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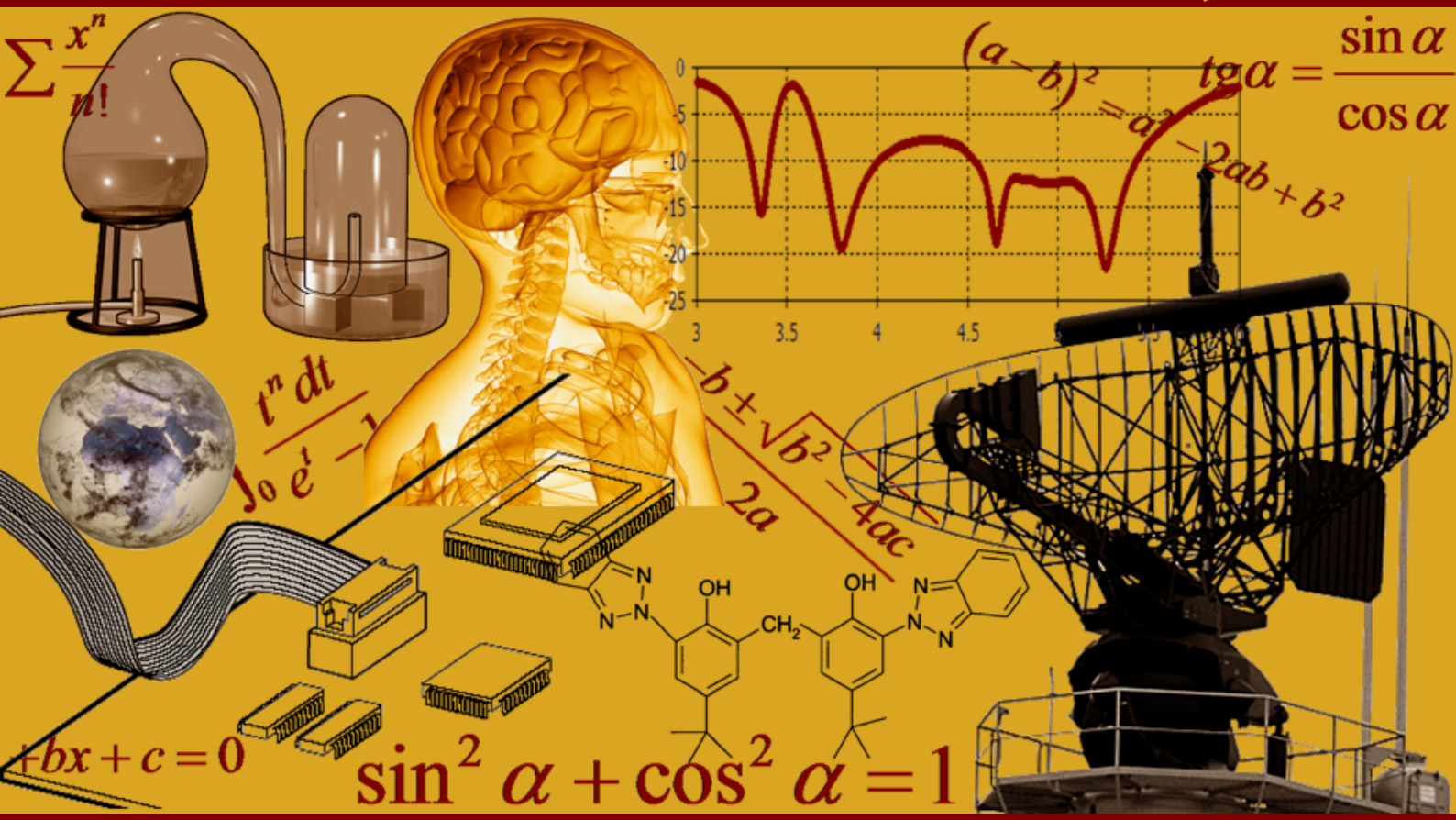

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Urban vegetable production as a survival strategy in Tanzania: A case of Morogoro municipal

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ABSTRACT: Horticultural products including vegetables play potential role in generating employment and are frequently produced on small plots thus are important source of additional income for poor farmers in developing countries. Objectives of this study were to assess the contribution of urban vegetable production for livelihoods of the households, to assess the strategies used in urban vegetable production and identify factors that hinder urban vegetable production. A sample of 35 respondents was simple randomly selected from 9 wards of Morogoro Municipality. The study used an explanatory cross-sectional design in which data were collected at a single point in time. Semi-structured interviews were conducted whereby questionnaires with both closed and open ended questions were used to gather information. Observation was another method used for data collection. Collected data were analyzed by using SPSS computer analytical program. Research findings show that vegetable production in Morogoro urban contributes to generate income as well as for food security of the households. Also strategies used in producing vegetables include; intensification in vegetable production which is backed up by the use of means of improving soil fertility and pests and diseases control. It is concluded that, since majority of farmers rely on vegetable production then increased production in study area will contribute to improved people's livelihoods in terms of increased income, vegetable consumption and nutrition which will eventually contribute to improved health status. Therefore, there should be a review of present research-extension-farmers link to be more effective with a great attention that it provides knowledge, information and skills on vegetable products chain management to farmers.

KEYWORDS: Urban agriculture, urban vegetable production, income generation, livelihood.

1 BACKGROUND INFORMATION

Agriculture is the raising of crops, plants and animals. Horticulture is one of its branches concerned with growing vegetables for people's food, medicine and aesthetics. Horticulture is concerned with those plants whose cultivation bring rewards, whether monetary or personal pleasure, sufficient to warrant the expenditure of intensive effort such as large input of capital, labour and technology per unit area of land (Janick, 1979). Horticultural production in Tanzania is a timely and important topic for study given the increasing commercialization of vegetables in the domestic economy and the potential of vegetable production for export. In most Third world countries there are large numbers of poor urban citizens whose needs should not be ignored even if there are more rural poor (Hardoy, 1989).

Urban agriculture (UA) is the practice of food production within the urban and peri-urban areas. It includes the cultivation of crops, fruits and vegetables, trees, gardens, orchards, animal husbandry, fuel wood plantation, aquaculture, and related activities(yeung, 1987 cited in Mlozi, 1995). In this study UA means vegetable production. Vegetable crops, as compared to other crop commodities, are generally early maturing, have high nutritive value and are suitable in various cropping systems, such as backyard gardening, subsistence farming, cash crop production and processed vegetable food production. It is worth noting that income from vegetable crops is generally higher than most field crops (Mc Lean, 1988).

UA is practiced in most Third World societies not as a hobby but as a necessity both for subsistence food production and to earn extra income (Mlozi, 1995). In Third World societies, UA is mainly practiced by citizens of lower socio-economic status

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(SES) to assist them with food production and to subsidize their income. UA is the occupation of people of the lower SES because of difficult economic conditions in their cities (Nyange, 1993). Urban and peri-urban agriculture has been gaining popularity in Tanzania in the past years. Low-income families are undertaking most of horticultural production where high income has biased towards raising dairy cattle (Nyange and Mdoe, 1995). Today, however studies suggest that, the activity is no longer the exclusive preserve of people of lower SES and wider ranges of people are engaged in urban agriculture for a variety of social, economic and cultural reasons (Mlozi, Mvena and Lupanga, 1991).

UA is a diverse, omnipresent, thriving, and profitable activity in cities all over the world, both for low-income and high income people (Smit and Ratta, 1992). These activities however vary enormously, both within and between countries, as well as throughout urban social economic status. Another benefit of urban agriculture not widely recorded is the "fungible" income. Fungibility is the ability to provide for extra income that can be spent on essentials like health care and education. This is important where over 50% of the family expenditure is for food (Mlozi et al., 1992).

A major advantage of UA is its potential to improve the socio-economic conditions of unemployed youth and low-income people. UA in developing countries in relation to rural agriculture has the following characteristics: high productivity per unit space, low capital per unit production, low energy consumption, low marketing cost, and freshness of the products (Smit, 1980). In Tanzania, the contribution of small-scale horticultural production both at household and at the national economies is unknown. Small-scale garden can be managed without agriculture subsidies, and they use less external inputs than field agriculture (Vuollet, 2000). Garden equipment can be quite simple and inexpensive. The input costs are low, the economic assistance needed is almost none, and the work is done by the household members on part-time basis (Vuollet, 2000).

Household gardens do not, traditionally compete with large agricultural activities. In fact they exist in a complementary fashion, especially since they often are limited to the production of indigenous vegetables and fruits (Opena, 1990). Horticultural products play good potential for generating employment and are frequently produced on small plots thus are important source of additional income for poor farmers in developing countries.

In recent years, there has been a great deal of interest among both policy makers and economic analysts in the role of horticultural products as a principle means of agricultural diversification and income generation in developing countries (Islam, 1990). The growth prospects for income generating activities from horticultural products are therefore favorable for developing countries. Support for household gardens as one part of a developing strategy for private and governmental organizations has fluctuated over the years (Opena, 1990). Conditions for rising production are likely to be favorable in developing countries. This is partly because horticultural products in general are labour-intensive. Developing countries with abundant labour in relation to capital or land enjoy a comparative advantage in labour-intensive horticultural products, against, for example, cereal products which require more land in relation to labour and other inputs for efficient production (Islam, 1990). The growth prospects for income generation activities from horticultural products are therefore favorable for developing countries.

This study intends to investigate the extent to which vegetable production promotes income amongst small-scale growers. Small-scale gardeners may be dealing with other activities, for example, raising livestock and other crops.

1.1 PROBLEM STATEMENT AND JUSTIFICATION

In Tanzania agriculture is the mainstay of the economy and it account for over 60% of the country's foreign exchange earnings and supports about 80% of the population (Bukuku,1993 as cited in Nyange, 1993). Inspite of the large contribution of agricultural sector to the economy, the horticultural industry has remained dominant for many years and its contribution to the foregn exchange is given little attention. (Silk, 1986) says that, in the past UA was a neglected area of study, and presently, it is capturing the attention of a growing number of researchers and international bodies concerned with sustainable human development.

Horticulture involves not only the facets of production, but also the added increments of processing, service and maintenance (Janick, 1979). The prevalence of UA in cities such as Dar-es-salaam, Dodoma and Arusha clearly challenges concepts and common perceptions among mainstream urban economists and planners, which persistently assist that UA is not part of the form and function of the city. Therefore, it is not surprising that city authorities usually perceive UA to be an outmoded transitory activity appropriate only in rural areas. This perception does not concord with the need to feed the ever-increasing urban population (Sawio, 1993:1). There are so many horticultural crops, each of which has different pay back period. If they are grown during a year, the yield may differ greatly from time to time. Therefore this study will focus specifically on vegetable production.

The importance of horticulture is reflected in the national agriculture policy of 1982, which states that, there is a great potential for producing fruits, vegetables and flowers, both tropical and temperate varieties to satisfy domestic needs and for the export markets. With the changing economic conditions in Tanzania during the 1980's and the shift from home gardens and specialized growers, vegetables are coming to play a new role in the economic development strategies that are planned and implemented (Feldman *et al*., 1990). Since people living in urban areas usually have neither space nor the time to devote to gardening, or demand for commercial horticulture. The landless, for example, may have no fields, but they often have at least a small plot or piece of homestead land which could support a kitchen garden and some small stock, used either for income generation (Gill, 1991).

In recent years, horticulture sector in Tanzania has been given more attention and a much higher priority in the allocation of resources (Nyange, 1993). Fruits and vegetables are one of the main sources of nutrients (Vitamins) for the human body. The most important of these vitamins are A and C. Vitamin A deficiency affects roughly 15% of children aged between one and four years in 16 African countries, including Tanzania (Mclean, 1988). According to McLean, prevalence of vitamin deficiency is highest in low-income groups. The most serious illness related to vitamin deficiency is measles, which is the precipitating factor in roughly 0% of the cases of vitamin A blindness. It is further estimated that xerophthalamia leads to between 2,000 and 4,000 new cases of childhood blindness every year.

Table1: Average per capita food intake in Tanzania

Food category	Components	Consumption (gms/day)
Starches	Cassava, banana, other starches	479
Cereals	Rice, maize, wheat, millet, sorghum	417
Vegetables	Various vegetables	104
Animal products	Meats, eggs, milk, fish	96
Fruits	Various fruits	61
Fats and oil	Vegetable and animal origin	8

Source: United Republic of Tanzania, 1980

The observed standard levels of vitamins can be attributed to low consumption of fruits and vegetables. For example, per capital daily vegetable consumption in developed countries is 221g (McLean, 1988) compared to 104g in Tanzania (URT, 1980). Table 1 above indicates that vegetables and fruits are among the least consumed categories of food in Tanzania.

1.2 HYPOTHESIS

1.2.1 NULL HYPOTHESIS

Vegetable production has been carried out not purposely for generating household income.

1.2.2 ALTERNATIVE HYPOTHESIS

Vegetable production has been carried out purposely as an activity for generating household income.

1.3 RESEARCH OBJECTIVES

1.3.1 GENERAL OBJECTIVE

To assess the contribution of the urban vegetable production to the household's livelihood.

1.3.2 SPECIFIC OBJECTIVES

- To assess the contribution of urban vegetable production for livelihoods of the households.
- To assess the strategies used in urban vegetable production
- To identify factors that hinder urban vegetable production

2 LITERATURE REVIEW

2.1 STRUCTURES AFFECTING AGRICULTURE IN THE TROPICS

2.1.1 POPULATION PRESSURE

Despite some uncertainly as to then precise rate of growth, it is common knowledge that the population of most tropical countries has grown rapidly during this century and must be expected to continue to do so at least for some years ahead. The emergence of urban farming in most cities of developing countries has been mainly due to the desire of alleviating poverty and satisfying the nutrition needs of the urban population. The Food Agriculture Organization (FAO) estimated that in 1969 that the population of developing countries as a whole was growing at a rate of 2.5 to 3.5 percent per annum, which indicated that it would be more than doubled by the end of the century (FAO, 1969). To feed this expanding population vastly more food will be needed and much of this will have to come by way of larger yields from land already in cultivation. Unfortunately, however, population pressure has already caused a decline in the productivity of much land farmed by indigenous methods. In Africa, traditional shifting cultivation was formerly capable of providing indefinitely for the subsistence of a sparse population, but in many places increased population pressure has rendered restorative fallow impracticable, or too short to be effective, with the result that soil fertility and crop yields have greatly declined and the land is no longer capable of adequately supporting the people.

2.1.2 FARM EQUIPMENT AND OTHER INPUTS

The widespread demonstration of substantial and economic responses to fertilizers until recently, led to some increase in their use by small farmers, although it was still on a very limited scale. Pesticides have also only been used to a relatively small extent. It is difficult to see how good yields can be obtained in permanent farming systems on the majority of tropical soils without the regular and general use of fertilizers and unless much more resistant crop varieties are bred, insecticides and fungicides will also be needed to avoid loss from pests and diseases. The recent large increases in the cost of these materials therefore posses a serious problem as it makes it doubtful whether small farmers will be able to afford to buy enough of them unless food prices are set or subsidies provided, at levels unlikely to be accepted to governments (Vuollet, 2000).

2.1.3 VEGETABLE FARMING

Vegetable production in Tanzania has had growing importance as a complement to diets and consumption practices as well as for sale in the domestic and export market (Feldman *et al*., 1990). It is the one of the most importance sources of farm income and their cultivation as such occupies an important place in the agricultural development. Urban agriculture is a socio-economic survival strategy for urban poor residents, providing food and employment (Sawio, 1993).

In Tanzania vegetable farming has had a rapid expansion over the last few years since the country started its transition into market economy. This has been accompanied by a marketable changeover in agriculture from traditional and largely subsistence vegetable cultivation towards commercial production for urban sale and export. Inspite of a large and expanding market in urban areas to absorb vegetables produced market functions such as assembling, grading, transport and others seem to lag behind production and the expanding demand for vegetables. This problem has been further magnified by the uncertainty of supply and prices of vegetables in the market risks which in turn affect the decision making process of producers and other market participants (McLean, 1988).

2.1.4 PRODUCTION AND MARKETING OF VEGETABLES

According to Ashimogo (1996), agricultural marketing refers to all the activities associated with agricultural production and with food, feed and fibre assembly, processing, storage and distribution to consumers, including analysis of consumer needs, motivation, and purchasing and consumption behaviour. Agricultural marketing increases the values of horticultural products through the application of the marketing functions i.e exchange, physical and facilitating (Janick, 1972). The Morogoro rural and urban districts are potential for vegetables and fruits production (Mlambiti, 1975). But like other potential vegetables producing areas in Tanzania, currently the vegetables production is mainly subsistence under small scale and is carried out in three spatial environment systems: the peer-urban, open spaces and home gardens (Mlozi, 1998). In Dar es salaam, UA takes place in small open spaces, in valleys, vacant land; land around residential areas and in the institutions and in the peer-urban areas.

The Mount Uluguru slopes are some major producers and suppliers of vegetables (Mlambiti, 1975). The main vegetables include spinach, amaranths, pumpkins (leaves), cabbage, eggplants, tomatoes and Chinese cabbage. These crops are here referred to as major ones because of their relatively large supply and volume; and frequency of availability at the markets.

3 METHODOLOGY

3.1 STUDY AREA

This study was conducted in Morogoro Municipal in Morogoro region. The region lies between latitude 5°58' and 10°0' to the south of equator and longitude 35°25' and 35°30' to the east. It occupies a total area of 72,939 square km which is approximately 8.2% of the total area of Tanzania mainland. Morogoro region covers an extensive area which is well endowed with fertile land, numerous water sources, irrigable areas and low population density (Morogoro region Socio-economic profile, 1997). All these factors make it an attractive area for horticultural investment.

3.2 RESEARCH DESIGN

This research employed a cross-sectional design whereby data were collected at a single point in time from a sample to represent some larger population (Babie, 1994). The design is suitable for data collected through cross-section for description and determination of relationship between variables.

3.3 SAMPLE AND SAMPLING TECHNIQUES

A sampling unit was a household. A total of 35 respondents were sampled to generate required data by using simple random sampling technique.

3.4 DATA COLLECTION METHODS AND INSTRUMENTATION

Interview was the main method used to gather relevant information from 35 vegetable growers in Morogoro Municipal. Semi-structured interview was conducted by using questionnaires with both closed and open ended questions. Observation was another method used to collect information like land size used for cultivating vegetables, cultivation methods used, types of fertilizers used to improve soil fertility etc.

3.5 DATA PROCESSING AND ANALYSIS

The questionnaires were designed in English, but interviews were conducted in Kiswahili for easy data collection due to respondents being conversant in Kiswahili language. The collected data in Kiswahili were then translated in English for coding exercise and analysis.

The translated data in English were then verified, summarized, coded, and analyzed by using Statistical Package for Social Science (SPSS/PC+) version 9.0 for windows, whereby descriptive statistics like frequencies, percentage and coefficient of variability were determined.

4 RESULTS AND DISCUSSION

4.1 FARMERS CHARACTERISTICS

Table 2 shows that of the 35 interviewees, 5.7%, 60%, 28.6% and 5.7% had age between 21-25, 26-35, 36-45 and above 45 years respectively. Most of respondents were found in the age category of 26-35 years. This is the most active group in farming activities. Of all respondents, 80% were male and 20% were female. This implies that, males contributed more to farm production activities than females. In a generalized assumption, it can be said that female labor may be different from male labor in various activities such as building the houses, cleaning the compound and weeding. In farm labor estimation, quasi-farm tasks were ignored that is fetching water, cooking and other domestic chores. However, these activities have some consequences of decreasing amount of female labor available for farm work yet, they are just important as other tasks in the farm. They facilitate pleasure and comfort for family life and welfare.

Results in terms of marital status show that, 20% were single, 65.7% were marriage, 2.9% were widows and 11.4% were divorced. This implies that married people had more access to vegetable production activities than the rest, but this should

not be a surprise since a couple has a great impact in decision making in regard to vegetable production. However, production activities are not only by married people but other groups have to be encouraged to undertake production.

Also table 2 shows that of all respondents, 2.9% had no formal education, 8.6% attended adult education, 71.4% attained primary education, 11.4% had secondary education, 2.9% had standard eight and 2.9% was a diploma holder. This indicates that most of farmers were educated enough to solve their problems and could prioritize allocation of resources pertaining vegetable production in order to make sure that enough income was generated for the households. Therefore, farmers in Morogoro urban and peri-urban stand a better chance in adopting recommended packages/innovations in relation to vegetable production. It should be noted that education is a key factor in making decisions; it is education which influences individual's perception of an innovation before making adoption decision. However, literate farmers are more accessible to technical information like those related to agricultural inputs application than illiterate farmers.

Table 2: Farmers characteristics (n=35)

Variable	Parameter	Frequency	%
Age (years)	21 – 25	2	5.7
	26 – 35	21	60
	36 – 45	10	28.6
	Above 45	2	5.7
Sex	Male	28	80
	Female	7	20
Marital status	Single	7	20
	Married	23	65.7
	Widowed	1	2.9
	Divorced/separated	4	11.4
Education level	None	1	2.9
	Adult	3	8.6
	Primary	25	71.4
	Secondary	4	11.4
	Standard eight	1	2.9
	Diploma	1	2.9

4.2 CONTRIBUTION OF URBAN VEGETABLE PRODUCTION FOR LIVELIHOOD OF HOUSEHOLDS

4.2.1 EARNED INCOME FROM VEGETABLE PRODUCTION PER GROWING SEASON

Results show that 66.7% of the respondents earned income ranging from 36,000.00 - 400,000.00 Tsh, 16.7% of the respondents earned income between 400,001.00 – 800,000.00, 12.5% of the respondents earned income ranging from 800,001.00 – 1,200,000.00 Tsh and 4.2% of the respondents earned income between 1,200,001 – 1,600,000 Tsh. This finding suggests that majority of vegetable growers in Morogoro municipal earn low income per growing season, this might be due to the fact that majority of farmers grow vegetables in relatively small plots (supported in table 13 below).

Table 3: Earned income per growing season

Variable	Category	Frequency	%
Income range	36,000-400,000	16	66.7
	400,001-800,000	4	16.7
	800,001-1,200,000	3	12.5
	1,200,001-1,600,000	1	4.2

4.2.2 CONTRIBUTION OF VEGETABLE PRODUCTION FOR FOOD SECURITY

Table 4 below gives findings that show that 42.9% of all respondents spend between Tshs 191,001 – 282,000 per year to buy food, while 28.6% of respondents spend Tshs 100,001 – 191,000 per year for food, 14.3% of the respondents spend Tshs 9,000 – 100,000 per year, also 14.3% of all respondents spend about Tshs 282,001 – 373,000 yearly for buying food. The

results show no great variations among the frequencies. This implies that, there exist various categories of people among vegetable farmers (employed, livestock keepers and food crops producers). To some extent this integration of activities help farmers to use little amount of money accrued from vegetable production for buying food but those who rely on vegetable production only had to draw much in order to buy food.

Table 4: Amount of money spend to buy food per year

Variable	Category	Frequency	%
Amount (Tshs) spent for food per year	9,000-100,000	1	14.3
	100,001-191,000	2	28.6
	191,001-282,000	3	42.9
	282,001-373,000	1	14.3

4.3 VEGETABLE PRODUCTION STRATEGIES IN URBAN SET UP.

4.3.1 USE OF MEANS TO IMPROVE SOIL FERTILITY

It is observed from the results table 5 below that, most of the respondents (85.7%) accepted to use some means of improving soil fertility, while 14.3% of the respondents did not accept to use any means of improving soil fertility. This indicates that majority of respondents were aware about nutrients recycling whereby exhausted land were fertilized to make sure that productivity per unit land is maintained.

Table 5: Acceptance of using any means of improving soil fertility

Variable	Category	Frequency	%
Acceptance	Yes	30	85.7
	No	5	14.3

4.3.2 USE OF PESTS AND DISEASES CONTROL

Research findings (table 6) show that 74.3% of the respondents accepted to use some means pests and diseases control while 25.7% proved to be in a position of not using any means to control pests and diseases. This result concurs with the principles of improved agricultural technologies which support application of agricultural inputs (fertilizers, pesticides) towards increased and improved production. Application of pesticides tends to add to cost of production but at the same time once carelessly applied can end up polluting environment and leading to little revenue as well.

Table 6: Acceptance of using any means of pests and diseases control

Variable	Category	Frequency	%
Acceptance of using any means for controlling pests and diseases	Yes	26	74.3
	No	9	25.7

4.3.3 INTENSIFICATION IN VEGETABLE PRODUCTION

Vegetable farming is one of the most important sources of farm income. Table 7 below shows that most of the respondents (77.1%) earned income from vegetable production, 5.7% of all respondents accrued income from paid employment, 5.7% of respondents derived income from both vegetable production and livestock farming, 2.9% of respondents were self employed and another 2.9% of the respondents derived income from vegetable production, livestock farming and self employment. Findings suggest that most of respondents concentrated on vegetable production as a major earning activity. This in turn connotes that, owing to hard life and increased unemployment, most urban dwellers do conduct vegetable production in order to supplement income they get from other sources to sustain their life.

Table 7: Major sources of income

Variable	Category	n	%
Major source of income	Paid employment	2	5.7
	Self employment	1	2.9
	Crop production	27	77.1
	Paid employment, crop production and livestock keeping	2	5.7
	Self employment, crop production and livestock keeping	1	2.9
	Crop production and livestock keeping	2	5.7

4.3.4 ADOPTED MEANS OF ACCESS TO LAND RESOURCE

Results on table 8 below show that 34.3% of the respondents acquired land through renting, 42.9% owned land through inheritance, 5.7% of the respondents acquired land by purchasing, 2.9% acquired land after getting permission from the railway authority and 14.3% of the respondents acquired land by both renting and inheritance. This indicates that majority of respondents acquired land by inheritance from preceded generation and implies if they would rent land then could add to the production costs, so it would be difficult to realize income.

Table 8: Means of access to land

Variable	Category	Frequency	%
Means of acquiring the land	Rented	12	34.3
	Inherited	15	42.9
	Purchased	2	5.7
	Permission from railway authority	1	2.9
	Rented and inherited	5	14.3

4.3.5 USING MONEY TO RENTING LAND FOR VEGETABLE GROWING

Table 9 below shows that, most of the respondents (88.2%) were renting land by 2,000-20,000Tsh per season in order to grow vegetable production, 5.9% of respondents paid 21,000-39,000Tsh seasonally for the use of land and also 5.9% rented land by above 39,000Tsh for growing vegetables. This indicates that majority of vegetable farmers in the study area use small (pieces of) plots to grow vegetables (see table 13 below) and this lead farmers to spend small amount of money for renting land.

Table 9: Money paid seasonally to rent land (n=17)

Variable	Category	Frequency	%
Rent	2,000 – 20,000	15	88.2
	21,000 – 39,000	1	5.9
	Above 39,000	1	5.9

4.3.6 REASONABLE EXPERIENCE IN PRODUCING VEGETABLES

Table 10 below shows that 20% of the respondents had below 5 years of experience in growing vegetables, 80% of the respondents had above 5 years of growing vegetables, This finding shows that, majority of farmers in Morogoro Municipal had a substantial experience in growing vegetables. This implies that, since long time ago people in study area have been practicing vegetable production as a livelihood generating source.

Table 10: Experience in growing vegetables

Variable	Category (years)	Frequency	%
No years used by farmers to grow vegetables	<5	7	20
	>5	28	80

4.3.7 SOURCE OF KNOWLEDGE OF VEGETABLE PRODUCTION

Results from table 11 show that, 51.4% of the respondents acquired knowledge of vegetable production from their neighbors, 42.8% of all respondents used their indigenous knowledge to produce vegetables, 2.9% of all respondents derived knowledge from agricultural extension workers and another 2.9% of all respondents were using knowledge of vegetable production which they were taught from primary school gardening. This finding implies that, extension staffs that to a great extent are responsible in dissemination of agricultural packages had least impact to farmers except that farmers rely knowledge which they copy from how their neighbors do as well as their indigenous knowledge.

Table 11: Source of knowledge of vegetable production

Variable	Description of variable	n	%
Source of knowledge of vegetable production	Neighbors	18	51.4
	Indigenous knowledge	15	42.8
	Extension workers	1	2.9
	Primary school gardening	1	2.9

4.3.8 DIVERSITY OF SEASONS USED FOR CULTIVATING VEGETABLES

Research findings (table 12) show that 48.6% of the respondents grow vegetables throughout a year, 28.6% of the respondents grow vegetables once a year, while 14.3% of the respondents grow vegetables twice a year, and 8.6% of the respondents grow only amaranths throughout a year but other types of vegetables are grown once a year. This finding implies that, farmers in Morogoro municipal are able to produce vegetables throughout a year due to the fact that existence of river Kikundi that originates from Uluguru mountains supplies water which is useful in irrigation of vegetables and it was discovered above that farmers apply means to control pests and diseases.

Table 12: Number of seasons per year used for cultivating vegetables

Variable	Description of variable	Frequency	%
Number of seasons	Amaranths throughout but others once a year	3	8.6
	Once	10	28.6
	Throughout	17	48.6
	Twice	5	14.3

4.4 CONSTRAINING FACTORS FOR VEGETABLE PRODUCTION

4.4.1 CLIMATIC AND MARKETS RELATED FACTORS

Generally, pests and diseases, market and insufficient water supply are problems that hinder Morogoro urban vegetable production to the extent that producers fail to produce throughout a year. Table below shows that lack of markets whereby 40% of all respondents gave this information that in the area is a great problem for vegetable producers. This may be due to the fact that, now days-large number of people engage themselves in vegetable production and hence influence supply-demand structure. However market is important to farmers as it can assure them to sell their products. Good and stable market stimulates high level of production and therefore high income. Also pests and diseases outbreak (37.1%) had a substantial effect on vegetable production and productivity. This indicates that there was a need to control them since they influence production and quality of produces that eventually lead to low income to farmers.

4.4.2 ECONOMIC RELATED FACTORS

a) Land size (acres) used for vegetable production

Vegetable growing is often an alternative to farmers whose acreage is too small to provide an adequate income from field crops. From the results in table below, 25.7% of the respondents had land area ranging from 1.10-4.00 acres, 2.9% of respondents had land area between 4.10-6.0 acres and 2.9% of the respondents had land area ranging from 6.10-8.0 acres. However, the majority (68.5%) of all respondents had land area ranging from 0.05-1.0 acres. This finding indicates that, vegetable growers in Morogoro municipal had small plots being pieces of homestead land available for agricultural

(vegetable) production in order to augment their livelihood. However this implies that, major part of land spaces in Morogoro municipal is being used for other activities like residential housing leaving little pieces of land for agriculture (vegetable) growing.

Table 13: Constraining factors for vegetable production

Variable	Category	Frequency	%
Problems that hinder vegetable production	Lack of markets	14	40
	Pests and diseases outbreak	13	37.1
	Insufficient water supply	5	14.3
	Water insufficiency, pests and diseases outbreak	3	8.6
Land size (acres) used to grow vegetables	0.05 – 1.00	24	68.5
	1.10 – 4.00	9	25.7
	4.10 – 6. 00	1	2.9
	6.10 – 8.00	1	2.9
Support provision to vegetable growers	Supported	1	2.9
	Not supported	5	97.1

b) Support provision to urban vegetable growers

Also table 13 below indicates that 97.1% of all respondents were not supported and 2.9% were receiving support for vegetable production. This implies that, there were almost no supporting systems amongst Morogoro urban vegetable growers. The reason behind may be due to the fact that, majority do conduct production under individual basis and therefore it becomes difficult for donor agencies to provide support/fund basing on individual basis. Opena (1990) says support for household gardens as one part of a development strategy for private and governmental organization has fluctuated over the years. Technological changes in agriculture, such as the use of mechanization, fertilizers, improved seeds, pests and disease control measures require greater capital investment at the farm level, however under these conditions, and support is an essential factor for a poor resource-farmer to achieve high production and productivity.

4.5 CORRELATION RESULTS

Pearson's product moment correlation coefficients (r) between the income and some independent variables are given in table below.

Table 16: Correlation coefficients with income generated

Independent variable	Correlation coefficient (r)	Coefficient of determination r^2 (%)	Significant levels (P-value)
Age of respondents	-0.926	86	0.123 ns
Area used for vegetable production	+1.000	100	0.001**
Money paid to rent land per year	+1.000	100	0.007**
No years used by farmers to grow vegetables	+0.994	99	0.036*
Amount of money spent to buy food per year	+0.482	23	0.340 ns

*Key: ** = Highly significant, * = Significant, ns = none significant. At confidence interval 5% (P < 0.05)*

According to Cohen and Holliday (1982), cited in Bryman and Gramer (1992) correlation coefficients are interpreted as follow: below 0.19 is very low, 0.20 - 0.39 is low, 0.40 - 0.69 is modest, 0.70 – 0.89 is high and 0.90 – 1.00 is very high. In a tentative explanation, it can be observed from the results that vegetable production in urban areas contributes significantly to income generation.

Age of respondents had a negative correlation (r= -0.926) with income generated. This is a stronger relationship between these variables, meaning that higher incomes were associated with lower levels of age and the vice versa is true. Its coefficient of determination is 86% that means 86% of variation in income generated may be due to differences in age of respondents.

Area (acres) used for vegetable production showed perfect relationship (r=1.000) with income generated. This means that as area used for producing vegetables increased, the income generated also increased. Its coefficient of determination was 100% meaning that area that was used explained 100% of the variation in income generated.

Amount of money paid for hiring land (rent) indicated perfect relation (=1.000) with income generated. This implies that the amount of money paid to the owner of land increased as the earned income increased, It can mean that land utilization was under an agreement between the owners and users (vegetable growers), that is coefficient of determination of 100% meant that 100% of the variation in income generated might be due to amount of money paid per season for the use of land.

Time (years), the farmers started growing vegetables showed strong relationship (r=0.994) with the income generated. This finding shows that higher incomes from vegetable production were associated with long time/many years that farmers were producing vegetables. This means 99% of the variation in income was substantially caused by number of years that farmers grew vegetables.

Amount of money spent per year for buying food seemed to have weak relation (r=0.482) with income generated. This finding shows that income generated increased with decreased amount of money spent yearly for buying food. This may be due to the fact that probably farmers had other sources of getting food other than relying on incomes from vegetable production. Thus any increase in income seemed to have little or lower supplement towards buying food. Coefficient of determination was 23%, which means 23% of the variance in income generated, could be attributed to amount of money spent per year for buying food.

4.6 T – TEST RESULTS

t – test was carried out in order to test the hypothesis of the research that vegetable production has been carried out not purposely for generating household income (null hypothesis) and vegetable production has been carried out purposely as an activity for income generation (alternative hypothesis).

A t-test gave significant results between the dependent variable and the following independent variables: area used for vegetable production (P=0.001), it is very likely that significance has been expressed because different farmers possessed different land sizes. Amount of money spent for hiring land (P=0.007), the significance may be due to income generated per unit area that means higher rent was a result of higher income generated. Also number of years used by farmer to grow vegetables had significant impact (P=0.036) on income generated. This implies that farmers with many years in growing vegetables were more liable to get higher income than the other group of producers. The reason behind is the experience built on vegetable production.

Other independent variables showed non significance, these are age of respondents (P=0.123) and the amount of money spent for buying food (P=0.034). The latter implies that probably farmers had other means or sources of getting foods for instance production of food crops instead of relying on income earned from vegetable production.

5 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Study in Morogoro Municipal shows that majority of respondents depend on vegetable production as the only source of their income meaning that profitability of vegetable production is substantially attained. Increased production in study area will contribute to improved people's livelihoods in terms of increased income, vegetable consumption and nutrition which will eventually contribute to improved health status.

The study highlighted a number of significant constraints which limit productive capacity. Among the constraints was a market for vegetables. Lack access to market inhibit farmers to attain higher production and productivity as they are not sure of market, this situation affects vegetable produces due to their perishability nature.

The study has revealed that, most of farmers acquired knowledge of producing vegetables from their neighbours as well as they have indigenous knowledge. These sources of knowledge have been transferred successful from one generation to another with negligible impact of extension services. Even if innovations can be available at affordable costs in Morogoro Municipal, it can not reach majority of farmers at a greatest need of technical assistance and advice.

Despite of the vegetable production in study area contributes to income generation, but limited land holdings - where majority of households (68.5%) own 0.05 – 1.00 acres – inhibit expanding productive capacity. Small size of most farm units plus persistent poverty of a large proportion of vegetable growers limit adoption of technology that could increase labour efficiency and urban income.

Farmers produce vegetables under individual basis, the situation which makes it difficult to overcome barriers in vegetable product chain management.

5.2 RECOMMENDATIONS

This research suggests that, there should be a review of present research-extension-farmers link to be more effective with a great attention that it provides knowledge, information and skills on vegetable products chain management to farmers. This will help respective farmers to know the importance of improving vegetable management practices for higher productivity and subsequently more profitability.

There is a need for growers to form or to be mobilized into groups. Such networking can help to inform each others on various matters pertaining to vegetable products chain management including improved production technology and marketing. However, there is a need for an effective system of market information collection and management.

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Microflora and Processing method of *adjuevan*, an Ivorian fermented fish condiment

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ABSTRACT: This study was designed to describe the processing of a traditionally fermented fish named *Adjuevan* in Côte d'Ivoire. We studied the processing techniques, the percentage of salt used and the microflora composition of the *Adjuevan* prepared from *Chloroscombrus chrysurus*. The fermentation process is done in 4 or 7 steps respectively according to the size of fish: gutting, carving, washing, prefermentation, salting, fermentation and drying. *Adjuevan* is obtained with an average of 35.09% marine salt. A total of 72 samples of *adjuevan* were analysed. The Mean values of pH were 5.38 ± 0.27. The microbial load of *adjuevan* samples revealed a range of 2.1 10^5-2.8 10^5 cfu/g for the total count. The predominant microorganisms were lactic acid bacteria (1.3 10^3-1.2 10^4 cfu/g) followed by *Bacillus* (4.7 10^2- 3.3 10^3 cfu/g), with a frequency of isolation of 100%. *Pseudomonas* and *E. coli* were not detected in the *adjuevan* samples analysed but *Staphylococcus* was isolated with a prevalence of 60.65%. These contaminations can represent a risk for the consumers and also for the public health. It comes out that *adjuevan* is found not to be safe microbiologically.

KEYWORDS: Adjuevan, fish, fermentation process, salt, microorganisms.

1 INTRODUCTION

Fish is an important food in human diet. Artisanal fish processing remains the predominant and most important method of fish preservation in Africa. The principal methods are smoking, sun-drying, salting, fermentation, grilling and frying [1],[2]. These processes may either be used alone or combined in order to achieve the desired product. Salting and sun-drying are often combined to get a well preserved product. The final product is distinguished by peculiar qualities such as aroma, flavour and colour according to the consumer's preference [1], [3], [4].

The choice of fish processing method is greatly influenced by socio-economic factors. For instance, in Côte d'Ivoire, due to the availability of fuel wood and solar salt, a lot of fish is smoked, fermented or salted and dried. These cured fishery products are the most popular form in which fish is generally consumed in Côte d'Ivoire. Fish is usually consumed after being cooked in a sauce, braised, roasted, fried or cured [5]. Different types of cured fishery products are normally used to prepare the family meal in order to achieve a desirable flavour in the sauce which is eaten with the traditional starchy staples such as cassava, plantain, yam or rice [4]. Fermentation is one method of fish curing in which the development of a distinctive flavour in the final product is the principal objective [6], [7], [8]. Therefore, this product is mainly used as a condiment in the preparation of traditional sauces [9], [10].

In Southeast Asia the fermentation process often lasts several months and the final product is usually a paste, a sauce (liquid) [11], [12]. Fish sauce is called "nam pla" in Thailand, "nuoc mam" in Vietnam, "patis" in the Philippines, "shottsuru" in Japan, "ngan-pya-ye" in Burma, "tuk trey" in Cambodia, "nam pa" in Laos, and "yeesui" in China. The name basically means "fish water" [1], [13], [14].

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In the West African region, and particularly in Côte d'Ivoire however, fish fermentation lasts from a few hours to about two weeks. Fermented fish is called in Ghana "momoni", "lanhouin" in Bénin, etc. [9], [10]. Fermented fishery products in Africa may either be soft with a high moisture content, semi-dry or very dry. Some products are also heavily salted and dried whilst others are dried without any salting.

In Côte d'Ivoire, fermentation practices are also used and fermented fish conduct to a fermented condiment called "*Adjuevan*" [8],[4]. It is a fermented condiment used as flavouring agent in soup and sauces, as an exhauster of the taste, giving a particular flavour and authenticity. *Adjuevan* is produced in presence of high salt concentration. This product is popularly used and appreciated as condiment in many types of flavourings and cuisines for seasoning sauces for the consumption of *foutou* yam, *foutou* plantain, *attiéké*, *placali*, *bêdêcouman*, etc. [15], [3], [16], [17] . When used in sauce, *adjuevan* imparts a distinct aroma and flavour on its own. *Adjuevan* is inexpensive, available everywhere, convenient to all social classes and very popular despite its strong and unpleasant odour.

Despite the fact that *adjeuvan* is well known and used by the Ivorian population, very few scientific study of this product was performed. Indeed, to the best of our knowledge, there is no report in the literature on *adjuevan* processing. Thus, the aim of this study is to determine the fermentation process, the percentage of salt used, and to evaluate the microbiological status of *adjuevan.*

2 MATERIAL AND METHODS

2.1 MATERIAL

The study was carried out on *adjuevan*, a fermented fish made in Côte d'Ivoire. The fermented fish were purchased the same day of each experiment from the unique collective fish fermentation processing site, located in Vridi Zimbabwé (Abidjan, Côte d'Ivoire). The salt was obtained from retail outlets in Abidjan.

2.2 METHODS

2.2.1 SAMPLING

Three processing posts (PP) coded PPA, PPB and PPC were randomly chosen among the 9 that were available at the unique collective fish fermentation processing site in Abidjan. Sampling was done every week over a period of 6 months. Samples were collected per processing site at the end of the fermentation process, from a basket containing the fermented fish, one day of a week and the same day of production. A processing site is defined as a space shared by 3 to 5 processors (women); it is equipped with a well, a dryer, and one or several round-shaped concrete tanks, barrels, buckets (for water drawing from the well), rattan baskets or made in bamboo bark. The capacity of a basket ranges from about 2000 to about 3000 fermented fishes according to the size of *adjuevan*. A sample consisted of 3 to 5 fermented fishes (200 to 300 g) from the same basket. A total of 72 samples of *adjuevan* were randomly and aseptically collected at a week interval. Samples were collected into sterile plastic bags (30x40 cm) and stored in icebox filled with ice and transported to the laboratory for analysis.

2.2.2 *ADJUEVAN* PROCESSING

The process of *Adjuevan* production and the environment of processing were observed using the 9 processing sites with 20 processors (women) at the unique collective production site in Abidjan, located in the periphery of the industrial zone of Vridi, township of Port-Bouet, a commune of the district of Abidjan, on the border line of the Ebrié lagoon. The site and the process observed were then described (fig.1).

2.2.3 DETERMINATION OF *ADJUEVAN* PH

The pH of the samples was measured with a pH-meter (Hanna Instrument HI 9318) on a mixture of 20g of blended *adjuevan* meat and 80 ml of distilled water.

2.2.4 DETERMINATION OF THE PERCENTAGE OF SALT USED

The percentage of salt used for *adjeuvan* production was determined using the following technique: the total mass (M_p) of fish to ferment is determined as well as the initial mass (M_i) of the salt bag where the appropriate quantity of salt for fermentation will be withdrawn. After the withdrawal of the necessary amount of salt, the final mass (M_f) which is the quantity of the remaining salt in the bag is determined. The percentage of salt used during fermentation is obtained following this formula:

$$\% \text{ salt} = (Mi - Mf) \times 100 / Mp$$

Mi = initial salt bag mass (kg)

Mf = final salt bag mass after use (kg)

Mp = quantity of fish used for fermentation (kg)

2.2.5 MICROBIOLOGICAL CHARACTERIZATION OF *ADJUEVAN* SAMPLES

Each sample of *adjuevan* is cut into pieces and ground in a stomacher into a homogeneous mixture. Twenty five grams of the mixture were suspended in 225 mL of sterile peptone buffer and homogenized again for 30s at a normal speed. The homogenates were used for all the microbiological analyses. Counts were enumerated according to the methods stated in Compendium of Methods for the Examination of Foods [18] and Food and Drug Administration (FDA) [19]. Suitable decimal dilutions were pour-plated on Plate Count Agar (AES Laboratory) for total aerobic count.

Staphylococci spp. were determined on Baird Parker Agar (Oxoid CM 275) at 37°C for 24-48h. Typical black colonies with zones around and atypical black colonies were considered as *Staphylococcus* sp. *Escherichia coli* (*E. coli*) was determined on Violet Red Bile Lactose Agar (Oxoid CM 107) and incubated at 44°C for 24h. Pink-red colonies with precipitation were streaked on Endo Agar (Oxoid CM) and incubated at 37°C for 24-48 h. The isolates were characterized phenotypically using Portoir réduit De Leminor and a positive indole reaction in the Tryptone Water indicated the presence of *E. coli*. We investigated lactic acid bacteria on Man Rogosa and Sharpe Agar (MRS) (Biomérieux) with the pH adjusted to 5.5. *Pseudomonas* sp. were isolated on Pseudomonas Agar (Oxoid CM 559) aerobically at 30°C for 24-48 h. Oxidase (+) colonies were taken into consideration. Bacilli were investigated on Dextrose Tryptone Agar (DTA, Oxoid CM 75) and the plates were incubated for 48 h at 35°C. MRS plates were incubated anaerobically at 30°C for 48 h, while others were incubated at 30°C for 48 h. Selected distinct colonies were enumerated. Duplicate agar plates of between 30 and 300 colonies were counted, and mean counts calculated. The colonies appearing were counted as Colonies Forming Units / g wet weight of sample. All tests were carried out in duplicate.

3 RESULTS AND DISCUSSION

3.1 RESULTS

3.1.1 *ADJUEVAN* PROCESSING

The unique collective site for *adjeuvan* production in Abidjan, is an open site of about 3000 m^2 surrounded by refuse with at least 40 brine barrels and 15 drying grids and leads used by about thirty processors. For the preparation of *adjuevan*, different types of fish can be used, but usually *Chloroscombrus chrysurus*, an atlantic bumper is frequently used. The fishes are gutted followed by carving (larger size) washing, pre-fermentation, salting, fermentation and drying. The plastic bags, barrels and baskets are never washed and the microorganisms inside these materials may serve as starter cultures for spontaneous fermentation.

Two processing techniques exist in Côte d'Ivoire depending on the size of the fish: smaller fish (weight < 600 g) technique and that of larger species of fish (weight > 600 g). Only fish of the same species are fermented together. The mixture of species is proscribed. The end product named *adjuevan* is golden light brown in colour with a semi-dry, firm texture and a characteristic strong smell (fig.1).

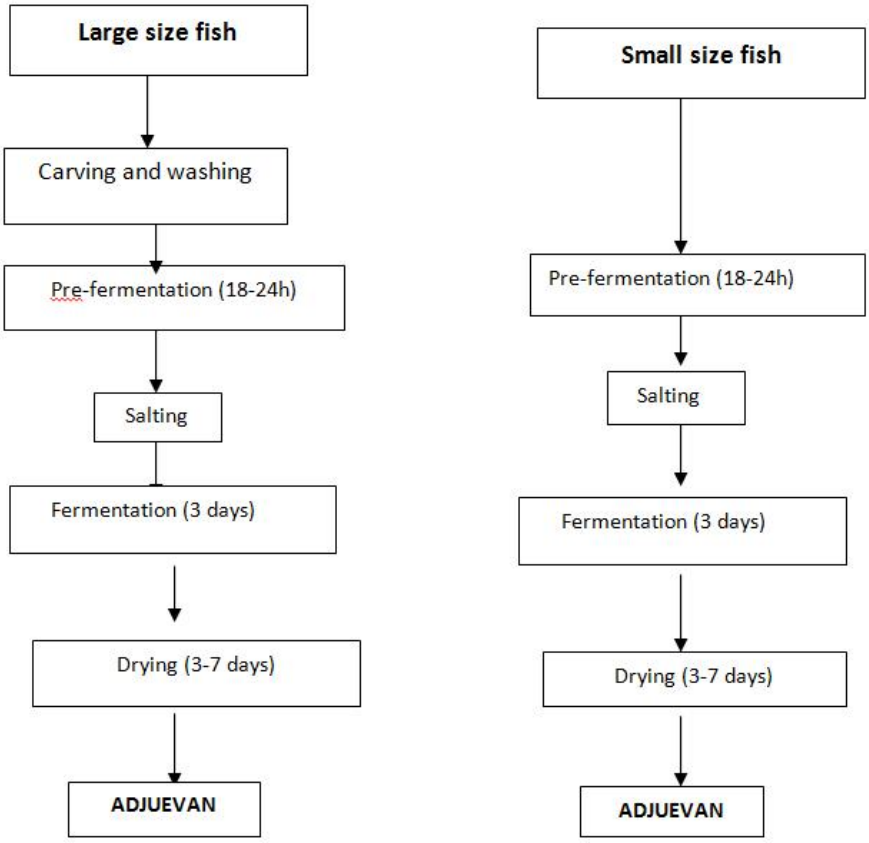

Figure 1: *Adjuevan* processing of large size and small size fish

3.1.2 PROCESS OF LARGE SIZE FISH FERMENTATION

When fish weight is at least 600 g (shark, captain, carp…), fermentation is made by immersion. Fish are first gutted, rinsed, cut into pieces of at least 400 g, rinsed again and then arranged into baskets. The baskets are covered with plastic or jute bags for about 18-24 h. This is the pre-fermentation stage. After the pre-fermentation, the fish are withdrawn from the baskets, placed in concrete fermentation tanks with alternate layers of salt. The tanks are topped with a layer of salt. Then a woven bamboo mat or plastic bags are placed over the fish and weighted down with heavy rocks to keep the fish from floating. After three days of fermentation, the fermented fish are withdrawn from the tank, sun-dried during an average of three days before being marketed as *adjuevan*. However, the fermented fish can remain on the driers until the delivery that takes place within a maximum of seven days. During that period, *adjuevan* is withdrawn from the driers every evening to be dried again the following day.

3.1.3 PROCESS OF SMALL SIZE FISH FERMENTATION

As opposed to the fermentation process of larger fish, the fermentation of the smaller fish (<600 g) as generally that of the Carangidaes family (jacks, pompanos, jack mackerels, and scads, leatherjackets, etc.) is not made by immersion.

The whole small fresh fish are not gutted but wrapped directly in bags made of jute, and left to ferment for 12-24 h. that is the pre-fermentation step.

Then, the pre-fermented fish are placed in concrete fermentation tanks with alternate layers of salt as stated for larger size fish, then the following steps are the same as for the larger size fish.

3.1.4 PERCENTAGE OF SALT AND PH OF *ADJEUVAN*

Depending on the processing post, the percentage of salt used for *adjuevan* production ranged from 30.42 to 44%, while the pH of *adjeuvan* ranged from 4.9 to 6.01 (Table I).

Table 1. Percentage of salt used during *adjuevan* production and mean value of pH in *adjuevan* according to processing post (PP)

	I	II	III	Mean values
Mass of salt used (kg)	25.23 ± 20	28.5 ± 11	22.72 ± 10	25.5 ± 14
Mass of fish produced (kg)	83 ± 12	72 ± 6	63 ± 9	72.06 ± 9
Percentage of salt (%)(w/w)	30.42	39.6	44	35.09
pH	6.01 ± 0.3	5.23 ± 0.21	4.9 ± 0,3	5.38 ± 0.27

3.1.5 MICROBIOLOGICAL CHARACTERISTICS OF *ADJEUVAN*

The microbial load of *adjuevan* samples revealed a range of $2.1\ 10^5$ to $2.8\ 10^5$ cfu/g for the total count, $4.7\ 10^2$ to $3.3\ 10^3$ cfu/g for *Bacillus*, $1.1\ 10^2$ to $4.1\ 10^3$ cfu/g for *Staphylococcus*, $1.3\ 10^3$ to $1.2\ 10^4$ cfu/g for lactic acid bacteria. *Pseudomonas* and *E. coli* were not detected in *adjuevan* (Table 2). Total aerobic count, *Bacillus* and lactic acid bacteria were found in all the samples of the three processing posts with a prevalence of 100%, while *Staphylococcus* spp. prevalence ranged from 58.14 to 62.5% depending on the processing post (Table 3).

Table 2. Mean values of bacterial load (cfu/g) in *adjuevan* according to the processing post (PP)

Microorganisms (cfu/g)	**Processing posts**			
	I	**II**	**III**	**Mean values**
TAC	$2.8\ 10^5 \pm 7.1\ 10^4$	$2.4\ 10^5 \pm 7\ 10^4$	$2.1\ 10^5 \pm 6.8\ 10^4$	$2.4\ 10^5 \pm 7\ 10^4$
Escherichia coli	<1	<1	<1	<1
***Staphylococcus* sp**	$4.1\ 10^3 \pm 7.1\ 10^2$	$1.1\ 10^2 \pm 84$	$2.2\ 10^3 \pm 1.2\ 10^3$	$2.1\ 10^3 \pm 6.6\ 10^2$
***Bacillus* sp**	$2.8\ 10^3 \pm 1.310^3$	$4.7\ 10^2 \pm 3.2\ 10^2$	$3.310^3 \pm 3.8\ 10^2$	$2.2\ 10^3 \pm 6.3\ 10^2$
Pseudomonas	<1	<1	<1	<1
LAB	$1.2\ 10^4 \pm 8.610^3$	$1.2\ 10^4 \pm 1.3\ 10^3$	$1.3\ 10^3 \pm 10^3$	$8.4\ 10^3 \pm 3.6\ 10^3$

TAC = Total aerobic count ; LAB = Lactic acid bacteria

Table 3. Prevalence (%) of bacteria isolated in *adjuevan* according to processing post

Microorganisms	**Processing posts**			
	I	**II**	**III**	**Mean values**
Total aerobic count	100	100	100	100
E. coli	00	00	00	00
***Staphylococcus* sp.**	62.5	58.14	61.3	60.65
***Bacillus* sp.**	100	100	100	100
Pseudomonas	00	00	00	00
Lactic acid bacteria	100	100	100	100

3.2 DISCUSSION

Adjuevan is made from small or large fish, but small fish, particularly the Atlantic bumper, *Chloroscombrus chrysurus,* an ecologically important species in the southern Gulf of Côte d'Ivoire, which is seasonally abundant, is used. This small fish (length and width ≤ 20.5 and 8 cm respectively) would otherwise have little value for consumption. Smaller fish are easily dehydrated by the salt and dry readily. Larger varieties of fish, such as captain and shark or carp also make good *adjuevan*, but because they are relatively more expensive due to their value as food fish, they are seldom used in the commercial production of fermented fish. This argument confirms that of [20] and also [4] who reported that fish used for fermentation are usually small, with low commercial value and seasonally abundant.

Larger and smaller fish fermentation processes are almost similar. *Adjuevan* processing is done in 4 or 7 steps according to the size of the fish used: gutting, carving, washing, prefermentation, salting, fermentation and drying. The results of this study are almost similar to those of [10] who indicated that "lanhouin", a fermented fish produced in Benin, is processed in 5 or 6 steps. Gutting reduces the microflora of fish gut; washing cleans residues of viscera and others and carving is done to favour brine spreading. Washing can reduce or eliminate some microflora from digestive tract. However, the development of microorganisms is essential for the final characteristic of product. Consequently, unwholesome or inferior quality small raw fish is often processed into fermented products which are, however, acceptable by traditional quality standards.

The objective of the prefermentation is to obtain the softening of the fish. This step is done in 18-24 h. During this step, the fish undergo a process of tissular degradation due to the activity of microorganisms which leads to a soft product because the fish loose their rigidity (*rigor mortis*) [21] . For larger fish, the prefermentation is realized after gutting, carving and washing while for smaller fish, the prefermentation is done directly after purchase. The *post mortem* degradation processes that take place in the fish muscle gradually modify the initial state of freshness. Tissue degradation is accompanied by drastic myofibrillar proteolysis produced as a consequence of the activation of proteolytic enzymes [22], [23].

Salting in fish processing may either be by dry salting (smaller fish) or wet salting (larger fish). In dry salting, the granular salt is applied directly to the fish either in the gills or on the surface. *Adjuevan* is obtained with an average of 35.09% salt (w/w). In Africa, the percentage of salt for fish fermentation process is different for each country depending on the cost of the salt [1]. In the coastal countries such as Côte d'Ivoire, Ghana and Senegal, marine salt is produced by the natural evaporation of sea water and is readily available and inexpensive (easily accessible). Therefore, fermented fish is heavily salted. This could explain the high usage of salt for *adjuevan* processing. The results obtained in this study are in accordance with those used for fermented fish in European and Asian countries [24] [25], [9], [20]. Our results are also similar to those of [10] who reported the percentage of salt used to process “lanhouin” to be between 20 and 35%. [20] stated that the high concentration of salt was used to maintain the product under adequate microbiological control. Salt and fermentation time are responsible and influence the final product quality. Salting inhibits the environmental microorganisms from the water used for washing or on the working material and the undesirable microorganisms not necessary for fermentation. Salting also dehydrates the fish partially through osmosis. The partial dehydration inhibits the photolytic endogenous enzyme activity responsible for histamine (a toxic compound for human) production [20].

Fermentation for *adjeuvan* production lasts 2 to 3 days. Only the microorganisms that are able to develop under high salt concentration will participate to this step. *Adjuevan* is prepared through a spontaneous anaerobic fermentation, commonly initiated by repeated use of the same utensil and reuse of the brine at ambient temperature (30±2°C). The texture of *Adjuevan* was not significantly affected by the fermentation, compared to fermented fish such as Norvegian rakefisks, Suedish surchomings and Vietnam fermented fish [1], [26] . This means that the anaerobic degradation is not advanced and consequently, the fish can be used as a condiment but not eaten as food fish because of the strong smell.

The last step is sun-drying which reduces the water activity in *adjuevan*. This step is also observed during the fabrication of “lanhouin”, but to the difference of *adjuevan* which is directly dried after fermentation, “lanhouin” is washed after fermentation before the drying step [10]. Drying is a delicate and hard operation that lasts from 3 to 7 days depending on the season. This step is partly responsible for the quality of *adjuevan*. An insufficient drying can favour not only a quicker microorganisms development during the preservation, but also enzymatic reactions which can negatively modify the organoleptic quality of the contaminated product. During the drying process, fermented fish are exposed to insect infestation and microorganisms contamination, and therefore requires periodic re-drying to maintain a good quality. *Adjuevan* is obtained after this last drying step.

The pH values of the *adjeuvan* (below 7) are similar to those of *momoni* and *lanhouin*, fermented fish from Ghana and Bénin respectively [9],[5] and are also in accordance with pH values usually reported on other fermented products. These pH values are due to acid production during the fermentation.

The enumeration of the total aerobic count on samples showed a high microbial population in *adjeuvan*. The predominant microorganisms were lactic acid bacteria followed by *Bacillus*. Various authors have reported similar microflora in fermented fish products [24], [27], [9], [8], *Pseudomonas* and *E. coli* were not detected in *adjuevan*. This result shows that *adjuevan* is weakly subjected to faecal contamination and *Pseudomonas* spoilage. This may have been the result of the salt concentration. These observations correlated with the work of[28] who demonstrated that some lactic acid bacteria strains had bactericidal activity on *E. coli*. Bacilli and lactic acid bacteria generally considered as a normal microflora of such products were present in all the samples analyzed with a prevalence of 100%. Lactic acid bacteria could be useful for fermentation.

The presence of *Staphylococcus* sp with a prevalence of 60.65% is significant and shows that there is a need for improved handling and processing procedures of *adjuevan.* These results are in agreement with those of [5] and [29] who indicated the presence of Staphylococci in fermented fish. *Staphylococcus* may play a potential role in fermented fish with production of volatile fatty acids [30]. *S. aureus* are normal flora in human and animal, their presence in foods is an indication of excessive human handling [31]. The concentration of the salt used could not only inhibit the microflora of the fish surface, but also select microorganisms such as *Staphylococcus* and lactic acid bacteria responsible for the fermentation [5].

The reuse of the brine may be a potential source of bacterial contamination to fresh batches of fish. The bacterial load of the brine becomes extremely high. Contamination of fermented fish can come from the processing equipment (tanks, drying

racks, baskets…) which are reused [8]. These contaminations can represent a risk for the consumers and also for public health. However, fermented fish have not been reported to be responsible for infection [3].

4 CONCLUSION

Fermentation is an important method of preservation and helps to salvage fish which would otherwise have been thrown away. It comes out that *adjuevan* is found not to be safe microbiologically. Bacilli and lactic acid bacteria were found in all the samples of *adjeuvan*. The sanitary conditions of fermented fish production were generally found to be poor and the processing methods were not standardized. In the light of the observations made, we suggested to the processors to respect hygienic conditions in order to improve the quality of *adjeuvan* and enhance the intra-regional trade of fishery products.

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Facteurs d'abandon de la récupération nutritionnelle des enfants de moins de cinq ans en Guinée

[Factors abandoning the nutritional recovery of children under five years in Guinea]

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RESUME: La Guinée a ratifié toutes les conventions des droits des enfants à l'alimentation à la santé. En l'absence de projets de nutrition publique durable et de large échelle, elle bénéficie ponctuellement de l'aide d'ONGs étrangères de lutte contre la malnutrition aiguë. Suite à l'intervention d'une de ces ONG dans la commune de Matoto, six centres de santé ont été intégrés pour assurer la continuité des activités de nutrition. Malgré la gratuite des services de nutrition et de soins, il a été constaté de plus en plus l'abandon du programme par les bénéficiaires. C'est dans le cadre d'une meilleure compréhension des raisons et la prévention des facteurs d'abandon liés à la récupération nutritionnelle que s'inscrit ce travail.
Une étude cas-témoins a permis d'identifier les charges familiales des accompagnants (44, 19%) et les déplacements de l'accompagnant (37.21%) comme les principales raisons (P<0.0001) de l'abandon. Parmi les facteurs, nous avons identifié qu'il y a moins d'abandons lorsqu'il n'y a eu aucune absence (OR = 0,07[0,03-0,18]) et plus d'abandons lorsque la durée probable de la récupération a été expliquée à l'accompagnant (OR=2,71[1,28-5,70]).
L'amélioration de cette situation est bien possible en Guinée. Pour y parvenir, nous proposons que soient prises des mesures de sensibilisation des accompagnants, de flexibilité dans la distribution des vivres aux bénéficiaires, de décentralisation approfondie et d'extension des activités de nutrition.

MOTS-CLEFS: Malnutrition, raison d'abandon, programme, réhabilitation nutritionnelle, traitement, Communautaire, Guinée.

ABSTRACT: Guinea ratified all the conventions of the rights of the children for the food in the health. In the absence of projects of sustainable public nutrition and wide scale, it benefits punctually from the assistant of foreign NGOS of fight against acute malnutrition. Further to the intervention of one of these NGOs in the municipality of Matoto, six health centers must to be integrated to assure the continuity of the activities of nutrition. In spite of the free of the departments of nutrition and care, was noticed more and more the abandonment of the program by the beneficiaries. It is within the

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framework of the better understanding of the reasons and the prevention of the factors of abandonment bound to the nutritional recovery that joins this work.
A case control study allowed to identifying the family responsibilities of accompanying (44, 19 %) and the travels of accompanying (37.21 %) as the main reasons (P < 0.0001) of the abandonment. Among factors(mailmen), we identified that there are fewer abandonments when there was no absence (OR = 0,07 [0,03-0,18]) and more abandonments(relinquishments) when the likely duration of the recovery(recycling) was explained accompanying (OR=2,71 [1,28-5,70]).
The improvement of this situation is very possible in Guinea. To reach there, we propose that are taken the measures of raising sensitization of accompanying, flexibility in the distribution of foods to the beneficiaries, thorough decentralization and extension of the activities of nutrition.

KEYWORDS: malnutrition, reason of abandonment, programs, nutritional rehabilitation, treatment, community, Guinea.

1 INTRODUCTION

« Le rapport annuel de la FAO, l'Organisation des Nations unies pour l'alimentation et l'agriculture estime que l'agriculture mondiale pourrait aujourd'hui nourrir normalement 12 milliards d'humains, presque le double de l'humanité. Au seuil de ce nouveau millénaire, il n'y a plus aucune fatalité, aucun manque d'objectif. La planète croule sous la richesse. Un enfant qui meurt de faim est assassiné. Il n'est pas la victime d'une «loi de la nature » [1].

Pourtant, le rapport 2012 de la FAO estime que 870 millions de personnes, plus que la population des USA, du Canada et de l'Union Européenne combinée souffraient de la faim en 2010-2012 [2].

En 2010, 27% (171 millions) des enfants de moins de 5 ans souffraient d'un retard de croissance et 16% (104 millions) d'insuffisance pondérale [3] dans le monde. Le retard de croissance intra-utérine, le retard de croissance infanto juvénile et l'émaciation sont responsables de 2,2 millions décès chez les enfants de moins de 5 ans **[**4].

Tout cela a des répercutions sur le développement physique, intellectuel et la productivité économique des individus et des Nations **[**5]. La malnutrition aiguë sévère tue au moins un million d'enfants par an, soit en moyenne un enfant toutes les trente secondes. Ces enfants comparés à ceux qui sont bien nourris ont jusqu'à 20 fois plus de risque de mourir [6].

En Guinée, selon l'enquête démographique et de santé (EDS IV) de 2012, le risque de mortalité avant l'âge de cinq ans est de 122 ‰ naissance vivants contre 163 en 2005. En d'autres termes, près d'un enfant sur huit meurt avant d'atteindre l'âge de cinq ans. La prévalence de la malnutrition aiguë est de 10 % dont 4 % sous la forme sévère. Elle atteint plus de 20 % chez les enfants de 12-17 mois(9). Ces chiffres sont dans les seuils d'intervention en santé publique de nutrition, selon les recommandations de l'OMS, l'Organisation Mondiale de la Santé.

Pour lutter contre la malnutrition aiguë, les pratiques ont évolué dans le temps. Au départ, avant les années 2000, toute la prise en charge se faisait dans les hôpitaux et uniquement par les professionnels de santé. Mais à cause de l'abandon des services par les accompagnants des enfants, une nouvelle stratégie a été mise en place au début des années 2000. A cette période, grâce à une nouvelle génération de produits thérapeutiques prêts à l'emploi, le nutritionniste Steve Collins propose d'améliorer l'approche hospitalière par l'approche communautaire [7]-[9]. Ceci permettra que plus de 80% des enfants atteints d'une malnutrition aiguë sans complications médicales de bénéficier d'un traitement au sein même de la communauté. Cette approche a permis de décongestionner le circuit de soins, d'augmenter la couverture et la guérison des malnutris aboutissant à moins d'abandons [10], [11]. Du fait de son succès, cette approche a été conseillée par l'OMS à ses pays membres [6].

Dans l'histoire de la prise en charge de la malnutrition aiguë, l'abandon a été déterminant dans la décentralisation (communautaire) des activités de nutrition. L'abandon du traitement (durée de trois mois) de la malnutrition est défini dans le protocole national comme une absence de deux séances consécutives, deux semaines d'absence [12]. Il a des conséquences tant sur l'individu, la communauté, la couverture du système de soins que sur le respect des engagements de l'Etat vis-à-vis des résolutions internationales.

En Guinée, la malnutrition infantile se présente sous la forme de retard de croissance, d'émaciation et de carences en micronutriments. Elle s'expliquent par la mauvaise pratique de l'allaitement maternel et l'inadéquation de l'alimentation de complément. D'une manière générale, cette malnutrition survient très tôt et parfois touche les enfants avant leur naissance.

Environ 11% des enfants ont un poids insuffisant à la naissance (inférieur à 2,5kg). Parmi les enfants de moins de 5 ans, 40% souffrent de malnutrition chronique dont 20,7% sous la forme sévère [13].

La prévalence de l'émaciation est de 8% chez les moins de 5 ans avec 2,8% sous la forme sévère. Elle varie en fonction de l'âge. Les enfants âgés de 6-11 mois sont les plus touchés : 16,6% dont 6% sous la forme sévère.

L'insuffisance pondérale est de 21% dont 6,7% sous la forme sévère. Elle augmente avec l'âge pour atteindre 30% entre 24-35 mois. Elle est de 23% en milieu rural contre 15,2% en milieu urbain. Les garçons sont aussi touchés que les filles : 22% et 20%, respectivement. La prévalence de l'insuffisance pondérale est associée au niveau d'instruction: 22% pour les enfants dont la gardienne n'a aucun niveau contre 12% pour un niveau scolaire du secondaire et plus. Elle est également associée au niveau de vie du ménage: 23,7% pour les enfants issus de ménages les plus pauvres contre 18,6% pour ceux vivant dans les ménages les plus riches [13].

Pour la carence en micronutriment, il faut signaler qu'en Guinée, l'anémie affecte plus 70% des enfants âgés de 6 à 35 mois et 46% des enfants âgés de moins de cinq ans vivent dans des ménage ne disposant de sel iodé.

Pour identifier les facteurs et comprendre les raisons qui motivent les accompagnants qui abandonnent la PCN des enfants admis dans un programme de traitement de la malnutrition, nous avons cherché dans la littérature les facteurs de risque qui expliquent cette situation. Certes il y a des abandons dans les programmes de récupération nutritionnelle, mais, nous avons trouvé peu d'articles sur l'abandon du traitement de la malnutrition au niveau communautaire. Pourtant, on trouve assez d'articles sur l'abandon de la vaccination, des maladies chroniques (Diabètes, HTA, Obésités, Cancer), des maladies mentales, des infections comme le VIH ou la tuberculose. C'est à la lumière des informations sur ces pathologies et les rapports ou les protocoles nationaux de prise en charge de la malnutrition que nous avons présenté le problème de l'abandon de la PCN des enfants malnutris.

Le poids économique de la lutte contre la maladie est énorme sur le développement. Plus de 20 et 30 milliards de dollars sont engagés par an pour la lutte contre la malnutrition [14]. Ces investissements ont permis d'enregistrer des acquis considérables dans la gestion et la prévention de la malnutrition. Cependant certains problèmes comme l'abandon du traitement de la malnutrition risquent de compromettre ces acquis.

Dans l'identification et l'analyse des causes de l'abandon du traitement de la malnutrition, on a souvent le réflexe de jeter la responsabilité sur les patients, les accompagnants, les professionnels de santé ou sur le système. Les chercheurs, en s'intéressant au sujet de l'abandon du traitement, nous ont permis de répertorier quelques facteurs et raisons.

Au Canada, CATOR Magalie et all. dans leur étude sur la non-observance du traitement de la tuberculose à Montréal, ont trouvé que 19,8 % des patients qui avaient absorbé moins de 80 % des doses totales d'antituberculeux prescrites. Et les facteurs de risques incriminés étaient, naître dans un pays à forte prévalence de tuberculose, les effets secondaires reliés à la médication, le suivi dans une clinique non spécialisée dans le traitement de la tuberculose, l'alcoolisme et la coinfection au VIH [15].

En Norvège, Hasvold PE et coll ont mené une revue sur l'utilisation des rappels téléphoniques et SMS dans l'amélioration du respect des rendez-vous hospitalier par les malades ambulatoires. Il ressort de cette étude que ce moyen a permis de récupérer plus de 29 à 39% des absences potentielles [16].

En Suisse, Wittmer M et coll. dans une étude sur l'attente, la satisfaction et la prévention d'abandon en réadaptation cardiaque, ont trouvé un taux d'abandon de 12,9%. Les raisons étaient l'aggravation de leur état cardiaque, l'obésité, les activités professionnelles, le tabagisme, le veuvage, le niveau de formation supérieure, la profession de haut niveau [17].

Au Bangladesh, Nielsen CC et all ont mené une étude sur les facteurs d'abandon de la réhabilitation nutritionnelle. Ils ont trouvé comme raison d'abandon la perception des accompagnants que l'enfant était amélioré et la non-implication d'autres membres de la famille dans l'accompagnement de l'enfant [18].

En Iran, Khazaie H et all, dans une étude sur les facteurs d'abandon, ont rapporté 20 à 80 % d'abandon. Les facteurs déterminants étaient le jeune âge des patients, le sexe masculin, faible niveau d'éducation, le chômage, le manque d'assurance sur le système de soins et le divorce. Les raisons évoquées étaient l'oubli, l'aggravation de l'état de santé, le sommeil prolongé, la peur de la dépendance au médicament et le manque de confiance de l'efficacité du traitement [19].

Au Sénégal, Faye A et col. ont fait une étude sur les déterminants des abandons de la vaccination. Ils ont enregistré un taux d'abandon de 18,2% entre le BCG et le vaccin antirougeoleux (VAR). Les raisons évoquées étaient entre autres : l'oubli du rendez-vous, le manque de temps, la perte de la fiche de vaccination, le voyage [20].

Au Gabon, Médard Toung Mvé et all. dans leur étude sur les performances du Programme national de lutte contre la tuberculose ont trouvé qu'en 2006, 45 % des patients avaient abandonné le traitement. Les causes rapportées sont: l'insuffisance de moyens financiers et une impression de guérison [21].

L'analyse de certains protocoles nationaux de Prise en Charge de la malnutrition aiguë [22], [12], [23], [24] nous ont permis de trouver les raisons suivantes :

- l'éloignement des structures de prise en charge au domicile des bénéficiaires;
- les occupations ménagères
- la saison de la récolte ou des cultures;
- la participation à des fêtes coutumières ou religieuses
- le flux migratoire des populations (du fait de la sécheresse, de l'insécurité etc..);
- les mères ne comprenant pas le but du programme;
- la mauvaise organisation du service (lenteur des distributions, insuffisance de communication)
- le mauvais accueil
- la rupture des vivres
- l'insuffisance d'amélioration du patient,
- la perception de guérison du patient,
- l'amélioration du statut nutritionnel du patient,
- la difficulté de déplacement de l'accompagnant.

Tout ce qui précède nous permet de comprendre que l'abandon du traitement est un problème de santé complexe, il varie en fonction des temps, des circonstances, des personnes et des systèmes de prise en charge.

1.1 HYPOTHÈSE DE RECHERCHE

La responsabilité des accompagnants de répondre aux charges familiales quotidiennes serait la raison principale de l'abandon de la récupération nutritionnelle des enfants de moins de cinq ans qui ont été suivis dans les six centres de santé de la commune de Matoto.

1.2 OBJECTIF GÉNÉRAL

Identifier chez les enfants, les accompagnants et les services de nutrition les facteurs associés à l'abandon de la prise en charge de la récupération nutritionnelle des enfants de moins de cinq ans qui ont été suivis dans les six centres de santé de la commune de Matoto d'avril 2011 à Septembre 2012.

2 METHODOLOGIQUE

2.1 CADRE D'ETUDE:

La présente étude s'appuie sur des démarches de terrain dans les centres de santé de Matoto une des cinq communes urbaines de la capitale Conakry et auprès des personnes qui y avaient accompagné des enfants pour leur prise en charge nutritionnelle. Les interventions de prise en charge de la malnutrition aiguë se faisaient dans centres de santé de Gbésia, Matoto, Tanènè, Tombolia, Dabompa et le centre de santé de Yimbaya a été intégré en 2010. Avant de mener cette enquête, nous avons consulté la littérature, dans le but d'avoir des supports pouvant contribuer à comprendre le problème de l'abandon. A l'aide d'un questionnaire administré, nous avons contacté des acteurs qui ont été impliqués dans la prise en charge communautaire des enfants malnutris aigus.

2.2 TYPE D'ÉTUDE ET PÉRIODE DE L'ÉTUDE

Notre étude est de type cas témoin. Elle vise à mesurer la force de l'association entre l'exposition à différents facteurs avec l'abandon (les cas) et le non abandon (les témoins) de la récupération nutritionnelle. L'étude ne prend en compte que les données d'avril 2011 à septembre 2012.

2.3 POPULATION ET CRITÈRES DE L'ÉTUDE

Pour recueillir les informations sur les facteurs d'abandon de la récupération nutritionnelle des enfants de moins de cinq ans, nous avons

- Ciblé : toute accompagnante d'enfant qui avait été prise en charge pour malnutrition aiguë dans l'un des six centres de santé intégrés de Matoto entre avril 2011 et septembre 2012.
- Inclus : toute accompagnante de la population cible qui a été retenue dans l'échantillonnage et qui a accepté de participer à l'étude.
- Exclus : toute personne incluse, qui n'a pas répondu totalement ou partiellement au questionnaire de l'étude.

2.4 VARIABLES DE L'ÉTUDE ET DÉFINITION

La variable qui définit l'appartenance aux groupes des cas et des témoins est l'abandon. Il est défini par une absence successive à deux séances de suivi de l'enfant dans le centre de récupération nutritionnelle.

Les variables indépendantes ont été regroupées en quatre catégories :

- Les variables liées aux enfants : le sexe, l'âge, la vaccination et le nombre d'enfants dans le ménage.
- Les variables liées aux accompagnants : le type de foyer, l'âge, la garde de l'enfant, l'alphabétisation, la couverture du besoin alimentaire, l'ethnie.
- Les variables liées aux services de PCN : type de dépistage, le type de malnutrition, l'explication de la durée probable du traitement, le nombre d'absences non-successives
- Les raisons des accompagnants à abandonner la PCN des enfants.

2.5 SAISIE, ANALYSE ET PRÉSENTATION DES DONNÉES

Nous avons utilisé différents logiciels pour la saisie, le traitement et l'analyse des données. Ces logiciels sont : Microsoft Word, Excel et PowerPoint, SPSS 18.

Nous avons élaboré un plan d'analyse des résultats et avons dépouillé les fiches d'enquêtes qui étaient correctement et totalement remplies. Nous avons aussi, recodé certaines variables pour faciliter l'analyse et obtenir l'Odds ratio. Les variables recodées sont :

- Chez l'enfant : le nombre d'enfants dans le ménage.
- Chez l'accompagnant : le type de foyer, l'âge, et l'ethnie.
- Les variables liées aux services de PCN : le nombre d'absences non-successives.

Les données ont été saisies et analysées dans le logiciel SPSS18. Le test Chi2 et le test de Fisher ont été utilisés pour la comparaison des pourcentages avec un seuil de signification statistique fixé à 5%. Pour chaque caractéristique, nous avons calculé l'effectif, déterminer la signification du test (P de Fisher pour l'effectif < 5 ou le Chi2 si l'effectif est >5), l'Odds ratios (OR) non ajustés dans l'intervalle de confiance (IC) à 95%.

2.6 CONSIDÉRATIONS ÉTHIQUES

La confidentialité et l'anonymat des personnes enquêtées ont été respectés et nous l'avons mentionné sur chaque fiche d'enquête. Nous avons adressé à la Directrice Communale de Santé de Matoto une demande d'autorisation qui a été obtenue.

3 RESULTATS

Nous avons envisagé la participation de 150 accompagnants, mais c'est 141 qui ont accepté de participer à notre enquête, soit un taux de participation de 94%. Les données recueillies ont permis d'identifier les facteurs d'abandon associés:

- aux enfants qui ont été suivis dans les six centres de santé de Matoto pour PCN.
- aux accompagnants des enfants de moins de cinq ans qui ont suivi les enfants dans les six CS de Matoto pour PCN.
- à la prise en charge nutritionnelle des enfants dans les six CS de Matoto.

Tableau 1: Synoptique de suivi des activités dans les centres de santé de Matoto

Centres de santé de Matoto	Acteurs de la Nutrition		Total		Echantillon de notre Etude		
	Agents santé	Relais	Admission	Abandon	abandon	Non abandon	Total
Yimbaya	3	1	620	25	0	12	12
Tanènè	4	2	584	6	6	14	20
Dabompa	4	4	831	121	10	11	21
Gbéssia	4	4	1330	132	7	28	35
Matoto	2	4	410	18	13	19	32
Tombolia	3	4	728	171	7	14	21
Total	20	19	4503	473	43	98	141

Entre Avril 2011 à Septembre 2012, sur 4503 enfants de moins cinq ans reçus pour malnutrition aiguë, les services de nutrition des centres de Matoto ont enregistrés 473 abandons soit 10,50%. Nous avons échantillonné 50 abandons et 100 non abandons. En termes de résultat, le niveau de réalisation de l'étude est de 94% soient 28,66 % de cas d'abandons contre 65,33 % de cas de non abandons.

Deux raisons principales ont été fournies par les accompagnants pour expliquer l'abandon : les charges familiales pour 44% d'entre eux et les déplacements pour 37% (Tableau 5). Seulement 14% évoquent le manque de récupération, et 2% un temps d'attente trop long ou une distance trop grande (Tableau 2).

Tableau 2: Les raisons d'abandons selon les accompagnants

Raisons d'abandon	attentes prolongées au centre	charges familiales	déplacements	Centre distance de plus de 5km	Enfant non récupéré	Total
Effectifs	1	19	16	1	6	43
%	2,33	44,19	37,21	2,33	13,95	100,00

Aucune caractéristique de l'accompagnant (Tableau 3) n'est associée significativement à l'abandon.

En revanche certaines caractéristiques de la prise en charge nutritionnelle sont associées à l'abandon (Tableau 4) : il y a moins d'abandons lorsqu'il n'y a eu aucune absence (OR = 0,07[0,03-0,18]) et plus d'abandons lorsque la durée de la récupération n'a pas été expliquée à l'accompagnant (OR=2,71[1,28-5,70]). Enfin, ni la sévérité de la malnutrition, ni le fait qu'il y ait eu un dépistage ne sont associés à l'abandon (tableau 4).

Tableau 3: Facteurs caractérisant l'accompagnant

N°	Facteurs	Caractéristiques	Nombre	Abandons %	P	Odds ratio non ajusté	IC 95%
1	Type de foyers	Polygame	62	24,2	0,149	0,58	[0,28-1,22]
		Monogame	79	35,4		1	
2	Age	Inférieur 20 ans	20	20	0,203	0,53	[0,16-1,68]
		20 ans et plus	121	32,2		1	
3	Garde	Maman	128	32	0,178	2,59	[0,55-12,23]
		Autre	13	15,4		1	
4	Alphabétisation	Analphabète	82	29,3	0,708	0,87	[0,42-1,80]
		Alphabétisé	59	32,2		1	
5	Besoin Alimentaire	Oui	47	25,5	0,365	0,7	[0,32-1,53]
		Non	94	33		1	
6	Ethnie	Autre	80	36,3	0,089	1,91	[0,90-4,05]
		Soussou	61	23		1	

Tableau 4: Facteurs caractérisant la prise en charge nutritionnelle

N°	Facteurs	Caractéristiques	Nombre	Abandons %	P	Odds ratio non ajusté	IC 95%
1	**Dépistage**	Dépistage actif	104	33,7	0,172	1,84	[0,76-4,44]
		Dépistage passif	37	21,6		1	
2	**Type de malnutrition**	Malnutrition aigüe sévère	31	35,5	0,494	1,34	[0,58-3,11]
		Malnutrition aiguë modérée	110	29,1		1	
3	**Récupération**	Durée expliquée	68	41,2	0,007	2,71	[1,28-5,70]
		Durée non expliquée	73	20,5		1	
4	**Absence**	Aucune absence	79	8,9	1E-04	0,07	[0,03-0,18]
		Une absence et plus	62	58,1		1	

4 DISCUSSION

Les raisons qui motivent les accompagnants à abandonner la PCN des enfants qu'ils suivaient dans les centres de santé de Matoto sont d'abord les charges familiales (44,2%) et les déplacements en dehors de la zone de couverture médicale du centre de prise en charge Nutritionnelle (37,2%), ainsi qu'à moindre titre l'échec de la récupération nutritionnelle de l'enfant (14,0 %). Les délais d'attente prolongée au centre (2,3 %) et l'éloignement du domicile (supérieurs à 5km) au centre (2,3 %) semblent être des facteurs négligeables dans le contexte de Matoto. Différentes études viennent confirmer ou infirmer nos résultats.

Kruk ME et coll ont trouvé la durée du traitement comme raison d'abandon [25]. Nielsen CC et all ont trouvé comme raisons d'abandon : la perception des accompagnants que l'enfant était amélioré et la non-implication d'autres membres de la famille dans l'accompagnement de l'enfant [18]. Faye A et al. ont évoqué: l'oubli du rendez-vous, le manque de temps, la perte de la fiche de médicale, le voyage [20]. Thiam S et al. ont trouvé : l'insuffisance de communication entre le personnel de santé et les patients, la non décentralisation du traitement, les effets secondaires du médicament et l'insuffisance de supervision des activités de prise en charge [26]. Au Gabon, Médard Toung Mvé et al. ont rapportées comme causes d'abandon : l'insuffisance de moyens financiers et une impression de guérison [21].

Aucun des quatre facteurs caractérisant l'enfant : sexe, âge, vaccination et nombre de fratrie, n'ont d'association statistiquement significative avec l'abandon de la récupération nutritionnelle.

En plus aucun des six (6) facteurs (type de foyer, âge, garde de l'enfant, alphabétisation, couverture du besoin alimentaire et ethnie) caractérisant l'accompagnant n'est significativement associé à l'abandon.

Dans cette étude, 35,4% des accompagnants qui sont de foyer monogame avaient abandonné la PCN des enfants par rapport à 24,2% des accompagnants de foyer polygame. Bien qu'il n'y a pas d'association (p=0,149, OR = 0,58[0,28-0,22]), en regardant les proportions le résultat peut paraitre surprenant, au regard des difficultés dans les familles africaines polygames. On aurait été tenté de penser que c'est dans les foyers polygames qu'on pourrait rencontrer plus d'abandons de PCN d'enfants. Car dans les familles polygames, en plus des propres enfants, chaque femme à tendance à se faire entourer par ses proches. Une façon de s'entourer d'un bouclier social et constituer un groupe de riposte ou de pression en cas de menaces éventuelles dans le foyer. Ainsi, lorsqu'un enfant est malnutri, la maman a la possibilité de se faire remplacer dans les activités ménagères ou quotidiennes par un proche. Cela permet à la maman ou à une autre personne de la famille de se consacrer à l'accompagnement de l'enfant pour la PCN. La polygamie entraine une rivalité permanente entre les femmes. Chaque femme fait l'effort de montrer à l'entourage et la belle-famille qu'elle est la meilleure femme. Cela crée une déviance positive envers les enfants et permet à chaque femme de se consacrer aux siens (enfants).

Dans cette étude, 32,2% des accompagnants qui avaient 20 ans et plus avaient abandonné la PCN des enfants par contre 20% d'accompagnants qui avaient moins de 20 ans. Mais il n'y a pas d'association significative (p=0,203, OR = 0,53[0,16-1,68]) entre l'abandon et l'âge de l'accompagnant. On aurait pu penser de prime abord que les personnes plus âgées prendraient plus soins des enfants que les moins âgées.

Dans cette étude, 15,4% des accompagnants autres que la maman avaient abandonné la PCN des enfants contre 32% des accompagnants qui étaient des mamans, mais l'association n'est pas significative (p=0,178, OR = 2,59[0,55-12,23]). La différence de proportion s'explique par le fait que le détachement de l'enfant à sa maman est du à des problèmes réels dans la vie de cette dernière. Cela peut être l'occupation, le divorce, les études, l'apprentissage d'un métier ou une activité qui

contraint la maman à ne pas accompagner son enfant au centre de santé. Dans de telles situations, l'enfant est confié à une personne de la famille qui a un lien particulier avec l'enfant.

Dans cette étude, 32,2% des accompagnants alphabétisés avaient abandonnés la PCN des enfants par rapport à 29,3 % des accompagnants analphabètes; il n'y a pas d'association entre cette caractéristique et l'abandon (p=0,708, OR = 0,87[0,42-1,80]). Ceci est en contradiction avec l'étude de Wierzbicki M. et al. qui dans une méta-analyse ont trouvé le faible niveau d'alphabétisation comme facteur d'abandon [27]. Et Fergusson P. et all [28] ont aussi rapporté comme facteur d'abandon du traitement le faible niveau d'éducation. Par contre, d'autre raison son apporté par des certains auteurs. C'est comme l'étude de Wittmer M. et al. qui porte sur l'attente, la satisfaction et les facteurs précoces de l'abandon en réadaptation cardiaque. Dans cette étude le fait d'avoir un niveau d'alphabétisation ou d'instruction supérieur était favorable à l'abandon [29].

Dans cette étude, 36% des accompagnants qui avaient abandonné la PCN des enfants n'avaient pas les besoins alimentaires satisfaits contre 25,5% des accompagnants qui avaient les besoins alimentaires satisfaits. Mais il n'y a pas d'association significative (p=0,365, OR=0,70[0,32-1,53]). Le revenu de la famille a une influence sur le respect des programmes de santé, même si le service est gratuit. L'étude de Wierzbicki M et coll, aux USA et celle de Tahiri L et al. au Maroc ont trouvé le faible niveau de revenu statistiquement significatif à l'abandon [27], [29].

Dans cette étude, 23% des accompagnants qui avaient abandonné la PCN des enfants étaient de l'ethnie soussou contre 36,3% d'autres ethnies, cependant l'association n'est pas significative (p=0,089, OR=1,91[0,90-4,05]), même s'il y a une tendance. Les Soussous constituent l'ethnie autochtone et majoritaire de la commune de Matoto voire de la capitale. Cette ethnie est connue pour son hospitalité et l'entraide familiale. Ainsi, les Soussous ont la facilité de trouver un proche pour s'occuper de certains leurs travaux de la maison pendant que la maman s'occupe de l'enfant malnutri. Les autres ethnies sont moins nombreuses dans leurs familles, elles ont à faire face à beaucoup de dépenses liées aux frais de loyer, aux frais alimentaires et de vie sans oublier de subvenir aux besoins des parents habitant dans d'autres localités du pays.

Parmi les facteurs caractérisant la récupération nutritionnelle, seuls le fait que la durée de récupération ait été expliquée ou pas et le fait qu'il n'y ait eu absence à une séance ou pas sont associés à l'abandon.

Dans cette étude, 21,6% des enfants qui ont été admis dans le programme de PCN par un dépistage passif avaient leur PCN abandonnée contre 33,7% des enfants admis par dépistage actifs dont la PCN avait été abandonnée, mais l'association n'est pas significative (p=0,172, OR= 1,84[0,76-4,44]). On pourrait expliquer la différence de proportion par le fait que les enfants admis par dépistage passif sont amenés au centre pour une autre raison et de la décision des parents. C'est dans le processus de prise en charge du motif de consultation qu'ils sont admis dans le programme de PCN.

Dans cette étude, il n'y a aucune association entre la sévérité de la malnutrition et l'abandon (p=0,494, OR=1,34[0,58-3,11]). Dans les proportions, 29,1% des enfants diagnostiqués malnutris aiguës modérés avaient leur PCN abandonné contre 35,5% des enfants diagnostiqués malnutris aigües sévères dont le traitement avait été abandonné. On pourrait expliquer les proportions par le fait que les accompagnants des enfants admis pour malnutrition aiguë modérée n'ont pas la même perception que les accompagnants des enfants admis pour malnutris sévères. Ces derniers sont plus soucieux peuvent de traiter leurs enfants. Ainsi, l'impatience de les voir récupérer peut les amener à ne pas avoir confiance au traitement surtout quand ils sont sous la pression des voisins ou des proches parents qui proposent de s'orienter vers d'autres sources de soins ou de guérison.

Dans cette étude, il y a plus d'abandons de la PCN lorsque la durée probable de récupération avait été expliquée aux accompagnants : 41,5% d'abandons contre 20,5% lorsqu'il n'y avait pas eu d'explication. L'explication de la durée probable de la récupération nutritionnelle est statistiquement liée à l'abandon (P= 0,007, OR=2,71[1,28-5,70]). L'explication de la durée probable de la PCN semble ainsi favoriser l'abandon. On pourrait expliquer cela par le fait que l'explication de la durée du traitement n'est pas habituelle chez les professionnels de santé en Guinée. Le fait d'expliquer amènerait les accompagnants à suspecter une issue défavorable de la PCN.

Dans cette étude, il y a eu 58,1% d'abandons de la PCN en cas d'absence supérieur ou égal à un, contre seulement 8,9% lorsqu'il n'y avait eu aucune absence (P= 0,0001, OR=0,07[0,03-0,18]). L'absence non successive est ainsi fortement associée à l'abandon. Plus l'accompagnant enregistre d'absence, plus il est tenté d'abandonner. Car l'accompagnement devient de moins en moins une préoccupation ou une priorité par rapport au facteur d'absence.

5 CONCLUSION

De ces résultats, il ressort qu'aucune caractéristique de l'enfant n'a de lien avec l'abandon de la PCN. Contrairement à cela, lorsqu'on associe les raisons évoquées par les accompagnants, on trouve que 81.4% des raisons d'abandon de la PCN sont liées aux accompagnants contre 18.61% qui sont liées aux services de PCN. Les facteurs statistiquement significatifs associés à l'abandon de la PCN, sont: le fait d'expliquer la durée probable du traitement (P= 0,007, OR=2,71[1,28-5,70]) et le nombre d'absences non-successives égal ou supérieur une absence (P= 0,0001, OR=0,07[0,03-0,18]), d'autres études plus exhaustives permettront d'apprécier mieux la force de liaison entre l'abandon et les caractéristiques de l'enfant, de l'accompagnant et de la PCN. Ce qui permettra de proposer des projets de lutte contre l'abandon de la prise en charge de la malnutrition sur la base d'évidences et de faits scientifiquement avérés.

CONFLIT D'INTERET: les auteurs n'ont eu aucuns conflits financiers ou autres, résultant de la publication de cet article.

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L'effet du trac sur l'interprétation instrumentale en musique arabe

[The effect of stage fright on the instrumental interpretation in Arabic music]

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RESUME: Ce travail de recherche s'intéresse à un sujet resté depuis toujours d'actualité dans le milieu socio-artistique en général et dans le domaine de l'interprétation musicale plus particulièrement, de nombreuse constatations ont pu être soulevées à ce propos en plus d'une synthèse ayant portée, sommairement, sur ce phénomène d'anxiété ou Trac, sa caractérisation, une symptomatologie descriptive et finalement les moyens pratiques pour y faire face.

MOTS-CLEFS: Anxiété, Symptôme, Concert, Instrument, Formes, Origines.

ABSTRACT: This research focuses on a subject has always remained relevant in the socio-artistic community in general and in the field of music especially interpretation, many findings have been raised about this in more synthesis with scope, briefly, on the phenomenon of anxiety or Stage fright, characterization, descriptive symptoms and ultimately practical ways to cope.

KEYWORDS: Anxiety, Symptom, Concert, Instrument, Forms, Origins.

1 INTRODUCTION

L'homme, depuis des millénaires, a su trouver dans la musique certains éléments nécessaires à son épanouissement. Cette voie d'expression artistique, en plus qu'un moyen divertissant et de communication universelle, lui a été d'une nécessité presque vitale afin d'exprimer certaines pensées que le langage conventionnel ne permettait pas le plus souvent. Ainsi, il s'est toujours mis en quête d'idées et de thématiques musicales puisées de son historique d'être humain, de son quotidien de personne civilisée et de ses croquis de projets futuristes à concrétiser en solitaire ou à partager avec autrui, tout en étant soucieux de la qualité du message à transmettre.

Ce praticien affairé de musique, appelé communément interprète ou instrumentiste et s'adressant essentiellement en tant qu'amateur ou professionnel à un public cible ou auditeur, n'est pas toujours en mesure de bien connaître son auditoire afin de satisfaire au mieux ses attentes, ses désirs et ses penchants musicaux et par conséquent de remédier ou d'anticiper en temps réel ses variables réactions comme étant un éventuel connaisseur en la matière. Dans cette situation un peu ambigüe où l'interprète s'y reconnaît généralement, exception faite de quelques instrumentistes hors du commun où leur niveau d'interprétation musicale demeure irréprochable quelque que soit les circonstances, seul ou en présence d'auditoire, il ferait de son mieux pour bien préparer son récital en fournissant un effort non négligeable à travers une série de répétitions parfois à un rythme soutenu mobilisant ainsi des ressources mentales et physiques considérables. Cependant, l'intensité de cette phase préparatoire et le degré de professionnalisme atteint par l'interprète, en plus de l'expérience

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cumulée au fil du temps ne sont pas nécessairement synonymes de bonne interprétation instrumentale de l'œuvre musicale, en partie ou dans son intégralité, présentée à l'auditoire au moment choisi. Ainsi, durant la présentation, le résultat de son effort consenti serait fort probablement en dessous des attentes de l'auditeur et celles de l'interprète lui-même en tant que premier auditeur et auto évaluateur et de son œuvre. Cette remarquable baisse de performance, pouvant être passagère ou récidivante durant une carrière d'artiste, est considéré à la fois comme extrêmement embarrassante chez l'instrumentiste et déplaisante pour l'auditoire, Ce symptôme est dû essentiellement à l'existence d'un facteur étroitement lié à l'état d'esprit de l'interprète se manifestant lors de son passage sur scène, plus précisément, durant la période s'étalant de ces ultimes préparatifs jusqu'au commencement du récital. Ces perturbations, occasionnées au niveau de ses capacités psychologiques et émotionnelles, se répercutant négativement sur son comportement et ses aptitudes cognitives, sont dues, par conséquent, à l'existence d'un état pathologique chez l'instrumentiste appelé phénomène d'anxiété et désignée couramment par la notion du " trac ".

En effet, mon choix pour cette thématique de recherche, intitulée " l'Effet du Trac sur l'Interprétation Musicale Arabe", n'est pas le fruit d'un simple tâtonnement, mais plutôt ça reflète l'existence de plusieurs raisons et catalyseurs déterminants à ma motivation d'aborder ce sujet de plus prés, Premièrement, ce phénomène d'anxiété, à cause du contact direct avec le public, touche la plupart des artistes, en particulier, ceux relevant du domaine musicale et exerçants dans différents formes d'interprétations (improvisation libre ou rythmée, chant et pièce instrumentale…), deuxièmement, en ce qui me concerne et en tant que luthiste professionnel, Doctorant en musicologie et éducateur-enseignant, j'ai pu observer directement ce préjudiciable phénomène d'anxiété chez la majorité de mes élèves et collègues sur scène, et même vivre personnellement l'expérience du trac à maintes reprises lors des spectacles dans différentes manifestations locales, régionales et nationales et ceci en essayant toujours de dissimuler ses signes caractéristiques et de s'en sortir avec le moins d'imperfections possibles tout en étant soucieux en permanence que ça pourrait éventuellement être un risque potentiel d'une baisse plus au moins relative de la qualité de mes prestations aussi bien en soliste qu'en groupe.

Le plan de travail du présent papier, comporte en premier lieu une introduction générale plaçant la thématique du sujet dans son cadre de recherche préalablement fixé. Ensuite, je traiterai en profondeur le phénomène d'anxiété, en définissant la notion du trac, ses formes et son origine en mettant l'accent sur le rôle de l'entourage chez l'instrumentiste, décrire les conséquences de cette pathologie par une étude symptomatologique à trois niveaux : émotio-psychologique, comportemental et cognitif. Enfin, proposer une issue à ce phénomène d'anxiété en essayant de trouver les solutions adéquates pour surpasser le trac et éviter par conséquent une éventuelle manifestation des symptômes. Finalement, je traiterai l'impact préjudiciable du trac sur l'interprétation musicale, et plus précisément sur les éléments d'expression musicale suivants : ornementations, nuances, tempo, rythme, technique et mélodie.

2 LE TRAC

2.1 DÉFINITION

Le mot trac est un terme dont on ne connait pas exactement ces origines. Il est considéré dans les dictionnaires généraux comme étant un phénomène d'anxiété d'une forme normale de peur sociale explosive limité**[1]**, qui fait son apparition aux environs du XV siècle dans la langue française. Il vient du mot «tracasser» ou traque puisque ce terme est issu du vocabulaire de la chasse au XVème siècle**[2]**, pour désigner l'allure et la piste suivies par un animal. On fait comparaison donc entre la peur et l'angoisse de l'animal d'être enserré par les chasseurs à celle de l'artiste sur scène encerclé par le public. Alors le trac est un phénomène d'émotion particulier, qui touche tout le monde et rares ceux qui n'en pas ressenti ces effets au moins une fois dans leurs vie, à l'occasion d'un discours, d'une réunion professionnelle, d'un examen, d'un concours, d'un entretien ou de quelques autres situations en générale, où il aura fallu s'exprimer en présence d'une personne. Selon cette définition, le trac peut être un phénomène qui se manifeste lorsqu'on sent, de prés ou de loin, le danger, d'après l'appréciation de chacun et l'intensité de la peur éprouvée. Le trac, donc, peut se définir également comme une angoisse, une inquiétude, une crainte, une panique ou n'importe quel autre terme émotif sur ce thème. Dans ce cadre de définition, ce phénomène peut avoir des visages fort divers qui peuvent être aussi accompagnés de certaines manifestations physique et morale. D'autre part, on a trouvé des définitions presque identiques dans les dictionnaires comme le petit Robert le définissant par : «*une peur ou une angoisse irraisonnée que l'on ressent avant d'affronter le public, de subir une épreuve, d'exécuter une résolution, et que l'action dissipe généralement*…»**[3]**et pour de nombreuses personnes on peut le considérer comme «*un problème extrêmement douloureux et terriblement frustrant*»***[4]***

Ainsi, le trac reste toujours comme un état de peur qui se manifeste lorsque on est exposé sous un regard attentif et observation du public plus au moins large. C'est une peur inconsciente puisqu'il n'y a pas de danger réel. Mais malheureusement, chez certaines personnes, ce phénomène d'anxiété persiste et entraîne des diminutions de la prestation

ou bien si les effets sur le jeu musical ne sont pas visibles, il cause vraiment une souffrance à la personne. Il est considéré comme un moment d'hésitation puisque qu'il touche même les grands artistes. Quelques chiffres d'une étude réalisée par Elizabeth FRESNEL **[5]** ou le trac est la plainte la plus fréquente : 24% le considèrent comme un problème de santé, 16% comme un grave problème de santé. Ainsi, ce problème est plus fréquent chez la femme (19%) que chez les hommes (14%). Ce problème reste, donc, toujours un événement d'expérience chez certains instrumentistes ou artistes en général, puisqu'il est rangé dans la catégorie des anxiétés de performances**[6]**.

2.2 LES FORMES DU TRAC

De manière générale, le mot trac est assimilé à un phénomène négatif. Mais, au contraire, cet état d'anxiété peut prendre deux aspects *« l'anxiété adapté et l'anxiété inadapté»***[7]**

2.2.1 L'ANXIÉTÉ ADAPTÉE

Dans cette situation, la personne canalise l'anxiété pour faire face au danger et répondre efficacement à la situation. Lorsqu'on joue d'un instrument de musique devant un public, est également une situation où l'anxiété adaptée permet de mettre l'organisme en état d'alerte, d'ajuster le comportement à cette situation douteuse, de préparer le corps à l'action, à la représentation et d'enlever le niveau de vigilance et de conscience scénique. Ainsi, un certain degré d'anxiété peut être un enjeu bénéfique pour améliorer la performance sur scène. Cette anxiété on peut la garder toute la vie sans en souffrir, mais ce trac nous permettra d'avoir une meilleure performance aussi bien le jour du concert ou de l'examen que le jour de la répétition. C'est pour cette raison que de nombreux artistes après une carrière de métier artistique ont toujours ce phénomène d'anxiété comme au premier jour. En effet, il ne serait pas réaliste de vouloir entrer sur scène ou de passer un concours avec le même état de détente, donc il s'agit du bon trac ou c'est ce qu'on l'appelle **le petit trac [8]**.

2.2.2 L'ANXIÉTÉ INADAPTÉE

Dans cette situation, la personne ne pourra pas canaliser sa peur et répondra de manière inadaptée au contexte qui la menace, c'est **le vrai trac**. Celui qui par excès, mal géré deviendra une entrave, une paralysie et voire même une souffrance qui entraînera des troubles divers : moteurs et psychologiques. *«Cette forme de trac provoque des symptômes précis qui vont nous inhiber et faire perdre soixante, soixante dix voire quatre-vingts pour cent de nos possibilités.»**[9]*** Cette anxiété inadaptée devient tellement handicapante et négative, que certaines personnes sont prêtes à changer de voie artistique pour s'en défaire à jamais. Elle nous accompagne jusqu'à la fin de la représentation, nous diminue au lieu de nous grandir, nous perturbe et nous déséquilibre totalement. Elle est si incontrôlable et si terrifiante, qu'elle risque de provoquer une souffrance devenant plus importante que le plaisir d'être sur scène et qu'elle peut être aussi un trac traumatisant.

3 L'ORIGINE DU TRAC

Pour que ce phénomène d'anxiété se déclenche, il y a plusieurs facteurs qui se contribuent, par exemple : le regard attentif des auditeurs, ou bien la présence d'un auditeur spécialisé dans le domaine musical, ou qu'il n'a pas eu l'occasion de nous écouter, ou bien un nombre important d'auditeurs**[10]**. Si au contraire, des personnes sont attentives à ce que on est en train de faire, par exemple on joue un morceau de musique alors que les individus sont dans une autre occupation : dans ce cas là, le trac ne sera probablement pas au rendez-vous.

D'autre part, le trac se manifeste, en général, par un manque de confiance en soi, puisque il y a une théorie qui circule dans le monde artiste stipulant que le trac apparaît lorsqu'on a un manque de préparation**[11]** à la situation dans laquelle il va se trouver. C'est une peur engendrée par le regard ou l'écoute ; même une personne, ayant confiance en elle, voudra tellement donner une bonne image d'elle-même qu'elle aura l'angoisse ou la peur de ne pas réussir. Elle sera donc sujette au trac, par le besoin de prouver, le trac est ainsi la peur de subir une dégradation de l'estime en soi et il deviendra à force de répétition un ancrage qui se manifeste dés qu'un public sera présent. Cet ancrage entraînera une réponse corporelle avec des manifestations différentes ou variées d'un individu à l'autre. Par ailleurs, l'intensité du trac sera aussi principalement variable selon le niveau d'implication personnelle, le degré de pression mis ou non par l'entourage (professeur, jury, public,…). D'autres facteurs peuvent également influer : l'environnement, les capacités, les croyances, l'identité, l'appartenance aux styles musicaux et plusieurs autres raisons. D'autre part, d'après Gilbert GABRIBAL, les croyances sont *«les idées reçus, qui par essence, participent à la formation de nos préjugés, nous viennent de notre entourage…depuis l'enfance, nos éducateurs,… »**[12]*,* qui provoquent et alimentent quotidiennement le trac et ces points se transforment en un véritable doute et manque de confiance «prescription d'échec»**[13]**. Donc, c'est à cause de notre entourage que nos

croyances s'installent, puisque notre organisme est constitué par des éléments internes (ensemble de perceptions, de sensations, d'émotions que nous ressentons à un moment donné). Le trac découle, par conséquent, de nos croyances et de nos valeurs, car si une personne a pour valeur importante la réussite, cette dernière servira de base à la création d'un certain nombre de croyances. Comme pour tout état interne, le trac est directement lié aux croyances que nous avons sur nous-mêmes, sur ce que nous faisons, ou sur ce qui nous attend. Elles auront donc le pouvoir d'orienter nos réactions affectives vers un « bon trac », un « mauvais trac » ou pas de trac.

3.1 LES SYMPTÔMES DU TRAC

Dans son livre *"Vaincre le trac grâce à une meilleure connaissance du fonctionnement mental",* Michel RICQUIER explique que :

« Les symptômes que nous ressentons ne dépendent pas de notre système nerveux volontaire, sur lequel nous pourrions avoir une action, mais de notre système nerveux autonome, nommé également ***système nerveux végétatif****, qui fonctionne à notre insu.»***[14].**

c'est ainsi que ce système neurovégétatif provoque des tremblements, des palpitations, sensation de la bouche sèche, les mains moites et autres symptômes lors de conditions particulières. Que l'on soit instrumentiste à corde, à vent ou à percussion, « le trac se manifeste par une kyrielle de symptômes physiques et psychiques, variables d'un individu à l'autre »**[15]**. Pour résumer ces différents symptômes, le trac à probablement, d'après Elizabeth FRESNEL**[16]**, trois catégories ou dimensions : aux niveaux psychologique et émotionnelle, comportemental (physique) et cognitif.

3.1.1 AUX NIVEAUX PSYCHOLOGIQUE ET COMPORTEMENTAL

- Impression de ne pas être là, de ne pas être l'acteur de ce que l'on fait, « d'être dans le brouillard ».
- Etats d'enthousiasme, d'exaltation, survalorisation de soi ou de ses capacités favorisant la prise de risque.
- Présence d'injonctions négatives, de pensées catastrophiques (« je ne vais pas y arriver », « j'ai tout oublié », « je ne suis pas à la hauteur », etc.).
- Jugement critique.
- Problème de mémoire, oublis, absences, trous, etc.
- Inhibition de la volonté ou difficulté à passer à l'action.
- Pensées non cohérentes, difficultés à « rassembler ses idées ».
- Perte de concentration
- Sensation de malaise

Remarque : Tous ces signes se manifestent le plus souvent juste avant la performance, en générale quelques minutes, plus rarement durant quelques heures, exceptionnellement avant plusieurs jours, disparaissent dans les premières minutes de la performance, exceptionnellement réapparaissent après le spectacle et plus rarement ils durent pendant toute la durée du spectacle.

3.1.2 AN NIVEAU COMPORTEMENTAL (PHYSIQUE)

- Accélérations du rythme cardiaque, palpitation (impression d'irrégularité des battements.
- Sudation (transpiration).
- Sensation de bouche sèche (diminution de la salivation qui insiste à boire avant la représentation), gorge serrée.
- Refroidissement des extrémités (doigts, pieds, nez, etc.).
- Respiration courte (besoin de grandes prises d'air profondes)
- Tremblements des mains, crampes musculaires, crispations, etc.
- Envie d'uriner.

- Estomac noué.
- Vertige avec fatigue intense.
- Modification de la voix avec perte des harmoniques.

Remarque : Aucun de ces signes ne peut se manifester si le trac est à léger degré et bien accepté et se sont juste des symptômes se manifestant avant la représentation.

3.1.3 AU NIVEAU COGNITIF

Ce sont les pensées et les sentiments qui se manifestent avant d'entrer sur scène. C'est en quelque sorte les pensées anxieuses qui peuvent être source d'inhibition avec les sentiments négatifs (sentiment de véritable panique, sentiment de honte), les pensées rationnelle par l'effet de s'adapter à la situation.

Tous ces éléments accumulés accentuent notre nervosité. Nous sentons que, psychologiquement, on n'est pas prêt à cette situation. C'est un vrai problème, pourtant tous ces signes peuvent se transformer en véritable moteur. En effet, nous avons besoin d'être dans cet état de stress pour donner le meilleur de nous-mêmes, c'est ce que ressentent la plupart des musiciens. C'est la raison pour laquelle notre trac n'est pas forcément un handicap.

4 LES SOLUTIONS POUR EVITER LE TRAC

La question pouvant se poser à ce niveau est "Comment gérer ce phénomène d'anxiété ?"

Le trac ne se dissipe pas du jour au lendemain d'un claquement de doigt. Il existe d'innombrables façons de s'en débarrasser, comme il existe d'innombrable cas de tracs différents. Même le mot « débarrasser » est ambiguë. En effet, il existe plusieurs tracs, à plusieurs degrés, plus ou moins forts selon les individus. Pour certains, s'en débarrasser leur changera la vie, alors que pour d'autres cela consistera juste à vouloir se débarrasser de cette petite boule au ventre avant l'évènement. Tandis que d'autres, voudront juste l'atténuer, en le considérant finalement comme indispensable (à petite dose) à leur concentration, etc. Il existe donc de petites astuces mais également de vraies solutions faisant appel à la médecine et aussi bien à la psychologie, puisque pour les traqueurs sont toujours la victime de leurs états psychologiques, par le biais de leurs croyances notamment négatives, est la source primordiale de leur trac.

4.1 SOLUTIONS MÉDICALES

Deux types de médicaments sont couramment conseillés [17]:

- Les **bêtabloquants**, utilisés normalement pour les affections cardiaques, auront pour effet, de diminuer le rythme cardiaque malgré la présence d'une situation stressante ou anxiogène.
- Les **anxiolytiques** permettront d'apaiser l'anxiété et de réduire l'intensité des symptômes générés par l'angoisse.

Comme nous avons énoncé auparavant, le trac est bien plus que le fait de ressentir une accélération du rythme au niveau cardiaque. Le fait de pouvoir changer, atténuer la réaction d'un individu par rapport à une scène vécue par le biais de la médecine ne sera pas une solution durable. Il n'est pas inutile de rappeler que pour mieux gérer son trac, il faut apprendre ou connaître les raisons de sa présence, dont la cause est psychologique et non physique. « Si les médicaments représentent une aide ponctuelle d'urgence, ils ne pourront en aucune manière être une solution durable au problème du trac dont la cause est psychologique et non physique»[18]. Seul un travail à ce niveau pourra apporter un changement durable en modifiant la manière même dont le trac se structure mentalement et entraîne les effets cités plus haut.

4.2 SOLUTIONS PSYCHOLOGIQUES: TECHNIQUES COMPORTEMENTALES ET COGNITIVES

Dans la formation artistique, aussi bien pour une pratique amateur que professionnelle, il est indispensable d'intégrer une meilleure connaissance clinique du trac, des processus de mise en jeu, ainsi des moyens pour le gérer.

La P.N.L, ou « Programmation Neuro-Linguistique »**[19]** est le nom que deux américains, John GRINDER (linguiste) et Richard BANDLER (mathématicien), ont donné vers 1975 à un ensemble d'outils cognitifs élaborés dans le but de modéliser l'excellence humaine. Pour résumer, cette méthodologie a pour objectif de mettre à jour des programmes ou des automatismes qui génèrent (souvent inconsciemment) notre manière d'être et d'agir. Ces programmes sont stockés dans

notre cerveau et dans nos circuits neuronaux et c'est grâce à notre langage (verbal ou non-verbal) qu'il est possible de les mettre en évidence ou de les modifier. Sans rentrer dans les détails, voici quelques techniques utilisées en P.N.L contre le trac :

Positiver[20] : Présenter une image positive de soi-même. Ne pas prononcer de phrases nous dévalorisant. Partir gagnant plutôt que de chercher quelle est l'opinion des gens sur nous. En quelque sorte, positiver est une forme d' « amélioration » de nos croyances.

Agir sur nos croyances[21] : Le sujet étant assez complexe, mais c'est le fait d'agir sur les croyances (les modifier), permet de les rendre « moins autoritaires ». C'est ainsi qu'on modifie l'impact que certaines croyances ont sur notre vie et sur notre manière de nous comporter afin de bénéficier de nouvelles ressources, quand cela est nécessaire.

La visualisation[22] : Rappelons que pour ce qui se rapporte au **système nerveux végétatif**, il n'y a aucune différence entre une situation vécue mentalement et une situation vécue dans la réalité. En effet,

*« Grâce à une nouvelle technique d'investigation médicale, l'I.R.M., Imagerie par Résonance Magnétique, on peut voir précisément que les régions cérébrales qui travaillent sont exactement les mêmes, que l'on fasse ou que l'on imagine une action »**[23]**.*

Donc pour nos neurones, la réalité est la même pour toute expérience interne ou externe : les rêves, les hallucinations et autres mirages en sont d'ailleurs la meilleure illustration, étant parfois plus vrai que nature.

La visualisation consiste donc à s'imaginer jouant lors d'un concours, avec tous les détails que l'on peut y mettre, en essayant d'être le plus détendu possible, en jouant le mieux possible, en s'entendant jouer, en se sentant jouer. Il est indispensable d'imaginer un auditoire enthousiaste, des collaborateurs enchantés, un public sous le charme. Pour la plupart d'entre nous, le fait de penser à l'examen sera source de stress au début, et nous voudrons à tout pris penser à autre chose. Il sera donc important de s'obliger à s'imaginer dans notre cerveau des situations**[24]**, en étant le plus détendu possible. Hors, à force de répétition, on constate par surprise la diminution de ces symptômes jusqu'à leur disparition complète.

Ainsi, lorsque l'on aura fait cet exercice un certain nombre de fois, on en aura assez de vivre cette scène en imagination, et l'envie sera d'y être réellement ! Ce sera donc plutôt bon signe, car en règle générale, si on appréhende un examen à cause du trac, on n'a pas envie de vivre cette situation stressante, d'y être confronté. Toutefois, pour avoir un résultat, il est important d'y croire et d'avoir une réelle volonté. Il est conseillé (tout dépend là encore du niveau de stress et de l'individu) de faire des séances quotidiennes de visualisation, à des moments calmes, notamment avant le coucher (le subconscient s'imprègne davantage des informations données juste avant de sombrer dans le sommeil !) quelques semaines, ou même quelques mois avant l'épreuve tant redoutée. Au début, il sera important de s'imaginer tout de A à Z. A force de répétition ce ne sera plus nécessaire.

Comme énoncé plus haut, il existe une multitude d'autres manières d'apprendre à gérer son trac. Hors pour les cas les plus graves, cela relève du domaine des spécialistes psychologiques. En général des thérapeutes sauront employer les moyens pour aider à faire durablement disparaître les effets négatifs du trac.

*« la P.N.L possède de nombreuses techniques et outils cognitifs, notamment pour agir directement sur les croyances. Certaines de ces techniques, par les mutations profondes qu'elles peuvent opérer au niveau psychologique, sont réservées à la thérapie et ne doivent être utilisées que par un psychothérapeute expérimenté et averti ».**[25]***

Alors que, nos sens nous permettent, en plus de percevoir la réalité extérieure, de créer notre réalité intérieure. Nous avons donc tous la capacité de visualiser. Nous pouvons par exemple, entendre une musique ou se chanter intérieurement une chanson, et qu'on peut alors imaginer certaine situation grâce à ce fabuleux potentiel d'imagination et de visualisation que nous pouvons nous conditionner pour des événements futurs, envisager positivement des expériences négatives, modifier notre manière d'être dans certaines circonstances et créer ainsi, une « réalité interne » fidèle à nos besoins et à nos attentes .

5 DEPOUILLEMENT DES FORMULAIRES D'ENQUETES RELATIFS A L'ETUDE DE L'EFFET DU TRAC SUR LES PERFORMANCES ARTISTIQUES DE L'INSTRUMENTISTE

5.1 PRÉSENTATION DU FORMULAIRE D'ENQUÊTE

Côté forme, la fiche est présentée en une seule page comprenant huit (08) questions en relation directe avec la thématique de recherche entreprise. En ce qui concerne son contenu, le formulaire est subdivisé en deux (02) parties : la première s'intéresse aux données personnelles du sujet interrogé (âge, instrument de spécialité, niveau d'étude, nombre de

concerts effectués,..), alors que la deuxième se focalise sur une éventuelle interaction existentielle entre l'instrumentiste et le phénomène d'anxiété ou trac. Un modèle du formulaire d'enquête est joint en annexe de ce rapport.

5.2 METHODOLOGIE SUIVIE ET CONDITIONS DE REALISATION DE L'ENQUETE

5.2.1 PUBLIC CIBLE

Le choix des personnes à interroger est une étape primordiale étant donné qu'elle se situe en amont de la procédure de réalisation de l'enquête et que son bon déroulement se reflète positivement au niveau des résultats escomptés.

5.2.2 DIFFICULTÉS TROUVÉES & IMPRÉVUS RENCONTRÉS

- Les engagements surtout professionnels pour certains sujets choisis conditionnaient pour autant leurs disponibilités afin de répondre aux éléments de l'enquête, et ceci est nettement observé pour le cas des enseignent-chercheurs dont ceux ayant une riche activité artistique.

- On a enregistré également un retard lors des remises des formulaires pour certains malgré un délai ne dépassant pas les 7 jours qu'on leur a accordé afin qu'ils trouvent leur aise pour répondre à certaines questions requérant de la concentration et du discernement.

- Malgré le nombre peu élevé des formulaires remplis et recensés, le recours à l'invalidation des fiches était inévitable pour quatre (04) d'entre eux, soit 10% du total de l'effectif concerné, à cause notamment de quelques réponses non convaincantes trouvées incompréhensibles ou ne reflétant pas la réalité des choses après observation directe de l'interrogé sur scène.

- La masse d'informations collectées a été enrichie par des remarques et observations pertinentes et d'intérêt pratique aimablement fournies par certains enquêtés voulant apporter leurs contributions à cette étude.

6 RÉSULTATS DU DÉPOUILLEMENT

6.1 L'EFFECTIF

L'enquête a concerné un total de 35 individus. Ils sont tous issus du domaine de la recherche et de l'enseignement (chercheur-enseignents, étudiants, …) en musicologie y compris quelques instrumentistes professionnels et amateurs.

6.2 INSTITUTIONS CONCERNÉES

L'enquête a été menée durant 45 jours environ dans deux Instituts Supérieurs de Musique en Tunisie ; soient l'I.S.M.Tunis et I.S.M de Sousse. A notre échelle, ce choix s'est porté strictement sur ces deux organismes nationaux d'enseignement et de recherche spécialisé pourvu que d'autres institutions seront concernées dans des futurs travaux de recherche exhaustives et plus avancés. A titre indicatif, 82.9 % des sujets interrogés sont issus de l'I.S.M.Tunis.

6.3 DONNÉES PERSONNELLES

- Selon leurs moyennes, la répartition du total des effectif est comprise dans deux intervalles, tel que; 29 sujets (83%) $\subset$ [19 – 26] et 6 (17%) $\subset$ [37 – 45] avec des moyennes respectives de l'ordre de 22 ans et demi et 41 ans. La moyenne d'âge globale est égale à 32 ans.
- La totalité des sujets interrogés sont du domaine de l'interprétation musicale et plus précisément des instrumentistes en musique arabe. Étant donné, que l'étude de la musique arabe est un passage obligatoire pour l'ensemble des étudiants dans leur cursus universitaire.
- En ce qui concerne leurs niveaux d'étude, les individus questionnés se répartissent en deux groupes distincts sachant que chacun peut se référer à la fois à plus qu'un profil susmentionné. En se basant sur la classification établie selon leurs tranches d'âge, on remarque que le 1^{er} intervalle renferme essentiellement des étudiants alors que le $2^{ème}$ est exclusivement formé d'enseignant-chercheurs.
- Nombre de concerts effectués et date du dernier spectacle : Cette rubrique n'a pas été au centre d'intérêt pour la majorité des personnes interrogées ; ceci pourrait être expliqué par le faite que, d'après eux, quelque soit le nombre

de concerts donnés, cela ne pourrait en aucun cas diminuer un éventuel effet d'anxiété existentiel. Exception faite pour le cas d'un étudiant mentionnant qu'il a cumulé un total de 80 concerts en public sur une période de 4 ans successives (une moyenne de 3 spectacles tous les deux mois).

↳ En se basant sur ces données récoltés à ce niveau, on peut affirmer que la population cible est, par conséquent, assez homogène tel que leurs niveaux sont suffisamment avancés et rapprochés pourvu que cela permettra certainement de mieux apprécier l'effet du trac, en pratique, dans le milieu professionnel et pour une catégorie bien spécifique de personnes.

6.4 ANALYSE DU QUESTIONNAIRE

- **A)** La totalité des sujets (100%) on affirmé avoir déjà exprimé au paravent un sentiment d'anxiété lors des circonstances bien précises de leur quotidien, comme : Examen, entretien/audition, récital, concert. Ils les ont bien mentionnés selon leur degré d'importance et ordre chronologique. Ainsi, on peut avancer l'hypothèse suivante stipulant que les deux facteurs suivants "importance de l'événement" et "présence d'une personne" pourrait provoquer un sentiment d'anxiété ou trac chez l'intéressé.
- **B)** On a recensé neuf (09) individus, soit le un quart (1/4) de tout l'effectif, ayant affirmé qu'ils interprètent de la même façon en solitaire que devant un auditoire. Ceci peut être expliqué par le faite que L'état d'esprit de l'instrumentiste reste irréprochable quelque soit les circonstances de l'interprétation, ou que celui-ci, ayant acquis une maîtrise solide de son trac par l'expérience, a su trouver les solutions ou astuces pour atténuer son impact.
- **C)** Parmi les 26 interprètes affectés par la présence d'un auditoire, on note l'existence de 17 personnes (65.4%) où la qualité de leurs interprétations instrumentales tend à baisser. Ainsi, plus que la moitié d'entre eux se trouve confronter à un sérieux problème non négligeable et d'ordre psycho-réactionnel artistique où les répercussions négatives du phénomène d'anxiété sont significativement atténuants pour le cas d'une interprétation instrumentale publique.
- **D)** D'après les informations recueillies et basées sur un total de 93 notations effectuées sur les 26 sujets consultés, ces répercussions négatives concernent six (06) éléments d'expression musicale cités, comme suit, selon leurs degrés d'importance nettement mentionnés par les intéressés, soient ; la Technique (22.6%), la Nuance (22.6%), le Tempo (18%), l'Ornementation (14%), le Rythme (11.8%) et la Mélodie (10.8%). A ce niveau, on constate, d'une part, que les valeurs des pourcentages sont assez rapprochées ce qui montre que le trac possède un effet de paralysie générale sur l'interprétation musicale chez l'instrumentiste souffrant des symptômes d'anxiété. D'autre part, on remarque que les trois (03) premiers éléments d'expression musicale précédemment mentionnés (la Technique, la Nuance et le Tempo) sont les plus touchés étant donné qu'ils sont les éléments majeurs, déterminatifs et les plus corrélés entre eux, tel qu'à eux seuls ils représentent approximativement 63 % du total des notations enregistrées. L'Ornementation se situe en seconde position car elle dépend étroitement de la Technique et de la Nuance. En ce qui concerne, le Rythme et la Mélodie, ils sont les moins concernés par la baisse de performances artistiques car ils sont considérés comme des indices de manifestation tardive une fois que le phénomène d'anxiété est installé.
- **E)** En ce qui concerne le facteur "Nombre d'auditeurs", on a enregistré 23 personnes affirmant que ce paramètre influe directement sur le jeu musical. Nonobstant, il s'est avéré, après mûre discussion avec la majorité d'entre eux, que l'importance de l'auditoire (connaissance approfondie, expertise confirmée, valeur scientifique,…) et les circonstances du jeu sont, en faite, d'autant plus importants que le nombre, tel que quelques uns ont même avancé une équivalence approximative à ce propos :

(01) Auditeur Connaisseur/Expert ≥ [75-100] Auditeurs Amateurs/inexpérimentés

- **F)** Quatre vingt et onze pourcents (91%) des sujets ont confirmé que la baisse de niveau est seulement transitoire. Cette affirmation très significative de leur part est nuancée par le faite que ce sentiment d'anxiété ou Trac se manifeste dans la majorité des cas qu'au début de l'interprétation et pendant un laps de temps variable (de quelques minutes jusqu'à plusieurs dizaines de minutes) et que l'interprète ne retourne à son niveau habituel qu'après avoir encaissé le "Choc" du 1^{er} contact.
- **G)** A propos de la cause principale relative à la baisse de niveau observée chez la personne angoissée, 27 instrumentistes (77%) ont témoigné que le Trac demeure la cause principale. Cela réaffirme, d'une part, la majeure dominance de ce phénomène par rapport aux autres facteurs (préparatifs non suffisants, absence d'interaction entre le musicien et son auditoire, réaction spontanée et perturbante des auditeurs, …). D'autre part, cette affirmation des enquêtés appui l'intérêt porté de notre part au choix ultime pour cette thématique de recherche.

- **H)** Parmi les 35 individus ayant fait l'objet de cette investigation, 63% d'entre eux ont exprimé leur préférence d'entamer un récital par une œuvre musicale de tempo lent. Ces derniers ont argumenté leur choix par le faite que, dans la plupart des cas, l'interprète, au début de l'exécution de son programme musicale, est situé dans une phase d'acclimatation vis-à-vis de son entourage ou environnement immédiat où il arrive à peine à se repérer dans ces circonstances et voir même à s'auto-évaluer ou entendre convenablement son propre jeu musicale. La deuxième alternative qui consiste en une improvisation de la part de l'instrumentiste lui permet d'acquérir plus de confiance en soi en ayant plus de degré de liberté (absence de rythme et de cellule rythmique) et des connaissances en modes musicaux, tel que : L'improvisation ou Tãqsîm en musique arabe ne se réfère à aucune règle et ne peut être soumise à aucune démarche pédagogique (Hafedh LAJMI, *L'enseignement de la musique en tunisien évolution des idées et des pratique de la pédagogie*, thèse de doctorat en musicologie, université Sorbonne , Paris IV, 1996).
- **I)** En s'intéressant, à ce niveau, sur la situation dans laquelle l'interprète se présente devant un auditoire n'ayant pas eu l'occasion d'assister au paravent à son spectacle : cas d'une œuvre présentée pour la première fois en public, on a constaté que la réaction de l'instrumentiste est préalablement imprévisible et ceci en s'appuyant sur les différentes affirmations de la part des sujets consultés; tel que 45% des interrogés ont exprimé leur sentiment de malaise au commencement de leur jeu musical devant un auditoire en 1ère fois, contre 55% manifestant une sensation contraire. Ces données chiffrées relativement proches, montre que, lors d'une représentation artistique en général et pour le cas d'une interprétation instrumentale plus particulièrement, il existe des facteurs extrinsèques de contexte à ne pas négliger (relatifs soit au cadre de l'action soit au musicien ou bien à l'auditoire ou l'interaction entre les deux), et qu'il est préférable d'atténuer leur impact par une préparation technique et psychologique rigoureuse du projet en ne sous estimant aucun paramètre.
- **J)** L'analyse des réponses récoltées se référant à une question posée à l'ensemble des personnes objets de cette enquête portant sur une hypothétique incapacité de quelques uns à effectuer quelques passages difficiles au cours d'un enchainement musical sous un regard attentif neutre (ni admiratif, ni blasé) de l'auditoire, a révélé que les enquêtés sont pour une légère majorité (au nombre de 19 sur un total de 35) à prédisposition craintive tel qu'ils ne veulent pas prendre de risque en une telle situation. Cette constatation est encore plus confirmée par leur affirmation, en cette circonstance, d'envisager, à 89.5% des cas, une diminution des techniques dans leur jeu musical. Ainsi, on peut prétendre plus d'effort au niveau du perfectionnement d'un paramètre intrinsèque et primordial à l'instrumentiste, la confiance en soi.
- **K)** Aux alentours des trois quarts (3/4) de l'ensemble des instrumentistes (74.3%), sollicités pour leurs avis, pensent qu'il existe d'éventuelles solutions remédiantes aux effets préjudiciables causés par un sentiment d'anxiété ou trac sur le niveau d'interprétation. Cette affirmation relativement très significative témoignent de leur souhait, implicitement exprimé, à surpasser les difficultés trouvées une fois que se phénomène est installé. Pratiquement, parmi les solutions préventives et curatives pertinentes proposées, on mentionne : La bonne préparation technique et psychologique devant être toujours en concordance, à la hauteur de l'événement et des attentes de l'auditoire quelque soit leur degré d'importance. Cette préparation pourrait être menée à bien si on donnait plus de gravité aux aspects suivants ; Une concentration bien maîtrisée ; Avoir plus de confiance en soi ; Saisir les bonnes opportunités pour se produire encore plus et régulièrement devant un auditoire ; Ne pas accorder une dimension ou poids plus que mérité(e) à l'auditoire qui n'est pas présent, toujours et uniquement, pour juger le niveau d'interprétation mais également pour apprécier le choix musical présenté ; Lors de l'exécution de l'œuvre musical en public, essayer de trouver, comme solution, une personne de référence réelle (parmi l'auditoire) ou fictive (dans l'imaginaire de l'instrumentiste) manifestant un intérêt apparent et fidèle au jeu musical de l'interprète ; Pratiquer la technique d'autoévaluation instantané lors des répétitions, soit d'une façon classique basée exclusivement sur la perception auditive de l'instrumentiste ou , en plus, au moyen des nouvelles technologies audiovisuelles si, bien évidement, sont accessibles afin de mieux apprécier la qualité du produit musical servi. L'intégration d'un module de préparation mentale des interprètes instrumentistes dans leur formation académique de base est une parmi les solutions proposées et méritant un regain d'intérêt de la part différents intervenant du domaine.

  Comme alternative à ses solutions ci-avant mentionnées, le recours à un traitement médical (à base de bétabloquants ou d'anxiolytiques) a été envisagé par un nombre infime d'intervenants (4%), et malgré qu'elle a prouvé son efficacité, d'après la littérature, chez plusieurs sujets souffrants d'un trac léger ou aigu, elle demeure l'issue de dernier recours et généralement non recommandée par les spécialistes ; Cela peut être dû au risque de dépendance ou à une manifestation d'effets secondaires indésirables.
- **L)** La majorité des sujets questionnés (77.1%) ont signalé qu'ils sont parfaitement conscients que ce phénomène d'anxiété ou trac constaté, plus particulièrement, en interprétation instrumentale et dans le domaine musical d'une façon générale, mérité qu'on lui accorde plus d'intérêt et qu'il soit traiter en profondeur, d'une part, dans la pratique en milieu

professionnel et dans les thématiques de recherche en musicologie d'une autre part. D'où notre choix bien ciblé, à notre niveau, de la présente thématique de recherche traitée, comme abordée par nos prédécesseurs du domaine, et de l'intérêt qu'elle peut gagner par la suite en plus des améliorations significatives qu'elle peut apporter dans l'intérêt général de tous.

7 CONCLUSION

Le dépouillement de l'enquête, réalisée sur un ensemble de 35 individus formés exclusivement d'interprètes instrumentistes de différents âges et niveaux artistiques et académiques, nous a permis d'avancer exhaustivement les approches suivantes :

- Les deux facteurs prédominants : "importance du contexte musical" et "présence d'un auditoire" pourrait provoquer un sentiment d'anxiété ou trac chez l'interprète instrumentiste sur scène.
- Si l'état d'esprit de l'interprète reste intact quelque soit les circonstances de l'interprétation c'est que celui-ci ait pu maîtriser efficacement son trac en trouvant, par expérience, les solutions ou astuces adéquates pour atténuer son impact.
- Le trac est capable de générer une paralysie quasi-générale chez l'instrumentiste souffrant des symptômes d'anxiété. Les éléments d'expression musicale suivants : Technique, Nuance et Tempo, sont les plus touchés puisqu'ils sont les éléments majeurs, déterminatifs et les plus corrélés entre eux.
- Le sentiment d'anxiété ou Trac se manifeste dans la majorité des cas en phase préliminaire de l'interprétation et pendant un laps de temps variable (de quelques minutes jusqu'à plusieurs dizaines de minutes) et l'instrumentiste ne revient à son niveau normal qu'après avoir subi l'impact de départ.
- La Trac est considéré comme un facteur dominant en comparaison aux autres paramètres (préparatifs non suffisants, absence d'interaction entre le musicien et son auditoire, réaction spontanée et perturbante des auditeurs, …) mais il existe une étroite relation entre eux, tel que l'un peut être le catalyseur de l'autre et vice-versa.
- Le recours à une improvisation de la part de l'instrumentiste pourrait redonner plus de confiance en lui. Ainsi, on peut prétendre plus d'effort au niveau du perfectionnement de ce paramètre intrinsèque et primordial à l'instrumentiste.
- La bonne préparation technique et psychologique tenant compte à la fois de l'importance de l'événement et des attentes de l'auditoire pourrait être considérée à la fois comme solution préventive et curative à un éventuel sentiment d'angoisse pouvant s'installé chez l'interprète instrumentiste plus particulièrement
- Le traitement médical (à base de bétabloquants ou d'anxiolytiques), malgré sont efficacité prouvée, devrait rester comme ultime solution curative contre l'anxiété.

En guise de conclusion, l'interprète, comme étant un être humain soumis à une multitude de variables environnementales et intrinsèques, devrait donner continuellement le meilleur de lui-même afin de minimiser au maximum la marge d'erreurs inévitable dans son propre jeu musical. Une fois atteint, le résultat final ne pourrait être qu'une adéquation entre autosatisfaction de l'artiste, réponse aux attentes de l'auditoire et enrichissement continu d'un répertoire musical infini.

Formulaire d'enquête

Elaboré par : *Aziz OUERTENI*

- ✓ Âge du sujet interrogé : .....
- ✓ Instrument : .....
- ✓ Niveau d'étude : .....
- ✓ Expérience professionnel N^{bre} de concerts effectués : .....

1- Avez-vous vécu auparavant un sentiment d'anxiété ou trac ?
Oui ☐ non ☐ ; Si la réponse est positive, à quelle occasion .....

2- Interprétez-vous de la même façon en solitaire que devant un auditoire? Oui ☐ Non ☐
Si la réponse est négative ;

2.1. Est-ce que la présence d'un auditoire "améliore" (+) ou "diminue" (-) la qualité de votre jeu musical ? (+) ☐ (-) ☐

2.2. A quel niveau la présence de l'auditoire agit-elle sur votre interprétation ?

☐ Ornementations ☐ Nuances ☐ Tempo
☐ Rythme ☐ Technique ☐ Mélodie

2.3. Le nombre d'auditeurs influe-t-il sur votre jeu musical ? Oui ☐ Non ☐
Si la réponse est positive, approximativement, de combien de personnes au maximum l'auditoire devrait se composer pour minimiser son impact négatif sur votre niveau? ....

2.4. Cette phase de baisse de niveau est-elle seulement transitoire ou bien elle perdure jusqu'à la fin de l'interprétation ? .....

3- A votre avis, si votre niveau d'interprétation tant à baisser devant un auditoire qu'en solitaire, est-ceci est dû essentiellement au trac (1) ou à un autre facteur (2) ? (1) ☐ (2) ☐
;Si c'est dû à un autre phénomène, précisez
:.....

4. Lors d'un récital, vous préfériez commencer par une :
☐ œuvre musicale de tempo rapide ☐ œuvre musicale de tempo lent ☐ improvisation

5-Lorsque vous êtes confronté à un auditoire n'ayant pas eu l'occasion de vous écouter précédemment ; est-ce que vous vous sentez mal à l'aise au cours de votre jeu musical ?
Oui ☐ Non ☐

6- Lorsque vous êtes sous un regard très attentif d'un auditeur ; serez-vous incapable de faire
quelque passage difficile au cours de votre enchainement ? Oui ☐ Non ☐ ;
si "oui" ; essayez-vous de faire le minimum de techniques ? Oui ☐ Non ☐

7- D'après vous, y a-t-il des solutions à proposer pour remédier à d'éventuels effets préjudiciables d'un sentiment d'anxiété ou trac sur le niveau d'interprétation musicale d'un sujet? Oui ☐ Non ☐ Si la réponse est positive, **citez au moins une** : .....

8- Finalement, pensez-vous que cette problématique requiert un regain d'intérêt dans les thématiques de recherche en interprétation musicale et que ce phénomène soit traité en profondeur dans la pratique en milieu professionnel? Oui ☐ Non ☐ ; Si la réponse est "oui", **Pourquoi?**.....

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Improving Business Growth through Marketing and Organizational Innovation in Doinyo Lessos Creameries in Eldoret, Kenya

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ABSTRACT: Entrepreneurial firms need to continuously undertake innovation seriously if they are to remain competitive. This paper examines the impact of marketing innovation and organizational innovation on business growth among Small and Medium Enterprises (SMEs) in Kenya. The paper is based on a study of Doinyo Lessos Creameries in Eldoret, Kenya. The study adopted a descriptive case study design on a sample of 169 respondents from the Creameries which is located in Uasin Gishu County. Response was received from 161 participants. Purposive sampling technique was used to identify the area of study, stratified and simple random sampling techniques were used to select the respondents from the target population. Questionnaire and interview schedule were the main instruments of data collection. Qualitative data was analyzed descriptively in form of frequency counts, percentages and measures of central tendency. It was clear that majority of the respondents concurred that new products had attracted many customers and in turn increased the sales volumes. Very few of the respondents disagreed that marketing innovation had led to improved sales. It was clear that lesser than half of the respondents agreed that Doinyo Lessos is fast to roll out new product to the market. It was further shown that more than three quarters of the respondents agreed that the company's management team members have relevant education and skills. All business units need to develop innovation policy so as to form the impetus of great thinkers within the industry. This will help to instil a desire to innovate among all the stakeholders in the dairy industry. Continuous innovation activities in any business should be sustained through R&D support, and employee motivation to ensure business growth is realized over time.

KEYWORDS: Business Growth, Marketing, Organizational Innovation, Doinyo Lessos Creameries, Eldoret, Kenya.

1 INTRODUCTION

Small and Medium Enterprises vary significantly according to different stages of economic development and economic structures [1]. Some analyses define them in terms of total revenue, while others use the number of employees as an indicator. Although the definition of SMEs is specific to each individual country and is based on size and level of economic development, there is not yet an agreed definition for SMEs. Attempts have been made to define SMEs in developing countries. Albaladejo [2] defines SMEs as firms that employ between 5 and 19 workers while medium enterprises are firms that employ between 20 and 29 workers therefore an SME is a business with a head count ranging from 5 employees to 99 employees.

GrowthFin [3] reports that SMEs are profit-driven entities whose financial needs are either too large, or too complex for microfinance, and have been excluded from mainstream financial institutions that consider the financial needs of SMEs either too small or too risky. The banks have in the last few years recognised SME trade finance requirements as a clear growth area. It is however vivid that a large number of these banks are not prepared to devote the necessary time, energy and manpower to assist SMEs structures their operations. This is solid evidence that the growth of SMEs in Kenya is highly slowed by such aspects.

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1.1 SMALL AND MEDIUM SIZED BUSINESSES GROWTH INDICATORS

There is no general measurement for firm growth and scholars use various growth indicators when undertaking research [4]. The most common indicators are to measure absolute sales growth or relative employment growth during a specific period of time. Sage [5] identifies several stages in which a business must go through in its life. The first stage is where sales and marketing are focused on generating awareness and motivating the customer to try a new product or service. The second stage is growth where the customer strategies shift from new customer acquisition to "selective" demand generation. After growth the business enters a crucial stage known as the maturity stage. At this stage businesses reach a point when revenues slow down from double digit growth. If not well managed the business moves to the decline stage. Sage [5] notes that once a business has entered decline, it should be focused on diversifying or harvesting to maximize cash flow that can be used to fund new product or service offerings. If all fails to work in favour of the business rejuvenation, the business enters its final stage of existence which is exit stage. At this stage the business is forced to be closed down due to higher expenses than income as well as diminished number of customers. At this stage the business can think of innovation.

Davidsson et al. [6] identify several indicators of business growth as including; assets, market share, physical output and profits. However, these indicators are generally not commonly used such as sales and employment, since their applicability is limited. Thus, total assets value depends on industrial capital intensity and is sensitive to change over time, market share and physical output vary within different industries and are therefore difficult to compare and finally, profits are only relevant in order to measure size over a long period of time [7].

Sales and employment are two important indicators when analyzing growth of firms [7]. Employment is often used within studies since it is relatively easy to access and measure since it lies within interest for policy makers. Sales are the most common used measure or indicator of firm growth though they are affected by inflation and exchange rates. Furthermore, it can be difficult to compare sales figures in different industries. Delmar et al. [7] suggests the importance of using multiple growth indicators when studying firm growth. Davidson et al. [6] highlight the importance of using at least one indicator based on changes in turnover when studying firm growth, one alternative could be to use added value as a variable.

According to Lind [8], SMEs in developing countries are often competing in price, thus, they do not focus on adding value to products and services. Lind [8] points out the importance of added value since value creation is what makes a firm competitive and it is argued that added value is a more accurate measurement of SMEs' competitiveness than market shares, return on investment or profit. SMEs in developing countries have generally lower productivity than developed countries and since a country´s ability to produce high level of productivity is one of the contributors towards improved living standards, added value could be seen as an important growth indicator.

Davidson et al. [6] posit that even if restricted to the change-in-amount view, growth remains a multi-faceted phenomenon due to heterogeneity in growth indicators and in the tools used to measure growth. They further treat heterogeneity in the regularity or irregularity of growth over time, and in the type of growth. Growth, they argue, consists solely of demand-driven volume expansion for existing products or is achieved through the acquisitions of business activities that were already up and running within another organization but is not an aspect of entrepreneurship.

As cited by Davidson et al. [6], the other indicators are less generally applicable and therefore not applied as frequently. The 'market' in market share calculations may be ambiguous; differences in market share may be irrelevant for small firms, and comparing share for firms operating in different markets may be indefensible. The value of assets varies with the capital intensity of industries and is difficult to assess where the key asset is knowledge. Physical output can hardly be compared across industries. While profits are universally relevant they reflect many other aspects of a firm apart from its size. Besides, it is perfectly possible for a large and/or growing firm to be unprofitable.

Davidson et al. [6] conclude that owner-manager's willingness to grow is deemed to be very important. Related to this, there is strong indication that human capital factors like education and experience lead to growth only when the wish to expand is also there. A factor that is sometimes crucially important but not a universal growth recipe is the availability of external capital. In the frequent cases when the owner-manager does not see growth as a goal, or the market potential for the firm's products is limited, increased provision of external capital is not going to change much. While there is probably an over-representation of male-run firms among the top growers, gender is largely unrelated to growth for the large majority of the firm population.

1.2 REVERSE INNOVATION

Reverse innovation [9] [10] is a new conceptualization that has been developed to explore innovation from emerging economies. This new line of research argues that innovation is less likely to come from, and is adopted in, developed

countries first, but is conceived and adopted in emerging economies first to then be introduced to developed markets. It is then "exported" to the developed economies. These dynamics reverse the innovation process as intended in past literature and managerial practice. The reasons that support such an inverted process lie in the market growth of the developing countries that are supporting and leading the global economy [11].

The trend of innovation from developing countries, thus reversing the innovation process as generally intended from developed to developing economies, is partly anticipated by the concept of disruptive innovation from emerging economies. Brown and Hagel [10] define disruptive innovation as, "innovation blowback", introducing the risk of Western companies being displaced by Multi National Corporations (MNCs) from emerging economies that are going global and disrupting the markets of developed economies [12]. Brown and Hagel [10] stress the importance of learning by operating in emerging economies; serving the low income segments of these markets to gain a competitive advantage that will foster their growth on a global basis. They explain how western MNCs cannot simply adapt global products to local needs by cutting costs thanks to the local low-cost labour force. They have to reshape their business and management practices in order to gain access to these promising markets and build their future global competitive advantage on this experience [11].

1.3 ECO-INNOVATION

Carrillo et al. [13] define eco-innovations as "those that reduce the environmental impact caused by consumption and production activities, whether the main motivation for their development or deployment is environmental or not". They further argue that it is difficult to measure the intension or motivation of the innovation than the result of the innovation. Despite intentional problem, some definition of eco-innovation consider novelty, others focus on other forms of innovation including product, process, models and systems innovation [14].

Rennings and Zwick [15] identify forms of innovation which lower the environmental impact. Whereas engineering related studies consider eco-innovation is a technological change in production processes and products change, management and policy related studies consider a change in behaviour of individual users or organizations, strategic view consider change in the business but all these are intertwined [16].

Eco-innovation in firm reduces environmental harm while generate value for the market. In support to be green and competitive, Foxon and Andersen [17] suggest that firms should seek to enhance its green competitiveness in two ways: either by acquiring a premium price for its green reputation or product, or to reduce production costs by achieving greater resource efficiency or reducing the costs of costly emissions. According Kemp and Andersen [18], eco-innovations may be technical, organisational or marketing innovations which improve the green competitiveness of a company.

Ahmed and Kamruzzaman [19] suggest that technology push was particularly relevant for the initial stage of the innovation and market factors was for further diffusion. Although both are necessary for successful innovation, for eco-innovation another factor appear as an important issue in the academic literature. In this context, several recent studies [20] [21] [22] [23] on environmental innovation stress on regulation, policy, institutional and political effects.

According Horbach [20] and Oltra [23], the general innovation theory has been enlarged with respect to the analysis of the influence of environmental policy and institutional factors and categorizes determinants of eco-innovation in three broad categories that include, supply side, demand side and regulation and policy. Following their determinants categorization, drivers of eco-innovation could broadly be categorized as demand side, supply side, regulations and policy related drivers [19].

1.4 STATEMENT OF THE PROBLEM

Although SMEs contribute much to GDP, their growth has been hindered by several factors. Small businesses in Kenya face a number of challenges which affect their growth and profitability and hence, may in the long run exit the market [24]. These include lack of managerial training and experience, inadequate education and skills, technological change, poor infrastructure and scanty markets information [24]. Most SMEs in Kenya tend to copy existing ideas rather than develop innovative value. This leads to undifferentiated markets that compete purely on price rather than on new market value [25].

Innovation is deemed a solution to many of the challenges that hinder growth. It is believed that innovation is likely to enhance business growth. Nevertheless, it is not clear whether innovation by itself can lead to business growth in SMEs owing to the fact that these firms face various challenges. It has been reported in literature that some firms do not even get the pay offs of their innovation due to other factors that determine growth. This paper attempts to unravel the role played

by market and organizational innovation in the growth of the SMEs based on a case study of Doinyo Lessos creamery in Eldoret, Kenya.

2 MATERIALS AND METHODS

This study adopted a descriptive case study design. A case study is an in-depth investigation of an individual, group or a phenomenon whose primary objective is to determine factors and relationships among the factors that have resulted in the behaviour under study [26]. A case study makes a detailed examination of a single subject, group or phenomenon placing more emphasis on full analysis of a limited number of events or condition and their interactions giving a clear insight into what is being investigated. It was therefore deemed appropriate for the study which concerned itself with examining the effect of innovation on growth of medium sized enterprises taking a case of Doinyo Lessos Creameries.

The target population comprised all employees of Doinyo Lessos Creameries, including those in management. A total of 302 employees were targeted from which the sample was drawn. The author adopted a sample design which was reliable and appropriate for this study. Being a case study, non-probability sampling was used, employing purposive sampling technique which allowed for the use of cases that had the required information with respect to the objectives of the study. In addition, stratified random sampling technique was used to select the study sample from three groups of employees that included management, processing employees and those in marketing and sales in the organization. The sample size in the study was one hundred and sixty-nine (169) respondents of the Creameries. To ensure that each stratum was represented in the sample, the author used stratified random sampling. Under stratified sampling respondents were selected from each sub group to constitute the proportion of each stratum in the sample meaning that the sizes of the sample from different stratum was kept proportional to the sizes of the strata [27].

For the study, data collection was done through the use of questionnaires prepared by the author. The author used drop and pick method to collect data from the respondents. Based on the data collection instruments, data was analysed both quantitatively and qualitatively. Open-ended questions were analysed through reporting themes and quotas that emerged. The data was analyzed and presented in frequency tables, graphs and charts to present the findings of the study. The themes emerging from secondary data were identified to augment the primary data. The quantitative measure was used to generate descriptive statistics that were presented in frequency tables, bar charts, percentages, means and standard deviation.

3 RESULTS

3.1 MARKETING INNOVATION AND BUSINESS GROWTH

3.1.1 MARKETING INNOVATION AND MAGNITUDE OF SALES

The research sought to establish whether marketing innovation had any influence on the quantity of sale of products at Doinyo Lessos Creameries. A non-significant proportion of 4(2.5%) respondents did not find marketing innovation a factor that led to increased sales and therefore business growth at Doinyo Lessos. They instead attributed the increase in product sales to other factors. However, an overwhelming proportion of 88(54.7%) and 63(39.1%) agreed and strongly agreed, respectively, that marketing innovation had led to increase in product sale at Doinyo Lessos Creameries. Only 6(3.7%) of the respondents were undecided about this item, as indicated on Figure 1 below.

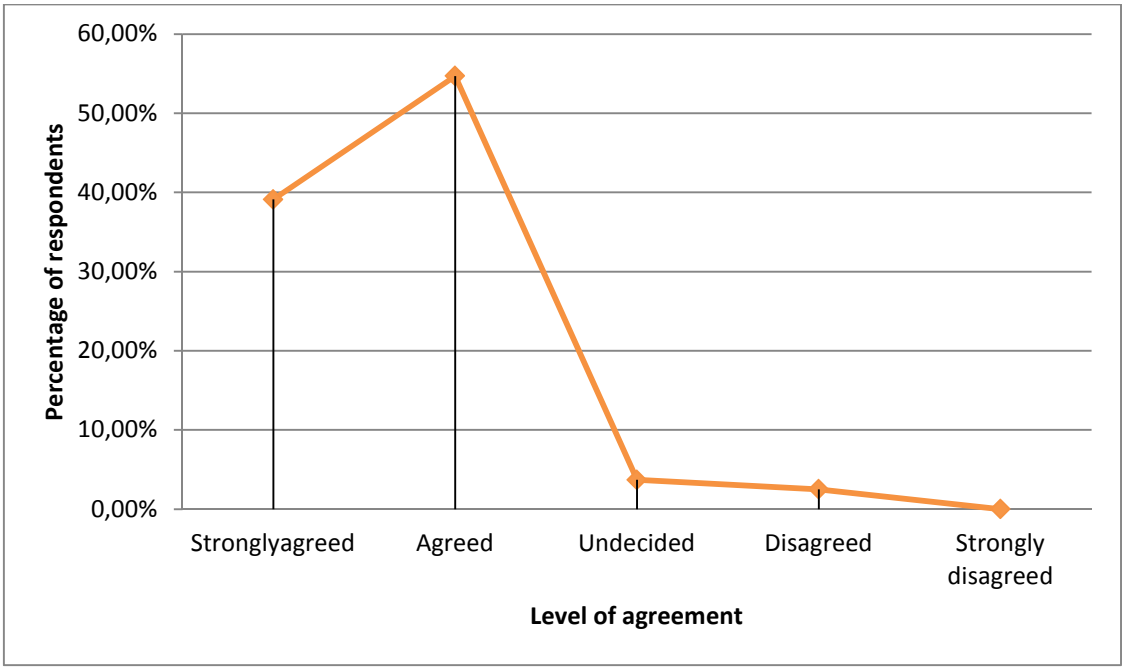

Figure 1. Respondents' perceptions of marketing innovation and magnitude of sales

Source: Field data, 2013

From the figure above, it is apparent that marketing innovation had led to increased sales at Doinyo Lessos Creameries.

3.1.2 MARKETING INNOVATION AND PRODUCTS' DELIVERY

Data collected in the study area indicated that a majority of employee respondents were in agreement that marketing innovation had led to timely delivery of products from Doinyo Lessos Creameries to their consumers. Fifty-five (34.2%) of them strongly agreed while 90(55.9%) agreed. Only 7(4.3%) of the respondents did not have a comment on this study attribute while 9(5.6%) disagreed. There was a clear indication, however, that marketing innovation has led to timely delivery of products of Doinyo Lessos Creameries (Figure 2).

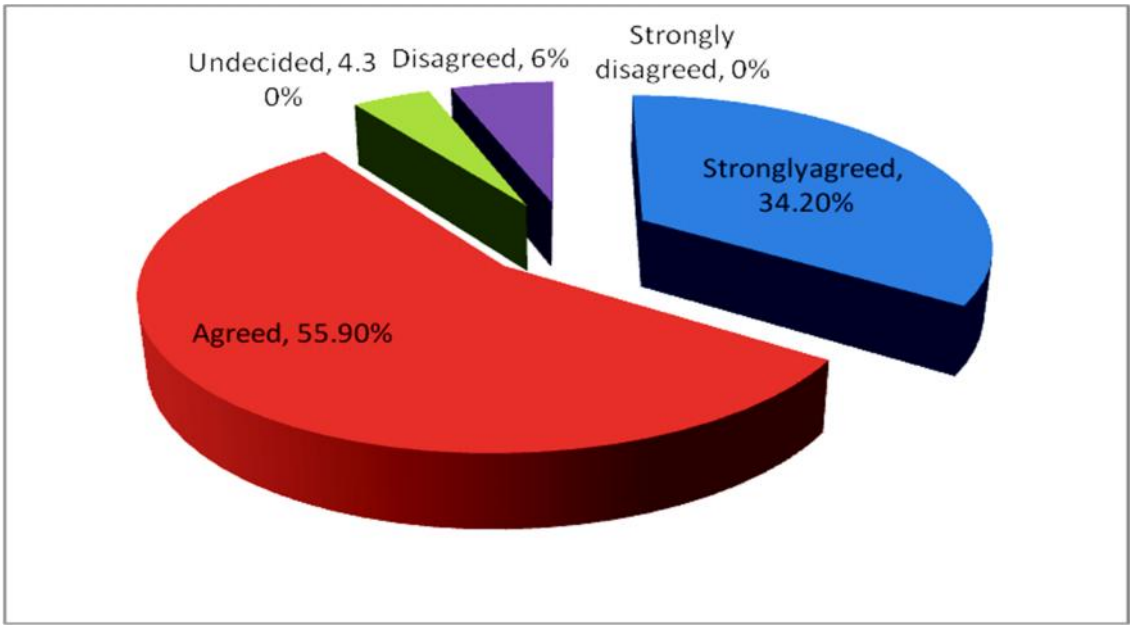

Figure 2. Respondents' perceptions oofn marketing innovation and products' delivery

Source: Field data, 2013

3.1.3 MARKETING INNOVATION AND MARKET EXPANSION

One hundred and forty-four respondents (89.5%) affirmed the fact that innovation in the marketing department at Doinyo Lessos had led to expansion of the market of the company's products. The remaining proportion of respondents was either undecided or disagreed with this study variable, as indicated on Table 1 below.

Table 1. Respondents' Perception of Marketing Innovation and Market Expansion

Level of agreement	Frequency	Percentage
Strongly agreed	94	58.4%
Agreed	50	31.1%
Undecided	10	6.2%
Disagreed	7	14.3%
Strongly disagreed	0	0%
Total	**161**	**100%**

Source: Field data, 2013

These findings could be attributed to the fact that innovation in the marketing strategy encompasses innovations in publicity strategies as well and therefore implies that the sales department is able to reach a larger consumer base.

3.1.4 MARKETING INNOVATION AND COMPETITIVE ADVANTAGE

This study also sought to establish whether or not innovation in marketing gave Doinyo Lessos Creameries undue advantage over other competitors in the dairy industry. A large proportion of respondents (144), accounting for a percentage of 89.5%, were in agreement that innovation in the marketing department of Doinyo Lessos had given it a competitive advantage over other enterprises. A proportion of 10(6.2%) and 7(4.3%) was undecided and disagreed with this assertion respectively. Figure 3 illustrates these findings.

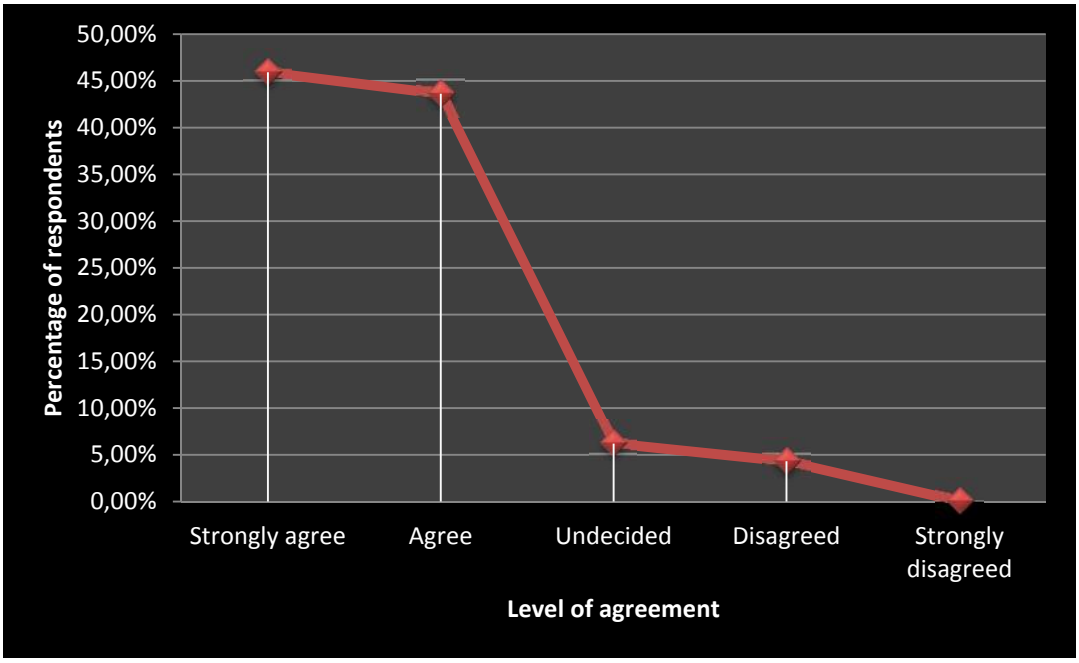

Figure 3. Respondents' perceptions of marketing innovation and competitive advantage

Source: Field data, 2013

These findings could be attributed to the fact that with marketing innovation in place, the company continually renews the design of its products thereby staying abreast with consumer needs. Besides, such new design products tend to be of superior quality than that of other producers who may not have embraced innovation. This gives it an edge over other competitor enterprises.

3.2 Organizational Innovation and Business Growth

This study also sought to establish how organizational innovation influences business growth at Doinyo Lessos Creameries. The findings were evaluated on the basis of a five-item Likert scale and presented in Table 42. The mean and standard deviation of respective responses were computed as well in order to determine the degree of variation among the employees' responses.

Table 2. Organizational Innovation on Business Growth

Factors	SA	A	U	D	S D	M	S/Dev
Doinyo Lessos is fast to roll out new products	10.6% (17)	34.2% (55)	11.2% (18)	28.6% (46)	15.5% (25)	3.04	1.296
The company management have relevant education and skills	17.4% (28)	55.3% (89)	0% (0)	15.5% (25)	11.8% (19)	2.49	1.275
The company emphasizes on customer relationships and retention	6.8% (11)	33.5% (54)	13.0% (21)	29.2% (47)	17.4 (28)	3.17	1.256
The management supports new ideas from employees	16.8% (27)	46.6% (75)	8.1% (13)	18.0% (29)	10.6% (17)	2.59	1.257
Team building is a normal training event	5.6% (9)	55.3% (89)	18.6% (30)	11.8% (19)	8.7% (14)	2.63	1.054
N=161							

Source: Field data, 2013

The findings of the study indicate that 44% of the respondents agreed that Doinyo Lessos was fast to roll out new products to the market while 43% disagreed to the assertion. It was further shown that majority (72%) of the respondents agreed that the company's management team members had relevant education and skills while 26% held to a contrary opinion. It was clear that 39% of the respondents agreed to the fact that the management of Doinyo Creameries emphasizes on customer relationships and retention.

However, 46% disagreed with this opinion and felt that the management did not emphasize on this aspect. In addition, 62% of the respondents agreed that the management of Doinyo Lessos supported new ideas from the employees while 28% held a contrary opinion. It was further shown in the results that the management of Doinyo Lessos supports team building in most training seminars or workshops. This was accounted for by 60% of the respondents in the study. It was also noted that some of the respondents, accounting for 19% of the respondents, were of a contrary opinion and believed that the management did not emphasize on team building skills. The responses on organizational effect on business growth were as further represented in Figure 4.

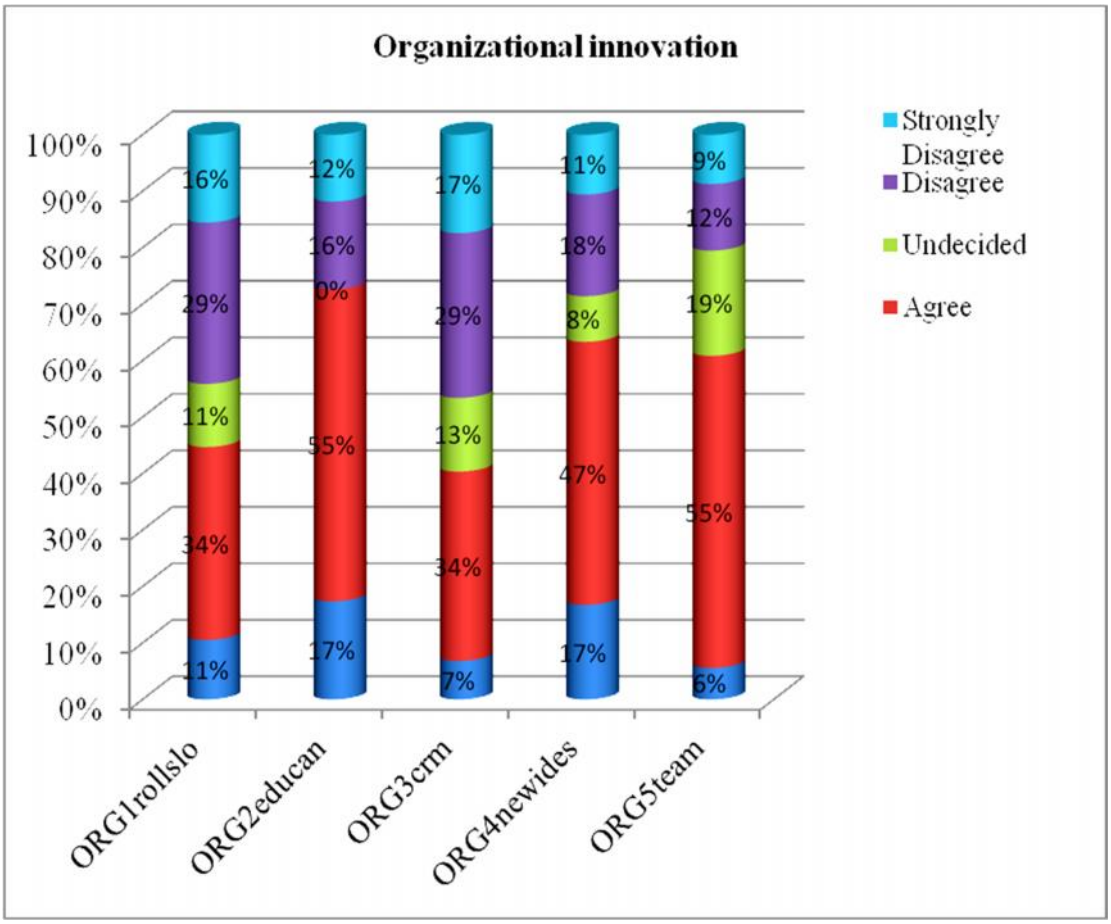

Figure 4. Respondents opinion on organizational innovation and business growth

Source: Field data, 2013

In terms of organizational innovation, Table 2 shows that the study recorded a high mean of 3.17 and a low of 2.49. Only two components of this variable had a mean above 3.00 which implied a disagreement or imprecise decision. The standard deviations recorded imply that the range of variation was not wide. The lowest standard deviation recorded was 1.05 while the highest was 1.29.

4 DISCUSSION

4.1 EFFECT OF MARKETING INNOVATION ON BUSINESS GROWTH

The study investigated the effect of marketing innovation on business growth at Doinyo Lessos Creameries. It was clear that majority of the respondents concurred that new products had attracted many customers and in turn increased the sales volumes. Very few of the respondents disagreed that marketing innovation had led to improved sales. Approximately half of the respondents agreed that marketing innovation had led to timely delivery of products and in good condition while some disagreed with the assertion. It was further shown that three-quarters of the respondents held the opinion that Doinyo Lessos had unique marketing and publicity strategy that was effective enough to enhance business growth.

The research sought to know whether or not Doinyo Lessos renews design of the products through changes such as appearance, packaging, shape and volume without changing their basic technical and functional features. The results had slightly more than half of the respondents agreeing. This finding is in agreement with Avlonitis and Salavou [28] who hold the opinion that innovation is a company's ability to introduce new products, which are also successful.

The study also sought to know how the company has dealt with the competition forces. Some of the respondents agreed that competitors were slow to copy the company product innovations while majority disagreed to this notion hence feel that competitors copy their product innovation at a fast rate. The results had more than half of the respondents agreeing that Doinyo Lessos had the ability to introduce new products to the market before competitors in most cases. Lastly the respondents were asked whether the product were superior. The results showed that only about half of the respondents agreed that the company had superior products than the competitors while almost the same number did not share the same opinion. The results showed that almost all of those with experience below 5 years agreed that the new products had attracted many customers. It was also found that almost all of those with experience between 6 years and 10 years agreed to the assertion. The results further showed that majority of the respondents with experience between 11 and 15 years agreed to the assertion while those with above 15 years were not an exception.

4.2 EFFECT OF ORGANIZATIONAL INNOVATION ON BUSINESS GROWTH

Finally, the research investigated the effect of organizational innovation on business growth at Doinyo Lessos Creameries. It was clear that lesser than half of the respondents agreed that Doinyo Lessos is fast to roll out new product to the market. This is contrary to the notion created by Hausman [29] who argues that medium sized businesses are more flexible and have better opportunities to adapt to situations as well as accept and implement changes more quickly and faster. It was further shown that more than three quarters of the respondents agreed that the company's management team members have relevant education and skills. This finding is supported by Yap et al. [30] who say that medium sized enterprises have smaller top management teams, which mean less functional diversity in experience. It was further apparent that some of the respondents agreed that management emphasizes on customer relationships and retention.

However, there was almost an equal group who disagreed with this opinion and felt that the management did not emphasize on this aspect. There were more than half of the respondents who agreed that the management of Doinyo Lessos supports new ideas from the employees while very few held a contrary opinion. It was further shown in the results that the management of Doinyo Lessos supports team building in most training seminars or workshops. This was accounted for by more than half of the respondents in the study. It was also noted that very few of the respondents were of a contrary opinion and believed that the management did not emphasize on team building skills. It was evident that all of the management respondents agreed that team building was being trained frequently while more than half of those in the processing section agreed to the same assertion. In addition half of the respondents in the marketing and sales section agreed that team building was a commonly trained skill in the marketing and sales section.

5 CONCLUSION

From the study findings, it is clear that new products attract many customers and in turn increase the sales volumes among SMEs. Doinyo Lessos renews the design of its products through changes such as appearance, packaging, shape and volume without changing their basic technical and functional features. In addition, Doinyo Lessos has had the ability to introduce new products to the market before competitors in most cases.

More than three quarters of the respondents agreed that the company's management team members have relevant education and skills. In addition, more than half of the respondents who agreed that the management of Doinyo Lessos supports new ideas from the employees while very few held a contrary opinion. Evidently, the management of Doinyo Lessos supports team building in most training seminars or workshops.

6 RECOMMENDATIONS

All business units need to develop innovation policy so as to form the impetus of great thinkers within the industry. This will help to instil a desire to innovate among all the stakeholders in the dairy industry. In addition, continuous innovation activities in any business should be sustained through R&D support, and employee motivation to ensure business growth is realized over time. Organizations also need to adapt participative management style and team building to motivate employee to contribute and support innovation within the firm.

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TOWARDS CONCEPTUAL AND THEORETICAL FOUNDATION FOR IDENTIFYING PROBLEMS, CHALLENGES AND MECHANISMS FOR MUNICIPAL WASTE MANAGEMENT IN DEVELOPING COUNTRIES

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ABSTRACT: This article reviews conceptual and theoretical issues in municipal solid waste management. Definitions and explanation of different concepts in municipal solid waste management are assessed. This article also examines the integrated sustainable waste management framework to determine its relevance in developing countries context. It further analyses measures by different stakeholders in coping with the problems of solid waste management practices and factors that influence the choice of the coping mechanisms. Finally the article provides a synthesis in form of a conceptual framework that may be adopted in aiding in formulation and design of sustainable municipal solid waste management practices.

KEYWORDS: Waste, Waste management, Municipal waste, Integrated waste management system.

1 INTRODUCTION

The process of urbanization is one of the most important drivers of economic, social and physical change in developing countries such as those in Sub-Saharan Africa (Pieterse 2008). Rakodi (1997) argued that it is "almost a truism that the planet's future is an urban one and that the largest and fastest growing cities are primarily in developing countries." The United Nations Centre for Human Settlements- UNCHS (now UN-Habitat) (2001) report indicated that approximately 25 percent of continent Africa's population lived in towns and cities in 1975. In the year 2000, due to the combined effects of rural-urban migration and rapid rates of natural population increase, 38 percent of the continent's population lived in urban areas and the proportion is expected to increase to 47 percent by 2015, and to double by 2050 (UN-Habitat 2009; Hall and Pfeifer 2000). The increase in the world urban population has led to challenges in the provision of public services. One of the most pressing issues in global cities is solid waste management. In spite of the data issues, it is clear that most cities' waste quantities are increasing rapidly. The reasons behind this is the fact that the population in the urban areas is increasing hence waste, the amount of waste is increasing with the increase wealth, the amount of waste from businesses is increasing and the substances in waste are also increasing in complexity and variety (U.N Habitat 2010).

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2 CONCEPTS OF WASTE

Waste

As noted by Palmers 2005 “the term waste is frequently left undefined, primitive in spite of its critical importance” and “in most cases a list of what is included in waste is substituted for underlying definition”. This is clearly evident, for instance Zerbok (2003) defines solid as non- hazardous industrial, commercial and domestic refuse including household organic, street sweepings, hospital and institutional garbage and construction waste.

The revised oxford dictionary defines waste as unused material or substance produced while making something. The word net dictionary on the other hand defines waste as any material unused and rejected as worthless or unwanted. Gilpin (1996) defines waste to be “all unwanted and economically unusable by products or residuals at any given place and time, and any other matter that may be discarded accidentally or otherwise into the environment”. The common idea in these definitions is that “waste is any material that is considered not of worth anymore and should be disposed off”. However, it should be noted that not all materials that are considered as not of worth anymore to the current holder are discarded, some are kept and are later passed on to another user (either for free or at some amount) to whom the materials become raw materials.

Palmer (2005) defines waste to be “any object whose owner does not want to take responsibility for it”. This definition implies that anything that does not have a owner should be considered as waste regardless of whether its new or in a condition which it can be recycled, however if someone is ready to take responsibility of that material then it’s no longer considered as waste. This notion that waste to one person can be a resource to another corroborates with Davies (2008) whose definition noted that “what some people consider to be waste materials or substances are considered a source of value by others”

USEPA (2000) regulatory gives a broader definition of waste. It defines solid waste to include items discarded, things destined for reuse, recycling, or reclamation, sludge and hazardous waste excluding radioactive waste and mining waste.

Solid waste management is guided by principles such as “to minimize waste generation, maximize waste recycling and reuse, and ensure the safe and environmentally sound disposal of waste” as identified by Schubeller et al. (1996). This means that waste management should be approached from the perspective of the entire cycle of material use which includes production, distribution and consumption as well as waste collection and disposal. While immediate priority must be given to effective collection and disposal, waste reduction and recycling should be pursued as equally important longer-term objectives.

Having looked at the definitions above by different authors it is good to come up with a definition of solid waste that will be adapted in this article, “waste is any material that the holder considers of no value in its present form and therefore is no longer willing to take its responsibility regardless of whether the material has fulfilled its purpose or not and if possible, the holder is willing to discard be it to another holder to whom it may have value or to waste disposal points”.

Municipal solid waste (MSW)

As noted with the definition of waste, instead of defining what municipal solid waste, some authors substitute the definition of municipal solid waste with a list of what is included in municipal solid waste, for instance Zurbrugg (2002) in his definition of municipal solid waste just provided a list of what is included in municipal solid waste. According to him municipal solid waste include “product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries all which comes from industrial, commercial and institutional establishment (including hospitals), market waste, yard waste, and street sweeping” also Cointreau (1982) defines municipal solid waste as non-air and sewage emissions created within and disposed of by a municipality, including household garbage, commercial refuse, construction and demolition debris, dead animals, and abandoned vehicles, municipal solid waste is generally made up of paper, vegetable matter, plastics, metals, textiles, rubber, and glass. Schübeler, Wehrle and Christen (1999), Zerbok (2003) in their work added that hazardous waste and hospital waste by definition are not categorized under municipal solid waste but however it is difficult to separate them especially when their portions are small and that and also in most cases they end up in the municipal solid waste system.

This article will adapt the definition of municipal waste to be “any material that is no longer considered of importance to the owner in the present form/condition and the owner is willing to discard it if possible and this material must have its source in the urban areas mainly from the residential areas and commercial enterprises.” This definition implies that all the solid wastes not produced in the urban areas are not considered municipal solid waste; also that the form of material can be changed in to another form making the same material a resource to another person.

Management on the other hand is a "cyclical process of setting objectives, establishing long term plans, programming, budgeting, operation and maintenance, monitoring and evaluation, cost control, revision of objectives and plans and so forth" Schübeler et al (1999). Municipal solid waste management therefore entails the whole process of collection, transfer, treatment, recycling, resource recovery, and disposal of solid waste in urban areas. This article will adapt Skitt (1992) definition of municipal solid waste management (MSWM) which entails "the purposeful, systematic control of generation, storage, collection, transport, separation, processing, recycling, recovery and disposal of solid waste" specifically in urban areas.

MSWM is a relevant service since solid waste is inevitable based on the fact that human beings produce waste at all levels of development both in the economic as well as in the social activities of life Karanja (2005)

The overall goal of urban municipal solid waste management is to collect, treat and dispose of solid wastes generated by all urban population groups in an environmentally and socially satisfactory manner using the most economical means available World Bank (2011), protecting the urban population from suffering from the impact of poor waste management such as diseases caused by poor waste management which include lung diseases as a result of air pollution from the decomposing solid waste and burning pollution among other diseases.

http://urbanindia.nic.in/publicinfo/swm/chap2.pdf and other authors gave an outline of the specific goals of municipal solid waste management which include:

- Promoting environmental conditions by controlling air water and land pollution as well as ensuring sustainability of various ecosystems in urban areas.
- To support urban economics a development by providing demanded waste management services and ensuring the efficient use and conservation of valuable materials and resources Schübeler et al (1999).
- Valorization of recyclable and organic materials – according to U.N.Habitat (2010) waste is a resource and the entire waste system should be designed to maximize the benefits from the discarded materials.

Having looked at the definitions of waste, municipal waste and municipal waste management, its relevance and goals in the discussion above, the discussion below will focus on Integrated Sustainable waste management.

3 INTEGRATED SUSTAINABLE WASTE MANAGEMENT (ISWM)

ISWM was first developed by a Dutch N.G.O called WASTE in the mid 1980s, it was further developed in 1990s by the collaborative working group on solid waste management in low and middle income countries and has of late become like a norm as far as solid waste management is concerned (Imad, 2011).

Before embarking on elaborating the concept of ISWM, it is necessary to have a clear understanding of what entails the terms 'integrated solid waste management' and sustainable waste management' both which are coined to make the concept of ISWM. Below is a discussion on what the terms 'integrated solid waste management' and 'sustainable waste management' entails.

Integrated solid waste management

Conventional solid waste management consisted of collection, followed by transportation, and disposal of waste. However this approach of waste management has not been able to cope with the challenges of rapid urbanization and waste evolution. This has therefore called for an approach that includes innovative techniques to enhance the capability of the system to cope with the challenges of increasing volume of waste. The innovative techniques therefore should be able to regulate waste generation, recovering materials for recycling, producing energy as well as reducing hazardous effects for more safe and efficient disposal. Solid waste management systems that integrate innovative system for the sake of sustainability of solid waste management system are called integrated solid waste management system Penjor (2007). Klundert and Anschutz (1999) and (2001) on integrated waste management noted that an Integrated system is "that system which uses a range of inter-related collection and treatment options, at different habitat scales (be it household, neighborhood or city), involves all stakeholders i.e. governmental or non-governmental, formal or informal, profit- or non-profit oriented and takes into account interactions between the waste management system and other urban systems as outlined in World Bank (1999). White et al (1999) points out that an integrated solid waste management system deals with all types of waste materials- the alternative of focusing on specific materials , all sources of municipal solid waste and a system that include waste collection and sorting followed by one or more options of recycling, biological treatment of organic materials, thermal treatment or landfill.

From the above definitions it can be concluded that an integrated solid waste management is 'the approach of solid waste management that takes the solid waste management system as a whole and not in compartments. An integrated system therefore includes all kinds of waste regardless of whether they are recyclable or not, all the stakeholders and importantly involves all the innovative waste management techniques'.

However good and beneficial integrated solid waste management is ,it is an approach that is prone to criticism since solid waste management is made up of different compartments and integrating all of them sometimes can be impractical depending on the setting where it is being implemented.

Sustainable waste management

Sustainable waste management is an integral part of sustainable development (Brundtland Commission's approach to development which seeks to "meet the needs of the present without compromising the ability of future generations to meet their own needs") WCED (1987) because the amount of waste generated and how it is managed has profound implications for the quality of the environment and for the prospects of future generations. This therefore means that in keeping with the objectives of sustainable development, sustainable waste management can be regarded as an approach to waste management that, in addition to achieving its main goal which is to protect human health and the environment, ensures that the limited resources of the earth are conserved for both present as well as the future generations. It therefore becomes important to minimize the amount of natural resources that human beings extract as well the consumption by recycling waste materials, and conduct waste management efficiently to curtail the environmental impacts of waste disposal and protect ecosystem services for both current and future generations Baabereyir (2005). Klundert and Anschutz (1999) and (2001) in their definition of SWM points out that it means a system that is appropriate to the local conditions in which it operates, from a technical, social, economic, financial, institutional, and environmental perspective, and; capable to maintain itself over time without reducing the resources it needs as noted by a definition which corroborates with that of World Bank (1999). It can therefore be concluded that a sustainable waste management system is that which takes into respect sustainable development aspect of producing more with less and should be appropriate to local context so that it can be in a position to maintain itself for a long time and can be achieved through the minimization of waste impacts in terms of quantity or negative impacts, by reducing the volume of waste, reusing the waste products with simple treatment and recycling the waste by using it as resources to produce the same or modified products.

Having explained the terms integrated waste management and sustainable waste management, below is a discussion on integrated sustainable waste management.

Integrated sustainable waste management

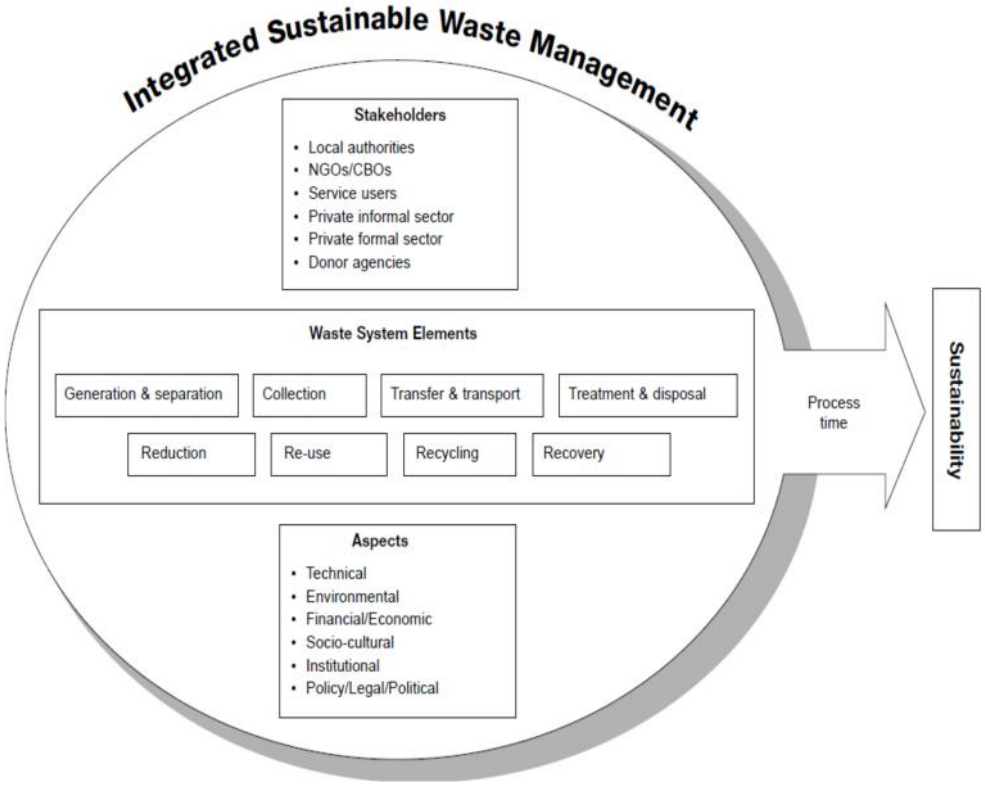
According to UNEP (2009) integrated sustainable waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency. The core concept of ISWM has been developed out of experience to address the certain common problems with the municipal waste management, Klundert and Anschutz (2000). Klundert and Anschutz (2000) continue to explain that ISWM is a waste system that fits the society, the economy and the environment of a particular place. Klundert and Anschutz (2001) in further explanation of ISWM indicates that ISWM differs from the traditional approaches to waste management since the new approach gives room for participation of other stakeholders in waste management and also inclusion of the elements of waste prevention and waste recovery which was not the case in the traditional approaches to waste management where the mandate of waste management was all laid on the hands of the municipal government and the elements of waste reduction and recovery were all missing.

3.1 The dimensions of integrated sustainable waste management

ISWM is a system approach recognizes three main dimensions including stakeholders, system elements and strategic aspects. The different dimensions are interrelated and their linkages enable the overall function of the system, U.N Habitat (2010). It can therefore be concluded that ISWM considers municipal solid waste management not just as technological system with infrastructure and facilities that facilitates handling and disposal of municipal solid waste (MSW) but is a management system that contributes and deals with many other elements such as socio economic, environmental among others (Imad, 2011) and Klundert and Anschutz (2001)). The above statement corroborates with U.N.Habitat (2010) where it is stated that when the ISWM framework was introduced in developed countries, it became clear to the municipalities that solid waste management problems were not solely technically based since the success of waste management requires active cooperation from the service users and also that solid waste depends on institutions, government and policy frameworks.

Figure one below gives an outline of the main dimensions of the ISWM framework as outlined by Klundert and Anschutz (2001) followed by a discussion on the three dimensions.

Figure 1: ISWM framework



Source: Adapted from Klundert and Anschutz (2001)

The discussion below is on the three dimensions of integrated sustainable waste management starting with the stakeholders, then to system elements and finally strategic aspects.

Stakeholders

The number and type of stakeholders regarded as essential to solid waste management has been growing and broadening over time. While traditionally waste management was the responsibility of the local government, the private and community sectors are increasingly taking over certain tasks, Lardinolois and Furedy (1999). As anticipated by Corinne et al (1999) that the environmental problems of cities that are associated with poor solid waste management can be addressed in large part by the interaction of several actors/ stakeholders, ISWM one of the approaches for solving the problems of SWM in urban areas recognizes high interaction between multiple stakeholders. According to Imad (2011), stakeholders are the people and organizations participating in solid waste management, this definition corroborates with Majale (2011) who stated that stakeholders in waste management are people or organizations who have a stick or are interested in good solid waste management and their involvement and activities makes that possible. Anschutz et al (2003) elaborated on the subject and stated that stakeholders in waste management differ with cities; this creates the need for their identification in every context. Joseph (2006) in support of this statement stated that identification and participation of different stakeholders in each city as well as their interests is paramount in their coordination in solid waste management.

Broadly, stakeholders in solid waste management can be categorized under state and non state actors. State actors are generally the local municipal governments while as the non state actors include the nongovernmental organization, community based organizations and the private sector both formal and informal as discussed below;

Municipal governments

Local Municipal governments have the role to plan and provide public services within their areas of jurisdiction solid waste management included. In most cases the local municipal governments both from the developed and developing countries receive their powers and responsibilities from the central government, all geared towards protecting the rights of the citizens and providing services for the common good of the citizens. In their day to day activities local municipal authorities also ensure the implementation of laws and regulations, Gidman et al. (1995).

However due to some reasons such as financial constraints, the local authorities may outsource the services to the private sector, but however, the local authority always holds the responsibility of ensuring the quality of the service, Majale (2011).

Non-Governmental Organizations (N.G.Os)

These encompass a diverse range of organizations such as churches, universities, environmental or social organizations and lobbies (Lardinolois and Furedy, 1999).

Non Governmental Organizations play different roles in waste management. These roles include education, advocacy, liaising between small C.B.Os and individuals who do waste collection and large scale private companies. In terms of education, some NGOs seek to facilitate community exchanges for instance they bring people from different communities where they can exchange information and innovation with one another. NGOs, also in some countries mandate schools to provide environmental education and waste recycling. What happens is that these schools bring students of school age in the waste recycling plant where the member of the N.G.O takes them through a program on waste management.

N.G.Os acts as liaisons between the community and the City, as well as between the community and the private sector. In most of the cases the N.G.Os are usually in contact with leaders of C.B.Os and relay the information back to the City.

Community Based Organizations (C.B.Os)

The community members and their representatives have a direct interest in solid waste management. In developing countries especially in the low income areas, the community receives little if not no solid waste management services (Karanja, 2005). Sometimes the communities organize themselves in to a Community Based Organization with a direct goal of improving the state of the solid waste management within their areas (Gidman e t al. 1995). C.B.Os in waste management also plays a role of community organization, education, collection and small business development. C.B.Os, are organized to create income generating activities in waste. In most cases C.B.Os are organized by local community leaders who play an important role in solid waste management by organizing and educating their community about issues and opportunities in solid waste. Sometimes, the CBOs take the overall role of providing solid waste management services hence in this situation they operate and maintain solid waste management systems within their areas of operation.

Formal private Sector

The “formal private sector” refers to privately-owned corporations, organizations, firms and/or institutions. Formal private sectors must be formally registered with the city and have official business licenses as well as have some level of capital investment and necessary equipment related to waste management. The main objective of the formal private sector is to gain profit from the variety of activities they are engaged in which include waste collection, resource recovery, incineration and landfill operation (Gidman et al. 1995). Private sector can be sub-dived in to two categories-small scale private business that basically have in most cases one vehicle which helps them in the whole process of transferring waste and large scale private business which are large firms with a fleet of vehicles and large capital infrastructure.

Individual and/or informal sector actors

The term ‘informal private sector’ refers to unregistered, unregulated, or casual activities carried out by individuals and/or family or community enterprises that engage in value adding activities on a small-scale with minimal capital input, using local materials and labor-intensive techniques” (Gidman e t al. 1995).The difference between the formal private sector and the informal private sector is that the informal private sector is most of the times driven by poverty, their activities are also labor intensive and are performed in a haphazard manner.

System elements

Elements of solid waste management comprises of technical components of waste management starting from the generation of solid waste to dumpsites or to the treatment plant (Imad, 2011). Klundert and Anschutz (2001) stated that ISWM framework recognizes the high-profile elements collection, transfer and disposal or treatment. The framework gives

equal weight to the less well understood elements of waste minimization, reuse and recycling and composting. Below is an explanation of the various waste management system elements.

Waste generation

Waste generation refers to the process in which waste is formed. Bringi (2007) noted that waste generation "includes all the activities where a product is considered as no longer important and the owner is willing to discard that waste". It is also noted in http://urbanindia.nic.in/publicinfo/swm/chap2.pdf that "both technological processes and consumptive processes result in the generation of waste." Bringi (2007) further explains that the waste generated in one place may significantly differ from that generated in another place due to factors such as "geographic location Season of the year, frequency of collection, characteristic of population, extent of salvage and recycling, legislation and public attitudes"

Sorting and waste handling

Sorting involves the process of separation of waste with different characteristics. Waste handling takes two levels, the first one involves "activities associated with management of wastes until they are placed in storage containers for collection" while as the second level "involves the movement of loaded containers to the point of collection" as noted in http://urbanindia.nic.in/publicinfo/swm/chap2.pdf.

Storage

Waste storage takes two levels i.e. on-site storage which involves the activities of storing waste at individual level. The other level involves storing of waste at a communal storage point, Bringi (2007).

Collection

Solid waste collection is a critical part of a local waste management system, Tchobanoglous and Kreith (2002). Solid waste collection involves gathering of solid waste before transporting it to the place where the collection vehicle is emptied. The process starts with the containers holding materials that a generator has designated as no longer useful and ends with the transportation of solid waste or recyclable materials to a location for processing, transfer, or disposal (Tchobanoglous and Kreith, 2002).The collection system is uniform in most countries, wherein individual households place their daily refuse into a container nearby, then the refuse is collected and delivered to the waste collection point or disposal site. Zerbok (2003) noted that many cities employ neighborhood-level collection points.

Transportation of waste

Transportation of waste refers to the use of any transportation facilities to move waste to a transfer station, processing or to the disposal facility (Bringi, 2007). Bringi (2007) continues to explain that "the transportion of collected waste is a major problem in developing countries since the vehicles spend most of operation time on transporting wastes to the disposal sites due to traffic and road conditions and a small payload".

Reduce, Reuse, Recycling and Recovery

Bringi (2007) as many other authors on solid waste management noted that reduce, recycle, reuse and recovery are important aspects in solid waste management due to their major contribution to sustainable waste management. He continues to explain that the four functions are more successful in developed where waste management technology is considerably advanced than in the developing countries.

Processing and Treatment

Processing involves the technological activities of trying to get something out of the waste .

Disposal

Disposal is the final element of solid waste management system; it entails the activities of disposing of waste which takes different forms such as sanitary land filling and open dumping which dominates most of the urban areas in developing world (Bringi, 2007).

Strategic aspects in waste management based on ISWM

As mentioned earlier, Klundert and Anschutz (2001) and Imad (2011) stated that to achieve sustainable and effective waste management, strategies must go beyond technical aspects to formulating specific objectives and implementation of appropriate measures to a focus on financial, environmental, institutional and political aspects of municipal solid waste management. The following section discusses various aspects of ISWM.

Technical aspects

Technical aspects of integrated sustainable waste management are concerned with the planning and implementation and maintenance of collection and transfer systems, waste recovery, final disposal and hazardous waste management (Lardinolois and Furedy,1999). Technical facilities and equipment must be designed and selected with careful regard to their operating characteristics, performance, and maintenance requirements and expected life-cycle costs as well as paying close attention to preventive, maintenance, repair and spare parts availability. Thereby, one has to take into consideration the design and selection of transfer facilities and equipment must match the characteristics of local collection systems and the capacity of existing disposal facilities (Majale, 2011). Local collection systems should be designed with active participation of the communities concerned. Informal waste recovery and scavenging may be rendered more productive through support measures and appropriate technical design of the waste management systems. Public sector involvement in waste recovery and/or leasing of waste recovery rights to private sector enterprises may be considered. Sources of hazardous waste materials must be identified, registered and targeted for appropriate management; special attention needs to be paid to infectious healthcare wastes (Klundert and Anschutz, 2001).

Financial and economic aspects

Lardinolois and Furedy (1999) noted that financial and economic aspects in solid waste management involves the budgeting and cost accounting within the waste management system which are normally based on the local, regional, national and international economic contexts. Some specific issues are: privatization, cost recovery and cost reduction, the impact of environmental services on economic activities, the commodities marketplace and how the recycling infrastructures connect to it, efficiency of municipal solid waste management systems, macroeconomic dimensions of resource use and conservation and income generation.

Environmental aspects

Environmental aspects in solid waste management pertains the effects of waste management on land, water and air; on the need for conservation of nonrenewable resources; pollution control and public health concerns (Lardinolois and Furedy, 1999).

Institutional aspects

This relate to the political and social structures which control and implement waste management, the distribution of functions and responsibilities, the organizational structures, procedures and methods implicated, the available institutional capacities, and the actors such as the private sector who could become involved. Planning is often considered the principal activity in relation with institutional and organizational aspects (Lardinolois and Furedy (1999).

Political /legal aspects

Political/legal aspects address the boundary conditions in which the waste management system exists: setting goals and priorities, determination of roles and jurisdiction, the existing or planned legal and regulatory framework, and the basic decision making processes (Lardinolois and Furedy, 1999).

Social cultural aspect

The social aspect of solid waste management entails the participation of citizens and the possibilities of public private partnerships in waste management practices (Majale, 2011).

Legal/ political

The legal aspect of solid waste management refers to the policies guiding the whole process of solid waste management (Lardinolois and Furedy, 1999).

Having looked at the three dimensions of integrated sustainable waste management framework, below is a discussion on the principles that guide integrated solid waste management under which one can analyze the problems facing a certain solid waste management system.

Principles of ISWM

There has been a tendency in many municipal functions to move directly from problems to solutions without understanding what actually is happening. This leads to the municipal functions diving in to purchasing of technologies as well as high investments on waste management all which in most of the cases end up being useless.

The principles of ISWM outlined in the table below form a base for the analysis of the problems in SWM so as to have a better understanding of the situation at hand before diving in to solutions. The principles basically outlines what should be the case in a certain SWM system meaning if the opposite is happening definitely there is a problem in that particular part of the system.

Table 1: Principles of ISWM

Strategic aspect	Principles
Technical	**All the technological aspects should be:** • Adapted to the physical environment, topography and other physical requirements • Preferably locally manufactured and based on indigenous technology • Geared towards efficiency and optimum utilization of equipment • Adapted to the local availability of spare parts • Durable and of good quality; the equipment used should have a long expected life span.
Financial/economic	**Financial management of technologies and systems should:** • Be based on the 'all beneficiaries contribute principle', i.e. besides the waste generators paying user charges, the resource recovery sector and the local government should also contribute by respectively paying a profit tax and allocating municipal revenues to waste management • Be geared towards the most efficient overall system, leading to the lowest cost per ton to operate, taking into account the cost of other affected urban systems • Ensure highest productivity of labor and capital in the local situation • Lead to full cost analysis and full cost recovery, including all costs and benefits involved.
Social/cultural	**Technologies and systems should:** • Be provided to all strata of the population regardless of ethnic, cultural, religious or social background • Be adapted to user demands and priorities • Be adapted to local willingness and ability to pay, leading to affordable systems • Incorporate management models which are acceptable to people and institutions involved • Be geared towards improvement of working conditions of system operators • Be geared towards income and employment generation
Environmental health	**Technologies and systems should:** • Be clean, i.e. minimize the negative impact on soil, air and water at local, regional and global level • Promote closed cycle systems and avoid loss of raw materials, energy and nutrients • Follow the 'waste management hierarchy', preferring options that promote waste prevention, source separation, re-use and recycling, above those merely aimed at collection and disposal • Encourage treatment and resource recovery as close to the source as possible • Minimize risks to public health
Institutional	**Technologies and systems should be:** • Geared towards capacity-building of operators and managers, especially of local authorities • Creating room for involvement of all stakeholders in planning and implementation, especially weaker and underprivileged groups • Encouraging 'social privatization' • Promoting organizational cultures that foster professionalism, transparency and accountability • Based on decentralized management, giving sufficient regulatory and financial autonomy to local governments to improve waste management sustainably • Ensuring competitive bidding for waste service provision by private sector • Encouraging incentives, recruitment and promotion based on merit and performance • Promote inter-sectoral co-operation (with other urban systems)

Legal/policy	**Technologies and systems should be supported by:** **A legal framework that:** • Encourages involvement of non-governmental actors and the private sector • Supports decentralization of tasks, authority and finance • Contains rules and regulations that are transparent and unambiguous • Enables impartial enforcement of rules and regulations **A policy framework at national and local level that:** • Encourages decision-making at the lowest level of authority, usually the municipality, regarding financial matters and selection of technologies • Gives waste management high priority both in policies and budgets • Recognizes waste management as an environmental health issue, that necessitates equity in service provision • Recognizes the role of non-governmental actors and the private sector in waste management • Fosters accountability of decision-makers to ensure efficient use of public funds • Supports the 'waste management hierarchy', giving preference to waste prevention, source separation, re-use and recycling, above mere collection and disposal

Source: Adapted from (Klundert and Anschutz, 1999) and (World Bank, 1999).

Regardless of the fact that most of the principles outlined above apply to many contexts, the opinion of the author of this work is that not all these principles apply to each and every context e.g. one of the principles is that the technology is preferred when locally manufactured, this cant apply in all countries since very few countries manufacture such things as transfer vehicles and therefore they have to rely on the imports from other countries.

Cointreau (2001) gives a summary of the above outlined principles in her ten principles that should guide a sustainable and integrated solid waste management program. According to her scheme, such a program should: be supportive of good governance, provide economic service delivery, establish cost recovery mechanisms for long-term financial sustainability, conserve natural resources, embrace public participation, foster environmentally appropriate technologies and sites, seek appropriate levels of source segregation, recycling and resource recovery, conduct strategic facility planning and development ,build institutional capacity and invite private sector involvement

Having looked at the dimensions of integrated sustainable waste management i.e. the stakeholders, strategic aspects and the system elements and also the principles that guide ISWM, the following discussion is about the problems in solid waste management particularly in developing countries.

4 PROBLEMS IN SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES

The quantity of solid waste is generally considered to be growing across the globe as a result of increased population, increased industrialization, and increased urbanization and rising standards of living among other factors, UNEP (1994). However developing countries have solid waste management problems different from those of countries that are fully developed. Indeed, the composition of their waste is different from those of developed countries (Zerbok, 2003).

As noted by Ogawa (2002) "solid waste management in developing countries is coupled by problems which low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities". This scenario has led solid waste management to be inefficient and improperly performed by many urban areas in developing countries.

Zurbrugg and Schertenieib (2002) and Zebrok (2003) in their discussion gave umbrella of problems in the sector of solid waste management. According to them problems in SWM can be explained under inadequate service coverage, operational inefficiencies, and inadequate management of hazardous waste and limited utilization of recycling activities. Ogawa (2002) on the other hand categorized problems in the sector of solid waste management into technical, financial, institutional, economic, and social constraints. However as it will be noted in the discussion below, the umbrella problems are well explained by the specific problems outlined above, in fact some of the umbrella problems are impacts of the specific problems.

The following discussion may not cover all the problems but will try to summarize those that affect the people, residents, waste workers, policy makers and decision makers and governments in the cities and urban residential areas in typical developing countries.

However as noted in the discussion above, some authors look at the problems facing solid waste management sector as specific problems while the others take them as umbrella problems. The discussion below will therefore look at the specific problems and then the umbrella problems.

4.1 Specific problems

Financial constraints

Many writers have cited scarcity of funds as a major problem in the field of solid waste management, Contreau (2001) and Majale (2011). Financial constraints can be defined as the imbalance between the revenues and expenditures in the sector. Financial constraints in the sector of solid waste management can be attributed to various reasons as discussed below;

With increasing urbanization, demands for services will logically increase. Municipal tax and fee revenues however are not likely to rise as quickly as the population, this is explained by the fact that people moving to the city are likely to be poor immigrants from rural areas in search of employment, unable to contribute significantly to the revenues of the municipality. Zurbrugg and Schertenieib (2002) on their argument on financial constraints in SWM stated that financing safe disposal of waste management in developing countries have become an issue because people are just willing to pay for removal of waste at their site but they don't care about the ultimate disposal.

Inadequate resource mobilization is another factor that is attributed to the financial constraints in the field of solid waste management. In most cases, municipal taxes and charges in developing countries are inadequately and poorly administered. Informal urban communities which characterize the small and medium towns in developing countries pay no municipal taxes and service charges, and this fact has often been used as a principal argument of not providing these communities with municipal services (Coffey & Coad, 2010).

Low budgetary allocation from the central government is another factor contributing to financial constrains in the field of solid waste management. In developing countries the local government is charged with the responsibility of providing solid waste management among other municipal services. As noted in many studies on solid waste management, solid waste "solid waste management is not one of the public services that is given high priority especially in developing countries." As a result, very limited funds are provided to the solid waste management sector by the government (Ogawa, 2002). On top of the low budgetary allocation from the central government, the transfer is also conditional; this limits the relative autonomy of the councils in deciding their immediate needs (UNEP, 2005).

Technical constraints

Many researchers and writers on the subject have observed that developing countries employ the technology that is neither efficient nor sustainable. Zurbrugg (2002) and Majale (2011) noted that the local authorities in developing countries import technology from developed countries. This has a direct impact on the operation and maintenance of the imported technology. This is due to the fact that the developing countries don't have the technological knowhow on how to operate and maintain the imported technology, the other factor is that the imported technology for instance the vehicles rarely have their spare parts available in the developing countries. The other factor that contributes to the inefficiency of the imported technology is that most of the times they are designed to operate in areas which have different geographical characteristics than where there are used.

Ogawa (2002) on the other hand noted lack of overall plans for solid waste management at local and national levels. Without such plans technology in the sector is often selected without the consideration of whether it is appropriate or not in the overall solid waste management system. Ogawa (2002) also noted that research and development activities in SWM are often low priority in the developing countries. This has led to the selection of technology that is not appropriate to the local climatic and topographic conditions, human and financial capability as well as social cultural acceptability. The result is that such a technology may end up not being used, regardless of the huge amount of time and resources that might have been invested in it (Majale, 2011).

Institutional problems

Ogawa (2002) noted that in most developing world, there is usually more than one body that deals with solid waste management, however, the responsibilities of such each body is not in all cases clear hence cases of overlapping and duplication of the function. Ogawa (2002) continues to explain that coordination between the different bodies responsible for solid waste management is a missing element in developing countries as well as different legislations which are evidently fragmented governing solid waste management.

Social cultural problems

Social problems in the sector of SWM are experienced in both developing and developed countries. However the problems are more complex in the developing countries. As noted by Ogawa (2002) "social status of solid waste management workers is generally rated low a situation which can be explained by the negative perception of people regarding the work which involves the handling of unwanted material".

Political interference

The introduction of multiparty system in some of the countries in the developing world Kenya included has led to political jostling. In Kenya for example, the councilors are selected or nominated by the local authorities through their affiliated political parties and will usually pursue the interest of their political parties when voting or decision making in committee by which they chair. In other words, if a decision has to be made by the councilors it is influenced by the political parties where they belong a scenario which has led to delay of activities in solid waste management. For example in cases of purchasing collection trucks – there are instances where councilors hinder particular projects for political reasons only (Rotich et al 2006).

Environmental health problems

Most developing countries have informal waste collection rates going up to 30-60 % in low income countries and 50-80% in middle income countries, U.N Habitat (2010). The accumulation of waste in the streets creates room for the growth of germs, insects, rats and other disease vectors. In cases where there is no sufficient sanitation infrastructure human excreta might end up mixing with the municipal solid waste hence increasing the complexity of the characteristics. Uncollected waste sometimes also ends up causing clogging in the drainage system which creates a bleeding area for the mosquitoes which spread malaria (U.N Habitat, 2010).

There are also cases of improper solid waste management activities that dominate the developing world. As noted by Majale (2011), low levels of solid waste collection in developing countries have led to people adapting measurers such as burning and open dumping as a way of doing away with waste. These measures are usually associated with some environmental health problems such as respiratory diseases due to the smoke that comes out of the burning waste, environmental(air, ground and surface water and soil) pollution among other environmental health problems (www.epa.gov).

4.2 Umbrella problems

Inadequate Service coverage

Municipal solid waste collection in the developing countries serves only a small portion of the urban population. The inhabitants who are left without waste collection services are usually in the low income population living in the poor conditions of the peri urban areas (Zurbrugg et al 2000).

Operational inefficiencies

Operational inefficiencies are due to inefficient institutional structures, inefficient organizational procedures, or deficient management capacity of institutions involved as well as use of inappropriate technology.

With regard to technical system, collection and transportation of solid waste from their generation sites to the final disposal site is a growing problem. Transport also relies on operation vehicles whereby frequent breakdowns coupled with shortage of spare parts (Majale, 2011) characterize the process. This problem is attributed to overreliance on developed world technical system in waste management. Often the developing countries use similar vehicles as those ones used in developed countries (Zurbrugg and Schertenieib, 2002).These vehicles are usually sophisticated, expensive and difficult to operate and maintain in the developing countries. After a short period of being in use the vehicles start suffering from frequent breakdowns. It is not uncommon for 60% of the vehicles fleet or even more to be unserviceable at any time since it's hard to get the spare parts of these vehicles in the developing countries. These leads to the delay of waste collection or at

times no waste collection at all and thus problems in the whole process of waste management (Coffey & Coad, 2010). With rapidly growing urbanization, less priority is being given by the cities for adequate layout and planning (Zerbok, 2003). Garbage dumps with their associated diseases, odor, and frequent fires (in some cases) would ideally be located on suitable land away from most densely populated areas. These areas are becoming harder to find as population urbanize and municipal traffic increase the transport of waste becomes longer and more time consuming and therefore more expensive and less efficient.

Inadequate waste disposal

Most of the municipal solid waste in developing world is dumped in open dumps which are more or less uncontrolled and makes very uneconomical use of available space and often produce unpleasant and hazardous smoke from slow burning firers (Zhu et al. 2009). These dumps also allows free access to waste pickers, animals and flies and often produces unpleasant smell and hazardous smoke from slow burning fires. With the rapidly increasing urbanization the present situation is expected to become more complicated. Such inadequate waste disposal creates serious environmental problems that may impair health of human beings and animals and cause economic and other welfare losses (Zurbrugg and Schertenieib, 2002).

Some of the reasons attributed to inadequate disposal are the mostly inappropriate guidelines for sitting, design and operation of new landfills as well as missing recommendations for possible upgrading options of existing open dumps. Many of the municipal officials think that uncontrolled waste disposal is the best that is possible. In most cases the only available guidelines are from developed countries which cannot be applied in the developing world since they are sophisticated and expensive and do not take into account for the different technical, economical, social and institutional aspects of developing countries and therefore cannot be implemented n the developing world (Zurbrugg and Schertenieib, 2002).

Limited utilization of recycling activities

According to Zurbrugg and Schertenieib (1999), recycling inorganic materials from municipal solid waste is often well developed by the activities of the informal sector although such activities are rarely recognized, supported or promoted by the municipalities. Reuse of organic waste material often contributes to 50 % of total waste material but still fairly limited but often has great recovery potential (Zerbok, 2003). The advantages of recycling are that it reduces the cost of disposal facilities; it also prolongs the lifespan of the disposal site as well as reducing the environmental impact of disposal of organic material such as leachates and methane problems.

Having looked at a number of problems and challenges in municipal solid waste management, the following part of the article will make an attempt to look at the strategies and options for fixing the problems explained above.

5 COPING MECHANISMS

5.1 Coping mechanisms to the problems facing the field of solid waste management

Municipalities and other stakeholders in waste management take different initiatives to deal with the problems they face in solid waste management, before embarking on the coping mechanisms, the discussion below will start by giving a brief description of waste hierarchy which according to White et al. 1999) has formed the base for current thinking on the best waste management practices which have been applied by municipalities to deal with the problems in MSWM. Other coping mechanisms besides those based on the waste management hierarchy will also be explained in the discussion below.

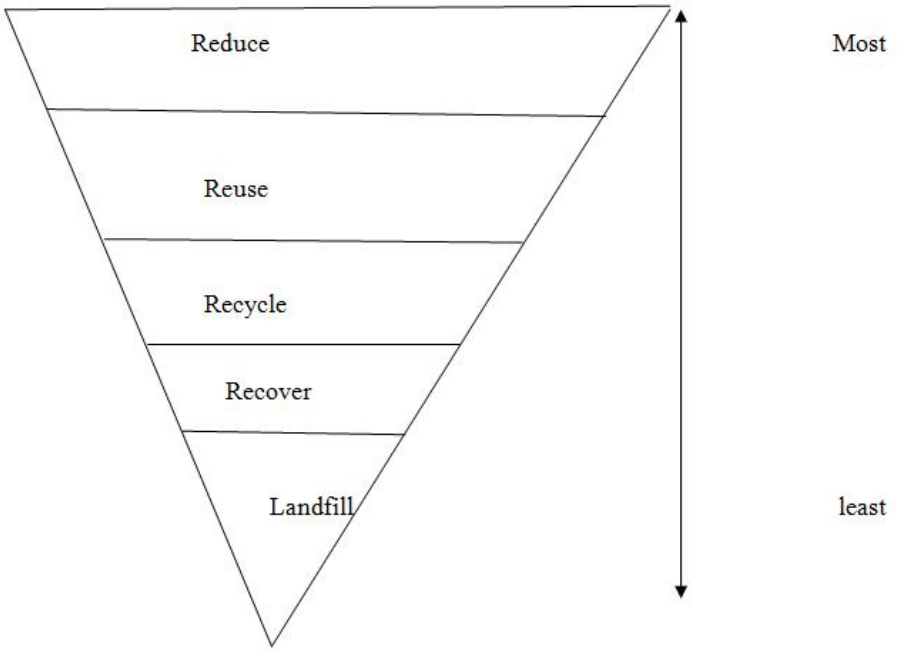
5.1.1 Coping mechanisms based on waste management hierarchy

Before embarking on coping mechanisms based on waste management hierarchy, the discussion below gives a brief explanation of what waste management hierarchy entails.

Waste management hierarchy

Current thinking on the best methods to deal with waste is centered on a broadly accepted 'hierarchy of waste management' (arrangement in order of rank) (urbanindia.nic.in/publicinfo/swm/chap2.pdf), as shown in Figure 2 below. Waste management hierarchy gives a priority listing of the waste management options available (White et al. 1999; Lardinolois and Furedy, 1999). Hierarchy of waste unlike the conventional waste management system which focused on street sweeping, collection, transportation and disposal only focuses to long term environmentally sound or sustainable waste management (Lardinolois and Furedy, 1999).

Figure 2: Waste hierarchy



Adapted from: http://urbanindia.nic.in/publicinfo/swm/chap2.pdf

The hierarchy gives important general guidelines on the relative desirability of the different management options. The hierarchy of waste management options is an essential prerequisite for any waste management strategy. Though there has been a range of variations of the hierarchy of options currently in use basically, the options are similar and have been used as a policy guideline that has formed part of many National Environmental laws and policies- it is the cornerstone of ISWM. Below is an explanation of how the hierarchy is adapted

Waste minimization/reduction at source

Waste minimization/reduction is the highest rank in the hierarchy of waste management options. It involves reducing the amount (and/or toxicity) of the wastes produced hence entering the waste stream. Waste minimization or reduction is ranked the highest due to the effectiveness associated with it in terms of reducing the cost for handing as well as the negative environmental health problems that are caused by waste (urbanindia.nic.in/publicinfo/swm/chap2.pdf).

Recycling

Waste recycling involves the separation and sorting of waste material, preparation of these materials for reuse or reprocessing; and the reuse and reprocessing of these materials. As noted (www.scribd.com/doc), recycling is an important element in solid waste management since it contributes to the reduction of the financial, technological as well as human resources required for final disposal of waste.

Waste processing (with recovery of resources i.e. materials (products) and energy)

Waste processing involves alteration of wastes to recover conversion products (e.g., compost) and energy (urbanindia.nic.in/publicinfo/swm/chap2.pdf). The processing of waste materials usually results in the reduced use of landfill capacity (www.scribd.com/doc)

Waste transformation (without recovery of resources)

Transformation of waste, without recovery of products or energy, may have to be undertaken to reduce waste volume (e.g. shredding and baling) or to reduce toxicity (www.scribd.com/doc).

Disposal on land (land filling)

This is given the lowest rank in the hierarchy of waste management options.

Although the hierarchy of waste management options is a useful guideline, using it to determine which options are preferable does not always resulting to sustainability. The logic behind this is that different kinds of solid waste will of course be dealt with in different processes so to deal with the whole range of management stream, a range of waste management options are desirable, White et al (1999).

Having a clear understanding of what waste management hierarchy entails, the discussion below gives an outline and explanation of sound waste management practices based on waste management hierarchy.

Sound waste management practices (based on waste management hierarchy)

According to UNEP 1996, a sound practice in SWM refers to any policy or technology that embodies a reasonable balance of feasible cost effective, sustainable, environmentally beneficial and socially sensitive solutions to SWM problems. Selection of sound practices for SWM is context specific based on factors such as level of development including relative cost of capital, labor and other resources, technological development and human resource development, natural conditions such as topography, soil type, waste characteristics e.t.c, social and political conditions such as the degree to which decisions are constrained by political considerations, degree of importance of community involvement in solid waste management e.t.c. In the selection of sound practices in SWM, it is important for policy makers to direct their resources where they would yield the greatest return to the society. The following part discussion may not cover all the sound solid waste management solid waste management practices but will try to give a summary of a bigger number of them.

Reduction at source

Source reduction would involve all means of reducing the amounts of waste that reaches the drop off points. Waste reduction can be done by all waste generators from big companies to small households. Source reduction takes a number of measures such as product design and packaging to make them easier to reuse, using of existing packaging materials as opposed to new ones, lengthening the usage of products to minimize the frequency of replacement and developing alternatives to disposal such as organic composting (Rotich et al. 2006).

Waste reduction would seem the most effective and easiest way of managing solid waste. In developed countries waste reduction is meant to deal with the issue of lack of enough space for land filling, big municipalities in developing countries also use waste reduction for the same purposes; small municipalities in developing countries can also benefit from waste reduction, in most cases the small municipalities are characterized with inadequate finances for solid waste management. Waste reduction can be used to fix these problems.

The approach has been gradually gaining acceptance though not overwhelmingly successful there have been contributions which cannot be ignored regardless of how minor they are. This can be attributed to the emphasis of mass production and the development of cheap consumer goods have led to people adapting the “throw away culture” whereby instead of reusing the old goods, the consumers go for new products hence increasing the amount of waste in the stream.

Several simple ways of reducing waste can be used both by the residents and businesses as well. This ways include buying only what one needs to buy, repairing old products, repairing old products and buying products which are more reusable and durable. Waste reduction can also be done by donating old items such as clothes to the needy as well as selling them to be sold as second hand clothes or exchanging them with some other goods.

Composting

The waste of many developing countries have a higher composition of organic waste than in the developed countries for example (Hoornweg et al. 1999) estimated that in developing countries, the average city’s municipal waste stream is composed of over 50% organic material, Penjor (2007) on the other hand estimated more than 40%. The nature of organic waste makes it start decomposing immediately after it has been produced. If mixed up with other types of waste, it becomes more difficult to manage the waste due to the odor and also due to the fact that decomposing waste acts a vermin attraction. Composting is an effective and sustainable approach of reducing the amount waste that goes to the drop off points as well as improving environmental health conditions. It’s one element of ISWM strategy that can be applied to mixed municipal solid waste management or separately collected leaves, yard wastes and food wastes. The four basic functions of composting are preparation, decomposition, processing and marketing (Tchobanoglous and Kreith, 2002).

The logic behind composting as far as solid waste management is concerned is to take in natural resources, process them, and close the loops of pollution through improved municipal solid waste systems in connection with urban agricultural activities (Tchobanoglous and Kreith, 2002). Organic composting can be considered one of the low cost ways of dealing with waste. However, regardless of composting being a low cost technology of waste management, it has not been so successful

in most of the countries such as in Africa and Latin America, UNEP (1996), a scenario that can be blamed to low technological advancement which is a basic requirement for successful large scale decomposing. To make these systems successful and sustainable, they have to be designed in economically viable, environmentally sound and socially uplifting ways.

If properly done, organic waste composting has got a number of advantages among them in included being reduction of costs of the disposal facilities, it also prolongs the sites life span, and also reduces the environmental impact of disposal sites as the organics are largely to blame for the polluting leachates and methane problems. This is one of the reasons why solid waste managers in many parts of the world are now exploring ways to reduce the flow of biodegradable materials to landfills, Zurbrugg (2002).

Recycling of inorganic materials

Recycling means any method, technique or process utilized to separate, process, modify, convert, treat or otherwise prepare solid waste so that its component materials and substances may be beneficiary used or reused (http://urbanindia.nic.in/publicinfo/swm/chap2.pdf).

Recyclable materials include papers, glass, metals (ferrous and non ferrous, bulk metals, plastic, vehicular batteries, used motor oils, and cardboard. As stated earlier, recycling of inorganic materials from MSW is often well developed through the activities of the informal sector (Zhu et al. 2009). In America, recycling took a greater significance than just providing an alternative method of treatment of solid waste (Tchobanoglous and Kreith (2002). With the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries. Initially scavenging was driven by poverty and a desire to earn a living. However this has taken another shape. N.G.Os and C.B.O s have been engaging in the activities of sorting and recycling waste.

However solid waste managers should be keen on recycling, keeping it in their minds that placing a large part of the responsibility of solid waste management for community in recycling alone puts an undue burden on recycling and could damage a strong sound recycling initiative if it results in excessive cost or excessive contamination of high value products (Tchobanoglous and Kreith, 2002). With proper arrangements for recycling, it makes it possible to reduce the amount of waste that goes to the drop-off points hence reducing the financial burden of collection, transfer and treatment of waste, recycling also hence to prolong the life of the disposal site since lesser waste reaches there besides other economic benefits.

It should also be noted that the three solid waste management practices explained above are interrelated in a way, sometimes it is difficult to separate them except may be by definition since in most cases one leads to the other and therefore in most cases they are discussed together. For instance as indicated above, source separation or reduction at source is done to allow composting and recycling.

5.1.2 Other coping mechanisms

As it will be noted in the discussion below, there are other coping mechanisms to the problems of solid waste management that have been discussed in studies on solid waste management besides the ones that are discussed above based on waste management hierarchy.

Public participation

As noted by JICA (2005), people's participation is a driving force for sustainable waste management. People are the generators of waste and at the same time the greatest beneficiaries of solid waste management service. Population assuming responsibilities of the municipal authorities and setting up an appropriate institutional and technical waste collection scheme while taking their economic situation in to account is the most realistic and promising approach seen to improve the situation of low population coverage in provision of solid waste management service (Zurbrugg and Schertenieib, 2002). Population assuming the role of local authorities in municipal solid waste management can take two levels i.e. privatization and community participation.

Privatization

Many local government budgets are facing extraordinary challenges as shrinking revenues and rising expenses lead to major shortfalls. One of the most logical responses is to reduce the cost and size of government by concentrating on providing critical municipal services such as police and fire protection (http://www.environmentalistseveryday.org). Many municipalities have in fact turned to privatization as a potential solution. It is believed that through privatization of waste collection, disposal and recycling the private sector will provide improved service at a lower, increase efficiency among other benefits. However, financial picture is cleared somewhat when the entire system is turned over to outside local governments will still be held to account if service declines (Zerbok, 2003). Making better use of comparative advantage of the private

sector to provide solid waste collection services is an important step to improving operational inefficiencies in provision of solid waste management services (Zurbrugg and Schertenieib, 2002).

Community Participation

Community participation in solid waste management can be defined as "the process by which individuals and families assume responsibility for their own health and welfare and for those of community and develop the capacity to contribute to theirs and the community development ensuring that their voices are heard in urban environmental management and the decision-making process" (Mwangi, 2000). A successful solid waste management system therefore starts with the participation of the community in the whole process of planning and implementation of SWM practices.

These will ensure that the community who are basically the beneficiaries of SWM service give their opinions and once the decision makers put the opinion of the community members to consideration, the outcomes will definitely reflect the views aspirations and aspirations of the community (Mwangi, 2000). This is very important in avoiding situations whereby the decision makers provide services that do not meet the needs of the community hence might end up losing a lot of money with no positive outcomes.

In addition to involving the community members in the planning process, they can also be involved in other levels such as primary waste collection (neighborhood wide collection and storage), administering and financing the primary collection system, planned cooperation with municipal service agencies, to ensure a reliable transfer of waste from primary to secondary cycle, development of recycling activities within the community and development of income generating activities through processing and upgrading of waste materials and development of local industries. Community participation in primary waste collection can be manifested in the efforts of the community to collect and transport waste to a few central places, where the municipal refuse–collection service will remove it for final disposal elsew - this requires co–operatio from the whole community and special tasks for a few individuals (Mwangi, 2000). Community participation can also be manifested in the efforts of the community to extract certain materials from the waste for commercial or manufacturing purposes (recycling) - this requires separate storage of certain items so that these materials can be recycled with the least possible soiling (Mwangi, 2000).

Partnerships

Mwangi (2000) defined partnerships as "cooperative working arrangements aimed at achieving a specific objective." Municipal governments are responsible for the provision of public services solid waste management included. However due to rapid rate of urbanization especially in developing countries among other factors mentioned earlier in this article, providing solid waste management has become a problem for many municipal governments. Partnerships have proven to be a sort of a solution to this problem. This is where different actors take part in SWM activities helping to relieve municipal governments the burden of providing the service.

Improving efficiency

As noted by Dijk and Kwarlenge (2007), economic and technical efficiency are a key to attain a sustainable solid waste management system. This therefore means that efficiency of solid waste management system has to be measured by productivity of the system. Efficiency in SWM ensures financial sustainability of the system. Productivity of a solid waste management system can be achieved through planning collection routes, vehicle scheduling and operation, supervision of operations and monitoring and enforcement of the role of local authorities.

Capacity building

Insufficient capacity is a fundamental impediment to sound solid waste management programs in much of the developing world. Operating an efficient, effective, environmentally sound municipal solid waste management program requires building administrative capacity for government and private sector players and technical capacity for designing, operating, maintaining, and monitoring each part of the process.

Often those people working in solid waste management- private sector companies, NGOs, and government entities lack technical and financial knowledge of solid waste management. Training that builds human resource and institutional capacity for all stakeholder groups at appropriate levels should be a part of every waste management project. Peer-to-peer training for everyone from waste-pickers to local government officials has proven effective in extending and sustaining these programs.

Generally and as it is the case in the discussion above, coping mechanisms are determined by the problems. However, a number of factors influence in a way the choice of coping mechanisms applied in a certain setting as it will be discussed below:

6 FACTORS THAT INFLUENCE THE CHOICE OF COPING MECHANISMS

The discussion below is about some of the factors that influence the choice of coping mechanisms in the field of solid waste management. Most of the researchers on the topic of solid waste management mention that solid waste management is "context specific" at one point of their study or another. According to Coffey and Coad (2010), one of the main reasons for difficulties in the field of solid waste management is the failure to recognize the differences in geographical regions, nations, between cities and even within a city. Bernstern (2004) stated that the specific local and country context defines the municipal solid waste management needs of a particular society. Majale (2011) also made the similar remarks on the subject, according to her; arrangements for solid waste management service in the urban centers have evolved in direct response to locally specific conditions.

From the above remarks, it can be concluded that the nature of problems facing the field of solid waste management differs from one place to another and therefore different coping mechanisms which best suits their specific context are applied. The differences in the coping mechanisms can also be explained by the facts that cities are different and solutions to a problem in one city might not apply to another regardless of the problem being similar (U.N Habitat, 2011). However other factors than just problems can explain the unique coping mechanisms as discussed below;

Waste characteristics

Waste characteristics both in terms of quantity and composition determine solid waste management of a particular place. The reason why waste characteristic vary from one place to another can be explained by the factors discussed below;

Cooking and eating habits

In most cases, the difference is determined by whether the food is sold prepared or not. In some countries, food like poultry is sold alive and some vegetables e.g. maize are sold with additional materials to the part that is to be consumed. It can therefore be concluded that different kind of food produce waste with different characteristics as well as in terms of volume and characteristics (Coffey and Coad, 2010). Cooking methods also has a major impacts on the characteristics of waste, for instance solid fuel creates the need to use papers which otherwise may have been discarded, hot and abrasive ashes affect the characteristics of waste of waste as well as damaging plastic containers, liquid fuel on the other hand may not have all this (Coffey and Coad, 2010).

Social and economic factors

The way of life of people in most cases determines the amount and the characteristics of waste that they generate as well as how they handle waste. Differences in lifestyle can be big sometimes even within a city. More literate people may tend to buy magazines and newspapers, more affluent people are more likely to discard durable items that become obsolete instead of repairing them. The use of domestic servants may also have an impact on the characteristics of waste generated in a particular household (Coffey and Coad, 2010).

Economic activities

The economic activities of a certain urban area also influence the choice of the coping mechanisms applied in that particular setting, for instance composting will be a more preferred coping mechanism in a more agricultural area than in a less agricultural area, for instance in some towns, much of the waste is also fed to the livestock and poultry (which is a sub-conscious way of dealing with the problems in waste management- determined by the economic activity, in this case poultry keeping) (Coffey and Coad, 2010).

Culture

Culture provides the context or stage setting within which human activities operates; its impacts can therefore touch a host of societal functions including management of solid waste. Culture differs from one group of people to another group. Culture influence on the choice of coping strategies to the problems facing the field of SWM can be manifested well in holism and individualism ways of life. In holism kind of life, it is possible for stakeholders to have successful community participation in SWM since the communities live as one, however in the individualistic way of life, it is difficult to involve the community members since every person lives his or her own life, such activities as neighborhood waste collection and community

product upgrading to earn income are very possible in a holism living community but on the other hand, these activities are very difficult to execute in a community where everyone lives his or her own life (www. zendergroup.org).

Availability of market for recycled products

As indicated earlier, for recycling to be successful there is need for market for the products recycled, if there is no market for the products recycled, then it makes no sense for the commercial recyclers to do their work, on the other hand , where market is readily available it acts as an incentive for the execution of recycling activities

Having looked at the major problems facing the field of solid waste management and the coping mechanisms that the different stakeholders use to cope with the problems and the other factors that influence the choice of coping mechanisms, the discussion below is on the conceptual framework which article proposes.

7 CONCEPTUAL FRAMEWORK

Conceptually, this article proposes ISWM framework. ISWM framework recognizes three main dimensions i.e. stakeholders, system elements and sustainability aspects.

As indicated earlier, ISWM framework recognizes the more understood elements of waste management as well as the less understood elements of waste management namely waste reduction, reuse, and recycling and composting. These elements are outlined and explained well in the concept of waste management hierarchy. As mentioned earlier, current thinking on the best methods to deal with waste is centered on a broadly accepted 'hierarchy of waste management'.

ISWM also calls for the integration of different stakeholders who of course play different roles and apply different measures in the provision of solid waste management services.

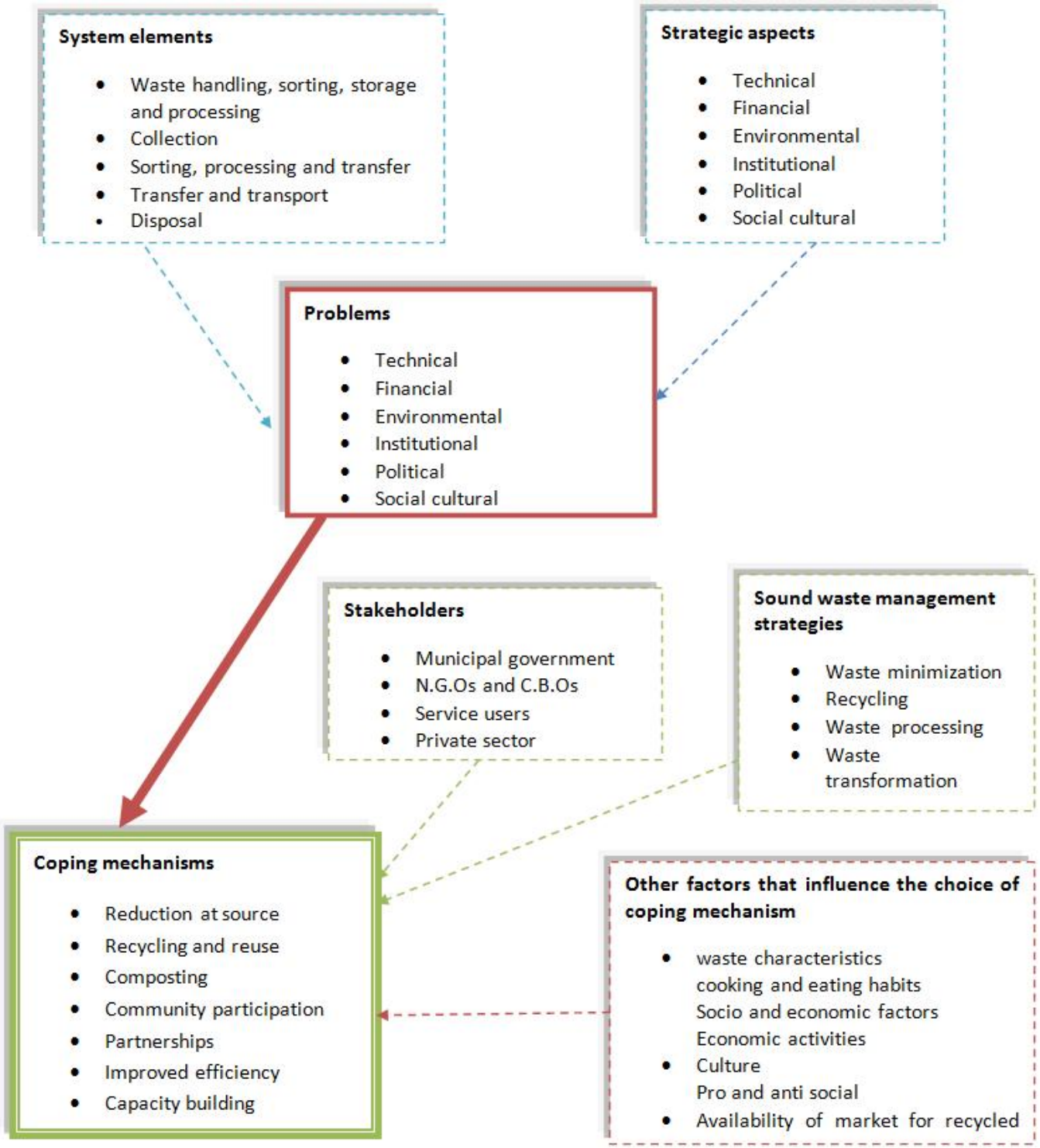
The figure below is a conceptual framework for problems and coping mechanisms in SWM. The problems identified in solid waste management in this area are based on the strategic aspects of solid waste management and solid waste management system. Stakeholders (in most cases but not always) use the hierarchy of waste to select the coping mechanisms. Coping mechanisms on the other hand are determined by the problems; however the conceptual framework also shows the other factors that influence in any way the choice of the coping mechanisms.

8 REFLECTIONS ON THE CONCEPTUALAND THEORITICAL REVIEW

This article provides the a better understanding of the problems that the developing countries are facing as far as SWM is concerned as well as the coping mechanisms adopted to cope with the problems facing the field of SWM. The review has clearly indicated the problems that the developing countries are facing in the field of SWM. Some of the authors however discuss the problems as specific problems while the others discuss the problems as umbrella problems. .

The review has also clearly indicated the coping mechanisms which in this case were based on the waste management hierarchy and stakeholders under ISWM hierarchy; however it is worth noting that not all stakeholders in SWM are involved in the function, the involvement depends on the specific context. However, ISWM have just given an outline of the system elements , strategic aspects and stakeholders and provided some principles guiding the framework, however it should be noted that all that is outlined in the framework can apply in all the contexts as mentioned earlier some system elements are more favored by the existing local conditions of a particular place, also the waste management hierarchy has given an outline of the most preferred to the least preferred without considering that there are some waste management practices that are more applicable in some areas due to the existing local conditions regardless of whether they are preferred as provided by the hierarchy or not. The two frameworks should therefore have some considerations on the features of the specific context and may include other factors that influence the choice of waste management strategy with the corresponding strategy so that it is easy for the waste managers to select waste management strategy that fits their local context instead of scenarios where they apply some strategies that later fail to work for instance the two frameworks have given composting as a strategy for managing solid waste, however without the influencing factor which in this case is economic activity and specifically agriculture some municipal corporations might apply the strategy in areas where there are no agricultural activities taking place hence end up failing due to lack of market for their products

Figure 3: Conceptual framework for identifying problems and challenges and different coping mechanisms by different stakeholders by authors (2014) based on literature review.



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The Analysis of geothermal operation cost factors

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ABSTRACT: In this paper, the main independent variables that can impact the running cost of geothermal industries are analyzed, and these analyses are aim at finding the relationship between the impacts and cost. For the first, the development situation of geothermal is deployed and some negative barriers of geothermal are listed. Then, the main barriers are defined and introduced with the lectures researches, the degrees and the reason that these barriers can make extra investment to the geothermal are analyzed. The analysis help finding a new way to solving and utilizing the ground energy and with comparison with current hydrid and steam geothermal features, ground source heat systems is proved that it indeed can help to solve the listed problems of geothermal. And the conclusion of the advantages of the new technology can be used develop geothermal in future.

KEYWORDS: Geothermal development, Geothermal barriers, New solution geothermal technology, New geothermal technology methods.

1 INTRODUCTION

Power plants such as dioxins,whilst needing to be considered in any environmental impact assessment necessary for a resource consent when developing a new plant,were not considered since they have relatively low importance(Ralph,2002).As the fossil energy be stuck in the problem of market prices increasing, the environment pollution limits becoming strict ,the renewable energy filed increase fast by the time of 30S of 20centrury(Ralph,2003). Geothermal energy like any others new energy technologies also get a out stand develop as it have captured 8000MW ,18% percents in sustainable energy contribution all over the world(Ingvar,2001). Any type of new technology energy equipment can have impacts on the environment, the differences just in the impacts degrees, but geothermal is the type that make emission most than any other type of renewable energy(Ladislaus,2003).Although it have help word cut more than 8000M tonnes waste ejections. Besides these, geothermal also face the financial and environments policies problem from the governments and market challenges from others new type of technology(Subir,2004). What is worse, the sharpest completive still from the low price and high pollution conventional fossil facilities.And these problems has come up with some negative barriers and made bad impacts to geothermal industry from 80s 20centrury(Hugh,1999). So these problems of geothermal energy make a gap that let the operates cost difficultly drop to the fossil power levels(Hugh,1999). The main five points that contribute to the extra high cost of geothermal should be pay attention and can be conclude from lecture researches as five highlight asides as below: position of land captured problem, problems of work conditions risk, poisonous pollution, problem of system investment and policy of economic and legal; For as short ,this five asides can be said as Position, Protection, Pollution, Profits and Policy, can be called as 'Five Peas'.

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Positons of land captured: Human beings have a long history for using geothermal, though the way we utilize the energy is very different form heat in ancient to electricity now. Though many towns and city locate besides the place that can get nature heated water in history, such as Etruscans, Romans, Greeks, Mexicans, Chinese, Japanese, and Maoris and other earth quake boundaries, but today many city locate the position far from geothermal source because of economic reason. So the location of geothermal always in remotes place in many countries(Ingvar, 1994). So this situation will make the energy transport cost increase more no matter transport the heat or electricity.Such as for American , the main geothermal energy distribute around and in the LOS ALAMOS mountains , so from 1970S to now time, the technics and cost to use energy situation still very complex.

Problems of work conditions risk: For the people and safe. The technology of geothermal alway have to draw hot water steam or gas from underground or lake bottom for generate the electricity(Ralph). But always electricity always come with all products embracing indigenous steam, hot water, and hot brine, gases results from water, acid gas, or other fluids artificially introduced into geothermal formation(Thomas, 1976). So the geothermal have to set the wash and filter process and pay money for wastes and promote the worker equipments for safe. All the methods fro prevent viperous hurt people, so like many factory, geothermal industry must invest much money to use and check the complete facilities and educate the advanced worker and engineer.

Poisonous pollution:For the surroundings, the protect attitude is very different from the problems of work conditions risks which focus on keep life safe. poisonous pollution always increase the cost from business and tax pay for governments. Because the waste should not emission to atmosphere and surrounding directly.And what is more these waste ingredient steam and water always can not go to the second terms for recycling refining and using(Ladislaus, 2003). So these consideration must be taken into consideration well or the industries may sulfur a series problems before start a process(Thomas, 1976).

Problem of system investment: Before a factory of geothermal start work, project investments in management must have a good estimate, because unlike traditional fossil and Hydro-Electric, the geothermal always low productivity, high investments so the profits always lower though as a sustainable project ,geothermal always have priority to use public and social support funds(THEODORE,1982). Further more, the investments also are compared with other type of new energy projects and the social requirements.Though both capital cost and operations and maintenance costs of geothermal power have declined substantially over the last decade, in light of this development, it is worthwhile assessing the overall cost of geothermal power today(Sayal, 2004).

Policy of economic and legal: government policy is the most complex part for cost. Because geothermal always use some trade estate from governments, what the governments are interesting in not the company benefit, but the location or nation benefit. For one acres which can use in geothermal always go into comparison that whether it can give more social benefit if use for refine minerals, Nature Preserve zone or business quarter in suburb, or it make residence life annoy(Robert D,1982).What is worse, like religiously in spired civil war, bad policy can lead industry's innovations or adverse trend for geothermal(Donald, 1982).So the policy can influent the geothermal cost in very deep level.

From the introduction above , the definition of 5P has been given, and all of them is just the main factors that can make the cost increase. So it is necessary to find the new models to solve them better, and make the society citizens and environments benefit from energy from under ground , also achieve the goals that government and business investors get double-win results.

2 RESEARCH METHOD

A new ameliorate skills use a contacting the contaminated steam with a nonaqueous sorbent to finish the acid wash process to protect the waste leak out from geothermal facilities.(Darrell L,1999).Also a scientist use experimental way to test a well-head technics to increase the economic advantages of geothermal and it also can prevent the systems from anti-corrosion and anti-fouling precautions (Kubiak,1988). Another groups have a test to detect the number of energy storage under the 100meters ground and try to design a series methods to increase the power of geothermal(Burkhard,2001). While a converter technology for ground source can practice a functions than transform the low temperature ground heat to high temperature, as a results this experiments can widen the land can be used for geothermal(Larry,1980).For more , a new production process which manufacture joint productions industry have been tried to increase the profits of geothermal(Tolga, 2009).

The methods illustrated above mainly are based on the experimental process to optimize the results, from this detections have been practiced. And all of this detection also focus on the five problems.Such as Darrell solve the waste gas process and promote the filter efficiency, so does Kubiak; And Burkhard and Larry try the new ground heat skills to generates

electricity;And Tolga introduce a different business way to manage the geothermal production.So from the research method analysis ,All coming up models should focus on the experimental and experiential way to solve the five problems.

3 FACTORS OF COST EXPLORATORY RESEARCH

3.1 ANALYSIS THE FIVE POINTS THAT CAN IMPACT COST

Though geothermal make a function that cut the emissions, but it has still many problem to solve in many sides, and also face big market challenge by far, so the negative difficulties should be paid attention. (Hugh, 1998).There are some asides need attentions.Because geothermal need special geology positions, so the construction and transport process need special extra cost(INGVAR, 1993). It is possible to make accident for people by the emission of geothermal and the unstable geological environments(Ralph,2002). And also for the environments, if it can get efficiency methods to deal the wastes, pollution also can be harmful with surroundings(Ladislaus, 2003).What is more, geothermal still stay in the disadvantage sides compare with conventional energy, so it is necessary to cut extra the cost(Grant, 2009).Last, government always is the factors that can impact the profit and market trends(DONALD, 2014).

It is really that we should not just agree the achievements that the geothermal have gotten, because there are still many problems make obstacles to it, or make it doubtable in future.There are enough data can prove that land limits can make most geothermal have to increase the survey cost and shrink the survey range(INGVAR, 1993).And also the accident in geothermal factory higher than other type energy,the threaten brought to workers is nearly in nuclear power plant.so company must use very accuracy way to operates. For the environment , the geothermal indeed can eject out the waste to the out surrounding so the waste must exhaust cost(Grant, 2009).Market judge always for any business so does geothermal, and geothermal also face the market challenge(Grant, 2009) And, policy always can lead the business situation of geothermal, so geothermal development need more government support to protect the environment (DONALD,2014).

3.2 POSITION OF LAND LIMITS

Geothermal are indeed very depend on the land position as the power of geothermal is far lower that fossil equipment, it still face the transmit power with long distance(INGVAR,1993).So it will increase the power waste.Besides, it may captured the commercial land or mineral land of business(Richo, 1997).So all this prove that before set a geothermal explorations are the most importance part of strategy plan, and it also need technology test for some years and pay the cost though some place can not be adopted at last (Bloomster,1975,Hui-Ming,2012), and also if the energy can be have a good way to convert into hydrogen and transport to far place ,but the process still in higher cost(Tolga, 2000).

Though land limit is the problem, but many professor give the advise to solve the problem, some agree the choice of land is important, geothermal can be chosen near the heat source also very near city ,or geothermal can be use for can make its production just for hydrogen and others pure elements come outs.what is more Richo also give warn that the place fit for geothermal also have more passibilities occur geologic hazard, so it need a numerous cost for construction and maintain safe.

3.3 POISONOUS STEAM RISK

As geothermal features, there are always toxic threaten which caused by the steam containing many elements for people and life who live or work around(Enrico,1997). So the safe filter and absorption facilities must always work in high status, so the cost will come high and but it is still a tough problems(Darell,1999).Not only operates a geothermal have risk, but also plan or construct a place for geothermal still need high risk works in special place(PETER,1982).All above is not guess, but it is fact that geothermal accident have happened many times around the world.

Geothermal is a sustainable energy that can cut emissions, but it still have risk about the wastes, for people and lives around the geothermal, it will be in dangers if the waste can not deal with the toxic steam well. So geothermal factory always keep high level for safe than any other type of energy factories.And also the risk not only in operates period but also in construct and design period. There have been some accident cause by toxic recent years, and also just in Italy there are 4,500 men work in geothermal dead with accident or chronic disease disease cause by geothermal toxic steam from 1950 until now.

3.4 ENVIRONMENT POLLUTION

At the renewable fields, geothermal is the one kind which can make the more pollutions when compare with others, because the heat transport process always have to make the gas containing the water discrete from medium then go to the air(Ingvar,1994).Geothermal indeed can cut the emission but it still have to emission gas though the value is lower than fossil(Ingvar,2001).The steam and water come out of geothermal always can make pollution if eject to the surroundings.So

geothermal need many technologies and procedure to deal with the wastes and pay the tax(PETER,1982). What is more except the air and water pollution, geothermal also can bring noise and land waste(Enrico,1997).

It is like some professors say that any type of energy can impact environment, what different just the degrees.(Ladislaus,2003). So geothermal also can make influence to surroundings though it is better than fossil and coals, what is more ,when it make wastes far less than conventional fossil equipment, it also can make wastes more than solar, turbine and etc(Ingvar,1994;PETER,1982).Besides this it also can make pollution can not be seen, such as land solid waste and noise(Enrico,1997).So this academic results which from experiences and test tell people geothermal is a kind of energy not so friendly with environments.

3.5 PROFITS OF INVESTMENT

Geothermal not only a public careers but also combined with business motivation especially under the market challenge from other types of new energy. So the disadvantages is the lowe emissions but high prices(Grant,2009).Though some one have methods that use geothermal generate hydrogen to increase the profits, but the series of facilities still need amazing investments(Tolga,2000). And also if take policies,sources and technologies conditions, the profits is tough problem to drop(Kubiak,1988).

Though the geothermal is achievements of technology, but the develop will be impacted by the market and government support. As the high price of geothermal electricity, the fossil still attract the stake stocks eyes and the investments of technologies need to be cut(Grant,2009;Tolga,2000). For the first ,just the stable requirements and policies that can make geothermal develop well(Enrico,1997).For the second, the decrease the new efficiency of new technology is the only way to cut the price and increase the benefit(Kubiak,1988).

3.6 POLICY OF GOVERNMENT

The policy for the geothermal not always good for it, but al the problem need to solve by the support policies from governante.During the factors beyond technics, the influence from local and nation policy and support even higher than market(John stone, 2010), because as environment career, government must give many boon policy that geothermal can cut some tax(Ingvar , 2001).But in fact, government should not always consider one industries develop rather than consider the whole society benefits. For government, geothermal just an alternative type energy that can benefit the environments.And also, sometimes, geothermal set in a land will incur doubt of residence. (DONALD,1982).Such for one lands, if it can create more employments, tax,it may be used for minerals(Robert.1982).

Government aims is not just benefits the geothermal, but aims to benefits all nations, so tax, federal laws, residence support will take into consideration though any one know geothermal is a stuff can be good with environments (Ingvar , 2001). But the problems it can bring to community also can make the plan stop(Robert,1982). What is more, government may choose other type of energy to take place geothermal if the facts permits.And also, the price challenge from the fossil and fuels still give new energy pressure include the geothermal energy though the government has give many policy to encourage them(Ingvar B,1994). So geothermal energy should take more advantages to get more support from society.

4 THE COST FACTORS DISCUSSION

From all explanations and evaluations we know that the Position of land , Protection of safe, Pollution of waste, Profits of investment , Policy of governments are reasons that main impact the geothermal operates cost. Position of land will increase the price of construct and electricity transport; Protection of safe will spend cost in safe facilities maintain and stuff education; Pollution of waste will let company pay extra cost and tax for environment; Profits of investments will determine whether the stake stocks profits and governments will support policy; Policy will increase the pressure from society.But from figure, we can see position, protection ,pollution can be solved by technologies , and even if the technologies can make geothermal environment friendly enough and the system cheap enough,these “five peas” problems will all be solved. So it is will be good that if we can use a kind of technics to utilize the ground energy with the way that no limits of land, no risk of safe, high profits for customers, not so independent with policies. It is will make geothermal develop better in future.

5 CONTRIBUTION AND NEW MODES OF GSHP

In recent years there is a new kind of cheap but powerful energy systems can use the geothermal energy within shallow surface of ground and also nearly zero emissions, it is ground source heat pump(GSHP). This kind of systems have many advantages than conventional geothermal.

"The underground in the first approx. 100 m is well suited for supply and storage of thermal energy.The climatic temperature change over the seasons is reduced to a steady temperature at 10-20 m depth, and with further depth temperatures are increasing according to the geothermal gradient(average 3 °C for each 100 m of depth)(Sanner,2001)."So the construct cost of the GSHP is very cheap, the construct requirement just dig bores within 10m of ground surface.The cost can be afforded by a common family.

"GSHP are one of the fastest growing applications of renewable energy in the world, with annual increases of 10% in about 30 countries over the past 10 years. Its main advantage is that it uses normal ground or groundwater temperatures (between about 5 and 30C), which are available in all countries of the world(Curtis,2005)." There is unlikely to be a potentially larger mitigating effect on greenhouse gas emissions and the resulting global warming impact of buildings from any other current, market available single technology, than from ground source heat pumps (Caneta Research 1999)."

The GSHP based work principle is very different the geothermal because there are two forms of heat transfer occur within the Earth:conduction and convection.Conduction transfer the energy between molecules internal verberation without the of mass. While the Convection is the common heat transfer process in liquids or gases from one place to another(Enricho,1997).So the work process of GSHP is totally different with geothermal.

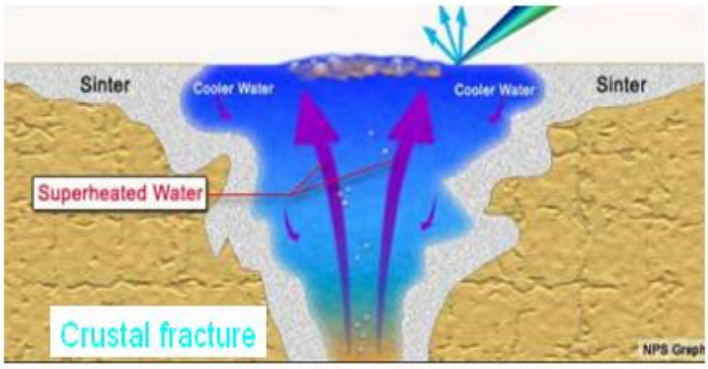

Fig. 1. The Mode of Heat Convection

Fig. 2. The Mode of Heat Conduction

So as ground is a kind of energy storage, and the energy contained by the ground can maintain normal ground surroundings' or groundwater's temperatures varying between 5 □ and 30 □ with the depths and latitudes(Trillat,2006). Due to the heat balance between the solar radiation and the mantle thermal conduction through the atmospheric transmission, the underground earth become a heat source at constant temperature. This feature can be utilized to construct a type of systems that can exchange heat from the earth to the evaporators with a heat pump and a couple of bores.

So far, GSHP (ground source heat pump) systems have increased to 8624MW(56% of global) in the U.S. Because it can operate at higher efficiency and no CO2 ejection compared with the conventional fossil power heat equipment; Moreover, compared with solar panels, wind turbines and tides hydroelectricity, GSHP can work without the limits of seasons and weathers(Sanner,2003).

GSHP system conducts heat with a couple of bores under ground which use water or air as medium. It can operates in

two modes. In the cooling mode, the pump rejects the hotter water to the ground earth from the evaporator in the room with one of the bores, and draws up the cooler water from under ground with the other bore, so it can make a cooling process(figure5 left). On the contrary, in the heating mode, the pump draws the hotter water from the ground earth to the evaporator in the room, and rejects the cold water to the under ground, so it can make a heating process. (figure6 right).

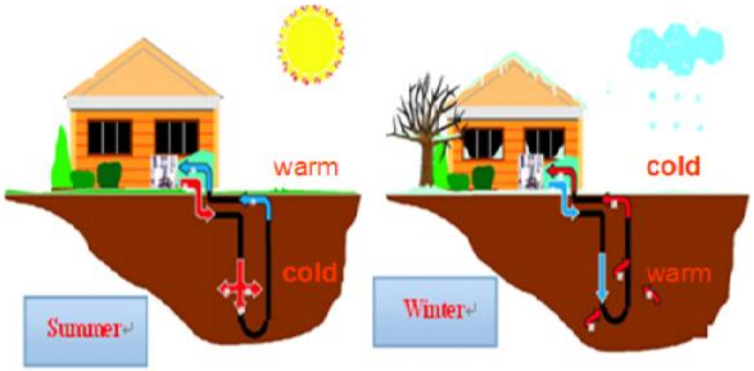

Fig. 3. GSHP Operating Modes

Though GHSP system still works with power pump, but the heat energy it can transfer are always higher than it exhaust. By the far, the highest efficiencies of this kind of systems can achieve 300% to 600%, it means that spend 1Kw•h powers can save 3Kw•h power exhaust at least.

So from the work theory and principle of the GSHP , it is not difficult to find that these new technology system can solve many problems of traditional geothermal. First, these systems can fit most kinds of geological environments, the bores can be digged anywhere ,no matter under school yard or a individual house, the depth always within 20m.Second, it no any emission, it work just with water as medium of heat transfer but the water volume no any exhausted when it work. Third,it no emission, so it is no any toxic things risk the thing need move away just the several kilograms of soil. Fourth, the investment scales always too much lower than geothermal, the most expensive GSHP for factory or greenhouse lower than 20thousands dollars, for residences family house always lower than 2000dollars ,but it have save 8624MW fossil energy by far.

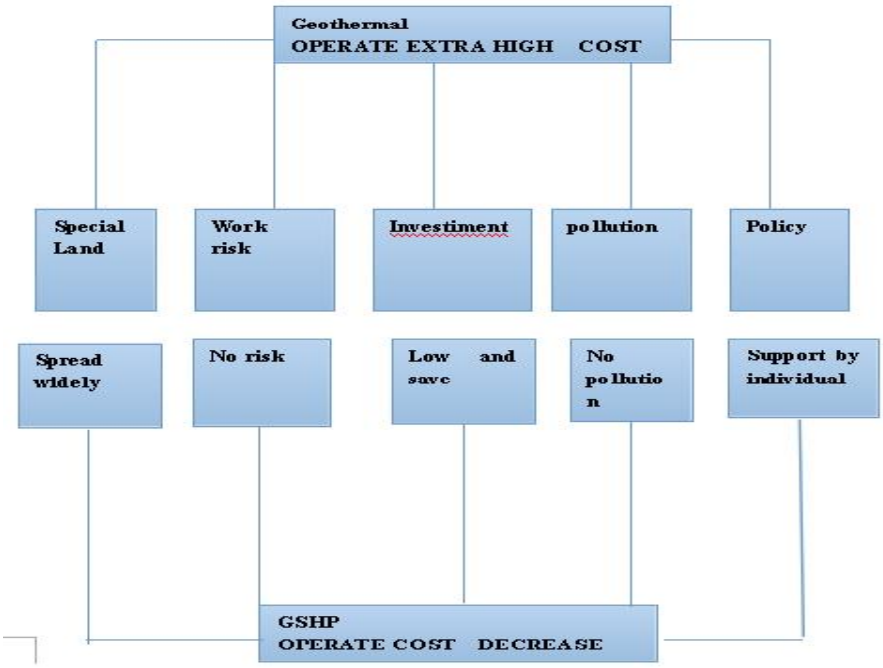

Fig. 4. GSHP Advantages Compare to Geothermal Disadvantages

Table 1. GSHP Advantages Factors

References	Variable and	Quotes
Sanner(2003)	Most of this market development took place, are such that by far the greatest demand is for space heating; air conditioning is rarely requested	1Market percents 2Market demands 3Space of heating 4Air conditions
Trillat(2006)	it can be seen that accounting for environmental factors is frequently a proactive act, motivation levels remain low in the general public	1Frequently proactive 2 motivation remain in public
Lund(2004)	The design type chosen depends upon the soil and rock type at the installation, the land available and/or if a water well can be drilled economically or is already on site	1Soil and rock type 2 The square of land available 3Water well
Hughes(2008)	The most important trade allies of the GSHP industry, electric utilities, today are better able to focus on peak load reduction and improved load factor, two key GHP system benefits, than they were in the past when restructuring was looming.	1 Electric utilizes 2 Peak Load reduction
Onder(2005)	Many variables must be controlled in order to provide the good environmental conditions. The most important parameters to be controlled inside a greenhouse are temperature, humidity and light. Especially, the temperature at night appears as an important critical variable to be controlled.	1 environment conditions 2 The temperature 3 Humidity

6 CONCLUSION

As lectures review and compare, five main reason and their relation to the geothermal extra cost cost have been found as bellows:

A : Position of land will increase the price of construct and electricity transport;
B : Protection of safe will increase cost in safe facilities maintain and stuff education;
C : Pollution of waste will let company pay extra cost and tax for environment;
D : Profits of investments will determine whether the stake stocks can get profits and governments will give support policy;
E: Policy will increase the pressure from society.

With the technology that have found are GSHP systems that use heat conduction to get energy from ground And also it can solve the problems that conventional geothermal with getting a glorious development after 2000year. And GSHP still have great potential power to cut the emission and benefit the society, environments, energy enterprise.

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A New Approach to Understand the Fundamental Cause of Gravity, and Time Dilation in Special and General Relativity

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ABSTRACT: In present article, the 'space' is considered as a physical entity, and the gravity is discussed as a consequence of equal and opposite interaction between 'mass' and the 'space' around every mass. In order to explain the cause of gravity, a very new concept of *root force* is introduced as a fundamental nature of 'mass' and the 'space' both. The unit of root force is (√m√kg/s) or square root of newton. It is learnt that may be, it is a *root force* which gives mass to every particle and make existence possible. The exact nature of *root force* is beyond current understanding of physics. Another new concept of *super-vacuum* (absolute emptiness) is also introduced in this paper. This concept is essential to understand the importance of the 'space'. It is concluded that 'mass' and 'space' shares equal and opposite interaction, which causes gravitation. And magnitude of root force causes time dilation.

KEYWORDS: Gravity, Root force, the 'space', Super-vacuum.

1 INTRODUCTION

Gravity is the most fundamental phenomenon of our universe, and still it is one of the most elusive concepts to understand [1, 2]. Even greatest minds in physics have failed to explain the cause of gravity. The reason for this elusiveness of gravity is probably lies in our ignorance. Something very special, something very fundamental is being ignored.

Right from the beginning of human understanding, it is assumed that the 'space' around us, or in which every mass moves, is infinite, and is there forever. We think that the 'space' around us, around every object, is inert and it has no special role to play. It is a human nature — more common, more ordinary is a thing — less we think about it. The 'space' around us, around every mass is extremely ordinary thing, and therefore we do not think about it at all. We take this 'space' granted. We ignore the concept of the 'space'. And as a result, we failed to understand the importance of it.

If we think our universe as a beautiful painting; the 'space' is a *paper* or a *canvas* on which the creator created his painting. Without paper/canvas or any two dimensional surface, one cannot create a painting. Similarly, without the concept of three dimensional 'space', the universe cannot be created. The 'space' itself is one of the most essential constituent of our universe. It is the 'space', which provides the ultimate structure to our universe. **The 'space' is there so that 'mass' can move inside it. The 'space' is there so that 'mass' can stay in state of 'mass' inside it.** We failed to consider the 'space' as a physical entity. Probably it is our ignorance towards the 'space' because of which we do not comprehend the most fundamental force of nature — Gravity.

2 A NEW APPROACH TO UNDERSTAND THE CAUSE OF GRAVITATION

2.1 ROOT FORCE

Root force is a very new thought for physics. It maybe something which makes existence possible.

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Root force is an inherent property or fundamental nature of 'mass' and the 'space' both. Normally, force exerted by one mass over other mass is regular force which is measured in newton. This regular force is seen as a movement or deflection of one body or both bodies. However, **force exerted by 'mass' over 'space' – and – 'space' over 'mass' is a root force.** Unlike regular force, we cannot see or feel root force but it is there. It is probably a root force which gives mass to every particle and makes existence possible. The exact nature of root force is beyond current understanding of physics. The unit of root force is **√m√kg/s** or square root of newton (√N).

Root force can be classified into two kinds: i) mass force and ii) space force. In order to understand the nature of mass force and space force, at this point, it is assumed that every mass itself is a 'mass force' and the 'space' itself is a 'space force'.

2.2 FIRST LAW FOR GRAVITATION

Every 'mass'– and the 'space' around every mass, exerts equal and opposite root force on each other.

This equal and opposite interaction between 'mass' and the 'space'— is fundamental cause for universal gravitation**.**

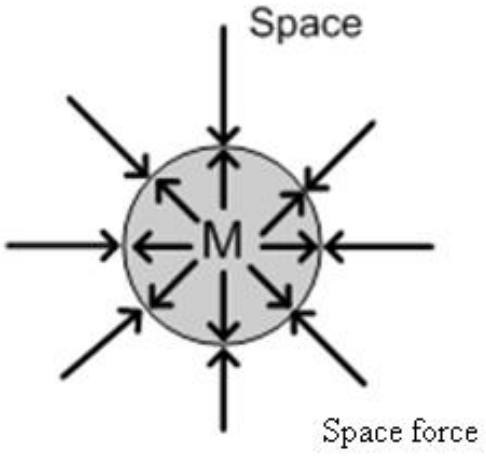

Fig 2.1

Every 'mass' exerts internal root force i.e. mass force in outward direction. The 'space' around that mass however, always exerts equal amount of root force i.e. space force in opposite direction. The result this equal and opposite interaction — is gravity.

When the 'space' exerts equal and opposite root force on mass (as a reaction to mass force), it creates a *gravitational slope* around that mass. When other mass enters in gravitational slope (or sloped space), follows the direction of slope. This notion is quite similar to the *gravitational field*. However, this paper intends to give cause for such gravitational field/slope. Mechanism of gravity is explained in section 2.4 in this paper.

The first law can be interpreted as follows…

The Space completes the mass,
And the Mass completes the space.

2.3 SECOND LAW FOR GRAVITATION

Root force exerted by the 'space' on any 'mass' from any given point in space (point relative to given mass) is directly proportional to that mass and inversely proportional to the distance between the mass and that *space point.*

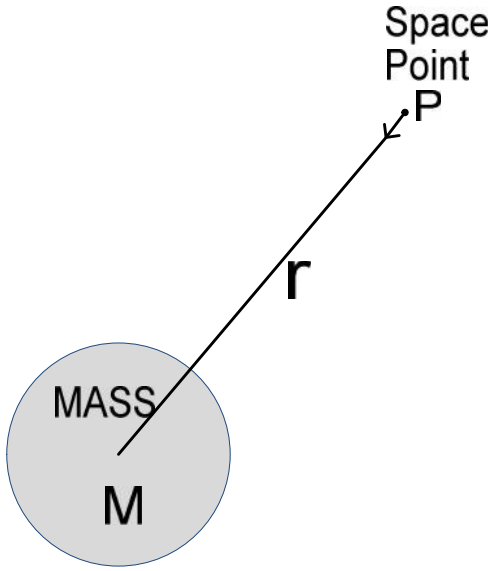

Fig 2.2

Let's have any mass **M** in the 'space', and *space point* P, any point in space at relative distance **r** from that mass (fig 2.2).

Therefore, root force/space force (fVN) at point P is given by

$$fVN \propto \frac{M}{r}$$

$$fVN = \frac{SM}{r}$$

Where S is constant for space force …S = 8.169 x 10^{-6} $m^{3/2}kg^{-1/2}s^{-1}$ … (Square root of G)

2.4 MECHANISM OF GRAVITY

2.4.1 2.4.1 WHY THINGS FALL DOWN?

The 'space' around the earth exerts equal and opposite root force on earth as a reaction to earth's mass force. When the 'space' exerts root force on earth, it creates a gravitational slope around the earth. This gravitational slope of the 'space' can be assumed as a flow of water. A piece of a paper thrown in flowing water will follow the direction of water. (Not exactly but) In somewhat similar manner, when other body enters into this gravitational slope, it follows the direction of the slope. The direction of this slope is the direction of root force exerted by the 'space' i.e. towards the center of earth. It is the 'space' itself because of which things fall down and earth has no direct relationship with it. Whenever physicists encounter the term √g or √-g in their equations, probably they are dealing with this gravitational slope i.e. root acceleration of the 'space' itself. Gravitational slope of the 'space' on surface of earth is directly proportional to square root of mass of earth and inversely

proportional to radius of earth. On surface, its value is about 3.13√m/s. There is no need of another body to understand the gravity.

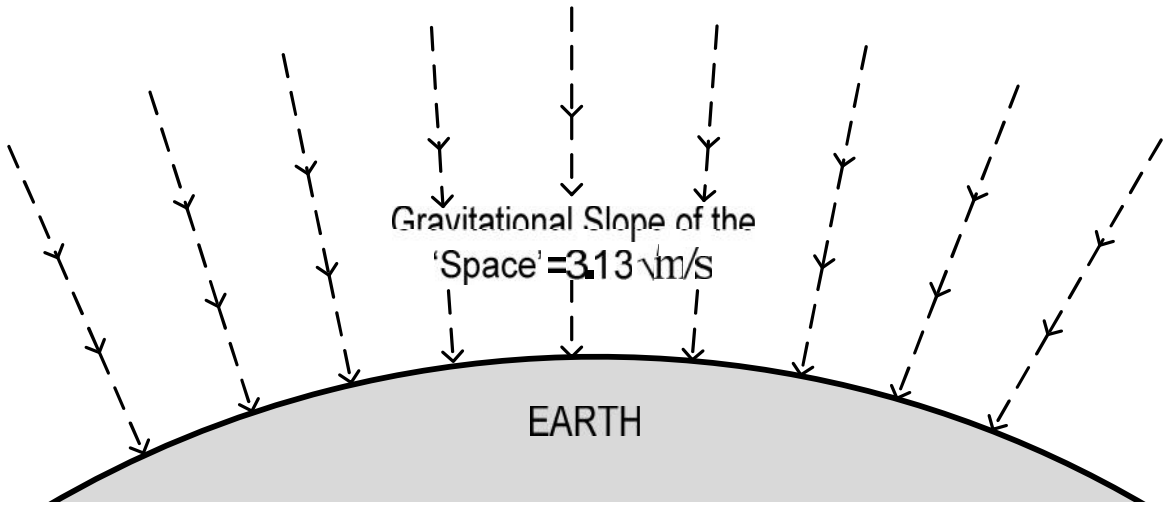

Fig 2.3

2.4.2 EXPLANATION FOR NEWTON'S LAW

Let's have two masses $\mathbf{m_1}$ and $\mathbf{m_2}$ in the 'space' separated by distance '**r**' (Fig 2.4). The 'space' around those masses exerts equal and opposite root force on those masses as reaction to their mass forces. While exerting root force, the 'space' creates gravitational slope around those masses. As both masses are in gravitational slope of each other, the sloped 'space' pushes them towards each other. It is the 'space' itself brings both masses closer.

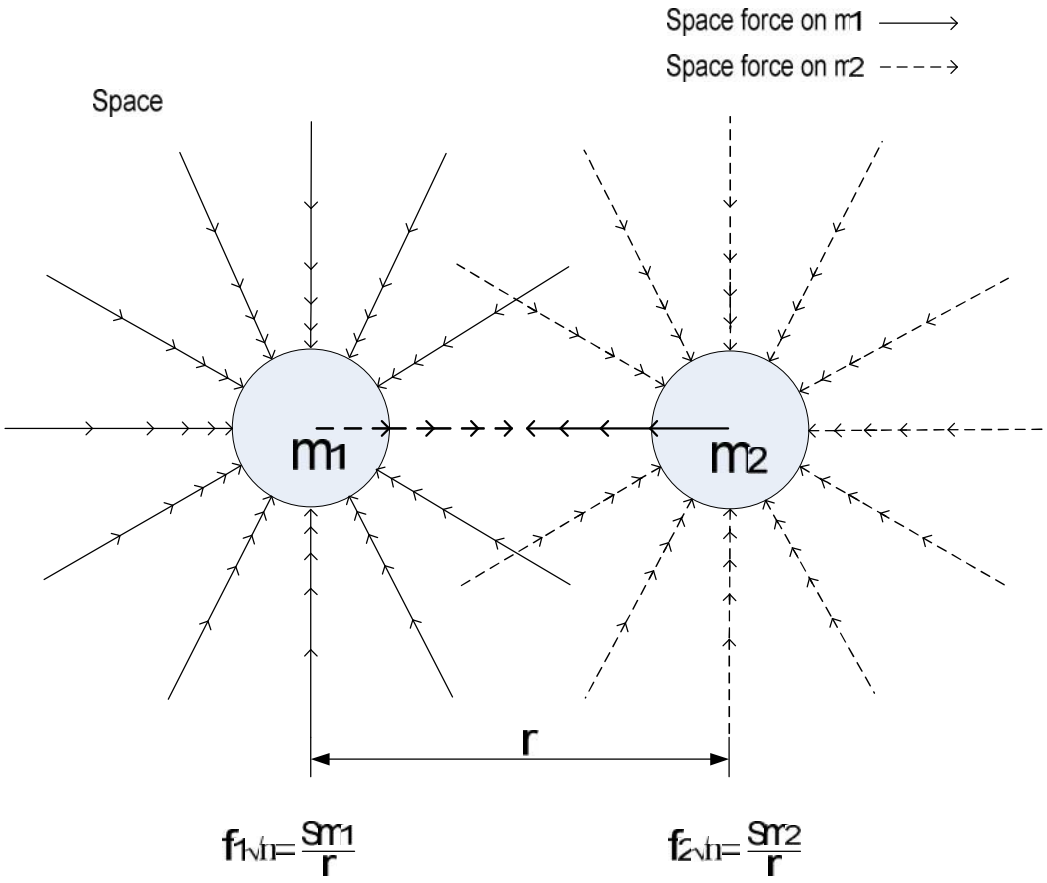

Fig 2.4

By second law of gravitation: root force on body **m1** at distance r is-

$$f1vN = \frac{Sm_1}{r}$$

Root force on body m2 at distance r is-

$$f2vN = \frac{Sm_2}{r}$$

Therefore combine force i.e. gravitational force (F_N) on these two bodies is given by

$$FN = f1vN : f2vn$$

$$FN = \frac{Sm_1}{r} \times \frac{Sm_2}{r}$$

$$FN = \frac{S^2 m_1 m_2}{r^2}$$

$$FN = \frac{G m_1 m_2}{r^2}$$

3 SUPER-VACUUM AND BIG BANG.

3.1 SUPER-VACUUM

Super-vacuum is a thing where root force exerted by the 'space' (i.e. space force) is absent. In other words: *Super-vacuum is an absolute emptiness*. It is a thing or a place where even the 'space' does not exist. The perception of super-vacuum is essential for one very special reason — it tells us importance of the 'space'.

3.2 BIG-BANG, SINGULARITY AND MASS-SPACE CONVERSION

The big bang theory is a widely accepted theory for the origin and evolution of our universe. It proposes that the universe expanded around 13.8 billion years ago from an extremely hot and dense state known as singularity. In this section, the probable cause of expansion of singularity is discussed shortly.

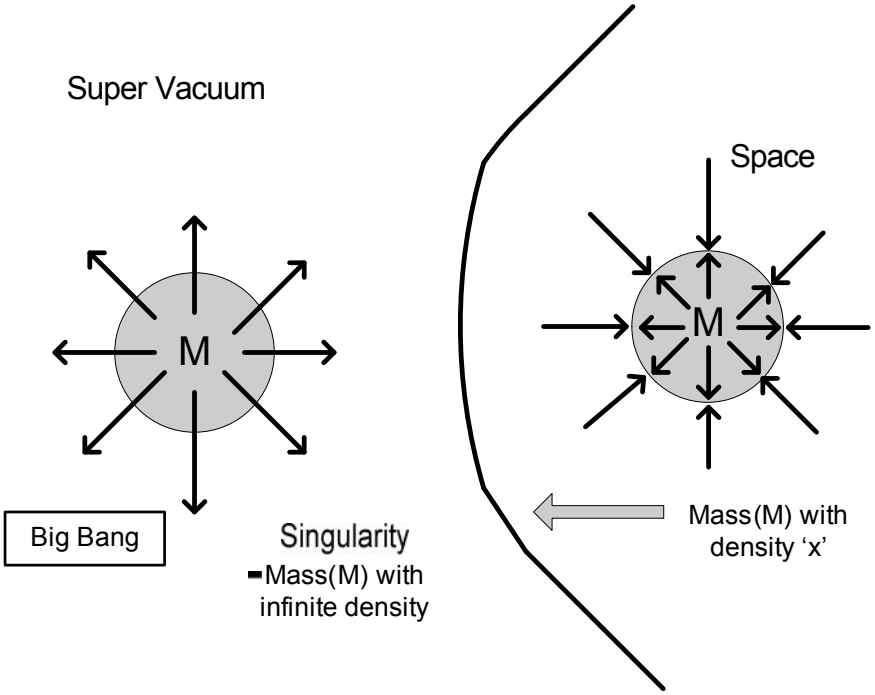

Fig 3.1

When any mass in the 'space' (fig 3.1- at right) enters into super-vacuum (left in fig 3.1), as there is no 'space' in super-vacuum, volume of that mass becomes zero, and therefore density of that mass becomes infinite. This is a state of singularity. As there is no space force to prevent the mass force exerted by mass, the mass expands with great speed, and gives a birth to new universe. As the 'space' is also created with an expansion of mass, probably mass and the 'space' both are forms of the same thing (energy), and may be are inter-convertible.

4 PROBABLE CAUSE OF TIME DILATION IN SPECIAL AND GENERAL RELATIVITY

4.1 TIME DILATION IN SPECIAL RELATIVITY

One of the important properties of the *space* is — it has its own braking mechanism and a speed limit for any mass travelling through it at relatively high speed. Time slows down for the mass which is travelling at relatively high speed. It happens because space exerts more root force on the mass at higher speed. In a reaction to that root force exerted by mass is also increases. This is nothing but relative increase in mass at higher speed (Fig. 4.1)

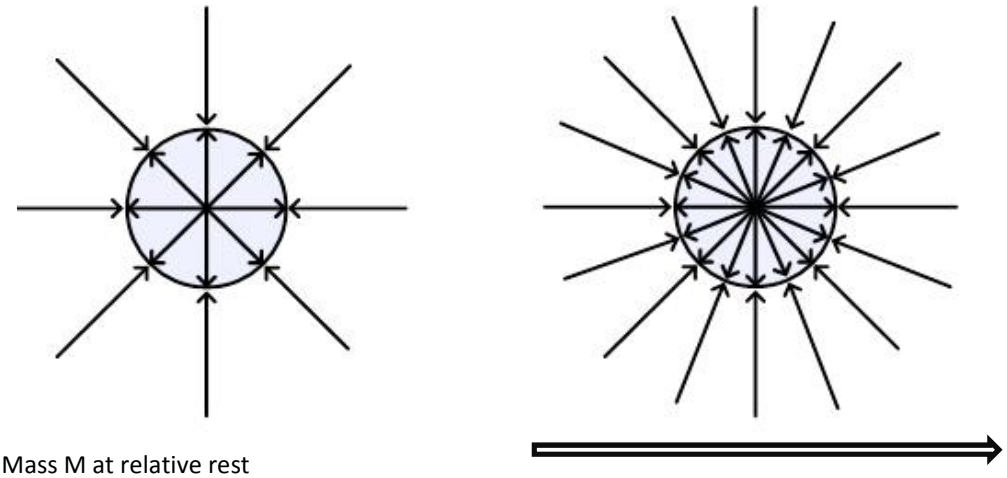

Fig. 4.1

Relative speed of time is inversely proportional to root force exerted by mass and space on each other. It means at more root force time will run more slow. At relatively higher speed, space exerts more root force on mass. The result is reactionary mass force increases and relative time slows down.

Time is equally associated with to mass and space both. Therefore it would be wrong just to use the word *space-time.* Either we should say *mass-time* and *space-time* both, or we use words *mass* and *space* as it is, and assume that *time* is equally and fundamentally associated with both.

4.2 TIME DILATION DUE TO GRAVITY (GENERAL RELATIVITY)

Time will run a lot slower on the surface of neutron star than to the surface of earth. The reason is the same as in special relativity. At more root force exerted, time will run more slowly. The only difference is — in special relativity time runs slow because of root force exerted by space on moving mass, whereas in general relativity time runs slow because of root force exerted by heavy mass on space.

5 CONCLUSION

Gravity is probably a consequence of equal and opposite interaction between 'mass' and the 'space' around every mass. When space exerts root force on mass, it creates gravitational slope around that mass. When other mass enters in that gravitational slope, follows the direction of the slope. Therefore, gravity can be defined as *a slope of a space at any given point in the 'space',* where the space point is at relative distance from given mass*.* There is no need of another body to understand the gravity. As the 'space' does all the work, mass has no direct relationship with gravity (i.e. things falling down).

I conclude this paper with following cause statements:

1) Gravity is *the* fundamental consequence of *existence*.
2) Gravity is a result of equal and opposite interaction between mass and space.
3) Every mass and space around that mass produce equal and opposite root force on each other. This root force is fundamental cause of universal gravitation. The unit of root force is square root of newton.
4) Relative speed of time is inversely proportional to root force exerted by mass and space on each other. It means at more root force exerted by any of the entity (mass or space), time will run more slow.
   Space completes the mass. And mass completes the space.

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A Review on various Location Management and Update Mechanisms in Mobile Communication

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ABSTRACT: Mobile computing is a new emerging computing paradigm of the future. Data management and location management in this paradigm poses many challenging problems to the Mobile database community. In the past decade, Mobile communications have experienced an expensive growth due to recent technological advances in mobile networks and cellular telephone manufacturing. Location management is a very important problem among these challenges. It consists of updating the location of the user, searching the location and performing search-updates. When the host changes location, an update occurs. When the host wants to communicate with a mobile host whose location is unknown to the requesting host, a search occurs. A search-update occurs after a successful search, when the requesting host updates the location information corresponding to the searched mobile host. The goal of a good location management scheme should be to provide efficient searches and updates. In this paper, the different location management schemes, various update strategies are discussed.

KEYWORDS: Mobile Communication, Mobile Database, Location Management.

1 INTRODUCTION

Managing location information of mobile nodes is an important issue in mobile computing systems. Location management is one of the fundamental issues in cellular networks. It deals with how to track subscribers on the move and how to update his or her movements. In mobile communication environment, they are going to accommodate more subscribers; the size of the cell must be reduced to more efficient use of the limited frequency spectrum allocation. This will add to the challenge of some fundamental issues in cellular networks. Location management consists of updating the location of the user, searching the location and performing search-updates. Various strategies can be discussed in this paper for the efficient performance of updating, searching and search-updating strategies throughout the execution.

Location server is maintaining the details about mobile user, it consist separate location directory for each MH. Creating a fixed location directory of all the nodes a priori is not a solution. The location directory has to be dynamically updated to account for the mobility of the MHs. The design of a location directory whose contents change dynamically raises important issues.

Some of them are as follows:

- When should the location directory be updated? If the updates are done each time an MH's location changes, the directory will always have the latest location information, reducing the time and effort in locating an MH. However, such a policy imposes burden on the communication network and the location servers, i.e., nodes that maintain the directory,

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- Should the location directory be maintained at a centralized site, or should it be distributed? A central location server has problems with regard to robustness and scalability. Hence, a distributed directory server is referable. This leads us to the next questions.
- How should the location information be distributed among the location servers?
- Should location information about an MH be replicated across multiple location servers? It is not possible to a priori determine the variations in spatial distribution of MHs in the network and the frequency with which node location will be updated or queried. A location management strategy is a combination of search strategy, update strategy and search-update strategies throughout the execution.

2 SYSTEM MODEL

A roaming mobile subscriber, moves freely within the GSM network. Because the network knows the location of the mobile station, it is possible for the mobile subscriber to receive a call wherever he or she is. To keep the system updated with the current subscriber location information, the mobile station must inform the system whenever it changes location area. A location area consists of one or more cells in which a mobile station can move around without needing to update the system on its location. A location area is controlled by one or more Base Station Controller (BSC) but by only one Mobile Services Switching Center (MSC). The BSC sends paging messages to the Radio Base Station (RBS) defined within a certain location area. If the mobile station moves between cells belonging to different location areas, then that network must be informed via a procedure called location updating.

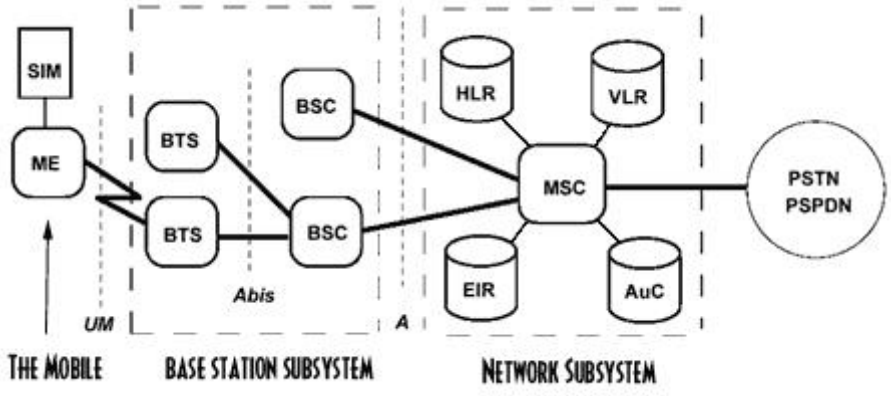

Figure 1 - Logical View of a Mobile Computing System

A mobile host can communicate with other units, mobile or static, only through the mobile service station of the cell in which it is present. If a node wishes to communicate with a mobile host, first it has to determine the location of MH (the cell in which the MH is currently residing). This location information is stored at location servers. Depending on the frequency of location updates, this location information may be current, or out-of-date. Once the location of the MH has been determined, the information is routed through the fixed wire network to the MSS of the cell in which the MH is present. Thus the MSS relays the information to the destination MH over a wireless channel. We assume that MSSs act as location servers. Hence all the MSSs collectively maintain the location directory.

3 MECHANISMS FOR LOCATION MANAGEMENT

Papers can be written in English, French, Spanish or Arabic. The Base Transceiver Station (BTS) of every cell continuously transmits the location area identity on the control channel (BCCH). When the mobile station detects that the broadcast location area identity is different from the one stored in the SIM card, it performs a location update.

If the mobile subscriber is unknown to the Mobile Services Switching Center/Visitor Location Register (MSC/VLR) (that is, the broadcast location area belongs to a new MSC/VLR serving area), then the new MSC/VLR must be updated with subscriber information. This subscriber information comes from the Home Location Register (HLR).

This location updating procedure is described in the steps below and in Figure 2.

- The mobile station requests a location update to be carried out in the new MSC/VLR. The IMSI is used to identify the mobile station. An International Mobile Equipment Identity (IMEI) check is also performed.

- In the new MSC/VLR, an analysis of the IMSI number is carried out. The result of this analysis is a modification of the IMSI to a mobile global title which is used to address the HLR.
- The new MSC/VLR requests the subscriber information for the mobile station from the HLR.
- The HLR stores the address of the new MSC/VLR.
- The HLR sends the subscriber data to the new MSC/VLR.
- The HLR also orders the old serving MSC/VLR to cancel all information for the subscriber because the mobile subscriber is now served by another MSC/VLR.
- When the new MSC/VLR receives the information from the HLR, it sends a location updating confirmation message to the mobile station.

Note: The HLR is not informed if the mobile subscriber moves from one location area to another within the same MSC/VLR serving area.

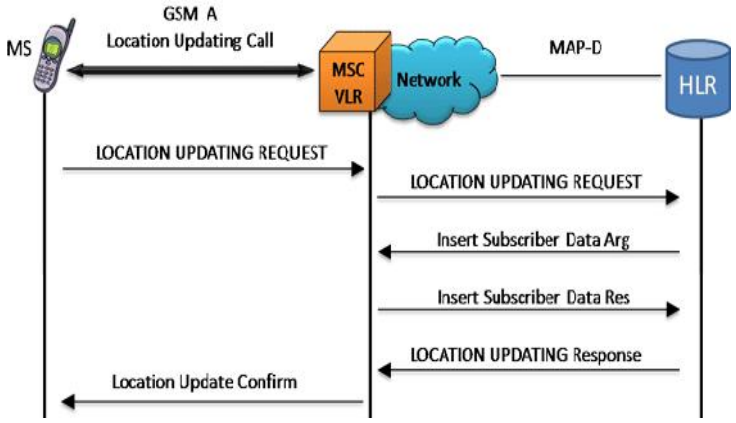

Figure 2 - Location Update Procedure

3.1 LOCATING USER

Location management deals with how to keep track of an active mobile station within the cellular network. In this paper there are two basic operations involved in location management is discussed. These are location update and paging. The cellular network performs the paging operation. When an incoming call arrives for a mobile station, the cellular network will page the mobile station in all possible cells to find out the cell in which the mobile station is located so the incoming call can be routed to the corresponding base station.

A location update scheme can be classified as either global or local, A location update scheme is global if all subscribers update their location at the same set of cells, and a scheme is local if an individual subscriber is allowed to decide when and where to perform the location update. A local scheme is also called individualized or per-user-based. A location update scheme is static if there is a predetermined set of cells at which a mobile station regardless of its mobility must generate location updates. A scheme is dynamic if a mobile station in any cell depending on its mobility can generate a location update. A global scheme is based on aggregate statistics and traffic patterns, and it is usually static too.

In general, it is unnecessary to track locations of all users all the time. Hence, a database, which stores locations of users, will often be imprecise in terms of the exact user's location. For instance, a user's location may only be updated when the user crosses the border between two different areas or zones as opposed to updates on crossing a small cell. This, in general, will save on the number of location updates that the moving user will have to perform but will put an additional burden on the search process if the exact location of the user is sought.

3.2 LOCATION QUERY

A static note, say MSS or a mobile host in the cell corresponding to the MSS, wishing to communicate with the target mobile host first needs to know the location of the target. Let the target mobile host's identity be MH_id. To locate the target, the function locate_MH is invoked. First, MSS searches its cache for MH_id's entry. If such an entry is found the corresponding mobile service station, MSSi, is probed to determine if MH_id is still in the same cell. If so, MSSi returns its own location in the response. Otherwise, one of the virtual identities of MH_id is arbitrarily selected. This virtual identity is

used by the hash function to determine the set of MSSs that should be queried about MH_id's location which is the read set for location information.

If a queried mobile service station, MSSi, has the location MH_id in its directory, it is sent in the response. If no query mobile service station has the location of MH_id, the query is broadcast over the network. Once MSS receives the location of the cell in which MH_id is present the messages sent over the fixed wire network to the corresponding mobile service station. If MH_id has moved out of the cell since the last location update, a sequence of forwarding pointers (depending on the path taken by MH_id since it moved out of MSSi's cell) is followed to the cell in which MH_id is currently present.

3.3 LOCATION MH

The problem at hand is as follows: given an MH, determine the location server (s) that will store the location of the MH. Storing the location information of an MH at only one MSS (serving as the MH's location server) is not desirable due to the following reasons:

- MHs exhibit a spatial locality of reference: even though all nodes in the system can potentially communicate with the network, bulks of the references originate from only a subset of them. The nodes in the working set may be clustered in different parts of the networks. So, to reduce query costs, it is advisable to have location servers for the MH in the vicinity of such clusters.
- Multiple location servers for an MH make the distributed directory tolerant to the failure of some of the servers.

```
Locate_MH(MH_id,MSS)
    {
    int i,j,k;
    if((i=location(MH_id))Elocal cache)
    {
    send(MSSi,QUERY,MH_id);
    wait(response from MSSi);
    if(response==YES)
    return(response.location);
    else
    delete(location(MH_id) from local cache;
    }
    i←any virtual; identity of MH_id;
    j←h(MSS,i);
    for all k E Si do
    send(MSSk,QUERY,MH_id);
    wait(positive response from any MSSk);
    location(MH_id)←response.location;
    if no positive response
    send (broadcast,QUERY,MH_id);
    }
```

When a mobile host moves from one cell to another, its location has to be updated at the appropriate MSSs that act as the distributed location server. The choice of the update strategy (time based, no of movements based, distance based (is referred in the later part)) is orthogonal to the location update procedure. The parameter old_MSS denotes the MSS of the cell in which the mobile host was resident when the last update was done. The current cell's MSS is called the new_MSS. When

a mobile service station with identity MSS_id, or an MH inside the cell corresponding to this MSS wishes to locate an MH whose identity is MH_id, the MSS takes following actions:

```
Assign_virtual_ids(MH_id)
{
int i; boolean found;
VMH_id(MH_id)← {MH_id + x};
i←0; found← false;
while(i<x and not(found))
{
if(assigned[i]=FALSE)
{
assigned[i]←TRUE;          VMH_id←VMH_id(MH_id)U{i};
Found←TRUE;
}
i←i+1;
}
}
VMH_id (MH_id)
```

The set of virtual identities associated with an MH whose identity is MH_id. The MSS of the cell in which the MH is resident maintains this set, on behalf of the MH. When the MH moves from one cell to another, the set is migrated from the MSS of the old cell to the MSS of the new cell.

3.4 LOCATION UPDATE

Upon a move, apart from MSSs involved (i.e., MSS of the source and destination cells), location updates take place in all the LSs located on the path from the MSS of the source and destination cells to the root. The scheme and an example illustrating it follow.

```
Location_update (MH_id, old_MSS, new MSS)
{
int i,j,vmh;
for all vmh E VMH_id(MH_id) do
{
i←h(old_MSS,vmh);
for all j E Si do
send(MSSj, delete, MH_id, old_MSS);
i←h(new_MSS,vmh);
for all j E Si do
send (MSSj,add,MH_id, new_MSS);
}
}
```

4 LOCATION UPDATE STRATEGIES

4.1 TIME BASED LOCATION UPDATE

Given a time threshold T, a mobile station updates is location every T units of time. The corresponding paging strategy is also simple. Whenever there is an incoming call for a mobile station, the system will first search the cell the mobile station last reported, say i. if it is not found there, the system will search in cells i+j and i-j, starting with j=i and continuing until the mobile station is found. The time-based strategy is dynamic in the sense that the cells for reporting are not predefined. The time-based strategy is dynamic in the sense that the cells for reporting are not performed. In time-based strategy a mobile station dynamically determines when to update its location based on its mobility pattern and the incoming call arrival probability. Whenever a mobile station enters a new cell, the mobile station needs to find out the number of cells that will be paged if an incoming call arrives and the resulting cost for the network to page the mobile station. The weighted paging cost at a given time slot is the paging cost multiplied by the call arrival probability during that time slot.

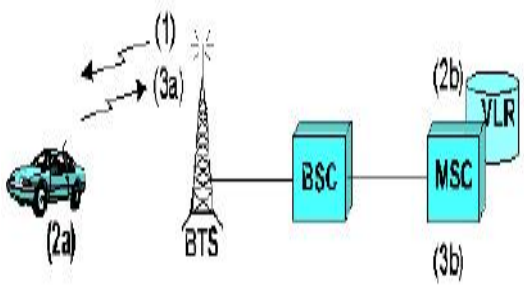

Figure 3 - Location Updating

4.2 MOVEMENT BASED LOCATION UPDATE

In the movement-based location update strategy, each mobile station keeps a count that is initialized to zero after each location update. Whenever it crosses the boundary between two cells, it increases the count by one. The boundary crossing can be detected by comparing the IDs of those two cells. When the count reaches a predefined threshold, says M, the mobile station updates its location, and resets the count to zero. The movement-based strategy guarantees that the mobile station is located in an area that is within a distance M from the last reported cell. This area is called the residing area of the mobile station. When an incoming call arrives for a mobile station, the cellular, system will page all the cells within a distance M from the last reported cell. The movement-based strategy is dynamic, and the movement's threshold M can be determined on a per-user basis, depending on his/her mobility pattern. The advantage of this strategy is its simplicity. The mobile station needs to keep a simple count of the number of cell boundaries crossed, and the boundary crossing can be checked easily. An enhanced version of the movement-based location update is selective paging strategy. In this strategy the difference is that when a subscriber moves back to the last reported cell, the movement count will be reset to zero. The effect is that the total location update and paging cost will be reduced by about 10-15% with a slightly increased paging cost.

4.3 DISTANCE BASED LOCATION UPDATE

In the distance based location update strategy, each mobile station keeps track of the distance between the current cell and the last reported cell. The distance here is defined in terms of cells. When the distance reaches a predefined threshold say D, the mobile station updates its location (i.e., cell ID). The distance-based strategy guarantees that the mobile station is located in an area that is within a distance D from the last reported cell. This area is called the residing area of the mobile station. When an incoming call arrives for a mobile station, the cellular system will page all the cells within a distance of D from the last reported cell.

In location management mechanisms, that incorporate the distance-based location update scheme with the selective paging mechanism that satisfies predefined delay requirements. In the distance-based strategy, when an incoming call arrives, the cellular system will page all the cells within a distance of D, the distance threshold, from the last reported cell of the called mobile station within one polling cycle. To compute the distance between two cells in a cellular network, an address can be assigned to a base station based on the position of the base station in the virtual hexagonal network. Therefore the distance between two cells can also be computed.

5 CONCLUSION

In this paper several static location management strategies for identification of user, updating the user location in location server based on a hierarchical tree structure database are discussed. Static location management uses one combination of search, update and search-update strategies throughout the execution. It was noticed that performing search-updates significantly reduced aggregate costs.

Dynamic location management and tracking scheme are also discussed. Location management about mobile host is replicated, so, not all MSSs need to store the location of every mobile host. Mobile hosts that are query more often than others have their location information stored at a greater number of MSSs. The set of MSSs that store a mobile host's location change dynamically as the host moves from one part of the network to another. Also, MSSs that store location information of frequently queried mobile hosts store information about fewer hosts than the MSSs that only store location information of infrequently queried mobile hosts. As a result, the location directory is fairly distributed throughout the network, and no single MSS is overburdened with the responsibility of responding to location queries. The location management scheme imposes low computation, communication and storage overheads. Moreover, mobile hosts and the wireless links do not incur any of these overheads, which is a desirable feature as they are usually resource poor. The overheads are visible to the MSSs and the fixed wire line network, which are comparatively resource rich.

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A Microcontroller Based Building Automation System for real time Sensing and Control

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ABSTRACT: The research paper discusses a microcontroller based building automation system for real time monitoring and control for a standard three-bedroom unit. Standard buildings designed and built in Nigeria are without any form of automation and with emerging technologies that support automation of certain sections/processes in buildings the intelligent building paradigm can be a realizable objective. This paper thus proposed a microcontroller based design interfaced with appropriate sensors, actuators and voice recognition abilities to develop a building automation system (BAS) that could open/ close two doors, three windows and turn-on a light bulb with the detection of appropriate control signals with the flexibility of leaving room for future improvement increased complexity.

KEYWORDS: BAS, Microcontroller, Sensors, Actuators.

1 INTRODUCTION

An intelligent building according to the European Intelligent building group (EIBG) is one "that incorporates the best available concepts, materials, systems and technologies integrating these to achieve a building which meets or exceeds the performance requirements of building stakeholders which includes the owners, managers and users as well as the local and global community" or the definition by the intelligent building institute (IBI) as one that provides a productive and cost effective environment through optimization of its four basic components – structure, systems, services and management as well as the interrelationships between them.

Buildings since the 1980's have slowly been integrated with technologies and processes that have created a safer, comfortable and more productive facility for its occupants. Intelligent building technology thus refers to the integration of four systems namely a Building Automation System (BAS), a Telecommunication System (TS), an Office Automation System (OAS) and a Computer Aided Facility Management System (CAFMS) where a sophisticated BAS is actually the basis of every intelligent building [10]. The desire to improve comfort inside new, large building after the World War resulted in more complex mechanical systems, better heating and control systems, Pneumatic controls and mounted electrical switches. The period through the 50's, 60's, 80's and the current time saw the emergence of different technologies such a Pneumatic sensor transmission that permitted local indication and remote signaling, electrochemical multiplexing systems which resulted in the reduction of installation cost and maintenance, Automatic control, emergence of user friendly systems, man-machine interface, smart multiplexers, field interface devices (FID's), Microprocessor based distributed direct digital control (DDDC), interoperability and expandability that allowed the linking together of monitoring and control systems and more compatible communication protocols that were suitable for implementation of diverse technology towards achieving the "Intelligent Building" is very wide and almost never ending as changing human wants/needs would require bigger complex building designs that need to be automated to meet future standards.

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2 RELATED WORK

Reference [6] proposed a research methodology that describes an integrated approach to using results of literature search and inputs from expert survey in the field of building automation and thus presented a framework for identifying and classifying key parameters thus, a building automation performance index (API) model. Reference [7] developed a system that can be utilized in assessing a building's energy or operating cost performance where in such case, the building automation system was simply treated as a set of options chosen from a list where automation would be assumed to be at optimum levels whenever an option from the list is selected.

Reference [8] provided a novel survey of prominent international intelligent buildings research efforts with the theme of energy saving and user activity recognition and thus devised new metrics for comparative study, determination of most valuable activities and behaviours with focus on their impact on energy saving potentials for each of the main subsystems that we used as a case studies such as HVAC, light and plug loads. A conclusion with principles and perspectives for energy intelligent buildings based on user activity with clear reference to the most promising and appropriate activity recognition technologies and approaches were discussed. The CASAS Smart home project is a multi-disciplinary research project at the Washington State University focused on the creation of an intelligent home environment. The approach attempts to view the smart home as an intelligent agent that perceives the environment through the use of sensors, and can act upon the environment through the use of actuators [2].

Reference [5] presented SPOT-LIGHT which was a prototype system that can monitor energy consumption by individuals using a proximity sensor. The basic idea is that an occupant carries active RFID tag which is used for detecting proximity between user and each appliance. This proximity information is then used for energy apportionment, reporting the energy consumption profiles in terms of useful/wasteful power of each user with each appliance.

3 METHODS

A structured approach to system analysis as summarized below was used in developing the system.

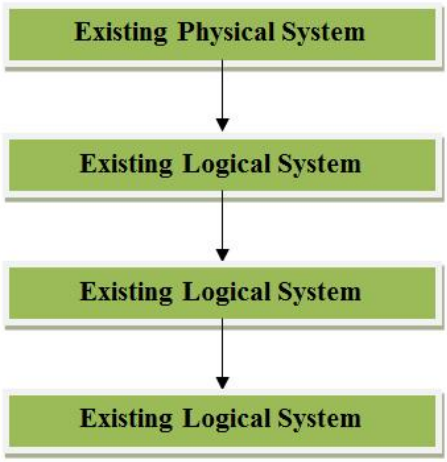

Fig. 1. A Structured approach to System Analysis

Source: Reference [9]

To provide answers to the following questions relating to the problem statement such as:

- What programmable control device can be used to implement the automation required for the three (3) bedroom apartment?
- What sensors and actuators would be required to execute the control action?
- What level of automation is currently being employed and is developed/deployed system flexible for the future?

A top-down design approach was used where the overall system was broken down into smaller modules to handle different areas of the study. AutoCAD was used to draw the design of a standard three bedroom apartment, A microcontroller, sliding motor (Actuator), Infrared sensor and voice recognition device with appropriate electronic circuitry was used to develop the building automation system (BAS) such that the infrared sensor is used to detect human presence at the main door "A" which in turn causes the microcontroller to trigger the sliding motor enabling the door to open and close.

The microcontroller on detecting the presence of an individual in the house would switch on the main bulb in the room and trigger the actuators to open the windows “B”. The system remains in this state till a preprogrammed voice signal tells it to open door “C” then the microcontroller triggers door “C” to open.

Module One: AutoCAD is used to draw the design of the three bedroom apartment.
Module Two: A microcontroller based design that can automate the apartment as required was developed.
Module Three: The developed system is interfaced with the original building design to effect the control action.

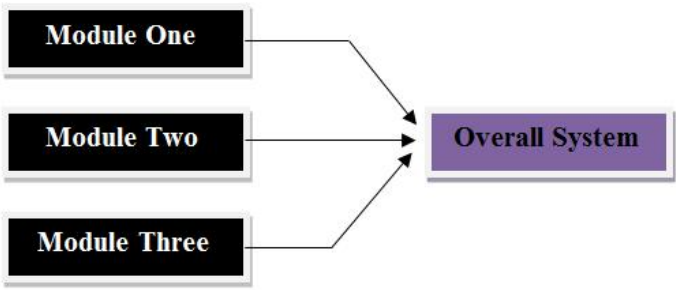

Fig. 2. Modular Framework of System

Source: Reference [3].

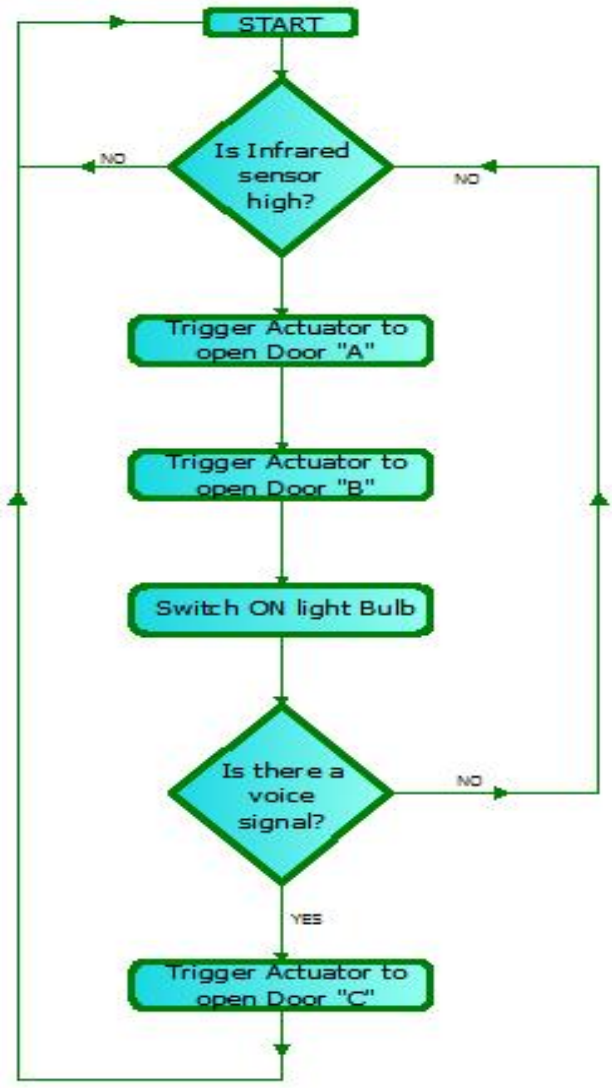

Fig. 3. Flow diagram showing the operation of the microcontroller

The combination of the three modules whose mode of operation is based on the system flow diagram is shown clearly below.

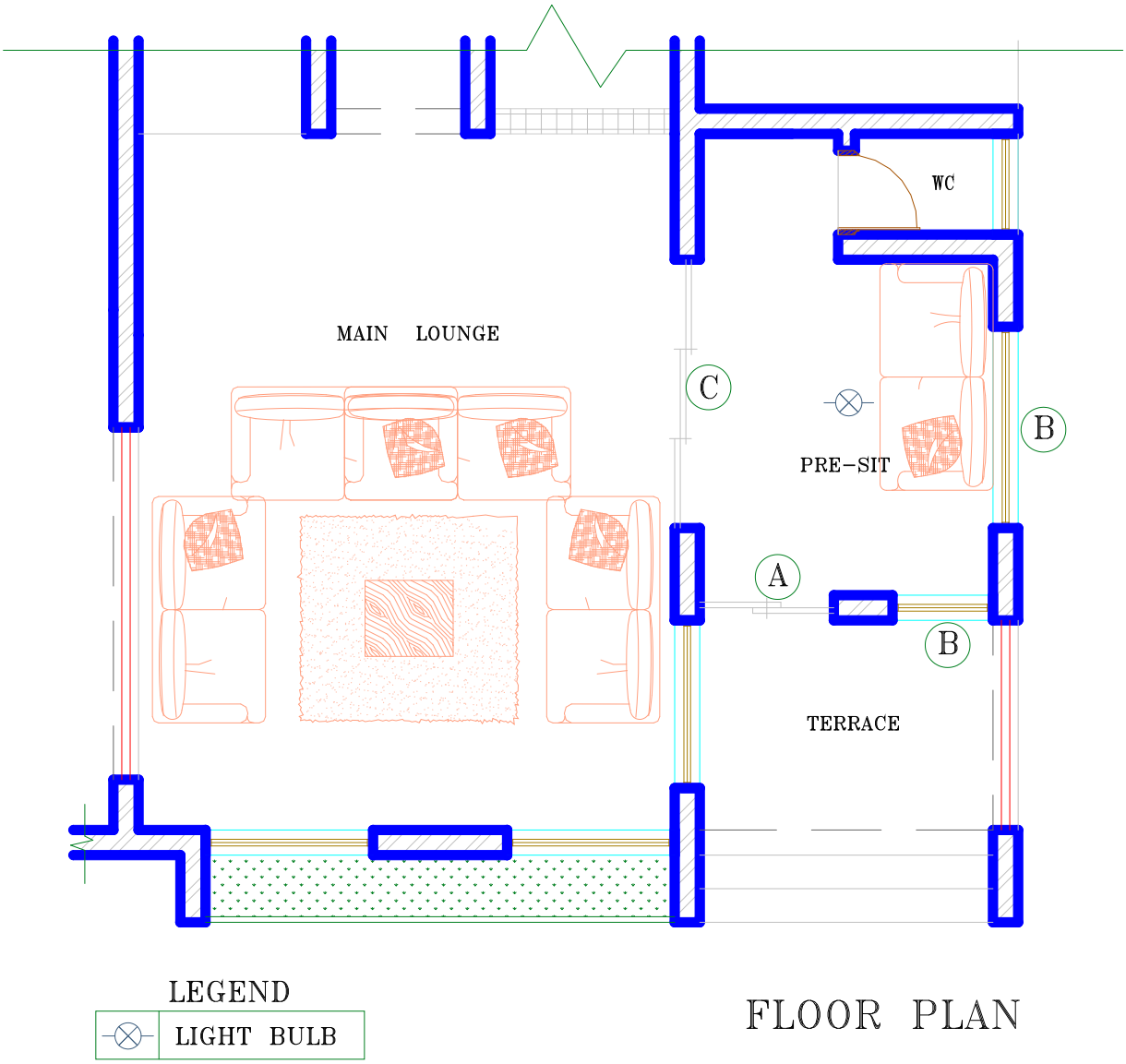

Fig. 4. Floor plan of the proposed building

Source: Authors research design

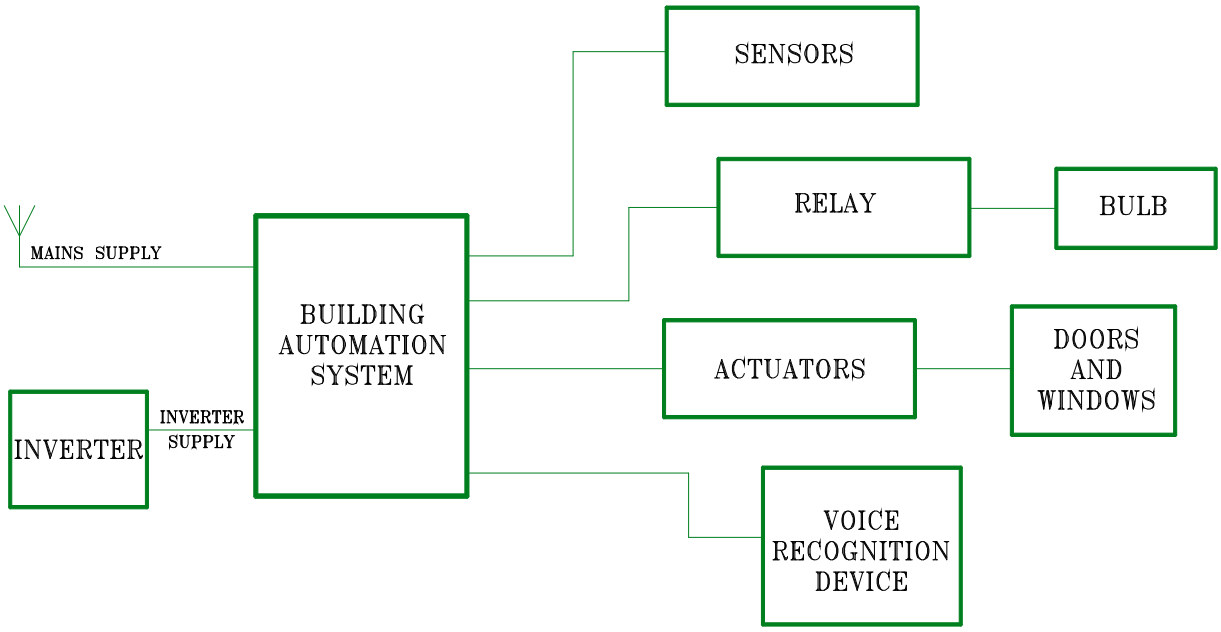

Fig. 5. Total system overview

Source: Authors research design

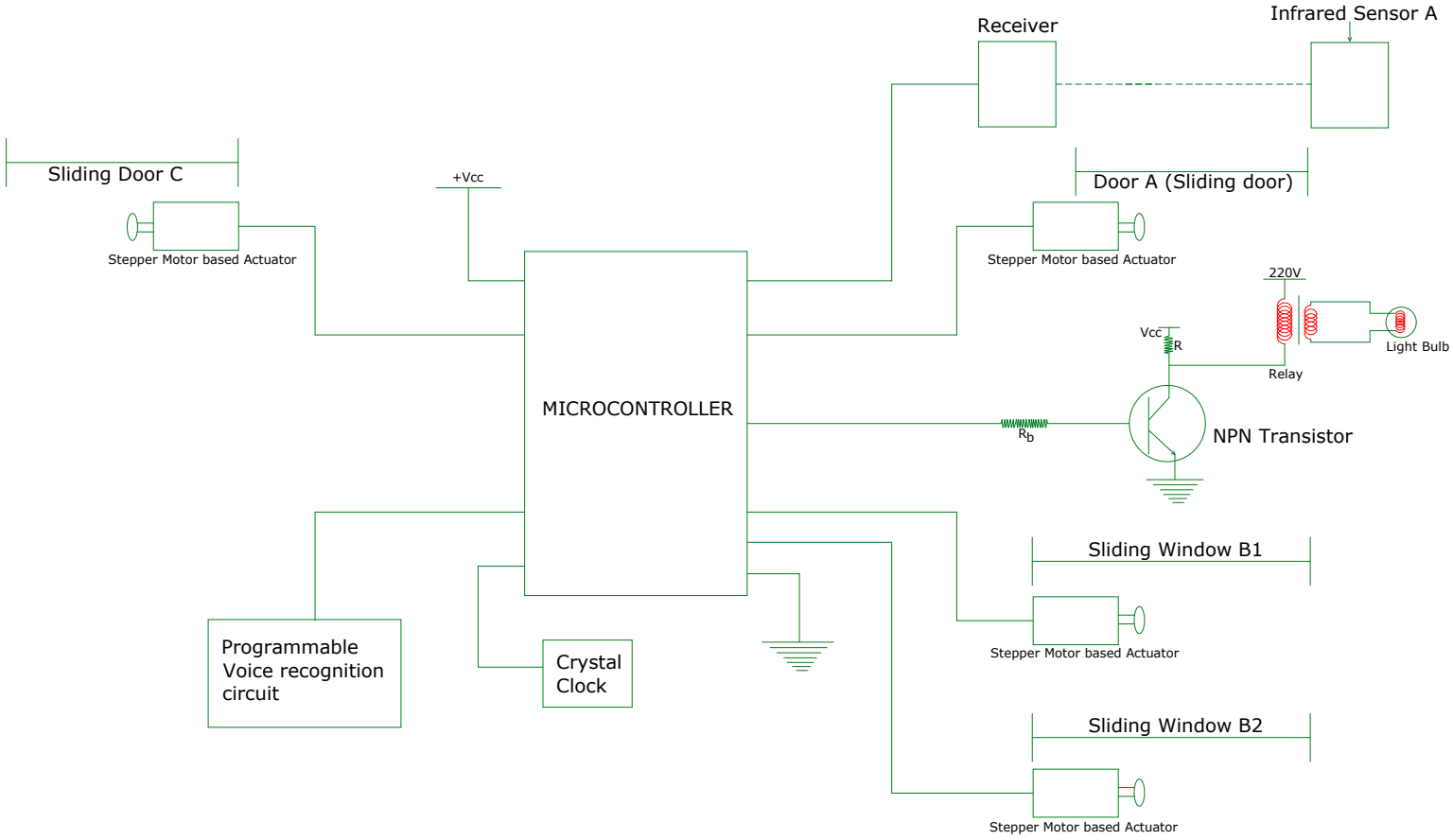

Fig. 6. A Microcontroller base BAS design

Source: Authors research design

4 RESULTS AND DISCUSSIONS

The system operates by the microcontroller sensing a disruption at the receiver end of the infrared sensor which indicates the presence of a human, thus prompting the system to trigger the actuators connected to open door A and windows "B" to slide them open as well as switching ON the light by turning the pin connected to the VPN transistor ON or Logic 1 in order to bring the transistor to saturation thus energizing the relay which turns ON the light.

A voice recognition device is also interfaced with the microcontroller so in the event, the keyword has stored in memory observed the controller triggers the appropriate actuator to open door "C".

The microcontroller can be coded using assembly language or suitable high level programming language like C, in order to provide 24-hour service especially in a country like Nigeria which experiences incessant power outages an appropriate inverter could be employed to provide a back-up power solution.

5 CONCLUSION

The research paper proposed a microcontroller based building automation system for real time sensing and control in a typical three bedroom apartment design where an attempt was made to control two doors, two windows and a lighting bulb. The control for the first door was based on physical sensing while the second door was based on voice recognition.

The research endeavor to develop an intelligent building based on user activity and as current situation has shown that building control is mainly done manually from switching lights and appliances to controlling heating systems. We have clearly shown that using appropriate technology the "Intelligent Building" concept can be applied using cheap off the shelf components applied to small residential homes.

6 FUTURE WORK

The researchers intend to carry out further research on the subject topic by incorporating security features that ensure authorized entry, complete automation of the building that incorporates remote monitoring and control functions using smart objects and internet-of-things as well as entire coverage of the entire building plan to achieve the "Intelligent Building".

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Energy Efficient Clustering Protocol in Wireless Sensor Networks Using Local Cluster Head Selection Techniques

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ABSTRACT: Unequal clustering is an elementary method for manipulative energy-efficient and mountable in distributed sensor networks. Heed* is top most dynamism efficient clustering protocol. By using this protocol, the message overhead is squat and cluster heads are circulated unequally across the entire network. In our distributed clustering protocol, heed*, which improves heed, leach and equal clustering of heed* protocol to realize energy adeptness with three methods: 1. Native clustering, i.e., whenever a cluster head guzzles a constraint part of its energy, it only notifies its participant nodes to hold cluster head designations for the forthcoming curved. Therefore, clustering is performed natively (in difference to performing it universally). 2. Dropping the number of message interactions and each iteration over abolishing redundant cluster head messages. 3. In heed*, each node with radical amount of residual energy is considered more eligible applicant for determination as a cluster overhead. Also, each node discovers a communication cost, and a consistent (non cluster skull) node picks the cluster skull with the lowest communication rate to connect to. Simulation results show that the protocol outstrips heed, leach and equal heed* protocol in standings of network lifetime.

KEYWORDS: - HEED; HEED*; LEACH; Network Lifetime; Sensor Networks; Unequal Clustering; Sensor Networks.

1 INTRODUCTION

Wireless sensor network (WSN) is an emerging technology that has attracted a great deal of research attention due to the extensive ability to monitor and instrument the physical world. A wide-range of potential applications such as environmental monitoring, industrial sensing, infrastructure protection, battlefield awareness etc., can be developed by this network .A wireless sensor network is a collection of nodes organized into a cooperative network. Each node consists of processing capability (one or more microcontrollers, CPUs or DSP chips), may contain multiple types of memory (program, data and flash memories), have a RF transceiver (usually with a single omni- directional antenna), have a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc fashion. Systems of 1000s or even 10,000 nodes are anticipated. Such systems can revolutionize the way we live and work. Currently, wireless sensor networks are beginning to be deployed at an accelerated pace. It is not unreasonable to expect that in 10-15 years that the world will be covered with wireless sensor networks with access to them via the Internet. This can be considered as the Internet becoming a physical network. This new technology is exciting with unlimited potential for numerous application areas including environmental, medical, military, transportation, entertainment, crisis management, homeland defense, and smart spaces. Node localization is the problem of determining the geographical location of each node in the system. Localization is one of the most fundamental and difficult problems that must be solved for WSN. Localization is a function of many parameters and requirements potentially making it very complex.

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For example, issues to consider include: the cost of extra localization hardware, do beacons (nodes which know their locations) exist and if so, how many and what are their communication ranges, what degree of location accuracy is required, is the system indoors/outdoors, is there line of sight among the nodes, is it a 2D or 3D localization problem. Multihop routing is a critical service required for WSN. Because of this, there has been a large amount of work on this topic.

Wireless Sensor Network (WSN) is composed of a large number of sensor nodes, which are densely deployed either inside the phenomenon or very close to it. WSNs are basically data gathering networks in which data are highly correlated and the end user needs a high level description of the environment sensed by the nodes. The requirements of these networks are ease of deployment, long system lifetime, and low-latency data transfers. The main task of a sensor node in a sensor field is to detect events, perform quick local data processing, and then to transmit the data. As mentioned in [Distributed clustering in ad-hoc sensor networks: A hybrid, energy-efficient approach and [A survey on routing protocols for wireless sensor networks], nodes have typically low mobility and are limited in capabilities, energy supply and bandwidth. The sensor network should perform for as long as possible. On the other hand, battery recharging may be inconvenient or impossible. Therefore, all aspects of the sensor node, from the hardware to the protocols, must be designed to be extremely energy efficient [An application-specific protocol architecture for wireless micro-sensor networks]. In direct communication WSN, the sensor nodes directly transmit their sensing data to the Base Station (BS) without any coordination between the two. However, in Cluster-based WSNs, the network is divided into clusters. Each sensor node exchanges its information only with its cluster head (CH), which transmits the aggregated information to the BS. Aggregation and fusion of sensor node data at the CHs because a significant reduction in the amount of data sent to the BS and so results in saving both energy and bandwidth resources. On the other hand, clustering is particularly crucial for scaling the network to hundreds or thousands of nodes [Hausdorff Clustering and Minimum Energy Routing for Wireless Sensor Networks]. In many applications, cluster organization is a natural way to group spatially close sensor nodes in order to exploit the correlation and eliminate the redundancy that often shows up in the sensor readings [Cluster head election techniques for coverage preservation in wireless sensor networks]. However, these benefits, compared to those of the direct communication WSN, result in extra overhead due to the cluster formation's message exchanges. This paper proposes an improvement to the HEED clustering protocol. Clustering is a key technique to improve the network lifetime, reduce the energy consumption and increase the scalability of the sensor network. A scalable sensor network is obtained by means of clusters. A cluster head (CH) could be elected or pre-assigned. The clustering that

- Reduces the size of the routing table by localizing the route setup within the cluster.
- Conserves communication bandwidth
- Prolonged battery life of individual sensor
- No topology maintenance overhead
- Reduce rate of energy consumption

In order to achieve high energy efficiency and assure long network lifetime, sensor nodes can be organized hierarchically by grouping them into clusters. In clustered sensor networks, the sensor nodes do not transmit their collected data to base station (BS), but to designated cluster heads which aggregate the data packet and send them directly or via multi-hop communication to BS. For directly communication, the modes furthest away from the BS are the most critical nodes, while in multi-hop communication; the nodes closest to the BS are burdened with a heavy relay traffic load and die first.

The cluster head role is usually periodically rotated among the nodes to balance the load. Although rotating the cluster head role ensures that sensors consume energy more uniformly, the hot spot problem described above cannot be completely avoided. Thus, choosing the appropriate sizes and number of clusters is essential for the performance of the network lifetime. The cluster's radius is too large, it will host many nodes and a lot of energy is wasted due to inter-cluster collisions. On the other hand, if the radius is too small, a large number of clusters is required to cover the observation area and many of them will have to transmit their data over a large distance to sink.

As one possible solution to this problem is Unequal Clustering Method (UCM). Many routing protocols are developed, but among those protocols unequal clustering method is energy efficient, scalable and prolongs the network lifetime. we analyze an approach where the network is organized into cluster of different sizes. Cluster heads closer to the BS should support greater cluster sizes because of lower energy consumption during sending data packets to the BS. The bigger clusters should be closer to the BS. The clusters radius should increase as its distance to the BS decreases.

2 RELATED WORK

Wireless Sensor Network (WSN) is composed of a large number of sensor nodes, which are densely deployed either inside the phenomenon or very close to it. Clustering is one technique that can be used to extend the lifetime of sensor networks by grouping sensors together. But, there exists the hot spot problem which causes unbalanced energy consumption in equally formed clusters. In this paper, we propose UHEED, an unequal clustering algorithm which mitigates this problem and which leads to a more uniform residual energy in the network and improves the network lifetime. clustering algorithms usually utilize two techniques; selecting cluster heads with more residual energy, and rotating cluster heads periodically to distribute the energy consumption among nodes in each cluster and extend the network lifetime. but, they rarely consider the hot spot problem in multi-hop sensor networks. When cluster heads cooperate with each other to forward their data to the base station, the cluster heads closer to the base station are burdened with heavier relay traffic and tend to die much faster, leaving areas of the network uncovered and causing network partitions. To mitigate the hot spot problem, we propose an Unequal Cluster-based Routing (UCR) protocol. It groups the nodes into clusters of unequal sizes. Cluster heads closer to the base station have smaller cluster sizes than those farther from the base station, thus they can preserve some energy for the inter-cluster data forwarding. A greedy geographic and energy-aware routing protocol is designed for the inter-cluster communication. When cluster heads cooperate with each other to forward their data to the base station, the cluster heads closer to the base station are burdened with heavy relay traffic and tend to die early, leaving areas of the network uncovered and causing network partition. To address the problem, we propose an Energy-Efficient Unequal Clustering (EEUC) mechanism for periodical data gathering in wireless sensor networks. It partitions the nodes into clusters of unequal size, and clusters closer to the base station have smaller sizes than those farther away from the base station. Thus cluster heads closer to the base station can preserve some energy for the inter-cluster data forwarding. We also propose an energy-aware multihop routing protocol for the inter-cluster communication. a novel distributed clustering approach for long-lived ad hoc sensor networks. Our proposed approach does not make any assumptions about the presence of infrastructure or about node capabilities, other than the availability of multiple power levels in sensor nodes. We present a protocol, HEED (Hybrid Energy-Efficient Distributed clustering), that periodically selects cluster heads according to a hybrid of the node residual energy and a secondary parameter, such as node proximity to its neighbors or node degree. HEED terminates in O(1) iterations, incurs low message overhead, and achieves fairly uniform cluster head distribution across the network. We prove that, with appropriate bounds on node density and intra-cluster and inter-cluster transmission ranges; HEED can asymptotically almost surely guarantee connectivity of clustered networks. Simulation results demonstrate that our proposed approach is effective in prolonging the network lifetime and supporting scalable data aggregation. A wireless network consisting of a large number of small sensors with low-power transceivers can be an effective tool for gathering data in a variety of environments. The data collected by each sensor is communicated through the network to a single processing center that uses all reported data to determine characteristics of the environment or detect an event. The communication or message passing process must be designed to conserve the limited energy resources of the sensors. The large-scale deployment of wireless sensor networks (WSNs) and the need for data aggregation necessitate efficient organization of the network topology for the purpose of balancing the load and prolonging the network lifetime, LEACH (Low-Energy Adaptive clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of Cluster-Heads (CHs) to evenly distribute the energy among the sensors in the network. But LEACH cannot select CHs uniformly throughout the network. Therefore there is the possibility that the elected CHs will be concentrated in certain area of the network. Hence, some nodes will not have any CHs in their vicinity. LEACH is a cluster-based protocol. LEACH is one of the first hierarchical routing approaches for sensors networks. LEACHES randomly selects a few sensor nodes as cluster heads (CHs) and rotate this role to evenly distribute the energy load among the sensors in the network. In LEACH, the cluster head (CH) nodes compress data arriving from nodes that belong to the respective cluster, and send an aggregated packet to the base station in order to reduce the amount of information that must be transmitted to the base station (negotiation). Wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. Most of the attention, however, has been given to the routing protocols since they might differ depending on the application and network architecture [4], data gathering that maximizes lifetime for wireless sensor networks. It involves three parts. First, nodes organize themselves into several static clusters by the Hausdorff clustering algorithm based on location, communication efficiency and network connectivity. Second, clusters are formed only once but the role of cluster-head is optimally scheduled among the cluster members. We formulate the cluster-head scheduling that maximizes the network lifetime as an integer programming problem

3 SYSTEM DESIGN

- Energy Efficiency
- UnCluster Module
- Cluster Head Election
- Energy Consumption
- Comparison Between Heed* with other protocols

3.1 ENERGY EFFICIENCY

Nodes have typically low mobility and are limited in capabilities, energy supply and bandwidth. The sensor network should perform for as long as possible. On the other hand, battery recharging may be inconvenient or impossible. Therefore, all aspects of the sensor node, from the hardware to the protocols, must be designed to be extremely energy efficient. Aggregation and fusion of sensor node data at the CHs cause a significant reduction in the amount of data sent to the BS and so results in saving both energy and bandwidth resources. On the other hand, clustering is particularly crucial for scaling the network to hundreds or thousands of nodes

3.2 UNCLUSTER MODULE

The problem of prolonging the lifetime of a network by determining the optimal cluster size. For a general clustering model, they find the optimal sizes of the cells by which maximum lifetime or minimum energy consumption can be achieved. Based on this result, they propose a location aware hybrid transmission scheme that can further prolong network lifetime. Clustering a wireless sensor network means partitioning nodes into clusters, each one with a cluster head and some. Data is locally collected from the cluster at the cluster heads, there is a potential benefit of compressing the data messages into a packet of smaller size before transmitting it to the BS. Let us assume that a cluster consists of $N_t$nodes and each transmits a data message of length *Len*to the cluster head. The cluster head receives these messages and fuses it together with its own measured data to a single packet.

To improve network lifetime by reducing the number of cluster head elections. It uses a battery depletion ratio to determine when new cluster head elections should occur, providing a balanced distribution of load on nodes in the network. The protocol Simulation results demonstrate that the benefits of unequal HEED* over HEED* and LEACH protocol, in terms of improving network lifetime and energy savings are noticeable.

3.3 CLUSTER HEAD ELECTION

`An improvement to the HEED* and LEACH clustering protocol, called Unequal HEED*, to improve network lifetime by reducing the number of cluster head elections. CH node has dropped by a certain percent. That CH node sends elec-msg to its member, all the nodes in that cluster perform CH election again to find new CH node. Therefore, the CH election is performed locally i.e. all the nodes in the network will not participate in the CH election. The second primary difference is that Unequal HEED* diminishes the messaging overhead, by integrating communication cost value in CH messages. The simulation results by comparing network lifetime, and the number of CH elections with HEED* and LEACH protocol. Finally, the conclusion is presented.

3.4 COMPARISON OF HEED* WITH OTHER PROTOCOLS

The performance of the Unequal HEED* is compared with HEED protocol and LEACH protocol and the results are obtained. The results shows that Unequal HEED * performs extremely well compared to other two protocols. The Energy and nodes lives of the Unequal HEED* is extremely improved. The resulted graphs are given in the paper.

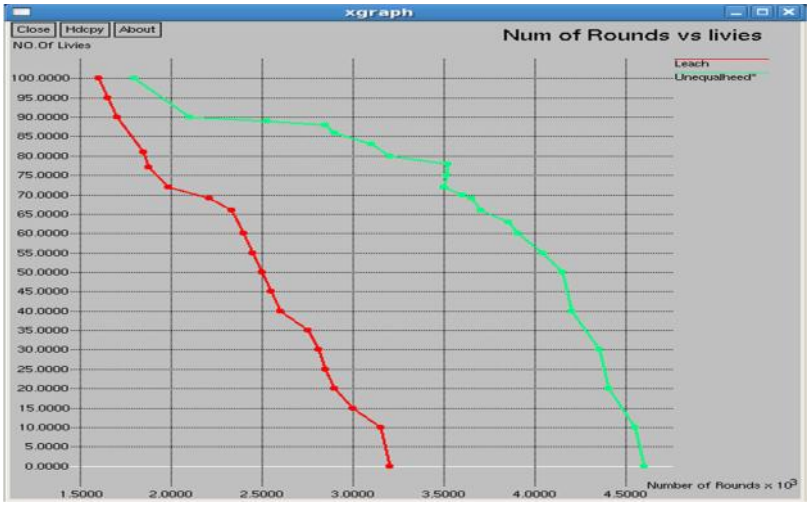

Fig {Comparison between UNEQUAL HEED* and HEED* protocol}

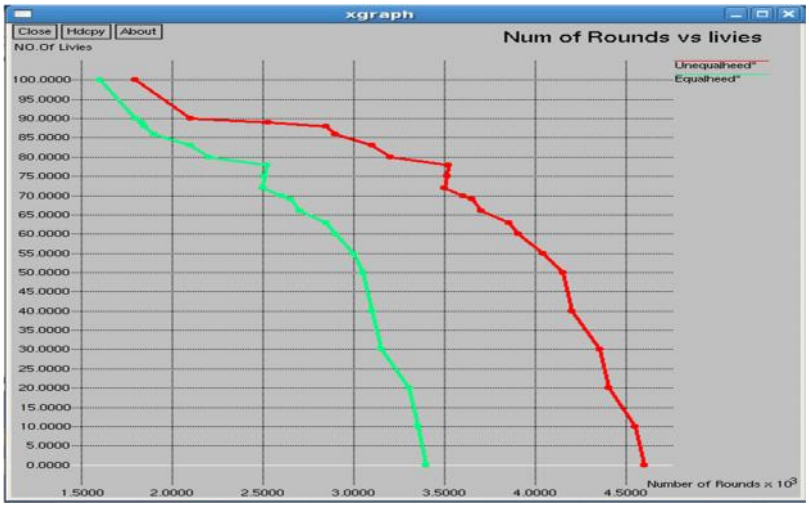

Fig {Comparison between UNEQUALHEED* and LEACH Protocol}

4 ALGORITHM

4.1 UNEQUAL CLUSTEING METHOD

In Unequal clustering Method, the circles of unequal size represent our clusters of unequal size and the traffic among the cluster heads .In clustered sensor networks, the sensor nodes do not transmit their collected data to the base station (BS), but designated cluster heads which aggregate the data brackets and send them directly or via multi-hop communication to BS. In Single-hop communication every sensor node can directly reach the destination. In Multi-hop communication nodes have limited transmission range and they are forced to route their data over several hops until the data reach the final destination. Cluster heads closer to the BS should support greater cluster sizes because of lower energy consumption during sending data packets to the BS. The bigger clusters should be closer to the BS. The clusters radius should increase as its distance to the BS decreases. Unequal Clustering Method (UCM) which is an effective method to deal with the hot spot problem. It can prevent the premature creation of energy holes in wireless sensor networks.

The operation of Unequal HEED* is divided into rounds and each round is comprised of two phases:

• The setup phase, which includes CH election and consequently cluster formation. In addition, in this phase, every CH coordinates with its members to send sensing data during the following phase.

• The steady state phase, which is broken up into TDMA frames. During each frame, every regular node, at the time of its respective time slot, sends sensing data to its CH. At the end of each TDMA frame, every CH forwards the aggregated data to the BS through the CHs

5 CONCLUSION

We propose Unequal HEED*, an extension to HEED*which is a popular distributed algorithm for energy-efficient clustering in WSN. Main differences with the original contribution, rely on that Unequal HEED* does not trigger reorganization at each round, but only when one of the elected CHs goes below a certain fraction of the energy level it had once elected. On the other hand, only that uncluttered CH node and its cluster members participate in Unclustering process, i.e., unclustering is performed locally. HEED* also diminishes the messaging overhead, by integrating communication cost value in CH messages. Besides, it takes the residual battery level of a node into account for holding a new round of election and forming uncluster nodes. The simulation results demonstrate that Unclustered HEED* outperforms the clustered HEED* protocol in terms of network lifetime.

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Theoretical study of stone catcher with many pockets during the primary cotton cleaning process

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ABSTRACT: In this paper we consider theoretically study of many pocket stone catcher. The quality of cotton fiber depends on primary qualitative processing of raw cotton. One of the operations of cotton processing consists of cleaning cotton from various impurities such as small and large things like a heavy stone. Such extraneous things must be removed before ginning process. To separate the heavy things of cotton, stone catchers are needed, that is installed between separator and cotton gin. Constructions of stone catchers are in different form such as cylindrical, rectangular in pipe bends. Cotton from bale transported by air at high speed through pipelines with a diameter of 0.2 - 0.3 Air speed is 15-20 m / s. In the rotary section of the pipeline installed stone catchers. Due to centrifugal forces of inertia, heavy impurities separated from the cotton move to the working chamber and stone catcher. There is need to examine the trajectory of cotton and heavy impurities in order to install the pocket

Based on these considerations viewed the probability approach to the stone catcher: determined the effect of catching depending on the geometric dimension of stones, studied movement of cotton and heavy impurities at the entrance of the separation chamber.

Equations of motion such as character movement, trajectory of cotton and heavy impurities are obtained with the help of principle of d'Alembert. According to the theory of motion of heavy impurities and raw cotton, found the optimal location of the pockets at the bottom of impurity.

KEYWORDS: Cotton gin, Stone catcher, cotton fiber, differential equation, d'Alembert, separator, theory of probability.

1 INTRODUCTION

Uzbekistan is one of the leading countries in the world in the production and processing of cotton. Production and provision of high-quality fiber is the main objectives of the Republic of Uzbekistan, therefore scientists lead many large-scale scientific researches.

Fiber quality depends highly on the primary processing of cotton. Since the processing of the cotton consists of the following techniques.

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- Aerodynamic transportation of cotton.
- Selection of the composition of light and heavy impurities from the cotton.
- Separation of air from the cotton
- Drying cotton
- Cotton ginning

Any disturbance in the cotton processing technology could impair the quality of the fiber, in addition during the process of cotton harvesting and transporting accidentally added about 0.2% -0.3% impurities to the harvest in the cotton factories. External impurities are in the form of various small stones that violate ginning process.

Therefore, it is necessary to allocate such harmful external small and large stones from the cotton before the ginning process.

The authors of this article have developed various stone catchers, which are installed in the chain of cotton processing technology. Such construction requires the right approach to the theoretical studies on the movement of cotton and external small heavy impurities in the chamber of stone catcher. Based on theoretical studies determined the optimal parameters of geometrical sizes of stone catcher.

2 MATERIALS AND METHODS

2.1 A PROBABILISTIC APPROACH TO THE STUDY OF STONE CATCHER.

Existing catchers of heavy impurities have a limited ability to release the heavy impurities from the transported material, it depends on a variety of indicators of cotton such as design, geometric shape and operation of the device designed for this purpose. At the same time, operation of stone catcher is significantly affected by the size of the pocket. The useful section defines the possibility of loss of heavy impurities that are transported flow due to a significant proportion of heavy impurities in respect of cotton.

When the size of the pocket expands, "useful section" of catcher will increase, and useful section decreases by making the size of catcher smaller. However, experience shows that increasing the useful section by expanding the size of the pocket is the main reason for the failure of catcher. Raw cotton that is hit in the pocket leads to rapid filling then inactivates the pocket and cotton with heavy impurities. Therefore, a significant expanding the pocket is not advisable.

Increasing "good ratio" can be achieved by increasing number of pockets in the separation chamber of stone catcher, while ensuring maximum loosening cotton, which also contributes to increase catching effect of device. It is known that while existing stone catcher is working, catching effect is on average 60%. The analysis shows that when various stones are skipped through an existing stone catcher its catching effect changes as follows (see Table I)

Stone size in mm	10-15	15 - 20	20 – 30	30 - 50
Trapping effect of CHTL in percentage	45	56	82	95

To study the influence of the number of pockets on the catching effect and determine the optimal number of pockets using a probabilistic approach, believing that the pockets work independently.

Since large heavy impurities mixed up mainly on the bottom of the pipe, it can be assumed that the highest probability of their loss in the first pocket. Mainly medium-sized impurities fall in the second pocket and large impurities not captured in the first pocket. [3]

Stone catcher's trapping effect can be determined from the following formula when two pockets installed.

$$P^{(p)} = P(A_1 or A_2) = P(A_1) + P(A_2) - P(A_1 \cdot A_2) \quad (2.1)$$

Where A and A1 - independent random events, ie first and second pockets operate independently

According to formula (2.1) determine the probability of catching stones when two pockets installed (see Table 2).

Stone size in mm	10-15	15-20	20-30	30-50
Chance of catching stones in stone catcher with two pockets, in %	66,44	80,84	97,2	99,7

Analyzing the impact of installing second pocket, determined the probability of collecting stones from raw cotton increased in the following order: on the rocks with up to 50 mm - 4.7%;

30 mm - 15.2%; 20 mm - 24.84%; 15 mm - 21.44%

Similarly, we define the probability of selection of stones after installing third pocket at the independent work of all three pockets.

Chance of catching in three pockets defined by the formula:

$$P^{(p)} = P(A_1 or A_2 or A_3) = P(A_1) + P(A_2) + \\ + PA_3 - P(A_1A_2) - P(A_1A_2) - P(A_2A_3) + P(A_1A_2A_3) \quad (2.2)$$

where: A3 - independent random event.

Probability of capturing stones from raw cotton after installing third pocket in accordance with formula (2.2) is equal to (see Table 3).

Table 3

Stone size in mm	10-15	15-20	20-30	30-50
Chance of catching stones in stone catcher with three pockets, in percentage	86,8	94,6	98,1	99,9

The stones can be found in the transporting raw cotton with size of 50 mm - 0.02%; 30 mm - I, I%; 20 mm - I3, 76%; 15 mm - 20%.

The research about the probability of catching stones by installing fourth pocket showed that while catching effect of stone catcher hardly increases, both large and small impurities that militate against a further increase in the pockets.[4],[5]

Theoretical studies on selecting the number of pockets in the stone catcher show the optimal providing.

High catching effect of working chamber with three pockets was confirmed by probabilistic approach.

2.2 MOTION STUDY OF COTTON AND HEAVY IMPURITIES ACCORDING TO THEIR DIVISION IN THE CHAMBER OF STONE CATCHER

In the previous chapter, on the basis of the probabilistic approach, selecting the optimal number of pockets stone catcher, proved that the best is to put three pockets in the separation chamber, further increase in the number of pockets gives sizeable increase in catching effect, but creates difficulties in production and operation, and also causes unjustified increase in hydraulic resistance.[6],[7]

Results of previous studies, as well as visual analysis of the movement of raw cotton in the pipeline show the uneven distribution of cotton in its transportation along the section of the pipeline, as well as the characteristic movement of heavy impurities.[4],[8],[9]

Depending on the mode of transport, mainly on the concentration of the mixture, or the performance and speed of transport, raw cotton and heavy impurities get mixed at different levels of pipeline section: to increase cotton trajectory of cotton, mixed-down occurs in the lower parts of the pipeline. This clearly explains that heavy impurities get mixed in the bottom of the main conduit.

Under the initial condition, according to figure 2.2 M is accepted a material point moving through air suction force λv and gravity $P = m \cdot q$, where: ($m -$ weight kg - acceleration of gravity). To study the motion of a point M hold-axes OX and OY from the center of curvature and form the equation of equilibrium of a material point on the principle of d'Alembert, directing the force of inertia against the direction of the driving force $J = -m \cdot w = m\ddot{s}$, we find the projection of forces λv to the axes OX and OY.

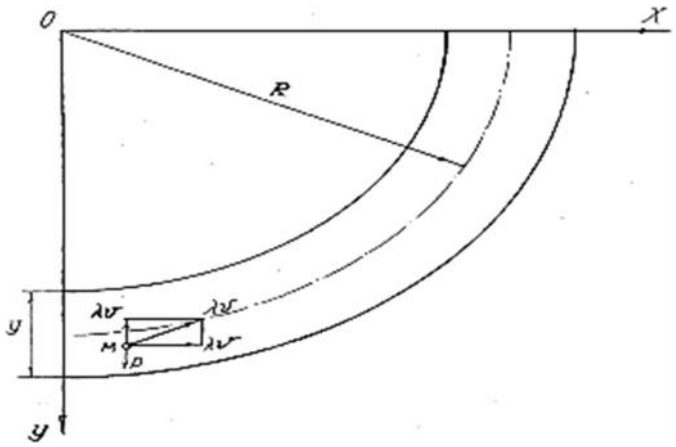

Fig. 2.2. Movement of raw cotton and heavy impurities

We find the projection of forces to the axes OX and OY

$$\left.\begin{aligned}\Sigma X_i = 0\\ \Sigma \mathrm{Y}_i = 0\end{aligned}\right\} \rightarrow \begin{cases} m\ddot{x} = -\lambda \cdot v_x + P_x \\ m\ddot{y} = -\lambda \cdot v_y + P_y \end{cases} \tag{2.3}$$

where: w - acceleration of raw cotton, m/s^2

$\ddot{x}$ - the second time derivative of the distance - a component of the acceleration of w on the OX-axis and –$\ddot{y}$ axis OY.

According to Fig.2.2: $Px = 0$, $Py = P = m \cdot q$ it is also known that $v_x = \dot{x}; v_y = \dot{y}$ i.e. speed - the time derivative of the distance.

The system (2.3) takes the following form:

$$\begin{cases} m \cdot \ddot{x} = \lambda \cdot \dot{x} \\ m \cdot \ddot{y} = mq - \lambda \dot{y} \end{cases} \tag{2.4}$$

For the initial conditions when

$$\begin{cases} x(0) = 0 \\ \dot{x}(0) = v_0 \end{cases} \tag{2.5}$$

$$\begin{cases} y(0) = h \\ \dot{y}(0) = 0 \end{cases} \tag{2.6}$$

where: h - the height (diameter) of the pipeline.

We find the general solution of the system of homogeneous equations:

$$\begin{cases} \ddot{x} = \dfrac{-\lambda}{m} \cdot \dot{x} \\ \ddot{y} = -\dfrac{\lambda}{m} \cdot \dot{y} \end{cases} \tag{2.7}$$

If we represent $x(t) = e^{kt}$ and $y(t) = e^{et}$ the system of characteristic functions is represented as follows:

$$\begin{cases} k^2 - \frac{\lambda}{m}k = 0 \\ e^2 \mp \frac{\lambda}{m}e = 0 \end{cases} \tag{2.8}$$

from which we have: $k_1 = 0$; $k_2 = \frac{\lambda}{m}$; $e_1 = 0$; $e_2 = +\frac{\lambda}{m}$ general solution of the equation has the form:

$$\begin{cases} x(t) = c_1 + c_2 e^{-\frac{\lambda}{m}t} \\ y(t) = c_3 + c_4 e^{-\frac{\lambda}{m}t} \end{cases} \tag{2.9}$$

To find the general solution of (2.3), we find a particular solution of inhomogeneous equations of the variation method. Particular solution represented in the form:

$$y(t) = c_3(t) + c_4(t)e^{\frac{\lambda}{m}t} \tag{2.10}$$

To locate $c_3(t)$ and $c_4(t)$ construct the following systems:

$$\begin{cases} c^1{}_3(t) + c^1{}_4(t)e^{-\frac{\lambda}{m}t} = 0 \\ c^1{}_3(t)\cdot 0 + c^1{}_4(t) - \left(\frac{\lambda}{m}e^{-\frac{\lambda}{m}t}\right) = q \end{cases} \tag{2.11}$$

Taking into account (2.11)

$$c_4(t) = -\frac{qm^2}{\lambda^2}\cdot e^{\frac{\lambda}{m}t}$$

$$c_3(t) = -\frac{qm}{\lambda}t \tag{2.12}$$

Substituting $c_3(t)$ and $c_4(t)$ in 2.10 we obtain:

$$x(t) = c_1 + c_2 \cdot e^{\frac{\lambda}{m}t}$$

$$y(t) = c_3 + c_4 \cdot e^{-\frac{\lambda}{m}t} + \frac{qm}{\lambda^1}t + \frac{qm^2}{\lambda^2} \tag{2.13}$$

Thus the general solution of the system (2.3) has the form:

$$y(t) = \frac{qm}{\lambda}t + \frac{qm^2}{\lambda^2} \tag{2.14}$$

Define constants C_1, C_2, C_3, C_4, C_5 using the initial conditions (2.5) and (2.6) has the form:

$$x(t) = \frac{-v_0 m}{\lambda}(e^{-\frac{\lambda}{m}} - 1)$$

$$y(t) = h + \frac{mq}{\lambda}t + \frac{qm^2}{\lambda^2}(e^{\frac{\lambda}{m}t} - 1) \tag{2.15}$$

The system of equations (2.15) represents the law of material flow in bends of pipeline, and is equivalent to Equation of flying cotton and heavy impurities, i.e respectively substituting m- weight values, $\lambda\nu$ so the suction force can be obtained for the corresponding equation of flying and heavy impurities. Heavy impurities equation can be displayed on the weight fraction, after finding the law of motion of a material point define the trajectory equation of motion of this point, what we want to exclude from the equation t.

The first equation is motion of a point of law that solves on the time t, and substitutes its Second equation. Thus we find the formula to construct the trajectory of motion of a material point M. substituting the corresponding values for flying cotton and individually by weight fractions of heavy impurities; we can get the appropriate path of movement for raw cotton and heavy impurities by weight fractions.

It is known that the equation of a circle with center (0,0) and the radius r, has the form

$$x^2 + y^2 = r^2 \tag{2.16}$$

Intersection point of flying impurities trajectory in the pipeline, with a circle of radius R, defines the solution of the following system:

$$\begin{cases} y - h - \dfrac{qm^2 n}{\lambda n}\ell n(1 + \dfrac{\lambda n}{mn \cdot v_0^{(m)}}x) + \dfrac{\dfrac{q \cdot mn}{\lambda n \cdot v_0^{(n)}}x}{1 + \dfrac{\lambda n}{mn \cdot v_0^{(n)}}x} = 0 \\ x^2 + y^2 = r^2 \end{cases} \tag{2.18}$$

If $y = \pm\sqrt{r^2 - x^2}$, we obtain the equation for x:

$$\sqrt{r^2 - x^2} - h - \frac{qm^2}{\lambda}\ell n(1 + \frac{\lambda_1}{mv_0}x) + \frac{\dfrac{q \cdot m}{\lambda \cdot v_0}}{1 + \dfrac{\lambda}{mv_0}x} = 0 \tag{2.19}$$

Equation (2.19) can not be represented in terms of elementary functions, so considered the following approximate cases: First case: let

$$\ell n(1 + Z) = Z and \frac{1}{1 + Z} = 1 \tag{2.19}$$

Then we obtain

$$\begin{cases} x = \sqrt{r^2 - h^2} \\ y = h \end{cases} \tag{2.20}$$

(2.20) - is a solution of (2.18).

Second case: let

$$\ell n(1+Z) = Z - \frac{Z^2}{2};\ \frac{1}{1+Z} = 1 - Z$$

then substituting these. Approximate expressions in (2.19) we have:

$$\sqrt{r^2 - x^2} - h - \frac{q}{2v_0{}^2}x^2 = 0 \tag{2.21}$$

From (2.21) it follows that the law of motion of raw cotton in the line described by the equation

$$y = h + \frac{q}{2v_0{}^2}x^2 \tag{2.22}$$

Now we find the roots of (2.21):

$$y - h - \frac{q}{2v_0{}^2}(r^2 - y^2) = 0 \tag{2.23}$$

$$y - h - \frac{qr^2}{2v_0{}^2} + \frac{q}{2v_0{}^2}\cdot y^2 = 0$$

$$y^2 + \frac{2v_0{}^2}{q}y - (r^2 + \frac{2v_0{}^2\cdot h}{q}) = 0$$

$$d = \frac{4v_0{}^4}{q^2} + 4(r^2 + \frac{2v_0{}^2\cdot h}{q}) \geq 0$$

$$y_1 = -\frac{v_0{}^2}{q} + \sqrt{\frac{v_0{}^4}{q^2} + \frac{2v_0{}^2 h}{q}} + r^2$$

$$y_2 = -\frac{v_0{}^2}{q} + \sqrt{\frac{v_0{}^4}{q^2} + \frac{2v_0{}^2 h}{q}} + r^2$$

$$x = \pm\sqrt{r^2 - y^2}$$

$$x_1 = +\sqrt{r^2 - (\frac{v_0{}^2}{q} + \sqrt{\frac{v_0{}^4}{q^2} + \frac{2v_0{}^2 h}{q} + r^2})^2}$$

$$x_2 = -\sqrt{r^2 - (\frac{v_0{}^3}{q} + \sqrt{\frac{v_0{}^4}{q^2} + \frac{2v_0{}^2 h}{q} + r^2})^2}$$

Thus, the coordinates of the intersection point

$$y = h + \frac{q}{2v_0{}^2}\cdot x^2;\ x^2 + y^2 = r^2$$

Indicated in Fig. 2.3 loci crossing trajectories of heavy impurities with a circumference wall (point indicated with an asterisk) separation chamber has a location slots, i.e establishing pockets and a place of the magnetic device.

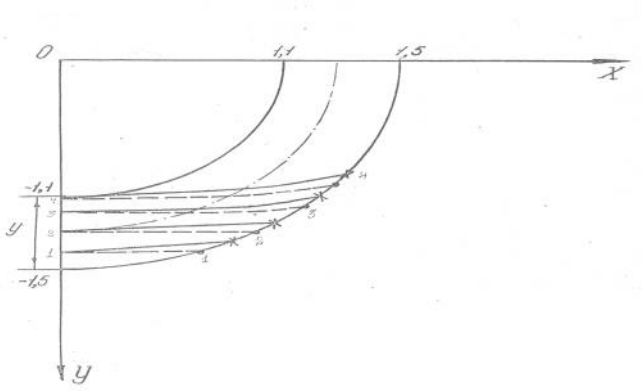

Figure 2.3

Thus, according to the motion theory of heavy impurities and cotton found the optimal location of pockets and magnetic device for the new catcher of heavy impurities from raw cotton.

3 RESULTS

The location of pockets for catching impurities was defined by probabilistic approach to the study of stone catcher. It is established the probability of catching stones from raw cotton, depending on the size of impurities. Theoretical studies have shown that the optimal effect of providing high capture is that working chamber with three pockets. This is confirmed by the calculations of probabilities. A system of equations received which is the law of motion of the material in the pipe bend. According to the theory of motion of heavy impurities and raw cotton, found the optimal location of the pockets on the pipe bend. On the basis of theoretical research, the author proposed new catching construction of heavy impurities from raw cotton.

4 CONCLUSION

1. The models of stone catcher and the analysis of work based on selected many pocket construction of magnetic stone catcher.
2. A scheme of the experimental construction, and the pneumatic installation conveyor for balanced distribution, with production parameters adapted to control performance and high-speed mode, prepared methodology for conducting experimental studies and aerodynamic measurements.
3. On the basis of the probabilistic approach to selecting the number of pockets on stone catcher shown that the optimal placements are three pockets.
4. The theoretical results are allowed to determine the trajectory of cotton and heavy impurities in the separation chamber. Defined by the point of intersection of heavy impurities from the bottom wall of the separation chamber, allowing the optimal location of pockets in which provides a more efficient capture of heavy impurities from raw cotton.

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Test Suite Generation using Genetic Algorithm and Evolutionary Techniques with Dynamically Evolving Test Cases

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ABSTRACT: Test oracles are mostly written manually by the user once test data are generated. This is because of the fact that each bug requires a different input and different data. This is a very difficult and time consuming task as the tester must produce quick and meaningful test cases for testing. However, the major problem of this approach is that they can cover only one goal at a time. They are dependent on one another and sometimes are not replicable. This paper presents a new approach by which test oracles are generated automatically by the usage of evolutionary algorithm. This method has successfully allowed bug identification in thousands of classes and it is quick to use.

KEYWORDS: Search-Based Software Engineering, Length, Branch Coverage, Genetic Algorithm, Evolutionary Algorithm.

1 INTRODUCTION

The goal of automatic test data generation in unit testing is to generate test data that can satisfy a given test coverage criterion. A common criterion for unit testing is branch coverage, i.e. the test set should execute every branch in the program unit under test [11]. Branch coverage is also a common criterion for assessing research in automatic test data generation and is the criterion adopted for the empirical investigation reported. A software test consists of an input that executes the program and a definition of the expected outcome. Many techniques to automatically produce inputs have been proposed over the years, and today are able to produce test suites with high code coverage [09]. Yet, the problem of the expected outcome persists and has become known as the oracle problem. This means that if we produce test inputs, then a human tester needs to specify the oracle in terms of the expected outcome.

2 LITERATURE SURVEY

Metaheuristic search techniques have been extensively used to automate the process of generating test cases, and thus providing solutions for a more cost-effective testing process [12]. This approach to test automation, often coined “Search-based Software Testing” (SBST), has been used for a wide variety of test case generation purposes. Since SBST techniques are heuristic by nature, they must be empirically investigated in terms of how costly and effective they are at reaching their test objectives and whether they scale up to realistic development artifacts. This paper [14] presents the results of a systematic, comprehensive review that aims at characterizing how empirical studies have been designed to investigate SBST cost-effectiveness and what empirical evidence is available in the literature regarding SBST cost-effectiveness and scalability. This paper [2] presents a novel approach to automatic software test data generation, where the test data is intended to cover program branches which depend on string predicates such as string equality, string ordering and regular expression matching. A search-based approach is assumed and some potential search operators and corresponding evaluation functions are assembled [11]. Their performance is assessed empirically by using them to generate test data for a number of test programs. A novel approach of using search operators based on programming language string operators and parameterized

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by string literals from the program under test is introduced. These operators are also assessed empirically in generating test data for the test programs and are shown to provide a significant increase in performance [2].

The natural mate-selection behavior of preferring individuals which are somewhat (but not too much) different has been proved to increase the resistance to infection of the resulting offspring, and thus fitness. Inspired by these results we have investigated the improvement obtained from diversity induced by differences between individuals sent and received and the resident population in an island model, by comparing different migration policies, including our proposed multiculturaity methods, which choose the individuals that are going to be sent to other nodes based on the principle of multiculturalists; the individual sent should be different enough to the target population, which will be represented through a proxy string (computed in several possible ways) in the emitting population.

The use of search algorithms for test data generation has seen many successful results. For structural criteria such as branch coverage, heuristics have been designed to help the search [5]. The most common heuristic is the use of approach level (usually represented with an integer) to reward test cases whose executions get close (in the control flow graph) to the target branch. To solve the constraints of the predicates in the control flow graph, the branch distance is commonly employed. These two measures are linearly combined [4]. Because the approach level is more important, the branch distance is normalised, often in the range. In this paper, we analyze different types of normalizing functions [13]. We found out that the one that is usually employed in the literature has several flaws. We hence propose a different normalizing function that is very simple and that does not suffer of these limitations. In the presence of an internal state, often a sequence of function calls is required to test software.

In fact, to cover a particular branch of the code, a sequence of previous function calls might be required to put the internal state in the appropriate configuration. Internal states are not only present in object-oriented software, but also in procedural software (e.g., static variables in C programs). In the literature, there are many techniques to test this type of software [7]. However, to the best of our knowledge, the properties related to the choice of the length of these sequences have received only a little attention in the literature. In this paper [5], we analyze the role that the length plays in software testing, in particular branch coverage. We show that, on “difficult” software testing benchmarks, longer test sequences make their testing trivial.

3 TYPES OF TESTS

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product. Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

3.1 SYSTEM TEST:

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results.

3.2 UNIT TESTING:

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration.

3.3 INTEGRATION TESTING:

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields.

3.4 FUNCTIONAL TEST:

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals. Organization and preparation of functional tests is focused on requirements, key functions, or special test cases.

3.5 WHITE BOX TESTING:

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose.

3.6 BLACK BOX TESTING:

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested.

3.7 ACCEPTANCE TESTING:

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

4 TEST SUITE GENERATION

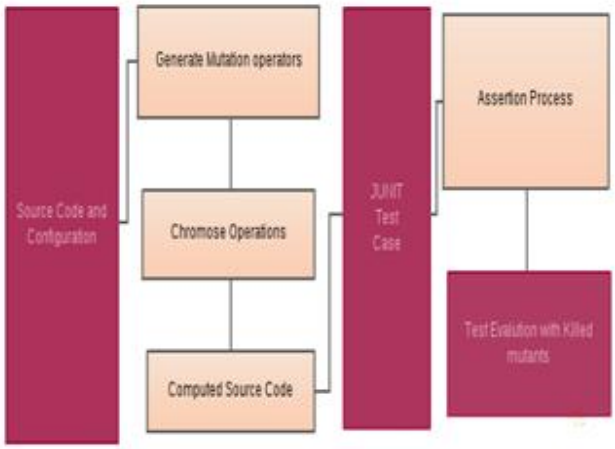

Figure 1- Architecture Diagram for Test Suite Generation

4.1 MUTATION TEST GENERATION:

It uses mutation testing to produce a reduced set of assertions that maximizes the number of seeded defects in a class that are revealed by the test cases. These assertions highlight the relevant aspects of the current behavior in order to support developers in identifying defects, and the assertions capture the current behavior to protect against regression faults.

4.2 GENETIC ALGORITHM:

Genetic Algorithms (GAs)[14] qualify as metaheuristic search technique and attempt to imitate the mechanisms of natural adaptation in computer systems. Population of chromosomes is evolved using genetics-inspired operations, where each chromosome represents a possible problem solution. In each iteration of the evolution, a new generation is created and initialized with the best individuals of the last generation (elitism). Then, the new generation is filled up with individuals produced by rank selection, crossover, and mutation.

4.3 BRANCH COVERAGE:

In branch coverage as test criterion, although the approach can be generalized to any test criterion. A program contains control structures such as if or while statements guarded by logical predicates; branch coverage requires that each of these predicates evaluates to true and to false [14]. A branch is infeasible if there exists no program input that evaluates the predicate such that this particular branch is executed.

4.4 RANDOM TEST CASES:

Random test case are used to evaluate the mutation testing ,Sampling a test case at random means that each possible test case in the search space has a nonzero probability of being sampled, and these probabilities are independent. For example, given a maximum length L, if each test case was sampled with uniform probability, then sampling a short sequence would be extremely unlikely [9].

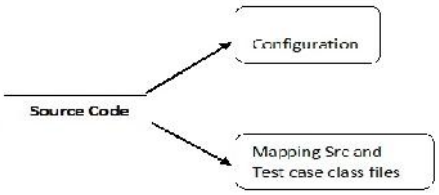

Figure 2- Mapping Source Code (Level 0)

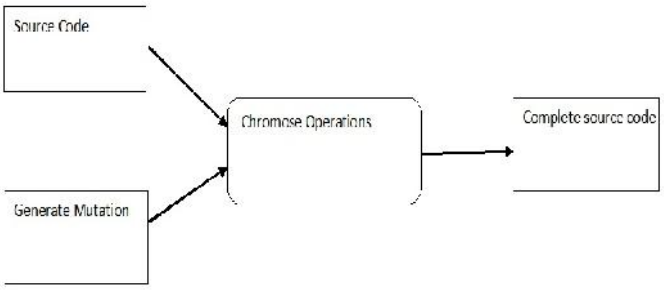

Figure 3- Chromosome Operations (Level 1)

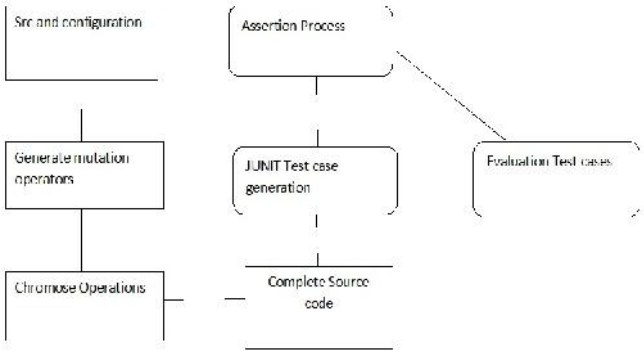

Figure 4- JUNIT Test Case Generation (Level 2)

5 CONCLUSION

Coverage criteria are a standard technique to automate test generation. In this paper, we have shown that optimizing whole test suites toward a coverage criterion is superior to the traditional approach of targeting one coverage goal at a time. In our experiments, this results in significantly better overall coverage with smaller test suites. While we have focused on branch coverage in this paper, the findings also carry over to other test criteria. Consequently, the ability to avoid being misled by infeasible test goals can help in overcoming similar problems in other criteria, for example, the equivalent mutant

problem in mutation testing. Even though the results achieved with EVOSUITE already demonstrate that whole test suite generation is superior to single target test generation, there is ample opportunity to further improve our EVOSUITE prototype.

For example, there is potential in combining search-based test generation with dynamic symbolic execution (e.g., [12]), and search optimizations such as testability transformation or local search should further improve the achieved coverage. Furthermore, there are general enhancements in the literature of search algorithms that we could integrate and evaluate in EVOSUITE, as, for example, island models (e.g., see the recent [3]) and adaptive parameter control. In our empirical study, we targeted object-oriented software. However, the EVOSUITE approach could be easily applied to procedural software as well, although further research is needed to assess the potential benefits in such a context. The approach presented in this paper aims at producing small test suites with high coverage such that the developer can add test oracles in terms of assertions. Although keeping the test suites small is helpful in this respect, the oracle problem is still very difficult. In this respect, we are investigating ways to support the developer by automatically producing effective [12] assertions and, to ease understanding; we try to make the produced test cases more readable [16].

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Improving Security Connection in Wireless Sensor Networks

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ABSTRACT: Wireless Sensor Networks (WSNs) have concerned much attention in recent years. The prospective applications of WSNs are massive. They are used for collecting, storing and sharing sensed data. WSNs have been used for various applications including habitat monitoring, agriculture, nuclear reactor control, security and tactical surveillance. Wireless sensor networks are threatened by numerous attacks. Therefore, security is now becoming a significant new path of research and attempts to counter these attacks.

KEYWORDS: Cryptography; Steganography; Nodes; WSN's; Authentication; Integrity; Confidentiality.

1 INTRODUCTION

Wireless Sensor Networks (WSN) are rising as both an imperative new level in the IT ecosystem and a rich domain of active research relating hardware and system design, networking, distributed algorithms, programming models, data management, security and social factors[1]. The basic idea of sensor network is to scatter tiny sensing devices; which are capable of sensing some changes of incidents/parameters and communicating with other devices, over a specific geographic area for some specific purposes like target tracking, surveillance, environmental monitoring etc. Today's sensors can monitor temperature, pressure, humidity, soil makeup, vehicular movement, noise levels, lighting conditions, the presence or absence of certain kinds of objects or substances, mechanical stress levels on attached objects, and other properties [2], [6]. In case of wireless sensor network, the communication among the sensors is done using wireless transceivers. The attractive features of the wireless sensor networks attracted many researchers to work on various issues related to these types of networks. However, while the routing strategies and wireless sensor network modeling are getting much preference, the security issues are yet to receive extensive focus [3], [4]. In this paper, we explore the security issues and challenges for next generation wireless sensor networks and discuss the crucial parameters that require extensive investigations.

Basically the major challenge for employing any efficient security scheme in wireless sensor networks is created by the size of sensors, consequently the processing power, memory and type of tasks expected from the sensors. We discuss these issues and challenges in this paper. To address the critical security issues in wireless sensor networks we talk about cryptography, steganography and other basics of network security and their applicability in Section 2. We explore various types of threats and attacks against wireless sensor network in Section 3. Section 4 reviews the related works and proposed schemes concerning security in WSN and also introduces the view of holistic security in WSN. Finally Section 5 concludes the paper delineating the research challenges and future trends toward the research in wireless sensor network security

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2 WIRELESS SENSOR NETWORKS

Wireless sensor networks are becoming more and more popular day by day as they revolutionize many segments of our economy and life. The research into this field has expanded to include all relevant topics imaginable. This chapter gives a small overview of the general operations and technologies involved for better understanding of this research [1].

3 EVOLUTION OF WIRELESS SENSOR NETWORK

3.1 SENSOR NETWORKS ARCHITECTURE

A system of acoustic sensors called the Sound Surveillance System (SOSUS) was placed at strategic locations on the bottom of the ocean. Around the same time the United States also deployed networks of radars for air defense [2], [4]. These sensor networks had a hierarchical architecture and they were in fact wired sensor networks. They were not fully automated, human operators played an important role in maintaining the network. Wireless sensor networks were introduced by the Defense Advanced Research Projects Agency (DARPA) in the early 1980's [3]. It was called the Distributed Sensor Networks (DSN) program where many low-cost sensing nodes were spatially distributed and they processed data collaboratively. By the mid 1980's the Massachusetts Institute of Technology (MIT) started developing a DSN to track lowing aircrafts [5].

3.2 SECURITY IN WIRELESS SENSOR NETWORK ISSUES AND CHALLENGES

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE and SI do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable [7].

- Reliability is one of the most important factors. a sensor node can fail due to several
- Reasons such as environmental interference, physical damage, depleted energy source and etc [8]. The failure of a single node should not affect the overall network performance. Reliability in a WSN is the ability of the network to sustain its functionality regardless of the failure of nodes.
- Scalability a WSN may consist of hundreds of nodes in a single network. WSN protocols have to be designed to be able to work with these large numbers of nodes and also utilize the high density of nodes [5].
- The density of a WSN can be anything from a few nodes to a few hundred nodes per square meter. The density can be defined as the number of nodes within the transmission range of a specific node.

4 CRYPTOGRAPHY

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you?

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

4.1 ABBREVIATIONS AND ACRONYMS

Since data aggregation is done at intermediate nodes, it is necessary to ensure confidentiality, integrity, authentication, etc. Symmetric Key Cryptography is easy to compute and the

Public Key Cryptography is more secure compared to symmetric but it is slow. By combining the advantages of these two cryptographic methods, the level of security can be enhanced [10].

4.2 SECURITY GOALS

- Security of a system addresses three major concerns namely confidentiality, integrity and authenticity [3].
- Cryptography is the basic technique to provide security services such as authentication, confidentiality, integrity in data networks as well as sensor network.
- In sensor network security, an open research problem is to design a bootstrapping protocol that establishes a secure communication infrastructure
- from a collection of sensor nodes where the nodes are pre-initialized with some secret information without having any prior direct contact with each other [7].
- This is often referred as the bootstrapping problem. The complexity of the bootstrapping problem stems from the numerous restrictions of sensor network.
- A bootstrapping protocol should enable a newly deployed sensor network as well as it should support the addition deletion of nodes after deployment.
- Key management scheme is a basic building block to ensure security in sensor network.
- Traditional key management techniques are not suitable for sensor networks since sensor nodes are resource constrained devices and also can be physically captured [12].
- Security in communication system has become increasingly prominent and its key technology cryptography technology develops rapidly.
- Wireless network has been experiencing an explosive growth in recent years and offering attractive flexibility to network operators and users [11].
- There have been a few recent attempts to use PKC in wireless sensor networks, which demonstrate that it is feasible to perform limited PKC operations on the current sensor platforms such as MIC motes [5].
- Elliptic Curve Cryptography (ECC) has been the top choice among various PKC options due to its fast computation, small key size, and compact signatures. For example, to provide equivalent security to 1024-bit RSA, an ECC scheme only needs 160 bits on various parameters, such as 160-bit unite held operations and 160-bit key size [2].

4.3 SECURITY FUNDAMENTALS

Security is a broadly used term encompassing the characteristics of authentication, integrity [13] Privacy, no repudiation, and anti-playback. The more the dependency on the information provided by the networks has been increased, the more the risk of secure transmission of information over the networks has increased [15]. For the secure transmission of various types of information over networks, several cryptographic, steganography and other techniques are used which are well known. In this section [14].

4.4 SECURITY SCHEMES IN WIRELESS SENSOR NETWORKS

- Confidentiality, integrity, and authentication have an important role in security
- Most of the threats and attacks against security in wireless networks are almost similar to their wired counterparts
- While some are exacerbated with the inclusion of wireless connectivity.
- In fact, wireless networks are usually more vulnerable to various security threats as the unguided transmission medium is more susceptible to security attacks than those of the guided transmission medium [8].

5 STEGANOGRAPHY

The abundant availability of multimedia devices such as small microphones and low-cost complementary metal oxide semiconductors (CMOS) has fostered the development of wireless multimedia sensor network (WMSN) [11]. This type of network has drawn increasing interest in the research community over the last few years. Wireless multimedia sensor networks (WMSN) are a new low-cost and emerging type of sensor network that is facilitated by digital signal processing containing sensor nodes equipped with ubiquitously capturing cameras, microphones, and other sensors producing multimedia content that respond to sensory information such as humidity and temperature. Hence, a WMSN will have the ability to transmit and to receive multimedia information such as monitoring data, image and stream video [3], [7], [9]. Since,

there is functionality to retrieve multimedia information, the WMSN will also be able to store, process in real time, correlate and amalgamate multimedia information from different sources. The primary function of WMSNs is to garner and disseminate critical data that characterize the physical phenomena secluded in the target area. Depending on the application scenario, WMSNs are used in many contexts and therefore their application domains are continuously growing [3].

5.1 ATTACKS IN WIRELESS SENSOR NETWORKS

Attacks against wireless sensor networks could be broadly considered from two different levels of views. One is the attack against the security mechanisms and another is against the basic mechanisms (like routing mechanisms). Here we point out the major attacks in wireless sensor networks [12].

Denial of Service (DoS) is produced by the unintentional failure of nodes or malicious action. The simplest DoS attack tries to exhaust the resources available to the victim node, by sending extra unnecessary packets and thus prevents legitimate network users from accessing services or resources to which they are entitled. DoS attack is meant not only for the adversary's attempt to subvert, disrupt, or destroy a network, but also for any event that diminishes a network's capability to provide a service [19], [23], [26].

In a sensor network, sensors monitor the changes of specific parameters or values and report to the sink according to the requirement. While sending the report, the information in transit may be altered, spoofed, replayed again or vanished. As wireless communication is vulnerable to eavesdropping, any attacker can monitor the traffic flow and get into action to interrupt, intercept, modify or fabricate packets thus, provide wrong information to the base stations or sinks [18], [22], [25]. As sensor nodes typically have short range of transmission and scarce resource, an attacker with high processing power and larger communication range could attack several sensors at the same time to modify the actual information during transmission.

The progressive nature of the Information Age creates increasing demands for processed data, and the consistent hlfillment of Moore's Law produces smaller hardware devices with improved capabilities to gather and process new data.

In the ideal world, a secure routing protocol should guarantee the integrity, authenticity, and availability of messages in the presence of adversaries of arbitrary power. Every eligible receiver should receive all messages intended for it and be able to verify the integrity of every message as well as the identity of the sender [12], [14].

5.2 PHYSICAL LAYER SECURE ACCESS

Physical layer secure access in wireless sensor networks could be provided by using frequency hopping. A dynamic combination of the parameters like hopping set (available frequencies for hopping), dwell time (time interval per hop) and hopping pattern (the sequence in which the frequencies from the available hopping set is used) could be used with a little expense of memory, processing and energy resources. Important points in physical layer secure access are the efficient design so that the hopping sequence is modified in less time than is required to discover it and for employing this both the sender and receiver should maintain a synchronized clock. A scheme as proposed in could also be utilized which introduces secure physical layer access

Employing the singular vectors with the channel synthesized modulation [14], [15], [17], [18].

Physical layer security has been established on the information-theoretic security that was initiated by the seminal work. In particular, physical layer security has been studied to understand the intrinsic security induced by physical layer capabilities such as randomness of wireless channels, signal-to-noise ratio gap, intended jamming, etc. Among the efforts, the study on a wiretap channel model, first introduced by Wiener, showed that secure communication over a broadcast channel is possible even [8].

Without resorting to secret key sharing. Wiener showed that a positive transmission rate of confidentiality messages can be achievable with the total ignorance at a passive eavesdropper. Meanwhile, the randomness of wireless channels was utilized as a common randomness shared among legitimate parities from which secret keys are extracted [24], [26]. This unique feature in physical layer provides a solution to a long lasting issue in secure communications, namely, the key distribution problem.

Wireless links are susceptible to eavesdropping, impersonation and message distortion. Poorly protected nodes that move into hostile environments can be easily compromised. Authorization of administration becomes difficult due to dynamic

topology [32], [33]. The scale of deployment of a WSN requires careful decision about trade-offs among various security measures. These issues are discussed and mechanisms to achieve secure communication in WSNs are presented in. Various security challenges in wireless sensor networks are analyzed and key issues that need to be addressed for ensuring adequate security are summarized in. Secure routing is a major research area [7].

Secure routing is a major research area. Types of routing attacks and their countermeasures are presented in. Secure routing in an ad hoc network is a daunting task because of some contradictions between the nature of the network and the associated applications. Various routing protocols have

Been presented with a focus on finding security vulnerabilities a survey of secure ad hoc routing protocols for mobile wireless networks is presented [29], [30], [33].

In WSNs, for the data confidentiality in distributed detection, capabilities of physical layer can also be exploited. In the presence of a passive eavesdropper called an enemy fusion center (EFC), sensors in a WSN individually or collaboratively transmit their local decisions on a target state to an ally fusion center (AFC), where a final decision is made. In this case, the central issue is how to design a physical layer scheme at the sensors to achieve reliable transmissions to the AFC, while preventing information leakage to the EFC. Two encryption methods, stochastic encryption and channel aware encryption, have been proposed to achieve reliability and security simultaneously. In this paper, we review existing physical layer security schemes for WSNs when there is an EFC performing passive attacks (i.e., eavesdropping). As most physical layer security schemes do not require expensive cryptographic techniques (in terms of computation and energy cost) for secure communications the encryption methods built based on physical layer are well-suited to WSNs [26], [28], [31].

6 ACKNOWLEDGMENT

Sensor networks are ideal candidates for applications such as target tracking, battlefield surveillance, and scientific exploration in hazardous environments. Typically, a sensor network consists of a potentially large number of resource constrained sensor nodes, which are mainly used to sense physical phenomena (e.g. temperature, humidity) from its immediate surroundings, process, and communicate the sensed data locally, and a few control nodes, which may have more resources and may be used to control the sensor nodes and/or connect the network to the outside world (e.g. a central data processing server).

Sensor nodes usually communicate with each other through wireless channels in short distances.

Sensor networks may be deployed in hostile environments, especially in military applications. In such situations, an adversary may physically capture sensor nodes, and intercept and/or modify data/control packets [13], [15]. Therefore, security services such as authentication and encryption are essential to maintain the normal network operations. However, due to the resource constraints on sensor nodes, many security mechanisms such as public key cryptography are not desirable, and sometimes infeasible in sensor networks.

Most of the attacks against security in wireless sensor networks are caused by the insertion of false information by the compromised nodes within the network. For defending the inclusion of false reports by compromised nodes, a means is required for detecting false reports. However, developing such a detection mechanism and making it efficient represents a great research challenge. Again, ensuring holistic security in wireless sensor network is a major research issue. Many of today's proposed security schemes are based on specific network models. As there is a lack of combined effort to take a common model to ensure security for each layer, in future though the security mechanisms become well-established for each individual layer, combining all the mechanisms together for making them work in collaboration with each other will incur a hard research challenge. Even if holistic security could be ensured for wireless sensor networks, the cost-effectiveness and energy efficiency to employ such mechanisms could still pose great research challenge in the coming days.

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Analysis of Cloud Computing Vulnerabilities

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ABSTRACT: Cloud computing is one of the most emerging networking technology, which has been considered as significantly effective among different types of users. Using cloud computing can be cost effective and organisation can focus more on their unique business idea instead of IT infrastructure or developing software, if they use IaaS or SaaS according to the business needs. However, there are issues with security of critical business data that is stored on cloud service provider's server. There are many concerns in regards to cloud computing security, which have many vulnerabilities and threats. In our previous paper, we have investigated security issues for cloud computing environment, where we have revealed the lack of awareness of cloud service providers to ensure the security. In this paper we have discussed about more threats and vulnerabilities of cloud computing, which cover some of the technical aspects of this burning issue. We would like to propose a cost effective and efficient security model for cloud computing environment after identifying the security risks involved in this sector of modern computing.

KEYWORDS: Cloud computing security, vulnerability of SaaS and PaaS, DoS and DDoS attack, authentication attack, cloud malware injection, metadata-spoofing attack.

Introduction: Gertner[1] study described cloud computing as one of the top 10 latest communication technologies, which is expected to have better prospects in coming years. They have described both personal cloud and cloud computing as top 10 strategic technology trends. Main concept of cloud computing is to reduce the processing burden from client end by improving the ability of "cloud". Cloud computing would encourage to use client's terminal as simple input output device and provide required services on-demand. There are many reasons why consumers have considered cloud computing very useful and fit for purpose. One of the key feature offered by cloud computing is flexibility of resources. Instead of paying significant amount of money in advance, customer can have processing power or storage capacity for exactly what they need; which can be increased at any time in future. Small business found this feature very useful along with the idea of paying only for their usage, which helps them to concentrate and invest more on their core business functions rather than IT infrastructure. Organisation can enjoy the flexibility of "not saving" upfront to buy expensive computing equipment. Cloud is offering range of different types of services, which includes storage, readymade and customisable software, IT platform for software development and use, processing power, applications, database or even virtual private computer according to needs. The consumers have hugely accepted SaaS, IaaS and PaaS in past years. Key advantages of using cloud are on-demand service, reduced upfront cost and maintenance cost, less maintenance responsibility, reduced risk, easier disaster recovery business continuity, efficient backup system etc.

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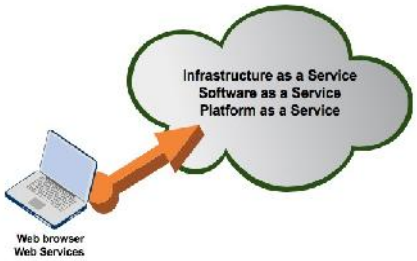
Shailza[2] has explained that structure of cloud computing that includes service model and deployment model. Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) are the example of cloud computing service model. Virtualisation is the key technology used by cloud service providers to offer these services. Cloud infrastructure and platforms are heavily depends on virtualisation, where different virtual machines may use same sets of hardware resources. According to Shailza[2], there can be three different cloud computing deployment models. Deployment model includes "public cloud" where number of customers' share same computing resources provided by cloud service provider, user will pay only for their use. This model is mainly on-demand service model. "Private cloud" is another type of cloud deployment model, where resources are used by a private organisation. Whether it is SaaS, PaaS or IaaS, cloud service will be used by using web browser or web service, where each of these media has different set vulnerabilities. Furthermore, each of these model of cloud computing are vulnerable to different security threats as well.

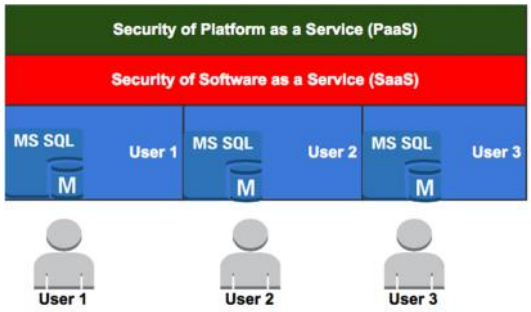


We have investigated about cloud computing security risks in our previous paper[3], where we have revealed number of critical threats for cloud computing environment, mainly the lack of awareness within cloud service providers to ensure the security of data. In this paper, we will be investigating about recent threats to cloud environment that focus on different technical aspects of security risks. The threats we will be discussing in this paper, will cover all of these different models of cloud structure.

Different types of cloud services are closely coupled or interlinked in many cases. For example PaaS and SaaS may be hosted on IaaS. Therefore, any security breach to IaaS will make the PaaS and SaaS vulnerable or other way around. Furthermore, SaaS can be hosted on other provider's PaaS, which also can be hosted on different provider's IaaS by renting the structure. In case of any security incident within any of these services, it will become very complicated to decide the responsibility as well as respond efficiently to resolve the issue [4].

Customers, who use SaaS, have minimum control in regards to security over this type of cloud service; therefore service providers are more responsible to ensure the security. However, as we have discussed in previous paper[3], significant number of cloud service providers are interested in providing different useful services rather than investing more to ensure the security. One of the key vulnerability for SaaS is the security of application, which allows user to use this service. Open Web Application Security Project (OWASP) has described top 10 threats for web applications, which is applicable for SaaS. Significant number of cloud service providers releases an application to use cloud services without effective penetration testing of the application, which makes whole SaaS vulnerable.

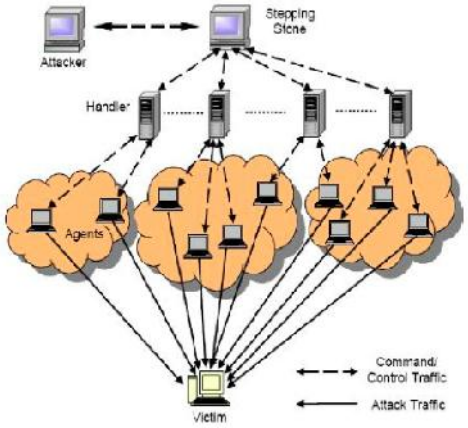
Multi-tenancy approach of hosting SaaS can also raise security concerns of data leakage. In this cloud architecture, service provider has different instances for individual customer but used the same application code. More likely, different customer's data will be stored on same database server; therefore risks of data leakage between these tenants are high[4]. Gartner[1] has found that virtually all the cloud service providers are offering secure socket layer to ensure the security and integrity of the data while transferring between different nodes. However, the security challenges remain while it comes to data storage within shared cloud service environment as many providers do not have encryption technology embedded to store user data into their server.



Platform as a Service (PaaS) provides the facility to develop or host a software without investing excessive amount of money to have hardware and software. Security of PaaS depends on data transfer security as well as the application security. PaaS also needs to have effective security system while data been stored of cloud provider's server. To ensure the security of data transfer, it is crucial to secure the network. Suitable encryption method should be used for data transfer. However, the challenges to ensure the security remain with customer's application instances and security of PaaS itself.

Infrastructure as a Service (IaaS) heavily depends on virtualisation technology, which offers consumers to use scalable computing power or storage capacity. Cloud service providers offer certain resource, which in their resource pool, by using server virtualisation technology. IaaS offer more control to the end users. However, it is also important that the IaaS itself is secured. VM Hopping and VM Escape are two common threats to virtualisation techniques[3]. Strong authentication technique can offer better security to IaaS along with data encryption technology within data storage.

In next section, we will discuss about some critical threats to cloud service environment, which is applicable for any of these cloud architecture explained above.



Denial of Service (DoS) / Distributed Denial of Service (DDoS) / Flooding Attack is one of the biggest security risks for cloud computing as like any other internet based service, where the availability of the data or service can go down because of high volume of traffic to the server. Normally attacker sends large amount of data packets, which can be simple TCP/ UDP or any other type of data. Target of any of these attacks is to negatively affect the availability of service for legitimate users by overloading server's capacity and bandwidth. "Buffer overflow attack" works on similar principle like DoS attack, where large amount of data, which exits the buffer size of a system, will be given to the service provider's system to process. This attack may cause Denial of Service (DoS). Furthermore, distributed denial of service (DDoS) attack is more dangerous for cloud computing, because of its distinctive nature of source of the attack. DDoS use hundreds of different computers, which are known as "bot", to attack on server. The nature of this type of attack make it complicated to protect the server against DDoS attack while the attacker uses different types of data packets. DDoS bandwidth attack can take place by using TCP SYN flood, ICMP or UDP flood; which will overload the allocated bandwidth of service provider so that legitimate customers will not be able to access their services. Smurf attack, Ping of Death attack, TearDrop or Land attack are some common ways to attacking cloud computing environment, all of these will cause denial of service to genuine user if successful. DoS or DDoS attack can take place against any SaaS, PaaS, IaaS, private cloud or public cloud environment.

Authentication Attacks: Regardless of architecture of cloud environment, all cloud service providers will use types of authentication system to give access to the service, which may include "something a person knows" , "something a person has" and "something a person are". However, most of the SaaS, PaaS and IaaS environment use the authentication method, where a person will know "something" such as username and password. Vulnerabilities in authentication process is one of the common target for attacker specially the one which does not have effective encryption system. There are very small numbers of service providers who offer cloud service based on "two factors authentication method" with encryption technology enabled.

Cloud Malware Injection Attack is one of the critical attacks on cloud computing environment, which is complicated to detect. Attackers use this method to inject malicious code or applications to one of the user instances, which is running on any SaaS, PaaS or IaaS architecture. When this specific instance starts running on cloud server, the only check take place is whether that instance is authorised to run certain services or not. In general, cloud server does not check the integrity of individual instances before running. If successful, attacker gets the opportunity to eavesdrop on other services and data on that server. This type of injection of malware in particular instances, therefore the cloud server, can create serious security concerns such as server deadlock, denial of service or loss of data within any type of cloud computing architecture. This can raise massive security issue within multi-tenant Software as a Service (SaaS) architecture[7].

Metadata Spoofing Attack: Metadata of cloud service will provide the information for the user about different services including location of different network components, format of data or security requirements. Attackers try to modify the information in server's metadata so that user can be redirected to different place, which is similar to the concept of DNS poisoning[9]. Following steps can be used for metadata spoofing attack:

Web Services Description Language (WSDL) is XML based widely used language that has been used by many service providers to describe the functionalities offered by particular web service. With this type of attack, attacker will change information within WSDL, which will take place as man-in-middle attack. It is possible to change endpoint URL, change message schema, add or modify WSDL security policy, eavesdropping, change cryptographic algorithm or running batch commands to execute certain operations. As the Cloud system itself has kind of WSDL repository functionality, new users most assumably will gather information for a service's WSDL file more dynamically. Thus, the potential spread of the malicious WSDL file and thus the probability for a successful attack rises by far[10].

Session Hijacking and Session Riding: Attacker can hijack a valid session key from authenticated user to access certain cloud service, which is capable of performing variety of malicious activities. Session hijacking can take place through browsers or application system's vulnerability. When attacker sends commands to cloud based web application on behalf of legitimate users. Session riding can cause user data deletion, sending spam or performing online transection etc[12].

Strong authentication system can help cloud service providers to provide efficient security against these types of attack. Strong hashing and digital signature can protect the organisation data against metadata spoofing and cloud malware spoofing. However, it is important to adopt different strategies and technologies to protect cloud services from DoS or DDoS attack, what we will be discussing in next paper. Application system's vulnerability is one of the biggest concerns for service providers, where authentication plays significant role with "single sign on (SSO)" architecture.

We have discussed about different critical security concerns of using cloud computing. One of the key security issues in cloud environment is "authentication system". In our next paper, we will be investigating potential method of authentication by using cost-effective hardware cryptographic system, which will allow end users to encrypt their data while using cloud based services.

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Influence Factors of Online Shopping

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ABSTRACT: Perceived risk, Shopping motivations, Experience, Service quality and Trust are five important factors to improve the competitiveness of online shopping.

KEYWORDS: Perceived Risk, Shopping Motivations, Experience, Service Quality, Trust.

1 INTRODUCTION

This paper wants to research influence factors of online shopping, the advantages and disadvantages of online shopping; and how to improve the competitiveness. The foundation of this paper was based on some factors about if people choose the online shopping. Via analyzed the factors, I will present some suggestion about how to improve the competitiveness. Online shopping had some problems in user-friendliness and aesthetics [1]. Now it is the first evolved of B to C E-commerce [2].

The first factor is Perceived risk. Perceived risk is an important part of online shopping factors. Consumers are worried much about perceived risk. It is a big factor if they choose buy products from online shopping companies or not. Hassan, Perceived risk is an important role, consumers know much about the products and online shopping companies [3]. If consumers found one of the perceived risks was too high, they would give up to buy something from the online shopping companies [4].

The second factor is shopping motivations. This part we will talk about shopping motivations. The companies will separately identify the key online shopping motivations of the products [5]. Shopping motivations are based on benefits and sacrifice [6]. I will to research the shopping motivations form two ways: dimensionalities and psychometrics. It is helpful for us to research the shopping motivations.

The third factor is Experience. The website of online shopping want to seek an easy way to use it [7]. If the online shopping companies can provide a better shopping experience, low-involvement products will be more successful [8]. Customers will like an easy and beautiful website. If they want to buy a product from online companies, they need a fast and safe way to buy products. It is hard to build a successful website; and online shopping stores need to think about how to solve some problems by customers' side.

The fourth factor is service quality. Many customers thought the service quality was too terrible [9]. Customer service quality is defined in global judgment, it has a superiority [10]. Service quality is hard to evaluate, it is more difficult than goods quality [11]. Some stores often ignore the service quality. It is as important as products quality, every customer needs a good product quality but they also need good service quality from online shopping stores. It is a big problem to online shopping stores because if people cannot provide good service quality, no one will buy their products, even though they have the best goods.

The last factor is trust. Trust in sellers in very important to build a relationship between sellers and customers [12]. Most of consumers do not trust the online shopping companies [13]. Trust is as important as price to influence the consumers

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choose online shopping [14]. To build the trust between sellers and buyers is very basic. A buyer want to buy the product form an online seller, they need to build trust with seller. Now, a lot of online shopping companies do not build a basic trust with consumers. It is an important factor of online shopping.

In discussion and importance, I will compare this five factors with local stores. I will find the advantages and disadvantages, and I will give some advice to disadvantages.

2 INFLUENCE FACTOR OF ONLINE SHOPPING

Table 1. INFLUENCE FACTOR OF ONLINE SHOPPING

Factor	Sub factor
Perceived risk	1.Privacy 2.System security 3.Fraudulent behavior 4.Credit card security 5.Products problem
Shopping motivations	1.Price 2.Discount 3.First publish 4.Service quality 5.Advertisement
Experience	1. Accessibility 2. Professional advise 3. Website design 4. Multi-terminal 5. Payment method
Service quality	1. Provide good introductions of products 2. Provide some other choices about the product. 3. Reliability 4. Pre-sales service 5. After-sales service
Trust	1. Provide salable product 2. Professional ability 3. Correct introduction 4. Payment security 5. Website security

2.1 MODEL OF FACTORS

Fig. 1. Influence Factors of Online Shopping with six main factors and 30 sub factors

3 DISCUSSION

3.1 PERCEIVED RISK

While the perceived risk was shared by customers, it is more likely near the true risk [15]. Perceived risk will has negative consequences, it is important to online shopping [16]. If you feel the benefits of online shopping, it will gain the consumers' subjective perception [17]. Perceived risk will discourage the consumers to buy products from online shopping [18]. Perceived risk is an important role, consumers know much about the products and online shopping companies [3]. If consumers found one of the perceived risks was too high, they would give up to buy something from the online shopping companies [4].

Perceived risk includes five sub factors: Privacy, System security, Fraudulent, Credit card security and Products problems. Every customer is worried about privacy, reveal customers' personal privacy is a general phenomenon. Many online shops did not do well in this factor before, it has a negative effect. Second sub factor is system security. Research shows many online stores have some system security problems, they cannot keep their systems safe.so it is a negative effect, and online stores need to solve this problem. The third sub factor is fraudulent behavior, normal online stores do it well, because they know a successful business is based on integrity. It is positive effect, most of online stores keep it well. Other online stores deceive customer, but it just a small part, they just want to deceive, they are not real online stores. The fourth sub factor is credit card security, it is very important to stores and customers because it is about money. Payment security is very important to American online shopping, so every online store do it well, if they cannot make sure customers' credit card safe, no one want to buy something in this store. So every online shop do it well, it is a positive effect. The last sub factor is products problems. Customers cannot touch the product which they want to buy, so they cannot sure they will like it. It is a negative effect.

3.2 SHOPPING MOTIVATIONS

This part we will talk about shopping motivations. The companies will separately identify the key online shopping motivations of the products [5]. Shopping motivations are based on benefits and sacrifice [6]. Internet shopping motivations

from various reasons, we need to research it [19]. The online shopping motivations come from utilitarian and hedonic perspectives [20]. If we want to validate the hedonic shopping motivations, we can focus on simple shoppers [21]. We need to examine the dimensionalities and psychometrics, so we can know the shopping motivations [22].

Shopping motivation means why customers buy this products. It is also can be explained how stores attract customers to buy their products. Online shopping has many positive effects in this factor. The first sub factor is price. The local stores need to pay much money in rent, so rent is a part of cost. Base on this condition, online shops can provide the same product in a lower price. Online shops just need a warehouse to keep products, the cost is much lower than local stores. So it has a positive effect in this sub factor. The second sub factor is discount. Because of online shops have lower cost, so they can give lower discount. Online shops can send e-mail to customers when they have discount, they can buy it on website on an easy way, but if the local stores have discount, customers have to go to the shop, it is not convenient. It is easy to find, online stores have a positive effect in this part. The third sub factor is first publish. First publish means customers can buy the product at the earliest time. Online stores also have an advantage. Customers need to line up in local stores when a hot product be published. More people will choose to buy it online because they do not need to line up. The fourth sub factor is advertisement. Online stores also have advantages in this factor. Advertising for a store on the internet is cheaper than outdoor advertising, the advertisement on the internet also can link to the website of a store. So online shops have a positive effect in this factor. The last one is service quality, it is a big problem of online stores. Websites have many security problem, it is not easy to solve.

3.3 EXPERIENCE

Online shopping experience is very important to online shopping satisfaction, it has a positive effect on it [23]. Some poor customer experiences like delivery delay will influence the customers' experiences, it will cause customer Sid satisfaction [24]. The website of online shopping want to seek an easy way to use it [7]. If the online shopping companies can provide a better shopping experience, low-involvement products will be more successful [8]. Some elements of flow such as feelings of skill can improve the online shopping experience [25]. A good shopping experience will be enjoyable and stimulating [26].

Shopping experience is important to customers. It includes five sub factors: Accessibility, Professional advice, Website design, Payment method and Multi-terminal. The first sub factor is accessibility. Online shopping store is easy to access. No matter customers want to buy something or not, they can access the website and see everything what they like. In local stores, if customers want to see some products, they need to call the sellers, some customers do not like it. Some customers do not like someone knows what they want to buy. Online shops can help them protect privacy. This sub fact is a positive effect. The second sub factor is professional advice. Local stores have advantages in this sub factor. Many local stores sell some products for many years, they can give you some very professional advises face to face. Customers can tell them what you want, and they can find some information from their mind, so customers can get the best shopping experience in this fact. Local stores have advantages in this sub factor. The third factor is website design. Many local stores also have websites, but they just provide new products' introduction and customers can buy something form this website. Online stores provide useful products' introduction and price, customers can buy this product in this website. In this sub factor, online shopping has an advantage. This fourth sub factor is multi-terminal. Online stores provide multi-terminal apps. Customers can buy something using computers, they also can buy it using cellphone apps. For example, Amazon provides a software for IPhone and android Phone, you can search some products' price and information. You need to go to local stores if you want to buy something from them. Online stores have advantages in this sub factor. The last sub factor is payment method, local stores can use cash and card, you cannot use cash in online stores. In this factor, local stores have an advantages.

3.4 SERVICE QUALITY

It is a very important part of online shopping factors. The service quality includes web site design, reliability, and responsiveness and so on [27]. Many customers thought the service quality was too terrible [9]. Customer service quality is defined in global judgment, it has a superiority [10]. Service quality is hard to evaluate, it is more difficult than goods quality [11]. Manage a good service quality is an essential challenge for online shopping companies [28]. The importance of service quality can be understated, it is very important to online shopping [29].

Service quality is very important to online stores. This factor includes five sub factors: 1. Provide good introductions of products 2. Provide some other choices about the product. 3. Reliability 4. Pre-sales service 5. After-sales service. The first sub factor is provide good introductions of products. Online stores has an advantages in this sub factor. Online stores have enough place to introduce this product, customers will know more details of the product. Local stores cannot provide so many information about products, they often introduce the products by talking, and customers often get the advantages but

don't know the disadvantages. In this sub factor, online stores has a positive effect. The second sub factor is provide some other choices about the product. Online stores can provide the same kinds of products in the same website, customers can choose the best one they think. Local stores often put the same kinds of products in the same place. Customers will be easier to choose the best one than online stores. Local stores have advantages in this sub factor. The third factor is reliability. Local stores have the physical stores, customers think they are more reliable. In the sub factor, local stores have advantages. The fourth sub factor is pre-sales service. Local stores can provide good pre-sales service because they can talk with customers face to face. Online stores often cannot provide a good pre-sales service, customers need to know something about the product just form the introduction on the websites. In the factor, local stores have advantages. The last sub factor is after-sales service. The after-sales service is one of the most important factors in online shopping. Customers can bring the products to local stores, they will help customers. If customers buy this products form online stores, they often don't know who can help them. Online stores need do more in this sub factor.

3.5 TRUST

This part I researched the trust. Trust in sellers in very important to build a relationship between sellers and customers [12]. Most of consumers do not trust the online shopping companies [13]. Trust is as important as price to influence the consumers choose online shopping [14]. Trust also is very important no matter in positive or negative toward events [30]. Trust is generally crucial in economic activities, it is also important in undesirable behavior [31]. Trust will build on the use of online shopping.

To build trust between online shops and online buyers is necessary and important. Losing trust will lose customers in the future. Get trust will avoid many other problems and it will build some fixed customers. This factor includes five sub factors: 1. Provide salable product.2. Professional ability.3. Correct introduction.4. Payment security.5. Website security. The first sub factor is provide salable product. Customers often easy to believe local stores provide salable product. Online stores often give them a bad impression. They often think that online stores just want you to buy, they often provide unsalable products. In this sub factor, online stores need to do more. The second sub factor is professional ability. Local stores often build a professional environment in their stores, and they often know much about their products. But online stores often cannot do it well. The third sub factor is correct introduction. Local often introduce the advantages of the product, and they do not tell customers the disadvantages. Online stores often give customers all of the information about the product. So online stores often provide more objective introduction. The fourth sub factor is payment security. Online stores often have many problems about payment. Customers are often worried about payment security because they need to use the safe number. If customers want to buy something from local stores, they do not need to worry about it. The last sub factor is website security, online stores have many problems about it. It is a disadvantage.

4 IMPORTANCE

4.1 COMPARISON

Perceived risk, Shopping motivations, Experience, Service quality and Trust are five important factors to improve the competitiveness of online shopping. Online shopping has some advantages in some sub factors, and it also has some disadvantages in some sub factors. First, list negative sub factors and positive sub factors in a table.

Table 2. Negative and Positive Sub Factors about Online Shopping

Factor	Negative sub factor	Positive sub factor
Perceived risk	1.Privacy 2.System security 3.Product problem	1.Fraudulent behavior 2.Credit card security
Shopping motivation	1.Service quality	1.Price 2.Discount 3.First publish 4.Advertisement
Experience	1.Professional advise 2.Payment method	1. Accessibility. 2.Website design 3.Multi-terminal
Service quality	1.Reliability 2.Pre-sales service 3.After-sales service 4. Provide some other choices about the product.	1.Provide good introductions of products
Trust	1.Provide salable product 2.Professional ability 3.Payment security 4.Website security	1.Correct introduction

Form this table, we can find there are 14 negative sub factors and 11 positive factors. More negative sub factors show that online shops need to increase their competitiveness. Online stores just need to keep the positive advantages, and think something about how to change the negative condition.

4.2 ADVISES

This part will show some way to change the negative sub factors. Make negative sub factors better than before is the best way to improve the competitiveness of online shopping.

There are three negative sub factors in Perceived risk: privacy, system security, product problem. The first negative sub factor is privacy. Online stores often reveal the individual information of customers. Many customers often get some telephone promotion calls after they bought some products from online stores. Some staffs sell this information to other companies. Online stores need to strengthen control the individual information in a small group of staffs. If some customers tell the mangers of online stores they get some telephone promotion calls from other companies, the managers will be easier to find who revealed the information. The second negative sub factors is system security. It is a big problem to online stores, they can get more help from security service companies. Building cooperation relationship with a famous security service company is the best way to solve this problem. This kind of companies will provide the best security services. The last negative sub factor is product problems. Online stores can establish a quality testing institute. This institute will test every product before they sell this product on their stores. Online stores can show this quality testing report in the introduction of product.

There is two negative sub factors in experience: professional advice and payment method. The first negative sub factor is professional advice. Many online stores do not have professors about products which they sell. They can get help from factories, they can invite a professor from factories as a counselor. They can help online stores answer some professional

problems. To some common questions, online stores can answer these questions in the introduction. The second negative sub factor is payment method. Online stores can provide more third party payment methods like PayPal or any other famous third party payment methods. Customers will be easier to trust this kind of payment methods, because they do not need to use the safe number of card.

There are four negative sub factors in service quality: Reliability, Pre-sales service, After-sales service, Provide some other choices about the product. The first negative sub factor is reliability. Online stores often cannot give customers a reliable image, because they don't give customer some reasons to trust them. Online store can provide more service to build trust with customers. The second negative sub factor is pre-sales service. The best way to improve pre-sales service is manual service. If customers have some problems about this product, they can get answers form manual service. If online stores can solve their questions, online stores will have a big choice to sell out the product. The third negative sub factor is after-sales service. The best way is seven days return without reason and if the product has some quality problems, online stores need to help them return or change in 15 days. The last negative sub factor is provide some other choices about the product. Local stores often put the same kind of products in the same place, online stores also can do it. Online stores can make a list which shows every kind of products. In a website of a product, they can provide different price or brand products in this website.

There are four negative sub factors in trust: Provide salable product, Professional ability, Payment security and Website security. The first negative sub factor is provide salable product. Online stores often provide salable products but customers can sure they provide. Online stores can show more detail pictures of the products, and provide seven days return without reason. The second negative sub factor is professional ability. Online stores can invent some professors from factories as counselors. The third negative sub factor is payment security. Payment security is not easy to keep by themselves. Online stores can cooperate with security service companies, and let them provide the customers some security software.

5 CONCLUSION

Perceived risk, Shopping motivations, Experience, Service quality and Trust are five important factors to improve the competitiveness of online shopping. Online stores do well in some factors, they have advantages in those factors. They also has some disadvantages because they have some negative effects. In my research paper, I analyzed every factor, and find the negative sub factors of every factor. There are three negative sub factors in Perceived risk: privacy, system security, product problem. There is two negative sub factors in experience: professional advice and payment method. There are four negative sub factors in service quality: Reliability, Pre-sales service, After-sales service, Provide some other choices about the product. There are four negative sub factors in trust: Provide salable product, Professional ability, Payment security and Website security. Giving some advice about how to improve the competitiveness. To develop the advantages and avoid the disadvantages, based on the research paper, find a best way to solve problems and keep advantages. The shopping experience is very important, every customer hopes he/she can have good shopping experience. Every store needs to think about how to improve shopping experience. There are many security problems in online shopping, many customers are worried about it. If online stores want to improve their competitiveness, they must to improve the five important points, it is important to build trust between customers and stores. Online stores have many advantages, if they can solve their problems and keep their advantages, they will get more customers.

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Data Mining and Knowledge Management for Marketing

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ABSTRACT: The goal of this paper is to demonstrate the importance of using knowledge management and data mining for supporting marketing decisions. It shows how the data mining techniques and tools can extract hidden purchase patterns that can help to make better decisions by the marketers. Practically, knowledge management and data mining techniques are really useful for marketing especially for organizations which have huge amount purchase transactions. Knowledge management and data mining also can help to increase the profit because of the correct decisions made by marketers. The paper also shows how knowledge management and data mining can be used to provide better answers from huge amount of data of customers and purchase transactions.

KEYWORDS: Knowledge, Data mining, Customer relationship management, Marketing decision, Hidden information.

1 INTRODUCTION

Due to the huge amount of information related to customers and daily purchase transactions, the businesses databases are dramatically increased and become huge. For this reason, knowledge management and data mining (DM) techniques and tools have became important for the marketing decisions. DM can be used to extract useful information of hidden purchase patterns that could be used to support the marketing decisions. Also, DM can help to analyze the overall market [1].

Marketing decisions are very important for any organization to increase the profit. It can affect customers behavior [2]. The marketing is becoming more difficult every day. Nowadays, the business environments are more complex. Marketing decisions are restricted by the surroundings and the society. For that reason, marketing decisions should be standardized which will help marketers to do the business in a professional way [3]. To make any marketing decision more accurate, some tools and techniques should be used. Data mining is important tool to support marketers [4]. Studies showed that DM can improve marketing significantly [5].

Good marketing decisions are based on knowledge about customers. This kind of knowledge is very important and considered as a key for the marketing functions. This critical knowledge can be found in the organization's databases but most of it is hidden [4].

Data Mining tools are used by decision makers to help them to get the useful hidden knowledge in order to make better decisions. DM is just a combination of database and artificial intelligent [6]. The process of data mining can be automated which makes it very common to be used in different areas including the marketing area. Data mining tools usually are used in areas that need to analyze huge amount of data.

One of the most important factors that might affect the marketing decisions is the knowledge management [4]. Last few years , there has been a growing interest in treating knowledge as a significant organizational resource [7]. Many corporations have developed an interest of KM because they realized its importance. Knowledge Management KM is a process of creating and utilizing knowledge [8].. KM processes can be integrated with the corporation system which can helps the marketers to get the knowledge easily [9].

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Customer relationship management (CRM) also affects the marketing decisions positively. It is a concept of managing customers in a long-term relationship [4]. CRM tools can be used to analyze purchase behavior of customers. But there are alot of tools in the market that can be used to help in Customer relationship management . For that reason tools should be evaluated before using the right one for the organization [10].

2 RESEARCH METHOD

The research method used for this paper is a literature review [11] on marketing [4, 12-14], data mining [4, 6, 15-18], knowledge management [4, 6, 15-18], and customer relationship management [4, 10, 19-21]. This literature review helped me to build a theoretical foundation of the topic. It improved my understanding and then helped me to identify the main factors of the marketing decisions. In this paper, I present the most important factors that help marketers to achieve the goal which is making better marketing decisions.

3 DATA MINING TOOLS AND TECHNIQUES

The importance of the data mining techniques is coming from the ability to extract useful and hidden information from large databases or data warehousing which is very difficult for any human being to analyze and extract. These tools and techniques can be used to improve the way of making any decision. One example of using data mining tools and techniques is in marketing area. It can extract useful information from old data and gives useful reports about the best time to do a product advertisement. Also based on the statistics provided by the data mining tools, it helps marketers to choose the best media to publish the product advertisement.

DM has several techniques that can provide different types of analysis. One of the DM technique is association analysis. This technique is used to check all the historical related data and compare the old transactions to provide informative reports to be used by the decision makers. Also DM techniques can be used to as market predict techniques to help to predict the market future. These techniques can be used by marketers to help them to make better decisions then increase the future sales [22].

Data mining process is complicated. It is an iterative process with a lot of feedback loops. Sometimes the whole process should be repeated from the beginning. It involves six phases.

- Problem definition.
- Data Preparation.
- Data Exploration.
- Modeling.
- Evaluation.
- Deployment.

Data mining tools and techniques usually deal with data stored in data warehousing. DW is defined as “A data warehouse is a subject-oriented, integrated, time-variant and non-volatile collection of data in support of management's decision making process [23]” . Different modeling techniques are used to design data warehousing. These modeling techniques are not the techniques used to model regular databases. DW can be designed by using dimensional modeling techniques [24]. The dimensional modeling techniques organize all the data into 2 types of tables – fact table and dimension tables. There are 3 types of architectures in dimensional model: star schema, snowflake schema, and galaxy schema [25]. The star schema is the most widely used in designing data warehouses [26].

4 KNOWLEDGE, INFORMATION AND DATA

In order to understand the knowledge management, we should first differentiate between data, information and knowledge. Data is facts. It might be just a description containing numbers or plain texts [27]. Having relationship among data will make information. Knowledge is a pattern formed from given information. That knowledge could be presented in a graphical report.

Knowledge management is a good use of available knowledge which might help any organization to reach its goal and objectives. It is actually a process of creating and sharing knowledge [9]. knowledge is now considered as an important asset which can be managed as physical ones in order to improve performance. Nowadays KM has improved and many methods have been developed which made it easy to deal with knowledge. KM improves companies performance in different areas. It

improves all the decision making process. One of the advantages of knowledge management is that can be automated and integrated with any organization's system. It also can be as a domain-independent system if it is needed [28]. For those reasons companies realized the importance of the KM. Marketing and marketers should get benefit of it to improve their marketing decisions [4]. Useful patterns gained from data mining and Knowledge management would help marketers to make better decisions in a systematic way [8].

5 DATA MINING AND KNOWLEDGE MANAGEMENT TECHNIQUES AND TOOLS

Data Mining (DM) is a combination of databases and (AI) artificial intelligent used to provide useful information to the users which will help them to make better decisions. It is usually used as a decision support system which could be used in different areas including marketing.

6 IMPORTANT FACTORS EFFECTING MARKETING DECISIONS

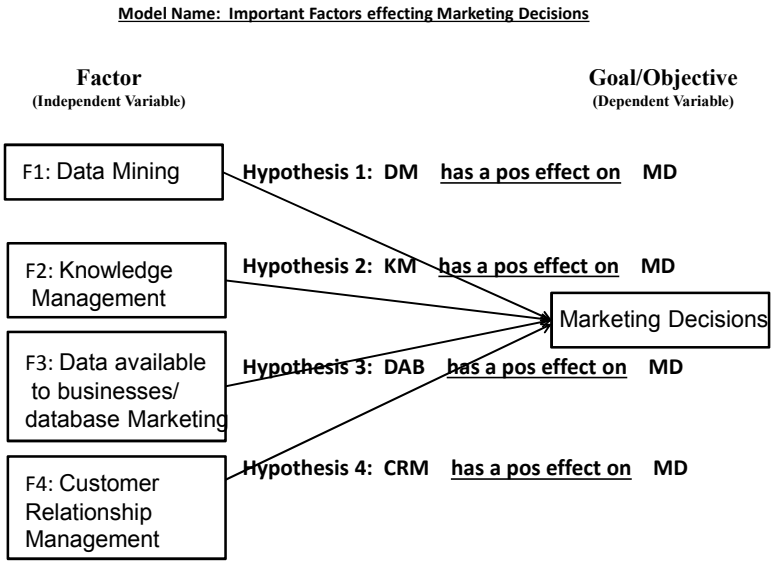

Fig.1. Important Factors effecting Marketing Decisions

7 EXPLANATION AND DISCUSSION

The model shows the goal which is marketing decision and the main factors that make up the decision. It also shows that all the factors have positive effect on making marketing decision.

7.1 GOAL (MARKETING DECISIONS)

Greene (1960) said, marketing decisions are very important for any organization to increase the profit. The marketing is becoming more difficult every day. According to Chakravarti et al., the environments are more complex. Also as Bell & Zabriskie stated that marketing decision based on demographic data [29]. Gelb & Cheney (1986) stated that marketing decisions are restricted by the surroundings and the society [12]. Aylmer (1970) said, the marketing decisions should be standardized which will help marketers to do the business [3]. Also, Shaw et al., stated that, some other tools and to techniques should be used to support decisions. Data mining is important tool to support marketers [4].

In my opinion , organizations may increase their profit when they have good marketing decisions [13]. Due to the increase of the data of the daily transactions, the environments have became more complex [30]. Also it depends on demographic data . [29]. For that reason some tools like data mining should be used to help marketers to make better

marketing decisions [4]. This kind of tool can be used to help in complex environment and surrounding restrictions [12]. Also I agree that the marketing decision should be standardized to make it easier [3].

7.2 FACTOR 1 (DATA MINING)

Shaw et al. (2011), stated that data mining can play an important role in different areas to help to predict and support the decision makers [4]. According to Bora (2011), data mining tools for decision support [15]. Guozheng et al., (2008) said, DM can be applied in different areas including Marketing [31]. Also, as Ding (2010) said, data mining (DM) can play an important role in improving marketing [16]. According to Guozheng et al., (2008) data mining become more popular because of the contributions that can be made in converting information to knowledge [31]. Also, as Hargreaves & Yi (2012) stated that data mining can be used to predict which can help in marketing area [32].

I think, the huge amount of data of customers, lead to the necessity of using technology like data mining techniques which will help to extract hidden information from that huge data [15]. This will help organizations to take correct decisions then maximize the profit [4]. DM shows that using its tools can improve the decision in different areas which lead marketers to think of using it in marketing [31]. It will enhance marketing decisions made my marketers [16]. DM is unique technique used to convert information to knowledge [31]. Also will help marketers to predict in case they need to do that in norder to make better decisions [32].

7.3 FACTOR 2 (KNOWLEDGE MANAGEMENT)

Shaw et al., (2001) stated that, one of the important factors that might affect the marketing decisions is the knowledge management . [4]. According to Alavi & Leidner, (2001), last few years , there has been a growing interest in treating knowledge as a significant organizational resource [7]. García-Murillo et al., said, (2002) Many corporations have developed an interest of KM because they realized its importance. Also, it can contribute to the organizations competitive advantage [33]. Palacios et al., (2009) stated that, KM is a process of creating and utilizing knowledge [8]. According to Applegate et al., (1987) KM can be used to design and implement domain-independent systems . [28]. Also, Singh et al., (2003) stated that, KM processes can be integrated with the corporation system [9].

I agree that nowadays , the knowledge management is making any marketing decisions . [4]. The knowledge is very important so we should find a method to deal with it [9]. Everybody realizes the importance of KM [7]. It contribute the advantages of any corporation [33]. KM together with data mining will help marketers to get more information and take marketing decisions in a systematic way [8]. KM can used for implementing domain-independent systems [28].

7.4 FACTOR 3 (DATA AVAILABLE TO BUSINESSES/DATABASE MARKETING)

Marketers uses data available to them to identify targets and then make customers profiles. This data will help to improve the process of marketing [4]. Database Marketing is used for the mass-market activities. According to Gogan, (1996), database marketing enables marketers to identify patterns in customer behavior and preferences within finer segments [34]. It increases the accuracy of the marketing effort . [35]. Also, Davis (1997) stated that, data helps to improve customer relationship which can improve marketing decisions [36] .

Data available to business and database marketing is one of the most important factors that can affect the marketing decisions in a positive way [4]. I think the data is the base of the marketing decisions [37]. Marketers use data to targets and then make customers profiles. Also this kind of data can be used to identify patterns in customer behavior and preferences within finer segments. Old data and statistics can be used to make appropriate decision. Customer relationship can be maintained by using available data of customers [36] .

7.5 FACTOR 4 (CUSTOMER RELATIONSHIP MANAGEMENT)

Customer Relation management is a concept of managing a long term relationships with customers in an organized way [4]. CRM can help organizations to increase their performance in different areas. It help them to do the marketing business. It help marketers to target the right customers by providing the best customers' profiles for a specific product. It also optimizes the use of customer information to be shared by different department within the organization. CRM also may help to increase the profit by providing information of most valuable customers to provide them more services and then increase the customers satisfaction in order keep the good relationship with them. This makes it very important for the marketers to give a special attention to the CRM to help them to in their business.

CRM has became an important success factor for most of enterprises. For that reason , most of the organizations have given a special attention to the CRM and turn to CRM software to help them to manage their customer relationship in a systematic way. CRM tools can be used to analyze purchase behavior of customers [20]. There are many CRM software in the market that can help organizations in that matter. For that reason tools should be evaluated before using the right one for the organization.

I think Customer relationship management (CRM), is in the top of the factors that affect the marketing decisions positively. Maintaining customers relationships in long term, can help marketers to make more accurate decisions and to the right target [4]. Also, it helps to maintain the updated interests and contacts of most valuable customers[20]. I agree that CRM should be emerged in the IT for more accuracy [21]. This helps to have more tools that can be used to help in Customer relationship management [10]. These tools can improve the process by testing and evaluating customer satisfaction [19].

8 IMPORTANCE OF MODEL/RESEARCH OUTCOME

The developed model emphasizes the important factors that affect the marketing decisions positively especially the data mining and knowledge management factors. This understanding leads me to think about a real case that uses data mining tools and techniques to increase the profit. I picked a product that the sellers usually do a lot of marketing and aim to increase number of customers to get that product. The chosen product is the credit cards. Credit cards sellers usually try to target the correct persons to get their credit cards. They do a lot of telephone calls and advertisements in different media just to increase the sales. By using the star schema design concepts, I assumed the credit cards sales has a fact table which is the credit cards sales table and four dimension tables which are time, location, employee and card type.

8.1 CREDIT CARD SALES COMPETITION

There are many credit cards sellers in the market with different interest rates. This leads the credit cards issuers and sellers to compete each other and offer different types of credit cards with different advantages to grab the customers attentions. This variety of credit cards and the sellers and the high competition among them, makes it difficult for the sellers to reach their customers even the marketing for this product has became difficult. Different types of credit cards should targeted to different people. Credit cards with very good advantages should be offered for special customers. Since these kinds of restrictions have to apply and having huge amount of information about customers, human being and regular database application cannot help the sellers to do an appropriate marketing for their credit cards. Those reasons together make the importance of using data mining tools and techniques to help marketers to target the correct customers to do their business.

7.1 DATA MINING AND WAREHOUSING

To get help and benefit of data mining techniques for the purpose of credit cards marketing then to increase the sales, a data warehouse should be built to allow the seller to apply that data mining techniques. All the data about customers and credit cards from the sellers' regular databases and other sources should be collected and stored in the data warehouse repository.

I proposed a design for the data warehouse that can be used by any credit card seller to help to apply the data mining techniques. The subject of the Data Warehouse is the Credit Card Sales. It is based on the information about customers and credit cards.

This data warehouse stores the historical and current information about customers and credit cards. Information includes:

- Customer information.
- Credit card information.
- Location.
- Time
- Historical Information about employees who sold and did marketing for any credit cards.

8.2 PROPOSED DESIGN

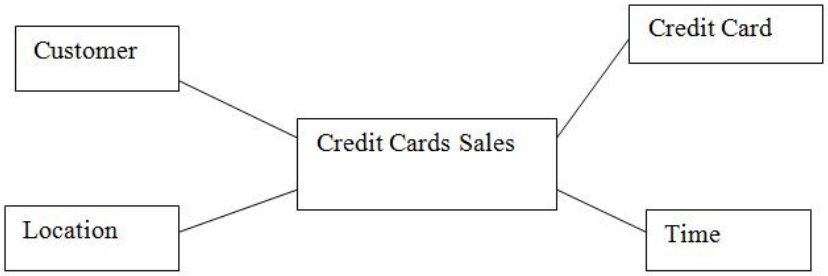

Fig. 1. Developed Star Schema for the proposed credit cards sales data warehouse

8.3 PROPOSED RESULTS

This proposed design will help the credit cards marketers to take better decisions and target the right customers. Applying the data mining techniques using that design will help to give better answers for better decisions made by marketers. For example:

- What credit cards are the most preferred by customers in general?
- What credit cards are the most preferred by customers in general in a specific location?
- What was the most requested credit card last month?
- What was the most accepted credit card offer by high income customers last year?
- What are the most used credit cards outside the USA?
- What credit cards are the most preferred by low income customers?

9 CONCLUSION

With the increase of data of huge number of daily purchase transactions made by huge number of customers, the use of knowledge management and data mining techniques and tools have became important for the marketing decisions support. It can be used to help marketers to get better answers about customers behavior and hidden purchase patterns in order to make much better marketing decisions.

The developed design showed that the use of data mining tools and techniques may increase the profit. Credit Cards sellers usually do a lot of marketing and aim to increase number of customers to get their products. They usually try to target the correct persons to get their credit cards. They do a lot of telephone calls and advertisements in different media just to increase the sales. The proposed results showed that the marketers can get better answers for some important questions which helps to target the right customers to do their business in marketing.

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A STUDY OF CROP COMBINATION REGION OF BARAMATI TAHSIL IN PUNE DISTRICT (Maharashtra State)

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ABSTRACT: The present study is an attempt to identify agricultural crop combination region of Baramati tahsil in Pune district for its better landuse planning. Baramati tahsil is situated in east part in Pune district covering 1382 square kilometer area and having 429690 populations (2011). This taluka consists of 117 revenue villages with one urban settlement. Administratively, this taluka has divided into six revenue circles. Population density of taluka is 311 persons per square kilometer (2011). The study region extends from 18º 2′ 44″ N to 18° 23′19″ North latitudes and 74° 13′ 8″ E to 74° 42′ 47″ East longitudes. The region falls under scarcity zone having rainfall between 400 to 500 mm. Monsoon generally commences in June, occurring highest rainfall in June (158 mm) and lowest in December (12 mm). The highest mean temperature is observed in May (34.60 centigrade) and lowest in January (18.50 centigrade). The slope of region is towards northwest and southeast. The study area has basaltic base having step like topography. Baramati tahsil is somewhat rectangular in shape. The study region is mainly agrarian having 84.89 percent net sown area of the total geographical area. Rafiullah (1965) modified Weaver's method and introduced a new method known as "Maximum Positive Deviation Method" apply to compute crop combination region for Baramati tahsil because of its accuracy.

KEYWORDS: Agriculture, Agricultural region, Crop Combination.

INTRODUCTION

The study of crop combination regions constitutes an important aspect of agricultural geography as it provides a good basis agricultural regionalization. Crops are generally grown in combinations (Weaver, 1954). The study of crop combination of any region has gained importance in geographical study. It gives us the relative position of crops on regional scale. Farmers grow crops in varied physical and cultural conditions. The pattern of crop combination gives rise to spatial predominance of certain crops or combination resulting the emergence of crop regions. Such analysis would ultimately minimize the change of oversimplified generalization (Ali, M. 1978). Crop combination study in geography is fruitful in many ways, firstly it provides an adequate understanding of an individual crop. Secondly, combination is in itself an integrative reality that demands definition and distribution analysis, and finally crop combination regions are essential for the construction of more complex structure of vivid agricultural region (Weaver, 1954). The study of crop combination thus forms an integral part of agricultural geography, and such study is greatly helpful for regional agricultural planning. First attempt for delineation of agricultural regions was made by Weaver in 1954. He studied crop combination for Middle East countries. Later on many more methods were introduced. Thomas (1963) modified Weaver's formula by including all crops with zero percent theoretical values in each step of the method, in the crop combination studies carried out in Wales but it did not yield different results than obtained by Weaver's method. Coppock (1964) also modified version of Weaver's method wherein he considered the rank in recognizing the leading crops. The Weaver's technique was subsequently modified by Doi (1959) where he supplied one sheet of table required only the summing up of actual percentages under different crops instead of finding differences between actual percentage and theoretical distribution. The present study attempts to study agricultural regionalization at micro level or village level of Baramati Tahsil.

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STUDY AREA

Baramati tahsil lies between 18º 2′ 44′′ N to 18° 23′19′′ North latitudes and 74° 13′ 8′′ E to 74° 42′ 47′′ East longitudes. It is located at an altitude of 538 meters above mean sea level. The tahsil lies in the eastern part of Pune district of Maharashtra. The river Nira flows west to east forming the southern boundary of the Tahsil and the district. The river Karha flows northwest to south-east Baramati tahsil is bounded by Indapur tahsil towards the east, Satara district towards the south, Purandar tahsil towards the west and Daund Tahsil towards the north. The total geographical area (TGA) of Baramati tahsil is 1382 sq. km., which is about 8.80 percent of TGA of the Pune district (**See Fig.1**).

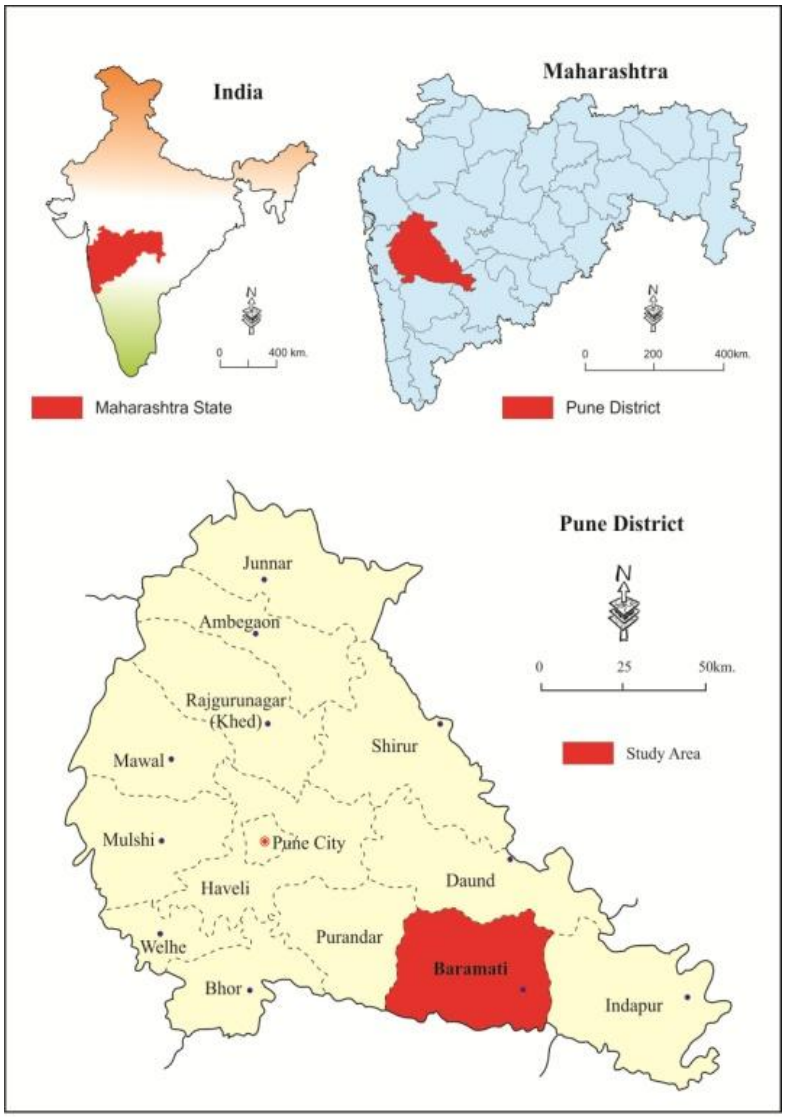

Fig.1 Location Map of the Study Area

OBJECTIVE:-

1) Identifying crop combination region of the Baramati tahsil.

DATABASE AND METHODOLOGY:-

The Present study was based on primary and secondary data sources. The published sources namely Tahsil Revenue Record, Socio-economic abstract of Pune District, District Census Handbook, Department of Irrigation, Groundwater Survey and Development Agency, Land Record office to obtain village wise crop data in Tahsil. Primary data was also collected at house hold level through questionnaires. Rafiullah's method used in crop combination has been applied for Baramati Tahsil. Rafiullah's (1956) Crop Combination modified Weaver method and introduced a new method known as 'Maximum Positive Deviation Method' The modified formula –

$$d = \sqrt{\frac{\Sigma D^2 p - D^2 n}{N^2}}$$

The under root sign may be ignored to save laborious calculations and the formula may be used in the following form:

$$d = \frac{\Sigma D^2 p - D^2 n}{N^2}$$

d = deviation

N = number of crops

Dp = Positive difference

Dn = Negative difference

SOIL TYPES:-

The fertility of soil is one of the factors affecting land capability of agricultural development. There are three types of soil found in the study area, namely, coarse shallow plateau soil, medium deep soil and deep black soil. Coarse shallow soil is observed in the hilly region. The medium black soil appeared in the surrounding area of Nira river and its tributary Karha. This soil is suitable for cultivation of sugarcane, wheat, oilseeds and pulses. The deep black soil lies along the bank of Nira river occupying 20 percent of the study region. This soil is rich in moisture and has high retentive capacity (**See Fig. 2 Soil Type of the Baramati Tahsil**)

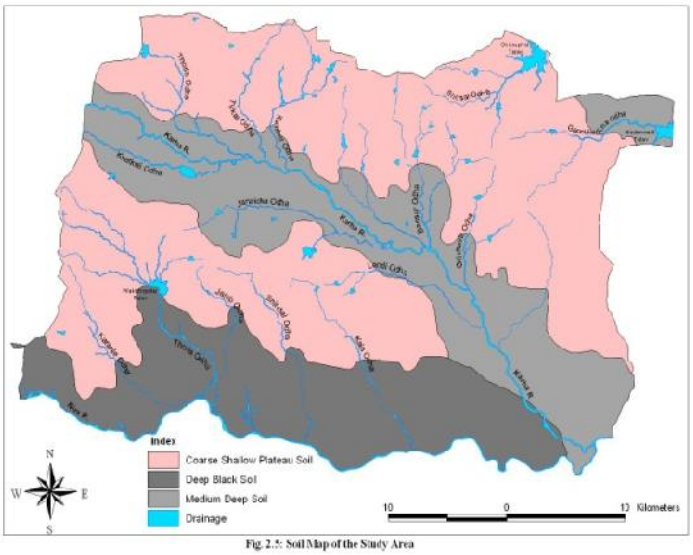

Fig. 2.5: Soil Map of the Study Area

Fig. 2 Soil Type of the Study Area

CROP COMBINATION REGIONS:-

The study of crop combination regions constitutes an important aspect of agricultural geography as it provides a good basis agricultural regionalization. The statistical technique adopted by Rafiulla is more accurate and rational and therefore it is quite popular for delineation of crop combination regions. According to this method percentage area of all crops was arranged in descending order for 117 villages. The crops having area less than 5 percent were omitted from the calculation and maximum positive deviation of variance was calculated. For monoculture medial value was considered at 50 percent, for two crop-combinations it is 25 percent, three crop-combination the value is 16.7 percent, for four it is 12.5 percent and for five crop it is 10 percent and so on. In present study area, 9 crops were used for computation of crop combination region. The obtained results of crop combination are shown in **Fig. 3**, **Table-1** and **Table-2**. Three crop combination regions have been identified in the Baramati tahsil by applying Rafiullah's method.

Table- 1: Crop Combination Regions in Baramati Tahsil

Sr. No.	Types of Crop Combination	Number of Villages	Percent to total villages	Area in hectares	Percent of Area
1	Monoculture	89	76.07	83608	80.31
2	Two crop Combination	26	22.22	18985	18.24
3	Three crop Combination	02	1.71	1514	1.45
	Total	117	100.00	104107	100.00

Source: Computed by Researcher.

MONOCULTURE

Jowar, sugarcane, Bajara and wheat crops have monoculture in the Baramati tahsil . These four crops are identified in eighty-nine villages (76.07 percent to total villages). Jowar is leading crop in study region showing highest coverage in forty-six villages (Fig. 3). It is grown on 47562 hectares area. Sugarcane is identified as monoculture in twenty-nine villages in south and central parts in study region on deep soil and irrigation (Fig. 3). Irrigation and fertile soil are major factors for growing sugarcane along the bank of Nira river and these villages are lying in east, central and south parts in study region on deep soil and Nira left canal irrigation in Baramati tahsil. Bajara is identified as monoculture occupying only 12.13 percent area in the study region, it is occurred in northwest and northeast part of coarse shallow soils. Nepatvalan village is identified as monoculture in wheat crop in study region. Nepatvalan is located on fertile soil **(See, Fig. 3).**

Table-2: Crop Combination Types and Crops

Crop Combination Types	Crops in Combination	Number of villages	Percent of total village	Area in hectares	Percent to total area
Monoculture	Jowar	46	39.32	47562	45.68
	Bajara	13	11.11	12623	12.13
	Sugarcane	29	24.79	22986	22.08
	Wheat	01	0.85	437	0.42
Two Crop Combination	Sugarcane + Wheat	21	17.95	15401	14.79
	Jawar + Bajara	03	2.56	2955	2.84
	Sugarcane + Fodder Crops	01	0.85	456	0.44
	Sugarcane + Pulses	01	0.85	173	0.17
Three Crop Combination	Sugarcane + Wheat + Fodder Crops	02	1.71	1514	1.45

Source: Author

TWO CROP COMBINATION REGIONS

Six crops, namely, sugarcane, wheat, jowar, bajara, fodder crops and pulses enter into two crop combinations in different villages. Fig. 3 reveals two crop combination twenty-six villages area is south part of the study region. Sugarcane has largest area entering in this combination with bajra, wheat, jowar, foddercrops and pulses. Twenty-one villages in study area have combination of sugarcane with wheat, bajra, jowar and foddercrops located in south and south-east parts in Baramati tahsil on deep black fertile soil. Three villages have found two crop combinations of jowar and bajara lying in west, east and central parts on coarse shallow and medium black soil. Jowar and bajra crop combination appeared in Morgaon, Sonkaswadi and Rui. Sortewadi and Pimplewasti located in south part entered in combination of sugarcane with foddercrops and pulses. These villages are located on the bank of Nira river. Jowar entered with bajara as two crop combination in Morgaon and Rui on coarse shallow soil.

THREE CROP COMBINATION REGIONS

Three crop combinations cover 1514 hectares of area in Baramati tahsil (Fig.3). In this combination following crops have entered i.e. sugarcane, wheat, and fodder crop (Table-2). Kurnewadi and Malad village have found three crop combination where sugarcane combined with wheat and fodder crop lie along the Nira and Karha river in south part in study region. The river Karha flows towards northwest to southeast and it joins Nira river in southeastern part in study area. Malad village located on the bank of Nira river, has found three crop combination of sugarcane, wheat and fodder crops in south part on fertile soil and irrigation facility in the study region.

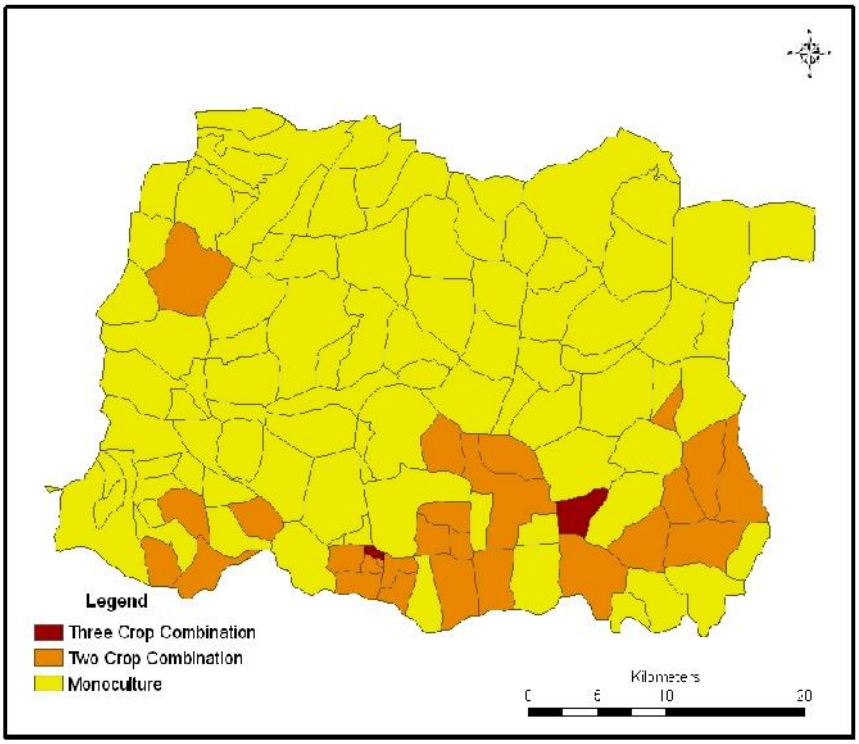

Fig.3 Crop Combination Region

CONCLUSIONS:-

The application of Rafiullah's method shows the realistic picture of crop combination. Three crop combination regions has found in study area. Monoculture is in eighty-nine villages. Jowar, sugarcane, bajara and wheat entered in this combination. Jowar, sugarcane, bajara and wheat as monoculture crops. Jowar is cultivated in fourty-six villages and sugarcane is cultivated in twenty-nine villages in study area. Two-crop combination region has observed in twenty-six villages and three crop combinations have observed two villages. A sugarcane, wheat and fodder crop is grown in this region on irrigation.

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REVIEW CENTRIC RESEARCH ON LEAN MANUFACTURING AND IMPLEMENTATION

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ABSTRACT: The purpose of this article is to review Lean manufacturing strategies and implementation to understand their implications. Based on these findings an attempt will be made to create a novel method of implementing lean principles into a new organization. If a novel method cannot be identified, areas of new research or possible theory building will be highlighted. Lepine's review centric strategies will be utilized to "summarize previously established studies and concepts, pinpoint potential problems (such as factual errors), and inspire new discussions and directions for further research activity (Lepine, 2010)." Lean manufacturing implementation can be seen as dependent on four main factors; Inventory control/reduction, Alignment with organizational goals, Cost allocation, and Management accounting. Lean principles and strategies are rarely effective without some level of control in these four areas. Time is a major limitation to thoroughly completing this task. It would be preferable to have more time to thoroughly delve into the questions and concerns found during this review. In addition Real world testing of the theories explored and developed through article exploration. For example surveys, interviews, and implementation of pilot programs based on theories. The current business climate is rapidly changing and advancing. Methods of continuous improvement are becoming the standard for organizational survival. Organizations that try to implement lean strategies in a hurried non-methodical manner can be as open to poor performance as organizations that don't recognize the need for continuous improvement. This research will hopefully be a first step to helping new comers to lean principles recognize the current state of their organization. This will better enable said new comers to plan a methodical approach to implementing lean principles.

KEYWORDS: Lean, Inventory control, Just in Time, Cost, Alignment, Management Accounting.

1 INTRODUCTION

As a young employee of a world class manufacturing company you are taught the general principles of lean manufacturing and it is implied that these principles are best in class. The purpose of this paper is to objectively review the axiomatic nature of these principles. There is an abundance of peer reviewed literature that examines different aspects of lean manufacturing. For this paper we will look at (Meade, Kumar, & White, 2010), (Bradley & Willett, 2004), (Ohlmann, Fry, & Thomas, 2008), (Hamblin, 2002), (Siggelkow & Rivkin, 2006), and (Brush & Karnani, 1996), all of which were used to determine key factors of implementing lean manufacturing.

1.1 RESEARCH METHOD

The review-centric approach was chosen because "There is great value in research intended primarily to review and summarize the theoretical and empirical knowledge existing in a given literature or content domain, especially when the review is relevant, comprehensive, and coherent as a compelling narrative that partitions and puts in order essential past accomplishments while identifying important challenges and future opportunities. The value of published reviews that accomplish these ends is supported indirectly by citation counts that can be quite remarkable, and also in the Academy of Management's recent decision to publish yearly reviews of advances in research in the Academy of Management Annals. In

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fact, the mission statement of the Annals explains why reviews of this type are important and valuable to scholars: the "Annals summarize previously established studies and concepts, pinpoint potential problems (such as factual errors), and inspire new discussions and directions for further research activity." From this statement it is easy to appreciate that these types of reviews not only provide for synthesis and a convenient repository for existing knowledge in a given area but can also impart the motivation for theoretical research that can advance our understanding of a concept or process relevant to management and organization. Although a review.(Lepine, 2010) p. 507."

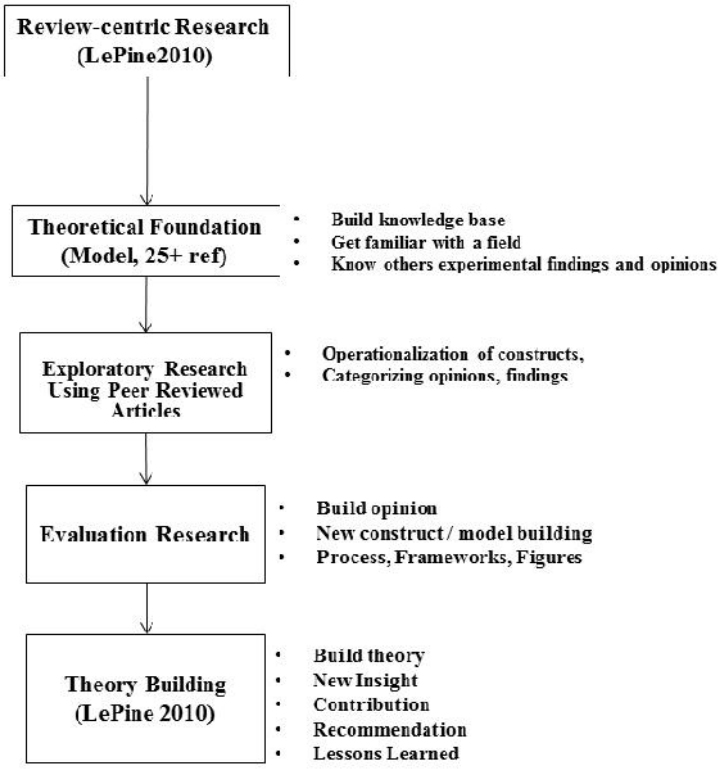

Fig. 1. Review Centric Research model from tcmg495spring14

Fig. 1 shows the process of the review centric research model used.

1.2 WHAT ARE THE FACTORS THAT CONTRIBUTE TO LEAN MANUFACTURING?

Causal Model: Figure 2 shows the relations between Lean manufacturing and its key drives: Inventory Reduction, Alignment, Cost Allocation, and Management accounting. The negative/positive effects will be explored throughout this paper.

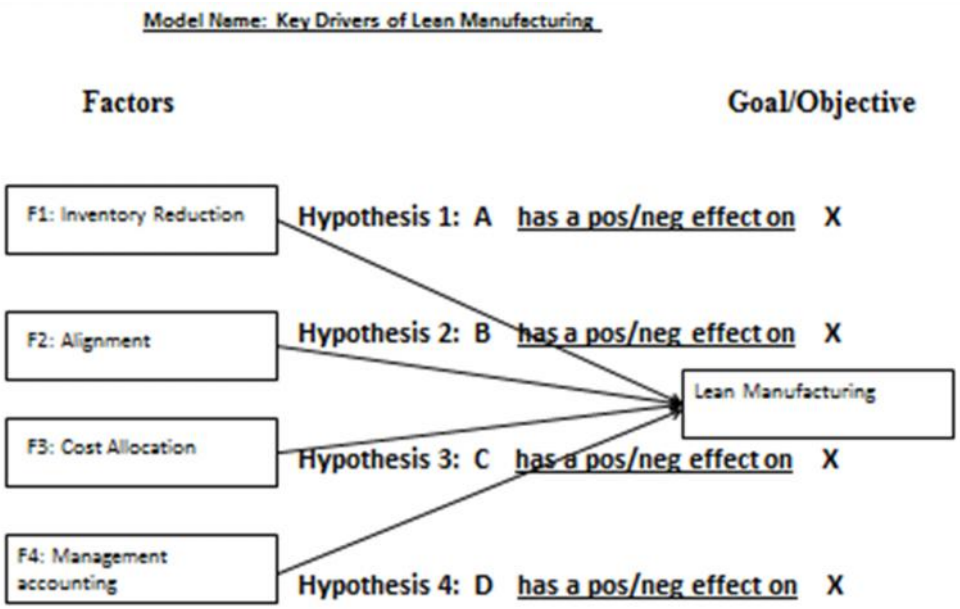

Figure 2: Lean manufacturing Causal Model

2 LEAN MANUFACTURING

2.1 EXAMPLE 1

"Under standard cost accounting systems, reductions in inventories lead to falling reported profits. Rapid reductions in inventories intensify the impact to the bottom line. When a company embarks on an improvement program such as lean manufacturing, a likely result will be an initial drop in reported profits due to the leaning out of inventories [1] p. 858."

2.2 EXAMPLE 2

"In the current economic climate, many companies have lowered prices in response to their customers' demands and competition while incurring higher costs for labor, benefits, and raw materials. The Lord Corporation relies on productivity improvement from its **lean-manufacturing** program to mitigate the resulting squeeze on profit [2] p.123."

2.3 EXAMPLE 3

"In just over 30 years, Toyota has grown from a fledging car manufacturer to a leader in the global auto mobile industry. Much of Toyota's success has been attributed to its efficient manufacturing operations, often called the Toyota Production System or **lean manufacturing**.[3] p. 352."

2.4 EXAMPLE 4

"The priority ranking of the performance measures for manufacturing industry has changed dramatically in twenty years. There has been a move from an emphasis on quality and reliability, to customer perceived value, to 'delighting the customer' and latterly to a total responsiveness to meet variability in customer needs. These changes in external emphasis have been parallelled by changes within organisations which have led to a paradigm of lean manufacturing with the emphasis on eliminating waste, delayered organizations, effective supply chain management, etc. [4] p. 272."

2.5 EXAMPLE 5

"Many organizations face the challenge of searching broadly for new configurations of activities. Broad exploration, spanning numerous individual activities, is particularly important in response to systemic innovations. Consider, for instance, the shift from mass manufacturing to '**lean' manufacturing** (Milgrom & Roberts, 1990). [5] p. 779."

2.6 EXAMPLE 6

"There has been much discussion recently about 'lean' manufacturing (Womack et al. 1990, Peters 1992), which reduces the specialization of supervisory workers, or eliminates the distinction between supervisory and production workers, by giving more responsibility to production workers. [6] p. 1070"

2.7 EXPLORATORY DISCUSSION

Based on the ideas of the above authors, we can infer that Lean Manufacturing is not a simple topic. Meade (2010) says Implementation of lean manufacturing can negatively affect profits[1]. While Bradley & Willet (2004) says lean manufacturing can be used to mitigate profit reduction as a result of lowering prices to meet customer demand [2] . Ohlmann (2008) says that lean manufacturing is given much of the credited for Toyota growing from a fledgling car company into a global automobile industry leader [3]. Hamblin (2002) says the lean manufacturing paradigm emphasis waste elimination and effective supply chain management to increase perceived customer value [4]. Siggelkow & Rivkin (2006) says lean manufacturing can be a result of organizations searching for new configuration of activities or responding to systemic innovations [5]. Brush & Karnani (1996) say lean manufacturing reduces the specialization of supervisory workers by giving more responsibility to production workers [6]. Lean manufacturing is a very versatile tool that can be adapted to a wide range of business needs e.g. adapting to customer demand, increasing customer satisfaction, fostering innovation, and helping a business grow. However, business implementing lean manufacturing should consider that the benefits may not be immediately visible.

I agree that the benefits of lean implementation can be slow to reveal themselves [1]. As such it might be important to have a visionary leader who can develop an implementation strategy to mitigate the perceived negative effects of this new strategy. When a proven manufacturing process approaches maturity, demand and competition usually forces a business to either reduce prices or create some new innovation to justify the cost. I also agree that lean manufacturing can help mitigate the impacts of price reduction [2]. When all the *low hanging fruits* of productivity improvement have been realized lean manufacturing is an efficient mitigation tool. Lean manufacturing has been proven to be a useful tool for expanding a business [3]. Customer satisfaction can be used as a feedback tool with lean manufacturing [4]. Lean manufacturing can help ease the transition into new business configuration or innovations [5]. What I find most important is that lean manufacturing is a powerful way to get employees from all levels of the business involved in productivity improvement [6]. An innovated leader can't accomplish innovative goals without getting employees at all levels to buy in. If done correctly lean manufacturing can accomplish this buy empowering subordinates.

3 INVENTORY REDUCTION

3.1 EXAMPLE 1

"**Inventory reduction** policy refers to the reduction targets for the finished goods inventory over the modelled period of months. A build-to-stock environment with a periodic review of random demand and consistent replenishment lead time is modelled. Reductions were accomplished through a gradual reduction in safety stock targets. Three scenarios were examined in the study [1] p. 860."

3.2 EXAMPLE 2

"While JIT ideas have been enthusiastically embraced by manufacturing practitioners, the small replenishment batch sizes advocated are difficult to reconcile with the standard management science cost trade-off approach. The difficulty is diagnosed as being due to the standard assumption that capital for inventor is borrowed and hence boundless. We present a new analysis of **inventory reduction** decisions, such as adopting JIT replenishment or component substitution, using a detertninistic batch sizing model which assumes that inventory is financed by the investors in the company and is thus finite [7] p. 750."

3.3 EXAMPLE 3

"A firm that deals efficiently with its suppliers will have low raw-materials inventories. A firm that has efficient internal operations will have low work-in-process inventory. From this perspective it appears that firms' inventory holdings in raw materials and work in process seem to have generally improved significantly over time. However, there is no strong empirical evidence regarding the finished goods inventory. Intuitively, a firm that produces based on forecasting may have higher finished-goods inventory in order to have a higher service level (based on the goods availability). But the firm may have its finished-goods **inventory reduced** with better forecasting through better supply chain coordination such as vendor-managed inventory. Neither of these contradictory predictions can be shown to have a dominant effect [8] p. 1016"

3.4 EXAMPLE 4

"The Manitoba Telephone System (MTS) wanted to forecast demand for telephones in order to control the inventory in their phone centers. Although this appears to be a very straight forward problem, data difficulties made it impossible to use most of the common forecasting models. Nevertheless, the use of a very simple forecasting model resulted in an **inventory reduction** of 45 percent [9] p. 95."

3.5 EXAMPLE 5

"In recent decades the automotive industries of Japan and the United States have experienced dramatic transformations. One major development has been the adoption of a set of process innovations commonly known as 'just-in-time' (JIT) manufacturing. Pioneered by Toyota in the late 1950s, JIT methods were widely implemented in Japan starting in the late 1960s, making their way to North America about a decade later (Im and Lee, 1989; Nakamura, Sakakibara and Schroeder, 1994). A central feature of JIT is the ability to operate with minimal levels of inventory. **Inventory reduction** exposes defects in the manufacturing process, forcing managers and workers to eliminate sources of variability and waste (Schonberger, 1982) [10] p. 73"

3.6 EXAMPLE 6

"In recent years manufacturing managers and academic researchers have dramatically changed their view of work-in-process (WIP) inventories. These inventories, held as a buffer between processing steps in manufacturing plants, were once considered essential for maintaining a steady production flow. But the wide acceptance of 'just-in-time' (JIT) production has led to the contrary view that these inventories prevent the discovery of problems on the shop floor and can thus be detrimental to productivity. According to this new perspective, **inventory reductions** expose defects in the manufacturing process, forcing managers and workers to eliminate (rather than accommodate) sources of process variability [11] p. 466"

3.7 EXPLORATORY DISCUSSION

Inventory reduction is an important factor when trying to create a lean manufacturing process. Meade (2010) defines inventory reduction as a policy that reduces targets for the finished goods inventory and utilizes a build-to-stock environment with periodic reviews of demand [1]. The build to stock environment is related to the concept of "Just in time" (JIT) replenishment. Betts & Johnston (2001) propose a novel approach to JIT because JIT ideas have been enthusiastically embraced by manufacturing practitioners, but the small replenishment batch sizes advocated are difficult to reconcile with the standard management science cost trade-off approach [7]. A journal written by Chen (2005) says that inventory reduction is a complex process because intuitively, a firm that produces based on forecasting may have higher finished-goods inventory in order to have a higher service level (based on the goods availability). But the firm may have its finished-goods inventory reduced with better forecasting through better supply chain coordination such as vendor-managed inventory. Neither of these contradictory predictions can be shown to have a dominant effect [8]. R. Cohen (1986) uses simple forecasting methods to achieve significant inventory reduction [9]. Lieberman & Asaba (1997) say that JIT and inventory reduction helped the automotive industries in Japan and the United states experience dramatic transformation and can expose defects in the manufacturing process [10]. Lieberman & Demeester (1999) say that the JIT approach to inventory reduction offers benefits over work-in-process (WIP) inventories because JIT

inventory reductions gives manufacturers the opportunity to expose defects in the manufacturing process, and allows them to eliminate (rather than accommodate) sources of process variability [11]. Inventory reduction is needed to fully

realize lean manufacturing but as stated above, for all its benefits it is not easy to accomplish and should be planned/forecasted carefully.

Inventory reduction aims to reduce finished good stocks and accomplish a build-to-stock raw material inventory [1]. "Just in time" (JIT) inventory replenishment is a strategy that reduces the raw material inventory of a business but can prove troublesome if traditional inventory analysis methods are used [7]. Inventory reduction can cause problems if a business requires higher levels of service but these difficulties can be mitigated with good forecasting and supply chain coordination [8]. Simple forecasting methods are useful when implementing inventory reduction [9]. Worldwide industries have benefited from the implementation of JIT inventory reduction and can be a key tool to identify and eliminate defects in the manufacturing process [10]. Although WIP inventories help the manufacturing process by providing a safety or emergency stocks, you will reduce your ability to expose defects in the manufacturing process [11].

4 ALIGNMENT

4.1 EXAMPLE 1

"It may not be surprising that poor organizational strategies often fail, but research in strategy implementation demonstrates that even good strategies fail during implementation (Bonoma, 1984; Huff and Reger, 1987; Wooldridge and Floyd, 1989). Failure of a new strategy or a strategic innovation is often due to the inability or resistance of **individual employees to commit to a strategy and adopt the necessary behaviors for accomplishment of strategic objectives** (e.g., Heracleous and Barrett, 2001) [12] p. 425"

4.2 EXAMPLE 2

"It has become increasingly clear in the research literature that successful organizations have found ways to ensure that their **organizational missions are aligned both in terms of fit with the external environment and with all factors internal to the organization** [13] p. 54."

4.3 EXAMPLE 3

"A more detailed account of the performance implications of human resources, however, goes beyond their role as a repository of knowledge and routines (Cohen & Bacdayan, 1994; Nelson & Winter 1982) and has to include the degree of **alignment of individual interest with organizational goals** (e.g. Wright, McMahan, & McWil liams, 1994; Wright & Snell, 1991). To the extent that individual members of the organization are motivated to behave in line with organizational goals, the potential advantage derived from the availability of knowledge and skills translates into actual performance[14] p. 418."

4.4 EXAMPLE 4

"This paper explores the nature of interpersonal risk and its propagation. It assumes a different tack from many of the main ideas discussed in the risk management literature which deals with human and financial consequences of risk (Francis and Armstrong, 2003). It is suggested that **how interpersonal risk emerges, evolves and is managed contributes to employee alignment with corporate goals**, and helps to engender a cultural commitment in relation to problem-solving and innovation as a firm-specific capability (Whitley, 2001) [15] p. 31"

4.5 EXAMPLE 5

"In addition to the traditional personnel and human resource management (HRM), there is a need for a new approach to personnel management, which we will call Human Capital Management (HCM). HCM emphasizes an **alignment between the individual and the organization** and in our view offers the challenge and the key to successful management in the future [16] p. 171."

4.6 EXAMPLE 6

"What is missing from the current study is a means by which to demonstrate **how founder- employee alignment might affect results**. If part of the problem in a growing firm is the dilution of owner-intention effects, we would expect this dilution to be less in firms where the employees' intentions and those of the founder are more consistently aligned. In effect, if

employees are hired because of a shared belief about innovation or strategy, or if they gain this orientation through training, socialization or role modeling, the resulting intention level of employees might better reflect those of the founding entrepreneurs, and the dilution effect seen here would be less [17] p. 43"

4.7 EXPLORATORY RESEARCH:

Alignment is how well the company's mission fits the goals of its stakeholders. Gagnon (2008) says both poor and good organizational strategies fail during implementation due to the inability or resistance of individual employees [12]. Crotts (2005) says it's clear in research literature that successful organizations have found ways to ensure that their organizational missions are aligned [13]. Grottschalg & Zollo (2007) says the performance implications of human resources includes the degree of alignment of individual interest with organizational goals, to the extent that individual members of the organization are motivated to behave in line with organizational goals [14]. Amour (2004) says that how interpersonal risk emerges, evolves and is managed contributes to employee alignment with corporate goals, and helps to engender a cultural commitment [15]. Marrewijk & Timmers (2003) says there is a need for a new approach to personnel management, which emphasizes an alignment between the individual and the organization [16]. Kundu & Katz (2003) says part of the problem in a growing firm is the dilution of owner-intention effects and this dilution is expected to be less in firms where the employees' intentions and those of the founder are more consistently aligned. If employees are hired because of a shared belief about innovation or strategy, or if they gain this orientation through training, socialization or role modeling, the intention of employees might better reflect those of the founder [17].

The authors quoted stress the importance of alignment. When implementing business strategies, lean manufacturing or any other strategy, alignment is essential [12]. Successful organizations find ways to ensure alignment when implementing new innovations or strategies [13]. Human resource departments are now being measured by how effectively employees are aligned with the current mission of the business [14]. To aid in alignment it is important to reconcile the personal goals of your employees with the mission of the business in order to foster a culture of commitment to the business [15]. As such manufacturing managers need to adapt their approach to personnel management in an effort to emphasize alignment between employee goals and the mission of the business [16]. When growing or expanding a business alignment is important because dysfunction can result from new employee's that have goals that are not aligned with the firm's leadership [17].

5 COST ALLOCATION

5.1 EXAMPLE 1

"While there is general agreement that incremental fixed costs are relevant for pricing decisions (e.g., Horngren and Foster 1987, p. 304), the question of how such a joint incremental cost should be allocated for pricing has not been answered. Indeed, the prevailing view appears to be that there is no optimal method of allocating the fixed costs-the choice among methods is arbitrary. To our knowledge, our model is the first in which a cost allocation arises endogenously in a firm's pricing (bidding) decision. We show that the firm's optimal implicit cost allocation is tidy in an ex ante sense, but not in an ex post sense [18] p. 1134"

5.2 EXAMPLE 2

"However, managers in both public and private sectors recognize the need for **cost allocation** in product costing, inventory valuation, and in the measurement of the decentralized unit's income. Modem cost accounting innovations have emphasized the need for full cost allocation when advocating activity based costing and management [19] p. 247."

5.3 EXAMPLE 3

"WHILE the topic of **cost allocation** has received a great deal of attention in the accounting literature, most of this attention was confined to guaranteeing the internal efficiency of the firm. In particular, issues related to the minimization of 'agency costs' have been addressed in this context (see Zimmerman [1979] or Magee [1988], as examples). No study has explicitly tied cost allocation to the firm's ability to compete vis-a'-vis other incumbent firms in the market. The reason such a linkage has been overlooked is the belief that overhead costs that are associated with the use of common resources tend to be mostly fixed in nature. As a result, the rule employed in allocating such costs to various departments or products should not affect production or pricing decisions, which are the main determinants of outside market performance [20] p. 387"

5.4 EXAMPLE 4

"If the **costs incurred by the firm are not easily traced to a particular output** (for example, the electric bill for a shared manufacturing plant), the costs must be allocated. The demand for a given output is assumed to be a function of the price. Hence, the cost allocation scheme that is selected will affect both the price and the demand for the output [21] p. 1060"

5.5 EXAMPLE 5

"Since cost allocation has been widely viewed as an arbitrary process, the theory of choice among allocation alternatives is little advanced. This paper illustrates some practical problems that result in the absence of well-established guidelines for choosing among cost allocation alternatives [22] p. 579"

5.6 EXAMPLE 6

"Cost allocation has long been a controversial issue in the economics and accounting literature. While economists and accounting researchers typically recommend marginal cost pricing in allocating firms' resources, firms usually go against the admonitions and persist in allocating costs.' This gap between theory and practice has been greatly reduced by Zimmerman (1979), who observes that control of agency problems and congestion costs can explain the pervasion of cost allocations in practice [23] p. 1264."

5.7 EXPLORATORY RESEARCH:

Cost allocation is one of the ways in which we can actively see the results of lean manufacturing implementation. Cohen (1990) says while there is general agreement that incremental fixed costs are relevant for pricing decisions. The prevailing view appears to be that there is no optimal method of allocating the fixed costs the choice among methods is arbitrary [18]. Balachandran & Ramakrishnan (1996) says managers recognize the need for cost allocation. Modern cost accounting innovations have emphasized the need for full cost allocation when advocating activity based costing and management [19]. Gal-Or (1993) says a great deal of attention is confined to guaranteeing the internal efficiency of issues related to the minimization of 'agency costs' but no study has explicitly tied cost allocation to the firm's ability to compete vis-a'-vis other incumbent firms in the market. The reason this link is overlooked is the belief that overhead costs that are associated with the use of common resources tend to be fixed. Therefore allocating such costs should not affect production or pricing decisions, which are the main determinants of outside market performance [20]. Pavia (1995) says if the costs incurred by the firm are not easily traced to a particular output, the costs must be allocated. The demand for a given output is assumed to be a function of the price. Hence, the cost allocation scheme that is selected will affect both the price and the demand for the output [21]. Verrechia (1982) says because cost allocation has been widely viewed as an arbitrary process, the theory of choice among allocation alternatives is not significantly advanced [22]. Whang (1989) says cost allocation is controversial, even though economists and accounting researchers typically recommend marginal cost pricing in allocating firms' resources, firms usually go against this advice and persist in allocating costs [23].

Although sometimes thought of as "arbitrary" the process of properly allocating cost and regularly monitoring them can help keep track of the "pulse" of your business. Even when there is no optimal method of allocating fixed cost, incremental fixed cost is relevant for making pricing decisions. [18]. Management has recognized the need cost allocation and as a result there is a cost allocation emphasis in accounting innovations. [19]. A lot of effort is geared toward cost minimization but it is not clear how cost allocation explicitly effects how a firm is able to compete with competing or larger firms because it's assumed that overhead is generally the same from firm to firm [20]. Cost allocation via expressing demand for a given output as a function of its price can be a method to account for various cost that are not easily traceable [21]. More advanced theories of choosing cost allocation alternatives need to be developed to combat the view of cost allocation as an arbitrary process [22]. Many economist and accounting professionals view cost allocation as an ill-advised method for allocating a firms resources [23]. Because of the controversy surrounding cost allocation towards the end of the twentieth century, there is a need to objectively examine the cost allocation process using modern tools and methods to conclusively determine the impact (positive or negative) of on the lean manufacturing process.

6 MANAGEMENT ACCOUNTING

6.1 EXAMPLE 1

"THE INCREASING complexities caused by growth in areas served, population, and finances make it imperative that **management accounting** assume an important role in management processes. In this article, some management accounting concepts will be explored, although detailed descriptions of how they work will be avoided [24] p. 692."

6.2 EXAMPLE 2

"While some academic accountants might consider that **after-the-event management evaluation** is something of an intellectual backwater, the ramifications of stewardship affect more than ex post considerations. It is our intention to show that broad stewardship requirements can be seen as a vital subject for ex ante decision making, especially by management. Furthermore, complexities associated with reporting to a firm's interrelated participants can put great strain on the intellectual and physical capacity of the profession [25] p. 544."

6.3 EXAMPLE 3

"PRICE-EARNINGS (P /E) RATIOS play a prominent role in investment analysis, and much attention has been given to exploring their determinants. This article investigates the relation between the **accounting method a firm** uses for reporting purposes and the firm's P/E ratio. In particular, we want to find out if a significant portion of the variability of P/E ratios is associated with differences in accounting methods [26] p. 41"

6.4 EXAMPLE 4

"Soviet accounting is primarily an instrument for control by higher agencies of plan fulfilment: 'This is the objective to which most of its practices and rules have been tailored' (p. 254). Mr. Campbell argues that the emphasis placed on tailoring the system to this function, and also some 'fundamental carelessness' in designing the system, have been jointly responsible for its major inadequacies. The **information supplied to the higher authorities for decision-making purposes** is often misleading, and leads to faulty pricing decisions. And as the information is assembled in categories adapted to the needs of the central planning control, it is unsatisfactory for control of costs within the enterprise [27] p. 483."

6.5 EXAMPLE 5

"If one is to discuss "**Management accounting**" one must know what it is. There is no common agreement so I make free to adopt a working definition, although before I am through I will have changed it. First what do I mean by accounting? Accounting is an activity, a certain kind of data-collection [28] p. 112."

6.6 EXAMPLE 6

"In **management accounting** literature an institutionalist stream is emerging that generates intense discussions and research (Scapens 1994; Burns and Scapens 2000; Duindam and Verstegen 2000). Although the discussion in the discipline of **management accounting** often refers to new institutional economics literature as well as original institutional economics literature, there are fewer references in the opposite direction. In this paper we try to strengthen the connection between **management accounting** and institutional economics. Analyzing the functioning of **management accounting rules** and practices creates an opportunity to substantiate the view of the economy seen as an instituted process. Management accounting practices are one part of the institutional infrastructure that control, coordinate and facilitate

human decision-making [29] p. 1137."

6.7 EXPLORATORY RESEARCH:

Management accounting is another method for keeping track of the health of a business strategy. Sound and refined management accounting can be used to make shareholders and the public aware of the businesses success. Singer (1961) says there is no common agreement on what management accounting is but accounting is an activity, a certain kind of data-collection [28]. Davies (1965) says accounting is primarily an instrument for control by higher agencies of plan fulfilment. The

information [is] supplied to the higher authorities for decision-making purposes [27]. Baker (1971) says complexities caused by growth in area, population, and finances make it imperative that management accounting assume an important role in management processes [24]. Aiken (1975) says academic accountants might consider after-the-event management evaluation an intellectual backwater. Broad stewardship requirements can be seen as a vital subject for ex ante decision making, especially by management [25]. Craig (1987) says much attention has been given to exploring the determinants of price earning ratios. [His] article investigates the relation between the accounting method a firm uses and the firm's P/E ratio [26]. Verstegen (2006) says management accounting practices are one part of the institutional infrastructure that control, coordinate and facilitate human decision-making [29].

There is no official agreement on how to define management accounting is but it is an accounting activity which involves data collection. [28]. It can be primarily an instrument for control by higher agencies of plan fulfilment in which case the information supplied to the higher authorities for decision-making purposes can be manipulated to achieve a specific outcome [27]. However, complexities caused by growth in multiple facets of business highlights how important the management accounting process can be [24]. In some cases management accounting can be a “hindsight” utilizing tool but, to be truly utilized management accounting strategies should be utilized on a broad stewardship level as a vital tool for ex ante decision making by management [25]. The relationship between management accounting and the determinants of price-earning-ratios is still unclear. [26]. Management accounting is important because it can help managers control, coordinate and enable decision-making [29]. Unfortunately, as in the case of Davies review management accounting tools can be abused by subordinates to influence the decision making process of executive leaders in an organization or as a tool to intimidate subordinates. However, with proper oversight and implementation it can be a useful decision making tool when implementing lean manufacturing.

7 EXPLANATION AND DISCUSSION

All of the main factors of lean manufacturing can have a positive effect on lean manufacturing. The different factors need to be used methodically while considering the effects that each factor has on the other. A tempting strategy in management is to “mimic” successful managers. However simple mimicry without good understanding and a methodical approach will not yield consistently positive result. For example if you were to employ JIT strategies without understanding the possible drawbacks, and without aligning the managers and workers in the manufacturing process, you might see cost savings on inventory in the short run. However your manufacturing schedule may suffer negative effects because proper contingencies designed into the new manufacturing process. This indicates poor performance and might negatively affect the motivation of employees that will have low performance ratings because the system is not flexible. Again all factors need to be considered in with respect to each other before implementation.

Strategies based on Cost allocation, alignment, management accounting, and their sub factors are the easiest to implement without adverse reactions. Inventory reduction however can adversely affect lean manufacturing. Strategies like Just in Time part flow for example may not have adequate systems to deal with random occurrences. For example, if a long lead time part fails during the manufacturing process, the JIT strategy may not be flexible enough to acquire a new part in time to meet schedule. If the part is acquired in time, there may be significant cost and quality implications for reducing the designed lead time of the part.

Lean manufacturing is important. “Citing anecdotes from a few firms including Litton, FMC, Westinghouse, Iron Age (1973) prophesied that ‘the big industrial plant may be going the way the big bands went.’ Contrary to that prophecy and other more recent business literature, plant size, on the average, increased from 1972 to 1982. However, the rate of this increase has been decreasing, and the larger plants grew in size at a slower rate than the smaller plants. Additional data from 1980 to 1984 show that the rate of growth slowed dramatically and even turned negative for some large plant size categories [6] p.1078.” Brush says that firms are ultimately getting smaller over time. However demand in manufacturing markets is not decreasing. There are more cars today in the United States than there were thirty years ago despite there being smaller and less car factories in the US. To meet this growing demand while seemingly shrinking in size manufacturers has to employ lean tools to be able to compete. The model generated in this paper can help firms focus on important aspects for successfully implementing these strategies.

7.1 REVISED MODEL OF LEAN MANUFACTURING AND IMPLEMENTATION

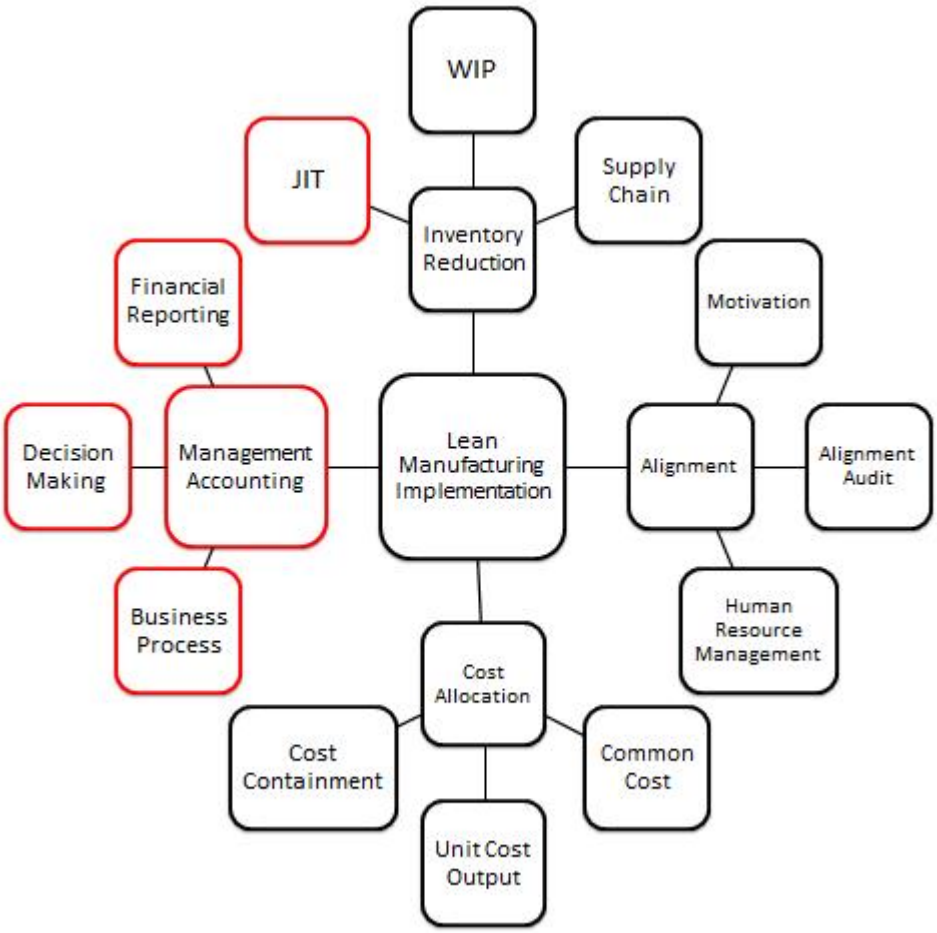

Figure 3: Expanded Model of Lean manufacturing based on research

Figure 3 above shows a revised model of lean manufacturing and its implementation. From the aforementioned references important sub-factors of the four main factors were identified. Factors and sub-factors that have the potential for expanding future research is highlighted in red.

8 CONTRIBUTION AND NEW INSIGHT

Based on the results of this study there are two possible areas of interest for future independent research and or expansion of this article. Regarding management accounting Baker says "To some, these may have sounded familiar, but for others these concepts may represent a new way of thinking about the ac- counting function. Consider what the accounting department is presently doing and what it could be doing. The disciplines and capabilities of the ac- counting department can provide the opportunity to develop powerful tools to aid in managing the utility [24] p.695." I agree with Baker's comment, Management Accounting might be the most important of the 4 main factors discussed in this paper because it can be a method to organize and track the performance of the entire organization and making sure that the other factors are being managed in a way that is well balanced and beneficial to the business. There is also much debate on exactly what constitutes management accounting and what methodologies should be used to implement this accounting practice. Future research should focus on designating an industry standard for management accounting

Regarding inventory reduction Betts says "Uncertainty introduces, as usual, the possibility that maintaining safety stock would increase performance. Since JIT replenishment eliminates uncertainty as well as buffer stock, such policies will be further encouraged at low investment levels due to their ability to liberate capital tied up in safety stock of these components. The situation with component substitution is more complex since while a substitution policy reduces buffer stock it also increases demand for the substituted item which in turn affects the safety stock setting. Additionally,

introduction of demand uncertainty raises the prospect that retaining some cash may be an optimal hedge against business failure, which further complicates the analysis [7] p.761." I am not as comfortable with JIT replenishment as Betts and I think Inventory reduction (JIT) concept of inventory control need to be thoroughly evaluated to help deal with the inherent inflexible aspects of the strategy. Reduction has to be balanced against cost allocation and alignment with employees. To help verify the validity of inventory reduction strategies, there needs to be a way to highlight poor performance that is directly attributed to the complications of inventory reduction. This will make it easy to gradually modify the inventory to better fit the particular manufacturing process; ultimately making your strategy more robust.

9 CONCLUSION

I found that the assumed axiomatic nature of Lean Manufacturing strategies is supported by the literature reviewed, as long as these strategies are implemented in a methodical manner. Four main factors of lean manufacturing were identified and supported by peer reviewed literature. The relationship between lean manufacturing and its factors is not simple. Depending on the implementation and how well each factor is balanced in respect to the other factors will determine the negative or positive effect. For example all three remaining factors will not be consistently successful if an organization's leadership and workers are not adequately aligned with the strategies being implemented. Likewise without good management accounting, it will be hard to keep track of the efficacy of strategies based on the remaining three factors if strategies are being implemented across a large organization. Ensuring that an appropriate balance is kept between the four main factors of lean manufacturing is a key to success.

Future research on this topic would benefit greatly from real world testing of the models presented. An additional item for future research would be evaluation to find a more flexible way of implementing JIT management without spending too much capital on safety stocks.

ACKNOWLEDGMENT

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USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TO PREDICT TEACHERS PRODUCTIVITY

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ABSTRACT: Information and Communication Technology (ICT) is a broad term that includes all technologies for the management and communication of information. The information needed by a good teacher is very crucial to his or her responsibility such that, tools and technologies that would fast track up the documentation, management and information conduct are not only vital but professionally essential. The value of precision, exactness, wholeness, significance and appropriateness are characteristics of information which ICT systems do breed to meet teacher's information needs. Seeing the critical roles of ICT in the humanity, the main objective of this paper is to investigate ICT usage as predictor of teachers' productivity in Schools/Institutions in Kumasi Metropolis of Ghana. The target population for this study was Teachers in both Government and Private Schools/Institutions in Kumasi Metropolis. Twenty Schools/Institutions made up of Junior High schools, Senior High Schools and Tertiary Institutions such as Teacher and Nursing Training Colleges, Polytechnics and Universities thus both private and Government in Kumasi Metropolis of Ghana was used. Cluster sampling was employ to select respondents across all the Institutions in the Kumasi Metropolis. The population was divided into clusters of Teachers and lectures in fifteen Government Institutions, and teachers and lectures from five private Institutions were randomly selected. The findings of this study have discovered that Schools in Kumasi Metropolis are currently making head ways towards participating in the global acceptance and use of ICT. The paper recommends effective human capacity building and user education programs for sustainable use of ICT in Kumasi Metropolis Schools.

KEYWORDS: *ICT, TEACHERS, PREDICT, PRODUCTIVITY, USAGE*.

INTRODUCTION

Information and Communication Technology (ICT) is a broad term that includes all technologies for the management and communication of information. The role of a modern teacher encompasses a high level of documentation and information processing, storage, and retrieval as a good teacher is supposed to keep good records of his or her students. The information needed by a good teacher is very crucial to his or her responsibility such that tools and technologies that would fast track up the documentation, management and information conduct are not only vital but professionally essential. The value of precision, exactness, wholeness, significance and appropriateness are characteristics of information which ICT systems do breed to meet teacher's information needs. The role of teachers in any civilization is indispensable and any developing country that wants to reach higher height in terms of economy must pay particular attention to it education where the teacher must be at the center of the whole process.

McWilliam and Kwamena-Poh (1975) state that it was not until the last quarter of the 19th century that Ghana began to take first steps towards a state-organized education. Before then informal systems of education had been the main way in which Ghanaian communities prepared their members for citizenship. It is interesting to note that in Ghana the first school

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was the home: the teachers were the parents and the elders in the family. The curriculum was life and learning was by observation.

They also stated the first major purpose of such education was the inculcation of good character and good health in the young members of the community. The second was to give them adequate knowledge of their history, beliefs and culture, thus enabling them to participate fully in social life. It could be seen from the foregoing comment that the purpose of non-formal education since the beginning of the Ghanaian society has been for national development.

Frankly speaking, the functions of a teacher is to help students learn by imparting knowledge to them and by setting up a situation in which students can and will learn effectively. But teachers fill a complex set of roles, which vary from one society to another and from one institutional level to another. Some of these duties are performed in the school, and some in the community. Roles in the school or university include: moderator of learning, councilor or controller of student behavior, Parent auxiliary, Friend to students, Reviewer of achievement, Manager of curriculum, Administrator, Scholar and research specialist, and member of Parents Teachers Association (PTA).Duties in the community also include, Community servant, Substitute of middle-class morality, Proficient in some area of knowledge or skills, Public leader and Mediator of social change.

From the above points it can be seen that the services of teachers are needed in almost all human activities and computers in the teacher's office can assists him/her and are useful for the performance of the following functions, to:

- Check and input student's records and ensure rightness and completeness.
- Prepare presentations for class.
- Analyze student's data to know their performance.
- Use for researching.
- For online teaching.
- Use as a medium for teaching instructions.
- Use for communicating with colleagues teachers to share ideas.

According to Pelgrum (2001), obstacles for ICT implementation include the following:

insufficient number of computers, teachers' lack of ICT knowledge/skills, difficult to integrate ICT to instruction, scheduling computer time, insufficient peripherals, not enough copies of software, insufficient teacher time, not enough simultaneous access, not enough supervision staff and lack of technical assistance.

Similarly, Lewis and Smith (2002) summarized these barriers as limited equipment, inadequate skills, minimal support, time constraints and the teacher's own lack of interest or knowledge about computer.

Kwacha (2007) also noted that the most common problems associated with the effective implementation of ICT are lack of qualified ICT personnel, cost of equipment, management attitudes, inconsistent electric power supply, inadequate telephone lines, particularly in rural areas and non-inclusion of ICT programmes in teacher's training curricula and at the basic levels of education.

According to Aina (2004), ICT has become an important field for all information professionals. This is because of its relevance and application to tasks in libraries and information centers. He further explained that the major application of ICT to information professionals is in the areas of networking, online searching, CD-ROM technology, library automation and the Internet.

Odunewu and Olashore (2009) also reported that information and communication technologies have been dominant in information provision, processing and handling. Through the use of internet, a user is able to access through ICT bibliographic and full text information in several millions document descriptors used for describing the documents needed.

For ICT to be noteworthy there must be outcome, yield, productivity or throughput. Throughput/productivity in economic term is described as output per hour. In the manufacturing sector the process of calculating throughput is straight forward while in the service industry it is more difficult to calculate. This is so because; it is difficult to compute exactly how throughput or productivity should be calculated.

For instance, how does one measure the productivity of a teacher? Do we measure the amount of salary he or she receives, the number of topics he cover at the end of each period, the number of hours he can teach or perhaps, the number of passes by his students in his subject during internal or external examination? Usually, productivity is defined as yield per hour worked.

Research suggests that there is wide variation in the productivity of teachers, yet traditional measures of teacher quality (i.e., education, degrees, and certification status) are not strongly associated with student achievement. This would suggest that the measures of teacher quality most commonly used by school districts are missing the mark in identifying highly effective teachers. Hanushek and colleagues (2005) and Ballou and Podgursky (2000), for example, found that uncertified teachers perform, on average, at roughly the same level as certified teachers. Hanushek and Rivkin (2004), Murnane (1975), and Ehrenberg and Brewer (1994) found that earning a master's degree has negligible impact on teacher effectiveness, with some exceptions for subject-specific degrees.

According to Harris et al (2010), Measurement of teacher productivity in both education research and in accountability systems is often based largely on estimates from panel-data models where the individual teacher effects are interpreted as a teacher's contribution to student achievement or teacher value-added. The theoretical underpinning for these analyses is the cumulative achievement model developed by Boardman and Murnane (1979) and Todd and Wolpin (2003). However, the assumptions necessary to derive empirical models from the general structural model are generally unstated and untested.

However, there should be consensus on how teacher's productivity should be measured. The substratum of this paper is the application of ICT which is an input that could improve work productivity of the teacher. This study will therefore endeavor to find out, ICT use as predictor of teachers productivity in Schools in Kumasi Metropolis of Ghana.

OBJECTIVES

Seeing the critical roles of ICT in the humanity, the main objective of this paper is to investigate ICT usage as predictor of teachers' productivity in Schools/Institutions in Kumasi Metropolis of Ghana.

SPECIFIC OBJECTIVES

1. Detect the available of ICT resources in the Education Service of Kumasi Metropolis.
2. Define the extent to which ICT resources are used for Teachers' productivity in Schools/Institutions in Kumasi Metropolis of Ghana.
3. Ascertain areas of ICT use in Schools/Institutions in Kumasi Metropolis of Ghana.
4. Ascertain the problems associated with ICT use in Schools/Institutions in Kumasi Metropolis of Ghana.

METHODOLOGY

The target population for this study was Teachers in both Government and Private Institutions in Schools in Kumasi Metropolis of Ghana. Twenty Institutions made up of Junior High schools, Senior High Schools and Tertiary Institutions such as Teacher Training colleges, Nursing Training , Polytechnics and Universities both private and Government in Kumasi Metropolis of Ghana were used as shown in table 1.

Cluster sampling was employ to select respondents across all the Institutions in the Kumasi Metropolis. The population was divided into clusters of Teachers and lectures in fifteen Government Institutions, and teachers and lectures from five private Institutions were randomly selected. These governments Institutions are; Kumasi High School, Yaa Asantewaah Senior High, Prempeh College, Opoku Ware Senior High, St. Louis Girls Senior High, Kumasi Anglican Senior High, Bantama Adventist Senior High , Kumasi Senior High and Technical School,University of Education Winneba Kumasi Campus, Kumasi Polytechnic, Wesley Teacher Training college,Komfo Anokye Nurses Training, Kumasi Girls Senior High ,State Girls Junior High, and State Experimental Junior High School . The Private Institutions also include; Christain Service University College, Garden City University College, Joy Standard College, Vicandy Junior High and Cambridge Junior High. In each of the selected Institutions, Teachers were purposefully selected based on availability and use of ICT resources in their homes and offices.

Questionnaire was the only process used for data collection for this study. A total of 755 questionnaires were administered to the twenty selected Institutions, out of which 650 were responded and returned, giving a response rate of 86.1%.

Table 1: Schools and Institutions in Kumasi Metropolis of Ashanti-Ghana

S/N	NAME OF SCHOOL/INSTITUTION	NUMBER OF TEACHERS
1	KUMASI HIGH SCHOOL	64
2	YAA ASANTEWAAH GIRLS HIGH SCHOOL	48
3	PREMPEH COLLEGE	30
4	OPOKU WARE SENIOR HIGH SCHOOL	32
5	ST.LOUIS GIRLS SENIOR HIGH SCHOOL	26
6	KUMASI ANGLICAN SENIOR HIGH SCHOOL	30
7	BANTAMA ADVENTIST SENIOR HIGH SCHOOL	16
8	KUMASI SENIOR HIGH/TECHNICAL SCHOOL	20
9	UNIVERSITY OF EDUCATION WINNEBA- KUMASI	60
10	KUMASI POLYTECHNIC	34
11	WESLEY TEACHER TRAINING COLLEGE	62
12	KOMFO ANOKYE NURSES TRAINING	34
13	KUMASI GIRLS SENIOR HIGH SCHOOL	32
14	STATE GIRLS JUNIOR HIGH SCHOOL	14
15	STATE EXPERIMENTAL SCHOOL	12
16	CHRISTAIN SERVICE UNIVERSITY COLLEGE	58
17	GARDEN CITY UNIVERSITY COLLEGE	64
18	JOY STANDARD COLLEGE	10
19	VICANDY JUNIOR HIGH SCHOOL	02
20	CAMBRIDGE JUNIOR HIGH SCHOOL	02
TOTAL		650

RESULTS AND DISCUSSION

The data gathered was analyzed using percentages and frequencies based on a number of variables. These variables include; demographic information about the respondents, availability of ICT equipment and resources, areas of ICT use in teaching/lecturing; regularity of ICT use and level of teachers/lectures' productivity.

Table 2: Age Distribution Variety of Respondents

Age Distribution Variety	Frequency	Percentage
20-30	367	56.46
31-40	184	28.31
41-50	56	8.62
51-60	26	4.0
61-70	13	2.0
71+	4	0.62
TOTAL	650	100

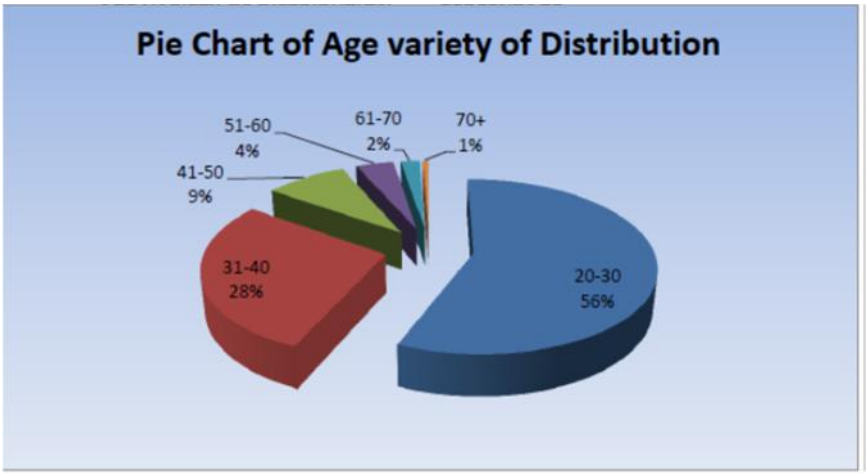

Figure 1 shows the age distribution variety of the respondents.

Table 2 and figure 1 shows the age distribution variety of the respondents. The data shows that 368 (56.46%) of the respondents are between 20-30 age range, 184 (28.31%) are between 31-40 age range, 56 (8.62%) between 41-50 age range, 26 (4.0%) between 51-60 age range, 13(2.0%) of the respondents were 61-70 years and 70 above had a little below 1 %. It can be concluded from the data that the mid age group used more ICT facilities than other groups. This may be due to the fact that their level of responsiveness whereas the older age group respondents rank the smallest.

Table 3: Distribution of Respondents according to where level that they are teaching/lecturing

Level of teaching/lecturing	Frequency	Percentage
Junior High Schools	30	4.62
Senior High Schools	308	47.38
Tertiary Institutions	312	48.0
TOTAL	650	100

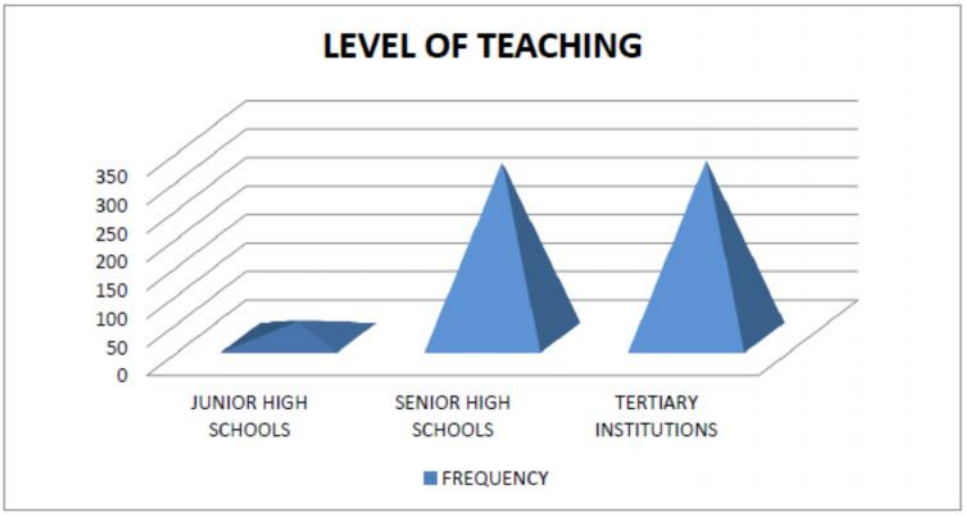

Figure 3 shows the levels of teaching of respondents

The data in table 3 figure 3, shows that 30(4.62%) of the respondents teach at the junior High school level , 308 (47.38%) teaches at the Senior High School whiles majority lecture at the tertiary level with a frequency of 312 and 48.0

Table 4: Educational Qualifications of Respondents

Educational Qualifications	Frequency	Percentage
Teachers Certificate A	144	22.15
Bachelor's Degree	478	73.54
Master's Degree	23	3.54
PhD upwards	5	0.77

The data in table 4 shows that only a small number of the respondents 5(0.77%) possessed PhD and above and all of them were lecturers at the tertiary level, 144 (22.15%) has teachers certificate A and all of them were also teaching in the Junior High schools, majority of the respondents possess a bachelor degree and also teaches at the Senior High School. Those with master's degree were 23(3.54%) and they teach in either Senior High or tertiary institution.

Table 5: Availability of ICT resources

S/N	ICT Resources	Available %	Very Readily Available%	Readily Available%	Not Available%
1	Telephones (Land lines, mobile phones and intercoms	1	95	4	-
2	Desktop PC	11	55	24	10
3	Laptop PC	20	30	20	30
4	Photocopier	25	7	10	58
5	Internet (e- mail)	15	70	20	5
6	Teaching notes on CD	5	5	10	80
7	Scanner	2	3	5	90
8	Tele-fax	2	2	1	95
9	Students Records on CD	15	10	5	75
10	Online Access to Research works.	15	70	20	5
11	Education Journals on CD	5	6	5	84
12	E-learning facility	4	1	10	85
13	Online Teaching Tutorials	2	5	3	90
14	Ipad/Tablet	5	45	10	40

Table 5 shows the availability of ICT resources, in the following categories. Telephones, (landlines, mobile and Intercoms) 100% rate of availability. It shows the highest rate of availability. This study concluded that every teacher/lecturer had access and used telephones both for teaching and private matters. Next on the list of ranking is internet (email) and Online Access to research works. It can be concluded that all those with internet access can also access the online research works with 95%. Other ICT resources with high availability ranking are; Desktop PC 80%, laptop PC with 70% available, the Ipad/Tablet with 60% available and with 40% not available. Whereas, the following ICT resources indicated high rate of non-availability; Tele-fax, teaching notes on CD, Scanner, Online Teaching Tutorials, E-learning facility, Students Records on CD, and Photocopier.

Table 6 Areas of ICT Use

S/N	Areas of Teaching	Yes%	No%
1	Recording students Marks	555(85.38)	95(14.62)
2	Giving Lectures/Lessons teaching	460(70.77)	190(29.23)
3	Administration	550(84.62)	100(15.38)
4	Counseling	374(57.54)	276(42.46)
5	Presentation Making	620(95.38)	30(4.62)
6	Supervision	600(92.31)	50(7.69)
7	Others	624(96.0)	26(4.0)

Table 7: Extent of ICT use

S/N	ICT Resources	LOW USAGE %	HIGLY USAGE %
1	Telephones (Land lines, mobile phones and intercoms	2	98
2	Desktop PC	20	80
3	Laptop PC	35	65
4	Photocopier	34	66
5	Internet (e- mail)	4	96
6	Teaching notes on CD	80	20
7	Scanner	85	15
8	Tele-fax	98	2
9	Students Records on CD	22	78
10	Online Access to Research works.	30	70
11	Education Journals on CD	45	55
12	E-learning facility	90	10
13	Online Teaching Tutorials	99	1
14	Ipad/Tablet	55	45

Table 7 provides information on the extent of ICT use in the teaching service. The result shows that the following ICT resources were highly used; telephones (mobiles, land line and intercoms) photocopier, Desktop PC, the Internet and laptop (PC), Students records on CD, Online Access to research works. Telephones with 98% crowned the list followed by internet with 96%.Whereas the following were lowly used; lpad/Tablet, Education Journals on CD, Tele-fax, Scanner, Teaching notes on CD. Tele-fax was ranked the least lowly used ICT resource with 1%.

Table 8: Perceived Productivity of Teachers

S/N	Perceived Productivity of Teachers	YES %	NO %
1	It leads to faster and speedier recording of student's marks.	89	11
2	It leads to faster preparation of teaching notes.	92	8
3	It makes teaching interesting.	90	10
4	It makes communication between colleagues easy.	88	12
5	It makes researching easy.	83	17
6	It makes lesson delivery simple.	77	23
7	It reduces cost of distance learning.	78	22
8	It makes tracking of students performance easy	67	33
9	It makes retrieving of information easier.	95	5

Table 8 shows the perceived productivity of teachers using ICT resources from the list of items. From the list of items, respondents were asked to say "Yes" or "No". The result showed that 89% agreed that the use of ICT resource leads to "faster and speedier recording of student's marks'. 92% also supported the argument that 'It leads to faster preparation of teaching notes, 95% also agreed that "it makes retrieving of information easier. Generally, almost t all the respondents agreed to a higher percentage to all the listed perceived productivity of teachers with the "Yes" higher than the "No".

Table 9: Problems Connected with ICT usage.

S/N	Problems with ICT usage	YES %	NO%
1	Inadequate funding	89	11
2	Poor Internet connectivity	98	2
3	Poor maintenance culture	85	15
4	Hardware/software problem	80	20
5	Poor knowledge of computer usage	97	3
6	Unstable government policies	89	11
7	Lack stable power supply	99	1

Table 9 shows the problems associated with ICT use. Majority of 99% of the respondents indicated 'Yes' for Lack stable power supply as the major problem hindering ICT use, while fewer respondents 1% indicated 'No'. The respondents agreed with other problems by indicating 'Yes' but with high rating 'No'.

CONCLUSION AND RECOMMENDATIONS

The significance of ICT implementation and use in the various schools and Institutions for active, efficient and good teaching practice, in Kumasi Metropolis of Ghana need not to be over-emphasized. The teaching profession in Ghana is a challenging one and quick access to and retrieval of appropriate teaching methods and notes by teachers, lectures, researchers etc. in the emerging digital era requires effective implementation and use of ICT in Schools/Institutions. The findings of this study have discovered that Schools/Institutions in Kumasi Metropolis are currently making head ways towards participating in the global acceptance and use of ICT. The paper recommends effective human capacity building and user education programs for sustainable use of ICT in Kumasi Metropolis Schools. Besides, Stake holders, and NGOs in Kumasi Metropolis should increase their level of funding towards enhanced participation in the ICT incorporation. The Government should provide enabling environment such as efficient and stable power supply in addition to relevant ICT policies to include lower tariff on all imported ICT equipment, accessories to boost ICT implementation and use in Ghana.

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Exploring Factors Influencing Nurse's Intention to Use a Technology-Mediated Training System

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ABSTRACT: This study proposes a conceptual model that investigates the factors affecting nurses' behavioral intention to use a Blended E-Learning System (BELS). We integrated motivation, the Theory of Planned Behavior (TPB), and the Technology Acceptance Model (TAM) to create a theoretical model to explain and predict the intentions of learners to use BELS. Additionally, in the research model, motivation is proposed as a formative second-order construct driven by intrinsic motivation. Self-reporting questionnaires were distributed to local community hospitals, regional hospitals, and medical centers in Taiwan. Among the 589 distributed questionnaires, we received 528 valid responses, yielding a response rate of 89.64%. Using structural equation modeling (SEM), the results indicated that perceived usefulness, attitude, and subjective norms influence behavioral intentions toward BELS. Perceived ease of use, perceived usefulness, and motivation considerably affect attitudes related to use. The present study demonstrated that the two antecedents, intrinsic and extrinsic of motivation, are crucial components of motivation. This study concludes with a discussion on the limitations of the study, and its implications in further research and practice.

KEYWORDS: Blended e-learning system (BELS), formative model, motivation.

1 INTRODUCTION

With the development of the Internet and information technology, numerous educational and training institutions, universities, enterprises, and hospitals are investing substantial amounts in developing e-learning courses [1]. Although the advantages of e-learning for individual learning or cooperative learning include usage flexibility, no space limitations, and increased convenience and efficiency [3]. Conversely, there are also some disadvantages, such as lack of communication and interaction between peers, expensive multimedia materials, system maintenance and update costs [2], [3]. In response to learners' concerns regarding e-learning and the challenges that various learning methods generate, educational workers regard using a blended e-learning system (BELS) as effective alternative teaching method [4].

In recent years, several universities have adopted BELS as on-campus e-learning platforms [3], [5], [6]. Using this platform, several learning methods are integrated, including face-to-face learning in class, simultaneous e-learning, and indirect e-learning. Not only can learners experience face-to-face learning but also use online learning materials. Learners can use functions in the BELS for mutual cooperative learning. However, learners consistently use BELS that will influence the behavioral intentions of use. Njenga and Fourie [7] claimed that e-learning platforms can promote the construction of cooperative learning and relationship establishment. Lin and Wang [6] noted that e-learning platforms can assist learners in collecting, constructing, and sharing knowledge. Wu et al. [2] asserted that to facilitate the efficient use of BELS, individual psychological factors (i.e., individual motivations, attitudes, and levels of use of information technology (IT)) and technical factors (i.e., course designs) should be considered and the influences that these factors exert on behavioral intentions should be investigated. Therefore, this study investigated how the innovation of IT affects learners' BELS behavioral intentions from the perspective of learners' psychological factors (individual motivation to and attitude toward using IT).

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This study integrated motivation, the Theory of Planned Behavior (TPB), and the Technology Acceptance Model (TAM) to develop a new model and explain learners' intention of use for BELS. The following reasons explain why these theories were integrated: The behavioral intention of users who adopt IT is influenced by individual subjective norms [8]. In addition, learners might exhibit usage behavior toward new technology but lack the necessary skills to use it, such as perceived behavioral control (PBC) [9]. TPB can be used to eliminate the aforementioned differences and apply the influences of individual and organizational systems to explain the adoption of new technology. Although behavioral intentions are influenced by individuals, organizational systems, and societies, the influence that attitude beliefs exert on the attitudes of learners who use e-learning has not been investigated in the TPB [10]. Taylor and Todd [11] observed that the TAM provides two attitude beliefs: perceived ease of use and perceived usefulness, which are crucial antecedent variables that affect attitudes in the TAM. In addition, the new learning environments and techniques provided by BELS are typically voluntarily used by learners. However, medical personnel's individual learning motivation also influences BELS usage.

The BELS investigated in this study was integrated with face-to-face teaching and online teaching. Learners can study teaching material and obtain relevant course information such as course assignments and other discussion questions. Numerous studies relevant to information system usage models have been conducted; however, these studies have not included a fixed model standard and a defined usage environment. Verifying and comparing the behavior patterns adopted in previous related studies to identify the optimal models for BELS learning environments can determine the causal relationship between learners and BELS behavioral intentions and decrease predicted costs and risks. Although BELS usage has been investigated in previous studies [2], [6], motivation, the TPB, and the TAM have not been combined. Therefore, this study integrated these three concepts to explain the BELS behavioral intentions of nurses and empirically evaluate crucial factors affecting behavioral intentions. The results of this study furthered studies on learners and BELS. In addition, structural equation modeling (SEM) was used to construct the BELS behavioral intention relationship model for nurses and verify whether the model is suitable for application in e-learning among nurses.

The remainder of the paper is organized as follows: Section 2 reviews the theoretical foundations of motivation, the TAM, and the TPB. Based on a critical review of the literature, we propose a theoretical framework and research hypotheses for nurses. Section 3 specifies the research design used in this study, and explains the scale source, sample frame, measurement instrument, data, and data processing used in detail. Section 4 provides the data analysis and results of SEM. Finally, in Section 5, the implications and discussion of the results, the drawn conclusions, limitations of the study and future research directions are presented.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Based on past research, this paper introduces a conceptual framework for further research, illustrated in Fig. 1. The following section provides a discussion on the theoretical bases and development of the hypotheses.

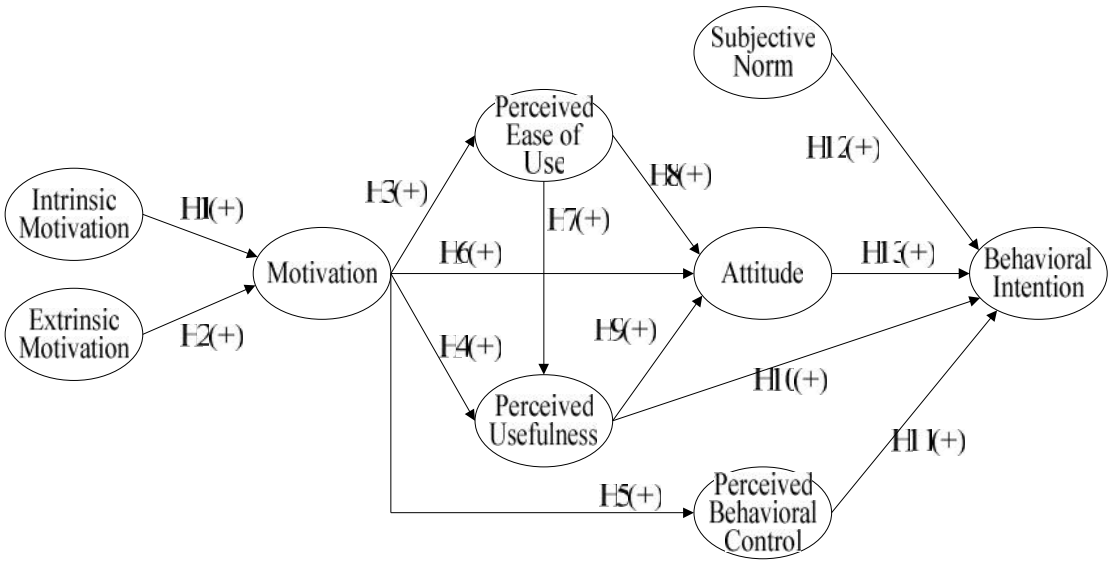

Fig. 1. Research model

2.1 MOTIVATION

Cognitive evaluation theory has been proven to affect personal intention and behaviors [13]. Researchers Senecal, et al. [14] have broadly divided motivation into intrinsic motivation and extrinsic motivation. Deci, et al. [13] and George and Brief [15] indicated that motivation is the key factor in recognizing a person's general or working behavior and it positively influences whether a person continues engaging in certain behavior. The importance of studying motivation is that it facilitates the understanding of how human beings are stimulated and how they maintain or terminate motivations. The study of motivation is a complicated intrinsic property. People can observe the effect of stimulations by using various approaches. A person can be stimulated or motivated by distinct factors depending on the place or context in which the person is located. However, Pierce, et al. [16] argued that extrinsic motivation refers to the involvement of an individual in an activity; for example, a person accesses new technology because of their own interest, satisfaction, happiness, preference, or any other emotions, without external pressure or incentives. Deci, et al. [17] considered extrinsic motivation as an individual being motivated by external and tangible things, such as remuneration and rewards, to engage in activities.

When a person is intrinsically [18], [19] or extrinsically [17] stimulated while engaging in a certain activity and the stimulation continues, extrinsic motivation reduces the person's intrinsic motivation [18], [20]. In the study of the motivations of individuals to use technology or computer technology, Davis [21] reported that practicality can be a motivation. In addition, the researcher addressed the significance of intrinsic and extrinsic motivations and noted that when a user becomes more experienced in using a computer training system, during the process of using the system, intrinsic and extrinsic motivations play a role in self-regulation and form new stimulations that encourage the user to adopt new IT. Therefore, Deci, et al. [17] stated that motivations are multidimensional latent variables. Furthermore, intrinsic and extrinsic motivations can be measured separately by using measurement items. To improve the explanatory power of motivations as latent variables in this study, motivation was considered to be a formative indicator, and intrinsic and extrinsic motivations were considered as reflective indicators. Therefore, six hypotheses are proposed:

- H1: Intrinsic motivation positively affects the motivation for BELS.
- H2: Extrinsic motivation positively affects the motivation for BELS.
- H3: Motivation positively affects the perceived ease of use for BELS.
- H4: Motivation positively affects the perceived usefulness for BELS.
- H5: Motivation positively affects the PBC for BELS.
- H6: Motivation positively affects the attitude toward using BELS.

2.2 TECHNOLOGY ACCEPTANCE MODEL (TAM) AND THEORY OF PLANNED BEHAVIOR (TPB)

Davis [21] proposed the TAM, which is an extension of the theory of reasoned action (TRA) [8]; the TAM superiorly explains learners' acceptance behaviors. Both the TPB and TAM were formed based on the TRA [8] and assert that behavioral attitudes and subjective norms affect behavioral intentions, and behavioral intention influences actual behaviors. TPB contains one more element than the TRA does, which is PBC. PBC influences behavioral intentions and actual behaviors [9]. The TAM suggests that perceived ease of use and perceived usefulness are two crucial factors influencing technology acceptance. The TAM has been applied to investigate learners' acceptance of various new technologies, such as e-mail, the Internet, health care, medical education, and e-learning [1], [6], [21], [22], [23].

BELS learners should consider BELS as a practical tool and use it to enhance personal learning efficiency and communication with colleagues, friends, and others. Therefore, BELS learners should regard the system as convenient. In addition, the TAM emphasizes that perceived usefulness directly influences learners' behavioral intentions. Perceived ease of use indirectly influences behavioral intentions through perceived usefulness [21]. In other words, perceived usefulness mediates the influence of perceived ease of use on behavioral intention, and several empirical studies have supported this argument [1], [10], [23], [24]. In summary, the following hypotheses are proposed:

- H7: Perceived ease of use positively affects the perceived usefulness of BELS.
- H8: Perceived ease of use positively affects the attitude toward using BELS.
- H9: Perceived usefulness positively affects the attitude toward using BELS.

In exploring the intention of using information systems, Lee [1] and Wu et al. [23] determined that both the TPB and TAM have acceptable explanatory power. The difference between TPB and TAM is that the TAM is a simplified model, and is used to investigate information systems. The TAM indicates that potential users' attitude toward an information system is

mainly affected by perceived ease of use and perceived usefulness, whereas TPB claims that whether potential users access an information system depends on social variables and the behavior control of users. Lee [1] indicated that although the intention of using e-learning systems is categorized as information system usage, if it is only measured using the TAM, the influence of social pressure would be overlooked. If the intention to use is predicted using only TPB, users' control over e-learning systems would be ignored. In addition, unlike the TAM, TPB is not designed to investigate the use of information systems. Therefore, this study combines the two theories to predict users' intention of using e-learning systems. Thus, four hypotheses are proposed:

- H10: Perceived usefulness positively affects the behavioral intention to use BELS.
- H11: PBC positively affects the behavioral intention to use BELS.
- H12: Subjective norms positively affect the behavioral intention to use BELS.
- H13: Attitude positively affects the behavioral intention to use BELS.

3 METHODOLOGY

3.1 QUESTIONNAIRE DEVELOPMENT

This study involved two main goals. The first was to construct a theoretical model to predict and explain the behavioral intention to use BELS, and conduct an empirical evaluation of the factors that are critical to behavioral intention. The second goal was to test the empirical model. The purpose of this study was to employ motivation, the TAM, and the TPB to investigate their interrelation with the behavioral intention to use BELS.

We used a questionnaire survey comprising two parts to test the proposed theoretical model. The first part contained questions used to measure the constructs included in the research model, whereas the second part contained participant demographic questions. All items were measured using a five-point Likert-type scale, with answer choices ranging from "strongly agree" (5) to "strongly disagree" (1), and most of these items were adapted from the extant literature. To reduce potential ceiling (or floor) effects, we induced monotonous responses to the items that were designed to measure the constructs.

The scale used in this study was developed following the recommendations and the standard psychometric scale development procedures presented by Devellis [25] and Straub et al. [26]. The scale items for motivation (intrinsic motivation and extrinsic motivation) were adapted from Deci, et al. [13], George and Brief [15], and Pierce et al. [16]; the items of perceived ease of use, perceived usefulness, attitude, and behavioral intention were adapted from the TAM scale [1], [21], [24]. In addition, the items used to measure subjective norm and PBC were adapted from the TPB scale [1], [11], [12].

To ensure that the survey questionnaire was concise and understandable, we conducted an in-depth interview and a pilot study. First, the initial questionnaires were administered to five researchers who were experts on e-learning or were interested in IT and information systems. The questionnaire was revised according to their comments and suggestions to make the wording of the items more precise. In addition, the face and content validity of the instrument was verified based on the interview, and the generation of constructs was based on an extensive study of the extant literature in related fields such as e-learning, motivation, the TAM, the TPB, and the adaptation of measurement items that have been validated in previous empirical studies.

Subsequently, we administered the initial questionnaire to 60 subjects comprising nurses who worked in medical institutions and had taken BELS courses. The Cronbach's alpha reliability scores ranged from 0.714 for perceived ease of use to 0.939 for behavioral intention. This result implies that the scales used in this study satisfactorily measured the constructs. Based on the pilot study results, we revised the questionnaire two times. The final survey included 35 items and a series of demographic and self-reported use items.

3.2 SAMPLE

To fulfill the research objectives, we used mail and interview surveys. The research participants were nurses from nine target hospitals (including medical centers, regional hospitals, and district hospitals) in Taiwan who had taken BELS courses. As a preliminary step, we recruited a local contact for each target hospital to administer the questionnaire. We conducted interview surveys in the nursing department of the hospitals that were willing to participate in the study. If the hospitals were unable or unwilling to distribute the surveys, we used mail surveys. All the participants were volunteers.

A total of 589 questionnaires were distributed to nurses who had used e-learning systems. Sixty-one responses that were returned questionnaires with incomplete or invalid answers were eliminated, and 528 valid responses were received. All the valid responses were used for statistical analysis and a valid response rate of 89.64% for the initial sample was achieved. Among the valid responses, 175 responses were gathered from a local community hospital, 305 were collected from regional hospitals, and 48 were obtained from major medical centers. Regarding demographics, the mean age was 33.59 y (standard deviation (SD) = 7.45 y). Regarding the education level of the sample population, 27 (5.1%) had received a degree from a nursing college, 488 (92.4%) had received a college education, and 13 (2.5%) had a master's degree. Regarding the nursing level of the sample population, 221 (41.9%) had a level of N1, 204 (38.6%) had a level of N2, 74 (14.0%) had a level of N3, and 29 (5.5%) had a level of N4.

Table 1. Profiles of Respondents (N=528)

Factor/ Level	N	%
Formal Education		
Nursing College	27	5.1
Faculty degree/ bachelor degree	488	92.4
Master degree or above	13	2.5
Type of Hospital		
Medical centers	48	9.1
Regional hospitals	305	57.8
Local hospitals	175	33.1
Levels of Nursing		
N1	221	41.9
N2	204	38.6
N3	74	14.0
N4	29	5.5

4 RESULTS

The most common SEM techniques used are linear structural relations (LISREL), partial least-squares (PLS), and analysis of moment structures. LISREL is a covariance-based SEM technique that involves the use of a maximum likelihood function to obtain estimators in models. PLS is component based and involves the use of a least-squares estimation procedure. PLS is an increasingly and commonly used method for analyzing the SEM [27], and has several advantages: (1) a small sample; (2) increased prediction ability; (3) a high number of constructs and/or indicators; (4) few demands on residual distributions; (5) and theories are tested at the early stages of development [28], [29]. To verify the hypotheses, we used PLS technology for data analysis. This technique can be used to analyze both a structural model (assessing relationships among theoretical constructs) and a measurement model (assessing the reliability and validity of measures).

4.1 MEASUREMENT VALIDITY

The relationships between the observed variables (i.e., manifest variables or indicators) and the latent variables (i.e., constructs being measured) are specified by the measurement model. The convergent and discriminate construct validity were both provided to verify the construct measures [30]. Convergent validity refers to the consistency that multiple items exhibit in measuring the same construct. Three criteria were used for assessing convergent validity [31], [32], [33]: (1) reliability coefficients (Cronbach's alpha coefficients) should be greater than 0.60; (2) the composite reliability coefficients for each latent construct should be greater than 0.70; and (3) the average variance extracted (AVE) for each latent construct should exceed 0.50.

We assessed internal consistency by using Cronbach's alpha coefficients and the composite reliabilities. The Cronbach's alpha coefficients ranged from 0.772 to 0.940. This high level of internal consistency is shown in the results listed in Table 2, in which all of the values exceed the suggested 0.6 level for scale robustness [33].

Table 2. Construct reliability results

Construct	CR	AVE	Cronbach's α
Intrinsic Motivation	0.926	0.760	0.894
Extrinsic Motivation	0.868	0.686	0.772
Perceived Ease of Use	0.894	0.680	0.844
Perceived Usefulness	0.927	0.719	0.902
Perceived behavioral control	0.871	0.692	0.778
Subjective Norm	0.919	0.654	0.894
Attitude	0.938	0.835	0.901
Behavioral Intention	0.954	0.806	0.940

Composite reliability is a set of latent construct indicators that are consistent in measuring the same construct. Specifically, composite reliability represents the degree of reliability of a set of two or more indicators that are used to measure a construct [33]. The composite reliability coefficients ranged from 0.868 to 0.954 (Table 2). In addition, all of the constructs exhibited a higher composite reliability than the 0.70 benchmark recommended by Fornell and Larcker [31].

We evaluated the convergent and discriminant validity of the model by calculating the AVE for each factor within each model. Convergent validity is established if the shared variance accounts for 0.50 or more of the total variance. Discriminant validity refers to the degree of distinctiveness among the concept measurements. Thus, within the same scale, the correlations among the items should be higher than those of items across various constructs. Discriminant validity is evident if the AVE for each construct is greater than the squared correlation between that construct and any other construct in the model [31]. All the constructs produced AVE values between 0.654 and 0.835 (Table 2), which exceeds the 0.5 benchmark recommended by Fornell and Larcker [31]. Overall, the items demonstrated satisfactory convergent and discriminant validity.

4.2 HYPOTHESIS TESTING

After establishing adequate convergent and discriminant validity, we empirically tested the hypotheses. Table 3 presents the results of the structural model. The PLS analysis results and the standardized coefficients for each hypothesized path in the model and the R-squared for each dependent variable are shown in Fig. 2. All the standardized path coefficients were statistically significant, except the weights of PBC and behavioral intention, excluding H11, which were rejected. Moreover, the R-squared values were used as a goodness-of-fit measure in the PLS analysis [34]. The model explained 70.9% of the variance in nurses' intentions of use e-learning systems, which is indicative of extremely strong explanatory power. Furthermore, perceived ease of use, perceived usefulness, and motivation explain 60.0% of the attitude. Perceived ease of use and motivation explain 52.1% of the perceived usefulness. In addition, motivation explains 29.0% and 29.2% of the perceived ease of use and perceived behavioral control, respectively. The intrinsic motivation and extrinsic motivation explain 100.0% of perceived motivation. The results reveal a high prediction rate in determining user intention. The structural model of this study produced favorable results for motivation, perceived usefulness, attitude and behavioral intention, with 50% explained variance for each construct. However, the perceived ease of use and PBC produced lower but acceptable results, with 29.0% and 29.2%, respectively.

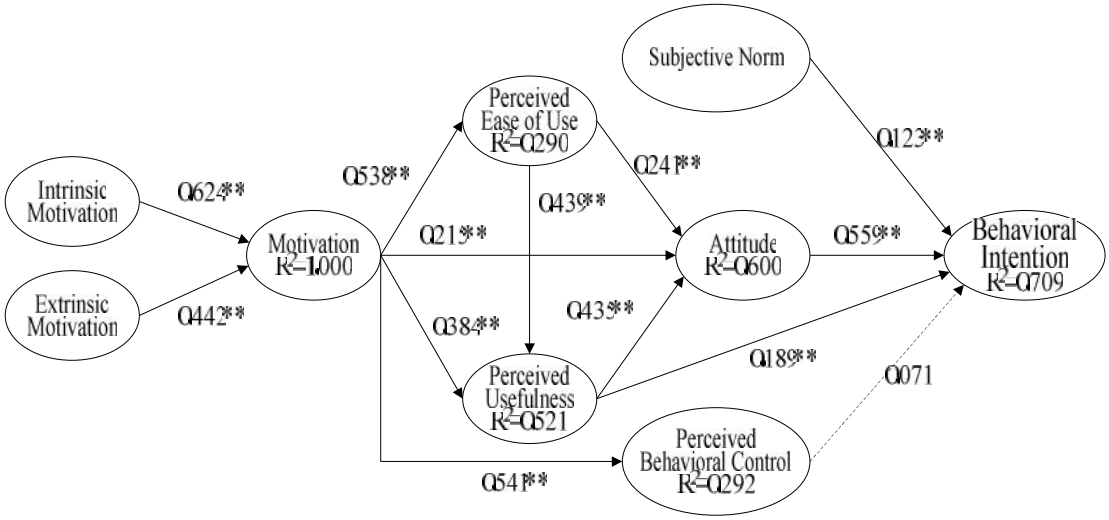

Fig. 2. Structural model results.

Value on path: Standardized coefficients (β), R^2: Coefficient of determination and *p < .05, **p< .01.

The path significance of each hypothesized association in the research model by each path was examined, and Table 3 shows the standardized path coefficients and path significance. All 13 hypothesized associations were strongly significant at p < .01 and supported, except for the relationship between PBC and behavioral intention. The path from intrinsic motivation and extrinsic motivation to motivation (H1 and H2), and the path from motivation to perceived ease of use, perceived usefulness, perceived behavioral control, and attitude (H3, H4, H5, and H6, respectively) were determined to be statistically significant at the p < .01 level. The path from perceived ease of use to perceived usefulness and attitude (H7 and H8), and that from perceived usefulness to attitude and behavioral intention (H9 and H10) were determined to be statistically significant at the p < .01 level. In addition, the paths from subjective norms and attitude to behavioral intention (H12 and H13) were supported at the p < .01 level. However, the path from PBC to behavioral intention was not significant in the model. Therefore, H11 was rejected.

Table 3. Estimation results for Hypotheses 1-13

Hypothesis	Path from/to	Standardized path coefficient	t-value	Test results
Hypothesis 1	Intrinsic motivation→ Motivati	0.624	76.835**	Accepted
Hypothesis 2	Extrinsic motivation→ Motivatic	0.442	49.864**	Accepted
Hypothesis 3	Motivation→ Perceived ease of use	0.538	15.133**	Accepted
Hypothesis 4	Motivation→ Perceived usefulness	0.384	8.225**	Accepted
Hypothesis 5	Motivation→ Perceived behavioral control	0.541	13.557**	Accepted
Hypothesis 6	Motivation→ Attitu	0.215	4.408**	Accepted
Hypothesis 7	Perceived ease of use →Perceived usefulness	0.439	10.284**	Accepted
Hypothesis 8	Perceived ease of use →Attitu	0.241	5.682**	Accepted
Hypothesis 9	Perceived usefulness →Attitu	0.435	8.815**	Accepted
Hypothesis 10	Perceived usefulness →Behavioral Intenti	0.189	3.296**	Accepted
Hypothesis 11	PBC →Behavioral Intenti	0.071	1.636	Rejected
Hypothesis 12	Subjective norm→ Behavioral Intenti	0.123	3.381**	Accepted
Hypothesis 13	Attitude →Behavioral Intenti	0.559	9.340**	Accepted

*p< .05, **p< .01

5 DISCUSSION

In recent years, BELS have become the primary alternative educational system and the interface of this system is mainly applied in e-learning. This study integrated motivation, the TPB, and the TAM and proposed a new framework to investigate the behavioral intentions of nurses toward BELS. We conducted a questionnaire survey, data collection, analysis, and arrangement, and applied the statistical techniques of the SEM to obtain an acceptable overall structural model (Fig. 2). The results indicated that reliability, validity, path coefficients, and explained variance (R^2) all produced favorable effects and increased the confidence of the results. We believe that the testing results can be provided to BELS suppliers as references for adjusting the system and increasing learners' behavioral intentions. The empirical results indicated that in the research model proposed in this study, the overall model explained variances in the following potential dependent variables: behavioral intention (0.709; R^2 = 70.9%), attitude (0.60; R^2 = 60%), PBC (0.292; R^2 = 29.2%), perceived usefulness (0.521; R^2 = 5.21%), and perceived ease of use (0.290; R^2 = 2.90%). These data revealed that the theoretical framework proposed in this study can explain the behavioral intentions of nurses toward BELS.

Previous researchers [19] have stated that learners generate extrinsic motivation when they receive tangible rewards. This motivation typically causes people to set higher goals and increases the ability to continually perform related learning behavior. This ability is a crucial motivational element for people. Regarding the forming of motivational perspective, H1 and H2 were supported, which was consistent with previous related studies, such as Goudas et al. [35] and Pierce et al. [16]. They claimed that after people receive external rewards, positive motivational effects are generated by psychological mechanisms to increase their intention to engage in that behavior. Based on the mechanism design of extrinsic motivation, after hospitals introduced information systems, they provided tangible motivation such as external rewards and incentives to encourage employees; thus, users' continual behavioral intentions were further generated. In addition, Goudas et al. [35] stated that motivation is the basis of learning behaviors and greatly influences learners' subsequent continual learning behaviors. In other words, users' motivation to use the system positively influences people's behavioral intentions toward the system. At the early stage when hospitals introduced the training system, nurses' motivations were easily affected by extrinsic motivations (i.e., the incentive of immediate rewards) and intrinsic motivations. Motivation is a formative indicator of second-order factors and did not involve specific evaluation items. Based on the arguments of Deci, et al. [13], the motivation perspective includes extrinsic and intrinsic motivation, and intrinsic motivation is more essential than extrinsic motivation, possibly because the effects of individual intrinsic motivations were generated by hospital operations that were based on teams and workgroups. In addition, the questionnaire items primarily focused on intrinsic factors, including the emotional factor of employees actively using the system, the convenience of acquiring knowledge, and whether the employees found using the system interesting; thus, intrinsic motivation exhibited a higher level of importance than extrinsic motivation did.

The empirical results indicated that perceived ease of use and perceived usefulness positively influenced attitude. The results were consistent with those of Taylor and Todd [11], who proposed that the two attitude beliefs of perceived ease of use and perceived usefulness are crucial antecedent variables that affect attitude in the TAM. In addition, we defined perceived usefulness as a secondary variable of behavioral intention. Several interesting phenomena were observed when comparing previous studies that have investigated the TAM; for example, perceived usefulness influenced behavioral intention more than attitude did [11], [12], [21]. In this study, attitude influenced behavioral intention more than perceived ease of use did and perceived usefulness did not affect user intention significantly. This result was different from that of previous studies [1], [21]. The reasons for this might be that although the nurses all knew that the BELS can assist them at work and increase their learning efficiency, they could not obtain sufficient rest if they used their own time for educational training after work; therefore, perceived usefulness did not influence behavioral intention significantly. If the nurses considered the BELS as an excellent tool and exhibited superior learning attitudes and intentions, the behavioral intentions toward the BELS were increased. Consequently, nurses' attitudes toward the BELS were a crucial mediating variable that affected the influence of perceived usefulness on behavioral intention.

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