unclear issues could be done “on the spot”. The main sources of secondary data were:

1. Official policy documents
2. Government of Kenya (GoK) national reports
3. Informal settlement project reports
4. Prior research work (theses, case studies, journal articles, etc)
5. Legislation

The data collected in this study was mainly of qualitative nature and was therefore analyzed qualitatively using descriptive analysis and presented in tabular and graphical form.

3 RESULTS AND DISCUSSION

Despite land information being in custody of the different stakeholders in the three informal settlements studied, little effort has been made to use this information in bringing environmental planning on board in these settlements. Besides, in some cases there is incomplete registration information, poor security of land information due to lack of back-ups, inflexible rules when requesting for access to such information as well as political interference.

Information on land registration, registration of rights and rights holders is in itself insufficient and does not address environmental planning in these settlements. As a result, these settlements are operating with inadequate infrastructural facilities and therefore the residents are living in deplorable conditions.

Residents of Lindi village in Kibera, for instance, live adjacent to a railway line as indicated in Figure 2. With the information on plot locations, this scenario should not have been allowed to exist because of the hazard it may cause to the habitants.

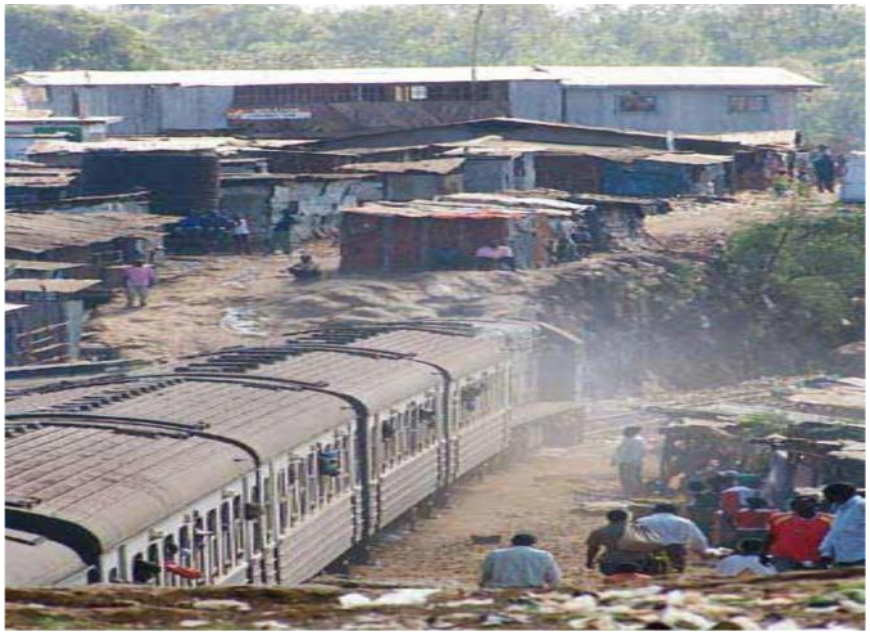

Figure 2. Locations of Settlements in Kibera

SANITATION

Sixty per cent of the population in Kibera, Mathare 4A and Mukuru kwa Njenga share pit latrines with approximately fifty others. Besides, the few toilet facilities available are not conveniently located, are unclean and using them at night poses a security risk. From the respondents' sentiments, children are especially vulnerable to inadequate toilets because they may lack access to household keys which unlock the community toilets.

With few toilets and pit latrines, there has also been a continued growth of "flying toilets". The reality behind these flying toilets is the inaccessibility of toilet facilities especially during late hours due to uneven distribution and lack of convenience resulting to insecurity. Most toilets and pit latrines are owned and managed by community groups and also individual businessmen who charge Ksh 5 per person per every visit.

The residents complain that this figure is high for them since their earnings are low.

WASTE MANAGEMENT

The study found out that there are inadequate garbage collection systems in the study sites. Due to this inadequacy, solid wastes have grown into heaps of mountains over the years with most of it being washed into water points during the rainy season further contaminating underground water. Tons of solid wastes are generated every month in these settlements and there are no solid waste dumping sites and no recycling plants. Any open space in these settlements forms a dump site.

Uncollected solid waste is one of these settlements most visible environmental problems. Waste collection services are provided only sporadically to low-income areas because of poor accessibility and very high waste generation which cannot be handled with available vehicles and equipment. The municipal services seem to fail most strikingly in garbage collection and disposal. Such a site in is shown in Mashimoni village of Kibera informal settlement in Figure 3.

Figure 3. Waste disposal in Mashimoni village (Kibera)

ENERGY AVAILABILITY

From the findings, residents of these three informal settlements rely almost exclusively on firewood and charcoal. Mostly women and girls have to walk for distances to look for firewood. Charcoal is often prepared for commercial purposes. Entire trees are being carbonized and sold in sacks to the poor in urban areas. More than 70% of the households in these settlements lack electricity.

Provision of energy is controlled by government owned firms which have not been able to set power transmission points in many parts of these settlements. In addition, the cost of electricity is quite high. This overreliance on firewood and charcoal has further degraded the environment that you can hardly see any vegetation in these settlements.

PROVISION OF HOUSING

From the study, 70% of the structures in the study sites are mud walled and thatched with corrugated iron sheets or entirely made of iron sheets. A household in these settlements comprises of seven members on average and costs between Kshs 300-Kshs 1000 per month.

The local authorities usually issue temporary occupation licenses to the owners. Around 10% of the residents in these settlements own the structures and sub-let them to the remaining 90%. The structures are owned by informal owners who are recognized by the tenants, but they have no legal ownership. The tenants pay a monthly micro-lease to the owners. Most residential units are single rooms approximately 10 by 10 feet in size. They offer little ventilation, security or privacy. Figure 4 displays the physical layout of some of these structures in Kibera.

Figure 4. Physical layout in Kibra Nubian village (Kibera)

WATER SUPPLY

The residents of these three informal settlements have three main concerns with water: access, cost and quality. They complain about the limited access to water points, which are located far from their houses. Besides, some landlords ration water such that it is only available on specific days of the week and at specific times.

This is a limitation, especially for people who have children and who require high amounts of water. However, for those who have access particularly in Mathare 4A, they decry the high cost of buying water in the informal settlements. They pay between Ksh 5-Ksh 15 per every twenty litre container. This is costly especially relative to the slum residents' income levels.

The study also established that some dwellers of these settlements use sewerage water for bathing and washing. This was particularly reported in Kambi Muru village of Kibera informal settlement. In fact, the Kenya government in 2007 admitted that sustainable access to water dropped to as low as 20 per cent in the settlements of the urban poor where half of the urban population lives [4]. This is a tragic situation given that the population in these settlements keeps rising every year.

4 CONCLUSION AND RECOMMENDATIONS

Negligence by the Kenya government to use land information to improve informal settlements and at least to provide the minimum support on basic requirements and services has led to unimaginable suffering to informal residents. This is coupled with the fact that the government fails to recognize the growth and proliferation of informal settlements and thus excludes them from the rest of the city's development plan.

The government and UN-Habitat development plan for some informal settlements like Kibera settlement upgrading is a good gesture but falls short of a comprehensive plan to recognize the settlements and to invest in improving the living conditions. Finally, there is an absence of a city land information development strategy to inform urban, physical and environmental planning particularly for the study informal settlements.

From the above conclusions, it is recommended that the government should develop a city land information strategy to inform urban, physical and environmental planning particularly for the informal settlements. The government should also work towards combining physical, economic and environmental planning in its development plan. Moreover, a regulatory framework and action plan should be put in place to ensure equitable and pro-poor access to urban resources and services. Apart from that, further research is necessary to establish whether environmental planning can be effective where regularization of informal settlements is ongoing.

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Effect of Deposit Volume on Banks' Lending Behaviour in the Nigerian Post-Consolidation Era

AKINYOMI Oladele John

Financial Studies' Department,
Redeemer's University,
Mowe, Ogun State, Nigeria

ABSTRACT: Lending represents one of the core functions of commercial banking system. The essential role of banks in the economy has been to intermediate funds between surplus and deficit economic units. In the process of carrying out this primary task, banks have found themselves performing a number of functions which include: the mobilization of savings, stimulation of investment and economic growth, assistance in resources allocation, boosting of international trade and promotion of the payment system. The few studies which have been conducted on bank lending in Nigeria focused on the pre-consolidation banking era. This study examines the effect of deposit volume on bank lending behaviour in the Nigerian post-consolidation banking period. The population of the study comprises the 22 deposit money banks operating in Nigeria as at December, 2012. Data were obtained from the audited annual reports of the 22 banks for the post-consolidation period of 2006-2012. The analysis was conducted using regression analysis with the aid of SPSS package. The results revealed a positive and significant relationship between deposit volume and loan and advances in the selected banks. The study recommends that future researchers should investigate other factors which may exert some influence on the lending behaviour deposit money banks in Nigeria beside deposit volume. Specifically, factors such as capitalization, interest rates, gross domestic product, and liquidity ratio were mentioned.

KEYWORDS: Business Size, Accurate Product Costing, Activity-based Costing, Manufacturing, Nigeria.

1 INTRODUCTION

Lending has been described as one of the services that deposit money banks do render to their customers [1]. It has been opined that lending is undeniably the heart of banking business [2]. Therefore, its administration requires extensive skill and agility on the part of the bank management. Lending timeframe may vary from short-term, medium-term to long-term duration. It has been observed [1] that banks do grant loans and advances to individuals, business organizations as well as government in order to enable them embark on investment and development activities as a means of aiding their growth in particular or contributing toward the economic development of a country in general.

According to [3], lending practices in the world could be traced to the period of industrial revolution which increases the pace of money deposit and production activities thereby bringing about the need for large capital outlays for projects. During this period, many captains of industry were unable to meet up with the sudden upsurge in the financial requirements and therefore turn to the banks for assistance. The essential role of banks in the economy has been to intermediate funds between surplus and deficit economic units. In the process of carrying out this primary task, banks have found themselves performing a number of functions which include: the mobilization of savings, stimulation of investment and economic growth, assistance in resources allocation, boosting of international trade and promotion of the payment system [4].

Reference [5] observed that commercial banks are the most significant savings, mobilization and financial resource allocation institutions in the world. Consequently, these roles make them an important phenomenon in economic growth

Corresponding Author: AKINYOMI Oladele John (email)

and development. In performing this role, it must be realized that banks have the potential, scope and prospects for mobilizing financial resources and allocating them to productive investments. Both theoretical and empirical finance literature reveals that the availability of bank credit is an important determinant of economic growth and development, particularly, in developing economies [6].

1.1 STATEMENT OF THE PROBLEM

Reference [1] conducted a study on determinants of commercial banks lending behaviour in Nigeria between 1980 and 2005. This period represents the pre-consolidation era. Several innovative changes have taken place in the Nigerian banking sector since the 2005 consolidation. These changes, no doubt have influences on the discharge of the fundamental functions of the banking sector in Nigeria. One of the widely recognized fundamental functions of the banking system is that of intermediation between the lender and the borrowing public [7]. However, there is dearth of current research in Nigeria on the effect of deposit volume on bank lending in the post-consolidation era. Thus, this study seeks to investigate the effects of deposit volume on banks' lending behaviour in the Nigerian post-consolidation era.

1.2 OBJECTIVE OF THE STUDY AND RESEARCH QUESTION

In response to the problem identified above, the main objective of this study is to investigate and report on the effect of deposit volume on banks' lending behaviour in Nigeria. The specific objective is to ascertain whether volume of deposit influences loan and advances in the Nigerian deposit money banks. In order to achieve the research objective stated above, the following research question has been raised. What is the influence of the independent variables (volume of deposit) on the dependent variable (loan and advances) in the Nigerian deposit money banks?

1.2.1 RESEARCH HYPOTHESIS

Based on the research objective and research question stated above, the following research hypothesis has been developed:

H_0: There is no significant relationship between the dependent variable (loan and advances) and the independent variables (volume of deposit) in the Nigerian deposit money banks.

H_1: There is significant relationship between the dependent variable (loan and advances) and the independent variables (volume of deposit) in the Nigerian deposit money banks.

2 LITERATURE REVIEW

Lending in its most general sense can be described as the temporary giving of money or property to another person with the expectation that it will be repaid [8]. In a business and financial context, lending includes many different types of commercial loans and advances.

In his onion, [9] asserts that bank lending plays an important role in influencing levels of consumer spending, investment and economic growth. According to [9] when bank lending reduced at the start of the credit crunch in 2008; the decline in bank lending was a significant factor in causing the 2008 UK economic recession.

In a related study [10] opined that lending is one of the two most important functions of banks, not only because of the banks' social obligation to cater for the credit requirements of diverse sections of the community, but also because lending is one of the most profitable. The interest rates realized by banks on loans have for all time been well above those realized on investments.

Similarly, [10] observes that deposits play a critical role in bank funding, as the main portion of a commercial bank's assets is generally financed through customer deposits. To boost deposit mobilization from the public, banks have used a variety of strategies and most increasingly adopt a marketing approach for deposits mobilization, which focuses on the identification of customer needs and offering of products accordingly [12].

In another study, [6] observed that, most business organizations, especially in emerging market economies are highly dependent on bank loans as a source of capital and the ability of banks in giving loans depends to a large extent on their ability to attract deposits. It was observed by [13] that bank loans are one of the most important long-term financing sources in many countries.

Similarly, [5] conducted a study on lending behaviour in Ghana. Using a dataset from the Bank of Ghana for 25 Ghanaian banks from 2005 to 2010, the study employed a random effects (RE) model with AR(1) and heteroskedastic disturbances to test the relationship between bank lending behaviour proxied as the ratio loans and advances to total asset and bank asset quality (ratio of nonperforming loans to gross loans and advances) while controlling for deposit mobilization, equity, management efficiency, intermediation spread and income diversification. The results of the study revealed that the effect of the deterioration of bank asset quality (high levels of non-performing loans) on bank lending behaviour is persistence and not contemporaneous. Additionally, bank deposit mobilization, intermediation spread and equity were also found to influence bank lending behaviour.

Likewise, [1] examined the determinants of commercial banks' lending behaviour in Nigeria. Data for the census study were obtained from secondary sources. The population comprised of the 89 commercial banks in Nigeria for the period 1980 – 2005. The scope was limited to 2005 because of the major banks' consolidation that took place from December 2005 which drastically reduced the numbers of banks in Nigeria. The results of the regression analysis conducted revealed that volume of deposits, investment portfolio, interest (lending) rate, stipulated cash reserve requirements ratio and liquidity ratio each showed a significant relationship with loan and advances in the commercial banks.

In a similar study, [14] surveyed the determinants of lending behaviour in Ghana. Particularly, the study observed a relationship between bank lending behaviour and a set of macroeconomic indicators, industry and bank level characteristics. The study utilized panel data which involved pooling of seventeen (17) banks over the period 1997 – 2006. The results revealed that the bigger banks seem to be in a better position to lend more than smaller ones. In other words, a positive relationship was established between bank lending and bank size. Similarly, the study showed that high level of bank capital was found to support much higher volumes of bank lending. Finally, relationship banking was found to have a positive correlation with bank lending behaviour in Ghana.

In a related study, [15] carried out an analysis of the deposits and lending behaviours of banks in Nigeria. Specifically, the study examined the extent to which banks in Nigeria have performed their intermediation functions of deposit mobilization and granting of loans and advances and the effects on their performance. The study employed secondary data obtained from the annual reports and accounts from 2006 to 2011 of seven purposively selected banks out of the 24 existing banks. The study used descriptive statistics of trend analysis, percentage growth and averages. The results of the analysis revealed that banks with high deposits and loans perform better in terms of profitability than banks with low deposits and loans.

For a period covering the pre-consolidation and post-consolidation era [16] carried out an assessment of the determinants of lending behaviour of commercial banks in Nigeria for 1975-2010 periods. Specifically, the study investigated the level of commercial banks loan advances in Nigeria and also examined those various determinants of commercial banks lending behaviour in Nigerian banking sector. The data obtained from secondary sources were subjected to regression analysis. The results of the analysis indicated a direct and positive relationship between commercial bank loan and advances and volume of deposit. The results also revealed a direct and positive relationship between commercial bank loan and advances and annual average exchange rate of Naira to dollars.

3 MATERIALS AND METHODS

The study adopted the correlational research design. The population of the study consisted of the 22 deposit money banks currently operating in Nigeria as at December, 2012. Data were obtained from the audited annual reports of the 22 banks for the post-consolidation period of 2006-2012. The analysis was conducted using regression analysis with the aid of SPSS package. The regression function is as follows: LOAD = f (VOD). Where LOAD = Loan and Advances, VOD = Volume of Deposit.

4 RESULTS AND DISCUSSIONS

Having subjected the data obtained for this study to regression analysis with the aid of SPSS Statistic version 17.0, the results are presented below beginning with the model summary. The model summary below provides the R and the R^2 value. The R value is 0.941, which represents the simple correlation. It indicates a higher degree of correlation. The R^2 value indicates how much of the dependent variable, "loan and advances", can be explained by the independent variable, "volume of deposit". In this case, 88.6% can be explained, which is very large. Furthermore, in order to test for autocorrelation in the residuals, the Durbin-Watson result is presented; the Durbin-Watson statistic is always between 0 and 4. A value of 2 means

that there is no autocorrelation in the sample while values approaching 0 indicate positive autocorrelation and values toward 4 indicate negative autocorrelation. Thus, the value of 1.425 is close to 2 which is an indication of no autocorrelation.

Table 1: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.941[a]	.886	.863	.0686014	1.425

a. Predictors: (Constant), VOD b. Dependent Variable: LOAD

Source: Output of data analysis by author

The ANOVA table below indicates that the regression model predicts the outcome variable significantly well. This is observable under the Sig column. It indicates the statistical significance of the regression model that was applied. Here, the p value of 0.002 is less than critical value of 0.05, and indicates that; overall, the model applied can statistically significantly predict the outcome variable.

Table 2: ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.183	1	.183	38.843	.002[a]
	Residual	.024	5	.005		
	Total	.206	6			

a. Predictors: (Constant), VOD b. Dependent Variable: LOAD

Source: Output of data analysis by author

The coefficient table below provides information on each predictor variable. This gives us the information we need to predict loan and advances from deposit volume. It shows that volume of deposit contributes significantly to the model.

Table 3: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.574	.517		1.111	.317
	VOD	.822	.132	.941	6.232	.002

Source: Output of data analysis by author

This study focused on the effect of deposit volume on lending behaviour in the Nigerian post-consolidation banking era The result of this study substantiates the one reported by [5] who conducted a study on lending behaviour in Ghana and reported a positive relationship between deposit volume and bank lending. Similarly, the result of this current study aligns with that of [1] who examined the determinants of commercial banks' lending behaviour in Nigeria during the pre-consolidated period. A positive relationship is established between the volume of deposit and bank lending in Nigeria. This connotes that the more deposit a bank is able to attract, the more fund would be available for lending to customers. This result is supported by [11] who observes that deposits play a critical role in bank funding.

5 CONCLUSION

This study examines the effect of deposit volume on bank lending behaviour in the Nigerian Post-consolidation banking era. The result of the regression analysis revealed that the independent variable (Volume of Deposit) has a significant and positive relationship with the dependent variable (Loan and Advances) on the Nigerian deposits money banks. In other words, the higher the deposit volume, the greater the probability of granting loans and advanced to prospective borrowers.

The result of this study reveals a positive relationship between deposit volume and bank lending. Therefore, there is need for bank management to devise new methods of enhancing customers' deposits. Besides, there are other factors which may

exert some influence on the lending behaviour of deposit money banks in Nigeria beside deposit volume. These factors include capitalization, interest rates, gross domestic product, and liquidity ratio among others. Therefore, it is recommended for future studies to examine the effect of these factors on lending behaviour of banks.

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Medium Term Expenditure Framework and Budget Effectiveness in Nigeria

Kenneth Enoch Okpala

Department of Financial Studies (Accounting) Redeemer's University, Nigeria

ABSTRACT: The inadequacy of annual budget system has in recent times forced many countries' government into search for a more appropriate framework that supports the reform of policy makers degree of planning, improves inter and intra-sectoral resource allocation by effectively prioritizing all expenditures and dedicating resources only to the most important activities as well as developing accuracy of revenue estimation. Medium term expenditure framework (MTEF) seems to be the framework that best meets these criteria. This research paper investigated the concept of MTEF and its relationship with budget effectiveness in Nigeria public sector. The study adopts a cross sectional survey research design. Six-point rating scaled structured questionnaire starting from highly ineffective to highly effective was used to elicit primary data from 258 selected members of the population which consists of senior staff of accounting, finance and internal audit department of federal Ministry of finance, Fiscal responsibility commission and CBN. The result shows that the MTEF positively and significantly correlates with budget process, sectoral planning, aggregate discipline and revenue estimation in Nigeria public sector. The study concluded that MTEF has influenced budget effectiveness by overcoming the shot sighted planning, irresponsible resource allocation, and has coordinated the linkage between policy, planning and budgeting which led to improved service delivery in Nigeria public sector.

KEYWORDS: Medium term expenditure framework, budget process, sectoral planning, aggregate discipline, top down resource envelope.

1 INTRODUCTION

According to Olomola (2009), budget process in Nigeria before effective adoption of MTEF in 2009 was facing numerous challenges which led to different reforms from one government to another. The main challenges surrounding the annual budget include: lack of political will and commitment to abide by stipulated rules and budget guidelines; inability to develop a proper macro-economic framework for budget formulation; ambiguities in the roles of various agencies involved in the formulation and monitoring of budgets; periodic changing of budget line items classifications that inhibited the formulation and monitoring of the budget; lack of coordination between the AGF office and the CBN, which hindered the smooth disbursement of funds after budget approval; slow budget process fraught with errors and delay; poor implementation of the capital budget; unsustainable spending; large government deficits financed by monetary growth; large recurrent spending and debt service costs; poorly conceived projects and programs; spending not properly linked to developmental priorities; and weak monitoring, auditing and reporting. Some of these issues were traced to annual budgeting framework. Due to inadequacy and inappropriateness of annual budget system in linking framework that allows expenditures to be driven by policy priorities and disciplined by budget realities, Medium-term expenditure frameworks (MTEF) was established in early 1980s (World Bank, 1998). MTEF constitute an approach to budgeting and public financial management (PFM) that addresses well-known shortcomings of annual budgeting (Wildavsky 1986). Most public programs funded from annual budget may have further cost and also yield benefits over a period of years but the annual budget largely ignores these future costs and benefits there by creating a mismatch. Annual budgets typically start with the previous year's budget and modify it in an incremental manner, making it difficult to reprioritize policies and spending (Kighir, 2012). Strategic budgeting system or multiyear budgetary planning is the defining characteristic of MTEFs which take a strategic forward-looking approach to establishing priorities and allocating resources. Nurudeen & Usman (2010) noted that MTEF allows the level and composition of public expenditure to be determined in light of emerging needs based on available resource envelope. MTEFs also require

Corresponding Author: Kenneth Enoch Okpala (kenenoch@yahoo.ca)

policy makers to look across sectors, programs, and projects to see how spending can be restructured to best serve established policy objectives.

The problem in most developing countries is that of the disconnection between of policy making, planning, and budgeting which has in the past years resulted in failure of budget to address major macroeconomic issues and undermined economic development (Nurudeen & Usman, 2010; Kighir, 2012). This common condition of developing countries' governance imbalance - disconnection between policy making, planning, and budgetary processes could not be resolved by annual budget hence adoption of MTEF. The MTEF has increasingly come to be regarded as a central element of PFM reform programs both in developing and advanced nations. The main objective of this paper to investigated MTEF and budget effectiveness in Nigeria and to achieve this, the researcher also need to examine the principle of MTEF and budget process in Nigeria, sectoral planning, aggregate budget discipline and also investigate MTEF and revenue estimation. The research questions developed include: To what extent has MTEF streamlined budget process in Nigeria? How does MTEF encourage sectoral planning? What is the influence of MTEF on aggregate budget discipline? And how does MTEF influence realistic revenue estimation. Formulated hypotheses are: $\mathbf{H0_i}$: There is no significance relationship between MTEF and budget process $\mathbf{H0_{ii}}$**:** There is no significance relationship between MTEF and sectoral planning and $\mathbf{H0_{iii}}$: MTEF do not have significant association with aggregate budget discipline. $\mathbf{H0_{iv}}$: There is no significance union between MTEF and revenue estimation. The rationales for the hypotheses are based on the fact that budget process, planning at sector level, aggregate budget discipline and accuracy of revenue estimation are important control factors moderating the effectiveness of budget in the public sector. Therefore, it was hypothesized that these control factors have no significant influence on budget effectiveness in Nigeria. The two key variables upon which this study needs to focus are MTEF and budget effectiveness (BE) in Nigeria. In order to test the hypotheses, the variables are operationalized as follows: Y = ƒ(X). Where: **Y** = dependent variable (BE) which comprises of $\mathbf{y_1}$ to $\mathbf{y_4}$**.** **X** = independent variable (MTEF) which comprises of $\mathbf{x_1}$ to $\mathbf{x_4}$ with the following definitions:

$$y_1 = \beta_o + \beta_1 x_1 + \varepsilon_1 \quad (1)$$

$$y_2 = \beta_o + \beta_2 x_2 + \varepsilon_2 \quad (2)$$

$$y_3 = \beta_o + \beta_3 x_3 + \varepsilon_3 \quad (3)$$

$$y_4 = \beta_o + \beta_4 x_4 + \varepsilon_4 \quad (4)$$

$$\mathbf{Y} = \beta o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon \quad (5).$$

$\mathbf{x_1}$ = Budget process (**BUDPROS**); $\mathbf{x_2}$ = Sectoral Planning **(SECPLAN);** $\mathbf{x_3}$ = Aggregate discipline **(AGREDIS); and** $\mathbf{x_4}$ = Revenue estimation (**REVEST).** Equation (1) to (4) shall be investigated by the study while (5) is the working equation for the research model which forms the basis for the model specification under methodology in section three.

2 LITERATURE REVIEW

According to Le Houerou & Taliercio (2002), failure to link policy, planning and budgeting which amounts to system fragmentation may be the single most important factor contributing to poor budgeting outcomes at the macro, strategic and operational levels in developing nations. They also noted that when policy making, planning and budgeting take place independent of one another, annual budget expenditure is made on an ad hoc basis because even small discretionary allocations are not predictable (World Bank, 1998)**.** Other weaknesses producing budget effectiveness includes: (i) unpredictability of revenue from one year to the next and within the budget year. In Nigeria, larger part of government revenue is oil based and depends on international market price dictation which cannot be predicted with a good level of accuracy (ii) failure to direct resources to policy priorities in budgeting as most annual funding exercise are not policy based and (iii) public expenditure are not limited by resources availability Gali (2006). All these have contributed to poor operational performance of public sector. Figure 1 below shows the linkages between policy, planning and budgeting.

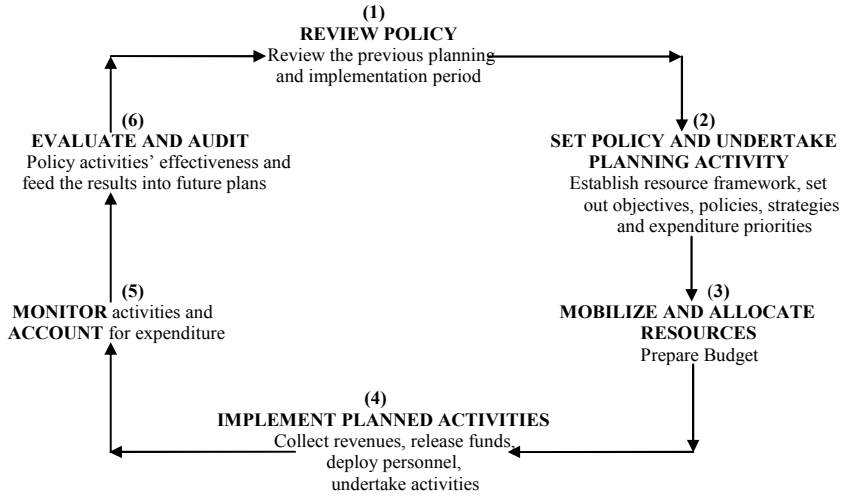

Figure 1: Linking policy, planning and budgeting in the planning and resource management cycle

Source: Le Houerou & Taliercio (2002)

World Bank (1998) stated that the MTEF is intended to facilitate a number of important outcomes such as: greater macroeconomic balance; improved inter - and intra-sectoral resource allocation; greater budgetary predictability for line ministries; and more efficient use of public monies. Improved macroeconomic balance and fiscal discipline is attained through good estimates of the available resource envelope which is useful in making budgets that fit squarely within the envelope. Under MTEF, greater budgetary predictability is achieved as a result of commitment to more credible sectoral budget ceilings which to a large extent produces legitimate budgetary decision making and greater political accountability for expenditure outcomes. The MTEF also endeavours to make public expenditures more efficient and effective, essentially by allowing line ministries greater flexibility in managing their budgets in the context of hard budget constraints and agreed upon policies and programs (Ighodaro & Oriakhi, 2010). MTEF consists of a top-down resource envelope, a bottom-up estimation of the current and medium-term costs of existing policy and ultimately, the matching of these costs with available resources in the context of the annual budget process. The "top-down resource envelope" is fundamentally a macroeconomic model that indicates fiscal targets and estimates revenues and expenditures, including government financial obligations and high cost of government-wide programs such as civil service reform. To complement the macroeconomic model, the sectors engage in "bottom-up" reviews that begin by scrutinizing sector policies and activities. This is similar to the zero-based budgeting approach which optimizes intra-sectoral allocations (Ighodaro & Oriakhi, 2010; Kighir, 2013). The value added of the MTEF approach comes from integrating the top-down resource envelope with the bottom-up sector programs as shown in figure 2 below:.

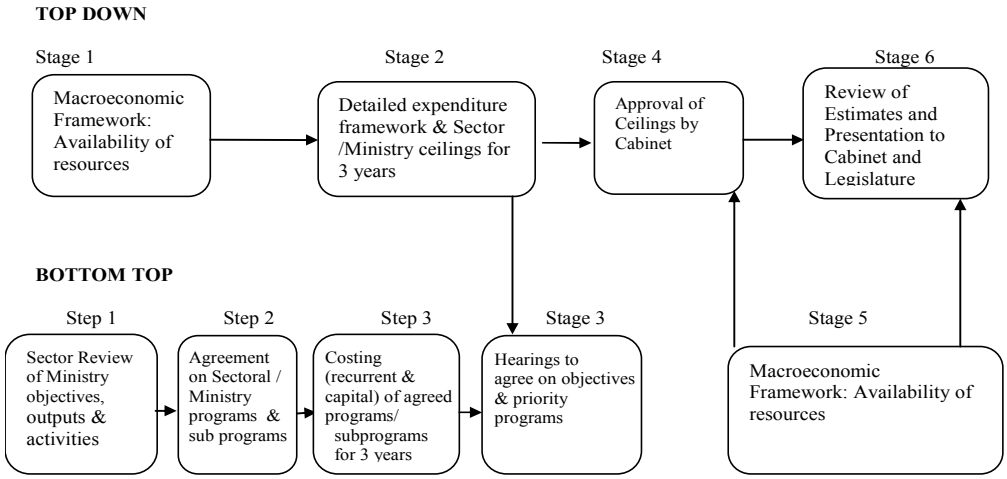

Figure 2: Six stages of MTEF (Top bottom /Bottom top)

Source: Anipa & Kaluma (1999)

The above diagram shows the linkage between policy making, planning, and budgeting processes. Once the strategic expenditure framework is developed, the government defines the sectoral resource allocations, which are then used by the sectors to finalize their programs and budgets. Key to the sectoral review process is the notion that within the broad strategic expenditure framework, which reflects the resource constraint as well as government policy, sectors have the management autonomy by making decisions that maximize technical outcomes like efficiency and effectiveness. The MTEF development is a type of rolling budget on the ground that the first outward year's estimates become the based period for the succeeding year's budget once the changes in economic conditions and policies are determined. The integration of the top-down resource envelope with bottom-up sector programs occurs by means of a formal decision making process which increases predictability and strengthens the links between **macroeconomic balance** and associated institutional mechanisms that facilitate the making and enforcement of strategic resource allocation decisions (World Bank, 1998)

2.1 MTEF IN NIGERIA

The World Bank has been strongly involved in the implementation of MTEF in Africa. More than sixteen African countries have adopted MTEF with Ghana and Malawi making the first appearance in 1996 and since then other countries in the region has followed. Yelwa (2010) stated that as part of the global trend, the Federal government of Nigeria (FGN) established the Fiscal Responsibility Commission (FRC) backed by the Fiscal Responsibility Act, 2007 (FRA) which came into force on 30 July, 2007 to institutionalize the concept of MTEF that builds the frameworks for multi years budgeting and public financial management (PFM) that addresses celebrated deficiency of annual budgeting (Wildavsky, 1986). Nigeria became a first time adopter of MTEF in her economic history on the 29 July, 2009. MTEF for 2010/2012 was produced and submitted to the FRC and National Assembly as required by the Act. The Act provided for prudent management of the nation's resources which ensures long-term macroeconomic stability of the economy, secures greater accountability and transparency in fiscal operations within a medium term fiscal policy framework, ensures the promotion and enforcement of the nation's economic objectives, and other related matters. The Part II (S.11-17) of FRA 2007 provides that MTEF shall be prepared and laid before the National Assembly for consideration and approval for the next three financial years not later than August of the preceding year after consultation with FGN and the states. The Act mandated the commission to enforce and monitor the preparation and implementation of the MTEF in Nigeria (Yelwa, 2010).

According to the Act, MTEF should contain a macroeconomic framework, a fiscal strategy paper, an expenditure and a revenue framework, a consolidated debt statement, a statement on contingent liabilities for the next three financial years an aggregate expenditure ceilings for the ministries, departments and agencies (MDAs) and the budget deficit if any, should not exceed three percent (3%) of the gross domestic product (GDP). Section 13 of the Act mandated the Minister of Finance to prepare the MTEF after consultation with some MDAs such as the CBN, National Planning Commission, etc., and non-governmental organizations (NGOs). The MTEF statement should be cleared with the Federal Executive Council before submitting it to the National Assembly (NASS). Yelwa (2010) noted that MTEF according to FRA, 2007 provides as follows: (i) Annual budgets of the Federal Government, including the MDAs, shall be derived from the MTEF as approved by the National Assembly (S.18) (ii) With regard to the institutionalization of the MTEF in fiscal governance in Nigeria, states and local governments which so desire may be assisted by the Federal Government to manage their fiscal affairs within the medium term framework (S.17). (iii) The constitutional autonomy of the states and local governments to manage their public finances in their own way are maintained and incentives will be given by the federal government to any state that judiciously followed the provisions of the Act (S. 17). Obademi & Shokefun (2009), stated that MTEF is still passing through experimental stage across Africa countries and the 3-year expenditure framework seems to be gaining ground nevertheless some arguments against its workability include: (i) the quality of a three-year budget may be poor especially in porous economies like Nigeria (ii) unforeseen macroeconomic shocks like inflation may undermined the objectives of an MTEF, (iii) capability of a 3-year MTEF based budget to deliver on its objectives can be undermined by exogenous factors such as economic crisis and natural disasters among others. (iv) another surprising fact in the real sense is that many MDAs have unspent fund in their coffers yet budget deficits are still recorded by the government. The workings of

2.2 MTEF AND BUDGET EFFECTIVENESS

Vian & Bicknell (2013) noted that the principle of MTEF is seems to the appropriate framework which supports effective budget process and national development plan on the ground that it ensure: extended time span budgeting from one to three years thereby allowing a long - range planning to overtake short term (Olomola, 2006); end the implementation hiccups that exist from inception of Nigeria independence (Olomola, 2000 & 2006); eradicate the delay in budget approval process; good estimates based on available resource envelope and encourage fiscal discipline (Yelwa, 2010; Kighir, 2012); facilitates greater macroeconomic balance; improved inter and intra sectoral resource allocation and greater revenue predictability (Kighir, 2012); implementation improvement of policy framework from short to medium term which

guarantees the long-term viability of the infrastructure development (Taliercio, 2002; Gali, 2006); and finally enable continuity of budget implementation in the medium term (Wildavsky, 1986; Le Houerou & Olomola, 2000; Yelwa, 2010; Kighir, 2012).

3 METHODOLOGY

A cross sectional survey research design was adopted. The population of the study consists of the 248 Accountant and internal audit staff of Central Bank of Nigeria (CBN), Fiscal Responsibility Commission (FRC), Federal Ministry of Finance (FoM) and Budget Office of the Federation (BOF) distributed as 116, 24, 81 and 27 respectively. A census survey was conducted and primary data obtained through structured qestionnaire. One hundred and eighty five (185) useable copies of questionnaire were returned representing 74.60% upon which data presentation, analysis and interpretation was based. The validity of the questionnaire was confirmed by the Experts. Pilot survey for the reliability test was conducted and Cronbach's Alpha Coefficients of Reliability (R_c) for the research constructs yielded 0.752 which is above the recommended benchmark of 0.70 (Nunnally, 1978). Statistical Package for Social Sciences (SPSS, IBM Version, 21) was used for processing and a Karl Pearson Product Moment Correlation Co-efficient technique was used for analysis to confirm the formulated hypotheses.

3.1 MODEL SPECIFICATION

$$\mathbf{MTEF = \beta 0 + \beta 1_{ps}\, BUDPROS + \beta 2_{ps}\, SECPLAN + \beta 3_{ps}\, AGREDIS + \beta 4_{ps}\, REVEST + \varepsilon} \quad (6)$$

A priori expectation: β0 > 0; β1 > 0; β2 > 0; β3 > 0; β4 > 0. Where: **BUDPROS**= Budget process; **SECPLAN** = Sectoral Planning; **AGREDIS** = Aggregate discipline; **REVEST** = Revenue estimation. β0= autonomous variable. It shows the degree of the need for MTEF. β1 = coefficient of Budget process. B2 = coefficient of sectoral planning which represent the extent of the need for quality planning in Nigeria. B3 = coefficient of aggregate discipline which confirms the level of accuracy of effective plan implementation according to the approved MTEF documents in Nigeria. B4 = coefficient of realistic the degree of correctness of revenue estimates to fund the medium term expenditure. Y = 1, if MTEF has positively influence budget effectiveness in Nigeria and If not Y= 0

4 RESULTS

Table 1. Correlations

		MTEF	BUDPROS	SECPLAN	AGREDIS	REVEST
BUDPROS	Pearson Correlation	.603	1			
	Sig. (2-tailed)	.000				
	N	185	185			
SECPLAN	Pearson Correlation	.712**	.567**	1		
	Sig. (2-tailed)	.011	.000			
	N	185	185	185		
AGREDIS	Pearson Correlation	.687**	.514**	.542*	1	
	Sig. (2-tailed)	.009	.012	000		
	N	185	185	185	185	
REVEST	Pearson Correlation	.587**	.611**	.569*	.534*	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	185	185	185	185	185

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Source: Field Survey, 2014

Table 2. Model Summary (b)

Model					Change Statistics					Durbin-Watson
	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig. F Change	R Square Change	F Change	df1	df2	
1	.728(a)	.368	.366	.259	.258	1.053	4	1	1598	1.907

a Predictors: (Constant), **BUDPROS**, **SECPLAN**, **AGREDIS**, **REVEST**.

b Dependent Variable: **MTEF**

Source: Field Survey, 2014

INTERPRETATION OF RESULT

The formulated hypothesis being tested is stated in null (H0) as shown below. **$H0_i$**: MTEF There is no significant relationship between MTEF and budget process in Nigeria, **$H0_{ii}$:** There is no significant relationship between MTEF and sectoral planning and **$H0_{iii}$**: MTEF do not have significant association with aggregate budget discipline. **$H0_{iv}$**: There is no significant rapport between MTEF and revenue estimation. To test the above hypotheses, PPMC was employed using SPSS, IBM version 21. Table 1 above showed the results of each control factor.

HYPOTHESIS (I)

The correlation between MTEF and budget process was .603 (p=.000) indicating a high, positive and significant relationship between MTEF and effective budget process in Nigeria.. **Hypothesis (ii):** The correlation between MTEF and sectoral planning was .712(p=.011) indicating a high, positive and significant relationship between MTEF and sectoral planning in Nigeria. **Hypothesis (iii):** The correlation between MTEF and aggregate discipline was .687 (p=.009) indicating a high, positive and significant relationship between MTEF and aggregate discipline in Nigeria. **Hypothesis (iv):** The correlation between MTEF and revenue estimates was .587 (p=.000) indicating an average, positive and significant relationship between MTEF and aggregate discipline in Nigeria. Thus these correlation results provide evidence in opposition to hypothesis one to four.

Table 2 above show the results of the regression analysis. The stepwise multiple regression estimates the coefficients of the equation, involving two or more independent variables that best predict the value of the dependent variable. The result shows that R^2 (regression value) of the four (4) moderating factors is 0 .728 % at 5% level of significance {sig. level = 0.007 (i.e. p<0.05). Meaning that MTEF is responsible for about 73% of the variation in budget effectiveness in Nigeria public sector. Durbin Watson (DW) of 1.907 shows the presence of auto-correlation which is at 5% level of significance. Based on the results of the analysis, it could be concluded that there MTEF has significantly influenced budget effectiveness in Nigeria. Therefore, the all null hypotheses **(Ho_i, Ho_{ii}, Ho_{iii} and Ho_{iv})** are hereby rejected and all alternate hypotheses not rejected.

DISCUSSIONS

This section of the study focused on the outcome of the analysis on the quantitative and qualitative data and the results from which the researcher interpreted and consequently made some findings. The result of Hypotheses reveals: Hypothesis1 (**Ho_i**) shows that budget process have been significantly influenced by the principles of MTEF as the probability (or significance) of the hypothesis test calculated is equal to 0.000 which is less than 0.05or 5%, hence there is a significant influence existing between the extent of effective budget process and MTEF in Nigeria. This result is in agreement with World Bank (2008); Olomola (2000 & 2006). In hypothesis 2 (**Ho_{ii}**), the hypothesis test calculated is equal to 0.011 which is less than 0.05or 5%, which reveal that there is a significant relationship between MTEF and sectoral planning in Nigeria. This shows the extent to MTEF has influenced need for quality sectoral planning in Nigeria. This result is agrees with the opinion of World Bank (2008); Olomola (2006); Wildavsky (1986). Hypothesis 3 (**Ho_{iii}**) test calculated is equal to 0.009 which is less than 0.05or 5%. It reveals that there is a significant relationship between MTEF and budget aggregate discipline in Nigeria. This confirms the degree of accuracy of effective plan implementation according to the approved MTEF documents in Nigeria. This result is consistent with the opinion of Houerou & Olomola (2000); Olomola (2006); Yelwa (2010). The result of hypothesis 4 (**Ho_{iv}**) shows that the hypothesis test calculated is equal to 0.000 which is less than 0.05 or 5%. It reveals that a significant relationship exists between MTEF and accurate revenue estimate in Nigeria. This confirms the level of realistic and correctness of revenue estimates to fund the medium term expenditure. This result is consistent with the opinions Olomola (2006); Yelwa (2010); Kighir (2012)

5 FINDINGS, CONCLUDING REMARKS AND RECOMMENDATION

The findings from the analysis of data relating to the objectives, questions and hypothesis (i) to (iv) reveals that there are significant relationships between MTEF and effective budget process, accuracy of sectoral planning, degree of plan implementation and realistic revenue estimation in Nigeria. Approved MTEF will enable institutionalization of multi year's fiscal governance in Nigeria. States and local governments can manage their fiscal affairs within the medium term

framework. There will be constitutional autonomy for states and local governments in management of their public finances with some levels of incentive for state that judiciously followed the provisions of the Act. The Act provided for prudent management of the nation's resources which ensures long-term macroeconomic stability of the national economy, greater accountability and transparency in fiscal operations within a medium term fiscal policy framework and the promotion and enforcement of the nation's economic objectives, and other related matters.

The study concluded that MTEF adoption and implementation is a right step in a right direction, although the result of the hypothesis test conducted above seems more theoretical than empirical as the implementation in Nigeria commenced in 2010/2012. This made the effect of MTEF on budget effectiveness too immature for reasonable conclusion. This framework has been in advanced countries with success story but not with the same level of achievement in Africa (Andrews, M. (2010). With Fiscal Responsibility Commission backed by FRA, 2007, the FGN seems to be committed budget reform. Consequent upon the findings of this study, it is recommended that government at all levels in Nigeria should be committed to the principle of MTEF. Furthermore, public servants concern with MTEF should be trained regularly keep them abreast with the current trend in MTEF development.

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Opportunities of Cloud Computing

Majed Balkhi

Technology Management,
University of Bridgeport,
Bridgeport, Connecticut, United States of America

ABSTRACT: The target of this paper is to review the opportunities of cloud computing and investigate its relationship among different factors that must be taken into consideration throughout the process. The paper design on overall research base to provide experiential aware of analysis the adopting cloud computing for innovation. Cloud Computing is a system of marvelous properties. All these properties should advertise to gain potential in the market of cloud computing technology. The lack of awareness of the uses of new technologies is a big hurdle in the way of progress of upcoming technologies such as cloud computing. By overcoming, these hurdles we can spread this technology widespread. The research as cloud computing technology is a new technology and many users are not familiar with its all positive aspects. There are many points that should be taught to the users and after that they will be able to utilize all of its aspects and after that, this technology will gain potential and will become much popular. To achieve more benefits of cloud computing, the research suggests that enterprises need assume number of steps. It suggests that collaborative innovation is not necessarily an immediate consequence of adopting cloud computing. The theoretical foundation of this paper formed by conducting a comprehensive literature review on opportunities of cloud computing. A new model presented to illustrate the relationship between cloud computing and four specific factors.

KEYWORDS: Cloud, Storage, Network, Application, Security, Sharing, Privacy.

1 INTRODUCTION

There is a growing literature on the opportunities in cloud computing (Lehman and Vajpayee 2011). A few is known about how discover or create the opportunities of cloud computing. The process in which we store our photos and important documents online instead of our computer is called the cloud computing. For this purpose, we use web mail and social networking sites. We can store our information and all our personal data in cloud computing instead of using hard drive or updating applications for our needs (Almulla and Yeun 2010). We can also do an online invoicing services instead of using the in house that people used years ago, that online invoicing service system is also a Cloud Computing. By The use of internet, we can store our information anywhere at any time at different locations. Cloud computing increase our privacy. Delivery of different services through internet is also called cloud computing services (Mell and Grance 2009). Sometimes cloud computing allows us to use hardware and software data online and all this data managed by other person know as third parties. For Example social networking sites online business web mail and online file storage are represent the service of cloud computing. If network connection is available, we can use Cloud computing service for the storage of our important files and other things. Computer processing power and user of specialized corporate and data space network are the applications that are the shared pool of resources which are provides by cloud computing (Robinson, Valeri et al. 2011). Cloud computing includes the characteristics of demand self-service, resource pooling, measured service, rapid electricity , and broad network access . Broad Network service means providing of internet network. On demand self-service means that customers can request and managed their own computing resources. In pooled resources, customers can draw a pool of computing resources it usually happens in remote data centers. Services can be larger or smaller and it can be measured according to the customer billing service (Catteddu 2010).

Corresponding Author: Majed Balkhi (majedbalkhi@gmail.com)

Cloud computing is an experience in which all the technologies of world involved. When it comes to technology, Cloud computing consists of two different words. Cloud is also known as symbol of technology in the cloud computing technology and there are many different services and applications which can be delivered in the internet cloud (Catteddu 2010). Cloud computing is an updated version of utility. Computing means the availability over the internet. when we think about it we really focus on cloud computing services (Leland 2008). It is a way to increase the capabilities and capacity to fly without investing in a new infrastructure. Cloud computing is symbol that we know as software service phenomenon. cloud computing is defined as web application is an application that is used via web browser over the internet which is the internet or an intranet .Its goes back to the days of presentations and flow charts that would represent the white clouds that are the basics of internet. Getting connections and doing out information as it floats (Voorsluys, Broberg et al. 2011). In cloud computing there are many advantages such as security and privacy too. There are many remote locations on which data travels. Cloud can provide different services to many customers at a time. All of this may move up the scale of coverage to likely breaches, both unintentional and intentional (Brandic, Dustdar et al. 2010).

Cloud computing is not about the hard drive it is about the storing of data from the hard drive to the internet storage .To access your data in cloud computing is very easy because of all our needs are actually closed to us in fast and easy way from one computer to the other network (Kshetri 2011). The Cloud Computing have been the burning issue since the companies are more inclined towards the cost cutting technologies. The aggressive corporate world has in fact made the idea of out sourcing more significant for the companies and now the companies don't be uncertain in outsourcing their needs in order to improve the effectiveness and success of the firms operations. The Cloud Computing concept is a very important in this world and in cloud computing we need to access our data or program over the internet or at the very least and that data can be synchronized with other information on the internet. With an online connections cloud computing can be done anywhere anytime (Ekanayake and Fox 2010).

2 OPPORTUNITIES OF CLOUD COMPUTING

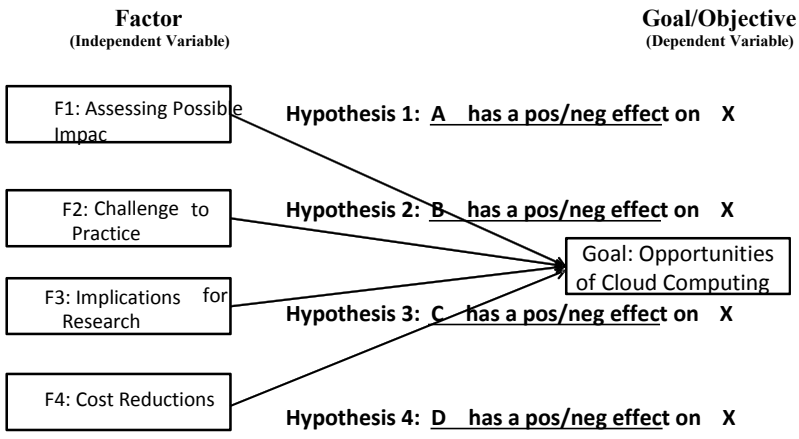

Fig. 1. The Opportunities of Cloud Computing and its relation to four independent variables

Cloud computing is a technology in which users can store their data online at a location which is governed by a third party, instead of keeping data in your own computer (Lehman and Vajpayee 2011). By this technology, there has been large number of opportunities in the development of the information technology. Different companies are interconnected through the internet. We can use a lot numbers of applications online and there is no need to update these application by ourselves (Ojala and Puhakka 2013). There are two types of computing, one is service oriented computing and other is cloud computing. The relationship between these two types of computing is reciprocal to each other. One computing system is responsible for providing service of computing and other for computing of services. These two types of computing system can provide services that can be interchangeably challenges (Batista, Mendonca et al. 2011). Cloud computing has played a very important role in ICT, and has played a role for overcoming the hurdles in the way of advancement in the technology (Firdhous, Ghazali et al. 2013). By this users have got awareness to use new technologies. This technology has also solved

problems related to virtual networking and cloud extensions (Yi and Blake 2010). This is an amazing technology as by using this we can save space on our computer and can share files with others on internet but one thing is of worry that our data can be theft from the remote areas at which the data is stored and third party might be able to access that data. So, steps should be taken to makes some way to ensure the security of the data (Azodolmolky, Wieder et al. 2013).

3 ASSESSING POSSIBLE IMPACT

In cloud models all the organizations are using application as (SaaS, PaaS, IaaS) and deployment models (Private, Public, Hybrid) (PalsonKennedy and Gopal 2010). There are many security issues that are associated with cloud computing as there are many users connected at one server and there is a chance of un-authorized access by a third party (Abuhussein, Bedi et al. 2012). When different computers connected by the internet then security depends on the main core router that is acting as a junction between these connected systems (Shetty, Luna et al. 2012). Different users are connected they might be consumers and customers and all they require a level of accessing for proper exchange of data or information between them (Pedersen, Riaz et al. 2011). Customers that have to use voice information for sharing using computing are reluctant to share due to some security problems. There should be secure system in cloud computing to ensure the privacy of the information to be shared (Silva, Hines et al. 2013).The merit for choosing a security system for cloud computing is that the system should have reliability, stability and scale ability. I think this is the basic need of any transmission system that it should have complete privacy and security of the information to be transmitted or being shared (Kantarcioglu, Bensoussan et al. 2011).

4 CHALLENGES TO PRACTICE

Keeping in mind the issues of security problems in cloud computing system, there have been developed some system that claims that they are completely secured system and can provide full privacy for the data to be transmitted (Behl 2011). These new system are implemented and can provide full privacy and can overcome the challenges related to the threats. There are problems but research is being done to overcome both in academic sectors and as well as in industrial sectors (Tosic 2012). There are some hurdles in the way of cloud computing technology and researchers are trying to solve this by study of problem. The study of cloud computing technology is not only restricted to cloud computing technology only, it is also being done on the mobile cloud computing technology that is very popular now a days (Zhang and Zhang 2012). Cloud technology has many advantages but they have also some drawbacks as leakage of information etc. so nothing is perfect in this world everything has some drawback (Amin, Bib Abu Bakar et al. 2013). So many efforts are being done to overcome drawback and promote the new technologies like cloud computing and mobile cloud computing (Chu, Chih-Hung et al. 2012). It looks like that this technology will got full potential in future as a lot of work is being done to remove the hurdles in the way of such new technologies (Keshavarzi, Haghighat et al. 2013).

5 IMPLICATIONS FOR RESEARCH

A lot of research has been done on this technology and this provided a roadmap for the IT technologies. It technologies emerged and faced a lot of problems (Zhenyu 2011). So the researchers have done work to overcome these problems and presented many theoretical work as well as they have implemented this work practically (Zhixiong and Yoon 2010). Also researches make the idea clear that what is the secure cloud computing, how it works and how it can be use full for the users and users might trust on this technology. While cloud computing allows to transparently scale back-end functionality, this functionality ensures the complete privacy while sharing the information that is much more sensitive processes (Henze, Hummen et al. 2013). This provides a confidence in users to use new technologies and have advantages of technologies like cloud computing and mobile cloud computing (Gueyoung, Mukherjee et al. 2013). Problem is that if a user want to choose a cloud computing technology then it is not as simple as a user think, there are provided different layers so he might not be able to choose a secure technology according to his requirement and might not be able have advantage of cloud computing technology (Pant and Parappa 2013). The researchers discussed all the technologies that ensure the security for the users, data send by users and received by receiver systems (Neal and Rahman 2012).

6 COST REDUCTIONS

The main advantage of cloud computing is that all the computers are interconnected and can share the information with them on the internet , can store data on internet, can use applications without updating but the main and very important feature is the reduction of cost (Anitha and Damodharan 2013). The main advantage is to the providers. They can save a lot of their money by providing connections to consumers in a properly planned manner. By this, a provider can reduce cost than

the on demand by proper planning the connections for users (Tanimoto, Hiramoto et al. 2011). Cloud computing is advantageous not only in a business sector but it is also advantageous economically because it has reduced cost of the system, cost of the hardware, cost of the software and also there is no need of maintenance related to such type of technology (Owusu and Pattinson 2012). It also does not require many operators for this so it is very advantageous to use this both I business sense and economically (Xinhui, Ying et al. 2009). The reduction in cost of the system is very important feature related to that technology and attracted the users in industries to use this technology but there are no efficient tools by which we might able to estimate the cost, that has been reduced because of using this technology (Peng, Yanbo et al. 2012). Unlike the traditional server optimization strategies which consider only load balancing and scheduling of resources based on the usage of CPU, RAM and BW in physical servers, this technology gives the cost reduction as well as gives maximum utilization of the system all the time (Sahu, Pateriya et al. 2013).

7 EXPLANATION AND DISCUSSION

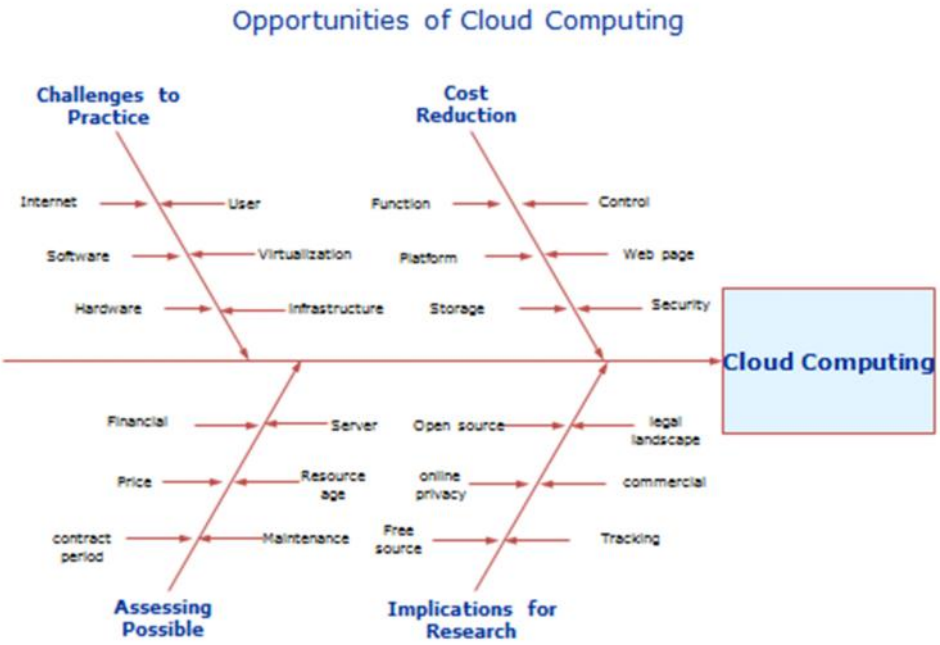

Fig. 2. Cloud Computing

There is plenty to consider as far as the functions of these specific factors, which play a role in regards to the Opportunities of Cloud Computing. Cloud Computing component cannot be easily implemented by one person alone. Successful implementation of computing requires proper implementation of cloud computing components. Cloud computing will not be possible without of these components. Cloud computing involves different experience and back grounds of persons. Cloud computing is very expensive business but companies' still use cloud computing because of its advantages. The first component of the cloud computing is the client the end user. Everything ends in Cloud computing with the client such as applications hardware components and everything is useful for client in cloud computing. Nothing will be possible without the client the end user. The Client involves two types of forms first the hardware component and the second is the combination of the hardware and the software. An important component of cloud computing is my model which is the end user of client as he is the benefited with the idea. Whether a corporate client or an individual client applications, are meant to be made to look the needs of the clients which may need us to make easy through the software or an hardware components. In any industry whether it is the product or service customers are king in the industry. Satisfaction of the customer is very significant in cloud computing concept as well in the marketing department (Wang, Wang et al. 2012).

The second component of the cloud model is the service or the function of cloud computing. The main reason of cloud computing become trendy due to the acceptance of the businesses and the easier way to execute the business process. Cloud computing is all about the services and the business process with an probable output. The component of cloud computing services is based on two things first the end user the client and the second is proper development of the

application. If client comes up with the optimization condition the company needs to expand the required software which is the function necessary to be done .With the experience of the user service could be used in a very effective manner (Youseff, Butrico et al. 2008).

Another important component of cloud computing is the application which is the back bone of service. The service is totally dependent on the application. The application is completely different because in this application services realized. Application is based on the actual coding of the developers. Applications are very important and due to their coding because they are well handling and provides security and functionally by this purpose application could work as predictable. The Applications will drop in the middle of the model while they are crucial as the first component of model. The other important component is the platform which is soft infrastructure for the application. In a normal applications or websites they do not work as cloud computing, in the applications are directly connected to the servers. But in the cloud computing the application is still begins to another application called the platform or the soft infrastructure. The platform usually includes different programming languages such as JAVA script , and XML (A Vouk 2008).

Storage is another important component of cloud computing which means the warehouse of cloud computing. The storage holds the data and information on function that how they will be implemented. Everything that could be provided by the application knows and the function that could be gain by service are possible through storage. The storage facility is based on how to protect from different attacks and availability of backup. Cloud computing is always about reliability and accessibility of service which will obviously require the storage to be available all the time. The backbone of cloud computing is the infrastructure. Infrastructure is only possible through the needed data storage provide and the availability of service.(Michael Armbrust) Communications has the power to make different changes by management and load balancing .So infrastructure being a very important factor needs to up to the standard and requires larger investments in order to react to the needs of cloud computing. In cloud computing there are many components which have to be Optimize by well-functioning application and secured application for cloud computing (Dillon, Wu et al. 2010).

The cloud computing means anything that involves delivering services over the internet. These services divided into three categories: which are platform software and Infrastructure as a service. In the internet there are many clouds which represents the process of cloud computing that usually used in the internet to represent the diagrams and flowcharts (Dikaiakos, Katsaros et al. 2009). A cloud can be private or public. A public cloud sells their services on the internet to anyone. For Example Amazon web services is the biggest public cloud service. Private cloud is a network in which data and services can be supplies to a limited number of people. When a service provider use public cloud and to create their private cloud that will become virtual private cloud. Even its public or the private cloud computing the basic function of cloud computing is to give access to computing resources, IT services easy and scalable. For each model functions as the basic building block for cloud computing. However, in case of mutual infrastructure, there a case of ordinary layer that serves as the basic building block for the sharing. Usually, the common layer based on the total model. There are many examples of this happening today with solutions such Backup-As-A-Service or Storage-As-A-Service (Balaouras, Yates et al. 2009). Cloud computing services also called network-based services. The services which appears to be provided by real hardware server and are infect served up by virtual hardware simulated by software by running one or more machines this whole process also called cloud computing . Such services do not physically exist and cannot be moved anywhere and cannot be measured .Grid computing is comparable to cloud computing. It is a type of computing where unexploited in a network of processing cycle are harnesses to solve problems for any single machines (Turilli, Wallom et al. 2013).

Cloud computing work are not fully clear at present time it depends many companies to defined their own technologies of cloud computing. Connecting the computer systems and the software required to make computing work which the standards for are not completely define. Cloud computing is very important in the data center and for small business. For a small and medium sized business, the benefit of cloud computing is very high. In small and medium sized business sector there is a lack of financial resources and time to purchase and maintain an infrastructure. Small businesses can achieve these resources enlarge or reduce services as a change in business needs by using the cloud computing services (Buyya, Yeo et al. 2008). Cloud computing, web applications is important. The reality why cloud computing is requires for sure web application and protocols. Cloud computing facilities impact as well freed the companies from the trouble of infrastructure by connecting the applications through internet. The willingly available application will help in making the customer interrelate readily and professionally. The applications in it being difficult but the advantage of the application is in its use for educational purposes as well as corporate purpose. With the passage of time cloud computing becoming more complex and difficult and different types of hybrid, private and public cloud based infrastructure and systems are already in use, for this purpose companies collection of cloud management tools needs to fixed all these problems they are just as flexible and measurable as its cloud computing strategies (Miller 2008).

Cloud management tools help companies computing based services are working properly and act together with a user and other services. Cloud computing is an on demand service that is acquire by mass appeal in corporate data centers. These clouds helps the data center to operate like the internet and computing resources, like many function start in the market and convert into small business owner. In a simple word a cloud computing is taking services and moving them outside the systems. Economics has a great impact on the future of cloud computing. The computing economics will support the idea of economics with the computing model and will open the opportunities for cloud computing to a great contract which means computing economics will help in making computing more associated to social and environmental background (Subashini and Kavitha 2011).

8 CONTRIBUTION AND NEW INSIGHT

I believe that cloud computing can be improved productivity and use all around. The opportunities of Cloud Computing will become not only financial profit but also more secure for everyone. Cloud computing is used as the energy demand of the internet which is rising with the shift of cloud computing, supply of renewable energy keep rapidity to prevent having unenthusiastic impacts on the climate. As cloud becomes more well liked and demands on the internet companies hosting online services using more energy for their data centers. This looks at the contribution of cloud computing to climate modify to help bring about the benefits from well-built renewable energy policies. Cloud services also well liked because the cost and difficulty can be reduce by owning and operating computers and networks. The benefits are low upfront cost since customers do not invest in the business of information technology and they not get software licenses or hardware purchases. Cloud providers are specialized in a particular area such as e-mail can bring some superior services in which single company might not be able to have the funds for develop.

Cloud computing is an emerging concept, which contribute a lot to society and will help the companies to achieve their goals to cost compensation. The concept already has various factors to believe. It will take time to finally become the basic part of the association. The pros of cloud computing need lots of hard work and studies to moderate the concerns. The contribution of this subject cover many feature of the technological field. The insight that study provided will help the companies to be aware of the concept more and to study the concept in perspective of the marketing policy. The significant aspects of its linked concepts studied in the paper.

As Cloud Computing becomes more demandable and common on the internet, most of the companies offering online services for seeking more energy for their data centers. Contribution of cloud computing effects the climate change and bring some strong energy policies and economy-wide initials decrease. For Example, Google is most famous cloud based company to express the potential of a cloud. Nowadays, cloud computing growing more because of laptops, smart phones, iPods, tablets, and kindles. The trends in cloud based computing effects the greater attention and growth in development of energy efficient data centers design. It will also increase the scale and size of data centers which brings major trends. Due to the continuous significant development of cloud based computing despite economic downturn. Unless could data centers are intentionally with some most advanced sources of electricity the operators of data centers are also stuck with the same problem that a common man has. They are ready to accept the mix of dirty energy sources and clean energy sources that the electric resources provide to feed the cloud.

Many of cloud computing companies are following the sitting strategies and the design that can decrease the energy consumption of their data centers. Unfortunately, collective demand for computer resource increases even the more well organized data centers serve only two provide successful services. It is clear that the more demand of energy increases the cloud growth. Where necessary cloud extension or reinforcement costs should be increase by the operators of data center and shared between all customers. Because all the environmental benefits are good for public and system operation. Cloud computing may not be everything for everyone or even cheaper than anything in some cases there are many legal issues in it. However, is also an effect a big shift in the way things are done according to the IT domain. It might be slow nowadays but after time will fly and we will look back and see that it has changed everything. It is very big shift as the switch to client server computing. The education and cloud computing sounds indistinct on the face of it. It is because of very few publishers and people are come from the education sector. Most of the time cloud computing is only related with businesses and how they can influence their efficiencies. Most importantly, the evolution to the cloud brings unplanned change and change that can be to inefficiency in our business. However, cloud computing is your desired solution to gain operational cost saving or increase revenue it will depend on your ability to manage the changes that the cloud will have on people.

9 CONCLUSION

Cloud Computing provide many advantages. For teams and organizations, Cloud computing enabled to streamline processes. Cloud computing is huge nowadays and either we are using cloud computing for our business or for our personal use. That means we have learned lots from taking look at pros and cons. Cloud computing is a way in which IT department changed by IT. Cloud computing provides many range of paths in a business including platforms and applications infrastructure that are available as an online service of cloud provider. Many people may be confused by the range of terminology and offerings which are used to describe them and will be unsure of the benefits and risks. These Ranges are from basic infrastructure offerings through platform support to full applications. Because of Cloud computing nowadays knowledge is getting superior in demand market. Considering the offerings and current advances in cloud computing it shows that this technology is here to stay for a long time. Nowadays all of the big businesses in the IT industry have some sort of cloud computing offering their standards for cloud computing services such as Microsoft, Amazon, and Google Etc.(Jensen, Schwenk et al. 2009).

As we conclude that Cloud computing is a powerful new concept for large-scale data processing which is measurable, dependable and available. In cloud computing there are large self-handle server pools available that decreases the overhead and reduce management annoyance. Cloud computing services can also develop and reduce in size according to need. Cloud computing is mainly valuable to small and medium businesses, where effective and affordable IT tools are significant to helping them become more dynamic without spending lots of money on data centers and technical equipment. In addition, it is a new promising construction needed to expand the internet to become the good computing platform of the future. The factors of utility computing and web applications are the ventures in many ways. They shows the concept by means of providing a vast lots of choices for the companies to choose between in order to fulfill their technological needs without investing any sources of income or capital resources. The experience also bring anxiety along with that and these are the concerns of security and dependability. As well obliges a lots of trust on the company on condition that the service and along with that it needs to dealt the subject in a way that customers who are the eventual user of the application will be grateful for the company's efforts and vast investments of the company. The paper had existing it is own model of cloud computing and discussed the important factors in the model in which the client were the most important of them. Software licensing and computing economics are also converse and it is exposed from the studies that software licensing have negative collision on the concept while computing economics have allot of impact but only requires the experience to be studied more (Rittinghouse and Ransome 2009).

After reading and reviewing Cloud Computing studies, government reports and white papers attending several Cloud Computing events and reading many Cloud Computing blogs. I came to know that privacy, infrastructure, and security in Cloud Computing are the main factors of the whole process. So, still cloud computing have not been fully squeeze by education systems, education leaning environment, universities and, the business community. Education systems and business are enthusiastic for the next generation technology solutions the infrastructure problems and the systems. That is features in the 21th century education, business model and workplace. Cloud computing can be the basic technology infrastructure that can transform business, education if it is correctly and safely implemented (Turilli, Wallom et al. 2013). The concept is very much inclined by the factors discussed in the study and establish out that these factors are further divided into many sub factors that will collision the concept of cloud computing. The factors have their advantages and as well disadvantages and the earlier researcher done an important work over the issue. However, there is still a need to do a lot of work on the cloud computing particularly when discussing it in association with the marketing subject. The experience requires lots of investment and will brought vast revenues but is riskier as well. There are many examples of cloud computing such as Microsoft, Apple, Amazon, Dropbox etc. (Kshetri 2011).

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Convexity of the Set of k-Admissible Functions on a Compact Kähler Manifold

JBILOU Asma

Pôle énergies renouvelables,
Université Internationale de Rabat (UIR),
Laboratoire des Energies Renouvelables et Matériaux Avancés (ERMA),
Parc Technopolis Rabat-Shore, campus de l'UIR, Rocade Rabat-Salé,
11100, Rabat-Sala El Jadida, Morocco

ABSTRACT: We prove in this article using some convex analysis results of A. S. Lewis, the log-concavity of spectral elementary symmetric functions on the space of Hermitian matrices, and the convexity of the set of k-admissible functions on compact Kähler manifolds.

KEYWORDS: Spectral functions, symmetric functions, log-concavity, convexity, admissible functions, hessian equations, Kähler manifolds.

1 INTRODUCTION AND STATEMENT OF RESULTS

All manifolds considered in this article are **connected**.

Let $(M, J, \mathrm{g}, \omega)$ be a compact connected Kähler manifold of complex dimension $m \geq 1$. Fix an integer $1 \leq \mathrm{k} \leq \mathrm{m}$. Let $\varphi : \mathrm{M} \to \mathbb{R}$ be a smooth function and let us consider the (1,1)-form $\tilde{\omega} = \omega + \mathrm{i}\,\partial\bar{\partial}\varphi$ and the associated 2-tensor $\tilde{g}$ defined by $\tilde{g}(X,Y) = \tilde{\omega}(X, JY)$. Consider the sesquilinear forms h and $\tilde{h}$ on $T^{1,0}$ defined by $h(U,V) = \mathrm{g}(\mathrm{U}, \overline{\mathrm{V}})$ and $\tilde{h}(\mathrm{U}, \mathrm{V}) = \tilde{g}(\mathrm{U}, \overline{\mathrm{V}})$. We denote by $\lambda(g^{-1}\tilde{g})$ the eigenvalues of $\tilde{h}$ with respect to the hermitian form h. By definition, these are the eigenvalues of the unique endomorphism A of $T^{1,0}$ satisfying: $\tilde{h}(\mathrm{U}, \mathrm{V}) = \mathrm{h}(\mathrm{U}, \mathrm{AV}) \quad \forall \mathrm{U}, \mathrm{V} \in T^{1,0}$.

Calculations infer that the endomorphism A writes:

$$A : T^{1,0} \to T^{1,0}$$
$$U^i\partial_i \to A_i^j U^i \partial_j = g^{j\bar{l}}\tilde{g}_{i\bar{l}} U^i \partial_j$$

A is a self-adjoint/hermitian endomorphism of the hermitian space $(T^{1,0}, h)$, therefore $\lambda(g^{-1}\tilde{g}) \in \mathbb{R}^m$.

Let us consider the following cone: $\Gamma_k = \left\{\lambda \in \mathbb{R}^m, \forall 1 \leq j \leq k \;\; \sigma_j(\lambda) > 0\right\}$, where σ_j denotes the j-th elementary symmetric function.

Definition. φ is said to be k-admissible if and only if $\lambda(g^{-1}\tilde{g}) \in \Gamma_k$.

In a note in the Comptes Rendus de l'Académie des Sciences de Paris published online in December 2009 [1], we solve the equations $\tilde{\omega}^k \wedge \omega^{m-k} = \frac{e^f}{\binom{m}{k}}\,\omega^m\,(E_k)$, when the holomorphic bisectional curvature of M is nonnegative. In this proof performed by the continuity method, two results following from convex analysis techniques were needed, namely the Corollaries 1.5 and 1.6.

Let us now introduce some convex analysis notations. Let $H_m(\mathbb{C})$ be the space of complex Hermitian matrices of order m. We recall that for any two matrices B and C of $H_m(\mathbb{C})$, $\lambda \in \mathbb{C}$ is called a B-eigenvalue of C if there exists $x \neq 0$ in $\mathbb{C}^m$ such

Corresponding Author: JBILOU Asma (asma.jbilou@uir.ac.ma)

that $Cx = \lambda Bx$, x is then called a B-eigenvector of C. Let $B \in H_m(\mathbb{C})$ be **a fixed** positive definite matrix. Let us recall the following basic result :

Lemma 1.2. Let $C \in H_m(\mathbb{C})$, then:

1. The spectrum of $B^{-1}C$ (i.e. the B-spectrum of C) is entirely real.
2. The greatest eigenvalue of $B^{-1}C$ (i.e. the greatest B-eigenvalue of C) equals $\sup_{u\neq 0} \frac{<Cu,u>}{<Bu,u>}$, where $<.,.>$ denotes the standard Hermitian product of $\mathbb{C}^m$.
3. $B^{-1}C$ is diagonalizable.

Since the spectrum of $B^{-1}C$ is the spectrum of the Hermitian matrix $B^{-\frac{1}{2}}CB^{-\frac{1}{2}}$, the proof is an easy adaptation of the standard one for symmetric matrices.

For a given Hermitian matrix C, we denote by $\lambda_B(\mathrm{C})$ the eigenvalues of C with respect to B. In this article, we prove the following four results using the Theorem 2.3 and the Corollary 2.4 of Lewis [2] (see Theorem 2.1 of this article):

Theorem 1.3. For each $k \in \{1, \ldots, \mathrm{m}\}$, the function:

$$F_k^B : H_m(\mathbb{C}) \to \mathbb{R} \cup \{+\infty\}, C \to F_k^B(C) = \begin{cases} -\ln \sigma_k\big(\lambda_B(C)\big) \; if \; C \in {\lambda_B}^{-1}(\Gamma_k) \\ +\infty \text{ otherwise,} \end{cases}$$

where ${\lambda_B}^{-1}(\Gamma_k) = \{C \in H_m(\mathbb{C}),\ \lambda_B(\mathrm{C}) \in \Gamma_k\}$, is convex.

Theorem 1.4. If Γ is a (non empty) symmetric convex closed set of $\mathbb{R}^m$, then ${\lambda_B}^{-1}(\Gamma) := \{C \in H_m(\mathbb{C}),\ \lambda_B(\mathrm{C}) \in \Gamma\}$,

is a convex closed set of $H_m(\mathbb{C})$. In particular, ${\lambda_B}^{-1}(\overline{\Gamma_k})$ is a convex closed set of $H_m(\mathbb{C})$.

By the Theorem 1.3, and since ${\lambda_B}^{-1}(\Gamma_k)$ is convex (Theorem 1.4), we deduce that:

Corollary 1.5. The function:
$-F_k^B : {\lambda_B}^{-1}(\Gamma_k) \to \mathbb{R}, C \to F_k^B(C) = \ln \sigma_k\big(\lambda_B(C)\big)$ is concave.

The method used here to prove the Corollary 1.5, gives for $B = I$ a different approach from the proof of [3] and the elementary proof of [4, p. 51] and [5].

As an immediate consequence of Theorem 1.4, we get the following important result, that allows to notably simplify the proof of uniqueness of the solution of the equation (E_k) in comparison with [5]:

Corollary 1.6. For a compact connected Kähler manifold $(M, J, \mathrm{g}, \omega)$, the set of k-admissible functions:
$\mathrm{A}_k = \big\{\varphi \in C^2(M, \mathbb{R}),\ \lambda_\omega\big(\omega + \mathrm{i}\,\partial\bar{\partial}\varphi\big) \in \Gamma_k\big\}$ is convex.

2 SOME CONVEX ANALYSIS

The space $H_m(\mathbb{C})$ has a structure of **Euclidean space** thanks to the following scalar product $\ll A, B \gg = \mathrm{tr}({}^{\mathrm{t}}\overline{\mathrm{A}}\,\mathrm{B}) = \mathrm{tr}(\mathrm{AB})$, called the **Schur product**. Let us denote by $\Gamma_0(\mathbb{R}^m)$ the set of functions $u : \mathbb{R}^m \to \mathbb{R} \cup \{+\infty\}$ that are convex, lower semicontinuous on $\mathbb{R}^m$, and finite in at least one point. Given $u \in \Gamma_0(\mathbb{R}^m)$ symmetric and $B \in H_m(\mathbb{C})$ **positive definite**, we define:

$$V_u^B : H_m(\mathbb{C}) \to \mathbb{R} \cup \{+\infty\}, by\ C \to V_u^B(C) := u(\lambda_{B,1}(C), \ldots, \lambda_{B,m}(C))$$

where $\lambda_{B,1}(C) \geq \lambda_{B,2}(C) \geq \ldots \geq \lambda_{B,m}(C)$denote the **B-eigenvalues** of C repeated with their multiplicity. Such functions V_u^B are called **functions of B-eigenvalues** or **B-spectral functions**. Our first aim is to determine the conjugation for such a function V_u^B using the conjugate function of u. Let us remind that the conjugation or the Legendre–Fenchel transform of u is the function $u^* : \mathbb{R}^m \to \mathbb{R} \cup \{+\infty\}$ defined by:

$$\forall s \in \mathbb{R}^m,\ u^*(s) = \sup_{x\in\mathbb{R}^m}\{\langle s, x\rangle - u(x)\}$$

where $\langle .,. \rangle$ denotes the standard scalar product on $\mathbb{R}^m$.

Theorem 2.1 (A. S. Lewis [2], Conjugation of spectral functions). Let $u \in \Gamma_0(\mathbb{R}^m)$ be symmetric, then:

1. The conjugate u^* ($\in \Gamma_0(\mathbb{R}^m)$) is also symmetric.

2. The functions of eigenvalues V_u^I and $V_{u^*}^I$ (defined as above) belong to $\Gamma_0\big(H_m(\mathbb{C})\big)$ with $V_{u^*}^I = (V_u^I)^*$, so that in particular the function of eigenvalues V_u^I is convex and lower semicontinuous.

Proof. See the Theorem 2.3 and the Corollary 2.4 of Lewis [2]. ■

A similar theorem is proved in the case of symmetric matrices in [6] and [7] (you can see also [8] and [9] for some details).

Corollary 2.2 (Conjugation of B-spectral functions). Let $u \in \Gamma_0(\mathbb{R}^m)$ be symmetric, then:
1. The conjugate u^* ($\in \Gamma_0(\mathbb{R}^m)$) is also symmetric.
2. The functions of B-eigenvalues V_u^B and $V_{u^*}^B$ (defined as above) belong to $\Gamma_0\big(H_m(\mathbb{C})\big)$ with $V_{u^*}^{B^{-1}} = (V_u^B)^*$, so that in particular the function of B-eigenvalues V_u^B is convex and lower semicontinuous.

3 PROOF OF THEOREMS 1.3 AND 1.4.

3.1 PROOF OF THEOREM 1.3.

The proof of Theorem 1.3 is a direct application of the Corollary 2.2 to the function:

$$\mathrm{u} : \mathbb{R}^m \to \mathbb{R} \cup \{+\infty\}, x = (x_1, \dots, x_m) \to \mathrm{u(x)} = \begin{cases} -\ln \sigma_k(x_1, \dots, x_m) \; if \; x \in \Gamma_k \\ +\infty \; otherwise \end{cases} \quad (3.1)$$

Our function u is symmetric and belongs to $\Gamma_0(\mathbb{R}^m)$, indeed:

(i) It is clearly symmetric. It is finite in a least one point of $\mathbb{R}^m$ because Γ_k is non empty. And it is convex, because the function $(\sigma_k)^{\frac{1}{k}} : \Gamma_k \to \mathbb{R}$ is concave [3, p.269].

(ii) It is lower semicontinuous. Indeed, let $c \in \mathbb{R}$, and consider the set:

$$\{x \in \mathbb{R}^m / +\infty \geq u(x) > c\} = \{x \in \Gamma_k / u(x) > c\} \cup \{x \notin \Gamma_k / u(x) > c\}$$
$$= \{x \in \Gamma_k / -ln\, \sigma_k(x) > c\} \cup (\mathbb{R}^m \setminus \Gamma_k) \quad (3.2)$$

By continuity, $\{x \in \Gamma_k / -ln\, \sigma_k(x) > c\}$ is an open set of Γ_k, it is then an open of $\mathbb{R}^m$ since Γ_k is an open of $\mathbb{R}^m$. Furthermore, the cone Γ_k is also a closed set of $\mathbb{R}^m$ (as a connected component), consequently $\mathbb{R}^m \setminus \Gamma_k$ is an open set of $\mathbb{R}^m$. Therefore, $\{x \in \mathbb{R}^m / +\infty \geq u(x) > c\}$ is an open set of $\mathbb{R}^m$ too. This is valid for all $c \in \mathbb{R}$, so that u is lower semicontinuous.

Therefore, we deduce by the Corollary 2.2 that the B-spectral function V_u^B=F_k^B is convex, which proves the theorem.

Let us remark that the same technique allows to prove for example that the functions

$$V(C) := \text{"the greatest } B\text{-eigenvalue" of } C \quad \text{and}$$
$$V_s(C) := \text{"the sum of the } s \text{ greatest } B\text{-eigenvalues" of } C$$
$$\text{with } s \in \{1, \dots, m\}, \quad (3.3)$$

are convex on $H_m(\mathbb{C})$.

3.2 PROOF OF THEOREM 1.4.

The proof of Theorem 1.4 goes by considering the indicatrix function $f_0 := I_\Gamma$ of the set Γ, namely:

$$f_0 := I_\Gamma : \mathbb{R}^m \to \mathbb{R} \cup \{+\infty\}, x = (x_1, \dots, x_m) \to I_\Gamma(x) = \begin{cases} 0 \; if \; x \in \Gamma \\ +\infty \; otherwise \end{cases} \quad (3.4)$$

From the assumptions made on Γ, f_0 lies in $\Gamma_0(\mathbb{R}^m)$ and is symmetric, indeed:

(i) This function is clearly finite in at least one point since Γ is non empty.

(ii) The inequality $I_\Gamma(tx + (1-t)y) \leq t\, I_\Gamma(x) + (1-t)\, I_\Gamma(y)$ is valid for all $x, y \in \mathbb{R}^m$ and all $t \in [0,1]$. Indeed, if $x, y \in \Gamma$ then $tx + (1-t)y \in \Gamma$ by convexity of $\Gamma$and the two sides of the convexity inequality equal 0 in this case. Furthermore, if x or y does not belong to Γ then the right side of the inequality equals $+\infty$ and the inequality is then satisfied in this case too, which proves that I_Γ is convex.

(iii) I_Γ is lower semicontinuous. Indeed, let $a \in \mathbb{R}^m$: If $a \geq 0$ then $\{x \in \mathbb{R}^m / +\infty \geq I_\Gamma(x) > a\} = \mathbb{R}^m \setminus \Gamma$ is an open set since Γ is closed. Besides, if a < 0, $\{x \in \mathbb{R}^m / +\infty \geq I_\Gamma(x) > a\} = \mathbb{R}^m$ is an open set too.

So Corollary 2.2 implies that the function of B-eigenvalues $V_{I_\Gamma}^B$ lies in $\Gamma_0(\mathbb{R}^m)$; in particular it is, convex lower semicontinuous. But this function is given by:

$$V_{I_\Gamma}^B : H_m(\mathbb{C}) \to \mathbb{R} \cup \{+\infty\}, \; C \to V_{I_\Gamma}^B(C) = \begin{cases} 0 \; if \; C \in {\lambda_B}^{-1}(\Gamma) \\ +\infty \; otherwise \end{cases} \quad (3.5)$$

In other words, it coincides with $I_{\lambda_B{}^{-1}(\Gamma)}$, the indicatrix function of $\lambda_B{}^{-1}(\Gamma)$. So the latter must itself be convex lower semicontinuous. As a consequence, $\lambda_B{}^{-1}(\Gamma)$is a convex closed (non empty) set of $H_m(\mathbb{C})$, indeed:

(i) $\lambda_B{}^{-1}(\Gamma)$ is convex because if $C, D \in \lambda_B{}^{-1}(\Gamma)$ and $t \in [0,1]$, we have by convexity of $I_{\lambda_B{}^{-1}(\Gamma)}$,

$$I_{\lambda_B{}^{-1}(\Gamma)}(tC + (1 - t)D) \leq tI_{\lambda_B{}^{-1}(\Gamma)}(C) + (1-t)\, I_{\lambda_B{}^{-1}(\Gamma)}(D) \qquad (3.6)$$

But $I_{\lambda_B{}^{-1}(\Gamma)}(C) = I_{\lambda_B{}^{-1}(\Gamma)}(D) = 0$ then necessarily $I_{\lambda_B{}^{-1}(\Gamma)}(tC + (1 - t)D) = 0$ and $tC + (1 - t)D \in \lambda_B{}^{-1}(\Gamma)$.

(ii) The set $\lambda_B{}^{-1}(\Gamma)$ is closed because $\left\{M \in H_m(\mathbb{C})/\ +\infty \geq I_{\lambda_B{}^{-1}(\Gamma)}(M) > 0\right\} = H_m(\mathbb{C}) \setminus \lambda_B{}^{-1}(\Gamma)$ is an open set since $I_{\lambda_B{}^{-1}(\Gamma)}$ is lower semicontinuous.

4 SIMPLIFICATION OF THE PROOF OF UNIQUENESS OF THE SOLUTION OF (E_k).

The Corollary 1.6 allows to notably simplify the proof of uniqueness of the solution of the equation (E_k) in comparison with [5].

Let φ_0 and φ_1 be two smooth k-admissible solutions of the equation (E_k) such that $\int_M \varphi_0\, \omega^m = \int_M \varphi_1\, \omega^m = 0$. For all $t \in [0,1]$, let us consider the function $\varphi_t = t\ \varphi_1 + (1 - t)\, \varphi_0 = \varphi_0 + t\, \varphi$ with $\varphi = \varphi_1 - \varphi_0$. Let $P \in M$, and let us denote $h_k^P(t) = f_k\left(\left[\delta_i^j + g^{j\bar{l}}(P)\partial_{i\bar{l}}\varphi_t(P)\right]\right)$. We have $h_k^P(1) - h_k^P(0) = 0$ which is equivalent to $\int_0^1 h_k^{P\prime}(t)dt = 0$. But:

$$h_k^{P\prime}(t) = \sum_{i,j=1}^{m}\left(\sum_{l=1}^{m}\frac{\partial f_k}{\partial B_i^l}\left(\left[\delta_i^j + g^{j\bar{l}}(P)\partial_{i\bar{l}}\varphi_t(P)\right]\right) g^{l\bar{j}}(P)\right)\partial_{i\bar{j}}\varphi(P)$$

Let us denote $\alpha_{ij}^t(P) = \sum_{l=1}^m \frac{\partial f_k}{\partial B_i^l}\left(\left[\delta_i^j + g^{j\bar{l}}(P)\partial_{i\bar{l}}\varphi_t(P)\right]\right) g^{l\bar{j}}(P)$. Therefore we obtain:

$$L\varphi(P) \coloneqq \sum_{i,j=1}^m a_{ij}(P)\ \partial_{i\bar{j}}\varphi(P) = 0 \qquad \text{with} \qquad a_{ij}(P) = \int_0^1 \alpha_{ij}^t(P)\ dt$$

We show easily that the matrix $\left[a_{ij}(P)\right]_{1\leq i,j\leq m}$ is hermitian [4, p. 53]. By the Corollary 1.6, we know that for all $t \in [0,1]$ and all points $m \in M$, $\lambda\left(g^{-1}\widetilde{g_{\varphi_t}}\right)(m) \in \Gamma_k$, namely that the functions $(\varphi_t)_{t\in[0,1]}$ are k-admissible.

We check then easily that the hermitian matrix $\left[a_{ij}(m)\right]_{1\leq i,j\leq m}$ is positive definite for all $m \in M$ [4, p. 54]. Consequently, the operator L is elliptic on M. But the map φ is C^∞ and satisfies $L\varphi = 0$, then by the Hopf maximum principle [10], we deduce that φ is constant on M. Besides $\int_M \varphi\, \omega^m = 0$, therefore we deduce that $\varphi \equiv 0$ on M namely that $\varphi_1 \equiv \varphi_0$ on M, which achieves the proof of uniqueness.

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The present results are an auxiliary, but independent, part of my PhD dissertation [4].

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Implementation of Energy Efficient Scheduling - Based Data Aggregation through Dynamic Routing in Wireless Sensor Networks

Aarthi. T[1] and Pritha.T[2]

[1]PG Student, Department of Computer Science and Engineering,
Tagore Institute of Engineering and Technology,
Attur-636112, Tamilnadu, India

[2]PG Student, Department of Computer Applications,
Dhanalakshmi Srinivasan Arts and Science College for Women,
Perambalur-621212, Tamilnadu, India

ABSTRACT: Wireless Sensor Networks (WSNs) are networks that consist of sensors which are used to monitor physical or environmental conditions. The resources especially energy in WSNs are limited. Data sampled by sensor nodes have redundancy, data aggregation becomes an effective method to reduce amount of data that need to send to base station. Data Aggregation is the process of aggregating the data from distributed sensors to eliminate redundant transmission and provide fused information to the base station. The existing schemes, Attribute aware Data Aggregation (ADA) make the packets with the same attribute convergent for an efficient aggregation. ADA scheme is based on the concept of potential in physics and pheromone in ant colony. The overhead is that different depth values with respect to different sinks need to be maintained by nodes. In this paper to ensure the packets reach the sink at last Dynamic Scheduling (DS) is proposed. Dynamic Scheduling is implemented using the currently available information without the necessity of predicting the future.

KEYWORDS: Data aggregation, Redundancy, Potential, Packets, Transmission.

1 INTRODUCTION

Wireless Sensor networks (WSNs) constitute of small and low-cost sensors that gather and distribute the sensory data. They offer economical and effective solutions in a variety of fields; and their profound suitability to address mission critical problems that are common in health, transportation and military applications [1]. Most sensor network applications consist of one or more sink nodes which subscribe to specific data streams. The sink nodes are used to express the values of different applications such as the environmental temperature or the vibration of the building [2]. A WSN can sense a region and provide useful information about it by combining measurements reserved by individual sensor nodes and then routed over the wireless interface to a base station.

A base station provides a connection to the wired world where the collected data is processed, analyzed and presented to useful applications. But one of the important issues is energy consumption. So overcome this problem data aggregation technique is used. Data aggregation is the process of collecting data from different types of sensor nodes and provides fused data to the Base Station which is shown in fig 1. Data aggregation requires significant coordination between the sensor nodes because the packets to be aggregated must lie at the same node at the same time.

Corresponding Author: Aarthi. T (aarthisivamani@gmail.com)

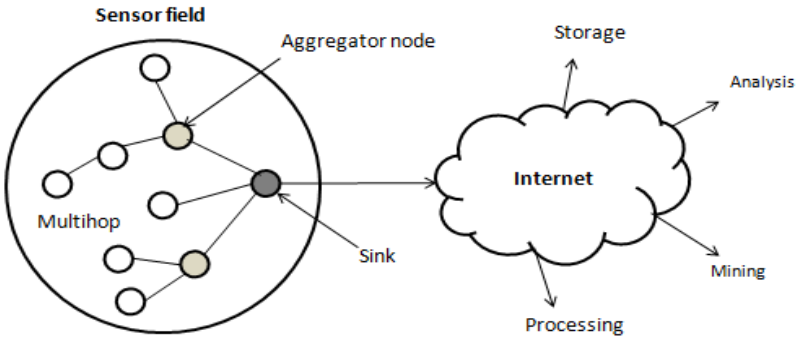

Fig.1. Architecture of Wireless Sensor Network

2 RELATED WORKS

Real-Time Query Scheduling (RTQS) [5], a novel approach to conflict-free transmission scheduling for real-time queries in wireless sensor networks. Timing Control Protocol [6] dynamically change the data aggregation period according to the aggregation quality. This protocol uses to phases. Setup phase distribute the parameters necessary for data aggregation. Data collection phase to reduce the control overhead.

Finding maximal non-conflicting transmission schedule set based on leaves and designed an algorithm with a latency bound explained by using Approximation algorithm [7]. Clu-DDAS [8] based on a novel cluster-based aggregation tree to avoid conflicting transmissions among neighboring clusters. Transmissions among different clusters are concurrent and conflicting free.

Contention-free Time Division Multiple Access (TDMA) [9] where nodes communicate on different time slots to prevent conflicts, offer several advantages for data collection as compared to contention-based protocols. They eliminate collisions, overhearing, and idle listening, which are the main sources of energy consumption in wireless communications.

Long-Lifetime and Low-Latency Data Aggregation Scheduling algorithm (L4DAS) [10] investigated the data aggregation problem and considered its latency and network lifetime for WSNs in scenarios of real-time and long-term applications.

3 MATERIAL AND METHODS

3.1 FORMATION OF POTENTIAL FIELDS

In this section, we describe how to construct the potential fields using depth and pheromone values on each node at the same time for balance the energy consumption. Combine the depth potential field and the pheromone potential field to form a hybrid potential field. Hybrid potential field ensure packets reach the sink as well as be more spatially convergent.

3.1.1 DEPTH POTENTIAL FIELD

Depth of the node is number of hops that it is away from the sink. Depth potential field force the packets along the shortest path.

$$Vd(d) = 1/d+1$$

Vd (d) - inverse proportional function of the depth

d=D (i) denotes the depth of node i.

3.1.2 PHEROMONE POTENTIAL FIELD

Pheromone potential field is constructed to gather the packets with the same attribute together. In WSNs the packets are treated as the ants leaving volatile pheromone at each passed node, a path selected by more packets will have more pheromone and can attract more packets with the same attribute.

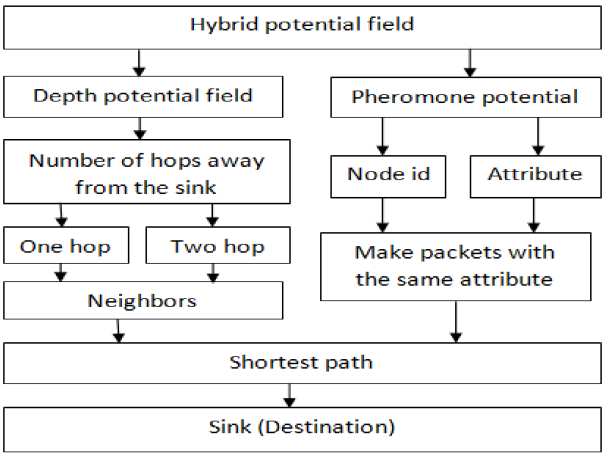

Fig. 2. Architecture for potential fields

Fig 2 shows the architectural design for potential fields. Each node can determine the number of hops that it is away from the sink. Depth is determined by using the depth value. The node has the lowest depth value considered as 1 which will be the next neighbor node. The different nodes have the same depth value which is not selected as the next neighbor node and also highest depth value is not selected. After the selection of neighbor node the pheromone potential field gathers and makes the packets with the same attribute along the shortest path. So the packets transmitted to the sink along the shortest path.

3.2 DYNAMIC SCHEDULING

In sensor networks the packets are received by different nodes. After receiving the packet the packets priority is checked based on the hop count of the packet and consequently sends it to the relevant buffer. Packet scheduling schemes can be classified based on the priority of data packets that are sensed at different sensor nodes in the buffer.

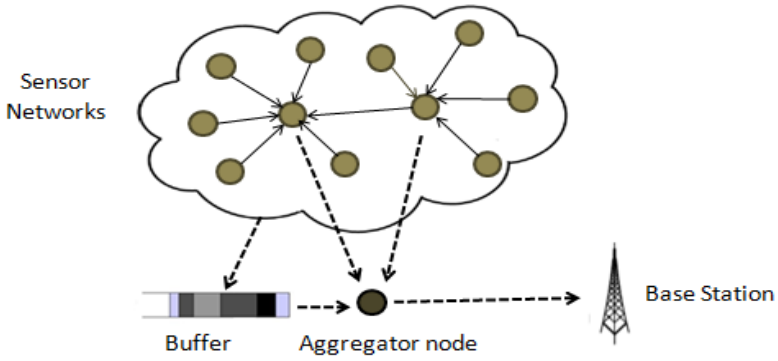

Fig.3. Buffer management in sensor networks

When a packet data arrives at the buffer of the scheduler, the packets priority is compared with the priority of the currently running data packet in the buffer which is shown in the fig 3. All types of data packets enter the buffer and are scheduled based on different criteria: type, priority, size, etc. Reward value is used to denote the important level of packets and process the most important and valuable packet first. Even two or more unimportant packets which just consume a small amount of energy, so like to process one important packet which may consume relatively larger amount of energy. Reward value is used to denote the priority level of packet.

A packet with a larger reward value means that this packet is more important. Therefore, the sensor nodes always accept the packets which have the highest reward value. Thus, we can guarantee that the most important packets can be processed first. Buffer acts as storage for the packets and works like to a queue. So consider a temporary buffer and multiple queue system in main buffer. First the input packet reaches the temporary buffer and then caters to different priority queues. We define different queues for different priority packets. For the first queue in the buffer, we push important packets first. Second queue is for normal packets.

3.2 DATA AGGREGATION

Data aggregation is an important paradigm for compressing data so that the energy of the network is used up efficiently. In aggregation mechanisms, the nodes aggregate received data and send aggregated result instead of raw data to sink, so the volume of the transmitted data is decreased.

Aggregation mechanism works as follow: each node senses data from the environment and receives other node's data, then aggregates these data, based on the aggregation function and transmits the aggregation result to the sink. Therefore aggregation decreases the data volume that is transmitted and this leads to less energy consumption. Also the aggregation process also decreases collision and retransmission delay [11].

Algorithm 1 Data aggregation using dynamic scheduling

```
Require: packet reaches aggregator
{
Store the packets in buffer
if (packet priority = Normal/Important) then
Forward packet to sink (no aggregation)
else
Wait for T Sec/Count M.
if (Time/Count reached) then
Apply aggregation
end if
end if
}//end aggregation phase
```

4 RESULTS AND DISCUSSIONS

We implement the ADA scheme with dynamic scheduling using the NS2 simulator to evaluate the performance. NS-2 is a discrete event network simulator built in Object-Oriented extension of Tool Command Language and C++. NS-2 can support a vast range of protocols in different layers. So using this, the data packets from different sensor nodes were transmitted to the sink node with minimum number of transmission. In this section we are verifying the data packets sent to the sink without any collisions. The proposed dynamic scheduling algorithm avoids the collision of data packets.

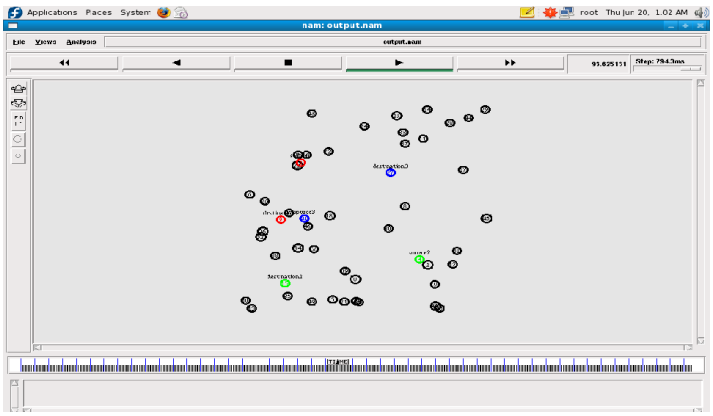

Fig.4. Formation of potential field

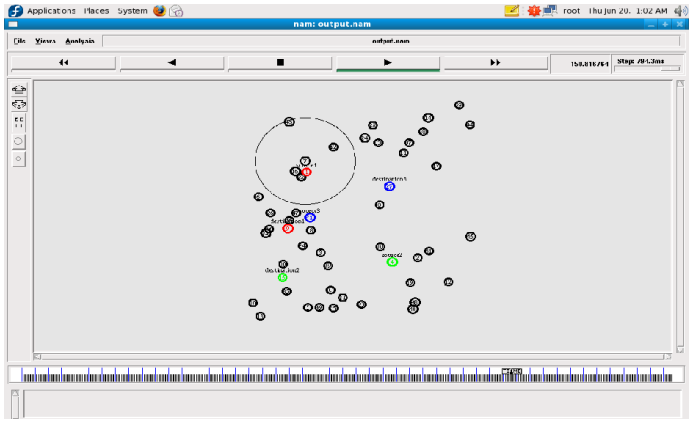

Fig.5. Perform dynamic routing

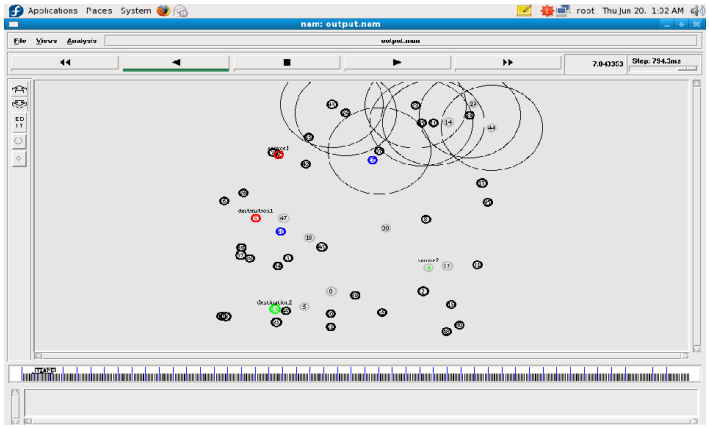

Fig.6. Result of data collection in different nodes

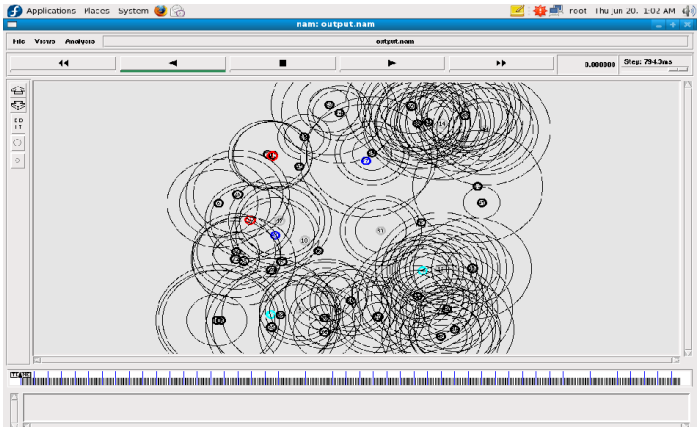

Fig.7. Scheduling the packets with data aggregation

4.1 PERFORMANCE METRICS

The design of sensor network is a challenge because many influencing factors such as fault tolerance, scalability, production cost, operating environment, network topology, hardware constraints, transmission media, power consumption

and others have to be considered. The performance of the network is then measured based on quantifiable parameters called performance metrics.

4.1.1 LATENCY

Latency is defined as the delay involved in data transmission, routing and data aggregation. It can be measured as the time delay between the data packets received at the sink and the data generated at the source nodes.

4.1.2 ENERGY EFFICIENCY

The functionality of the sensor network should be extended as long as possible. In an ideal data aggregation scheme, each sensor should have expended the same amount of energy in each data gathering round. A data aggregation scheme is energy efficient if it maximizes the functionality of the network. If we assume that all sensors are equally important, we should minimize the energy consumption of each sensor. This idea is captured by the network lifetime which quantifies the energy efficiency of the network.

Fig 8 shows the performance of different approaches. Attribute Aware Data Aggregation(ADA) with Dynamic scheduling scheme performs better than the other approches.In this ADA scheme consumes only mimimum amount of energy by receiving minimum number of transmissions. Since the ADA scheme always attract the packets Since ADA always attracts the packets with the same attribute, the buffer in the node can receive the packets from application and finally provide the aggregated data to the sink along the shortest path.

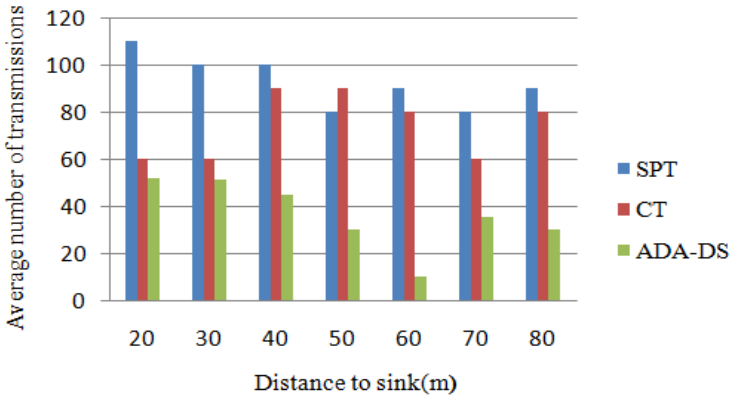

Fig. 8. Performance of different approaches

Latency is defined as the delay involved in data transmission, routing and data aggregation. It can be measured as the time delay between the data packets received at the sink and the data generated at the source nodes which are shown in figure 9.

Fig. 9. XGRAPH for Delay

5 CONCLUSION

The data aggregation is an effective mechanism to save limited energy in WSNs. Heterogeneous sensors and various applications likely run in the same network. To handle this heterogeneity, in this work, introduce the concept of ADA with Dynamic Scheduling which makes the packets with the same attribute as well as schedule the packets using buffer management. The buffer receive the important packets first based on the priority (i.e.) reward value. This scheme consumes less amount of energy by receiving minimum number of transmissions. The simulation experiments validate the effectiveness of our ADA with Dynamic Scheduling scheme and demonstrate that it also has some properties required by actual applications in WSNs, such as scalable with respect to network size and suitable for tracking mobile events and so on.

6 FUTURE WORK

Security is the major problem in wireless sensor network. Since there is more opportunity to hack the data because the aggregator node is compromised by attacker**.** To solve these problem packets from different sensor node were encrypted using encryption algorithms.

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A View of Cloud Computing

Majed Balkhi

Technology Management
University of Bridgeport
Bridgeport, Connecticut, United States of America

ABSTRACT: Nowadays cloud computing is a very latest concept in IT industry due to its different sources everyone is thinking about it that how useful is cloud computing. Cloud computing is only a system on the internet which can run applications and store them. Enterprise cloud computing is the application in which business and consumer both use the process of cloud computing. Normally to run a business application it would take a lot of money and need to pay for the update of software and servers. Nevertheless, in cloud computing it make simpler the whole process it reduced the system and store all the data on one cloud on the internet and shared the data in data center. Where customers and employees of business can easily use without spending any money. So the advantage of cloud computing is cost less and it maintains and update its software itself. They are more secure and reliable due to the policy of username and password to access the application on the cloud computing. User can use the cloud from anywhere and anytime. I came to know that privacy, infrastructure, and security in cloud computing are the major factors of the entire procedure. Cloud computing can be the essential technology infrastructure that can convert business, education if it is properly and carefully execute.

KEYWORDS: Cloud, Storage, Network, Application, Security, Sharing, Privacy.

1 INTRODUCTION

Cloud Computing was a dream since a long period. It can convert a large part of information technology and making software even more appealing as a service [1]; [2]; [3]; [4]. The growth of cloud computing is one of the major leading in the economics of using computing as well as in the computing field.

Cloud computing is a phenomenon in the emerging technological world that involves the taking applications and running them on infrastructure other than your own [5]. The cloud computing is a word consists of two words with specific meaning especially when it comes to technology [6]. The term “Cloud” used as a metaphor in the cloud computing technology and many different types of services and applications being deliver in the internet cloud [7]. The simplest of the definition of cloud computing is that Cloud computing is the delivery of computing services over the Internet. So, when we comprehend the concept we will come to know that cloud computing is a phenomenon where companies outsource their computer to another part or to another location and connect them over the internet to be used within the organization [8].

Cloud computing is achieved by gathering the accessories of the computer and making a package of storage and services. The utility computing is phenomenon we know as software as service phenomenon [9]. Amazon is using the concept at low level with software named EC2. An EC2 instance looks much like physical hardware, and users can control nearly the entire software stack [10]. Web application is an important factor that affects the cloud computing. Web application is an application that is accessed via a web browser over a network such as the Internet or an intranet [11]. Computer economics is a term that defined as converting capital expenses to operating expenses by outsourcing the software and technological needs of a company [12]. Software license is a legally binding agreement that specifies the terms of use for an application and defines the rights of the software producer and of the end-user [13]. We will see the impact of all of these factors on the

Corresponding Author: Majed Balkhi (majedbalkhi@gmail.com)

concept of cloud computing. How they benefit the concept as well as harm it? The researches have shown that cloud computing is an emerging concept and will benefit the organizations more [14].

Cloud computing have been the burning issue since the companies are more inclined towards the cost cutting technologies. The competitive corporate world has actually made the concept of out sourcing more important for the companies and now the companies do not hesitate in outsourcing their needs in order to enhance the efficiency and effectiveness of the firms operations [15].

2 A VIEW OF CLOUD COMPUTING

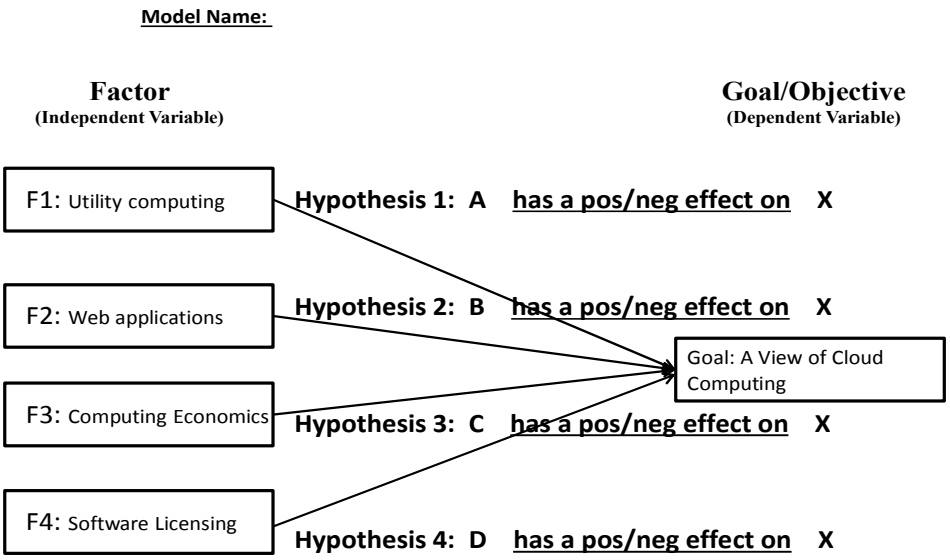

Fig. 1. A View of Cloud Computing and its relation to four independent variables

3 UTILITY COMPUTING

Capacity of a utility is measured or determined by its ability to reassign resources as the users are increased on the computing cloud or computing platform [16]. In cloud computing technology, the provider of service handles the CPU, hard disk and memory [17]. There are many methods by which price can be estimated but the most accurate method is of quantifying and is recommended to use [18]. In the forums of computing utilities price is a major factor that can affect the demand of the applications, and can be used, for the progress and to overcome the hurdles in the way of cloud computing technology [19]. Computing forums have exerted a huge effect on the way of communications and data transfer also in the areas where people were reserved to use new technologies [20]. In evolution of business models is potential role for computing services is of equal importance [21].

4 WEB APPLICATION

Web applications are very popular and being used at a large scale. Web applications not only used by students and education departments but also by the industries all around the world. They are not so simple, they are so complex that some web applications are further used to make the use of these applications as simple as possible for the users [11]. Web-based applications are task-oriented software that is accessed through a web browser and connected to a Hypertext Transfer Protocol (HTTP) for data communication [22]. Nowadays, web-based applications have become much more complex as their

operations are beyond simple browsing of information [23]. The applications include components such as images and objects on their interfaces [24]. Web applications should be functionally provided to the users so that they can easily interact and communicate [25]. Web applications are as much complex they are going to become as much popular also. On the web application there are a lot of software applications that are of great use in education and industrial departments and we can explore a lot of things using web applications [26].

5 COMPUTING ECONOMICS

This is a branch of computing in which computing is used between many users at a cloud computing forum. This concept is not new but when it is combined with the internet, it has gained a lot of popularity and is beng used in economics field [27]. With the advent and advancement in the Cloud Computing there is as well great advancement in the computing and the field of economics also have passed through great revolutions. Cloud computing is being used in many technologies but some of these major technologies are Software-asa-Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (Iaas). So if we are able to understand the importance of these software then we can well understand and explain the importance of cloud computing in the field of economics and can also guess how deeply the cloud computing is rooted in the field of economics [4]. Cloud computing is not only popular in the field of economics but it is as well popular in the field of business and gaining popularity in this field since 2006 [12]. cloud computing is a technology in which software and hardware that are being used are much cheaper and their cost might be further reduced and they do not require any labor to operate them and also there is no need of their maintenance [28]. Cloud computing is a technology and can be defined a computing tool or device that is used for the computing in social studies [29]. in the field of economics all the computing techniques should be utilized altogether then it would be possible to achieve well-structured web oriented computing system [30].

6 SOFTWARE LICENSING

First of all the software was free and all the users can access them but with passage of time and by increasing the users for software, developers have made three categories of license for their web applications are software. There are some types of the License that are associated with the web based software and are categorized as Strong-Copy left, Weak-Copy-left, and Non-Copy-left [13]. In OSS project, types of licenses are of great importance but there is little understanding in open source literature of the license choice from a developer's perspective. There have been developed many systems of protection but they failed to provide a method to user by which a user might be sure to secure and understand the mechanism to share the data over cloud computing forum using internet [31]. For the future work software will be issued to legal authorities and will be password secured and will provide protection against un authorized use [32]. Software are licensed given to the users for a free trial period. This trial period may be of 10 days or more after this trial period the software is due to be registered otherwise after the trial period they will not work. And one license is applicable only for one user [33]. Therefore, it is necessary to monitor licensing evolution [34]. Several models were introduced and proposed for the protection of software on the cloud computing technology but from all these models .NET is the model of coding protection of the software that prevailed and dominated all other models and is still used [35].

7 EXPLANATION AND DISCUSSION

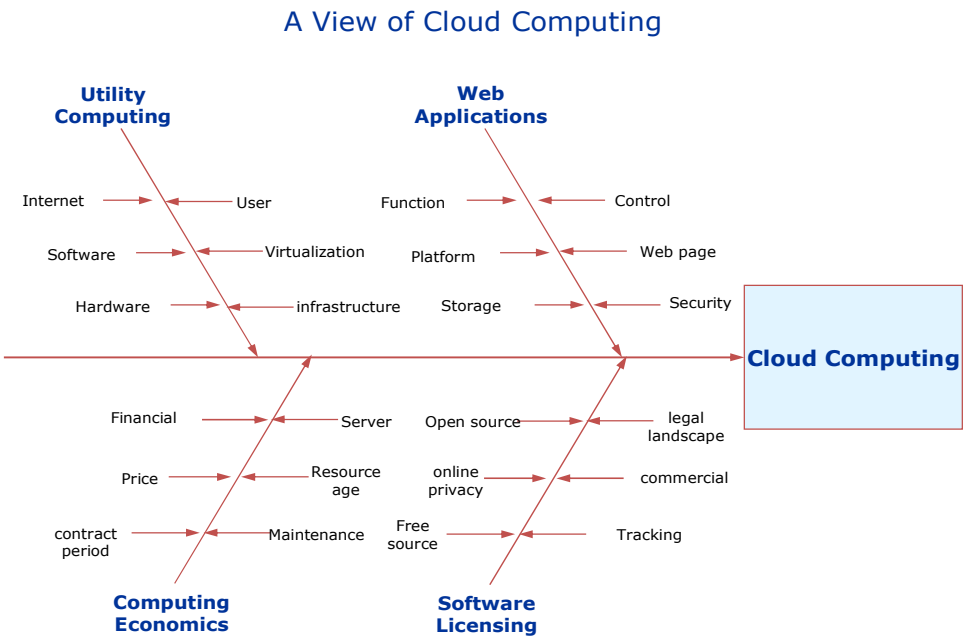

Fig. 2. Cloud Computing

There is plenty to discuss as far as the functions of these specific factors, which play a role in regards to Cloud Computing. The benefits of cloud computing is immense and can be studied via the impact of the factors that is being discussed in the paper [2]. Utility computing is a great phenomenon that affects the concept of cloud computing to a great deal. The concept of utility computing helps to a great deal as it help through meeting the data scarce needs by making the data available [36]. The service on demand is the primaries of the concept and provides managers with multiple resources. The phenomenon is helpful as it provides a fast programming execution but the phenomenon is concerned with many issues especially the security related risks [37].

Web applications is also an important factor that affect the concept of cloud computing. The reason is that phenomenon of cloud computing requires certain web application and protocols. The impact however is positive and it facilitates cloud computing as well as freed the companies from the burden of infrastructure by connecting the applications over the internet [38]. The readily available application will help in making the customer interact readily and efficiently. The harms of web applications lie in it being complex but the benefit of the application is in its use for educational purposes as well as corporate purpose [39].

The concept of computing economics has a great impact on the future of cloud computing. The motive of computing economics is to freed the organization and corporate from the burden of having large infrastructures in order to meet their data requirement [40]. The computing economics will align the concepts of economics with the computing models and will open the opportunities for cloud computing to a great deal. The development of computing economics will help in making computing more aligned to social and environmental context [41].

Software licensing is important to deal with the security risks that attached with the phenomenon. The license has different types and they have different licensing needs. The software licensing is a difficult phenomenon as it requires experts to draft the contract that have the knowledge of law as well as the technology [41]. Software licensing is actually the biggest hurdle in the way of the concept and much has been studied on the issues related to software licensing. The fact is that software licensing related to the concept of cloud computing is very complex and includes several kinds of dimensions like international and national perspective as well as the laws to be applied on the concept and the coherence of these laws [42].

8 CONTRIBUTION AND NEW INSIGHT

I believe that cloud computing can be improved productivity and be use all around. Cloud Computing will become not only financial profit but also more secure for everyone. Cloud computing will contribute a lot to the society and will help the companies in their goals to gain the cost advantages. The phenomenon will have new dimensioned more of the sort of something close to internet of things. Cloud computing is an emerging concept and will enhance the idea of outsourcing to a new level. The concept already has diverse factors to consider and will take time to eventually become the integral part of the organization. The pros and cons of the phenomenon are immense and will require lots of efforts and studies to mitigate the concerns. The contribution of the topic is manifold and will cover many aspects of the technological field. The insight that the study has provided will help the organizations to understand the concept more and to study the concept in perspective of the marketing strategies. The important aspects of marketing related to the concept studied in the paper.

The study would be a great help for the organizations that are still indecisive over the pros and cons of the concept. The financial concerns of the companies also discussed in the paper. It will also change the dimension of the concept as people think of it as a told for the huge companies or the market giants. Another perception about the phenomenon is that the concept is only useful for the multinational companies that have to deal with enormous amount of data. The contribution of the paper towards concept is manifold. It mostly addresses the concept in terms of marketing effects that the concept will bring in. The insights that the concept will provide to the business world as well as the educational one will help in defining the concept of technology in another way.

The future of cloud computing lies in the hands of experts dealing with the security concerns and the risks attached with virus attacks and data theft. The legal terms associated with the phenomenon also requires addressing the issue with lots of effort. Legal laws related to licensing and the diverse conflicts. Arising out of the phenomenon of computing economics will be the issues of core importance. The data will processed in a way of finding the authority that allows the use of material. The Cloud Computing concept has an immense potential and have the concerns and issues assassinated with different aspects of the concepts. The contribution of the concept will be in the form of revolution and will bring a change of its kind in the technological world. The phenomenon will lead to further outsourcing that may include finance and marketing and the processing and having analysis over the phenomenon.

9 CONCLUSION

For individuals and organizations, Cloud Computing offers many benefits. If you are thinking or using cloud service, you should know about how your information can be secure. The concept of cloud computing is being widely discussed in the study and found many sort of impacts that are related to the harms and the benefits that will be witnessed when the factors like software licensing and the computing economics are studied. The concept is greatly influenced by the factors investigated in the study and found out that these factors are further divided into many sub factors that will impact the concept of cloud computing. These factors have implication of various types that opens the insight into other fields of the subject. The factors have their pros as well cons and the previous researcher done a prominent work over the issue. However, there is still a need to do a lot of work on the topic especially when discussing it in connection with the marketing subject. The phenomenon requires lots of investment and will brought huge revenues but is riskier as well.

The factors like utility computing and web application benefited the project in many ways. They affect the concept by means of providing a huge lot of choices for the companies to choose between in order to fulfill their technological needs without investing heavily over the capital resources. The phenomenon also bring concerns along with that. These are the concerns of the security and reliability. As well requires lots of trust on the company providing the service and along with that it needs to deal the matter in a way that customers who are the ultimate user of the application will appreciate the efforts and huge investments of the company. The paper had presented its own model of cloud computing and discussed the important factors in the model in which the clients were the most important of them. Software licensing and computing economics are also discussed and it is revealed from the studies that software licensing have negative impact on the concept while computing economics have a lot of impact but requires the phenomenon to be studied more.

The concept of cloud computing is being successfully practiced by the famous company like Google. Google has launched many software's related to the cloud computing and has received a great response for the concept. The companies in the future world will require being more smart and cunning and for that they will need to support their data with lots and lots of historical data. These historical data will be available by using the concept. The companies will be more required to outsource the work related to the fields in which they do not work. Therefore, they will secured in investing heavily over their capital resources and will convert the capital expenses into operating one.

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Numerical investigation of heat transfer enhancement about a thermally isolated body: outcome of Hartmann and Reynolds numbers

M. U. Ahammad[1-3], M. M. Rahman[2], and M. L. Rahman[3]

[1]Department of Mathematics, Dhaka University of Engineering and Technology (DUET), Gazipur-1700, Bangladesh

[2]Department of Mathematics, Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh

[3]Department of Mathematics, Rajshahi University, Rajshahi-6205, Bangladesh

ABSTRACT: In this paper, coupled flow and heat transfer by combined convection in a laminar, incompressible, electrically conducting fluid-filled two-dimensional cavity with a thermally isolated body has been analyzed. The developed mathematical model is governed by the conservation of mass, momentum and energy equations and the problem is solved numerically. The effects of two physical parameters namely the Hartmann number *Ha* and the Reynolds number *Re* on the flow and heat transfer are discussed and exposed though graphs and tables. The phenomenon inside the cavity for the mentioned parameters is studied through streamline and isotherm patterns. Moreover average Nusselt number which is the representative of heat transfer rate at hot wall is calculated. It is observed that the rate of heat transfer at the bottom heated surface increases with a decrease in *Ha*, where as it shows reverse effect in case of the *Re*.

KEYWORDS: Hartmann number, Heat transfer enhancement, Reynolds number, Thermally isolated.

1 INTRODUCTION

The MHD combined convection and heat transfer in cavity has been studied extensively and is reasonably well-understood. It plays a significant role in controlling the rate of heat transfer as well as temperature distribution. In addition, the enclosure ventilated geometry has been widely considered in heat transfer for the reason of its fundamental importance and its many applications, including electronic equipment cooling, heat exchangers, solar thermal collector systems and thermal environmental control of dwellings etc. The most significant features occur in the context of MHD heat transfer is the existence of Lorentz force rising due to the imposition of magnetic field that changes the heat transport phenomena. Model studies of the above phenomena of MHD mixed convection have been made by many authors. Billah et al. [1] carried out aspect ratio and prandtl number effect on MHD mixed convection heat transfer enhancement in a lid-driven enclosure having a heat-generating body. Gau et al. [2] performed an experimental study on mixed convection in a horizontal rectangular channel that was heated from a side. Rahman et al. [3] performed the combined forced and natural convection problem in a ventilated square cavity containing a heat conducting horizontal circular cylinder. Huang and Li [4] calculated heat transfer enhancement of free surface MHD-flow by the wall with non-uniform electrical conductivity. The authors explained the flow behaviors, heat transfer coefficients, friction factors and pressure drops under different Hartmann numbers in their study. An unsteady laminar combined convection flow and heat transfer of an electrically conducting and heat generating or absorbing fluid-filled vertical lid-driven cavity in the presence of magnetic field has been analyzed by Chamkha [5]. Mehmet and Elif [6] examined the inclination effect of the rectangular enclosure for electrically conducting fluid with a magnetic field in the case of natural convective flow. Abo El-Nasr et al [7] developed heat transfer characteristics of horizontal cylinder cooling under single impinging water jet. Oztop et al. [8] performed the combined convection flow in a lid-driven cavity with a circular body. In their work the left wall of the cavity was kept heated while the right wall was considered as cool and other two walls were insulate. For understanding the effect of Prandtl number a Hydromagnetic mixed convection problem in a double-lid driven cavity with a heat-generating body have been investigated by Rahman et al. [9].

Corresponding Author: M. U. Ahammad (main3737@gmail.com)

Later on, Rahman et al. [10] studied combined free and forced convection problem in cavity vented with a heat-generating solid circular block and presented the significant role of Reynolds and Prandtl number. Thermal comfort in a room with windows at adjacent walls along with additional vents was studied by Prakash and Ravikumar [11]. Sharif et al. [12] reported the assisting flow behavior of MHD mixed convection inside a ventilated enclosure. Recently, modeling and simulation of MHD convective heat transfer of channel flow having a cavity was analyzed by Munshi et al [13].

The task in this article is to examine the fluid flow patterns along with the enhancement of heat transfer performance from the lower hot surface of the studied geometry so that the average temperature in the system can be kept below the allowable threshold value.

2 PHYSICAL MODEL

A square cavity containing incompressible fluid with a centered insulated obstacle is shown in the Figure 1. The cavity dimensions are defined by *L* for each side. The bottom wall is heated while the remaining walls are considered perfectly adiabatic. The entrance and outlet of the cavity are positioned at the bottom of the left wall and at the top of the right wall respectively. A magnetic field of strength B_0 is assumed to be applied transversely to the opposite flow direction. The size of each opening is equal to one-tenth of the cavity length. The inflow state is (u_i, T_i) while zero diffusion flux is assumed for outflow.

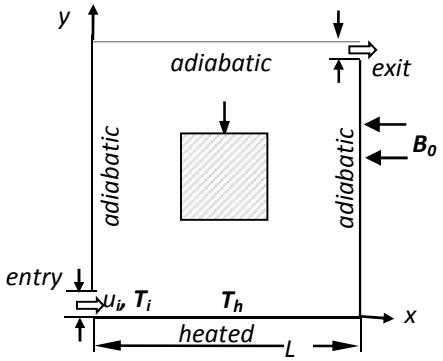

Fig. 1. Cavity configuration for studied problem

3 MATHEMATICAL ANALYSIS

The studied fluid is treated as laminar, Newtonian and incompressible with the flow in the mixed convection regime. Two-dimensional mass, momentum and energy conservation equations are considered as the governing equations in the present work and under the Boussinesq approximation the equations can be described in vector forms as follows:

$$\underline{\nabla}.\ \underline{q} = 0 \tag{1}$$

$$\left(\underline{q}.\underline{\nabla}\right)\underline{q} = -\frac{1}{\rho}\underline{\nabla}\, p + \upsilon\ \nabla^2\ \underline{q} + \underline{F} \tag{2}$$

$$\left(\underline{q}.\underline{\nabla}\right)T = \alpha\ \nabla^2\ T \tag{3}$$

$F_x = 0,\ F_y = g\beta\left(T - T_i\right) - \dfrac{\sigma\, {B_0}^2 v}{\rho}$ are assumed as two components of the body force $\underline{F}$.

where $\underline{q}$ stands for the velocity vector, $\underline{F}$ is the body force, T denotes the temperature of the fluid, T_i is ambient temperature, v is the kinematics viscosity, α is the thermal diffusivity, p is the pressure, ρ is the density and σ is the electrical conductivity of the fluid.

By introducing the following non-dimensional variables, the above equations are made dimensionless as stated in equations (4)-(7).

$$X=\frac{x}{L},\ Y=\frac{y}{L},\ U=\frac{u}{u_i},\ V=\frac{v}{u_i},\ P=\frac{p}{\rho u_i^{\,2}},\ \theta=\frac{\left(T-T_i\right)}{\left(T_h-T_i\right)}$$

P is the dimensionless pressure, u_i is the ambient velocity, θ is the dimensionless temperature, T_h is the constant temperature of hot wall of the cavity.

$$\frac{\partial U}{\partial X}+\frac{\partial V}{\partial Y}=0 \tag{4}$$

$$U\frac{\partial U}{\partial X}+V\frac{\partial U}{\partial Y}=-\frac{\partial P}{\partial X}+\frac{1}{\mathrm{Re}}\left(\frac{\partial^2 U}{\partial X^2}+\frac{\partial^2 U}{\partial Y^2}\right) \tag{5}$$

$$U\frac{\partial V}{\partial X}+V\frac{\partial V}{\partial Y}=-\frac{\partial P}{\partial Y}+\frac{1}{Re}\left(\frac{\partial^2 V}{\partial X^2}+\frac{\partial^2 V}{\partial Y^2}\right)+Ri\,\theta-\frac{Ha^2}{Re}V \tag{6}$$

$$U\frac{\partial \theta}{\partial X}+V\frac{\partial \theta}{\partial Y}=\frac{1}{\mathrm{Re}\,\mathrm{Pr}}\left(\frac{\partial^2 \theta}{\partial X^2}+\frac{\partial^2 \theta}{\partial Y^2}\right) \tag{7}$$

where, the Reynolds number, Prandtl number, Hartmann number, Richardson number are defined respectively as

$$\mathrm{Re}=\frac{u_i L}{\upsilon},\quad \mathrm{Pr}=\frac{\upsilon}{\alpha},\quad Ha=B_0 L\sqrt{\frac{\sigma}{\mu}},\quad Ri=\frac{Gr}{\mathrm{Re}^2}$$

The concerning boundary conditions in the dimensionless form are given below:

At the inlet: $U=1, V=0, \theta=0$

At the outlet: convective boundary condition (CBC), $P=0$

At the bottom heated surface: $\theta=1$

At the left, right and top walls: $U=0, V=0, \frac{\partial\theta}{\partial N}=0$

At the surface of the block: $U=0, V=0, \frac{\partial\theta}{\partial N}=0$

The average Nusselt number Nu_{av} at the hot wall is given by $Nu_{\alpha v}=-\int_0^1\left(\frac{\partial\theta}{\partial Y}\right)dX$

The bulk average fluid temperature in the enclosure is defined as $\theta_{av}=\int\theta\frac{d\overline{V}}{\overline{V}}$, where $\overline{V}$ is the cavity volume.

4 COMPUTATIONAL DETAILS

The solution of the governing equations with boundary conditions are obtained through the Galerkin weighted residual based finite element method. Firstly, the problem is defined as a two dimensional cavity and the solution domain is discretized into finite element meshes, which are composed of non-uniform triangular elements. Applying Galerkin weighted residual technique the governing equations are transferred into a system of integral equations. Boundary conditions are then imposed and the nonlinear equations are transformed into linear algebraic equations with the help of Newton's method which are finally solved by triangular factorization method.

In order to obtain the grid independence solution, a grid refinement study is conducted to select proper grid resolution. Various size of grid having 2024, 3540, 4508, 5554 and 7160 elements are used to determine the average rate of heat

transfer at the heated wall of the cavity. The average heat transfer rate at the hot wall with grid elements is revealed in Table-1 and Figure 2. As it is seen that there is no significant discrepancy ahead of 5554 elements, all computations are performed using this grid resolution.

Table 1. Average Nusselt number for different grid elements while Ri = 1.0, Ha = 10.0, D = 0.2, Re = 100 and Pr = 0.71

Elements	Nu_{av}	Discrepancy (%)
2024	**6.201839**	**---**
3540	**6.202839**	**0.02**
4508	**6.212839**	**0.17**
5554	**6.213839**	**0.19**
7160	**6.213939**	**0.19**

The solution procedure has been validated against the numerical results of Oztop et al. [8] shown in the Figure 3. This figure shows that the streamline and isotherm patterns in the present work have excellent agreement with those obtained by Oztop et al. [8]. Thus the numerical code used in this analysis can perform the present problem with logical agreement.

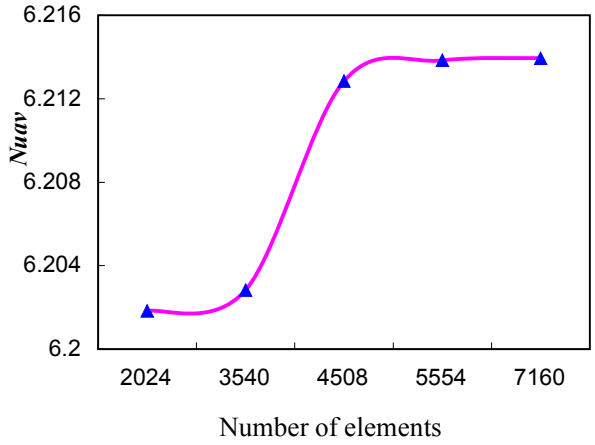

Fig. 2. Average Nusselt number for different grid elements

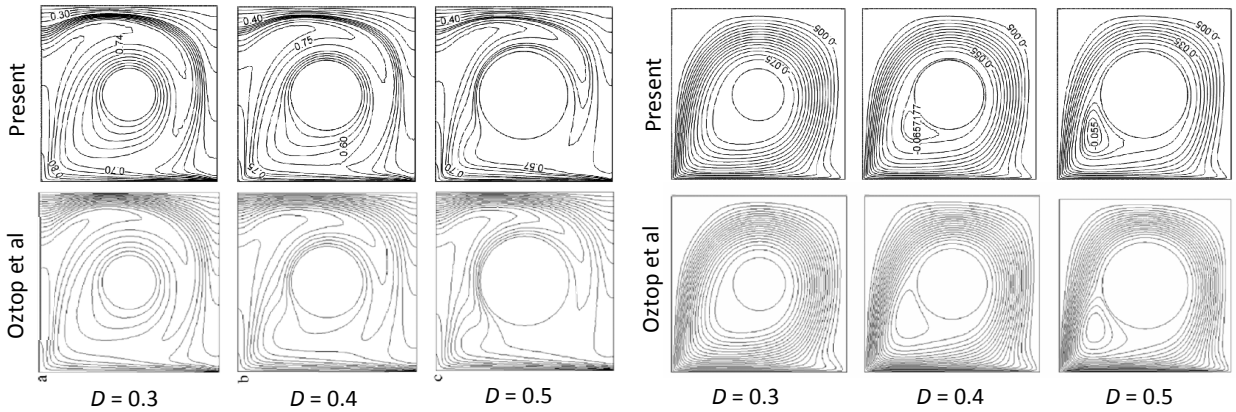

Fig. 3. Comparison of streamlines (left) and isotherms (right) between the work of Oztop et al. [8] and present while Gr = 10^5, Pr = 0.71, C = 0.5 and Re = 1000

5 RESULT AND DISCUSSIONS

In this section, among the related parameters of the current problem the impacts of two controlling parameters namely Hartmann number *Ha* and Reynolds number *Re* on the streamlines and isotherms are executed. The considered values of

Hartmann number and Reynolds number are *Ha* = (0, 20, 50, 100) and *Re* = (50, 200, 350, 500) while the other parameters Pr, D, are kept fixed 0.71, 0.2 respectively.

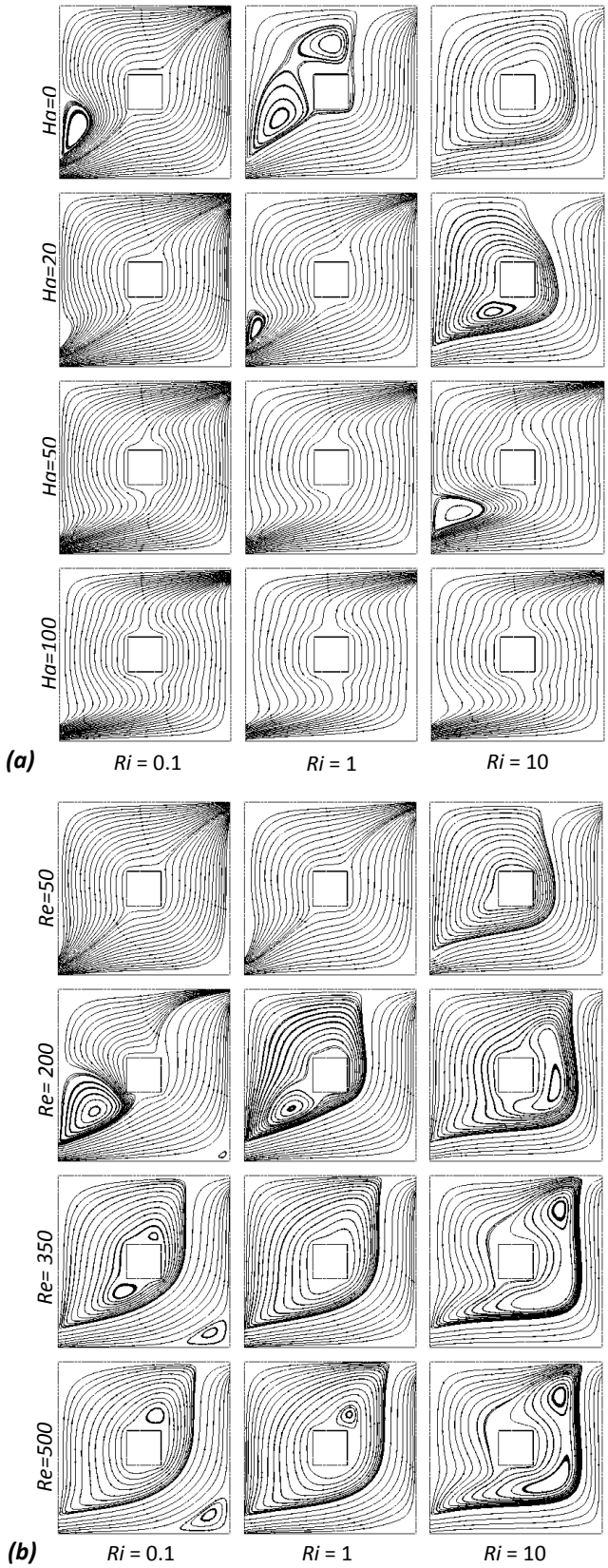

Fig. 4. Streamlines for various (a) Hartmann number and (b) Reynolds number with Richardson number in the range 0.1 ≤ Ri ≤ 10

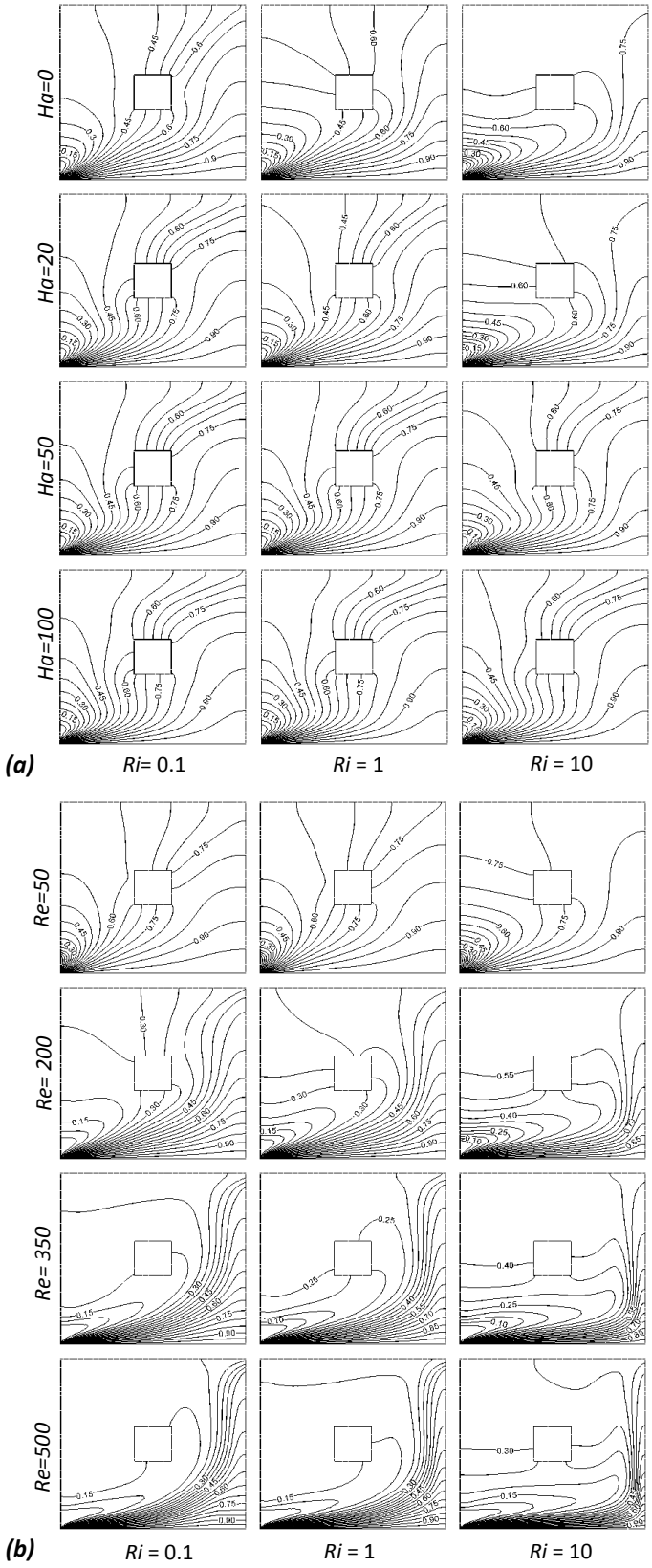

Fig. 5. Isotherms for various (a) Hartmann number and (b) Reynolds number with Richardson number in the range 0.1 ≤ Ri≤ 10

The mixed convection parameter *Ri* is varied in the range of 0.1 to 10. The outcomes of the present study are discussed here in three steps in order to focus the characteristic of flow field, temperature distribution inside the ventilated cavity as well as overall heat transfer including average Nusselt number at the bottom wall and average temperature of the cavity fluid.

5.1 FLOW FEATURES

Figure 4(a) depicts the effects of the magnetic field parameter on streamlines at different Richardson number. At low Hartmann number *Ha* = 0, a rotating cell is created just above the inlet in the domain *Ri* = 0.1 and it increases rapidly for the consecutive value of *Ri* = 1. On the other hand it is followed that for the above two convective regimes of Richardson number the flow structures are almost identical at the rest three considered values of *Ha* (= 20, 50, 100). Interestingly, in the dominant free convection domain the patterns of the cavity flow change dramatically for the cases of lower *Ha* than that of higher value of *Ha*. The reality established here is that the application of transverse magnetic field acting as Lorentz's force which retards the flow. As expected, the flow strength is reduced with increasing the Hartmann number.

A general observation concerning the influence of Reynolds number on streamlines has been demonstrated in Figure 4(b). In the dominant and pure mixed convection region the flow patterns inside the enclosure appear as an onion shape that elongated from the entry to the exit port at *Re*=50, while a large anti-clockwise rotating cell formed occupying the centered block for the case *Ri* = 10. When *Re* = 200, a vortex is seen near the lower left side of the cavity, consequently open lines shrinks towards the obstacle at *Ri* = 0.1 and this vortex enlarges very fast as *Ri* increases. For higher values of *Re* = 350, 500 the vortices expand in size and small eddies and these are nearly similar in all the ranges of $0.1 \leq Ri \leq 10$. This figure is also indicating that the Reynolds number is an effective parameter on streamlines.

5.2 THERMAL FIELDS

The inspection of the heatlines profile relating to these various values of the Hartmann number are illustrated in Figure 5(a). The isothermal lines are scattered through all over the enclosure for the choosing values of four Hartmann number as *Ha* = 0, 20, 50, 100 in the different values of Richardson number regimes with the exception of two cases. However a significant change is found for the lowest value of *Ha* = 0 that is, in the absence of magnetic field parameter along with *Ri* = 10. Also a noticeable variation is observed in the dominant natural convective domain at *Ha* = 20. It is seen that heatlines are crowded at the bottom wall near the inlet port and a boundary layer is created at the vicinity of the heated surface of the cavity for each case.

In order to clearly exhibit the thermal field characteristic of the working area for the different Reynolds number the corresponding isotherms are displayed in Figure 5(b). At smaller value of Reynolds number (*Re* = 50) temperature distribution inside the cavity shows non-linearity for all the values of *Ri* varies as 0.1-10 with a minor change in *Ri* = 10. In the dominant forced convection and pure mixed convection area it can be easily followed that isotherms are shrink gradually in the direction of bottom-right sided wall with the increasing values of Reynolds number from 200 to 500 as the basis of higher *Re* more suppression. In addition, for these three values of Reynolds number the tendency of heatlines minimization is more visible in the case of *Ri* = 10 and some folding isotherms are returned to the left wall.

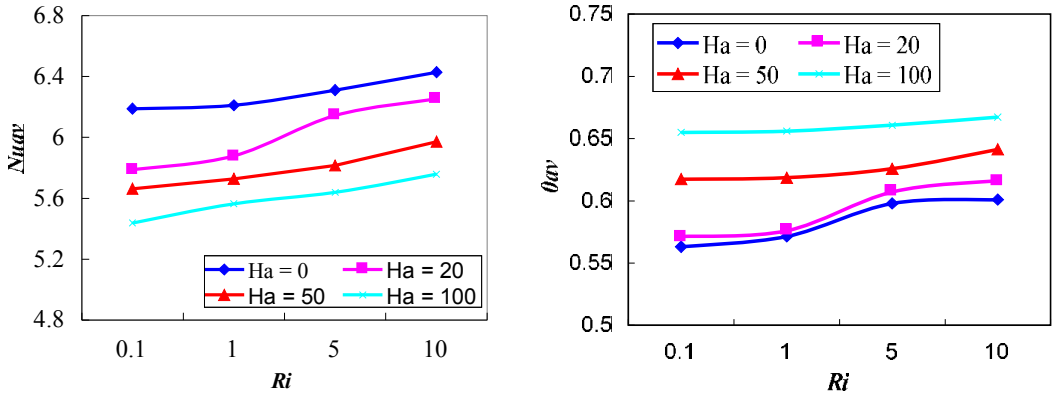

Fig. 6. Average Nusselt number and average fluid temperature versus Richardson number for different values of Hartman number

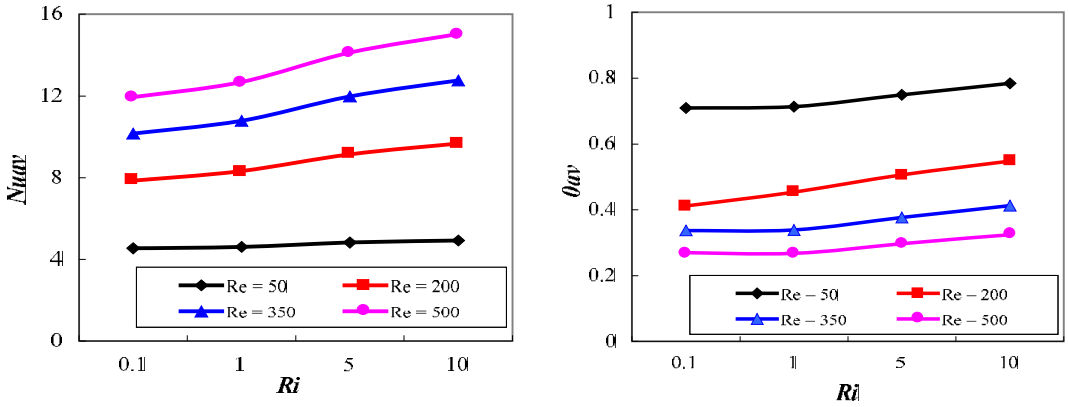

Fig. 7. Average Nusselt number and average fluid temperature versus Richardson number for different values of Reynolds number

5.3 HEAT TRANSFER

At last the heat transfer efficiency of the enclosure for the two above discussed parameters are presented in terms of average Nusselt number Nu_{av} and the dimensionless average bulk temperature θ_{av}. Figure 6 plots the variation of both average Nusselt number and average fluid temperature for different values of Hartmann number. The variation profile indicates that heat transfer rate decreases as the value of *Ha* increases within the range of $0.1 \leq Ri \leq 10$ and so an opposite result is found for the average fluid temperature in the cavity. The higher the Hartmann number the smaller are the fluctuations in the average temperature.

To show the effect of Reynolds number, Figure 7 records the variations of Nu_{av} and θ_{av} as the function of *Ri* within range of 0.1–10 for different values of *Re*. It is evident that average Nusselt number increases with the increase in Reynolds number *Re*, where as it shows reverse effect in the case of average temperature of cavity fluid.

Tables 2 and 3 show the heat transfer variation at the heated wall of the enclosure through the average Nusselt number for the different values of *Ha* and *Re* in that order. Results clearly give an idea about how the aforementioned parameters affect the thermal performance in the enclosure, and how the aforesaid parameters are significant on the overall heat transfer process across the enclosure.

Table 2. Variation of average Nusselt number (Nu_{av}) with Hartmann number Ha

Ri	*Ha* = 0	*Ha* = 20	*Ha* = 50	*Ha* = 100
0.1	6.189092	5.788497	5.663728	5.438015
1.0	6.211818	5.878837	5.728370	5.564770
5.0	6.310872	6.145266	5.816642	5.639284
10.0	6.429270	6.252779	5.97306	5.758791

Table 3. Variation of average Nusselt number (Nu_{av}) with Reynolds number Re

Ri	*Re* = 50	*Re* = 200	*Re* = 350	*Re* = 500
0.1	4.542412	7.851059	10.16379	11.93755
1.0	4.610437	8.320327	10.78297	12.69044
5.0	4.822014	9.143034	11.97443	14.12518
10.0	4.921946	9.671546	12.76067	15.03054

6 CONCLUSION

Two pertinent parameters of this article have provided some reliable information on the condition of the cavity vented flow and heat transfer. From the present investigation it is seen that for different Hartmann number *Ha* with fixed Reynolds number *Re* and Prandtl number *Pr*, heat transfer rate at the hot wall of the cavity is larger for smaller value of *Ha*. But an opposite effect is noticed for the case of different Reynolds number *Re* while Hartmann number *Ha* and Prandtl number *Pr* are kept stationary; that is, heat transfer enhanced as *Re* increases. In addition, the flow and thermal fields in the case of Reynolds number are much affected than that of Hartmann number. Thus the considered parameters in this study can be treated as heat transfer controlling parameter and it is observed that Hartmann number and Reynolds number is an important factor for the enhancement of heat transfer.

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