CASSAVA PRODUCTION, PROCESSING AND UTILIZATION IN NIGERIA: A REVIEW

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ABSTRACT

Food is any substance consumed to provide nutritional support for an organism. Food is usually meant for human beings, animals and plants and should contain the essential nutrients such as carbohydrates, fats, proteins, vitamins or minerals. Food substances are digested by an organism and assimilated by the organism's cells to provide energy. However, preservation of food remains a big problem affecting many crops including cassava. This study is aimed at reviewing the level of cassava production, processing and utilization in Nigeria.Cassava (Manihot esculenta crantz) is a starchy tuberous root crop belonging to the family of Euphurbiaceac. After rice, sugarcane, and maize, it is the fourth source of dietary energy in the tropical region and the ninth globally. Nigeria is currently the largest producer of cassava in the world with an annual output of over 34 million tons of tuberous roots.Indeed, it is grown by almost every household in Nigeria. Some of the principal recommended cultivated varieties in Nigeria include; TME419, TMS90257, TMS 91934, TMS81/00110, TMS82/0066. Machines for cassava processing are made to replace the hand-operated method (manual) and to increase output to attain the required demand for food, fiber, and materials. Suitable mechanization and automation are vitally needed to achieve the desired end product which include among others the following: garri, flour, apku, (fufu), dan wake, chips, starch, bread. Cassava performs five main roles: Famine reserve, Rural staple food, Cash crop for urban consumption, Industrial raw materials and Foreign exchange. Constraints in cassava production include a wide range of technical, institutional and socioeconomic factors. These include pests and diseases, agronomic problems, land degradation, shortage of planting materials, food policy changes, access to markets, limited processing options and inefficient/ ineffective extension delivery systems. Cassava is a major source of carbohydrates in human diet. It is widely cultivated and serves as a major source of income in countries like Nigeria, Brazil, India and most West African countries. The tubers of cassava cannot be stored longer after harvest before decaying. Due to this short storage period of the tubers,

cassava tubers are further processed into other forms to enhance its storage and to serve other purposes.

KEYWORDS: *Cassava, Garri, Production, Processing, Utilization*

INTRODUCTION
Background
Food is any substance consumed to provide nutritional support for an organism. It is usually meant for human beings, animals and plants and should contain the essential nutrients such as carbohydrates, fats, proteins, vitamins or minerals. Food substances are digested by an organism and assimilated by the organism's cells to provide energy. However, preservation of food remains a big problem affecting many crops including cassava.

Cassava (*Manihot esculenta crantz*) is a starchy tuberous root crop belonging to the family of Euphurbiaceac (United State Department of Agriculture, 2018). After rice, sugarcane, and maize, it is the fourth source of dietary energy in the tropical region and the ninth globally. It is also the staple food of roughly 800 million people worldwide in the developing countries, cassava is considered as drought, war and famine crop (Burns *et. al.,* 2010). It is commonly grown by low-income and smallholder farmers because of its tolerance to low soil fertilizer, drought and most pest and diseases (Howeler, *et. al.,* 2013). Thus, dependence on this crop will expectedly rise in the coming years with aggravation of climate change.

A major limitation of cassava is its rapid post- harvest physiological deterioration. It should be processed immediately after harvest because it is highly perishable. Deterioration normally starts within 48 to 72 hours after it is taken from the ground (Smith,*et. al.,* 1994). Hence, it is crucial that the tubers are processed as early as possible (Ajao,*et. al.,* 2013). Moreover, processing the cassava decreases the cyanide content which is poisonous. Consequently, this prolongs the products shelf life, reduces post-harvest losses, and prevent contamination of the products which will convert the crop to a safer and more merchantable form (Doydora,*et. al.,* 2017). In rural areas, manual processing of cassava is practical. These traditional ways of grating cassava are done by manually rubbing the peeled tubers against a roughened surface of galvanized mild steel on a wood or metal frame. Manual grating is tedious, time consuming and usually result in injuries to the fingers of the operator. Furthermore, the manual grating of cassava leads to non-uniform quality products. The quality can differ from one operator to another, and even with the same person (Jekayinfa, *et. al.,* 2003).

Cassava Production
Cassava Tuber
Cassava is a woody shrub, perennial plant that belongs to the spurge family (*Euphorbiaceae*). It is extensively cultivated as an annual crop in the tropical and

subtropical regions for its edible starchy tuberous root. Cassava is a primary staple food in the developing world, providing a basic diet for over half a billion people. It is one of the most drought-tolerant crops, capable of growing in marginal soils. The mature tubers can be 5-10cm in diameter and 15-30cm long when harvested 9-12 months after planting. The three layers of cassava tuber as described by (Abdulkadir, 2012) are the following:

i.   **The periderm**: the tubers uttermost layer, the peel (rind).
ii.   **The cortex**: usually about 1.5 to 2.5mm thick and white in colour. This lies below the periderm.
iii.   **The central portion of the tuber**: mostly composed of stored starch, which is white in colour. This makes up the more significant bulk of the cassava tuber.

(1a)   (1b)
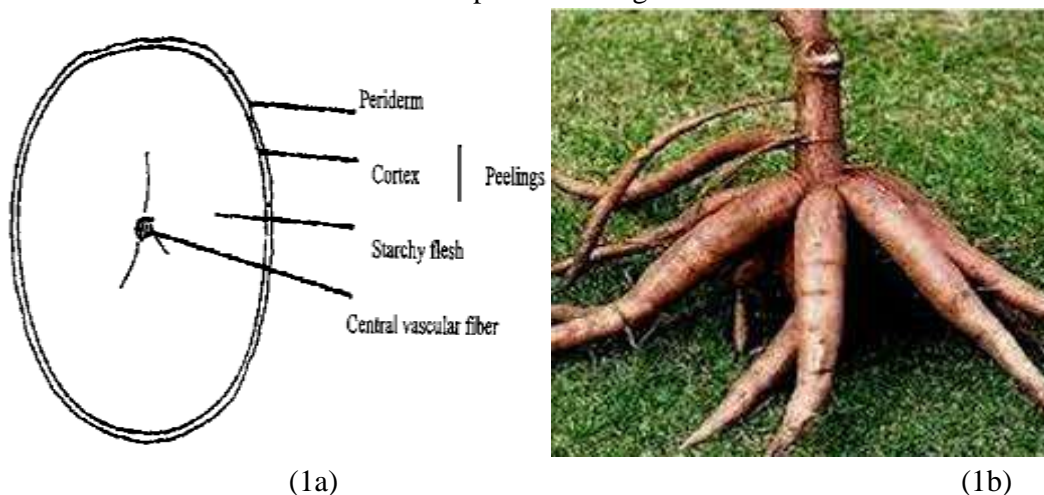
Figure1a: The different layers of cassava.
Plate 1b: Cassava tubers. Source: Anonymous, 2021

According to a study by (Nweke, 2002), cassava is vegetatively propagated through stem cutting and produces well on poor soils. He added that the tubers may be kept in the soil for extended time periods. This features and high crop yield contribute to the importance of cassava in Africa, South East Asia and South America. Also, cassava can be grown on poor soil with little or no investment in irrigation, fertilizer or pesticides.

Schael, (1999), studied the history of the crop and stated that the beginning of interest in the crop in recent time results from the realization of the potential of cassava as a food security and emergence crop which could generate employment for the rural poor and foreign exchange for the country. Since 1990, the government, through the ministry of food and agriculture has demonstrated its determination and commitment to promote cassava for the alleviation of poverty particularly in rural households and communities. He maintained that the main reasons for expansion of cassava production are population growth, famine or seasonal hunger and market availability. In Nigeria, cassava is moving from starvation prevention crop to cash crop for local urban consumption. The top cassava

producers are in order, Nigeria, Brazil, Thailand and Indonesia. The next six countries are all in Africa.

Cassava Production in The World

Nigeria is currently the largest producer of cassava in the world with an annual output of over 34 million tons of tuberous roots. Cassava production has been increasing for the past 20 or more years in area cultivated and in yield per hectare. On average, the harvested land area was over 80 percent higher during 1990–1993 than during 1974–1977.(Federal Ministry of Agricultrue and Natural resources, Department of Agriculture, 2021).

In 2018, global production of cassava root was 278 million tones with Nigeria as the world largest producer, having 21% of the world's total. Other major growers were Thailand and Democratic Republic of Congo (FAOSTAT, 2019). A summary of their major findings is presented in table 2.1 below.

Table 2.1: Cassava production 2018inselected countries

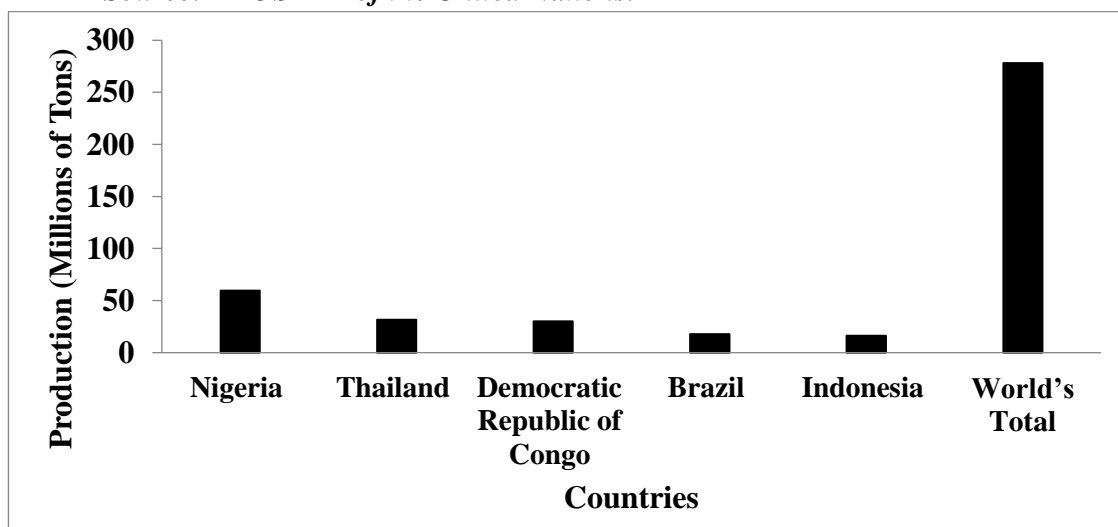| S/No	Country	Production (millions of tons)	Percentage (%)
i.	Nigeria	59.5	21.4
ii.	Thailand	31.7	11.4
iii.	Democratic Republic of Congo	30.0	10.8
iv.	Brazil	17.8	6.4
v.	Indonesia	16.1	5.8
	World's Total	278	100

Source: FAOSTAT of the United Nations.

Figure 2: Cassava Production in 2018 in selected countries

FAO, (2013), reported a steady rise in the production of cassava across the world. From their study, it can be deduced that the production in Nigeria drops from 44 million tons in 2008 to 36 million tons in 2009, there was however an increase in the production in the following year as production rises to about 42 million tons in 2010. In 2011 and 2012, Nigeria's production output was put at about 52 million tons and 54 million tons respectively. This goes to show that Africa has the largest production output in the world as reported by FAO, (2013).

Cassava Production in Nigeria

Prior to the discovery of oil in the 1970s, agriculture was the mainstay of the Nigerian economy, accounting for about two-thirds of the Gross Domestic Product (GDP). With the oil boom, agriculture's contribution to GDP declined to 25 percent by 1980 and Nigeria moved from being a large exporter to a major importer of agricultural products. Since the mid-1980s, as a result of a decline in oil revenue and policy measures implemented under a Structural Adjustment Programme (SAP), agriculture's contribution to GDP has risen to about 40 percent.

In all, over four-fifths of the cultivable land area is suitable for cassava growing (Figure 3)**.**
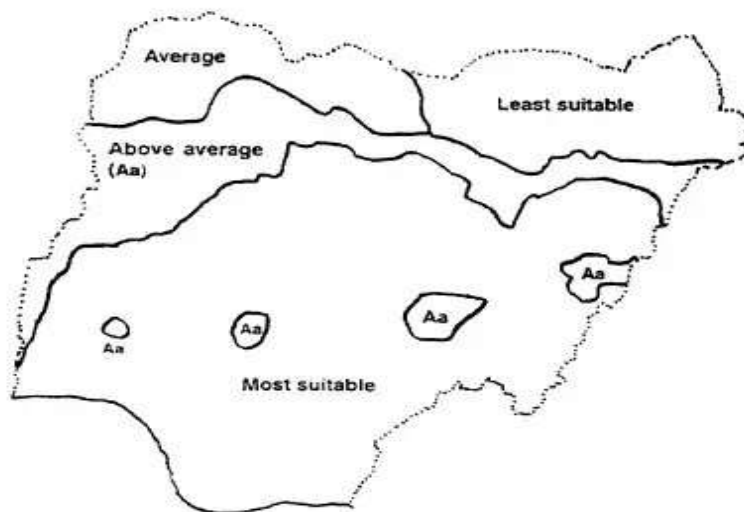

Figure 3. Agro-ecological suitability zones for the cultivation of cassava, based on combined data for soils, mean rainfall, mean temperature, temperature range and the length of growing season in Nigeria. Source: (FMANR, DA, 2021).

2.4 Varieties of Cassava Grown in Nigeria

In a study by FAO (2001), they stated that cassava is classified as either sweet or bitter, like other roots and tubers; both bitter and sweet varieties of cassava contain auto nutritional factors and toxins with the bitter varieties containing much larger amounts.The

major cyanogenic glucosides found in cassava are linamarin and lotaustralin, which can be hydrolysed into hydrogen cyanide (HCN) (Iglesias *et al.*, 2002). Hydrogen cyanide is a toxic compound harmful to human health and could lead to death if consumed in excess (Nhassico *et al.*, 2008; Burns *et al.*, 2012). Bitter cultivars of cassava root have higher level of cyanide content (28 mg HCN/ kg) than the sweet type (8 mg HCN/ kg) dry weight basis (Chiwona Karltun *et al.*, 2004; Charles *et al.*, 2005). Sweet cassava root cultivars with lower cyanide content can be eaten fresh or boiled (Nhassico *et al.*, 2008), while the bitter type with higher cyanide concentration require further processing to eliminate the toxins before consumption (McKey *et al.*, 2010). They must be properly prepared before consumption, as improper preparation of cassava can leave enough residual cyanide to cause acute cyanide intoxication, goiters, and even ataxia or partial paralysis. Cassava is the most favored among all tuber crops and even all food crops (Bamiro, 2007).

Some of the principal recommended cultivated varieties in Nigeria include; TME419, TMS90257, TMS 91934, TMS81/00110, TMS82/00661

Processing of Cassava
Cassava Processing
Machines for cassava processing are made to replace the hand-operated method (manual) and to increase output to attain the required demand for food, fiber, and materials. Suitable mechanization and automation are vitally needed to achieve the desired end product. Some manual methods like peeling, washing, grating, pounding, pulverizing and pressing are successfully mechanized with the help of development and modernization.

Cassava Graters
Grating of cassava means the transformation of cassava tubers into pulp form. Grating of cassava can be done by machine called cassava grating machine of various makes. The cassava grating machine is widely used in the garri and starch processing industries to grate raw materials into garri or starch slurry.

Manual grating
Adejumo, (1994) design and fabricated a wooden grater in which the cassava forced into a hopper is rubbed against the grater which is being electrically powered. Enhance quality of cassava can be grated using this method. However, the durability of the grater is low because of its wooden nature.

Ndaliman, (2006) described a pedal operated cassava grater which is powered by human efforts applied to pedal. The grater pulverizes the cassava tubers into paste which can pass through a wine sieve. The effective performance of the design was at 60%.

Mechanical (Motorized) grater
Darlene, *et. al.,* (2019), reported in their study "Design, Fabrication and Performance Evaluation of Motor-Operated Cassava Grater", that the motor-operated cassava grater

was developed, fabricated and evaluated using locally available and low-cost materials for household-level processing. Peeled cassava tubers were grated at three various grating drum rotational speed determined by using three pulley diameters (5, 6 and 8 in) with an average speed of 1424.30rpm, 1148.30rpm, and 857.40rpm, respectively. The cassava grater was run by 1.5-hp electric motor and its performance was evaluated in terms of grating capacity, grating efficiency, percentage loss and fineness modulus (FM). They analyzed Eachparameter statistically using completely randomized design. The manual grating was also conducted in comparison to the fabricated machine. From the parameters tested, they found out that the 5-in diameter pulley with an average grating capacity of 283.26 kg/hr, grating efficiency of 91.56%, percentage loss of only 8.44% and FM of 3.38 came highly recommended.
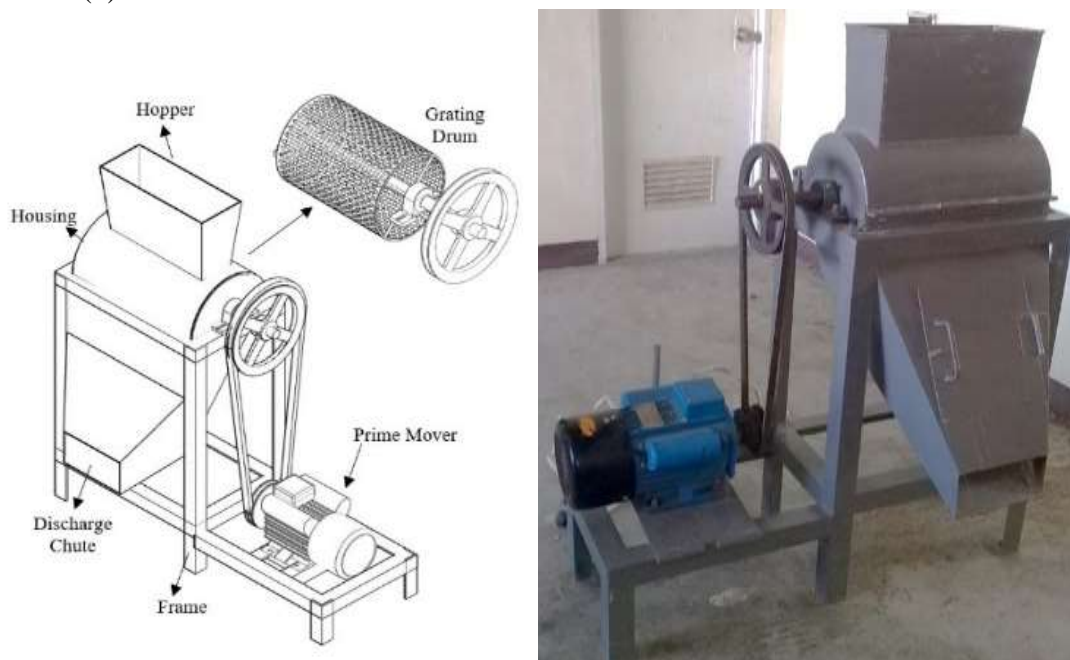
(3)

Figure 4. Perspective CAD image of the cassava grater
Plate 3: Actual view of the motor-operated cassava grater
Source: Darlene, *et. al.,* (2019),

This implies that as the pulley size decreases, the grating time also decreases. This is because smaller pulleys have faster operating speed than larger ones. Moreover, the time for the manual grating is much slower compared to the machine because it depends on the person grating the cassava. The manual grating is a painful and tedious work, as stated by (Opandoh, 2014), manual grating would require 10 to 15 working days to grate a ton of peeled cassava.
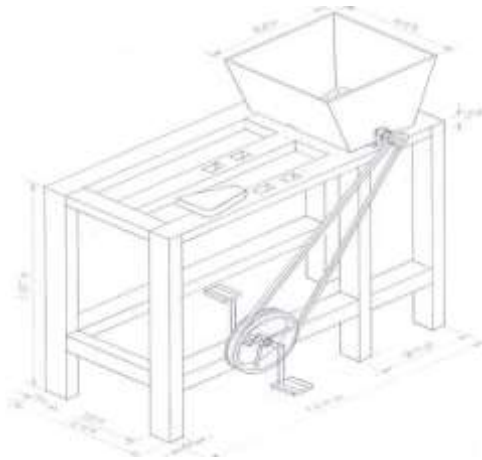
| (5) | (4) |

Figure 5. Isometric view of the cassava grater with dimension in mm
Plate 4. Picture cassava grater with grating chamber opened for visible grating roller
Source: (Yusuf, *et. al.,* 2019).

In a similar study by (Yusuf, *et. al.,* 2019), they researched that a simple manually operated cassava grater can be fabricated using hardwood, galvanized sheet, iron rod, bicycle pedal and bearing. They affirmed that the grater was effective for grating cassava tuber in rural areas where electricity, petrol and other social amenities were lacking. The test carried out shows that the grating efficiency of the cassava grater was 90.91% and the grating capacity was 102.9kg/h. They concluded by recommending that manually operated cassava grater be fabricated for rural women to remove drudgery and alleviate the problems associated with grating cassava tubers in the rural areas.

Plate 5. A Dual - Operational Cassava Grating Machine, Source: (Ndaliman , 2006)

Ndaliman, (2006), described the procedures of tests that were conducted using the machine. He reported that cassava tubers were obtained from a farm and peeled manually, thoroughly washed and weighed using weighing balance scale. The machine was operated for some minutes to allow speed to stabilize. Peeled cassava was introduced into it through the hopper. A piece of wood was used to press the cassava against the drum to prevent scattering of the cassava caused by machine vibration. The pulp was collected into a sac and taking to a press for dewatering. The dewatered pulp was weighed and recorded using the weighing balance scale. The pulp was then sieved. The weight of sieved and unsieved materials was recorded.

He also carried out a performance tests which indicated that high values of grating efficiencies are attainable when powered electrically and manually operated.

He reported that both tests were conducted using 2.0kg of cassava. When manually operated, the grating efficiency was found to be 92.4%. That of electrically operated machine gave the efficiency of 91.95%. These levels of performances according to himis satisfactory.
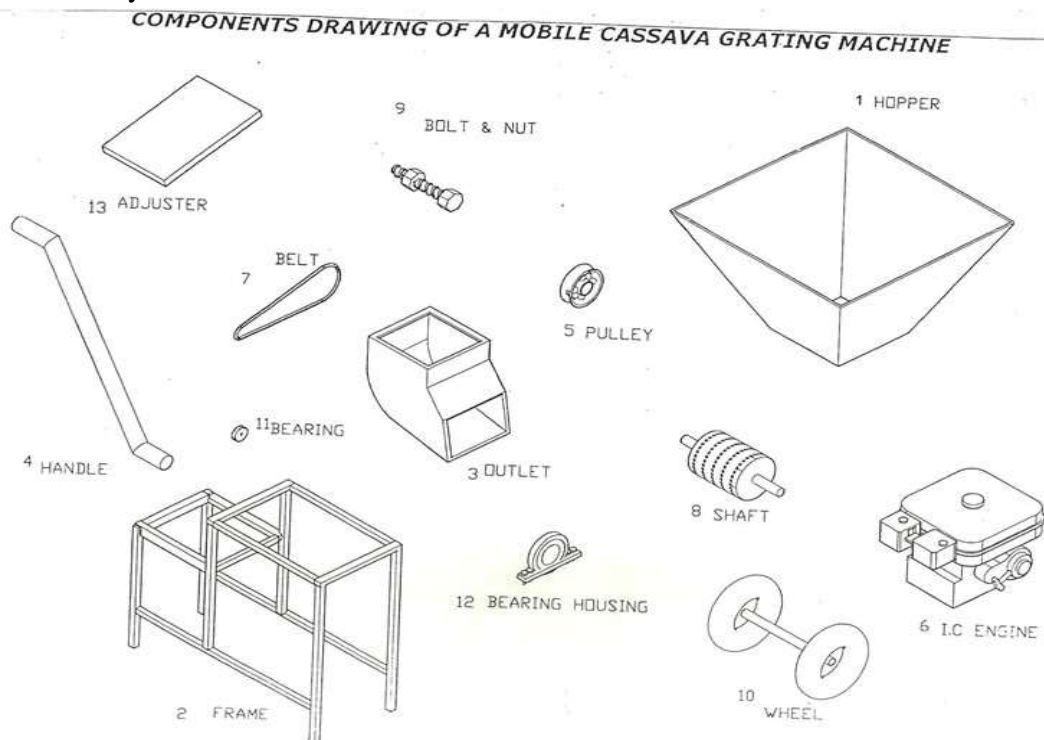

Figure 5. Components drawing of a mobile cassava grating machine. Source: (Aideloje, *et. al.,* 2018)

Aideloje, *et. al.,*(2018) contructed a cassava grater that consists of a hopper unit, the grating drum and the delivery channel; it also consists of tyres for easy mobility. All these components are assembled on a frame made from angle bars. The machine is mechanically powered; the grating drum is also made of metallic cylinder that carries a perforated plate

which served as the grater. The machine cost ₦42,000.00 to produce, with an output capacity of 55.79 kg/hr.

Utilization of Cassava Products
Uses of Cassava

Cassava is a major staple crop in Nigeria as cassava and its product are found in the daily meals of Nigerians. It has five primary industrial products which stand out to be very important for Nigerians, they are native starch, garri, cassava flour, crude ethanol and animal feed (cassava chips pellets) (Onyenwoke and Simonya, 2014). It has many uses in addition to producing nutrition to humans.The leaves can be eaten as a vegetable or cooked as a soup. They can also be dried as hay and given as feed stuff to animals for extra protein. The tubers can be processed into many products as follows:

Fermented cassava products

Fermentation is one method of processing cassava into another food form which not only improve the flavour and taste of the product but extends the shelf-life (FaladeandAkingbala, 2010). Fermentation is one major method employed during processing, which enhances the reduction of the cyanide level and detoxification of the root (Kostinek, *et. al.*, 2005). Some notable products from fermented cassava include:

Flour: the flour can be used to produce most of our local food and even foreign food.

Plate 8: Cassava flour. Source: Anonymous, 2021

These products include among others the following:

Cassava bread

Cassava bread is a fermented product prepared from the combination of wheat flour and cassava flour in the ratio of 5:1 (Shittu, *et. al.*, 2008). This proportion has been observed to give acceptable fresh loaf. Cassava flour is processed into dry flour by drying at temperature of about 50ºC to ensure that flour retains its creamy colour after drying. This process has the ability of improving the use of cassava flour as composite flour in baking industries.

Plate 10: Cassava bread. Source: Anonymous, 2021

4.2.1.2 Cassava fufu

Fufu is an acid-fermented cassava product that is processed through the submerged fermentation of peeled roots in water. Fufu is a common traditional food for the West African countries (OyewoleandSanni, 1995). The softened root is then pounded into wet fufu and the following processes are adopted: steeping the root in water for 2 – 3 days to soften the pulp and there after it is screened, allowed to sediment, dewatered with cloth bags, cooked and finally pounded into *fufu*. The quality of fufu is determined by the texture, aroma and colour (creamywhite or yellowish) depending on the variety used. The quality of fufu is greatly affected by season, the processors and also most especially the variety (Obadina *et al.*, 2009). **Plate 12: Cassava fufu (Akpu). Source: Anonymous, 2021**

Fermented cassava starch

This is a modified starch from fermentation of cassava root. It can be used for frying and baking of cheese bread in some countries such as Brazil (Srinivas, 2007). The process involves steeping already peeled and grated cassava roots in a tank of water for a period of 20 to 70 days to allow fermentation. This steeping process in adequate water helps in separating the starch granules from the fibre and other soluble compound. After fermentation, the obtained starch is dried to produce a powdered product. Although, soaking process is essential, it could cause deterioration of starch and thus reduce its usefulness in the food and pharmaceutical industries (Taiwo, 2006).

Plate 11: Cassava starch. Source: Anonymous, 2021

Garri

Garri is the most commercial and useful product from cassava processing. It is creamy-white, pregelatinized granular and high calorie food with a slightly sour taste (FaladeandAkingbala, 2010). It is processed from fresh cassava roots following very tedious operation of peeling and grating into mash (Fadeyibi, 2012). The grated pulp is put in sacks (Jute or polypropylene) and the sacks are placed under heavy stones or pressed with a hydraulic lack between wooden platforms for 3 - 4 days to dewater the pulp and allow fermentation to take place (FaladeandAkingbala, 2010). This traditional way of processing cassava root into garri is monotonous, timeconsuming, requires more labour and hazardous to health because processors are usually exposed to smoke and heat during frying (Taiwo, 2006).

Garri is regarded as precooked convenient food which can be eaten as a snack and the long period of frying contributes greatly to its longer shelf-life (Fadeyibi, 2012).

Plate 13: Garri. Source: Anonymous, 2021

4.2.6 Chips: cassava chips can be used for animal feed.

Plate 9: Cassava chips. Source: Anonymous, 2021

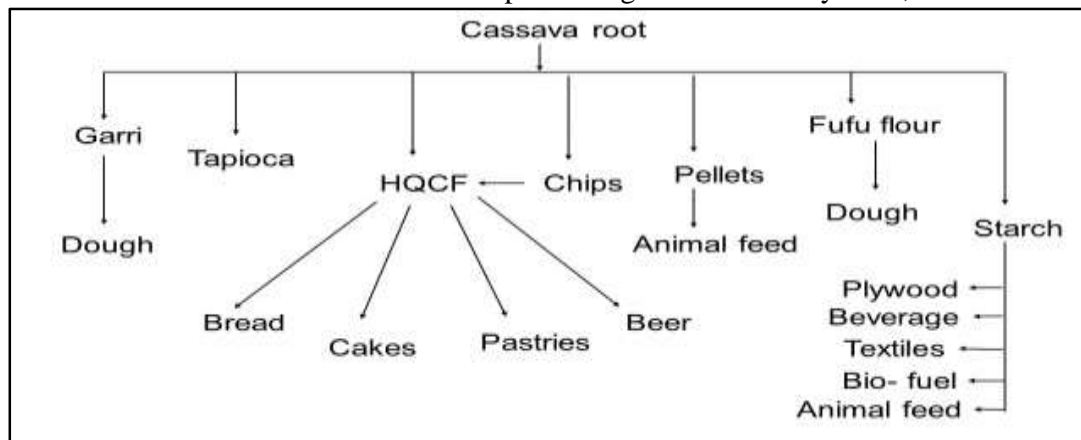Plate 14: Flow chart of Cassava ethanol processing. Source: Anonymous, 2021

Figure 7: Different products derived from minimal processing of cassava root (Montagnac *et. al.*, 2009; FaladeandAkingbala, 2010).

Economic Importance of Cassava Productions
Compared to grains, cassava is more tolerant of low soil fertility and more resistant to drought, pests and diseases. Furthermore, its roots are storable in the ground for months after they mature. These attributes combined with other socioeconomic considerations are therefore what IFAD has recognized in the crop as lending itself to a commodity-based approach to poverty alleviation (FAO/IC, 1995) as reported in (FMANR, DA, 2021).Cassava performs five main roles:
i. Famine reserve
ii. Rural staple food
iii. Cash crop for urban consumption
iv. Industrial raw materials and
v. Foreign exchange

Challenges of Cassava Production in Nigeria
Constraints in cassava production include a wide range of technical, institutional and socioeconomic factors. These include pests and diseases, agronomic problems, land degradation, shortage of planting materials, food policy changes, access to markets,limited processing options and inefficient/ ineffective extension delivery systems.

Pests and diseases
Cassava is plagued by various diseases and insect pests. Pests and diseases including the mealybug (which has been greatly controlled), green spider mite (GSM) and the large grain borer which attacks dry chips of cassava in storage.

In the 1997 season, the various diseases and pest considered to be most important in seven cassavaproducing states were: mosaic disease, bacterial blight, leaf rollers, termites, anthracnose, root rot, mealybugs, spider mites, white flies, rodents and stem girdlers. In different areas of the cassava production zone, one or more pests and/or diseases are important.

White ants (termites) destroy stems that are planted before they sprout. Some areas appear to be very prone to this problem. A higher plant population (12–13 000 plants/ha) is used to compensate for those that would be lost. Various chemical control measures are recommended, but the need for safe use and high costs restricts their use among many small farmers who grow cassava in mixtures. Also, the menace of rodents is a regular occurrence in the field.

Agronomic problems

Biotic constraints

Use of low yielding varieties. The varieties in use by farmers often yield less than 10 tons/ha when there are new varieties that can give root yields of over 30–35 tons/ha. The local varieties are very susceptible to diseases and pests of cassava although consumers and processors still prefer them for specific uses and characteristics. Also, Livestock damage of cassava farms have been widely reported. Thus, the community arrangements to protect farms are made to include as many crops as possible.

Abiotic constraints

Low soil fertility affects many cassava-growing areas because the fallow periods are shorter as the pressure on arable land near homesteads is increasing. At the fresh tuberous root yield of 30 tons/ha (which is feasible under good field practice), the amount of major nutrients removed from the soil at harvest amounts to 164 kg of nitrogen, 31 kg of phosphorus, 200 kg of potassium, 80 kg of calcium and 31 kg of magnesium. Also needed are about 7 kg of a combination of several important microelements, e.g. iron (3.6 kg), manganese (1.4 kg), boron (0.5 kg) and copper (0.2kg) (Asher *et al.,* 1980). Meanwhile, as the direct use of soil amendments in cassava cultivation is low, the yield potentials of the various varieties of the planted cassava crop are not often attained. The use of organic manure could improve soil properties, but this technical fact seems not to be economically feasible under the circumstances of most cassava farmers.

Land degradation

The principal causes of land degradation include soil erosion, deforestation and oil spillage. Erosion is a general problem all over the country, especially in the southeastern zone. Desertification resulting from deforestation is peculiar to central, northeastern and northwestern zones, while oil spillage occurs essentially in the oil-producing zones. Each

of these processes tends to reduce the productive potential of land and to impair the sustainability of soil fertility.

Shortage of planting materials

The cultivars released for cultivation in Nigeria have not all been extended to farmers. Although 17 have been released only about five of them have been made available to farmers. Out of these five, two varieties; TMS 30572 and 4(2)1425, continue to dominate. This seems to be related to the higher availability of the stems from distribution agencies of government and other partners. Many released varieties are yet to be multiplied on a large-scale and made available. Shortage of planting materials is also compounded by farmers' inability to preserve planting materials.

Food policy changes

The dramatic increases in prices of most tradable agricultural exports that accompanied the devaluation of the naira and the liberalization of exports were not applicable to cassava and cassava products to any significant extent because as a non-tradable staple food product, prices were not directly influenced by world market developments.

There is, thus, evidence of a lack of synergy between macroeconomic and sectorial policies; the macroeconomic policies have not been able to secure macroeconomic stability, an external balance or a diversified economic base. Consequently, there is a serious inconsistency giving conflicting signals to the farmers.

Poor access also makes movement of goods and people difficult. This is more so during the rainy season when many parts of the rural area are inaccessible. The roads linking the major towns are usually quite good. Though the farmer market access food network is better in Nigeria than in other countries studied by COSCA (Nweke *et al.,* 1992) the rural feeder road networks are poorly developed and absent in some places. This has significant implications for marketing, cost of inputs, access to health facilities and other social services and may therefore have adverse effects on production and rural standards of living.

Access to markets

Marketing can be a problem for poor farmers who may not have resources to transport their commodities to the market, especially those living in villages with poor feeder roads. Typically, farmers transport their farm produce to the market on heads as head loads, on bicycles or in lorries. With poor market access, marketing of cassava can be particularly problematic because of its bulky nature, especially if it is not processed.

Diversification of processing options

Compared with many countries of Africa, there is a wide range of cassava food products in Nigeria. However, industrial demand for cassava is relatively small, probably less than

5 percent of the total production. There is a potential market for cassava products in animal feed, flour and starch industries, but the size of the industrial, market is small because of an inadequate supply of cassava products, a weak link between industrial processors and producers of cassava products and a preference for imported starch.

Extension delivery system to farmers

There is the defectiveness in the use of contact farmers as recommended by Benor and Baxter (1986). In principle, contact farmers were expected to have multiplier effects on the adjacent farmers. However, there is insufficient formal feedback to the ADPs and limited spread of extension messages outside the contact farmers.

Furthermore, recent economic changes have caused input prices to rise more rapidly than product prices, reducing profit margins for small-scale processors of cassava products. To ensure that increases in yields bring some benefit to the women who are primary processors of cassava, alternate product markets need to be developed. Products that have a potential for improved market outlets include flour, starch and cassava chips for industry. Another fundamental problem with extension strategy is the irrelevant nature of some of the recommendations. Quite often, the technological options offered by extension do not fit into the farming system and the socioeconomic conditions under which the rural people are operating. For instance, a broader range of new varieties that match different ecologies and end-user requirements should be developed and released to farmers.

Conclusion

Cassava is a major source of carbohydrates in human diet. It is widely cultivated and serves as a major source of income in countries like Nigeria, Brazil, India and most West African countries. The tubers of cassava cannot be stored longer after harvest before decaying. Due to this short storage period of the tubers, cassava tubers are further processed into other forms to enhance its storage and to serve other purposes including garri, fufu, chips, bread, *danwake*, just to mention a few. Hence the constructed grating machine has been found to be effective and efficient in the processing and extension of the shelf life of cassava.

Recommendation

Consequent on the findings of this study, the following recommendations are made
i. Proper postharvest technology be researched that will help to store cassava tubers for a long period of time after harvest.
ii. Since the opportunities in world cassava market are high, it is essential that cutting edge scientific methods are invented to achieve optimization and precision in cassava production so that local farmers can directly and indirectly benefit from the growing global cassava market.

iii. Loan facilities should be provided for rural as well as commercial farmers of cassava so that they can expand the production of cassava and also purchase modern equipment's for harvesting, processing and storage of various cassava products.

iv. There should be deliberate efforts to raise awareness on improved yield performance through the agricultural extension services.

vi. Intensive advocacy for research institutes to make improved cassava and disease resistant cassava varieties available and accessible to farmers.

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THE PHYSICIAN NOT THE DISEASE: IMPLICATION OF CLINICAL IATROGENESIS ON HEALTH DELIVERY SYSTEM IN KEFFI, NIGERIA.

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Abstract

Clinical iatrogenesis is seen as an "epidemic" that has bedeviled the modern medical institution that is being practiced in the hospital/clinics. This study was set to find out the implications of this epidemic on health delivery in Keffi. It aimed to find out the factors responsible for persistent occurrence of clinical iatrogenesis in Keffi town, its implications on health delivery and then proffer solutions that will curb its existence for an effective health delivery in Keffi and Nigeria at large. The data used for the study were collected through the administration of questionnaires, focus group discussions and observations made on the sampled population. Data were qualitatively analyzed in simple frequency and percentage table based on the one hundred and ten retrieved questionnaires. Misdiagnosis, illegible handwriting, wrong prescriptions, unnecessary/wrong surgical operations, improper keeping of patient's records, impatience of practitioners, the monopolistic nature of practitioners over patients among other factors were discovered to be the causal factors to clinical iatrogenesis. This has negative implications on health delivery in Keffi. Thus, the government should encourage the training of more medical practitioners, in-house training/seminars/workshops to update practitioners' knowledge on the use of modern tools, development of an effective policy that will ensure that negligent practitioners are appropriately discipline, disclosure of practitioners' negligent acts among others. This will eradicate or reduce the occurrence of clinical iatrogenesis in Nigeria.

Keywords: *Implication, Clinical iatrogenesis, health delivery*

Introduction

Iatrogenesis is composed of two Greek words, "iatros," which means physicians and "genesis," which means origin or causes. The World Health Organization (2021) defines it as "any harmful and unwanted reaction related to the taking of a medication and

occurring incidentally" and then excludes poisoning, errors in prescriptions, overdoses and self-medication.The frustration that has become obvious from the experience of iatrogenesis in both private and public health sectors in Nigeria, has reached an alarming stage that a review in the health sector is now inevitable or self-extinction of citizens will become the alternative. It has now become a norm for somebody to go into the hospital for treatment and come out with more severe infections (Abel & Emmanuel, 2022). The situation is even more difficult as hospital's regulatory authorities seem to be indifferent about patient's safety and quality management in our hospitals and clinics. Modern medicine practitioners ignore preventable hospital infections and serious medical errors. Medical practitioners in Keffi and Nigeria in general, even go as far as denying the public access to valuable information about the rate of unrelated infections while in the hospitals receiving treatment (Abel & Emmanuel, 2022). In and around Nigeria, hospital/clinic infections have led to a substantial number of deaths annually. If hospital information were made public, people would have known the hospitals with a good record of infection management. Medical errors are alarmingly common in hospitals/clinics in Keffi; but very few results are made public, and only when the victims are literate enough and are able to defend their course. If not, the usual story is to give a reason.

Clinical iatrogenesis in health care posed a serious threat to patients' safety, especially in low-income countries like Nigeria where the level and quality of medical service is very poor. In Nigeria for instance available data shows that there is one medical doctor to every six thousand people in the population (WHO, 2021). Knowledge of the occurrence of clinical iatrogenesis in our health sectors (especially the public hospitals/clinics) is inadequate (Abel & Martha, 2022). What people know is based on conjecture as little scholarly research has been conducted and disseminated in the area of clinical iatrogenesis in Nigeria/Keffi.In a more general sense, clinical iatrogenesis comprises of all clinical conditions of which the remedies, physicians, hospital/clinics are the pathogens or the "sickening" agents. The clinical iatrogenesis is the focus of this study. Hence, it is not news again to see patients in the emergency section and even in the in-patient rooms languishing in pains because of delayed medical attention that may be as a result of medical practitioners' non-official engagement.The essence of this study is to find out the root causes of clinicaliatrogenesis, its implications on the lives of Keffi citizens and then, make a concise recommendation that will be relevant in solving the iatrogenic syndrome in health delivery in Keffi. This work will also bring to the notice of the general public, the complications imminent in the negligence in modern medicine; so that patients could be alerted to seek for redress in curbing induced harms by medical practitioners.

The Study Area

This research is carried out in Keffi town. The town was found in 1802 by Fulani cattle rearers called Abdul Zanga who came to Keffi from Katsina. Through invasion, Zanga

and his kinsmen expanded their control over the entire land of Keffi and established it as their territory. Keffi Local Government was later created in 1976 from the former Benue – Plateau State, but presently is one of the oldest local government areas in the present Nasarawa State of Nigeria. The town shares common boundaries with Kokona Local Government in the South. Keffi is the gate way to the nation's capital (Abuja) from the eastern part. The Local Government is headed by a chairman while the custodian of the tradition in Keffi is headed by first class chief or Emir. The people of Keffi are acquainted with three religions which are:Christianity, Islam and Traditional religion. The economy of Keffi is centered on Agriculture while the primary economic activities include farming, rearing of animals and petty trading. Linguistically, the people of Keffi are primarily very fluent in Hausa language while the educated ones also speak English language as a second language

Theoretical Framework

A theory is a set of ideas that provides an explanation to some or a phenomenon (for human society. The development of sociological theory has seen the increasing emphasis on science, not only on college and universities, but in society as a whole, thus, it is necessary that every research is backed up by theoretical perspective; this gives the research work a framework on which the findings can rest.

The counter-productivity of modern medicine has led to the death, maiming and the sickening reality of the medical institution on several occasions. This counter productivity resulted from the combination of several variables such as negligent, carelessness, institutional and intellectual monopoly, greed, poor handwriting, labeling of drugs, death infrastructure, among other variables.

For the purpose of clarity, two theoretical perspectives were used: the symbolic interactionism and the Marxist perspectives- to x-ray the phenomenon at hand. The symbolic interactionist perspective is concerned with examining the interaction between the different role players in the health and illness drama. Their focus is on how illness and the subjective experience of being sick are constructed through the doctor-patient exchange. While the Marxian perspective sees medicine as a major social institution, and in capitalist societies, it is shaped by capitalist interest.

According to the symbolic interactionist perspective, identity is created through interaction with others. Learning to be a social being means learning to be in control over this process by managing the impression others have about us. This creative capacity is apparent when we play the role of patients in our encounter with health-care practitioners. Practitioners also, attempts to create impression of themselves for us.

Most studies have shown that the power element in doctor-patient relationship is significant with doctor-centered interactions being the most common (Bryne& Long,

1976). Stewart &Roter (1989), have constructed a contrasting classification where the patient dominate, exercising a strong paternism over subordinate clients.

The power element in doctor-patient relations is particularly significant when a patient is allowed to enter the hospital. following the classic analysis of the institutionalization of the health institution by Goffman (1968), interactionist research into hospital life focus on the claim that the hospital regime is designed to restrict the opportunity of patients to fashion their identities. Hospital life mirrors life in other total institutions such as prisons, mental hospitals, convents and so on. Patients' power to control their identity is reduced as much as possible as soon as they are ill and admitted in the hospital.

The interactionist perspectives focus on power relations in the construction of health and illness. It brings to light the unequal distribution of resources available to health practitioners and patients in home visits, in the surgery, at the out-patient clinics or hospital wards.

Thus, the patient will never know about the danger of a drug unless another drug to replace it is available. Since it is them (medical practitioners) that has the power to label a patient as ill or not ill. Mendelson (1983), once said "modern medicine would rather you die using its remedies than live without using it. The pediatricians' reckless prescription of powerful drugs indoctrinate children from birth with the philosophy of a drug for every illness. Doctors are directly responsible for hooking millions of people on prescription drugs (Robert, 1983 retrieved). The doctor further observes that almost every stage obstetrical procedure in the hospital is part of the mechanism that enables the doctor to create his own pathology. He said that the vaccine is not in any way safe and are far more dangerous than the disease (Robert, 1983).

Methodology

The survey design method for the collection of data from the sample population is used which entails the gathering of information about a large number of people by collecting from a few of them.For the purpose of scientific deduction, a sample size of 130 respondents were selected cutting across four categories of social actors (such as civil servant, health workers, businessmen/women and students) who have reached 18 years of age, residing in the four selected areas (AngwanLambu, DadinKowa, GRA and Angwan NEPA / Federal Medical Centre region of the town.The quota sampling procedure; a type of non-probability sampling method was adopted. This sampling procedure divides the society into different quotas from which a representative sample is collected. Thus, out of the four quota areas: AngwanLambu has 30, Dadinkowa has 30,GRA has 30 while Angwan NEPA/Federal Medical centre region has 40 representations respectively according to their population size. The primary data were collected using many of the existing techniques like observation, interview, questionnaires and focus group discussion. The questionnaire and focus group discussion were adopted for the collection

of data for this project. Basically the questionnaire schedule was divided into two sections; A and B. Section A consists of personal bio- data of the respondents (age, sex, marital status and their occupation) while section B contains general questions on clinical iatrogenesis, its implications, causes, among others.

Also the concept of clinical iatrogenesis was simplified for easy comprehension in order to get the right information from the respondents. It is referring to harms done by medical practitioners' negligence/carelessness to patients in the "IN" and "OUT" of clinics/hospitals.

Data Analysis and Presentation
Socio-demography characteristics of the respondent
The age range, sex, marital status and occupation of the respondents were analyzed as follows. It indicates that52.73% (58) are male,47.27% (52) females; with 32-38 years representing the largest age range,46.36% (51) of the respondents are married while, 39.09% (43) are single, also most of the respondents are civil servants with 37.37% (41) followed by students and health workers with 30.91% and 22.73% (25) respectively.

Distribution of respondents' views on how often they experience clinical iatrogenesis in Keffi
The above title indicates respondents' awareness of the incidence of clinical Iatrogenesis in Keffi. 33.64% (37) of the respondents often witness or hear about the occurrence of clinical iatrogenesis in hospitals/clinics in Keffi.

Distribution of respondents' knowledge on the carelessness and negligence of other health practitioners' in Keffi
The above title indicates that about 81.18% (97) of the respondents have knowledge of the negligence/carelessness of medical practitioners in hospitals/clinics in Keffi. It is clear that clinical iatrogenesis (harms resulting from Doctors/Nurses and other health practitioners' negligence/carelessness) is a known social problem. It can also be inferred that people submit themselves for treatments in Keffi, not because they were ignorant of this counter-productivity, but because of lack alternative health delivery system, other the glorified hospitals/clinics. It also implies that majority of the respondents are familiar with this "epidemic".

In response to a similar question in the conducted focus group discussion; the respondents opined that clinical iatrogenesis is like a hidden secret in Keffi. That is to say most people are aware of how negligent/careless many practitioners have been and the attendants result of deaths and injury of patients. The patients don't litigate because of poverty and lack of burden of proves demanded for such litigation. One of the respondent quotes, "the reason

hospitals continue in this carelessness is because medical negligence is not disclosed and people don't litigate in Nigeria".

Distribution of respondents' views on the rate of occurrence of clinical iatrogenesis in Keffi

The majority of the respondents which is 31.81% (35), agreed that clinical iatrogenesis is on a very high rate. This means that about 45.45% of the respondents that its occurrence is high. This is in consonants with Illich, (1976) claim that the harm of the modern medicine as practice in the hospital is more than the expected benefits this also agrees with the findings in the journal of America medical association (2000) that postulated that death resulting from the negligence/carelessness of medical practitioners is the third leading cause of death.

This result corresponds with result of focus group discussion to a similar question; where it was agreed that the negligence/carelessness of medical practitioners in Keffi is very high and it is associated with both public and private hospitals/clinics in Keffi; with higher percentage in the public.

Distribution of respondents on people who became handicapped/died as a result of clinical iatrogenesis in Keffi.

The distributions above shows that 51.82% (57) of the respondents have knowledge of people who became handicapped/died as result of clinical iatrogenesis in Keffi. This agrees with the health news publications of January 28, 2004:28 that quoted Oladipo; a hospital administrator as saying that "every year at least half a million hospital patients are either harmed or killed by doctors, nurses and other hospital workers …." This could be one of the reason why there are so many handicaps in Keffi town who turn out to become beggars on the streets.

Distribution of respondents' view on nonchalant attitude of medical practitioners towards patients in Keffi.

The above indicates that50.91 % (56) of the respondents agreed that medical practitioners in Keffi have been very rude to them at the course of interacting or seeking for medical attention. This implies that the doctor-patient relationship is not cordial in Keffi's hospitals; thus, psychologically, patients seeking for health care are destabilized before being attended to.

It was also agreed in the focus group discussion that medical practitioners (especially doctors and nurses) are rude to the patients that they are paid to comfort and cater for.; especially practitioners in the public hospitals in Keffi. At the time of discussions instances abound were doctors and nurses were seen raining abusive words on their patients who struggle to express their feelings (women in labour) or because they have a stigmatized

illness (HIV/Aids patients). One of the nurse respondents said, "sometimes, doctor say they are not on duty or they have closed – even in emergency situation - so sometimes the patients die".

Distribution of respondents' views on the victims of clinical iatrogenesis in Keffi
The distribution shows that 71.82% (79) of the respondents agree that all category of people in Keffi have suffered from the negligence/carelessness of medical practitioners in the hospitals/clinics in Keffi. That is to say it is not only a specific category of people that are victims of clinical iatrogenesis but anybody could be, not minding whether such person is an infant, a youth or an adult. This means that the effects of clinical iatrogenesis does not spare any category of people. However, the categories of people that suffer most are usually children and youths. This is because the children are more vulnerable to epidemics and diseases, while the youths form the larger proportion of the active labour force and thus more associated with accidents and victims of clinical iatrogenesis, since this category of people form the larger proportion of patients.

Distribution of respondents' views on the class of people that are victims of clinical iatrogenesis in Keffi
From the population sample, it shows that 81.82% (90) of the respondents opined that the poor are the main victim of clinical iatrogenesis in Keffi town. This is because the rich have the means to either pay for extra care or go to other city/abroad where they can find a more humane environment for their health needs. From the above table it can be deduced that they rich are given special treatment in the clinic/hospitals in Keffi because of their wealth. This could be seen as the main reason for the creation of private wards for this class of people, so that even their care and treatment is done in a private way as their money can command (Obom-Egbulem, 2009).
Similarly the result of the focus group discussion on the same question was in consensus with the above result. It was agreed that the poor suffer most from the carelessness/negligence of medical practitioners, since most of the rich people because of their social status command more respect and they have what it takes to change from one hospital/clinic to more expensive ones whenever they are treated harshly/ negligently in one.

Distribution of respondents' views on the fact that clinical iatrogenesis leads to the deaths of patients in Keffi daily.
The above heading shows that 32.73(36) of the respondents agreed that clinical iatrogenesis leads to deaths/injuries of patients in hospitals/clinics in Keffi daily. Also another 20 % (22) of the respondents agreed that clinical iatrogenesis is alarmingly on a high rate that leads to the deaths/injuries of patients daily in Keffi. This makes a total of

52.73 % (58) of the respondents that agreed that several deaths in Keffi resulted from clinical iatrogenesis (avoidable harms caused by medical practitioners to patients); (Ruby, 2011:6).

More so, there was a consensus among the health workers who participate in the focus group discussion that at least twelve (12) people's illness were aggravated as a result of negligence/carelessness of medical practitioners, and at least four (4) deaths in a week result from such avoidable mistakes. This is aside deaths from unavoidable mistakes.

Distribution of respondent's views on the major ways that clinical iatrogenesis is perpetrated in Keffi's hospitals/clinics.

The distribution above indicates that 52.73%(58) of the respondents opined that the main ways that clinical iatrogenesis is perpetrated in Keffi's hospitals / clinics are through diagnosis (wrong medical test result), wrong prescription of drugs by partitions, to patients' wrong surgical operation i.e. Surgical operation on the wrong parts of the body or a wrong method of operation and eligible handwriting of medical doctors , that sometimes lead to the dispenser of wrong drugs / injection (Oyebode, 2006), (Manhood Magazine, 2009:10), Abayomi,w www.enextnews.com). Most of the respondents are of the view that wrong prescription / wrong dosage administration /wrong or inappropriate surgical operation are the most frequent means of clinical iatrogenesis is perpetrated in Keffi.

On the other hand, the result of the focus group discussion on the same question tallies with the above result from the questionnaires. It was agreed that from experience, the main means of perpetrating clinical iatrogenesis are wrong laboratory test result, wrong prescription of drugs, improper keeping of patient medical result, illegible handwriting, arrogated knowledge on the part of practitioners, lack of patience by practitioners, indifferent attitude towards patients' pleas by medical practitioners, etc.

Distribution of respondents' responses on their support for the disclosure of clinical iatrogenic incidence to patients

The distribution above shows that 60% (66) of the respondents support the ideal that incidence of clinical iatrogenesis should be disclosed to patients or their relations if the trend of clinical iatrogenesis is to be halted or reduced to the barest minimal. This will expose hospitals / clinics in Keffi, that are prone to clinical iatrogenesis; 29.09 % (32) of the respondent disagree. Positing that, that will be inimical to the health system in Keffi, since it will make medical practitioners to be tensed up in carrying out their duties.

Also, in line with the above, there was a consensus among the respondents' incidence should be disclosed to the patient or at least, the relative of the patient. This will make them to know the reason /causes or their unceasing illness. This will give room for litigation when necessary, and thereby curtail the excesses of the medical practitioners.

However, four of the respondents out of the twelve (12) disagree with the idea of disclosure of such harm, arguing that it will make practitioners to be tensed up while treating patients.

Distribution of specialists that make avoidable harmful errors due to carelessness/ negligence because of too many patients at their disposal

The above indicates that 32.73% (36) of the respondent agrees that the prominence of clinical iatrogenesis is because of too many patients at the treatment roll of a medical doctor per time, the argument is that in some public hospital in Keffi, the ratio is a doctor to fifty (50) patients (FMCK, Annualreport, 2010).

On the other hand , this also indicate that about 23.64%(26)and 22.23%(25)of the respondents strongly disagree and disagree respectively , that patients ratio to medical practitioners is the main reason for the negligent act .This shows that a total of 46.36% (51) of the respondents disagree that such carelessness/negligence is because of too much patients at the disposal of the medical practitioners.This is In consonant with the responses of the focus group discussion , where the respondent argues that most negligence of the medical practitioners were done when there are few patient to be attended to. They opined that such negligence / carelessness is because of in patients and arrogance of some medical practitioners. Also it was argued and consented that the exploitative nature of medical practitioners (especially medical doctors and pharmacists,) who divest drugs and other public hospital tools and equipment to their private hospitals, where they change exorbitant price for any treatment in order to maximize profit also contribute to poor treatment of patients. The desire for higher profit has become one of the reasons why surgeons sometimes carry out unnecessary surgical operations on patients, since it commands higher price; this higher profit but at the detriment of the patients 'health.

Distribution of respondents' views on the kind of discipline given to practitioners that harm their patients negligently

The above heading indicates that bulk of the respondents representing 41.82% (46) opined that such practitioners are to be sent for further studies/orientation before they are permitted to practice again. 32.73% (36) of the respondents suggested that such practitioners should be disqualified from practicing as medical practitioners.

 A similar question in the Focus Group Discussion (FGD) was concluded that such practitioners, if their action is certified as avoidable errors should be held responsible to pay for the damage and then asked to go for further training before practicing again as a practitioner. Few members of the group (FGD) argued that such practitioners should be killed, positing that it is only when medical practitioners begin to experience the same fate as their patients, just the way Pilots suffer with their crew for any carelessness; the practitioners will remain negligent at the course of discharging their duty.

Distribution of respondents' views on obsolete and inadequate equipment to the patients in Keffi

The above title indicates that the bulk of the respondents representing 45.45% (50) agree that obsolete and inadequate hospital equipment contribute to clinical iatrogenesis in Keffi. A total of 69.09% (76) of the respondents at least agreed that obsolete equipment is one of the causes of clinical iatrogenesis in Keffi.

Distribution of respondents according to their rate of visiting the hospital / clinic in Keffi.

The distribution in table 4.16 above shows that a total of 88.18% (97) of the respondents visit the hospital or clinic in Keffi out of which 39.09% (43) representing the bulk of the respondents often visit the hospitals / clinic in Keffi for their health care.It also shows that only 11.82% (13) of the respondents' does not consult the hospital / clinic in Keffi for their health need but rely on other alternative health care gives, such as traditional medicine. This implies that most people in Keffi depend on the modern medicine that is being practiced in the hospital for their health needs.

DISCUSSION OF FINDINGS

This study has shown that Clinical iatrogenesis is a social reality that is associated with the hospital setting of modern medical practices and the practitioners involved are discovered to be mainly responsible for the counter productivities of modern medicine through their negligence and carelessness which in turn has had a wrong effect onthe health care delivery and on the health status of patients in Keffi and Nigeria at large.

The negligence and carelessness of practitioners include swrong diagnosis and prescriptions, inadequate experienced medical practitioners; exchange of patient's medical test result in the Laboratory, Profit motivated instead of life saving motivation, Inadequate/Obsolete hospital equipment due to the diversion of some available medical treatment kits and tools for practitioners' personal practice, although the government still needs to do more in providing sophisticated tools for a better heath delivery system.

The resulting effect of the carelessness and negligence of medical practitioners are: amputation of patients from wrong injections, illness recurring from wrong treatment, loss of loved ones, hasty generalization of patient's condition by medical doctors/ other practitioners leading to prescription of drugs based on assumption, death, unwarranted loss of vital body parts as a result of surgical operations, mental disorder, paralysis, cripple, blindness, miscarriage, arising incurable sickness from wrong treatment of a curable sickness from dizziness, hair loss, miscarriage, loss of sight and leg, deafness, loss of womb, cancer, miscarriage resulting from wrong prescription /administration of drugs, inappropriate / unnecessary surgical operation, wrong blood transfusion, miss-matching of patients test results recorded, wrong injections, among others.

It was discovered in the course of this study that the main victims of clinical iatrogenesis are the poor. The rich are treated in the hospital in Keffi with respect in a special way and it was observed that in almost all the hospitals in Keffi, there is an in-built private ward separately reserved for the rich so as to give preferential treatment according to their pocket. It is difficult to address the problems of health inequality between the rich and the poor given the medicals exploitative role over the poor. Only 1.82 %(2) of the respondents admitted that the rich are also victims of clinical iatrogenesis in Keffi, which is very insignificant.

The implications of clinical iatrogenesis in Keffi in the near future is that if nothing is done to checkmate the excesses of medical practitioners in Keffi, a huge number citizens of Keffi in particular and Nigeria in general will continue to be murdered in cold blood, in the hospital the mortality rate of hospital clinic users will increase, the number of beggars will increase on streets and major roads in Keffi. Given that more victims will become blind, deaf, lame, crippled, psychopaths, bed-ridden, perpetual patients, etc. The handicaps will result in to begging or their relatives in other forms of crime, so as to meet their needs for survival in the absence of the government provisions (Researchers'' field work, FGD: 2011). The citizens and users of modern medicine in Keffi will continue to see the institution as a force programmes and a route to untimely death .It means that going to the hospital in Keffi is putting one's life at a greater risk and at the mercy of medical practitioners who have gradually lost their passion to save lives for their passion to make more money.

This is significant, since it is in line with Marxian perspectives of health that earlier pointed out that medicine has become a market commodity to be bought and sold like any other products in the market (Navarro, 1985). In line with Navarro (1985), who opined that despite the fact that more and more is being spent on health, more and more people are experiencing the inefficiency of the modern health system. This put the rich at a better position to access better treatment at the detriment of the poor who could not raise the needed cash.

The interactionists on the other pointed out the unequal distributions of the resources available to health practitioners and patients (Robert, 1983). He opined that medical practitioners prefer to see patients die using their remedies than to see patients living without using it. Thus in Keffi, doctors keep on working on patients (even when it is clear that it is not their areas of specialization) until they have sap every kobo from the patient, then they will direct him/her to the appropriate quarter (researcher's field work, 2011). This is because medical practitioners were indifferent to the plight and conditions of patients (focus group discussion, 2011).

This study reveals that clinical iatrogenesis can be reduced to the barest minimum; the training curriculum of the medical college could be upgraded to include social relationship for medical practitioners. The establishment of an effective public complaint

unit in all Keffi hospitals/clinics will monitor practitioners operations and compensate the victims of clinical iatrogenesis. The interactionist shares the perspective that clinical iatrogenesis' cases would subside if health practitioners put themselves in patient's shoes. This will make them to understand what it means to be treated negligently. As stated by one of the participants in the FGD "It is time that a few examples are set by the courts on the consequences of medical malpractices, let's not leave judgment to God. Let's start right here on earth. Right here in Nigeria. Right here in Keffi" by instituting action against negligent health providers in Keffi and then in Nigeria,.

Conclusion and Recommendations

From the study it was unveiled that clinical iatrogenesis has led to the deaths of several citizens of Keffi over the years as several deaths in the hospitals/clinics in Keffi is not of incurable disease but clinical iatrogenesis. The study also indicates that several handicaps in the Nigeria society and Keffi in particular were not born as handicaps but resulted from clinical iatrogenic incidence. the poor are the main victims of clinical iatrogenesis in Keffi as they cannot afford to access better health facilities being very expensive. It was observed that clinical iatrogenesis is perpetrated mainly through misdiagnosis (wrong laboratory test), illegible handwriting of medical doctors, wrong prescription/drug administration and unnecessary or inappropriate surgical operations.". It was also discovered that one of the reasons for the increasing occurrence rate of clinical iatrogenesis in Keffi is because most of the medical equipment in-use are obsolete and out of operation. The findings also revealed that most people in Keffi depend on the modern hospitals/clinics for their health needs.

Thus one can say at this point that the health delivery in Keffi is in jeopardy if nothing is done to bring this self-inflicted epidemic to a minimal level and since almost everyone visits the hospital when he/she is sick. If nothing is done to stop this epidemic, a time will come when everyone who visit the hospital/clinic in Keffi will serve as a medical cadaver for teaching medical students.Hence, the need to disclose clinical iatrogenic incidenceto the patients or the patients' relatives so as to solve the patient's puzzle of what his true condition is. This will also give the patients' the burden of prove for litigation if the need arises, and it will make practitioners to become conscious of their Hippocrates's oath of saving life first

Conclusively, health delivery in Keffi is being threatened by the present high occurrence of clinical iatrogenesis, which is mainly caused by medical practitioners' negligence/carelessness in prescription, diagnosing, administration of drugs and surgical operation. This has led to and is still leading to the deaths/injuries of many patients in Keffi particularly and Nigeria at large. The trends of clinical iatrogenesisare on the increase given that it is difficult in Nigeria to prove beyond doubts that an error or negligence had occurred in one's care or to actually prove that the mistake is actually

"preventable". The needs for burden of proves, illiteracy, cultural bonds and lack of adequate information hinder litigation against medical negligence or malpractices in Nigeria and Keffi in particular. Until the culture of disclosing clinical iatrogenic incidence and medical litigation is ingrained in our society, such negligence, misdiagnosis and unprofessional behavior will go unhindered.

The following are recommended as measures to curb the clinical iatrogenesis epidemic in Keffi and Nigeria at large: the government should purchase modern medical and diagnostic equipment to replace the obsolete ones that are being used in the clinics/hospitals in Keffi.There should be a deliberate effort by government to increase the numbers of medical practitioners in the country, so as to check the monopolistic nature of the few available ones and thereby reduce excessive pressure that the few sincere ones are facing. This can be done by encouraging and enrolling more students in the medical institutions. In so doing they should expand facilities and personnel to enhance this increase. Also, Government should emphasise primary health care as against curative medicine. This is where a lot of these clinical iatrogenesis are committed.

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FLOOD VULNERABILITY ASSESSMENT IN THE GBAKO RIVER BASIN, NIGER STATE, NIGERIA

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Abstract
Floods are among the most devastating natural disasters and cost many lives every year. It is reported that flood disasters account for about a third of all natural disasters (by number and economic losses). Nigeria is no exception to countries that experienced flood in recent time. Flood vulnerability of the communities inhabiting the flood plain of the Gbako river, Niger State, Nigeria was investigated. The study employed both qualitative and quantitative approach such as field survey, interview, questionnaire and geospatial techniques to achieve the objectives. The geospatial techniques was utilized to generate flood vulnerability map and create a Digital Elevation Model (DEM) of the study location. Questionnaire was also randomly administered to ascertain the adaption strategies and coping capacities of the communities in the study area. The result indicate that a greater number of families, household, cultural heritage are all prone to flood and that flood events impacted on the peoples livelihood by way of destruction to farm produce, food and cash crop, water and sanitation, low and poor harvest with dire consequences on socio-economic lives of the populace. The results also indicates that the area with elevation of between 42 meters and 123 meters above the sea level are vulnerable to flood with severe consequences for the inhabitant of the study area. The result also revealed that migration, evacuation, relocation to higher ground of the safer area are the adaption strategies to flood events in the study area. Conclusively, with the percentage of the inhabitant and community affected by flood and the critical infrastructure that are damaged, the study location and its habitants are severely vulnerable to flood. It is therefore recommended that flood control structures or buffer zone should be created in areas of high and moderate vulnerability effect and Multi-sectoral approach to flood mitigation as opposed to single sector should be promoted as there are inter-linkage in terms of flood effect on various aspect of society.

Keywords: Flood, Flood vulnerability, Gbako river, and Flood plain

Introduction

Floods account for approximately one third of global natural hazards and more people are adversely affected by flooding than any other geophysical phenomenon (Smith and Ward, 2018). On average, 20,000 people lose their lives due to flooding each year and it affects

75 million people globally, most of whom become homeless (Smith, 2015). Floods are one of the most common, costly natural disasters worldwide. For example, in the US, floods caused 8.17 billion in damages and 89 deaths annually over the period 1983 to 2012 (National Weather Service, 2014).

Nwilo *et al.* (2012) explained that floods are among the most devastating natural disasters and cost many lives every year. It is reported that flood disasters account for about a third of all natural disasters (by number and economic losses). Nigeria is no exception to countries that experienced flood hazard in recent time. Many communities have suffered losses due to flood problem. Niger State have being experiencing flood disaster which destroyed farmlands and claimed lives and properties (Nwilo *et al.,* 2012).

Flood disaster is not a recent phenomenon in the country, and its destructive tendencies are sometimes enormous. Akani and Bilesanmi (2016) reports how a Lagos flood forced Lagosians to relocate as a result of heavy rain of 7th and 8th of July 2011 not knowing there was going to be a more devastating torrential rain that will result in "more disastrous floods in Lagos Metropolis" in the following week, (Mordi, 2011; Amaize, 2011). According to literature there seems to be a real demand for continuous monitoring and planning to better cope with flood events in the future. The integration of the social dimension is taken into consideration as a main part of the flood vulnerability assessment. The risks and damages caused by flood disasters in terms of loss of life, property, displacement of people and disruption of Socio-economic activities as well as the loss of valuable agricultural land due to the attendant inundation of floodplains from floods can never be overemphasized. Flood is gradually becoming a serious environmental problem in Nigeria. Several areas along the major and minor river channels (floodplains) of the study area (Gbako River Basin) are affected by floods every year. To gain better understanding of the flood disaster, there is need to study the nature, type, extent, causes, the impact of flood on socio-economic activities as well as flood vulnerability factors in the study area. There is usually less or limited concern by government and other affected communities in this regard. There is however, need to embark on flood prevention and control/mitigation measures that would ensure free flowing drainage systems, as well as good operation and maintenance of hydraulic structures such as dams and reservoirs. These however will form the basis of the study, and it is hopeful that findings and suggestions from the study will enable people in the flood prone areas to live with the flood, appropriate its positive elements and mitigate the adverse effects associated with the flood disasters. Therefore, the aim of this paper is to assess the vulnerability of the inhabitants of the Gbako River Basin to flood.

Gbako River Basin is to be found as parts of the greater middle section of the Niger basin. It is located in the south western part of Niger State with elevation in height between (300 meters) lying between latitude 6^0 20''30N to 7^0 15''60N of the equator and longitude 5^0 40''10E to 6^0 33''15E of the Greenwich meridian.It has area coverage of 1,698km^2. The

area geographically it transverses boundaries with Gbako Local Government,Lavun Local Government Area, and Katcha Local Government Areas(Gobo and Abam, 2011).
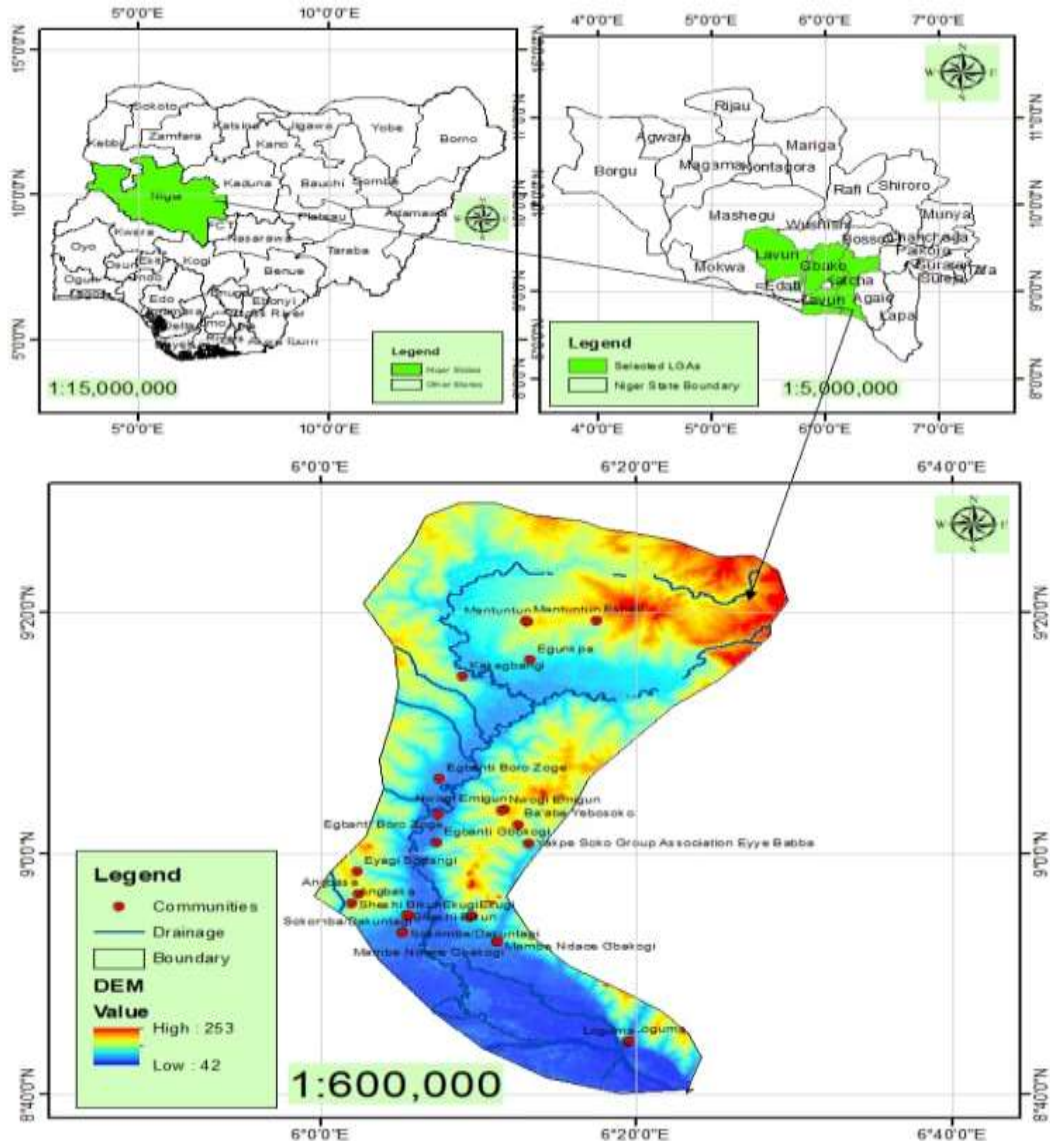
Figure 1: The Study Area (Gbako River Basin, Niger State Nigeria)
Source: Niger State Geographic Information System (2021)

Materials and Methods

The sources of data for this study include primary and secondary data sources. The primary sources of data include questionnaire administration, field survey and oral interview. Secondary data including rainfall data and records of flood damage in the affected areas (within the temporal scope of the study: 2011-2020) were collected from

reports made available by hydro-meteorological agencies like the Nigeria Hydrological Services Agency (NIHSA) and the Niger State Emergency Management Agency (NSEMA). The flood and socioeconomic data were used in determining the flood vulnerability factors, flood impact on socio-economic activities of the study area and the adaptation strategies put in place to reduce flood vulnerability in the study area. Other secondary data sources used for the purpose of the study include: 2018 satellite image of Moderate Resolution Imaging Spectrometer (MODIS) on Natural Aeronautic and Space Administration, drainage systems, Digital Elevation Model (USGS DEM), Maps, Newspapers, Magazines and Journals.

The study respondents were 399 and convenient sampling was used to distribute the questionnaires among the respondents. Two hundred and fifty (252) questionnaires were returned for data analysis. The methods of data analysis include factor analysis, frequency percentage and 3-point Likert type scale.

Results and Discussion

Generate a flood vulnerability map for Gbako River Basin

This occurs as a result of variations in degree of relief and drainage of the area; the map was based on susceptibility of settlement to flooding in the study area. The Digital elevation model (DEM) of the study area shows differences in height between 253 m to 42m above sea level across the flood plain. It shows that the northern and eastern part of the study area has highest elevation, lying between 151m and 153m above mean sea level depicted in green colour. The Centre towards the South eastern part of the study area has a moderate elevation between 99m to 123m while the southern part towards to the river Gbako, has the lowest elevation between 42m to 74m above mean sea level as shown in Figure 2 of the study.
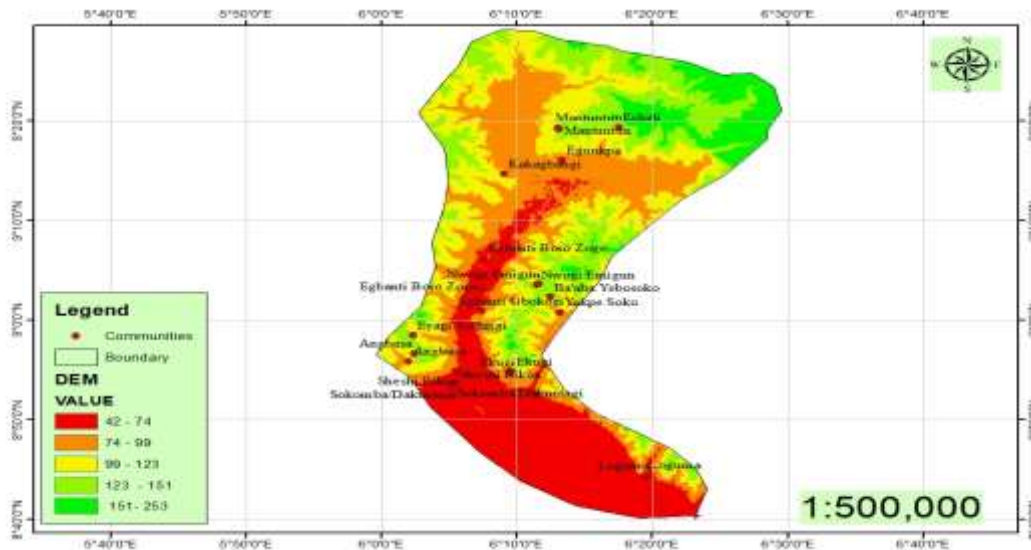

Figure 2: DEM of the study area
Source: Author's Analysis, 2022

Figure 3 shows digital elevation model of the study area. The DEM of the area revealed that the northern and eastern part of the area has high topography that is prone to gully erosion as a result of runoff. The DEM further revealed that the study area is generally more susceptible to rain induced flash floods as well as river floods. As presented, there are variations in the degree of susceptibility to flooding in the study area, these include high flood risk zone, Moderate, Low and No flood risk zones.

Figure 3: Digital Elevation Model of the Study Area
Source: Author's Analysis, 2022

Figure 4 shows the flood risk zones of the study area, it has revealed that the study area is in fact susceptible to flooding. This statement is drawn from the fact that several areas most especially the southern parts and the settlements are in low elevation. These have been attributed to some degree of susceptibility. This was also confirmed through a ground truth exercise. It is therefore necessary to create awareness and steer away development from areas highly susceptible to floods to areas with lesser susceptibility in the area. The classification of flood risk zones in the area was mainly based on the interaction of relief and drainage.

The areas marked as highly susceptible are mostly the areas closet to the River Niger. Flooding is experienced in most areas in this classification yearly. The areas are characterized by low relief and water-logged soils. Figure 4.9 is a classified risk map of the study area which shows the area occupied by each level of vulnerability. The result from the classified DEM shows that about 575.72square kilometer (23.73%) of the area is on very high vulnerable area which is an evidence of recurrent flooding in the study area. then about 590.78square kilometer (24.35%) are highly vulnerable risk areas and 626.63square kilometer (25.83%) are moderately vulnerable risk areas , 448.21square kilometer (18.48%) and finally 184.47square kilometer (7.60%) are no vulnerable risk areas . it can be therefore conclude that the study area is generally a flood plain area.
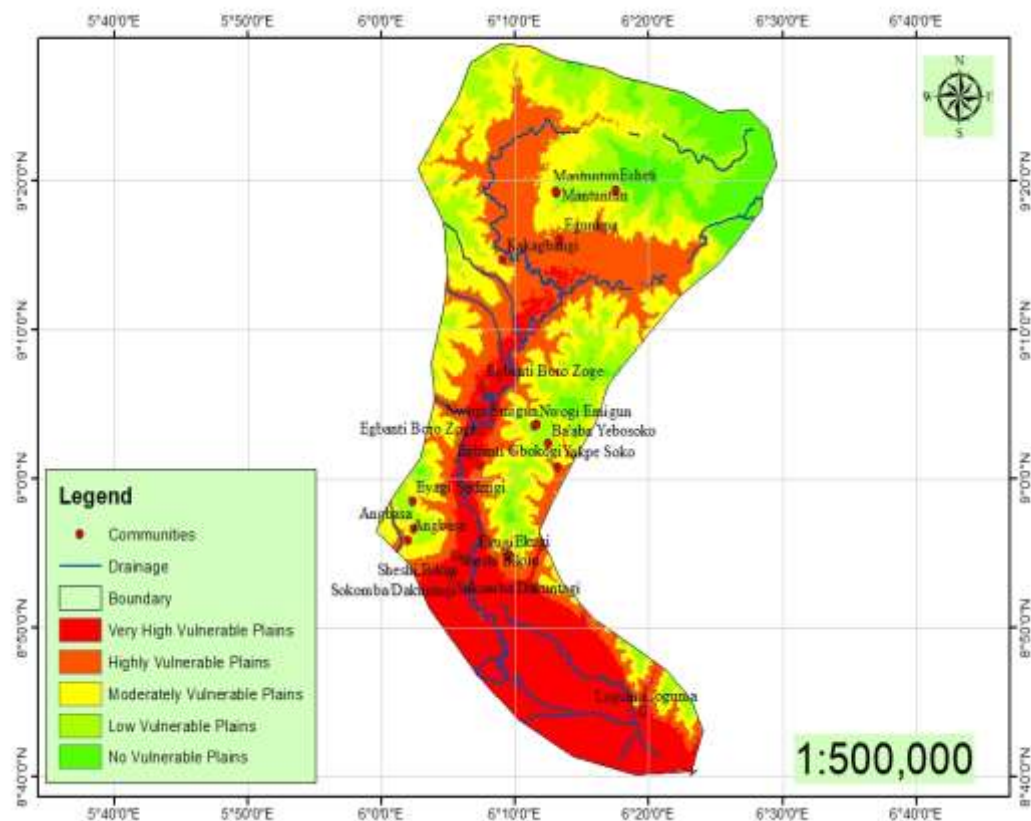

Figure 4: Map of flood Risk Zone of the Study Area
Source: Author's Analysis, 2022

Figure 5 shows the loss of farm produce during flood events in the study area. Sampled population who agree that they lose their farm produce during flood events constitute 78% while those disagree constitute the remaining 22%. This shows that majority of the sampled population lose their farm produce as a result of frequent flood events across the study area.
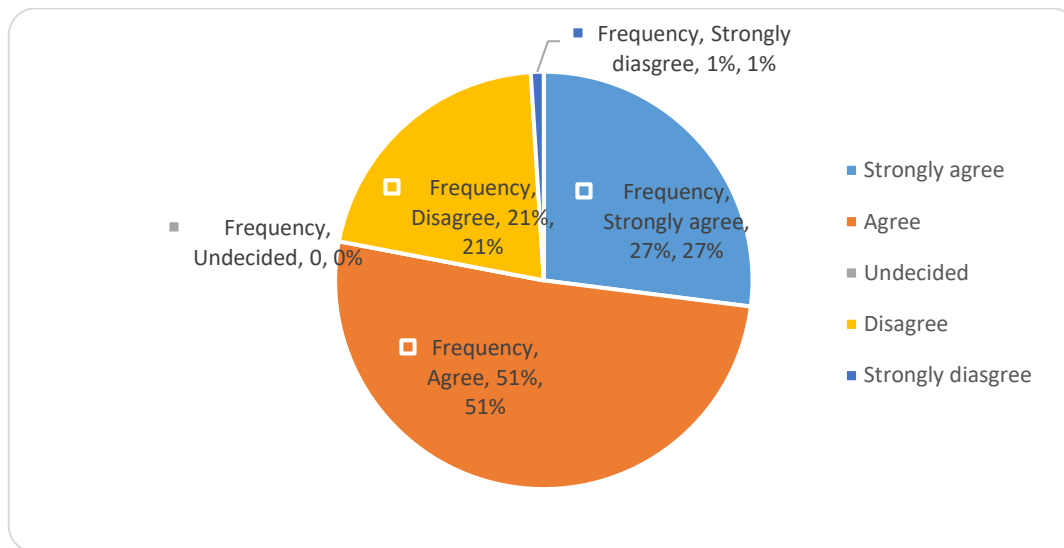
Figure 5: shows the loss of farm produce during flood events in the study area

The type of agricultural crop damaged during the past flood events include cash crops, food and cash crops and food crop only as indicated in Table 1 of the study. Sampled population who loss food and cash crops constitute 57.9% while those who loss cash crop ranked the least with 6.8%. This shows that majority of the sampled population loss food and cash crops which has affected their standard of living through increased in poverty level.

Table 1: Type of Agricultural Crop Damaged

Options	Frequency	Percentage (%)
Food crop only	89	35.3
Cash crop only	17	6.8
Food and cash crops	146	57.9
Total	252	100

Plate I: Damaged rice farm in the study area

Table 2 shows the effects of flood events on the sampled population in the study area. Sampled population with low and poor harvest constitute 34.1%, increased poverty constitute 27.8%, migration and displacement constitute 23.4% and landscape changes

constitute 14.7%. This shows that major effect of flood event on the sampled population was low and poor harvest which leads to increased poverty.

Table 2: Effect of Flood Events on the Sampled Population

Options	Frequency	Percentage (%)
Migration and displacement	59	23.4
Landscape changes	37	14.7
Low and poor harvest	86	34.1
Increased poverty	70	27.8
Total	252	100

Flood hazard adaptation strategies for the study area include Engineering Scheme, Flood Abatement Schemes, Flood-Protection Scheme, Public Relief Funds, Flood Insurance, Flood Forecasting and Warning Schemes and Floodplain Zoning as revealed in Table 3.

Table 3: Flood Adaptation Strategies Adopted by the Communities

S/No	Adaptation Strategies	VG	G	NG	Total	Percentage (%)
a	Engineering Scheme	10	1	0	11	4.4
b	Flood Abatement Schemes	4	3	0	7	2.8
c	Flood-Protection Scheme	39	7	0	46	18.3
d	Public Relief Funds	88	20	0	108	42.9
e	Flood Insurance	0	0	0	0	0
f	Flood Forecasting and Warning Schemes	48	12	0	60	23.8
g	Floodplain Zoning	9	11	0	20	7.9
	Total	198	54	0	252	100

Source: Field Survey (2022)

As indicated in Table 3, public relief funds ranked the highest with 42.9% of the sampled population, flood forecasting and warning schemes ranked second with 23.8% of the sampled population and flood abatement scheme constitute the least with 2.8%. The implication of this finding is that public relief fund either from government or private donor is the major flood adaptation strategy in the study area. Engineering Scheme include river training, works designed to prevent local bank erosion, flood embankments, channels enlargement, flood-relief channels and flood storage reservoirs; Flood Abatement Schemes include afforestation and reducing the land-to-channel runoff; Flood-Protection Scheme: stocking of suitable shields to be placed in position at doors and windows prior to a flood, raising of building above the flood level and inclusion of pumping facilities in basement and Floodplain Zoning include Prohibitive Zone, Restrictive Zone (All buildings should be flood proofed and establishment of Game reserve) and Warning Zone.

Conclusion

Flood vulnerability consists of the three factors exposure, susceptibility and lack of resilience. These factors consist of indicators which assess different characteristics of vulnerability and they all shows that the study area is vulnerable to flood events.Floods are natural phenomena which cannot be prevented. However, anthropogenic activity is contributing to an increase in the likelihood and adverse impacts of extreme flood events. The possibility to identify and predict flood prone areas on ungauged rivers is the major advantage of this method. The present study shows a simple way of using geographical information science and remote sensing for generating flood vulnerability factors (FVF), flood vulnerability zones (FVZ) and flood risk map (FRM) from the available remotely sensed data sets and the outcomes of this study can contribute towards an efficient flood risk management decisions towards sustainable development.

The produced vulnerability maps can give planners and managers a valuable tool for assessing flood vulnerability. Therefore the IFVI tool has been applied for post-flood evaluation to identify areas of risk and the associated probable vulnerability. The outcomes generated in the form of maps can help approaches to rehabilitation and mitigation. However, flood mapping is also possible along with other diagnostic tools like a GIS.

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ASSESSMENT OF pH, PROXIMATE COMPOSITION AND *IN-VITRO* GAS PRODUCTION ON SWEET POTATO VINE SILAGE TREATED WITH ADDITIVES

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Abstract

This study looks at the assessment of pH, proximate composition and in-vitro gas production on sweet potato vine silage (SPVS) treated with additives at three weeks. Two varieties of sweet potato vines silage (SPVS) were made with no additive as control T1, with molasses T2, with urea T3 and with yeast T4. The data collected was analyzed using chat in Microsoft Excel office Software for pH. ANOVA was used to analyze proximate composition and in vitro gas production using SPSS version 20, where significant differences occurred, the means was separated using general linear model. The results showed that though both King J and Dan china varieties had acidic pH values, King J had a better silage compared to Dan china variety of SPVS on control, molasses, urea and yeast with the following pH values; 5.3, 4.8, 6.1 and 5.6 on control, molasses, urea and yeast for King J variety, while Dan china Variety had 5.6, 4.9, 6.4 and 6.4 on control, molasses, urea and yeast. On additives, molasses produced the best silage for both varieties with pH values 4.8 and 4.9 for King J and Dan china varieties respectively. On proximate composition, results showed that Ash, OM, CF, EE, NFE, ADF, DMI, DDM and RFV (%) were significantly different (P<0.05) on the King J and Dan china varieties of SPVS on all additives. The results for in vitro gas production showed that King J and Dan china varieties were significantly different (P<0.05) at 3, 6, 9, 12, 18, 21 and 24hrs except 15hrs on all the additives. In conclusion, this study confirmed that the addition of molasses, urea, and yeast improved silage quality of two varieties of sweet potato vines silage including the control, with molasses as superior additive for both varieties in terms of silage, proximate composition and in vitro gas production. Molasses, urea and yeast are said to be recommended as additives in silage making using sweet potato vines.

Keywords: pH, Proximate Composition, In Vitro, Silage and Additive.

Introduction
Sweet potato forage unlike legume forages, does not contain notable quantities of antinutritional factors. The vines are separated from the roots after harvest and provide a

nutritive and relished green feed for ruminants (Nguyen Thi Tinh et al., 2006). It is a suitable protein supplement for animals receiving low quality forage. Sweet potato foliage, either fresh, dried or ensiled, is a valuable ingredient for diets. Although dried and ensiled sweet potato foliage has slightly lower lysine digestibility (Le, 2004). Many types of silages can be made with sweet potato foliage: sweet potato silage can be prepared with leaves alone or with synthetic lysine added, sweet potato leaves and cassava leaves, or sweet potato leaves and sweet potato roots (Nguyen Thi Hoa Ly, Le Duc Ngoan, Verstegen, & Hendriks, 2010; Le Van An, Tran Thi Thu Hong, Ogle, & Lindberg, 2005). Additives can be a substitute for good ensiling management. For example, additives will not make up for the negative effects on fermentation quality of tropical forages caused by practices such as the use of low quality oxygen-permeable plastic covers, or extended storage under temperatures above 30 °C (Tjandraatmadja, Norton, & MacRae, 1991).

It should also be emphasized that the efficacy of any additive will ultimately be assessed by animal performance and by dry matter (DM) recovery from the silo, which are parameters not commonly determined. Most of the experiments are restricted to measurements of traditional fermentation patterns under controlled laboratory conditions, where even untreated silages made from thick-stemmed *Pennisetum* species may show acceptable preservation (Woodard, Prine & Bates, 1991; Spitaleri, Sollenberger, Staples & Schank, 1995)

Silage is a product formed when grass or other green fodder with sufficient moisture contents is stored anaerobically, typically in the silo after wilting, to prevent spoilage by aerobic microorganism. (Woolford & Pahlow, 1998). The fundamental principles of silage process are maintenance of anaerobic conditions throughout the ensiling and rapid decline in pH value by lactic acid bacteria. (McDonald, 1981). Previously, forage has been preserved as hay (by drying) or as silage (by acidification or sterilization).

The key principle is rapid drying to <15 % moisture in order to prevent mould growth and formation of heat from aerobic bacteria. However, in situations where dry conditions are uncertain, then ensiling generally makes sense in order to preserve as much of the feed nutrient value as possible (Muck, 1988).

Objectives of the Study
1. To assess pH, on sweet potato vine silage treated with additives
2. To assess proximate composition on sweet potato vine silage treated with additives
3. To assess *in-vitro* gas production on sweet potato vine silage treated with additives

Materials and methods
Samples of sweet potato vines were obtained from two cultivars of sweet potato vines, *King J and Danchina* planted by Agronomy Department of Bayero University, Kano, while molasses, urea and yeast were used as additives. Samples were opened at 3rd week

to look at the effect of pH, and *in vitro* gas production on sweet potato vine silage treated with molasses, urea and yeast.

The study was conducted at two locations, first was silage making, physical analysis conducted at the Livestock Teaching and Research Farm and Laboratory of the Department of Animal Science, Faculty of Agriculture, Bayero University Kano located on the coordinates of Longitude 9° 30' and 12° 30' North and Latitude 8° 42' and 9° 30' East in the semi-arid region in Northern Nigeria. The area has two seasons, the wet (May-September) and dry seasons (October- April). The annual temperature and rainfall ranges between 21°C and 39°C and 787mm to 960mm respectively (KNARDA, 2001). While the second was on *in vitro* gas production study carried out in the Department of Animal Science, Ruminant Microbiology Laboratory, Faculty of Agriculture and Forestry, University of Ibadan Nigeria. The University of Ibadan (UI) is located five miles (8 kilometres) from the center of the major city of Ibadan in Western Nigeria located on the coordinates of Latitude: 7° 23' 28.19" N and Longitude: 3° 54' 59.99" E. (https://latitude.to/articles-by *country/ng/nigeria/15223/university-of-ibadan).*

Preparation of Experimental Samples
A total of 24 bottles were used for the silage preparation. Two varieties of sweet potato vines; *King-J* and *Danchina* were used as samples having 12 for each. The varieties were collected from Bayero University Kano, Faculty of Agriculture, Farm and Research unit in Kano State, and was chopped with cutlass to about 2 to 5 cm. The chopped forages were treated with (i) no additives (control); (ii) molasses; (iii) urea and (iv) yeast. Distilled water (1%) was added to the *King-J* and *Danchina* without additive as control in treatment 1 and the *King-J* and *Danchina* with added molasses, urea and yeast as treatments 2, 3 and 4 to adjust the moisture contents of the experimental forages. Thereafter, the experimental forages were packed tightly in bottles. Air was withdrawn from the bottles by means of a vacuum sealer. The bottles were stored at room temperature (27 ◦C to 30 °C). The triplicate silages per treatment were opened at 3rd week of ensiling for physical analysis, chemical composition and *in vitro* gas production analysis

The data collected was analyzed using line with marker chat in Microsoft Excel office Software for pH, while ANOVA was used for chemical composition and *in vitro* gas using SPSS version 20, where significant differences occurred, the means was separated using general linear model.

Statistical Analysis
The data collected was analyzed using chat in Microsoft Excel office Software for pH, while ANOVA was used for chemical composition and *in vitro* gas using SPSS version 20, where significant differences occurred, the means was separated using general linear model.

Results and Discussion

pH Values for *king J* and *Danchina* Varieties of Sweet Potato Vines Silage (SPVS) at Week Three

pH values for *King J* and *Danchina* varieties of sweet potato vines silage (SPVS) at week three is presented in figure 1. The pH values of *King J* and *Dan china* varieties of SPVS of treatments 1, 2, 3 and 4 (control, molasses, urea and yeast) respectively fall under acidic conditions. Based on pH values on control, molasses, urea, and yeast, with the pH values of 5.3, 4.8, 6.1 and 5.6 for *King J* and 5.6, 4.9, 6.4 and 6.4 for control, molasses, urea and yeast respectively on *Dan china* variety. *King J* variety made a better silage as compared to *Dan china* on control, molasses, urea yeast at week three, while there were equal pH values of yeast with 6.4 on *Dan china* variety. Among the additives, molasses seems to produce better silage followed by control, yeast and urea for King J variety, while for *Dan china* variety, molasses equally made the best silage followed by control then a tie of equal value of 6.4 each for urea and yeast treatments. At three weeks urea had the highest pH values of 6.1 and 6.4 for *King J* and *Danchina* varieties respectively at three weeks though under acidic condition as compared to control, molasses and yeast treatments which confirms the statement of Bolsen, *et al*., (1995), and Kuttu, *et al*., (2020) which says, addition of ammonia increases the pH level of silage to 6 or 9.
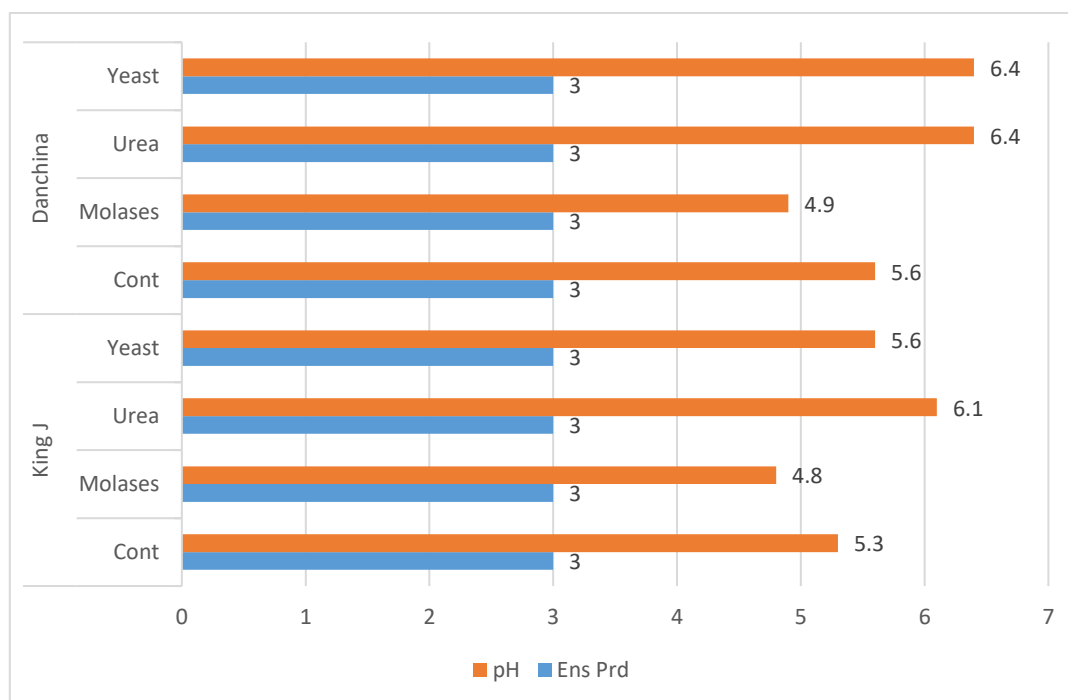
Key: CONT= Control, Ens prd= Ensiling period

Figure 1: pH Values for *king J* and *Danchina* Varieties of Sweet Potato Vines Silage (SPVS) at Week Three.

Assessment of vines Additives Ensiling Period on Chemical Composition of *King J* and *Danchina* Varieties of Sweet Potato Vines Silage (SPVS) Treated with Additives

The assessment of the vines, additives and ensiling period on chemical composition (%) of two varieties of sweet potato vines silage treated with additives is shown on Table 1. Ash, Organic Matter, CF, EE, NFE, ADF, DMI, DDM and Relative Feed Value (%) were significantly different (P<0.05) on the *King J* and *Danchina* varieties of SPVS on control. molasses, urea and yeast. *King J* variety at week 3, Ash was higher in values for *Dan china* variety on all additives compared to *King J* variety, molasses had the highest value of Ash (%) on both varieties, followed by control, yeast and urea. On Organic Matter (%), *King J* had higher values than *Dan china* on all additives with urea having the highest value of 96.38 and 95.42 for *King J* and *Dan china* respectively, while molasses having the lowest value of 92.77 and 90.60 for King J and *Dan china* respectively. On CF (%), *Dan china* variety had higher values as compared to *King J* on all additives, with molasses having higher values on *Dan china* varieties with 28.63 while control and urea had an equal highest values of 25.50 each for *king J* variety. On EE (%), all additives showed higher values on *Dan china* variety than *King J*, with control and yeast having highest values of 6.02 each and lowest values on molasses and urea with equal values of 5.99 each for *Dan china* variety, while for *King J,* molasses had the highest value of 5.44, with urea coming lowest with 5.40. *King J* variety had highest values on all additives for NFE (%), with urea having the highest value of 48.71 and lowest value of 45.42 on molasses for *King J* variety, while urea with the highest value of 45.69 and lowest value of 40.43 for molasses on *Dan china* variety. *King J* had higher values on all treatments for ADF (%) compared to *Dan china* variety, with urea having the highest value of 34,25 and 31.60 for *King J* and *Dan chiana* varieties respectively, while yeast having the lowest value of 34.18 and 31.52 for *King J* variety and *Danchina* varieties respectively. For DMI (%), *King J* had higher values on all additives, with molasses and yeast having highest values of 2.64 each and control with the lowest value of 2.62 on *King J* variety, while control, urea and yeast had the highest values of 2.56 each and molasses with the lowest value of 2,55 for *Dan china* variety. On DDM (%), *Dan china* variety had the higher values on all additives, with yeast having the highest value of 64.35 and lowest value of 64.28 on urea for *Dan china* variety, while control had the highest value of 63.72 and urea the lowest value of 62.22 for *King J* variety. On Relative feed Value (%), *Dan china* variety had the highest values on all additives except for yeast, *where king J* variety had the overall highest value of 147.25 and the lowest value of 126.28 on control for *King J* variety. While urea had the highest value of 128.42 and control the lowest value of 127.65 for *Dan china* variety.

Dry matter content of SPVS ensiled with molasses, urea, yeast and control at 3 weeks, for *King J* and *Dan china* varieties of SPVS is similar to values reported by An & Lindberg, (2003). Ash content confirms to the report of Mohammed *et al.,* (2018) and Yacout *et al.,* (2016). Crude protein values are similar to the report of Dominguez, (1992); Dongmeza

et al., (2009); Yacout *et al.,* (2016) and Mohammed *et al.,* (2018).The CF content ranges from 13.12 to 28.68 % which is comparable with the report of, Dominguez (1992), An & Lindber, (2003), Dongmeza, Steinbronn, Francis, Focken & Becker (2009), Yacout *et al.,* (2016) and Mohammed *et al.*, (*2018*). Percentage EE as reported by Dominguez, (1992), Dongmeza *et al.*, (2009) and Kuttu *et al.,* (2021), ranges from 2.50 to 10.40 % similar to the range of 5.40 t0 6.02 % obtained in the present study.

ADF value (31.52 to 34.25) obtained in the present study confirms the reports of Dominguez, (1992) and Dongmeza *et al.*, (2009), but slightly different from the report of Yacout *et al.,* (2016) and Mohammed *et al.,* (2018), this could be due to the differences in materials that make up the silage treatments. Dominguez, (1992) and Dongmeza, *et al.,* (2009), reported NDF values ranging from 29.80 to 51.60, similar to the NDF values obtained in the present study which range from 40.41 to 48.71. Hemicellulose content of silage in this study (11.31 to 15.41), is comparable to the findings of Yacout, *et al.,* (2016) who reported hemicellulose content of (10.40 to 14.74). Digestibility of dry matter (62.22 to 64.35) is similar to the report of (Mohammed *et al.*, 2018).

Table 1. Effect of Vines Additives Ensiling Period on Proximate Composition (%) of *King J* and *Danchina* Varieties of Sweet Potato Vines Silage Treated with Additives for Three Weeks

ITEM	VINES	ENS PERIOD	CONT	ADDITIVES MOLASES	UREA	YEAST	SEM	LS
Dry Matter	*King J*	3	87.31	87.75	60.70	88.88	5.314	NS
	Dan china		89.75	88.65	85.62	87.80	5.314	
Ash	*King J*	3	5.47	7.22	3.62	4.88	.103	*
	Dan china		7.64	9.37	4.58	5.82	.103	
Organic Matter	*King J*	3	94.53	92.77	96.38	95.52	.103	*
	Dan china		92.33	90.63	95.42	94.18	.103	
CP	*King J*	3	16.18	16.42	16.78	16.83	.092	NS
	Dan china		15.56	15.54	15.54	15.56	.092	
CF	*King J*	3	25.50	25.48	25.50	25.48	.147	*
	Dan china		28.19	28.63	28.20	28.20	.147	
EE	*King J*	3	5.43	5.44	5.40	5.42	.014	*
	Dan china		6.02	5.99	5.99	6.02	.014	
NFE	*King J*	3	48.60	45.42	48.71	47.79	.222	*
	Dan china		42.57	40.43	45.69	44.41	.222	
ADF	*King J*	3	34.19	34.23	34.25	34.18	.014	*
	Dan china		31.53	31.57	31.60	31.52	.014	
NDF	*King J*	3	45.88	45.54	45.57	45.54	.073	NS
	Dan china		46.91	46.97	46.93	46.93	.073	
Hemicell	*King J*	3	11.70	11.31	11.32	11.36	.075	NS

	Dan china		15.38	15.40	15.33	15.41	.075	
DMI	*King J*	3	2.62	2.64	2.63	2.64	.004	*
	Dan china		2.56	2.55	2.56	2.56	.004	
DDM	*King J*	3	63.72	62.23	62.22	62.27	.011	*
	Dan china		64.34	64.30	64.28	64.35	.011	
Relative Feed Value	*King J*	3	126.28	127.17	126.81	147.25	.202	*
	Dan china		127.65	127.79	128.42	127.74	.202	

SEM: Standard Error of Means, LS: Level of Significance, NS: Not Significant, CONT: Control, ENS: Ensiled, CP: Crude Protein, CF: Crude Fibre, NFE: Nitrogen Free Extract, ADF: Acid Detergent Fibre, NDF: Nitrogen Detergent Fibre, Hemicell: Hemicellulose, DMI: Dry Matter Intake, DDM: Digestilility Dry Matter

Table 2. The *in Vitro* Gas Production of *King J* and *Danchina* Varieties of Sweet Potato Vines Ensiled with Molasses, Urea and Yeast at Three Weeks

The *in vitro* gas production of sweet potato vines ensiled with molasses, urea and yeast is shown in Table 2. *King J* and *Dan china* varieties were significantly different ($P<0.05$) at 3, 6, 9, 12, 18, 21 and 24hrs except 15hrs on control, molasses, urea and yeast. *King J* variety produced less gas than *Dan china* variety on molasses and yeast, while there was an equal volume of gas 18.67 each for both varieties produced at 3hrs of incubation. At 6hrs of incubation molasses and urea had less gas production of 20.33 each on *King J*, while control and urea produced more gas of 30.33 and 27.67 respectively for *king J* variety. Molasses, urea and yeast produced less gas at 9 and 12hrs of incubation with gas volumes of 22.00. 30.67 and 23.00 at 9hrs and 32.33,32.67 and 24.33 at 12hrs on *King J* variety , while control had less gas production of 25.33 and 27.33 at 9hrs and 12hrs respectively on *Dan china* variety. At 18, 21 and 24hrs of incubation, *Dan china* had less gas volume produced on control with 30.00, 32.33 and 32.33 respectively. While on molasses, at 18, 21 and 24hrs of incubation, *King J* produced less gas of 32.67, 33.33 and 33.33 respectively. On urea at 18, 21 and 24hrs *King J* produced less gas of 33.33, 33.67 and 33.67 respectively, but reverse was the case on yeast where less gas volume of 27.00, 29.00 and 30.00 was produced by *King J* variety at 18, 21 and 24hrs respectively.

Table 2. *In Vitro* Gas Production of *King J* and *Danchina* Varieties of Sweet Potato Vines Ensiled with Molasses, Urea and Yeast at Five Weeks

Incubation Period	Vine	Ensiling Period	Control	Molasses	Urea	Yeast	SEM	LOS
3HRS	*King J*	3	25.00	17.33	18.67	14.33	3.36	*
	Danchina	3	16.67	22.00	18.67	17.00	3.36	

6HRS	*King J*	3	30.33	20.33	27.67	20.33	3.73	*
	Danchina	3	23.33	29.00	21.00	22.67	3.71	
9HRS	*King J*	3	33.67	22.00	30.67	23.00	4.30	*
	Danchina	3	25.33	32.00	31.33	24.67	4.30	
12HRS	*King J*	3	35.00	32.33	32.67	24.33	4.23	*
	Danchina	3	27.33	34.67	33.00	28.33	4.23	
15HRS	*King J*	3	35.00	32.67	33.33	25.67	3.80	NS
	Danchina	3	29.00	35.67	33.33	29.00	3.80	
18HRS	*King J*	3	36.67	32.67	36.33	27.00	3.51	*
	Danchina	3	30.00	35.67	33.33	29.33	3.51	
21HRS	*King J*	3	38.00	33.33	36.33	29.00	3.59	*
	Danchina	3	32.33	36.00	33.67	30.00	3.59	
24H	*King J*	3	38.33	33.33	36.33	30.00	3.58	*
	Danhina	3	32.33	36.00	33.67	30.33	3.58	

SEM: Standard error means, LOS: Level of significance, HRS: Hours, NS: Not significant

Conclusion and Recommendation

Based on the results presented, this study confirmed that the addition of molasses, urea, and yeast. Improved silage quality of two varieties of sweet potato vines silage including the control, with molasses as superior additive for both varieties in terms of silage, proximate composition and in vitro gas production. Molasses, urea and yeast are said to be recommended as additives in silage making using sweet potato vines.

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BACTERIOLOGICAL PROPERTIES OF TIGER NUT DRINK (KUNU AYA) SOLD IN SHEHU IDRIS COLLEGE OF HEALTH SCIENCES AND TECHNOLOGY MAKARFI, KADUNA STATE, NIGERIA

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Abstract

Kunu Aya (tiger nut drink) is regarded as one of the popular indigenous drinks produced mostly in the North. The research aim to determine the bacteriological properties of Kunu Aya sold in Shehu Idris College of Health Sciences and Technology Makarfi Kaduna State. Objectives included to determine the microbial properties, the bacteriological load of the drink, and the health implications associated with its consumption and to carry out intervention in educating the local beverage producers on hygiene practices. Study design was experimental. Four samples bought, coded (A,B,C, and D) are taken for bacteriological analysis. The result revealed the presence of staphylococci species, Eschericheria coli and Coliform in all the samples. Bacteriological load varies in ranges of 4.5×10^3, 5.0×10^3, 6.0×10^3 and 7.0×10^3 for Staphylococcus aureus in sample C,A,B, and D respectively. Coliform species was in the range of 1.3×10^4, 1.4×10^4, 1.0×10^4 and 1.8×10^4. Sample D had the highest coliform species while the least was in sample C with 1.0×10^4. Health issues associated with the consumption of these drinks include diarrhea, fever, stomach cramp which if not handled properly can be fatal. Hence, the need for producers and vendors of Kunu Aya to take hygienic measures in preparation, storage of the product to avoid food infection and intoxication associated with the micro-organism.

Introduction

In Nigeria, tiger nut juice (kunu aya) is regarded as one of the popular indigenous drink produced mostly in the North (Gaffa, Jideani, and Nkama, 2018). It is a traditional edible tuber which produce rhizomes from the base and tubers that are somewhat spherical, non-alcoholic beverage renowned for its thirst quenching properties (Elmahmood and Doughari, 2019). Kunu aya is consumed almost by all people because it is relatively cheap

and nutritious when compared to carbonated drinks (Adejuyitan, Adelekun.Olaniyan, and Popala, 2020).

Kunu is aya is made from cereal grains known as aya, otherwise called tiger nuts (*Cyperus esculentus*) (Mamudu, Hauwa, Agbara and Abdullahi, 2019). Garlic, pepper and ginger are some other ingredients which are added to enhance its flavor, while honey or sugar is also added to serve as sweetener. Cheesbrough (2016) reported that fermented cereals like ogi, burukutu, fura, kunu, etc. are particularly important as weaning foods for infants and as dietary staple for adults. The short shelf-life of kunu aya is however a major problem faced by its producer and consumers. A large number of lactic acid bacteria, coliforms, molds and yeasts cause spoilage in these drinks, thereby producing undesirable changes. Food pathogens such as Escherichia coli have been implicated in food poisoning resulting from their consumption. The effect of storage of kunu aya varies and the time lag during which the drink loses its nutritional property vary. Hence, there is a need to know the more appropriate method of storage, whether ambient or refrigerated, to reduce the incident of certain diseases (Olusola, Mariam, and Gloria, 2018).

The nutritional composition of kunu aya produced locally consists of 87-92% moisture, 3.19-7.86% crude protein, 0.37-0.75% crude fat, 0.93-1.20% ash and 2.69-5.84% carbohydrate per 100ml of kunu aya (Gaffa, Jideani, and Nkama, 2018). The most abundant amino acid is glutamic acid (4.49-11.66 g/100 g) with the least being cysteine (0.34-1.45 g/100 g) (Food and Agricultural Organization (FAO) Manuals, 2016). Research has shown that the lowest amount of amino acid except for tryptophan occurred when rice is used as substrate to produce kunu beverage (0.44-1.40 g/100 g) (Gaffa, *et al.,* 2018).

Also, among the amino acids, cysteine, valine, isoleucine and methionine are present in trace amounts when compared with FAO/WHO reference protein values (FAO, 2016). Considering the method of preparation of kunu which normally does not conform to standard preparation protocol and its nutritional constituents, kunu provides an ideal environment for the growth of food-borne microbial pathogens such as *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Salmonella* spp. among others (Bibek, 2018). Kunu can also undergo spoilage by fermentation processes carried out by indigenous microorganisms. Studies have shown that kunu contains lactic acid bacteria (LAB) such as *Lactobacillus* spp., *Streptococcus* spp. and *Leuconostoc* spp. that could cause spoilage (Osuntogun and Aboabo, 2016).

Other organisms that could cause spoilage of the food drink when present in large amount include *Staphylococcus* spp., *Candida spp*. and *Trichoderma* spp. (Osuntogun and Aboabo, 2016). Poor hygiene and preparation practices also introduce microbial pathogens in foods and have been implicated in causing food-borne illnesses. This constitutes an alarming development with significant public health consequences (United Food and Drug Administration (UFDA), 2017).

The production of kunu aya drink is still at village technology level where procedures and materials or ingredients used are always not standardized. In general, the process of production involves steeping the grains for 6-24 hours, wet milling with spices, wet sieving and partial gelatinization of the slurry (Oranusi, Umoh, and Kwaga, 2019). This is followed by addition of sugar and spices depending on the producer, such as ginger (*Zingiber officimals*) and alligator pepper (*Afromonium melegueta*) or red pepper (*Capsicum species*), or black pepper (*Piper guineense*). These serve as flavor and taste improver which are not quantified (Gaffa, *et al.,* 2018).

The sale and consumption of this locally made non-alcoholic beverage is on the increase in most cities in Nigeria with little attention being pay to the quality of this food product. Thus, this present work aimed at assessing the bacteriological properties of kunu aya sold in Shehu Idris College of Health Sciences and Technology Makarfi, Kaduna State. Though a nourishing beverage, it is a medium of microbial load (Wakil and Bibek, 2018). E.coli, S. aureus, enterobacter, yeat and molds. The beverages most especially accommodates growth of different species of bacteteria (Bibek, 2018), often responsible for food-borne illnesses in the form of food infections and intoxications which some can be fatal if not handled well.

Problem Statement

The consumption of locally made tiger nut drink (kunu aya) by both old and young people including market women and children at home pose serious health threats because these products are subject to microbial contamination as producers do not adhere to standard methods of preparation. They also lack information on the microbiological safety of ready-to-eat beverages and their health implications (Oranusi, Umoh, and Kwaga, 2019). The presence of *E. coli* indicates fecal contamination of finished products mainly at the point of preparation where untreated water is used. Other enteric and non-enteric pathogens may also thrive causing salmonellosis, *E. coli* infections, shigellosis, botulism, brucellosis, and other food-borne diseases (UFDA, 2017). In a developing country like Nigeria, the food safety, control and regulation agencies are plagued with myriad challenges that hinder their performance. As such, effective control on processing of hawked foods including locally made kunu drinks is not possible. This means that, the health implication of consuming these kunu beverages remain very high.

Materials and Methodology

According to Nafiu (2017), research methodology supplies the logic, procedures and processes for acquisition of data and processing of information. It is a system of explicit rules and procedure upon which a research is based and against which claims and knowledge is evaluated. This chapter therefore comprises of the research design, description of the study area, and population of the study, sample size/sampling technique,

instrument for data collection, validation of the instrument, reliability of the instrument, administration of the research Instrument and Procedure for Data Analysis.

Nafiu (2017) also stated that research design refers to the plan, structure, and strategy the researcher wants to adopt in finding answers to his/her research questions and probably test hypothesis formulated for the study. Therefore, the research design adopted for this study would be experimental method. Experimental designs are used to establish a cause-effect relationships among the variables of a study (Nafiu, 2017). The researchers adopted this method because it is more reliable in achieving actual results in a study.

Study Area

Shehu Idris College of Health Sciences and Technology Makarfi started in January 1954 as an infant and maternal welfare clinic in present day, known as family health unit in Tudun Wada, Kaduna. In 1988, the training of community nurses began and the name of the clinic was changed to Community Training Center (CTC). In January 1971, the three and half years training of community midwives started in the premises. In October 1977, the training of Community Health Nurses was merged with the taining of Sanitary Overseers that was taking place in the former Administrative Office (Magajin Gari). It was later taken to the present Tudun Wada Campus. The college was named School of Health Technology in line with the National Basic Health Services (NBHSS). In the new site, the college was developed following departments in Midwifery, Public Health, Community Health Assistants, Medical Laboratory Assistants and Pharmacy Technicians. In 1980-1981, the college conducted the training of community health aids while that of post-basic Community Health Workers was introduced between 1988-1989. The college was merged with two other schools; school of Dental Health Technology Unguwan Rimi and school of Technology Pambegua in 1999. Before that, in 1991, the school of Health Technology Pambegua was established within the premises of Primary Health Care Centres, founded in 1984. In 2003, the college was named Shehu Idris School of Health Technology Makarfi and later on in 2004, the school was renamed Shehu Idris College of Health Sciences and Technology Makarfi by Kaduna State Law No.8 (Student's Handbook, 2018).

Sample Collection and Procedure

The sample used for the study were obtained from four (4) different sellers within the study area. Sample was collected and labeled A, B, C and D and package in a bottle from each vendors and the samples collected were brought to the laboratory for analysis.

Isolation of Microorganisms

Nine (9) sterilized test tubes each containing 9m/s of distilled water was arranged in a test tube racks and labelled sample 'A' with dilutions 10^{-1}, 10^{-2}, 10^{-3} for each sample, 1ml of

the sample (kunu-aya) was taken and transferred into 9m/s of the first test-tube and also, 1ml from the first test tube was transferred to the second test-tube with dilution 10^{-2} and same process was repeated for the third sample and so for sample B and C. the samples were inoculated aseptically in nutrient and MacConkey agar. It was incubated at 37^{0c} for 24-48hrs after which the colonies appearing on the culture plates were counted and multiplied by the corresponding factors and reported as colony forming unit per ml. The discrete colonies were identified based on standard microbiological procedures (Student's Handbook, 2018).

Results

The microbial load of locally prepared Kunu Aya (Tiger nut) samples from fourth (4) sales outlets, sold within the college.

Table 1: Types of Microbial Properties in Kunu Aya (Tiger nut) sold in Shehu Idris College of Health Sciences and Technology Makarfi.

Microbial variable	Sample A	Sample B	Sample C	Sample D
Staphylococci	Present	Present	Present	Present
Escherichia coli	Present	Present	Present	Present
Coliform	Present but in little quantity	Present but in little quantity	Present but in little quantity	Present but in high quantity

Source: Researcher's Experimental Work, (2022)

Table 1 shows that staphylococci, Escherichia coli and Coliform species are present in all the samples. However, sample D has the highest colifrom bacteria. These coliform bacterias are not harmful. However, constant exposure to some of these can cause illness such as stomach upset, vomiting, fever and diarrhea. The presence of staphylococci could be from syrup, fermentation vessels and storage containers, sieves used for filtration, hands of handlers and even bottle in which it is packaged for sale. Therefore, there is need for high degree of sanitation during processing and packaging of the drinks.

Table 2: Bacteriologic Load of Kunu Aya sold in Shehu Idris College of Health Sciences and Technology Makarfi.

Variable	Staphylococcus species	Escherichia coli	Coliform species
Sample A	5.0×10^3	+ve	1.3×10^4
Sample B	6.0×10^3	+ve	1.1×10^4
Sample C	4.5×10^3	+ve	1.0×10^4

Sample D	7.0×10^3	+ve	1.8×10^4

Source: Researcher's Experimental Work, (2022)

Table 2 on the bacteriological load confirmed the presence of Escherichia coli in all the samples. It indicates fecal and environmental contamination. Sample D has the highest staphylococci species while sample C has the lowest followed by sample A and B respectively, while in coliform species, sample D has the highest and sample C the lowest, and sample B, then sample A respectively. The coliform bacteria can cause stomach upset, vomiting, fever and diarrhea.

Table 3: Health Implication associated with consumption of Kunu Aya sold in the campus

Microbial identification	Health implication
Staphylococcus species	Blood stream infection, pneumonia, joint infection
Escherichia coli	Stomach cramps, bloody diarrhea
Coliform species	Gastro-intestinal upset, fever, diarrhea

Source: Researcher's Experimental Work, (2022)

Table 3 shows the health implication of consuming contaminated Kunu Aya due to the presence of staphylococcus, Escherichia coli and coliform bacteria which shows the above health implication during the production and packaging by the producers which can be as a result of human contamination, fecal contamination and improper hygiene and handling by producers and vendors.

Discussion

The bacteriological analysis of the *kunu aya* (tiger nut) sample collected from four (4) different sales outlets revealed that some samples were contaminated with *E. coli*, *coliform bacteria, Staphylococcus spp.* The presence of these bacteria is of great danger to the public health, because these organisms have reported to cause food borne illness.

The sources of contamination could be as a result of unhygienic methods used in the preparation of the product, contaminated utensils, other sources could be due to air pollution such as dust and wind which can carry spores of bacteria from dirty environments. It can be concluded that kunu aya (tiger nut) or any form of kunu should be prepared carefully in a hygienic environment and packed aseptically before selling it to individual for consumption because of the danger or hazard involved in consumption of over stayed and contaminated drinks kunu aya (tiger nut).

Conclusion

The results of this study showed that the bacteria content of kunu drinks locally prepared and sold in the institution is high due to gross microbial contamination. The most predominant microbial pathogens were *E. coli*, colifrom bacteria, and *Staphylococcus spp*. The results of this study also showed that although, the microbial counts in these drinks are not within the standard limit of $<10^5$ cfu/ml for aerobic mesophilic bacteria in food, and does not conform to that stipulated by the Food and Drug Administration (FDA, 2018). Hence, there is need for regular monitoring of the local production protocol by the food safety agencies and sensitization on the importance of good hygiene and sanitation during preparation and processing of kunu and other drinks in order to reduce microbial contamination to acceptable level and improve the final product quality.

Recommendation

In order to minimize the bacteriological properties of kunu aya consumed in the study area, Environmental Health Officers should launch a sensitization campaign for both the sellers and consumers of kunu aya on the need for proper handling, good hygiene practice within environments where kunu aya is produced, personal hygiene of makers and vendors, sanitized processing environment with clean equipment used for the collection and storage.

More research should be carried out by a joint collaboration of Environmental Health Workers, Nutritionists, Dieticians and Agriculturists to identify the health effects associated to the consumption of kunu aya in other states within the country in order to educate the populace on the dangers of improper handling and consumption of contaminated kunu aya in the country.

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MYTRANSCRIPT: AN ACADEMIC TRANSCRIPT DECENTRALISED WEB APPLICATION SYSTEM BASED ON THE ETHEREUM BLOCKCHAIN

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ABSTRACT

MyTranscript is an academic transcript web application built on blockchain technology. The system leverages the Ethereum blockchain to create a decentralised academic transcript database whose aim is to simplify academic transcript sharing among network participants (the Institution, the Student, and an Employer) while providing the security benefits of a decentralised system. For privacy reasons, the system implements a restriction to only allow an Employer access to records he has been permitted to view. This access is given only by the Student whose record is concerned. However, the Institution have unrestricted access to Students' academic transcript. The system is built on the latest software technologies: Node.JS, REACT, Truffle etc., that enhances security and provide intuitive user interfaces for better interactions among its participants. The immutability, unique hashing algorithms, timestamps and transparency provided by a blockchain network makes records stored and generated on this system trustworthy and prevents the occurrence of counterfeits documents being distributed by cyber criminals. The testing phase of the development cycle was done immediately after each system logic function was implemented to avoid the debugging difficulty that comes with ambiguous codes, using dedicated JavaScript tests libraries: chai, mocha, and chai-as-promised. The application was built to be responsive, so, page contents were optimised and arranged to display perfectly across the different device screen sizes the system was tested on. The result during system use performed as expected, although, there is a significant drop in speed during activities involving the system interaction with the blockchain. All other activities, such as page navigation, exam record arithmetic, and page preview had no noticeable delay with response occurring instantaneously.

Keywords: Blockchain, Ethereum, Transcript, Decentralised system, Intuitive User Interfaces, Hashing algorithms

INTRODUCTION

A blockchain network is a peer-to-peer network in which a peer (also known as a miner, node, or bookkeeper) is in charge of transaction validation, block generation, and block validity verification. A bigger number of network peers must agree on a network rule not just to certify the authenticity of transactions in a block, but also to force a newly produced

block to follow the predetermined agreement. To put it another way, all peers must adhere to a recognized consensus mechanism to guarantee data integrity without the need to determine if a node in the network is trustworthy or malicious. The most common consensus protocols are Proof-of-Work (PoW), Proof-of-Stake (PoS), and Practical Byzantine Fault Tolerant (PBFT)." (Lamport, Shostak, & Pease, 1982)**.**Blockchain technology births a new generation of applications, commonly referred to as *decentralized applications* (DApp), which can for example; support the execution of cross-organizational business processes. In a few years of its inception, these technological innovations have become a trend to follow. International leaders, its members and organizations are starting to look meticulously at the application of this technology, and some have already adopted it. The crux of this "innovative technology is the production of immutable trustworthy records without the need of a trusted third party." (Lemieux, 2017). According to Redman (2016), it is a technology to watch.

In most school worldwide, documenting and issuing student's transcripts are traditionally done uploading the results in a central server and printing the downloaded transcript when required in a paper format which will be sent to a demanding party by a trusted courier service company. This process takes time, is bound for counterfeiting and costly.

For the following reasons, a blockchain system for academic transcripts will solve the aforementioned issues:

1. Transcripts, both unofficial and official, are recorded on a distributed ledger so that participants (school and employer) may access them from anywhere in the globe through the internet. In the local scene, students can view their academic transcripts at their leisure while remaining confident in their authenticity. For employers wishing to view employees' academic records they can simply request the transcripts from the concerned student via the application and be rest assured that supplied information is genuine.

2. Transcripts stored on a distributed ledger are tamper-proof; because it is difficult to update transcript data in numerous nodes at the same time, a malefactor cannot edit a transcript by himself.

3. It saves time and money and ensures document reliability and accessibility over the internet.

LITERATURE REVIEW
BLOCKCHAIN ARCHITECTURE

Figure 1 depicts a class diagram of a general blockchain network, which includes the basic components of peer (miner, node, or bookkeeper), consensus, and blockchain. "The application program interface (API) is a basic class that allows clients to connect with the blockchain network. Clients can be designed as a desktop, internet, or mobile application that permits users to conduct transactions after seeking IDs." (Nguyen, 2018)

Figure 1: Blockchain class diagram

Blockchain

A block is a storage vessel for transaction and meta data. A block header is used to hold meta data. In the Bitcoin blockchain, for example, a block stores hash value, preceding block hash value, nonce, date, size, number of transactions, block difficulty, and so on. A block also contains a list of transactions, which might be legitimate or invalid based on the blockchain solution's design. A blockchain is therefore a series of blocks linked together by pointers that are represented by the hash values of the blocks before them. "Because changing a single bit of data in the current block will affect the hash value of the preceding blocks, this design assures that data in the current block cannot be modified. It decouples not just the present block from the next block, but also the next block from the block after that, and so on, in a sequential manner." (Nguyen, 2018)

Figure 2: Blockchain

THE ETHEREUM BLOCKCHAIN

For the sake of the decentralized application we'll be building later in this paper, it is pertinent to discuss the Ethereum blockchain as it is the blockchain technology our application will be built on.

Vitalik Buterin and his colleagues suggested Ethereum as a solution for a new blockchain platform to construct decentralized apps in 2013 (Ethereum Wiki, 2015). The goal was to provide a "platform for creating smart contracts, automating company payment processes, and a "world machine" or environment for executing smart contracts."

To understand how the blockchain state is recorded within a block, we explore the core components below.

Ethereum Virtual Machine (EVM)

"The Ethereum Virtual Machine (EVM) is a sandbox and run-time environment for smart contracts that are loaded on Ethereum network nodes (miners)" (Wood, 2015). Because EVM is separated from the host machine's network, file system, and other processes, hackers cannot gain control of it to modify smart contracts. Solidity is a programming language for creating smart contracts, which are then converted into EVM bytecode and published to the Ethereum blockchain using Ethereum client software.

Gas and Payment

Each transaction on the EVM includes a fee that a requester must pay to a miner that hosts the EVM in order for the transaction to be completed. A miner is paid in Ether to validate transactions, execute chain codes, and produce a new block to update the status of the Ethereum network. The term "gas" is used to describe the total cost of all EVM operations. A sender specifies a gas limit and price for each transaction to indicate the charge that the sender is prepared to pay for the miner to perform the transaction. The gas limit and price are calculated in Wei (ethereum's smallest unit), with 1 Ether equalling 1018 Wei" (Wood, 2015).

Smart Contract

A smart contract is an agreement between accounts on the Ethereum network to actualize a transaction when a pre-defined set of criteria in the contract are satisfied. The phrase "smart contract" refers to a contract that may be used to initiate a transaction without the intervention of any other party. A smart contract is, in reality, a software program written in the Solidity programming language that is subsequently compiled to bytecode and published to the Ethereum blockchain. "This bytecode is performed in isolated EVMs that are deployed on Ethereum network dispersed nodes. When a smart contract is submitted, no one can change the code because it is protected by the Ethereum blockchain's security features."

Account

The Ethereum network has two types of accounts: external and contract accounts. An external account is comparable to the Bitcoin network's wallet idea, which allows users to

submit transactions to the network. A contract account is a storage location for smart contracts that run on EVMs. "A contract account executes the chain code (smart contract) on behalf of people, whereas an external account is where humans interact with the Ethereum network" (Dannen, 2017).

Characteristics of an external account include: Ether balance (ETH), Ability to make transactions, Controlled by a private key, No contract code.

The contract accounts have the following characteristics: Ether balance (ETH), Keep contract code in the memory, Can be triggered by an external account or another contract account sending a message, Can perform complex operations when executed, Possess no owner after release to the EVM, Possess their own persistent state and have the ability to activate other contracts.

RELATED WORKS

- Student Academic Record Management System (Eludire, 2011). The solution suggested here is based on a centralized database server. It has the ability to keep track of pupils' academic records. However, it was incapable of generating academic transcripts.
- "Students Record Analysis and Examination Result Computation Algorithm" (Osagie & Mallam, 2014). The application proposed here was capable of processing students' results, however, like Eludire's system, it was incapable of generating academic transcripts.
- "A Centralized Transcript Processing System" (Omogbhemhe & Akpojare, 2018) built on a MySQL server database. The system was comprehensive and processed students' transcript as intended. However, it lacked the trustworthiness and transparency a decentralised database would have provided.
- Gradubique (Nguyen, 2018), which is a Blockchain-based academic transcript database. Gradubique was built on Linux Hyperledger Framework (HLF), unlike Ethereum which is a permissionless (i.e. participation is allowed to all members on the internet) Blockchain, HLF is a permissioned (i.e. participation is restricted to a select network) Blockchain, and is most suitable for B2B transactions.

METHODOLOGY

This section describes the implementation of a web-application that stores and retrieves student academic results over the Ethereum blockchain network.

We have chosen to build this Decentralized Application (DApp) on the Ethereum blockchain because ethereum is a platform for many other blockchain solutions. Several blockchain solutions run on the Ethereum blockchain, for this reason, it is the most popular blockchain network that favours the development of DApps and has extensive development/usage resources on the internet.

DESIGN ANALYSIS
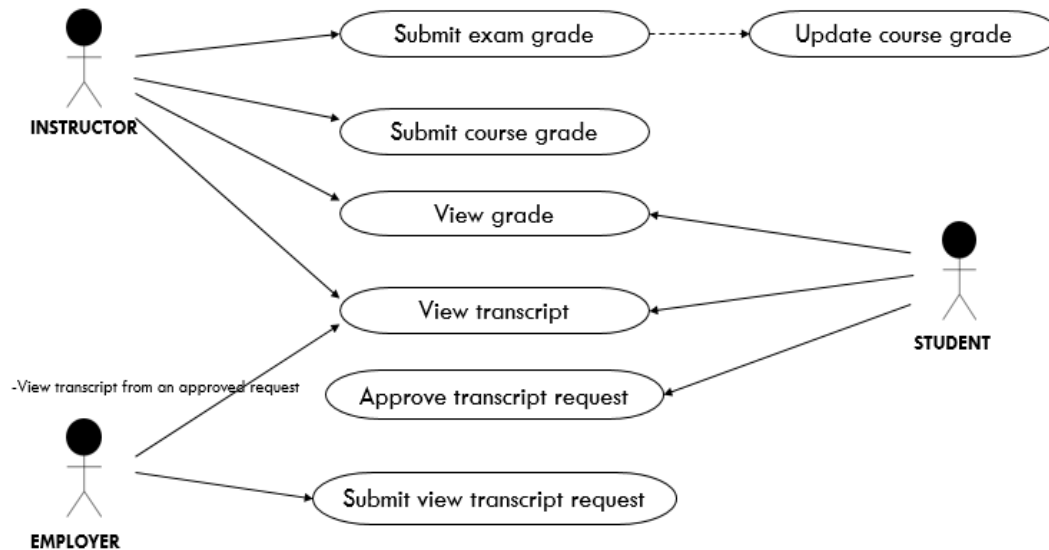
Figure 3: Use case diagram

Figure 3 above describes the use case diagram for the system.

SELECTION OF MATERIALS

This section describes the technologies that make up MyTranscript and the reason behind the selections of the technology.

NODE.JS

One of the core dependencies we have chosen to build this application with is Node.js. "Node.js is a server-side framework for creating fast and scalable network applications that is built on Chrome's JavaS6cript runtime. Node.js is lightweight and efficient because it employs an event-driven, non-blocking I/O architecture. It's ideal for data-intensive real-time applications that operate across several devices."

Node.js also comes with a large library of JavaScript modules, which makes it easier to construct web applications that rely heavily on Node.js.

TRUFFLE

Truffle is the most widely used Ethereum programming framework. We have chosen Truffle for the following reasons:

1. Smart Contract Lifecycle Management – Truffle takes care of maintaining smart contract artifacts automatically. Support for bespoke deployments, library linking, and complicated Ethereum applications is also included.

2. Automated Contract Testing – Truffle allows automated tests to be written for contracts in both JavaScript and Solidity, and facilitates fast contracts development.
3. Scriptable Deployment and Migrations – Truffle fosters dapp's evolution and ensures that contracts can be maintained far into the future.
4. Simple Network Management – Truffle allows the developer focus on dapp development while it manages all network artifacts.
5. Powerful Interactive Console – Truffle provides an interactive console that allows the developer interacts with his built smart contracts using powerful Truffle commands. This greatly saves development time.

GANACHE
Ganache is a personal Ethereum Blockchain for deploying contracts, developing dapps, and running tests. We have chosen to use Ganache for the following reasons:
1. It is available as both a desktop application as well as a command-line tool.
2. Ganache is a popular Blockchain development tool with wide range of online resources that can prove useful for reference during personal development.
3. Ganache has good visual mnemonic and well defined account information that allows one to quickly see the current status of all accounts, including their addresses, private keys, transactions and balances.
4. Ganache also provides a comprehensive Blockchain log output and responses that are vital debugging information.
5. Ganache has a built-in block explorer and powerful mining settings.

REACT
"React is a JavaScript library for building user interfaces. React makes it easy to create interactive user interfaces." We have basically chosen React for its ability to create interactive user interfaces. By simply designing views for each state of our application, React automatically updates and renders components when state data changes.

INSTALLING THE DEVELOPMENT DEPENDENCIES
This system was developed on a Windows 10 computer system. The following installation methods discussed are that for Microsoft Windows 10 operating system.

Node.js Installation
Node.js can be downloaded directly from the node.js website by simply navigating to https://www.nodejs.org/en/download/. To get the most recent default version, click the Windows Installer icon. The most recent version at the time this project paper was produced was node-v16.13.1. The NPM package manager is included in the Node.js

installation. After installation, open the download link in your browser and double-click the file, or navigate to the folder where the file is saved and double-click it to run it. Run the software when prompted by the system and follow the window prompts to install the software package.

To verify the installation, open a command prompt (or PowerShell), and enter the following commands:

> ***node -v***   *//The system should display the Node.js version installed*
>
> ***npm -v***   *//The system should display the NPM version installed*

Truffle Installation

Installing Truffle requires that Node.js was successfully installed along with the Node Package Manager (NPM) that comes with it. NPM is the world's largest software registry and is used by open source developers and organizations to share, borrow and manage software packages.

To install Truffle, open a command prompt and enter:

npm install -g truffle

Ganache Installation

Ganache can be installed on a Windows operating system by simply navigating to https://www.trufflesuite.com/ganache/ and clicking on the ***DOWNLOAD (WINDOWS)*** button to download the *.appx* package. Next, run the package and follow the window prompts to install the package.

React Installation

This project makes use of React, React-DOM, and React-router-DOM. I have created a project directory that would be a container for the Transcript application. This folder holds all of the dependencies used throughout this paper. All command line activities are also performed within the project directory.

To install React, React-DOM, and React-router-DOM, open a command prompt and enter the following command:

npm install react react-dom react-router-dom react-bootstrap --save

The packages can also be installed individually as shown:

npm install react --save

npm install react-dom --save

npm install react-router-dom --save

npm install react-bootstrap --save

React-router-dom makes it possible to create multiple page react applications by allowing routing through different components when there is a change in state; e.g. a clicked button or link, a selection etc.

React-bootstrap is a react package that makes it possible to add styling to the application without the need to have a separate style sheet(s). This is an easier and faster way to create user interfaces that are organized and coloured nicely.

Git Bash Installation
Git Bash is a Microsoft Windows program that acts as an emulation layer for the Git command line interface. Bash is an acronym for Bourne Again Shell. Commands on Git Bash are of Linux type which is my most preferred method of interacting with a computer system via the command line interface.
Git Bash can be installed with the procedures given below:
1. Download the Git Bash setup from the official website: https://www.git-scm.com/
2. Download the installer.
3. Run the .exe file and follow the instructions in the installer.
4. Right-click any folder and pick the Git Bash Here option from the context menu to launch Git Bash (right-click menu).

Chai and Mocha test packages Installation
Mocha is a Node.js-based and browser-based JavaScript test framework. Asynchronous testing, test coverage reports, and assertion libraries from any source are all possible with Mocha.
Chai is a BDD (Behaviour Driven Development) / TDD (Test Driven Development) assertion library for NodeJS and the browser that can be delightfully paired with any javascript testing framework.
For the sake of this project I have installed chai-as-promised from the chai library along with chai and mocha. The below command line installs the aforementioned:
npm install mocha chai chai-as-promised --save-dev
The above package can also be installed individually as with React.

SETTING UP THE DEVELOPMENT ENVIRONMENT
With all development dependencies installed, the next step is to set it up for use in the Transcript project. The following paragraphs describe the procedures to setting up the development environment.

Create React App
The first step is to create the react app. This process creates new directories and files essential for building the projects' client side application.
To create the react app, navigate into the project directory via the command prompt and run the following command:
npx create-react-app my-transcript   *//creates a react app named my-transcript*
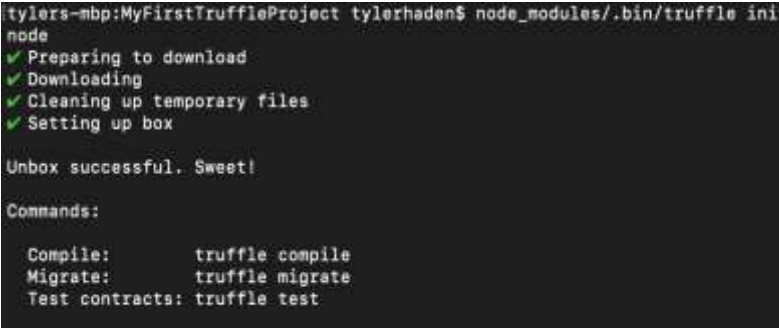
The above command creates a **client** directory within which a number of other directories and files .

Truffle Initialization

The next step is to initialize Truffle by typing *truffle init* into the command window (Git Bash in my case) and hitting the Enter/Return key
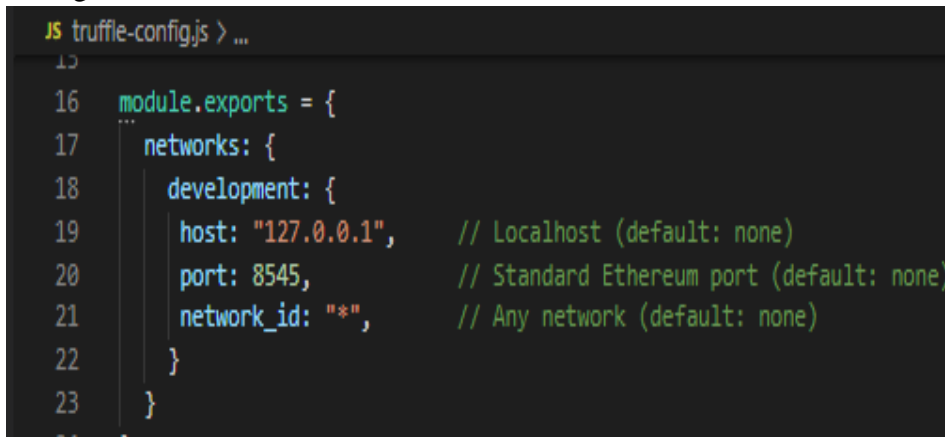

Figure 43: "truffle init" operation as shown in the CLI

NOTE: Truffle initialization is done within the client directory created by the react app. This is necessary to prevent files, directories redundancy that results from initializing npm. Within the project directory, Truffle Initialization (truffle init) produces three folders (contracts/, migrations/, and test/), as well as three files (Migrations.sol, 1 initial migrations.js, and truffle-config.js). The following is a list of the folders and files created:

- **contracts/** stores all Solidity (.sol) files. Any smart contracts, libraries, or interfaces required at compilation time are included here.
- Migrations.sol is a complete, fully functional Solidity smart contract. Truffle uses it to verify that a project's deployment to the blockchain is completed in the correct order.
- **migrations/** will store truffle "deployer" Javascript files. Every time a contract is deployed, it is important to tell truffle which one, and what constructor arguments is needed.
- **1_initial_migration.js** is the Migration contract's deployment script. Because it does not require library linking or constructor parameters, it is the most basic sort of deployment.
- **test/** Depending on the testing language used, it may contain.js or .sol files. It starts off empty, and the developers must place their test files here.
- **truffle-config.js** is the most important setting for a Truffle project. This is where we specify which networks to utilize, how much gas to use, which addresses to use, and a few other parameters.

Truffle Configuration

The truffle configuration file is truffle-config.js, and it is situated in the project directory's root directory. This is a Javascript file that can run any code required to build a setup. As

demonstrated in the screenshot below, it exports an object that represents my project settings.

```js
JS truffle-config.js > ...
15
16    module.exports = {
17      networks: {
18        development: {
19          host: "127.0.0.1",      // Localhost (default: none)
20          port: 8545,             // Standard Ethereum port (default: none)
21          network_id: "*",        // Any network (default: none)
22        }
23      }
```

Figure 5: truffle-config.js file showing the network objects

The Network object (default values given) indicates which networks are accessible for deployment during migrations, as well as transaction settings to use when dealing with each network (such as gas price, from address, etc.). If no transaction settings are supplied for a network, the following values will be used by default:

- **gas:** Gas limit used for deploys. Default is 4712388.
- **gasPrice:** Gas price used for deploys. Default is 100000000000 (100 Shannon).
- **from:** From address used during migrations. The first accessible account given by your Ethereum client is used by default.
- **provider:** Default web3 provider using host and port options: new Web3.providers.HttpProvider("http://<host>:<port>").
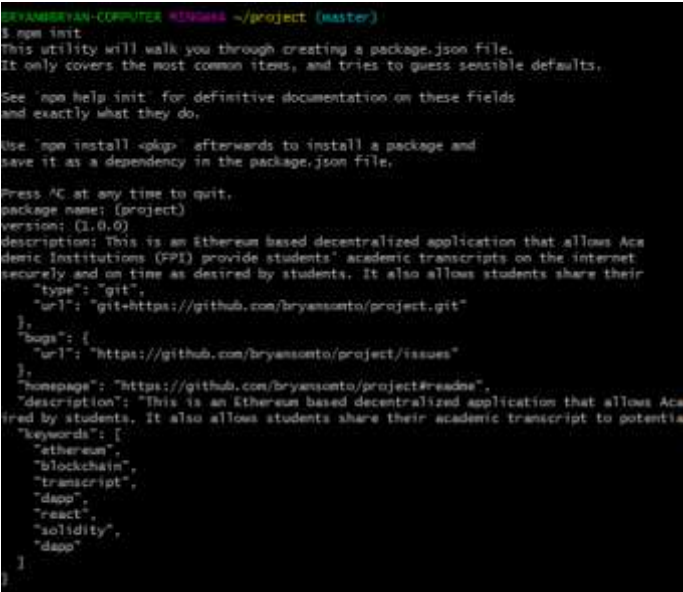
The truffle-config.js file can contain multiple network configurations, but in general, only one network can be worked with at a time.

NPM Initializer (npm init)

The project's package.json file is created by the npm init command. Any Node project's package.json file is its beating heart. It keeps track of key metadata about a project that is necessary before it can be published to NPM, as well as functional properties that npm utilizes to install dependencies, run scripts, and identify the package's entry point. It also contains metadata for the project such as version number, author, and description.

Not all fields are included in the bundle. Although json will be used in this project, I may get some significant advantages by capturing information about the program in its package.json. An example of such benefit is a case where I accidentally lose the node_modules folder for this project. By simply running "npm install" in the command line interface, npm will automatically scan the package.json folder and Install the

dependencies with their exact versions from there. The npm init command creates a package.json file for your project's frontend as shown below;

Figure 6: "npm init" operation as shown in the CLI

Setting up Ganache

It is necessary to set up the Ethereum client (Ganache) for this project. Any interaction made with truffle that is concerned with this project will require that Ganache is running. Some of those interactions include: contract migration, contract deployment, contract compilation, and contract testing.

Ganache GUI was set up through the procedures shown below:
- Open Ganache by double-clicking (left) the Ganache icon.
- Under WORKSPACES, left-click NEW WORKSPACE to select.
- Input a desired name in the WORKSPACE NAME column.
- Under the TRUFFLE PROJECTS column, left-click ADD PROJECT. This will open up the file browser window
- Navigate to the Project directory and select the **truffle-config.js** file. Double-click to select (left) or left-click and click open to select.
- The selected file will be seen within the TRUFFLE PROJECTS column.
- On the top right corner click SAVE WORKSPACE to save changes.

NOTE: The NETWORK ID, HOSTNAME and PORT NUMBER can be set under the SERVER tab.

MetaMask Installation

Metamask is a browser-based cryptocurrency wallet that works with Chrome, Firefox, and Brave. It's also available as a browser add-on. This implies it acts as a link between

standard web browsers and the Ethereum Blockchain. MetaMask is a software cryptocurrency wallet used to interact with the Ethereum blockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications. MetaMask can be used on Chrome, Firefox and Brave browsers. The following steps were followed to download the MetaMask extension on Chrome browser.

- Visit https://chrome.google.com/webstore/category/extensions?hl=en-GB on a chrome browser.

NOTE: The link above lands you on the Chrome web store page in the extensions category.

- In the "Search the store" bar, input metamask and hit the Enter/Return key.
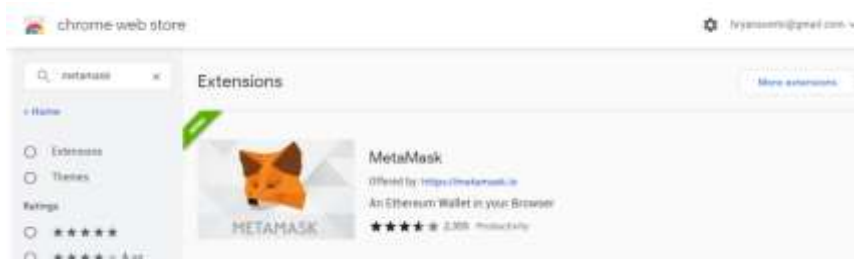

Figure 4: MetaMask Installation

- Left-click to select the app (shown in the figure above).
- Click on "Add to Chrome" to download the browser extension.

MetaMask provides an option to change from the Ethereum Mainnet to the network used by the Ethereum Client (Ganache). By changing to the network used by Ganache (Localhost:8545 as configured for this project) it is possible to import the accounts on Ganache and even make transfers to other accounts on the network.

THE SMART CONTRACT
Smart contracts are contracts that exist across a decentralized, distributed Blockchain network. They are self-executing contracts whose terms of agreement are directly written into lines of codes. This section focuses on the smart contracts' – logic, writing, compilation, migration and deployment.

Writing the Smart Contract
It is necessary to determine the functions required of the MyTranscript application before writing the smart contract. This will make the development process faster, precise and help the developer write functional contracts that meets the clients' needs.

The smart contract for the MyTranscript application is named *Transcript.sol*. The extension ".sol" tells us it is a solidity file. *Transcript.sol* has the contract called *Transcript*

and comprises a few globally and locally declared variables, constructors, structs, events, and functions.

A **constructor** in solidity is a special function declared using the constructor keyword. It is used to initialize state variables of a contract. When you build a contract, the constructor code is only run once.

A **struct** is a container-type structure like arrays, lists etc., however unlike its counterparts, structs allows a user store group of elements with different type.

An **event** in solidity is an inheritable member of a contract. It is emitted, and the parameters are saved in transaction logs on the blockchain, which are accessible via the contract's address while the contract is active.

Function like in every other programming languages are grouped code that are reusable and can be called anywhere in a program. In solidity however, there are four types of functions: *external, internal, public and private.*

- Internal functions may only be used inside the context of the current contract and cannot be used in other situations.
- External functions are invoked from the outside and through transactions as well.
- Private functions are only accessible within the contract in which they are invoked.
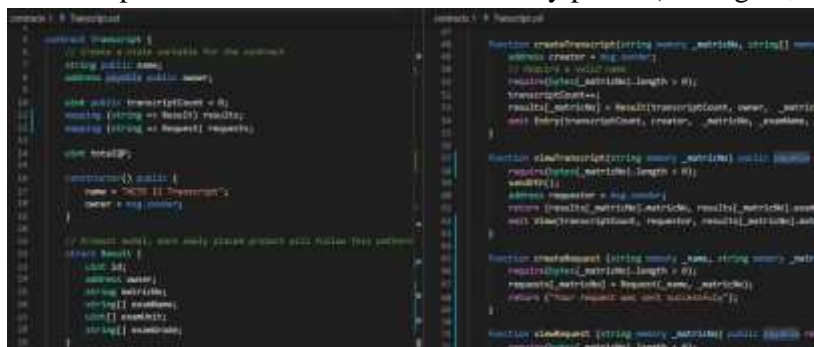- The public functions are called from any place. (BitDegree, 2021)

Figure 85: Transcript.sol

The figure above shows some of the smart contract terms discussed under this this section. It is worth noting some functions written in the smart contract as they perform the operations required of the smart contract.

- **createTranscript** function provides the functionality that allows a Lecturer/Examiner create and submit the details for a student academic transcript.
- **viewTranscript** function provides the functionality that enables the lecturer and student view their academic transcript.
- **createRequest** function provides the functionality that allows an Employer make a request to view a student transcript. This request is sent to the student and is only available to the Employer if the concerned student approves the request.

- **viewRequest** function provides the functionality that enables a student view pending transcript requests from potential Employers.
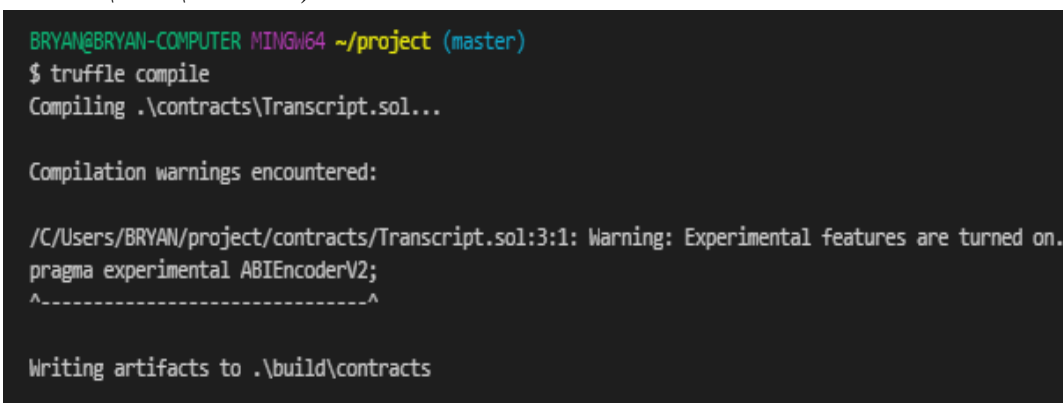
NOTE: Contracts (*Transcript.sol)* in solidity is saved in the *contracts* directory created during truffle initialization (*truffle init*).

Compiling the Smart Contract

After writing *Transcript.sol*, the next step is to compile the contract. Solidity is a high level programming language, hence, the need for compilation. Compilation converts the high level solidity code into bytecode (the language used by the Ethereum Virtual Machine).

Compilation is done via the command line interface (CLI). The following steps were taken to compile the contract:

- In a CLI window, navigate to the project directory
- In the project directory, input ***truffle compile***
- If compilation succeeds, a new *.json* file will be added to the build\contracts directory as shown in the last statement below (*Writing artifacts to .\build\contracts*)

```
BRYAN@BRYAN-COMPUTER MINGW64 ~/project (master)
$ truffle compile
Compiling .\contracts\Transcript.sol...

Compilation warnings encountered:

/C/Users/BRYAN/project/contracts/Transcript.sol:3:1: Warning: Experimental features are turned on.
pragma experimental ABIEncoderV2;
^-----------------------------^

Writing artifacts to .\build\contracts
```

Figure 96: Compiling the smart contract

- If compilation fails, an error ("*Compilation failed. See above."*), and the source of the error is displayed in the CLI.

Testing the Smart Contract

Using the test packages installed earlier (chai, mocha, chai-as-promised) we can test the smart contract. The goal of testing the smart contract is too find gaps, errors, or missing requirements in comparison with the actual requirements. By writing test codes, we can test the solidity functions by passing parameters where necessary and observing the behaviour of the function while making necessary adjustments until they meet the actual requirements.

```
describe('transcript', async () => {

    before(async () => {
        entry = await transcript.createTranscript('h/cte/19/0554', ['CTE 413', 'EEC 312'], [2,3], ['A','B'])
        transcriptCount = await transcript.transcriptCount()
    })

    it ('creates transcript', async () => {
        assert.equal(transcriptCount, 1)
        // console.log(entry.logs)
        let event = entry.logs[0].args
        assert.equal(event.examName[0], 'CTE 413', 'Course code is correct')
    })
})
```

Figure 70: Test code sample

Figure 16 above shows a snapshot of the *Transcript_test.js* file stored in the test directory of our project folder. The snapshot captures a test for the *createTranscript* function in the smart contract. Parameters such as the student matric number, course codes, course unit and grade are sent as parameters to the functions and tested to ensure it behaves as required. If not, necessary adjustments are made until the user is satisfied.

Migrating the Smart Contract
A migration file is created for each contract written. Migration files are JavaScript files that aid in the deployment of Ethereum contracts. These files are used to stage deployment tasks, and they are written with the assumption that deployment requirements will change over time. As your project grows, you'll need to write fresh migration scripts to keep up with the blockchain's progress. (Truffle, 2021)
truffle migrate //run migrations
NOTE: for migrations to run successfully, the Ethereum client must be running.

DEVELOPING THE CLIENT SIDE APPLICATION (MyTranscript)
This section describes the client application. The client side application or (front-end application) provides the interface the application users (Examiner/Lecturer, Student and Employer) interacts with during usage. Information about all the application package dependencies and the respective versions used can be viewed from the *package.json* file. The following sub-sections describes the client side application logically:

Connecting to the Ethereum Clients' API (MetaMask)
A central application that connects the Blockchain network with the client application is necessary to allow users interact with the smart contract. This central applications makes the functions written in the smart contract accessible via the user interface, it processes payments associated with performing transactions specified in the smart contract, and outputs transaction receipts to determine transactions status.
The function code that provides the connection is written on the client side application with the **web3.js – Ethereum JavaScript API**. Web3.js is a set of libraries that let you

use HTTP, IPC, or WebSocket to communicate with a local or distant ethereum node. (web3.js, 2016)

Interacting with the Browser Console

In the process of application development, it is a given the developer will encounter errors no matter how experienced. How to deal with this errors (debug) greatly affects the speed of development and help actualize neat codes.

Debugging for web applications (especially JavaScript) has been made easier thanks to modern browsers with informative and advanced debugging tools. Google Chrome browser is my preferred browser, its debugging console can be accessed via *Menu > More tools > Developer tools* or with the shortcut key *Ctrl + Shift + I*. React generates its error messages to help developers easily debug errors on the console. However, to observe code behaviours, the element(s) can be logged to the console manually by adding **console.log**(*element*) to the line of code.

As this is a dynamic web application that handles data and performs arithmetic and logic calculations on those data, interaction with the console was heavy. It was necessary to generate pages and values, and observe their behaviours so as to create page functions that meets requirements.

Also, during connections to the Ethereum clients' API (Application Program Interface) it is necessary to ensure all parameters (network, wallet address, smart contract methods, etc.) are observed via the console to ensure its general behaviour meets requirement.
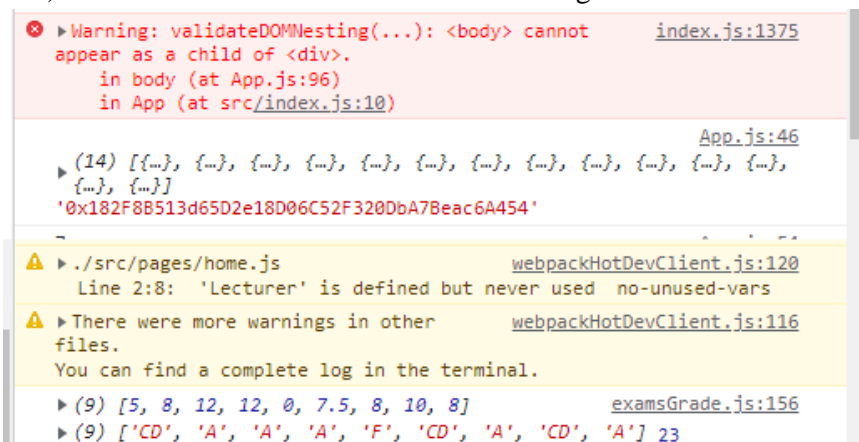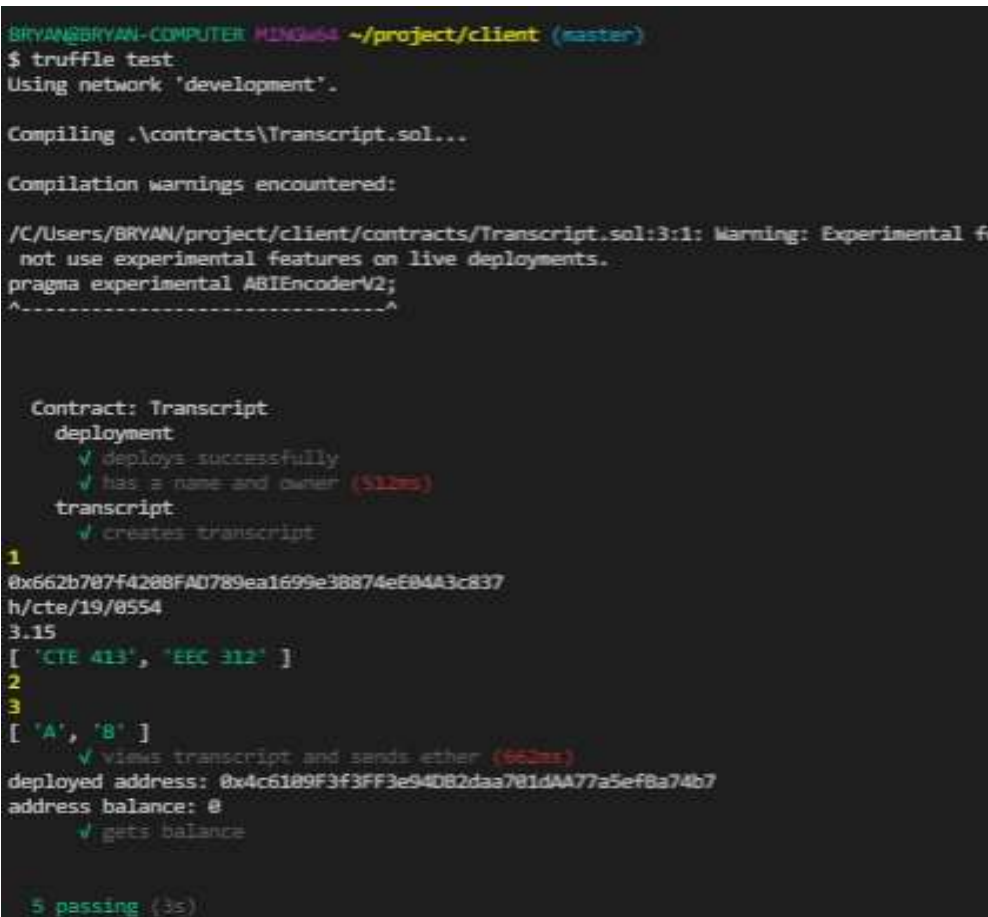

Figure 81: Developer console

Figure 11 shows a snapshot of Chrome browser developer console. Warnings on the console are shown in red and yellow. Warnings in red are fatal and will halt program flow until they are resolved. Warnings in yellow does not affect program flow and can be ignored. The white row (top) shows sets of arrays logged to the console. They can be expanded by left-clicking on them to get a detailed view. *'0x182F…'* shows the account

wallet address currently used by the application. The white row (bottom) shows some values (grade points, grade, unit total) being logged to the console to observe its behaviour.

RESULTS AND DISCUSSION
Performance Test

Figure 12 below shows a snapshot of the smart contract functions being tested by the JavaScript test file. Tests were made to ensure; the smart contract deployed successfully, has a name and owner, creates transcripts, views transcripts etc. From the snapshot, tests descriptions can be seen after the green tick (shows a test pass). The *"5 passing..."* at the end, indicates all five tests passed. Other information shown are values logged to the truffle console for further observations.

Figure 12: Running the smart contract test

Presentation of Results

The following figures show some important pages and operations result of the *MyTranscript* application:

Figure 93: Enter exams grade

Figure 14: Grades preview
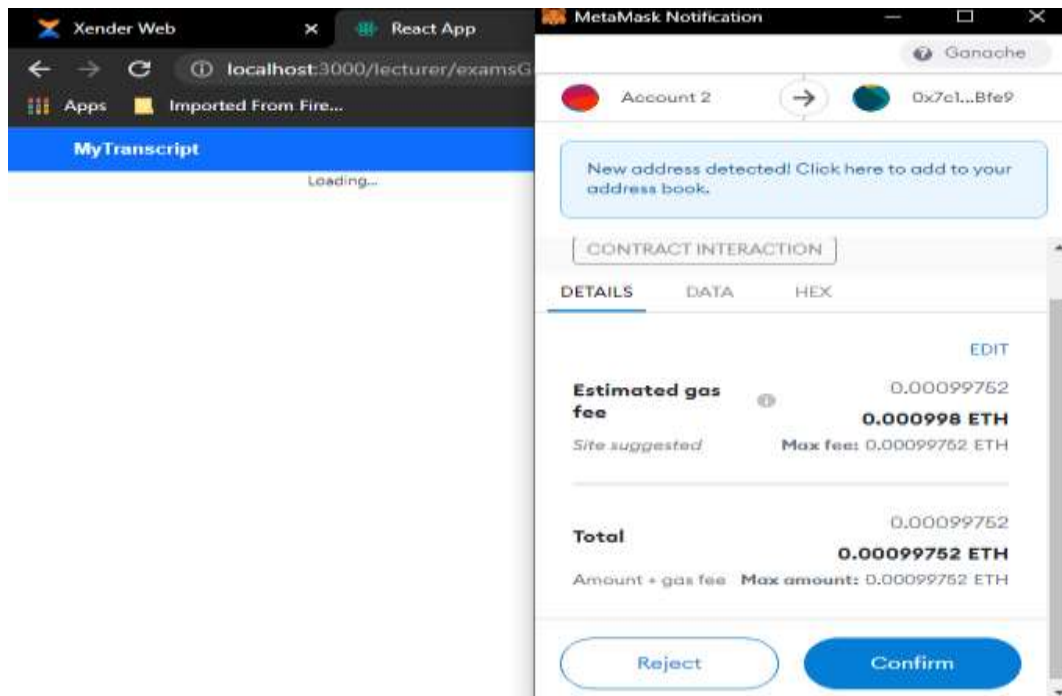
Figure 105: MetaMask transaction notification
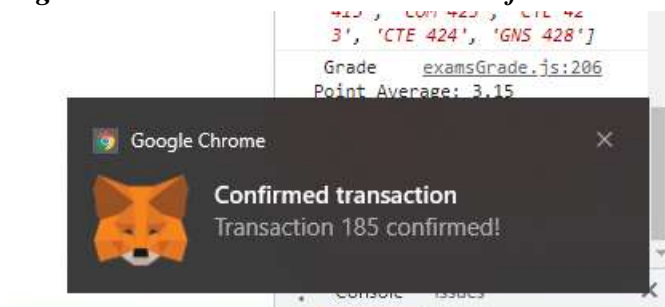
Figure 11: MetaMask popup to confirm transaction success
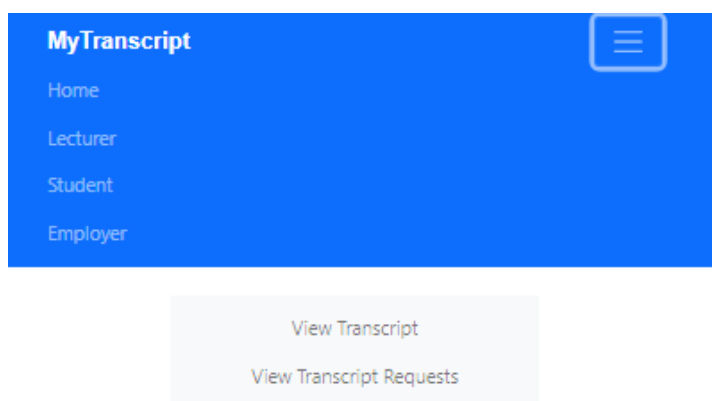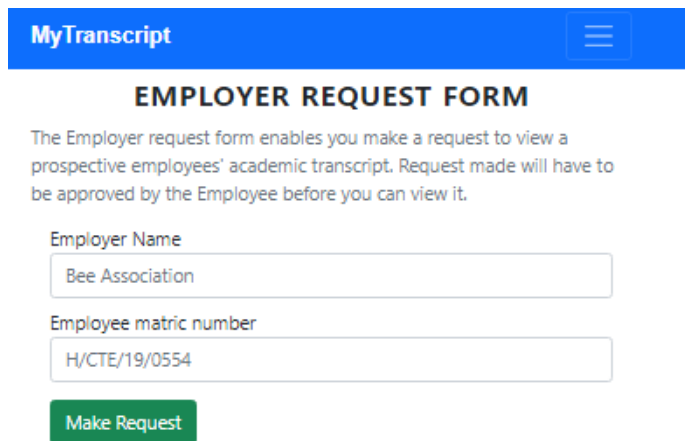
Figure 17: Student page

Figure 18: Employer request page

Discussion of Results

The MyTranscript decentralized web application was built using JavaScript and JavaScript Extensible Markup Language (which React is based on) on the client side to perform its logic and arithmetic functions where necessary. The user interface was styled with React Bootstrap CSS (Cascading Style Sheet) library and a few of my own locally written CSS. MyTranscript provides three major navigation options; *Lecturer, Student and Employer*.

The *Lecturer* page is subdivided into three main categories and provides a Lecturer or an Examiner the option to perform the functions listed below:

- **View Grade Scheme**: this provides the interface to view course information (code, unit, and title) of the two semesters. It is a page that is readily available to its users, hence, providing a way to access course information on the go.
- **Enter Exams Grade**: this provides the interface that enables the user input a students' academic grades for all courses. Like the *view grade scheme*, it provides the option to also switch between semesters and input its associated grades. On submission of inputted grades, a preview page with all entered information is shown to enable the user confirm all information provided were correct. On further submission, an alert box is displayed to inform the user of the Blockchain interaction and requests the users' intervention. On confirmation, the submitted information is processed on MetaMask and saved to the Blockchain.
- **View Transcript:** this allows the user view students' academic transcript previously saved on the Blockchain.

The *Student* page is subdivided into two main categories described below:

- **View Transcript:** this provides the functionality to allow students view their academic transcript.

- **View Transcript Request:** this provides the student with the functionality to view all requests made by Employers who have requested to view their academic transcript. This function gives the students privacy control over how their academic records are shared on the internet.

The *Employer* page provides the interface to allow Employers seeking to view a student academic record. The Employer fills the request form, and on submission, the student-of-interest can view the request and choose to (or not to) approve the request.

CONCLUSION AND RECOMMENDATION
CONCLUSION

The *MyTranscript* application is a web based decentralised application that employs a considerably large implementation of modern technologies involved in application development on the web. Technologies like NodeJs, Truffle, Ganache and React were the fundamental building block of this project.

In application development, it is good practice and necessary for the developer(s) to subject the application to potential use cases within the application scope in order to observe the application functionality from the end user perspective. For this reason, *MyTranscript* employs the Chai and Mocha test frameworks to ensure its functionalities were tested and behaves as required. The test frameworks employed makes up the application development dependencies.

RECOMMENDATION

The success of a product largely depends on the resources invested in it. The *MyTranscript* application can be made much more powerful by incorporating a centralised database management system to handle creation and storage of user accounts. This will enable institutions, students and employers to create user accounts which are stored on the centralised database and used to sign in to the application. Using the centralised database management system in conjunction with the Blockchain will facilitate detailed user tracking, allow application extensibility (provide an enabling environment for growth), and most importantly reduce the application interactions with the smart contract which in turn will save a lot of Ether (money) used in processing transactions and save application load time.

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EFFECT OF JOB STRESS ON PERFORMANCE OF EMPLOYEES IN KEFFI LOCAL GOVERNMENT SECRETARIAT, NASARAWA STATE.

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Abstract

Employees are expected to perform their duties diligently to enhance work ethics in their respective units by coming up with something good and unique but this is often not achieved in practice because job stressors like workload, depression and salary have seriously impacted on performance of employees with an alarming increase of economic consequences. The objective of the study is to investigate the effect of job stress on the performance of employees in Keffi Local Government (KLG). Survey method was used and data was collected using a well structure questionnaire which was analyzed using Descriptive Statistics and Regression Analysis to test the formulated hypotheses with the aid of statistical package for social sciences (SPSS) version 22 for analysis of data and a sample of 150 respondents using Taro Yamane's simplified formulae. The results showed that workload, depression and salary are positively related to performance in KLG with statistical significance. The study concluded that job stressors affects employee performance. In light of these, the study recommended that management of the KLG should ensure that job stress is reduce through employing qualify and professional personnel to reduce the workload, build recreational centre for relaxation and adequately equip it to alleviate the depression and encourage employee to go for annual leave, employees should be made aware of any changes in salary and give room for contributions to improve performance and seminars, workshops should be organized for employees'.

Keywords: Employee, job, performance, stress and stressor.

Introduction

Employees in any organization are essential assets to their organizations but stress is a common challenge that affects their performance. Administration of local government in a state are among the group of activities that face tremendous challenges due to antecedents of stress, employees perform different job in their units. The influence of job stress on humans' psychological and physiological well-being has been reoccurring in numerous organizations. Stress refers to emotional problems such as anxiety, depression,

low self-esteem, anger that interfere with employee performance in an organization. Job stress is one of the universal challenge influencing several employees around the globe. It is an organizational disease that creates emotional disruption either physically or psychologically that jeopardize the work ethics. Indeed, stress is beneficial to the organization if it is not excessive but if it is excessively and employees are struggling to cope with the situation then emotional problems might occur. Robbins (2001) cited in Ehsan & Ali (2019) asserted that stress is a dynamic condition in which an individual is confronted with an opportunity, constraint or demand related to what the individual desires and for which the outcome is perceived to be both uncertain and essential.

Job stress in a local government administration is increasingly becoming an essential issue due to the fact that employees have different perception about it. Indeed, job stress is beneficial to the organization if it is not excessive but if it is excessively and employees are struggling to cope with the situation then emotional problems might occur which can influence their performance. Also, job stress can be a positive or negative challenge which depends on the employee perception about it and employees see it as a positive challenge if it improves their performance and yield significant satisfaction while, if it cannot yield any significant satisfaction it becomes a negative challenge. Vijayan (2017) asserted that job stress is an outcome or response to certain stimuli in the environment and it has become more apparent and leads to low morale of employees.

Job performance of employees in local government administration especially Keffi has different factors to figure out and the quality of services offered in the local government varies significantly and every stakeholder has a unique role to play towards attainment of the organizational goals. The service quality of institutions change with time and every institution has a rare quality to play to achieve (Ahmed et al. 2020). Employee performance has always been a concern of every organization for their survival and sustainability of work ethics in the organization. Also, performance of organization depends on the knowledge and ability of its employees toward understanding the dynamism in the market (Ogbu and Osanaiye, 2017). Aguinis (2009) cited in Addai, Amoako & Adu-Gyamfi (2017) asserted that performance is about behaviour or what employees do and not what employees produce or the outcomes of their work. Meneze (2006) cited in Ehsan and Ali (2019) asserted that performance is the employee's ability to produce work or goods and services according to the expected standards set by the employers or beyond the expected standards. Performance has several variables that determine it and if the variables are critically solve it can improve the quality of services in the organization with minimal stress.

Employees are expected to come up with something good and unique to attain their goals but job stressors like workload, technological changes, time pressure, health condition and low salaries have significant effect on their performance. Keffi local government has employ several strategies for managing stress such as giving of special welfare package,

training, good working conditions, delegation of authority, payment of salaries on time, among others, despite all these efforts, job stress has seriously affected the employee performance with an alarming increase of economic consequences.

The objective of the study is to investigate the effect of job stress on the performance of employee in KLG. Besides, the study seeks to attain the following specific objective which includes:

(i). Assess the effect of workload on performance of employee in KLG.

(ii). Determine the effect of depression on performance of employee in KLG.

(iii). Assess the effect of salary on performance of employee in KLG.

(iv). Determine the effect of insufficient-training on performance of employee in KLG.

The following hypotheses were developed and tested:

H_{01}: Workload has no significant effect on performance of employee in KLG.

H_{02}: Depression has no significant effect on performance of employee in KLG.

H_{03}: Salary has no significant effect on performance of employee in KLG.

H_{04}: Insufficient-training has no significant effect on performance of employee in KLG.

The significance of this study in alleviating the stressors in today's competitive environment will benefit the employee and other stakeholders in the study area and beyond.

Literature Review

According to Ahmed, Maku and Hassan (2020) stress is an emotional problems such as anxiety, depression, low self-esteem, anger that interfere with employee performance in an organization. Erimife (2020) asserted that stress is part of human life and every living organism undergoes series of stress as a result of daily activities. Ehsan and Ali (2019) asserted that stress is a universal element and individual in every walk of life have to face it. Stress is not tangible and cannot be touched which makes it complex phenomenon (Ayodele, 2014). Job stress can interfere with work ethics, environmental factors and employee perception either negatively or positively due to external or internal factors.

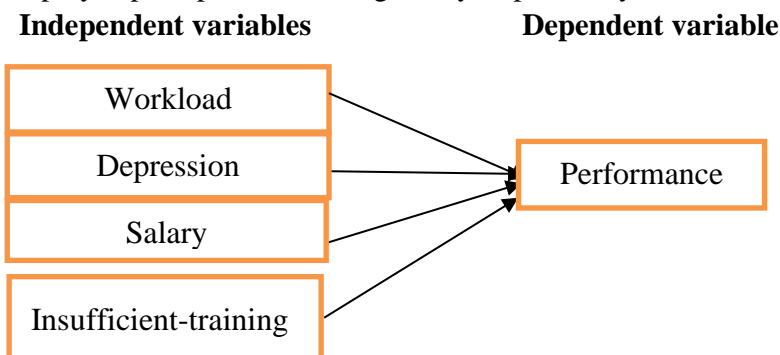**Independent variables**　　　　　**Dependent variable**

Figure 1: Conceptual framework

Workload is the actual amount of work that can be assigned to a particular worker or machine in specified time. Employees are given opportunities to demonstrate their competencies towards improving performance in their various unit using different strategy with minimal stress and maintain cordial relationship. Mohammed and Mohammed (2012) asserted that the behaviour of an individual result from conscious choices amongst options whose purpose is to maximize pleasure and minimize pains. Depression is a state of mind that lower the enjoyment of work and inability to be creative. Employees are expected to be innovative and creative whenever an opportunity is given to them to improve organizational performance. The perceived adequacies or inadequacies of employee conscious understanding of the work ethics will definitely give different descriptions about the depression which posed a great threat to the organization. Salary is the amount of money paid to an employee on a monthly basis to encourage an employee to meet the challenges posed by the work ethics in the organization. Insufficient training can make an employee to be idle due to the required skills to perform a task.

Employees working in the local government usually experience different job stress in the course of discharging their responsibilities in their various units. A few related theories underpinnings from which the study is grounded is adopted as theoretical framework and these include Transactional Theory of Work-related Stress, Psychological Job Control Theory and Social-technical System Theory.

The transactional theory of work-related stress laid the foundation for managing stress between an individual and their environment. It asserted that stress is the direct product of a transaction that threaten the general wellbeing of the parties involves in the transaction. Also, it is associated with exposure to particular workplace scenarios. According to Lazarus et al. (2001) cited in Pezaro (2017) it is the appraisal of transaction that offers a causal pathway that may better express the nature of the underlying psychological and physiological mechanisms which underpin the overall process and experience of stress.

The psychological job control theory entailed that a job with high demands and low control will lead to stress. Therefore, an understanding of how an employee carryout organizational tasks with high demand job that require high control and what the job require to enhance performance can reduce stress significantly. Kihara and Mugambi (2018) opined that job control theory has the perceptions of job control over work hours and perceived job autonomy. Besides, employees that their job is highly demanding usually experience significant level of stress.

The social-technical system theory described a holistic approach to workplace, it recognizes the interaction between employees and technology in workplace. Also, if number of employees is less than the require responsibilities in the organization then work overload may surface while, if the number of employees is more than the require responsibilities in the organization then high chance of resources to be scrambled may eventually emerge among the employees which can gradually create conflicts in the

organization. According to Trist (1981) there are two compulsory and complementary subsystems that assist the organization to operate smoothly. The social and technical subsystems are complementing each other towards reduction of job stress however, the social subsystem involves the employees while technical subsystem involves the technical resources that assist employees to work.

Empirical studies on job stress are numerous within the context of employee performance to enrich the existing literature however, Ahmed et al. (2020) carried out a research on effect of job stress on academic staff performance in Federal Polytechnic Nasarawa (FPN) with the aimed to investigate the impact of job stress on academic staff performance in FPN. Survey method was used with a population of 487 respondents and a sample of 220 respondents. The results showed that workload, technological changes, time pressure, health condition and low salaries are positively related to performance in FPN with statistical significance. The study concluded that job stressor affects academic performance in FPN. One major shortcoming with Ahmed et al. (2020) as observed by the current study was the used of academic staff to represent the entire employees without justification this alone would not be sufficient and justifiable for a study of this magnitude. Ehsan and Ali (2019), conducted a research on the impact of work stress on employee productivity with the objective to investigate the impact of work stress on employee productivity of employee of Faisalabad bank in Pakistan. Stratified random sampling technique was used to select fifty participants. Regression and correlation method was used to analyze the research hypotheses. The study revealed that there is significant relationship between work stress and employee's productivity in banking sector. It was recommended that the supervisors and managers need to explore the causes of the dissatisfaction of employees within the working environment. One major shortcoming with Ehsan and Ali (2019) as observed by this study was the used of stratified random sampling technique to select sample without justification. Consequently, it may be difficult to generalize these findings.

Kihara and Mugambi (2018), conducted a research on effect of stress management strategies on employees' performance in the public service with the objective to evaluate the influence of stress management strategies on employees' performance. Descriptive analysis and multiple linear regression model was used to study the relationship between stress management strategies and employees' performance with a population of seven hundred thousand respondents and a sample of four hundred. The study discovered that all variables studied indicated a significant effect on employees' performance of public service while, regression model indicated a positive relationship between employees' performance and the factor variables studies of relaxation techniques and counselling services. It was recommended that the management of the organization under study should create awareness to the employees to enable them be aware of utilization of stress management strategies available in the organization that can improve performance. One

major shortcoming with Kihara and Mugambi (2018) as observed by this study was the methodology used to obtain the sample was not justified, the policies to manage the stress in each organization cannot be generalized this alone would not be sufficient and justifiable for a study of this magnitude.

Bala et al. (2017), conducted a research on impact of job stress on employee performance with the objective to analyze the impact of job stress on employee performance. The study used regression for the analysis of data with a population of 310 respondents. It was revealed that time pressure and role ambiguity have significant and negative influence on employee performance while workload and lack of motivation do not have any significant influence on employee performance. The study concluded that increasing time pressure and role ambiguity would reduce employee performance in all aspects. Managers and supervisors are strongly recommended to discuss the time allotment and task completion dates and duration of the task with their subordinates to avoid time pressure. One major shortcoming with Bala et al. (2017) as observed by this study was the methodology used to obtain the sample was not justified, the duration was not clearly specified and the policies to manage the stress in each sector cannot be generalized, this alone would not be sufficient and justifiable for a study of this magnitude.

Addai et al. (2017), conducted a research on the effect of work stress and its relationship with employee health with the objective to assess the effect of work stress and its relationship with employee health. A descriptive approach was employed with a population of forty employees and a sample of thirty-six using Krejcie and Morgan formula. It was revealed that factors that bring about stress include lack of training to make work easier, work demands that outweigh abilities, working under poor working conditions, the risk factor associated with the work of employees, working under pressure from superior and dissatisfaction with job. The study concluded that can be managed ability to take mind off things, involvement in exercises, employee ability to understand their situation and talking over problems with colleagues at work. It was recommended that Sunyani West NHIS should invest in work stress which in return can pay huge dividends both in terms of reduced stress-related cost and increased job performance. One major shortcoming with Addai et al. (2017) as observed by this study was the methodology used to obtain the sample was not justified, the duration was not clearly specified and the policies of Sunyani West NHIS for managing stress cannot be generalized, this alone would not be sufficient and justifiable for a study of this magnitude.

Methodology

This study adopted a survey method. The survey population of this research consists of 400 employees of KLG. The choice of this population was based on the location and the general activities in KLG that require a unique services. The primary instrument used for

the collection of data for this study is the questionnaire which was administered and retrieved the same manner from a sample of 200 respondents.

The study sample was determined by Taro Yamane's simplified formulae for proportion, which is widely accepted in management sciences. The Yamane (1967) formulae is n = N/1 + Ne². Where: **n** is the calculated sample size, **N** is the population size, and **e** is the acceptable sampling error and the choice of 0.05 level of significance is purely and exclusive decision of the researchers.

Thus, $n = \dfrac{400}{1 + 400(0.05)^2}$ $n = \dfrac{400}{1 + 400(0.0025)}$ $n = \dfrac{400}{1 + 1}$ $n = \dfrac{400}{2}$ n = 200 respondents

The regression model is:

P = β₀ + β₁W + β₂D + β₃S + β₄I + μᵢ

Whereas:

P = Performance, W = Workload, D = Depression, S = Salary, I = Insufficient-training, b₀ = Intercept or Constant, β = Slope of the regression line with respect to the independent variables, μ = error term and i denotes cross-sectional dimension.

Results and Discussion

This section contains the presentation, analysis of data and the discussion of findings. The administered copies of questionnaire were designed in line with the research questions, objectives and hypotheses in order to ascertain the relationship among the different adopted variables of job stress in KLG.

Table 1 Return Rate of Respondents

Responses	Questionnaire Administered	Questionnaire Not Returned	Questionnaire Returned	Percentage of Total Questionnaire Returned
Works	50	5	45	25.3
Accounts	50	6	44	24.7
Personnel	50	7	43	24.2
Health	50	4	46	25.8
Total	200	22	178	100

Source: Field Survey, 2022

Table 1 shows response from the questionnaires administered to employees in KLG which shows that each of the units or departments was given 50 questionnaires respectively. Furthermore, 25.3% of the questionnaires collected are from works department, 24.7% from accounts department, while 24.2% of the respondents were from personnel

department, 25.8% of the respondents were from health department. 178(89%) of a total questionnaires administered was retrieved.

Table 2 Demographic Characteristics of Respondents

Variables	Respondents' Category	Freq.	Percentages
Gender	Male	122	68.5
	Female	56	31.5
	Total	**178**	**100**
Age	Below 30 years	34	19.1
	31-40 years	65	36.5
	41-50 years	35	19.7
	51 years and above	44	24.7
	Total	**178**	**100**
Qualification	Senior Sec. Sch. Certificate	67	37.6
	B. Sc. and Equivalents	89	50.0
	Postgraduate	22	12.4
	Total	**178**	**100**
Experience	Below 10 years	92	51.7
	11 – 20 years	64	36.0
	Above 21 years	22	12.3
	Total	**178**	**100**
Staff cadre	Top Management	19	10.7
	Middle Management	69	38.8
	Low (Line) Management	90	50.5
	Total	**178**	**100**

Source: *Field Survey, 2022*

Table 2 displayed the demographic characteristics of the respondents of this study. The table showed that 122 respondents representing 68.5% are male while 56 of them representing 31.5% are female, these responses showed preponderance of male more than female in KLG. The age brackets of these respondents showed that 34 are below 30 years of age representing 19.1% while 65, representing 36.5% being between the ages of 31 and 40 years. 19.7% and 24.7% of the respondents are between the ages of 41 and 50 and above 51 years respectively. Further revelation by the table is that 67 of these respondents representing 37.6% are secondary school certificate holders. Besides, 89 of them representing 50.0% are holders of first degree and equivalents. Also, 22 or 12.4% are postgraduate degree holders therefore, it shows that most employees in KLG have first degree and equivalents educational qualification. The breakdown showed that the working

experience of 92 employees representing 51.7% of the total respondents are below 10 years, 64 representing 36.0% of the total respondents are within the range of 11 – 20 years and 22 representing 12.3% of the total respondents are above 21 years, this implies that a good number of employees have more working experiences in the KLG. In addition, the table also revealed the different cadres of the respondents to include top, middle and low managements. The breakdown showed that 19 or 10.7% are top management, 69 respondents representing 38.8% make up the middle management and 90 respondents representing 50.5% are low management.

Table 3 Model Summary

Indicator	Coefficient
R	0.896
R²	0.871
Adjusted R²	0.820
Std. Error of the Estimate	0.312

Table 3, shows the goodness of fit between performance and workload, depression, salary and insufficient-training are sufficient. Also, R= 0.896 portrays simple correlation while R² = 0.871 indicates the four variables studied while, factors not studied is 12.9%. Besides, 87.1% variation in workload, depression, salary and insufficient-training concert the employees' performance. Also, adjusted R² = 0.820 indicates coefficient of determination. The standard error of estimate = 0.312 is the result factors outside this study.

Table 4 Analysis of ANOVA Variance

Indicator	Sum of Squares	Df	Mean Square	F	Sig.
Regression	433.847	4	433.847	2627.791	0.000
Residual	29.058	173	0.165		
Total	462.905	177			

The results of ANOVA in Table 4, shows the data is optimal and the model is acceptable. Therefore, workload, depression and salary influenced employees' performance in KLG.

Table 5 Regression Coefficient Results

Variable	Beta	Std. Error	T	Sig.
Constant	0.781	0.081	2.941	0.756
W	0.834	0.108	2.719	0.583
D	0.683	0.071	4.241	0.532
S	0.743	0.103	3.417	0.678

I	0.869	0.069	5.289	0

Table 5, indicates the relationship between performance in relation to workload, depression, salary and insufficient-training as shown in: $P = 0.781 + 0.834W + 0.683D + 0.743S + 0.869I$. Also, a strong positive relationship exists in the study variables as shown by a positive constant of 0.781.

Conclusion and Recommendations

Workload, depression, salary and insufficient-training are strongly related to performance of employees' in KLG with statistical significance. The findings showed that workload, depression, salary and insufficient-training destabilize employees' performance. It was concluded that workload, depression, salary and insufficient-training positively affects the performance of employees' in the selected departments in KLG.

Recommendations were made based on the findings and conclusion:
(i) Management of KLG should ensure that job stress is reduce through employing qualify and professional personnel to reduce the workload.
(ii) Management of the KLG should build recreational centre for relaxation and adequately equip it to alleviate the depression and encourage employee to go for annual leave.
(iii) Employees should be made aware of any changes in salary and give room for contributions to improve performance.
(iv) Seminars and workshops should be organized for employees' to improve performance of employees'.

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DESIGN AND IMPLEMENTATION OF ENERGY SAVER FOR AUTOMATIC ROOM LIGHT CONTROLLER WITH VISITOR COUNTER

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ABSTRACT

This paper titled design and implementation of Energy Saver for Automatic Room Light Controller with Visitor Counter. With limited energy resources, it is the need of time to revolutionize the traditional methods of counting visitors to control the electrical appliances. This paper describes the development and implementation of visitor counter along with automatic room light controller. As a visitor enters the room, the count is incremented by one and the lights are switched on, while the counting is decremented if a person leaves the room. Microcontroller is used in this design due to suitability and accessibility of the component and other components. This project design also helps to reduce human efforts. Also it is very useful to conserve resources. In nowadays world, there is a continuous need for automatic appliances. With the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life. Also if at all one wants to know the number of people present in room so as not to have congestion. The concept of an automatic room light controller counter can be built upon not just for household usage but tor such settings as hotels, schools, hospitals, industrial purpose or businesses. In conclusion, this project is successfully designed and implemented and it should be encouraged and put into large scale manufacturing because of its various advantages.

Keywords-- *Energy saver, visitor counter. Microcontroller.*

INTRODUCTION

The advent of microelectronics in 1959 by Jack Kilby, gave rise to the birth of both linear and digital circuits like Operational Amplifiers, Voltage Regulators, IC Timers, Combinational Logic, Structural and Sequential Logic ICs among a host of other digital system components. The control and automation of human counters for hotel rooms, Cinemas, Schools, and conference halls processes can be realized using a microcontroller integrated with an infrared sensor, which senses the passage of human beings and detects them and counts (Boylestad, 1996).

The discovery of the microcontroller in 1972 marked the beginning of micro program control in electronics. Microprocessors like 8080, 8086, 8088; Pentium, etc., were employed for program control of batch counters in the 20th century but microcontrollers became more preferable for such embedded .applications for control systems in contrast to the microprocessors which are better for general purpose applications. Other devices which may be similarly used for such control operations are programmable logic devices (PLDS) Such as Complex Programmable Logic Devices (CPLDs), Field Programmable Gate Array (FPGA) among a host of other devices, This automatic room light controller with visitor counter contains Sensors (Infrared Sensor) formed with a combination of infrared LEDs, while the digital readout was formed with 16x2 Liquid crystal display (LCD) (Edje et al., 2015). The control mechanism of this ARLFC with BVC is realized through a micro program control. The micro program which is the driving software is written in Ct+ language and flashed into the PIC16F876 microcontroller. By using the sensors and its related circuit diagram the system can count the persons in a given area, put ON/OFF lights automatically.

Due to the present day geometric increase in population of people in schools, seminar halls and places of learning and research, they become highly patronized. Hence, inability of knowing the exact number of people going in and out becomes a problem which may result to over population, temperature increase inside and people time wastage in searching seat before they can sit, and also courses electric power wastage, these are a few among numerous disadvantages this problem may cause.

Aim and Objectives of this Design
The aim is to Design and Construct energy saver for automatic room light controller with visitor counter.
The objectives are as follows:
  i.   To minimize wastage of electricity in our homes, schools, colleges etc by provide an energy saving room light controller.
  ii. To provide a means of counting number of people in a particular room hence saves time and labour.
To automatically switch ON and OFF a light in a particular room rather than manual switching.

PROJECT DESIGN CONCEPT
The main aim of this project is to design and implement of energy saver with automatic room light controller with visitor counter and display system. Therefore, the heart of this project is microcontroller which include the hardware and software parts. The hardware Which is the circuit design of the device, with the aid of a circuit design simulator called *proteus-VSM*. This makes the circuit design easier and allows one to simulate the system,

detect problems and make appropriate corrections before the actual construction. Writing source code for the microcontroller would be the next stage.

The circuit consists the following units;

   i. Regulated Power Supply
   ii. Processing unit (PIC16F1877A)
   iii. PIR Proximity Sensor
   iv. Display Unit.
   v. Switching Circuit Unit

In designing this project the block diagram shown in Fig.1, shows the above mention sections of each unit, which explain the project design methodology that will be used.
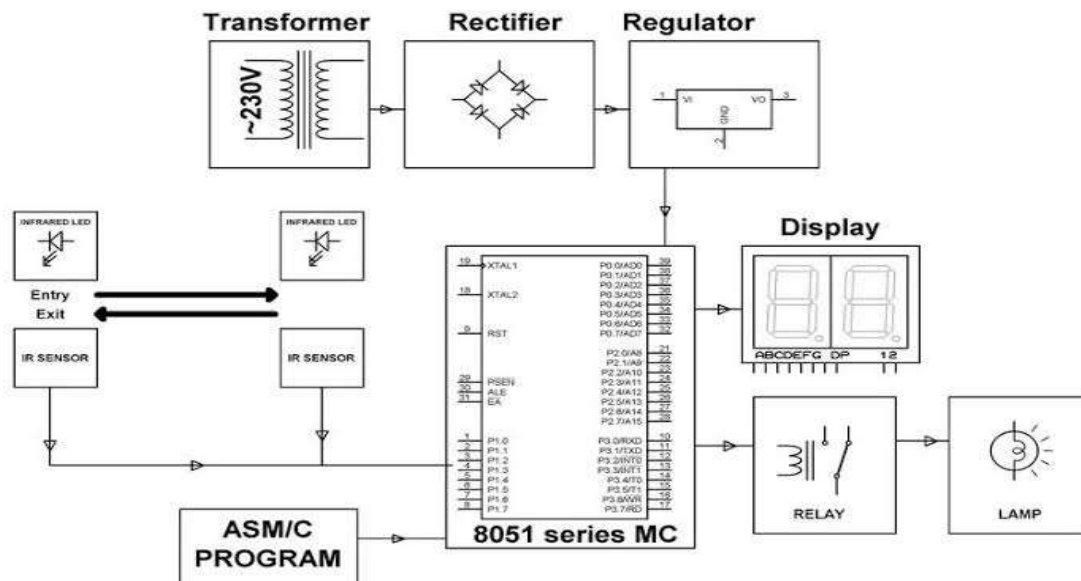
Fig 1: Block Diagram Automatic room light controller with visitor counter

i) Regulated Power Supply

This section contains the regulated power supply for the circuit operation, most electronic devices require dc voltage to operate. The more readily available source of power is the 240AC, 50Hz outlet. Where a de voltage is required, a dc power supply circuit is employed to convert the ac voltage to a de voltage during the process the sinusoidal ac waveform is converted to a semicircle dc waveform by the rectifier with ripples filtered by the capacitor.

In this project the power used in the circuit is 5volts for the microcontroller with other components, and 12volts for operating the motor and the relays. Hence, the power supply unit consist of a 220/240V, 50Hz, 500mA, DC: 12 x 2 step down transformer, rectifier and regulators.

ii) Processing Unit (PIC16F18 77A)

From the block diagram above, PIC16F877A serves as a heart for the project action that control all the input and output interfacing units. It is a Low-power (operating within 5V and 25mA sink/source current handling capabilities), high-speed Flash type with 256 byte EEPROM.

The PIC16F877A is a low-power, high-performance CMOS 8-bit microcontroller with 4Kbytes of In-system Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is Compatible with the industry-standard 16F876 instruction set and pin out. The on-chip flash allows the program, memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile8-bit CPU with-In-system programmable flash on monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly flexible and cost-effective solution to many embedded control applications.
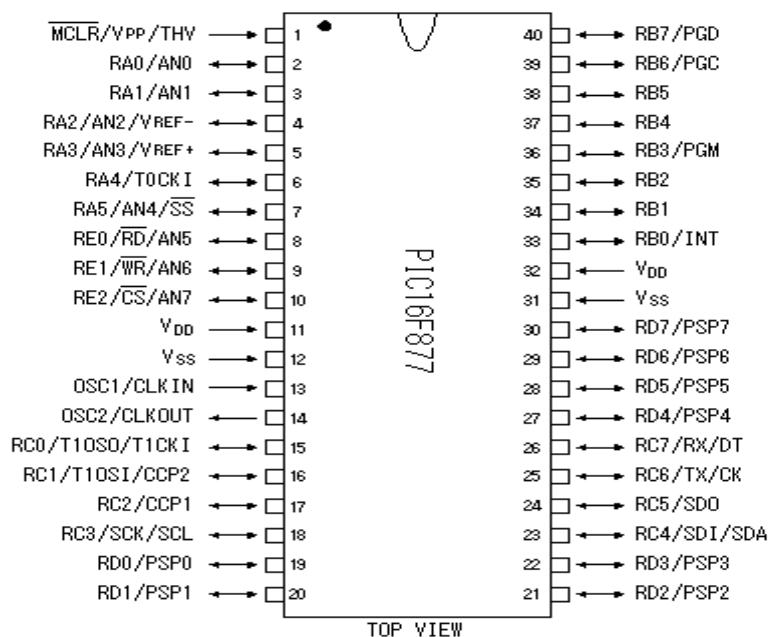
Fig.2. PIN Diagram of PIC16f877A

a. EEPROM

It is a memory used for storing important data that must not be lost if power supply suddenly fails, The PIC16F876A is made up of up to 256 X 8 bytes of EEPROM data memory. For instance the EEPROM stores the personal identification number which is compared with the user input so as to activate the port to which the door relay is connected.

iii. PIR Proximity Sensors

For visitor detection, two Passive Infra-Red (PIR) proximity motion sensor HC-SR501 were used. Operating voltage range of sensor is from 4.5V to 20V and the power is provided through the supply unit described in first section. Delay time and block time of the sensors are adjustable. The sensing range of HC-SRSOI is about 120 degrees up to the distance of seven meters. Though the linear range is useful for most practical scenarios, we found out experimentally that the angle is too wide for satisfactory operation of visitor counting in real world scenarios. The solution of this problem is also discussed in order to improve efficiency. PIR sensors sense an object by comparing the heat emitted by the moving object and the background. So, such sensors must be installed only for stationary backgrounds.

a. Sensory Unit

The sensory unit of this project consist of 4 squares D16 LMS1 - 1AB pressure switches. Two are used in the IN-Gate detection and the other two are used for OUT-Gate detection. These pressure switches serve as the sensors to the microcontroller; Pin 3,5 and Pin 4,5 are utilized for this purpose respectively. These pressure switches are connected to 10KΩ resistor each by data sheet Specification. Hence $R_9 = R_{10} = R_4 = R_3 = 10k\Omega$ and have a 5V dc supply each. The reset buttons are meant for OFF and ON function and are connected with 10kΩ resistor each by data -sheet specification. Therefore, R_1 and R_2 are both 10kΩ each and supplied with 5V dc through pin 1 and pin 2

iv. Display Unit

In order to display the increment or decrement of students into and out of the room, an LMO16L LCD display is used. LMO16L is of 16 x 2 lines capacity with an in-built LSI FID44780 controller and a display color of gray. The character size is 5 x 7 dots and requires an input voltage of +5V. The internal pin connection of the EMO16L LCD display can he given as follows:

Table 3.1: Internal pin connection of LMO16L LCD

PIN NO	SYMBOL	LEVEL	FUNCTION
1	V ss	-	OV
2	V DD	-	+5V
3	V EE	-	Contrast
4	R S	H/L	L: instruction code input H: Data input
5	R/W	H/L	H: Data read (LCD Module - MPU) L: Data write (LCD Module – MPU)
6	E	H, H-L	Enable signal

7	DBO	H/L	Data Bus line
8	DB1	H/L	Data Bus line
9	DB2	H/L	Data Bus line
10	DB3	H/L	Data Bus line
11	DB4	H/L	Data Bus line
12	DB5	H/L	Data Bus line
13	DB6	H/L	Data Bus line
14	DB7	H/L	Data Bus line

Fig 3: Breadboard Layout

Fig 4. System Assembling and Casing of Automatic Room light Controller with Visitor counter

Fig 5. Complete System Layout of Automatic Room light Controller with Visitor counter

System Operational Principle

The implementation of this project's design is done strategically (section by section) to analyze extensively in order to prove the functionality to a satisfactory level. This electronic device is set up in such a way that whenever a person walk through the sensor on the entry door of a hall, the sensor circuit becomes active and give the LCD command which displays the number of present people in the room and the light inside the hall will be switched ON. The LCD will keep counting the number of people present in the hall, the light in hall will be switched OFF automatically when the last person present in the hall walk out through the exit door.

v. Switching Unit

The switching unit comprises of two relays with two transistors (BC547) energizing them. More current is transferred to the first transistor which quickly performs the. Switching action. The current reaching the base of the transistor is 0.48mA and by datasheet specification of the opto-coupler Rg = Rg = R14 = R7= 1kM. Also, R16 = R13 F R7 = Rs2200 is connected to Pin 5 of the opto-coupler to protect the opto-coupler from back emf from the coil of the relay. Diode, D, and Da are protective diodes (free-wheeling diodes). In this project IN4007 is used where $D_1 = D_3$.

Also two pieces of LED's are used to indicate the proper action (switching, action) of the switching unit. Light emitting diode D = Da are used as indicators. These indicators are connected to the microcontroller through Pin 11 and 12, respectively. A limiting resistor of 1000 is connected to each of the aforementioned light emitting diodes. Hence, by, specification of the LED's, R12 R21= 1000Ω.

CONCLUSION

The automated state of the system gives the product certain flexibility and the potential to be integrated with some of the other household systems into a universal household and industrial eventually, one simple system like this has the capability to control air appliance conditioners, televisions, CCT, lighten system, sockets, washing machine, and other home appliances. This design began the framework for a more complex and more functional product. The concept of an automatic room light controller counter can be built upon not just for household usage but tor such settings as hotels, schools, hospitals, industrial purpose or businesses.

Eventually this designed product can be built using less expensive components thus making it affordable alternative for consumers, it is a simple upgrade to an existing standard product and it has endless expansion possibilities.

In conclusion, this project is a design which should be encouraged and put into large scale manufacturing because of its various advantages.

This project is a viable one in the sense that it will go a long way in making it more convenient easier for users to easily control their appliances, lighting points and even sockets because of its automatically in their homes, hotel, conference rooms, and classrooms importance as a household need, efforts must be geared towards designing a viable project like this one strongly recommend that the department should see this project as a priceless possession and should endeavor to provide financial assistance and more research, works relating to this project to support and encourage students embarking on this type of project so as to be used to be used not only in homes but also in offices, schools etc.

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THE DEVELOPMENT OF BASIC SKILLS, THE CASE STUDY OF LANDSCAPE ARCHITECTURAL DESIGN AND CONSTRUCTION FOR SUB-SAHARAN AFRICAN LANDSCAPE

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ABSTRACT

A profession is any type of work that needs special training or a particular skill, often one that is respected because it involves a high level of education, Many researchers had been making so many recommendations regarding the desert encroachment and desertification of the African landscape, where must of such researches were recommending planting of trees, but most of those researches are not providing design for such recommendations. The landscape Architecture profession is a profession that involves the systematic design and general construction of structures for the use of living things, investigation of existing social, ecological, and soil conditions and processes in the landscape, and the design of other interventions that will produce desired outcomes. The scope of the profession is broad because they design a wide range of structures and landforms for living things, the design includes; site planning, stormwater management, erosion control, environmental restoration, parks, recreational areas, visual resource management, green infrastructure planning and provision, and private estate, and residence landscape master planning, landscape designs and constructions. The United States with a population of 334,298,347 people as of 2022, approximately has over 16,400 licensed landscape architects and Nigeria with Zero licensed landscape architects with a population of over 200,000,000 people as of the 2021 census. The study areas for this research were researches on desert encroachment and desertification in Nigeria, Two hundred researches on desert encroachment and desertification were used in Nigeria. A random sampling technique was used in selecting 50 researchers from the entire number. Findings from the study revealed the following: No Design or Landscape Design in research of desert encroachment and desertification in Nigeria, and the unavailability of Landscape Architects is the reason for not having a design or landscape design in many kinds of research of desert encroachment and desertification in Nigeria. The researcher in this study recommend the followings; Government should add more schools of Landscape Architecture in tNigeria, Government should license the existing Landscape Architects in the country, Government should make it mandatory that, all landscape design and construction should be done by a Landscape Architect in the country, Individuals should engage Landscape Architects for their landscape works at all levels.

Introduction

A profession is any type of work that needs special training or a particular skill, often one that is respected because it involves a high level of education, Many researchers had been making so many recommendations regarding the desert encroachment and desertification of the African landscape, some of such researches include the planting of trees, but most of the researches are not providing design for such recommendations. The landscape Architecture profession is a profession that involves the systematic design and general construction of structures for the use of living things, investigation of existing social, ecological, and soil conditions and processes in the landscape, and the design of other interventions that will produce desired outcomes. The scope of the profession is broad because they design a wide range of structures and landforms for living things, the design includes; site planning, stormwater management, erosion control, environmental restoration, parks, recreational areas, visual resource management, green infrastructure planning and provision, and private estate, and residence landscape master planning, landscape designs and constructions. The United States with a population of 334,298,347 people as of 2022, approximately has over 16,400 licensed landscape architects and Nigeria with Zero licensed landscape architects with a population of over 200,000,000 people as of 2021.

The limited number of professionals or licensed Landscape Architects in Nigeria is affecting the development of basic trade skills in landscape design, leading to many kinds of research in the country with failed recommendations, sometimes due to poor site analysis, landscape planning, design and construction in the African landscape.

Conceptual Framework

Goodey B, (1992) As landscape architects and designers, we need to keep up to date with the latest industry trends, regulations, and technologies and improve our base design and technical knowledge. Also, many landscape architecture organisations and institutes require members to under a certain number of hours or accumulate points as part of their Continued Professional Development.

Development of profession of Landscape Architecture in Nigeria

After much procrastination and various other difficulties, two Master of Landscape Architecture (MLA) programmes were established in two Nigerian Universities, the University of Lagos in 2007, and Ahmadu Bello University Zaria in 2009. The programmes were established under the Department of Architecture of both schools. presently Nigeria has many professionals with Master's degrees in Landscape Architecture

Profession. Fifty-Eight of them were registered with the (SLAN) Society of Landscape Architects of Nigeria and waiting to be licensed by the Authority concerned in Nigeria. Before the development of the profession generally, landscape failures were because of;

•	**Unprofessional Planning**	•	**Inadequate Curing**
•	**Unprofessional Design**	•	**Inadequate**
•	**Unprofessional Bill of quantities**	•	**Maintenance**
•	**Unprofessional Construction**	•	**Fire problem**
			Natural
			phenomena

Methodology
This chapter covers the description and discussion on the various techniques and procedures used in the study to collect and analyse the data as it is deemed appropriate

Research Design
According to (John O. S, 2010) research designs are often referred to as the structuring of investigation aimed at identifying variables and their relationships to one another. In this study, questionnaire serves as useful guide to the effort of generating data for this study. The questionnaire is a survey method and it is an exploratory research.

Area Of The Study
The study area for this research were researches on desert encroachment and desertification in Nigeria.

Numbers Of The Study Used
Two hundred researches on desert encroachment and desertification were used in Nigeria.

Sample Of The Study
Random sampling technique was used in selecting 50 researches from the entire numbers. This was chosen due to the financial strength of the researcher coupled with time constraints.

Instrument For Data Collection
These are the tools or methods used in getting data from Researchers. In this study, questionnaires is the research instruments used. Questionnaire is the main research instrument used for the study to gather necessary data from the samples. The questionnaire is structured type and provides answers to the research questions and hypotheses therein. This instrument is divided and limited into two sections; Section A and B. Section A deals with the personal data of the developers while Section B contains research statement postulated in line with the research question and hypothesis in chapter one. Options or alternatives are provided for each respondent to pick or tick one of the options.

Reliability And Validity Of Instrument

Reliability means the accuracy of precision of a measuring instrument while validity means the extent to which the research instrument measures what it is supposed to measure. In order to determine the reliability and validity of the study, the test-retest method was used

Techniques Of Data Analysis

Having gathered the data through the administration of questionnaire, the collected data will be coded, tabulated, and analyzed according to the research question and hypothesis. In order to analyze the data collected effectively and efficiently for easy management and accuracy, the simple percentage method was the analytical tools used for this research project and a sample size of two hundred (200) will be represented by 100% for easy analysis of the responses.

Also, Chi-square statistical analytical method will be used in the research work chi-square as a statistical technique is used in testing of hypothesis so as to predict what the relationship between two variables should be. It is used in drawing and reaching conclusion by collecting the observed values from the questionnaire administered to the researches, testing the degree of freedom and carrying out a decision in determining the critical value of the hypothesis. The formular being

X^2 =	$\dfrac{(F0\text{-}FE)^2}{FE}$
Where O	= Observed Frequency
E	= Expected Frequency

The X^2 value obtained from the formular is compared with the value of tabulated X^2 for a given significance level and degree of freedom.

Data presentation, Analysis and

Interpretation

This chapter is devoted to the presentation, analysis and interpretation of the data gathered in the course of this study. The data are based on the number of copies of the questionnaire completed and returned by the developers. The data are presented in tables and the analysis is done using the chi-square test.

Data Presentation and Analysis

Tables Based On Research Questions

Table 1 No Landscape Design in researches of desert encroachment and desertification in Nigeria.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	25	50.0	50.0	50.0
	Agree	10	20.0	20.0	70.0

Undecided	5	10.0	10.0	80.0
Disagree	6	12.0	12.0	92.0
strongly disagree	4	8.0	8.0	100.0
Total	50	100.0	100.0	

Source: Field survey, December 2021.

From table 1 above, responses from the researches show that 25 of the researches representing 50.0percent strongly show that no any design or landscape design in the researches. 10 of the researches representing 20.0percent agreed that no any design or landscape design in the researches. 5 of the researches representing 10.0percent were undecided that no any design or landscape design in the researches. 5 of the developers representing 12.0percent disagreed that no any design or landscape design in the researches.

While the remaining 4 researches representing 8.0percent strongly disagree that no any design or landscape design in the researches.

Table 2 Unavailability of Landscape Architects is the reason for not having a design or landscape design in many researches of desert encroachment and desertification in Nigeria.

	Frequen cy	Percent	Valid Percent	Cumulative Percent
Vali strongly agree d	26	52.0	52.0	52.0
Agree	14	28.0	28.0	80.0
Disagree	5	10.0	10.0	90.0
strongly disagree	5	10.0	10.0	100.0
Total	50	100.0	100.0	

Source: Field survey, December 2021.

Table 2 above shows that unavailability of Landscape Architects is the reason for not having a design or landscape design in many researches of desert encroachment and desertification in Nigeria. 26 of the researches representing 52.0percent strongly agreed.

14 of the researches representing 28.0percent agreed.

5 of the researches representing 10.0percent were undecided.

5 of the researches representing 10.0percent disagreed.

While the remaining 5 of the developers representing 10.0percent strongly disagreed

Research Hypothesis

H_0: No Design or Landscape Design in researches of desert encroachment and desertification in Nigeria.

H₁: Unavailability of Landscape Architects is the reason for not having a design or landscape design in many researches of desert encroachment and desertification in Nigeria. Level of significance: 0.05

Decision Rule: Reject the null hypothesis if the p-value is less than the level of significance, accept the null hypothesis if otherwise. **Test Statistics**

	Unavailability of Landscape Architects is the reason for not having a design or landscape design in many researches of desert encroachment and desertification in Nigeria.
Chi-Square	**173.474ª**
Df	**4**
Asymp. Sig.	**.000**

a 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 46.4.

Conclusion based on the decision rule:
Since the p-value (0.000) is less than the level of significance (0.05), we reject the null hypothesis and accept the alternative thereby concluding that the unavailability of Landscape Architects is the reason for not having a design or landscape design in many researches of desert encroachment and desertification in Nigeria.

Summary of the Findings, Conclusion and Recommendations
Findings from the study revealed the following:

- No Design or Landscape Design in research of desert encroachment and desertification in Nigeria.
- The unavailability of Landscape Architects is the reason for not having a design or landscape design in many kinds of research on desert encroachment and desertification in Nigeria.

The following conclusions and recommendations are based on the most significant assessment deployed after checking research on desertification and desert encroachment in Nigeria.
The researcher in this study hereby recommends the followings:

- Government should add more schools of Landscape Architecture in the country.
- Government should license the existing Landscape Architects in the country.
- Government should make it mandatory that, all landscape design and construction should be done by a Landscape Architect in the country.
- Individuals should engage Landscape Architects for their landscape works.

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DETERMINATION OF SOME SELECTED ENGINEERING PROPERTIES OF TAMARIND (*Tamarindus indica*) SEED

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Abstract

An experiment was conducted to investigate some selected engineering properties of tamarind seed such as length, width, thickness, arithmetic and geometric diameters, surface area, true and true densities, sphericity, angle of repose and coefficient of static friction. An average values of 9.23 mm, 6.56 mm and 3.29 mm with coefficient of variation of 10.29, 7.24 and 5.87% were determined for length, width and thickness of tamarind seeds. The arithmetic mean diameter, geometric mean diameter and sphericity values of 6.14, 5.46 and 92.05% with CV values of 7.89, 8.10 and7.6% were recorded at 12.90% moisture content. The mean surface area, and volume of 84.25 mm^2 and 59.36 mm^{3}were obtained for tamarind seed. Porosity and angle of repose had the values of 36.90 and 31^0, respectively. Stainless steel had the lowest coefficient of static friction with an average value of 0.35, followed by galvanized with average value of 0.39 while the highest value of 0.42 was observed on plywood surface for tamarind seed.

Keywords: Tamarind, engineering properties, moisture content, angle of repose, sphericity Coefficient of Static friction

Introduction

Tamarindus indica L, (Tamarind) a member of the family *Leguminosae* (Fabaceae), is native to dry Savanna of tropical Africa (Mohamed *et al*., 2015). It is an important woody perennial fruity species known for its adaptability to variable climatic and edaphic conditions and for fruit production (Yusuf *et al*., 2007). The fruit is oval in shape with brown hard inedible shells and length of about 3.8 cm long. The fruits hangs in bunches of more than a dozen on the tree. The major areas of production of tamarind are Asian countries like India, Bangladesh, Sri Lanka, Thailand, Indonesia and some other African and American countries. The tamarind fruit contains about 55 per cent pulp, 34 per cent seeds and 11 per cent shell and fiber in a pod. The seeds are very hard, shiny, reddish or purplish brown in colour (El-Siddig *et al*., 2006). Tamarind is cultivated mainly for the pulp in the fruit, which is used to prepare beverages and to flavor confectionaries, curries

and sauces. Apart from pulp, tamarind seeds are also used to some extent. In Nigeria velvet tamarind is referred to as Awin among the Yorubas, Icheku in Igbo and Tsamiyarkurm in Hausa (Davis and Zibokere, 2016). The bark and leaves have medicinal properties and are used against several diseases.

It has been reported that some women chewed the fruits to improve lactation and check genital infection in Nigeria (Akinpelu *et al*., 2011). According to the findings of Arogba *et al*. (2006), the pulp is edible and sweet, low levels of ascorbic acid and tannins. The fruit has been ranked as one of good source of plant protein and minerals (Arogba *et al*., 2006). Some researchers reported velvet tamarind is used as chewing stick as an indigenous tooth brush among Nigerian populace (Davis, 2017). Velvet tamarind leaves and stem bark have been reportedly used for the treatment of infections such as diarrhoea, severe cough, bronchitis, wound, stomach aches, malaria fever, jaundice, antiulcer and haemorrhoids (Bero *et al*., 2009)

The design and manufacturing of equipment for post-harvest processes of velvet tamarind fruit such as cleaning, grading, sorting, cleaning, handling, transportation, separation, drying, aeration, juice and oil extraction processes, packaging and storing requires information on its physical and mechanical properties (Manuwa and Afuye, 2004). The knowledge of fruit volume, shape and density are imperative for the design of fluid velocities for transportation (Koocheki et al., 2007). Porosity is significant in determine the resistance to air flow through bulk solids. Information on frictional properties of fruits and seeds are important for design of handling and storage equipment (Koocheki *et al.*, 2007). Literature reviewed showed no detailed study on the engineering properties of velvet tamarind seeds has been investigated.

Materials and Methods
Source of Materials and Sample preparation
Tamarind seeds were obtained from wild bush at Igbo-Ologun Village, Saki in Oyo North Senatorial District, Oyo State, Nigeria. Samples of tamarind seeds for the laboratory experiment were prepared according to the methods described by Yusuf *et al*. (2007). Whole seeds of tamarind were sun dried, and the immature and damaged seeds were discarded. The sample was packed inside polythene bags and air sealed. The seeds were then put inside the freezer at -5°C to assume maintain expected moisture content. The moisture content of the tamarind seeds was determined by gravimetric or oven method as described by ASAE (2003) was found to be 12.9% dry basis.

Determination of Physical Properties of Tamarind Seeds
The physical properties determined include size and shape, arithmetic mean, geometric mean, surface area and volume. All the physical properties were determined at moisture content 12.90% d.b. For 100 seeds, (a) major (b) intermediate, and (c) minor diameters

were measured using a vernier caliper model CD (5cp Mitutoyo England), having a resolution of 0.01 mm.

Arithmetic mean

The arithmetic mean diameter of the seed was determined using the relationship proposed by Mohsenin (1970)

$$(D_a) = \left(\frac{a+b+c}{3}\right)$$

1

Where:

D_a = Arithmetic mean diameter (mm)

a = major diameter (mm)

b = intermediate (mm)

c = minor diameter (mm)

Geometric mean diameter

The geometric mean diameter (GMD) was determined from the major (a), intermediate (b) and minor (c) diameters using the formula:

$$GMD = (abc)^{1/3}$$

2

Where:

GDM = Geometric mean diameter (mm)

Sphericity

The sphericity of the seed was determined by using the following relationship (Mohsenin, 1970):

$$S = \frac{D_g}{a} \; x \; 100$$

3

Where:

S = Sphericity (degree)

Surface area

The surface area of tamarind seed was determined by using equation 4 described by Altuntas *et al.* (2005)

$$S = \pi (D_g)$$

4

Where S = Surface Area (mm^2)

Volume

The unit volume of 100 individual seeds was determined form values of a, b, and c using the formula proposed by Olatunji *et al.* (2011):

$$V = \frac{\pi abc}{6}$$

5

Where V = volume (mm^3)

Determination of gravimetric Properties of Tamarind Seed

The selected gravimetric properties determined are porosity, true and bulk densities of the tamarind seed and these properties were determined at 12.90% d.b moisture content using the method described by Mohsenin (1970).

Porosity

The porosity of the bulk seed was computed from the values of the true density and bulk density of the seeds by using the relationship given by Mohsenin (1970).

$$P_f = \left(1 - \frac{\rho_b}{\rho_t}\right)$$

6

Where: P$_f$ = Porosity in %, ρ_b = Bulk density, kg/m^3 and ρ_t = true density, kg/m^3

True density

The true density of the seed was determined using water displacement method. Hundred randomly selected tamarind seeds were selected and lowered into a graduated measuring cylinder 100 ml of water. The increased in volume was noted, the ratio of the mass (g) of the seed to the volume (mm^3) of water displaced due to the immersed seed gave the density of the seed (Altuntas *et al*., 2005).

$$\rho_t = \frac{weight\ of\ the\ sample\ (kg)}{volume\ of\ water\ displaced\ (mm3)}$$

7

Bulk density

A cylindrical container of known mass and volume was filled with tamarind seed and weighed. The mass of the tamarind seed was calculated by the difference between the weight of the empty cylinder and the mass after it was filled with tamarind seeds. The ratio of the mass of the seeds to the volume of the cylindrical container gives the bulk density (Amin *et al*., 2004) and the bulk density was calculated as:

$$\rho_b = \frac{weight\ of\ the\ sample}{volume\ occupied}$$

8

Frictional Properties
Angle of repose

A regular cylindrical container opened at both ends and placed on a galvanized surface area was filled with tamarind seed to the brim. Afterwards the container was lifted gradually and finally emptied to form a conical heap with the seeds. The tangent of the

angle of inclination to the horizontal was calculated from the height (h) and base radius ® of the formed heap (Amin *et al.*, 2004).

$$\theta = tan^{-1}\left(\frac{h}{r}\right) \qquad\qquad 9$$

Where; θ = the angle of repose, h = height of the pile (mm), r = radius of the pile

Coefficient of friction

The coefficient of static friction of tamarind seeds was determined on three different surfaces namely galvanized, plywood and stainless. The seeds were placed on galvanized surface of an inclined apparatus. The plane portion of the apparatus was raised and the angle of inclination to the horizontal, as soon as the seeds began to slide, was measured from a protractor attached to the inclined plane. The coefficient of friction was calculated from the following equation:

$$\mu = tan\alpha \qquad\qquad 10$$

Where μ = the coefficient of friction and α = the angle of tilting degree.

RESULTS AND DISCUSIONS
Physical Properties of Tamarind

The results of some physical properties of tamarind seed such as length, width, thickness, mass unit, arithmetic and geometric mean diameter, sphericity, volume, 1000 unit mass and surface area for tamarind seeds investigated at moisture content 9.21 % dry basis for are presented in Table 1. The mean length, width and thickness of tamarind seeds were 9.23 mm, 6.56 mm and 3.29 mm with coefficient of variation of 10.29, 7.24 and 5.87% respectively. This result is similar to the findings of Davies and Mohammed (2014) with mean length, width and thickness of soursop seeds values of 13.25±0.65 mm, 8.97±0.87 mm and 5.63±0.12 mm respectively. The average length, width and thickness of simarouba fruits reported by Dash et al. (2008) were 21.26 mm, 13.81 mm and 11.03 mm respectively.

The arithmetic and geometric mean diameter of tamarind seeds were 6.14 mm and 5.46 mm with correlation variation of 7.89% and 8.10%. The geometric and arithmetic average diameters of palm fruit ranged between 21.36 and 29.23 mm and 20.80 and 27.80 mm has been reported by Davies (2012). The average surface area of tamarind seeds determined was 84.25 mm^2 with correlation variation of 13.7%. Davies and Mohammed (2014) revealed that the surface area of Soursop seeds ranged from 195.10±7.73 mm² to 385.05±4.75 mm². The volume of tamarind seeds determined was 59.36 mm^3 with correlation variation of 13.5%. Volume of any seeds or fruits can be used evaluate the diffusion coefficient of shrinking systems.

Table 1: Physical Properties of Selected Tamarind Seed

Properties	Sample Number	Mean	Coefficient of variation	Standard deviation
Length (mm)	100	9.23	10.29	0.45
Width (mm)	100	6.56	7.24	0.62
Thickness (mm)	100	3.29	5.87	0.53
Arithmetic mean diameter (mm)	100	6.14	7.89	0.31
Geometric mean diameter (mm)	100	5.46	8.10	0.83
Sphericity (%)	100	92.05	7.6	0.80
Surface area (mm^2)	100	84.25	13.7	0.62
Volume (mm^3)	100	59.36	1.63	1.63

Gravimetric Properties

The experimental results of gravimetric properties of tamarind seed determined such as porosity, true and bulk densities are presented in Table 2. The porosity, true density and bulk density values of 36.90%, 1090 and 687.82 (kg/m^3) were recorded; respectively. The corresponded average values of true and bulk densities for hog plum fruits and nuts were 1023.51, 652.90, 431.48 and 837.70 kgm^{-3} has been reported by Davies and Yusuf (2017).

Table 2: Gravimetric Properties of Tamarind

Properties	Mean value
Porosity (%)	36.90
True density (kg/m^3)	1090.00
Bulk density (kg/m^3)	687.82

Frictional Properties

The experimental result of frictional properties such as angle of repose and coefficient of static friction on three different surfaces is presented in Table 3. The mean angle of repose value of 31^0 was obtained for Tamarind seed while the coefficient of static friction recorded were 0.35, 0.42 and 0.39^0 for stainless sheet, plywood and galvanized surface, respectively. Information on angle of repose and coefficient of static friction of biomaterial is important in the design of pneumatic conveying systems, screw conveyors as well as hoppers. This result is similar to the findings of Davis and Zibokere (2011) who reported an average value of 34^0 for gbafilo fruit. The static coefficient of friction and angle of repose are imperative for the design of conveyor and hoppers for planting of seeds machines.

Table 3: Frictional Properties of Tamarind Seed

Properties	Mean value
Angle of repose(^{0})	31
Coefficient of static friction	
Stainless steel	0.35
Plywood surface	0.42
Galvanized sheet	0.39

Conclusions

Determination of some engineering properties of tamarind seeds has been determined and the following points were drawn from the study:

i.   The mean major, intermediate and minor diameter of tamarind seeds were 9.23 mm, 6.56 mm and 3.29 mm with coefficient of variation of 10.29, 7.24 and 5.8% respectively. The arithmetic mean diameter and geometric mean diameter tamarind seed were 6.14 and 5.46 with CV of 7.89% and 8.10%. The Sphericity, surface area, and volume of tamarind seed determined were 92.05, 73.0%, 84.25 mm2 and 59.36 mm^3, respectively.

ii.   The average porosity, true and bulk densities obtained were 36.90%, 1090 and 687.82 (kg/m^3)

iii.   The mean angle of repose of 31^0 was recorded while the coefficient of static friction of 0.35, 0.42 and 0.39^0 were recorded on stainless, plywood and galvanized surface, respectively.

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DETERMINATION OF SEASONAL CHANGE IN WATER LEVEL OF GUBI DAM FOR SUSTAINABLE URBAN DEVELOPMENT

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Abstract

Gubi Dam is one of the largest dam located in Bauchi state and it serves as the major source of drinking water for the entire Bauchi metropolis. Due to the high level of water consumption ranging from domestics, industrial and agricultural use, there exist significant changes in seasonal water level in the dam as a result of meteorological and climatic variables. During reconnaissance, water levels and rainfall data was collected from Bauchi State Water Corporation whereas the hydrological and meteorological data was collected from NIMET office of Bauchi state. Gubi reservoir water level elevations and changes from 2015 to 2021 were examined using Landsat data 8. The water source in the dam varies in quantity and quality due to the seasonal variation over the catchments area. During rainy season, from the period of May to October, the quantity of water in the reservoir will increase due to the amount of the rainfall observed during these periods. During dry season the level of water reduced due to high consumption and the effect of evaporation due to high temperature, the peak value of evaporation mostly occurred within the period of January to April and is the period of drought and high demand of water and it cause a drawdown of the reservoir water level. The results were analyzed, discussed and presented. The surface area of Gubi reservoir in March 2015 was $5224500m^2$ and the mean of the dry season is $5988600 \ m^2$. The seasonal variation in Gubi dam from the period of March 2015 and the mean was $764100 \ m^2$. This shows that the dam has accommodated more water in 2015 than the mean of the dry season. So invariably it implies that Gubi reservoir level rise in 2015 during dry season, around March 2015 increase in water level. It is recommended other researcher to conduct research on hydrological modeling of Gubi reservoir to investigate the impacts of the reservoirs in water resources management.

KEYWORDS: Seasonal change, Water level, climatic variables, reservoirs and water resources

Background of the Study

Gubi Dam is one of largest dam located within Bauchi local government area of Bauchi state and its serves as the major source of drinking water for the entire Bauchi metropolis. Due to the high level of water consumption ranging from domestics, industrial and agricultural use, there exist significant changes in seasonal water level in the dam as a

result of meteorological and climatic variables. These variables may include seasonal rainfall, temperature (maximum & average) wind and radiation flux. Generally, whenever a dam is constructed along a river channel, the riparian communities around such locations are often affected directly or indirectly since; human activities are subject to changes. The dam was constructed purposely to supply water to the entire Bauchi Metropolis and its adjoining environment.

The source of water in Gubi dam is mainly coming from three tributaries, namely Gubi River, Tagwaye river link with Shadawanka and Ran River. The function of the dam is to supply the state capital and its environs with potable water. A temporary dam close to the site was constructed across one of the stream to provide water needed for the construction of the permanent dam. The embankment of the dam which has length of 3.86km and bottom earth-fill of 2,315, 000m^3 with a reservoir area of 590 hectares. The catchments area is 17,900 hectares with total storage capacity of 38.4 x 106 m^3, the expected yield from the reservoir is 90,000m^3/d (Bauchi State Water Board, 1981). The dam was started with temporary structures, which was constructed across one of the streams at the permanent dam site to provide water needed for the construction of the permanent dam. In this temporary dam about 500 million gallons of water which is equivalent to be impounded, while the construction of the permanent dam was going on it was decided to make use of the temporary dam to supplement the water supply to the town (Abdullahi, 2014). Change detection is the process of identifying the differences in the state of an object or matter or phenomenon by observing it at different times (Singh, 1989). There are varieties of digital change detection techniques which have been developed, such as mono-temporal change delineation, delta or post classification comparisons, multi-dimensional temporal feature space analysis, composite analysis, image differencing, multi temporal linear data transformation, change vector analysis, Distance Tree Classification (DTC), image regression, background subtraction and image rationing (Nori et al, 2005). Throughout the past decades, the change detection process was useful in many applications and researches that related to change detection such as landscape and habitat fragmentation (Munroe et al, 2005; Nagendra et al, 2006).

The basic purpose of impounding reservoir is to hold runoff during period of high runoff, and release it during period of low runoff; the specific functions of reservoir are hydroelectric flood control, irrigation, water supply and recreation. Many large reservoirs are multipurpose. The use of reservoir for temporarily storing stream flow often results in a net loss of total stream flow due to evaporation and seepage. While these losses may not be desired the benefits derived from regulation of water supplies from flood water storage, from hydroelectric power and from any recreational activities at the reservoir site may offset the hydrologic losses and the cost of reservoir storage capacity can be divided among three (3) major uses:- (i) The active storage used stream flow regulation and for water supply. (ii) The dead storage required for sediment collection, recreational

development hydropower production. (iii) The flood storage capacity reservoir to reduce potential downstream flood damage in the design of storage reservoir to serve as a water supply system for any community, it has been further recommended that judgment be based on the equalizing or operating storage which can be read from a demand curve during 12 and 24 hours respectively. Evaporation from lakes more especially from impounded reservoirs, where it may reduce the yield from a catchments area by a considerable amount, the amount lost depend upon temperature of the air and water, wind, velocity, and atmospheric humidity. The high evaporation loss from reservoir in arid region has stimulated experiment in methods of reducing it by application of thin chemical film floating cover, or floating granular materials. None of these technique have proved to be practical in large-scale application but are useful on small reservoir Steel and Terence, (1972).

The hydrological cycles of major lakes and rivers are of great importance for studies of local response on regional and global climate change. Lake level and temporal change can reflect water mass balance of a basin, and is closely related with climate parameters of precipitation, temperature, evaporation, humidity, wind, etc. Lake level variations also affect bottom sediment characteristics, ecological consequences, circulation pattern, and wind-driven waves. Lake level data, one of the most important and fundamental datasets used in hydrologic analysis, are traditionally obtained through gauge measurements. However, in many cases, limited spatial distribution of hydrological gauges is often not able to provide adequate or continuous observations due to economic and political reasons. There is even a decrease of globally gauging networks during the last decade. Many studies show that satellite radar and/or laser altimetry provide effective and powerful data for many potential applications in oceans, rivers, lakes, wetlands, and floodplains Medina (2010).

Rivers are the major water resources that accumulated to form dams. Water qualities of rivers tend to getting worse because of pollutants from surrounding watersheds (Bae, 2017). In addition, changes of flow rate of rivers between rainy season and dry season could bring difficulties to maintain river's water quality (Kim 2008). River's water quality might be affected by various factors. Among them, non-point source pollutants are the main concern for river's water quality management and rainfall events play a very important role as carriers for non-point source pollutants moving to the water body (Bae, 2017). The purpose of dam management is to efficiency put in place criteria leading the purpose of the dam as well as safety procedures. The dam should be planned considering other projects or river facilities in its river basin to demonstrate its purpose effectively. Furthermore, it is necessary to execute the investigation carefully from the early stage so as not to generate stagnation or retreat because the dam is large-scale and needed much cost for construction. Because the appearance of the dam reservoir exerts a big influence on the environment, the mitigation or conservation should be considered to decrease the

influence as much as possible. As the dam reservoir is forming by damming of the existing river, the management and operation of the dam should be carried out safely and properly unlike other facilities. In addition, the dams are operated for a long period of time in proper condition, so the countermeasure for the sedimentation is important for the longevity of dam reservoir.

There is even a decrease of globally gauging networks during the last decade. Many studies show that satellite radar and/or laser altimetry provide effective and powerful data for many potential applications in oceans, rivers, lakes, wetlands, and floodplains. Water surface changes are studied with high precision ICESat (the ice, cloud, and land elevation satellite) altimetry data (Guoqing, 2014).

Water supply issues are creating unprecedented pressures because of increasing population and economic demands. As irrigated agriculture represents 70% of global water consumption, managing water resources is a major concern in maintaining sustainable agricultural practices. Water management will become even more relevant in the future as urbanization, industrialization, and climate change exert greater pressures on water use (OECD, 2012). Water resources can be monitored on a global scale using three approaches: in situ measurements, modelling, and remote-sensing observations (Jorgensen et al., 2005; Harding and Warnaars, 2011; Hall et al., 2011; Duan and Bastiaanssen, 2013).

Singh and Gupta (2016), Observations and modeling of terrestrial water cycle is important for sustainable management of water resources as well as understanding the impact of climate change. Satellites provide an important role in measurements of various dimensions of water cycle components in spatio-temporal domain. Paper reviews the scientific basis and techniques of retrieval of various hydro-meteorological parameters (Rainfall, Soil Moisture, Evapo-transpiration, Groundwater, Water level, Surface Runoff, conjunctive water utilization and Water quality etc.) which are estimated using advanced satellite based instruments (Altimeter, Radar, Optical and Microwave Radiometers). Variability of various hydro-meteorological parameters and recent satellite based observation on flood and hydrological drought condition in selected regions over India is discussed.

Nagaraj et al (2015), water reservoirs are the main source of water supply for many settlements as well as power generation. So the water volume and extent of the reservoirs needs to be monitored at regular time intervals for efficient usage as well as to avoid disasters like extreme rainfall events and flood etc. Generally the reservoirs are remotely located so it is difficult to well monitor the water volume and extent. But with growing of Remote sensing and GIS in HPC environment and modeling techniques it is possible to monitor, estimate even predict the reservoir water volumes in advance by using the numerical modeling and satellite Remote sensing data. In this work the monitoring and estimation of the volume of water in the Krishna Raja Sagar (KRS) water reservoir in

Karnataka state of India. In this work multispectral images from different sources like Landsat TRS and Digital Elevation Model (DEM) using IRS LISS III (IRS- Indian Remote Sensing, LISS- Linear Imaging Self-Scanning) and ASTER (Advanced Space borne Thermal Emission and Reflectance Radiometer) are being used .The methodology involves GIS and image processing techniques such as mosaicking and georeferencing the raw data from satellite, identifying the reservoir water level, segmentation of water body using the pixel level analysis. Calculating area and depth per each pixel, the total water volume calculations are done based on the empirical model developed using the past validated data. The water spreaded area calculated by using water indexing is converted in to vector polygon using ArcGIS tools. Water volume obtained by this method is compared with ground based observed values of a reservoir and the comparison well matches for 80% of cases.

Baup (2014), this study presents an approach to determining the volume of water in small lakes (<100 ha) by combining satellite altimetry data and high-resolution (HR) images. In spite of the strong interest in monitoring surface water resources on a small scale using radar altimetry and satellite imagery, no information is available about the limits of the remote-sensing technologies for small lakes mainly used for irrigation purposes.

Cochrane et al (2014), the rapid rate of water infrastructure development in the Mekong Basin is a cause for concern due to its potential impact on fisheries and downstream natural ecosystems. In this paper, we analyze the historical water levels of the Mekong River and Tonle Sap system by comparing pre- and post-1991 daily observations from six stations along the Mekong mainstream from Chiang Saen (northern Thailand), to Stung Treng (Cambodia), and the PrekKdam station on the Tonle Sap River. Observed alterations in water level patterns along the Mekong are linked to temporal and spatial trends in water infrastructure development from 1960 to 2010. We argue that variations in historical climatic factors are important, but they are not the main cause of observed changes in key hydrological indicators related to ecosystem productivity. Our analysis shows that the development of mainstream dams in the upper Mekong Basin in the post-1991 period may have resulted in a modest increase of 30-day minimum levels (C17 %), but significant increases in fall rates (C42 %) and the number of water level fluctuations (C75 %) observed in Chiang Saen. This effect diminishes downstream until it becomes negligible at Mukdahan (northeast Thailand), which represents a drainage area of over 50% of the total Mekong Basin. Further downstream at Pakse (southern Laos), alterations to the number of fluctuations and rise rate became strongly significant after 1991. The observed alterations slowly decrease downstream, but modified rise rates, fall rates, and dry season water levels were still quantifiable and significant as far as PrekKdam.

Chih-Hua et al (2015),Surface water quality has been identified as potentially vulnerable to climate change. This study assesses the impacts of climate change on the water quality of Hsinshan Reservoir, Taiwan, through CE-QUAL-W2 simulations. The model

parameters were calibrated by field data collected during 2004–2008, and verified against observations made during 2009–2012. The projected temperature and precipitation data for the near- and long-term future were downscaled to regional and daily scales, and used to simulate the projected changes in water quality through the validated model. The simulation results were reported as probability-based cumulative distribution functions to access the impacts of climate change on water quality. The results indicated that the intensified thermal stratification caused by the rising temperature is the primary driver of water quality decline, which increases the probability of deep-layer oxygen depletion and the flux of limiting nutrients for algae growth, resulting in a higher risk of algal blooms and eutrophication. The adaptation strategies of multilevel-intake operations and increasing bottom-layer dissolved oxygen without destratification are recommended.

Statement of the Problem
Bauchi metropolis has witnessed remarkable expansion since its inception of Bauchi state in 1967. This has therefore lead to an increase in water consumption in Bauchi metropolis. The consumption of large volume of water which resulted in changes in water level from its water sources (Gubi dam). And also, this change in water level causes flooding to submerge the neighboring villages. The effect of this flooding resulted so many problems within Bauchi metropolis such as insufficient portable drinking water, shortage of water for industrial use, and also agricultural use. Water, and alterations in the status of her change in water level over time without any detailed and comprehensive attempt (as provided by a Remote Sensing data and GIS) to evaluate this status as it changes over time with a view to detecting the water consumption rate and also make attempt to predict same and the possible changes that may occur in the water level. The research will use remote sensing/GIS techniques to evaluate variation in water level of Gubi Dam.

Aim and Objectives
The aim of this research is to determine seasonal change in water level of Gubi dam and its relationship with Rainfall, Temperature and Wind flow using remote sensing techniques. The aim of the research will be achieved through the following objectives
  i. Mapping changes in water level of Gubi Dam using remotely sensed data and GIS techniques
 ii. Determining the trend and patterns in seasonal rainfall, temperature and wind flow.
iii. Determining the relationship between the parameter of objective one and two above

Scope of the Study
The scope of this research is restricted to Gubi Dam area in Bauchi state of Nigeria. The work comprises of field reconnaissance, data acquisition, georeferencing, image

processing, image enhancement, geometric correction, data integration and supervised classification.

Justification for the Study

Indeed, attempt has been made to document the growth of Gubi Dam in the past by conventional means. The dynamics in the change of population size and density of Bauchi metropolis has change the pattern and trend of water consumption for both domestic and industrial use. This has led to the shortage of water within Bauchi metropolis, inherently affecting water quality. The research would be useful for water resource planning and management, hydrological drought studies, flood forecast and pollution studies.

The Study Area

Bauchi metropolis lies between latitude 09^o52^1 and 09^o56^1 North of the Equator and longitude $10^o 45^1$ and $10^o 45^1$ East of the Prime Meridian (Fig. 1). The study area is located in Bauchi Local government area is located on the north-eastern edge of the Jos plateau. Bauchi state was derived from Bauchi town. It covers a total land area of 3,687 square kilometers, and a population of 493,810, according to the 2006 population census. It is the most populous part of the state, as it serves as the seat of the state government. This increase in population, coupled with the socio-economic activities in the metropolis has implications for solid waste generation, disposal and management in the area (Nigeria population commission).
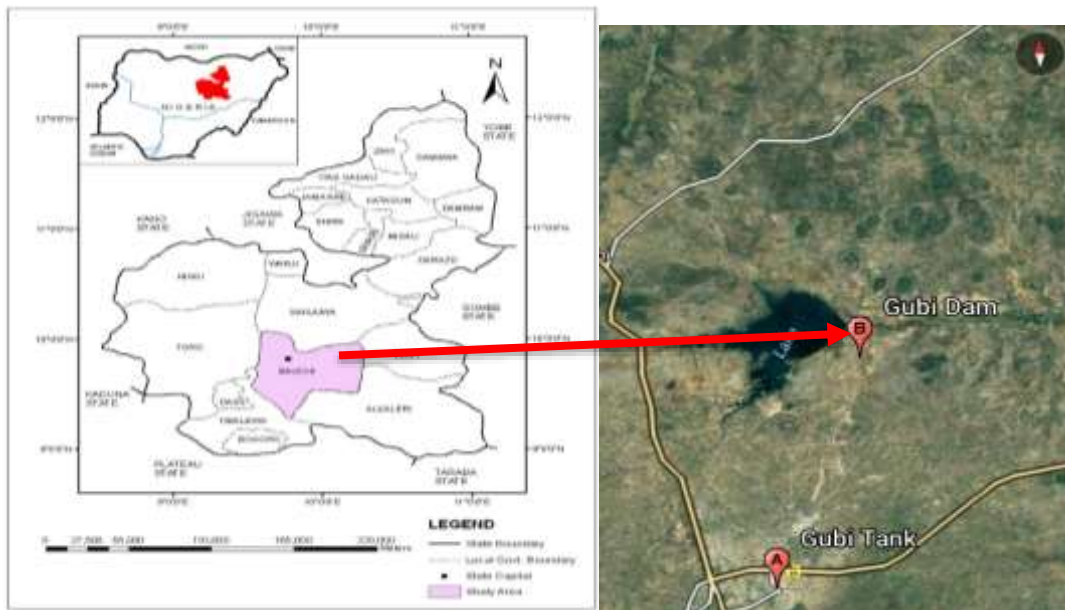
Figure 1 Map of Study Area

Materials and Methods

The methodology adopted for acquiring complete datasets for precise representation is divided into two stages namely: data acquisition and data processing. The former deals with the data collection while the latter focused on data manipulation and processing. Satellite images of the study area were downloaded for ten (10) different years for both drying and raining season. DGPS receiver was used to determine the coordinates of the points used for geo-referencing the satellite images. The downloaded satellite images were imported into ArcGIS environment and georeferenced. Image enhancement and geometric correction were carried out to improve the quality of the satellite images. The attribute data was also collected from which Bauchi State Water Corporation and NIMET office of Bauchi State; the data includes water levels, rainfall data and hydrological, meteorological data respectively. Statistical analysis was carried out on the attribute data and the results area presented.

Equipment Used

The equipment needed for the research work are as follows:

DGPS receiver and its accessories, Computer and its accessories for processing and analysis, ArcGIS 10.3 software, Microsoft Office word 2007 and SPSS Software for statistical analysis

Working Chart of the Methodology

The flowchart used for data acquisition, data processing and analysis is presented in figure 2 as indicated beside:

Reconnaissance

During reconnaissance, water levels and rainfall data was collected from Bauchi State Water Corporation whereas the hydrological and meteorological data was collected from NIMET office of Bauchi State. The study a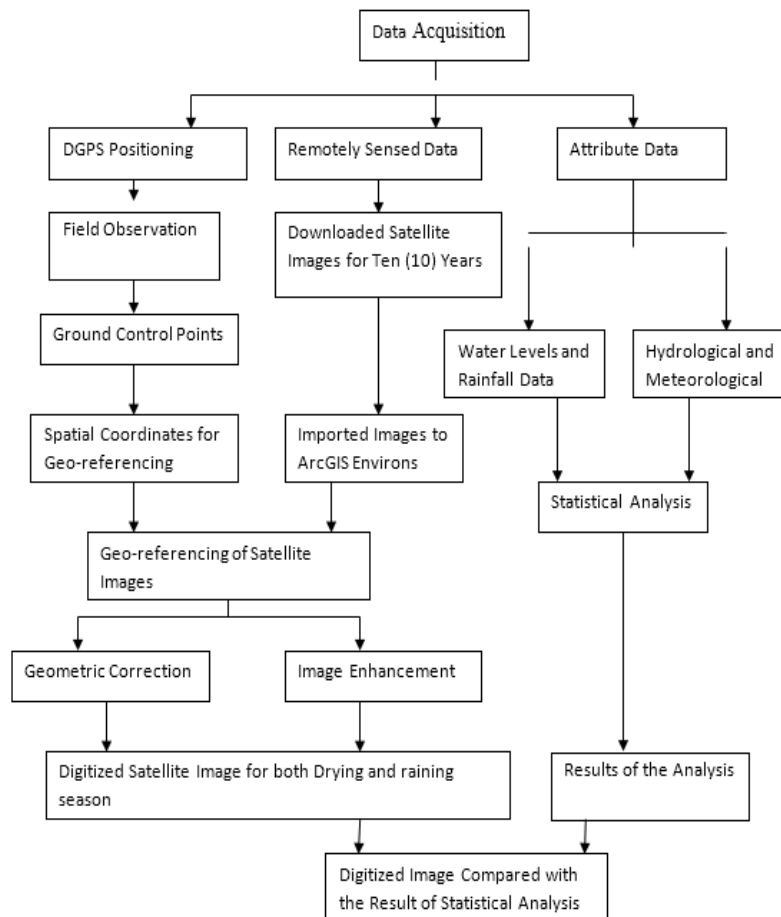rea was visited to have an overall picture and to acquaint with the nature of the study area for the purpose of ground truthing and planning of field work. During this exercise various land use land cover and dam facilities were visited and compare with Landsat images in order to reconcile between the features on the ground and image. Inaccessible areas such impounded reservoir and some of forest were viewed from Google map image. The coordinates of identified location on the images were captured for geo-referencing.

Data Used

The data used in this study are Landsat 7 and 8, map of the study area, water levels, and rainfall data, hydrological and meteorological data.

Remotely Sense Data

Considerable effort was put into selecting cloud-free data sets and to get data near the same date and the same season in order to reduce seasonal difference effects on the images. Landsat 8 satellite images of the study area. The selected images were acquired between November and April and July and October which is considered as dry and rainy season in the study area because there are no available imageries to maintain consistency in day but seasonal consistency was maintained. These images were downloaded from the United State Geological Survey (www.earthexplorer.usgs.gov).

Ground Control Points

The coordinates of prominent locations were observed with DPGS which was used for georeferencing the satellite images. During the field survey, 6 Ground Control Points (GCP) were collected for the purposes of ground truthing. These GCPs were captured from distinct features on the images such as road junctions, buildings, and much other landscape feature identifiable clearly on the satellite images. The Points were used for the minimization of geometric distortion of the images by georeferencing with ArcGIS Software. This was also used to unify the coordinate system of all the Satellite Images downloaded. The coordinates used for geo-referencing is as showed in Table 3.3.

Table 1: Coordinates used for Geo-referencing

S/No	EASTING (M)	NORTHING (M)
1	590272.076	1149941.615
2	590347.560	1149587.566
3	590630.023	1147949.555

4	590823.989	1147613.867
5	591265.472	1147062.609
6	591395.051	1146527.667

Documented Data: Hydrological and Meteorological Data

The water levels and rainfall data in the reservoir was collected from Bauchi State Water Board Corporation located in Gubi while the hydrological and Meteorological data, Temperature, Wind and Radiation flux was collected from the NIMET Bauchi State Centre.

The sample of the attribute data is showed in Table 2.

GUBI DAM WATER LEVEL RECORD

S/N	DATE	TIME	RECORD (MSL)
1	1-6-2010	8:30	554.245
2	2-6-2010	8:40	554.232
3	3-6-2010	8:54	554.220
4	4-6-2010	9:13	554.208
5	7-6-2010	8:55	554.179
6	8-6-2010	9:23	554.167
7	9-6-2010	8:34	554.155
8	10-6-2010	8:45	554.152
9	11-6-2010	9:34	554.140

Table 3: Sample of the Attribute Data

JULY 2006

| S/N	Temperature		Rainfall	Wind
	Maximum	Minimum		
1	31.0	24.0	TR	2
2	32.0	25.0		3
3	32.0	24.0	32.2	3
4	35.0	23.0	36.4	3
5	34.0	24.0	26.6	4
6	31.0	22.0	32.2	4
7	29.0	24.0	36.4	2
8	33.0	23.0	32.2	2
9	31.0	22.0	36.4	2
10	34.0	24.0	25.6	3

Data Integration

The main purpose of data integration is to allow data from different sources to be referenced in the same spatial domain so that this data can be effectively overlaid with other data for further analysis. Since data from different sources may use different map projections, there is a need for their conversion into a standard and common map projection. However, this task was performed with utmost attention to overcome data been inaccurately geo-referenced, which can result in spatial inconsistency among different data sources even though the same map projection is utilized. Data integration in this research started from the pre-processing stage where all satellite images and map were geo-referenced to a common coordinate system. The UTM Zone 32 WGS84) datum was select. SPSS (Software Package for Social Science) version 15 was used to analyzed the correlation between the change in water level and surface area of the reservoir, water level and temperature, water level and wind, water level and Radiation and Surface area of the reservoir and temperature respectively.

Analysis and Presentation of Results

Analysis of Map of Gubi Reservoir in 2014

The images of the Gubi reservoir as at March and July 2014 are showed in Figure 4.1 and Figure 4.2 respectively. The surface area of Gubi reservoir in March 2014 is 536.928 hectares whereas in July 2014 is 693.856 hectares. The seasonal variation in Gubi dam from the period of March 2014 to July 2014 is 156.928 hectares. This shows that the dam accommodates more water in July 2014 than in March 2014. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 556.895 m especially in the period of November 2014, whereas in the period of December to around March 2014 decreased to minimum of 553.226m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.
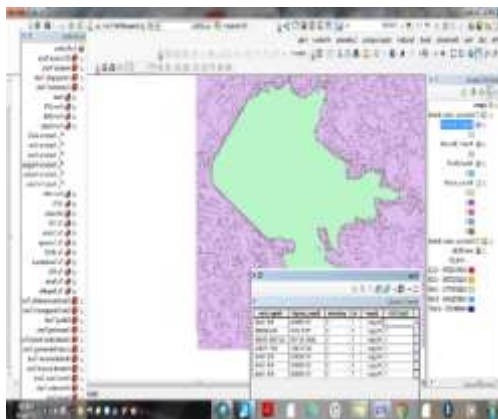
Fig. 3: Map of Gubi Reservoir
(01 March,2014)
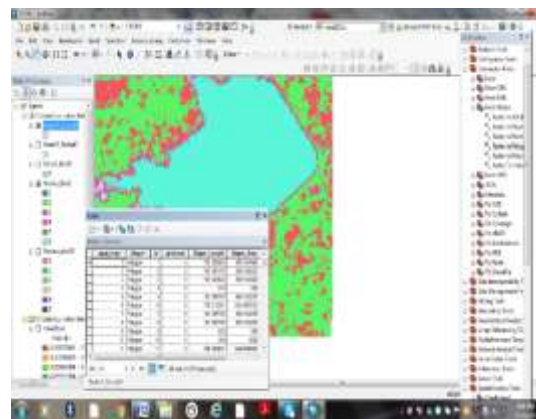
Fig. 4: Map of Gubi Reservoir
(31 July,2014)

Analysis of Map of Gubi Reservoir in 2015

The images of the Gubi reservoir as at March and July 2015 are showed in Figure 4.3 and Figure 4.18 respectively. The surface area of Gubi reservoir in March 2015 is 585.570 hectares whereas in July 2015 is 631.802 hectares. The seasonal variation in Gubi dam from the period of March 2015 to July 2015 is 46.232 hectares. This shows that the dam accommodates more water in July 2015 than in March 2015. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 556.982m especially in the period of November 2015, whereas in the period of December to around March 2015 decreased to minimum of 554.030m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.

Fig. 5: Map of Gubi Reservoir (12 March,2015)

Fig. 6: Map of Gubi Reservoir (02 July, 2015)

Analysis of Map of Gubi Reservoir in 2015

The images of the Gubi reservoir as at January and July 2016 are showed in Figure 4.5 and Figure 4.6 respectively. The surface area of Gubi reservoir in January 2015 is 596.235 hectares whereas in July 2016 is 681.257 hectares. The seasonal variation in Gubi dam from the period of January 2016 to July 2015 is 85.022 hectares. This shows that the dam accommodates more water in July 2016 than in January 2016. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 557.848m especially in the period of November 2016, whereas in the period of December to around March 2016 decreased to minimum of 554.674m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.

Fig. 7: Map of Gubi Reservoir (09 January, 2016)

Fig. 8: Map of Gubi Reservoir (04 July, 2016)

Analysis of Map of Gubi Reservoir in 2017

The images of the Gubi reservoir as at January and July 2017 are showed in Figure 4.7 and Figure 4.8 respectively. The surface area of Gubi reservoir in January 2017 is 514.965 hectares whereas in July 2017 is 622.675 hectares. The seasonal variation in Gubi dam from the period of January 2017 to July 2016 is 107.710 hectares. This shows that the dam accommodates more water in July 2017 than in January 2017. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 557.954m especially in the period of November 2017, whereas in the period of December to around March 2017 decreased to minimum of 555.262m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.
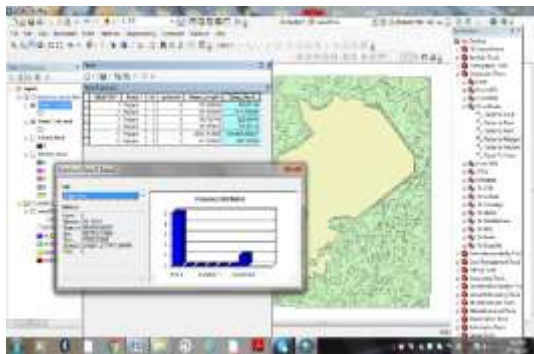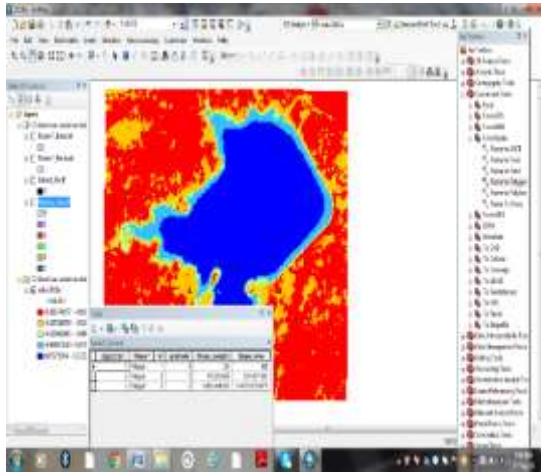

Fig. 9: Map of Gubi Reservoir (09 Jan,2017)   Fig. 10: Map of Gubi Reservoir (07 July, 2018)
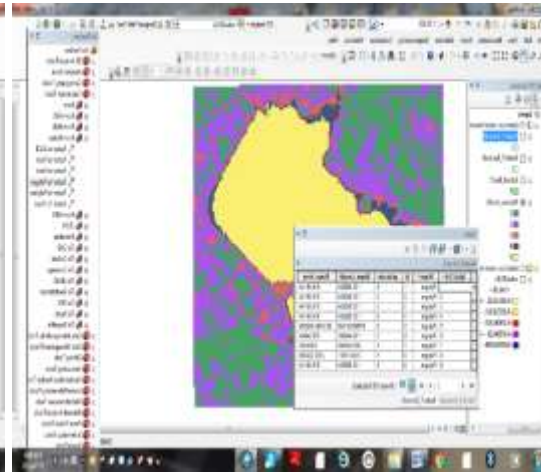
Analysis of Map of Gubi Reservoir in 2018

The images of the Gubi reservoir as at January and July 2018 are showed in Figure 4.9 and Figure 4.10 respectively. The surface area of Gubi reservoir in January 2018 is 614.641 hectares whereas in July 2018 is 673.724 hectares. The seasonal variation in Gubi dam from the period of January 2018 to July 2018 is 59.043 hectares. This shows that the dam accommodates more water in July 2018 than in January 2018. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 557.954m especially in the period of November 2019, whereas in the period of December to around March 2018 decreased to minimum of 555.262m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.
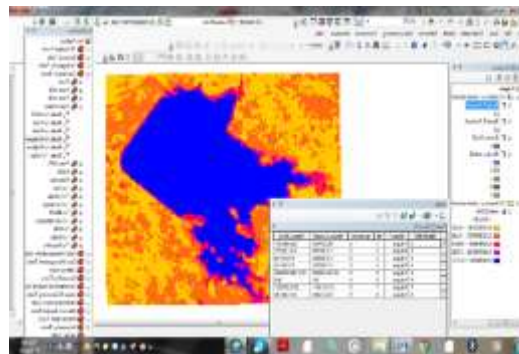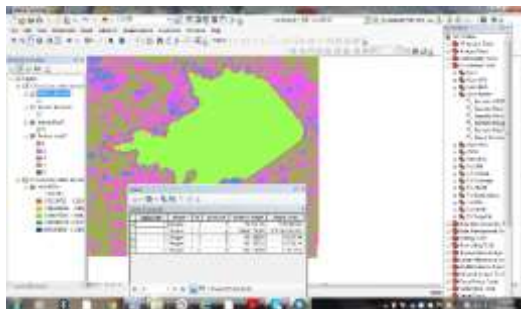
Fig. 11: Map of Gubi Reservoir (07 July, 2019)
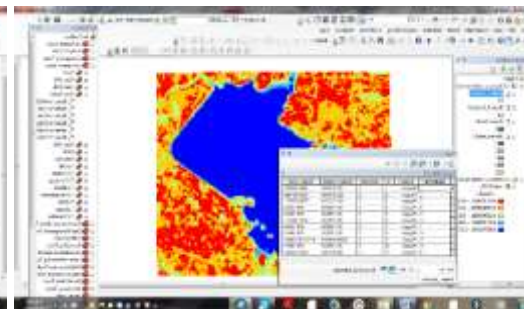
Fig. 12: Map of Gubi Reservoir (07 July, 2019)

Analysis of Map of Gubi Reservoir in 2019

The images of the Gubi reservoir as at January and July 2019 are showed in Figure 4.11 and Figure 4.12 respectively. The surface area of Gubi reservoir in January 2019 is 626.791 hectares whereas in July 2018 is 684.789 hectares. The seasonal variation in Gubi dam from the period of January 2019 to July 2019 is 57.999 hectares. This shows that the dam accommodates more water in July 2019 than in January 2019. The Gubi reservoir level in rainy season begin to rises up to a maximum value of 557.954m especially in the period of November 2019, whereas in the period of December to around March 2019 decreased to minimum of 555.262m as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux.
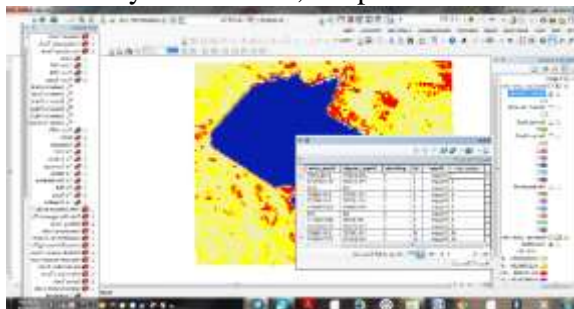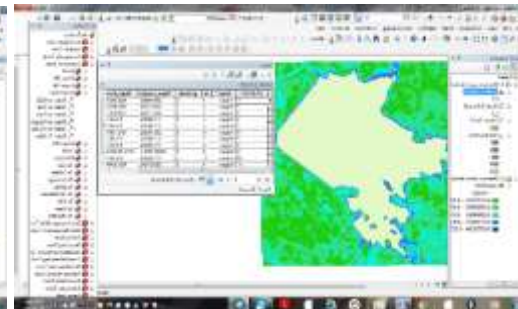

Fig. 13: Map of Gubi Reservoir (07 July, 2019)
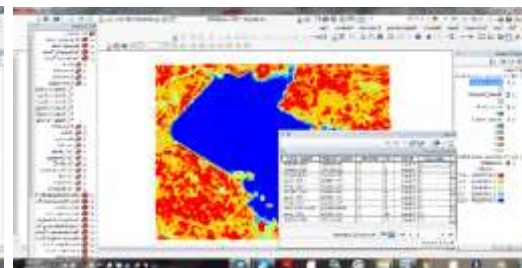
Fig. 14: Map of Gubi Reservoir (07 July, 2021)

Analysis of Map of Gubi Reservoir in 2021

The averages reduce level, surface area of the Gubi reservoir and the climatic variables are showed in Table 4.1. Plate 4.1 is the profile of the climatological Variables which indicated the variations between wind, temperature and radiation flux. Plate 4.2 showed the profile of the
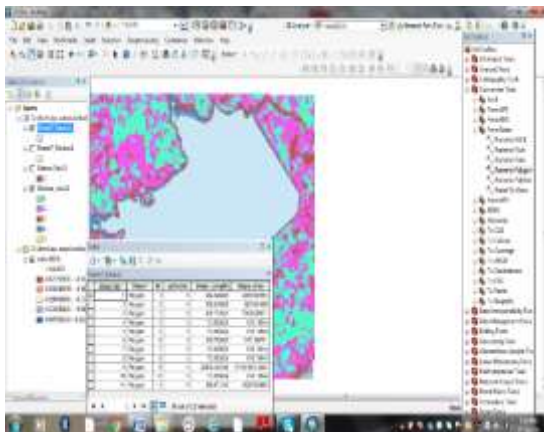
surface area of the Gubi reservoir and the average reduce level for each year. The higher the temperature, the higher the rate of evaporation in every year, therefore reduces the volume of the water in the reservoir.

Table 4: Sample of Climatologically Variables

Years	Days	Area (Hectare)	Aver. RL (m)	Diff in area(Hec)	Max-Tem (m)	Min-Tem (m)	Radiatio n	Wind
2019	12-Mar	625	554.030		30.6	20.2	23	2
	2-Jul	671	556.982	46	35.2	18.2	21	2
2020	9-Jan	648	554.674		24.5	12.2	25	4
	4-Jul	699	557.848	51	31.1	20.3	12	2
2021	7-Jul	694	557.954		32.5	17.9	16	3
	9-Jan	649	555.262	45	33.8	22.8	23	3
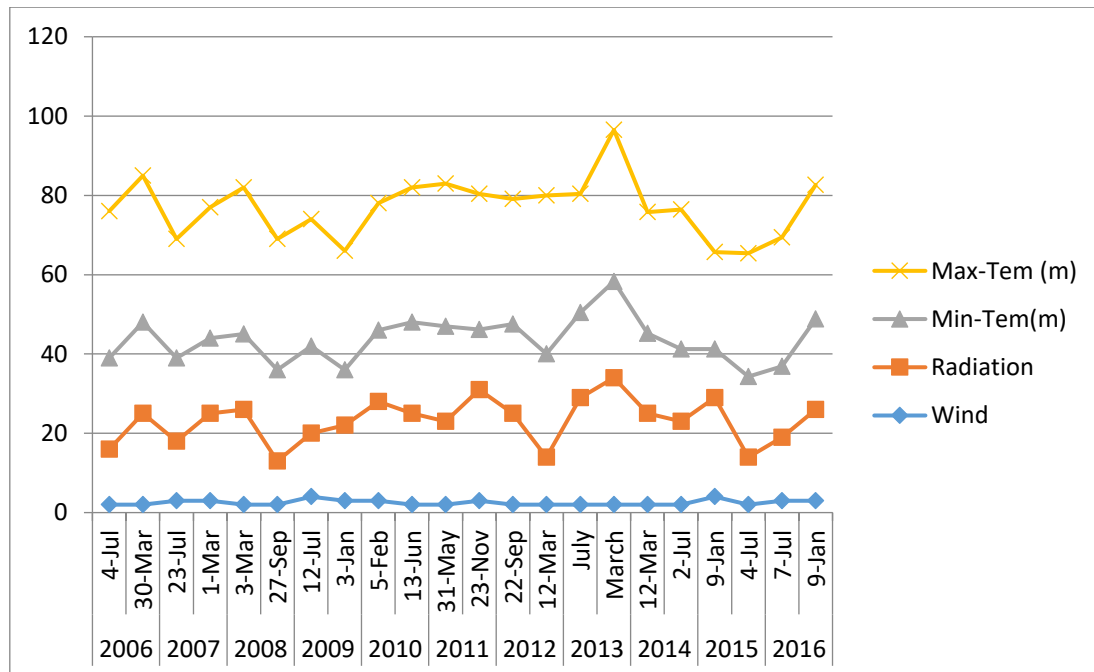
Plate 1: Climatologically Variables
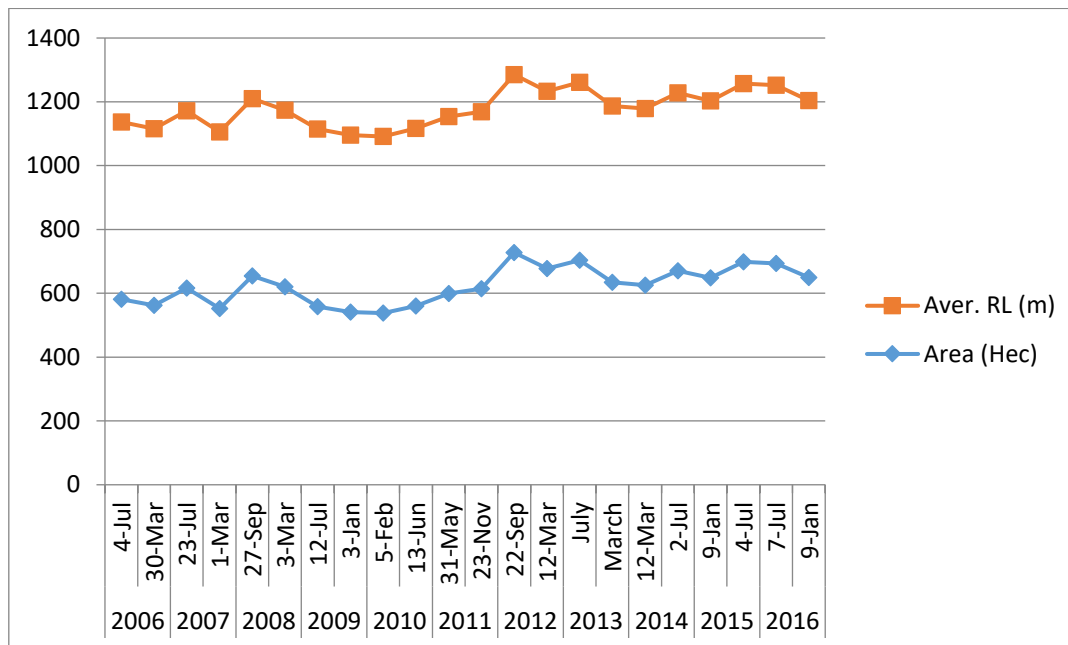
Plate 2: Profile of the Surface Area Covered and Average Reduce Level from 2014 to 2021

Summary

The LandSat imagery of the Gubi reservoir were downloaded from 2014 to 2021 and used for the analysis. The surface area of Gubi reservoir around January to April and November to December decreased drastically whereas in the period of May to October the surface area increased maximally. The seasonal variation in Gubi dam from the period of 2014 to 2021 varied increasingly due sedimentations from tributaries. The temperature and radiation flux has great influence on the volume of water in the reservoir whereas wind has little influence on the volume of water in the reservoir. The Gubi reservoir level in rainy season begin to rises up to a maximum level while in the period of December to around March of each year the reservoir level decrease as a result of water required by the community and in addition most likely due to wind, temperature and radiation flux. The profile of the climatological Variables which indicated the variations between wind, temperature and radiation flux were plotted. The results showed that the higher the temperature, the higher the rate of evaporation in every year, therefore reduces the volume of the water in the reservoir.

Conclusion

In this study, Gubi reservoir water level elevations and changes from 2014 to 2021 are examined using Landsat data. The water source in the dam varies in quantity and quality due to the seasonal variation over the catchments area. During rainy season, from the

period of May to October, the quantity of water in the reservoir will increase due to the amount of the rainfall observed during these periods. During dry season the level of water is reduced due to high consumption and the effect of evaporation due to high temperature, The peak valve of evaporation is mostly occur within the period of January to April and is the period of drought and high demand of water and it's may cause a drawdown of the reservoir water level.

Recommendations
  i.   We recommend that managers of Gubi dam should be able to predict the likelihood of floods with the available data and hence putting in place remedial actions to ensure that the community is not at risk.
  ii. We recommend other researcher to conduct research on hydrological modeling of Gubi reservoir to investigate the impacts of the reservoirs in water resources management.
  iii. We've also recommended further study on assessment of evaporation rates and sediment yield in Gubi reservoirs as this has a significant effect in water levels

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ANALYSIS OF EFFECT OF POULTRY MANURE ON GROWTH PARAMETERS IN MAIZE (*Zea maize*)

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ABSTRACT

The study analyse the effect of poultry manure on the growth parameters in maize. The field experiment was conducted at Kaduna Polytechnic Tudun Wada, Kaduna state in a Randomized Complete Block Design (RCBD) to observe and analyse the effect of poultry manure on the growth of maize. The experiment was carried out in sacks with three replications. Four rate of poultry manure applied at 0.0kg, 0.5kg, 1.0kg and 1.5kg per sack. Data collected from 2nd to 8th week after sowing were plant height, number of leaves and leaf area. The result obtain indicates that plants that receive 15% of poultry manure were superior at 8th week with mean height of 108.5cm, mean number of leaves of 15 and mean leaf area of $639.5cm^2$ based on the findings of the study, 1.5kg poultry manure was best to be used for the growth of maize.

Keywords: *Poultry, Manure, Growth parameters, Maize*

Introduction

Maize (*Zea mays*) is a major cereal and one of the most important food, feed and industrial crop in Nigeria. it is the most dominant grain crop in the savannah zones. Maize has become a staple food in many parts of the world, with total production surpassing that of wheat or rice (Linda Campbell Franklin 2013). It ranks third following wheat and rice in world production (FAO, 2002). Widely grown in the humid tropics and sub-Saharan Africa, the crop serves for food and livelihood for millions of people today (Enujeke, 2013).

It is consumed roasted, baked, fried, boiled or fermented in Nigeria (Agbato, 2003). In developed countries, maize is source of such industrial products as corn oil, syrup, corn flour, sugar, brewers' grit and alcohol (Dutt, 2005). As an energy supplement in livestock feed, maize is cherished by various species of animals, including poultry, cattle, pigs, goats, sheep and rabbits (DIPA, 2006).

The numerous uses of maize notwithstanding, yield in Africa has continuously declined to low as 1 t/ha due to such factors as rapid reduction in soil fertility and negligence of soil amendment materials. (DIPA, 2006, Enujeke, 2013).Sonetra (2002) suggested that subsistence farmers should apply organic manure directly to the soil as a natural means of

recycling nutrients in order to improve soil fertility and yield of crops. Manures and fertilizers are the life wire of improved technology contributing about 50 to 60% increase in productivity of food grains in many parts of the world, irrespective of soil and agro-ecological zone (DIPA, 2006).

Poultry manure has traditionally been treated as a waste product and applied to surrounding crop and pasturelands to recycle nutrients, primarily nitrogen (N), phosphorus (P), and potash (K) (Lorimor and Xin, 1999). Poultry manure is often applied to meet the crop N requirement, resulting in excessive P application. While the agronomic benefits are well established, the environmental aspects of poultry manure management have primarily focused on water quality (Harmel et al., 2009; Vervoort et al., 1998). A more comprehensive assessment of poultry manure usage in agro-ecosystems considers crop yield, soil health, and water quality, as well as the economic impact of integrating poultry manure into cropping systems. Economic factors are of paramount importance as they are a primary, if not the leading factor driving farm-scale decision-making.

A recent, comprehensive review of 90 studies examined the effect of poultry manure on crop yield, when compared to inorganic fertilizer application. Overall, results depend on soil types, tillage, method of application, and cropping system (Lin et al.,2018). In general, poultry manure has significant, positive yield increases under strip-till or no-till practices; higher yields were observed from cotton, corn, soybean, and peanut crops amended with poultry manure; and yield benefits were more pronounced with repeated applications. We also previously reported statistically greater soybean yield from field plots in CS rotation amended with PM when compared to UAN fertilizer at the same application rate (Nguyen et al,. 2013)

Reported increased productivity from poultry manure amended soils likely indicates that repeated application to cropland has potential to improve soil health characteristics such as soil organic matter and soil fertility (Lin et al.,2018).. Crop N needs are met by soil N as well as fertilizer inputs. By building soil organic matter and mineralizable soil N, crop production is less dependent on N additions (Spargo et al,. 2011), resulting in more sustainable agro-ecosystems. However, studies of manure application to cropland have not always resulted in improved soil health indicators (Clark et al,. 2017) partially because of difficulties in assessing soil health in short-term studies due to the complex and dynamic nature of soil N and organic matter. Soil health characteristic measurements typically include bulk density, total soil carbon (C) and nitrogen (N), particulate organic matter (POM) content, POM C and N, and aggregate size distribution, but can also include soil biological activity and potentially mineralizable N. Early work by (Wander et al,. 1994) reported improved active organic matter in an animal-based rotation which included poultry manure, and another study recently reported that poultry manure application prior to raspberry planting improved soil bulk density and aggregation relative to control and cover crop treatments (Forge et al., 2016)

Poultry manure application to pasture and cropland has long been documented as a contributing source of non-point source (NPS) pollutants N and P to downstream waters through surface pathways Heathman et al., 1995; et al.,Soupir et al., 2006).

Reijnties and Adepetu (1992) remarked that the downward trend in food production should prompt farmers to amend the soil with different materials in order to enhance growth and yield of crops. Several organic materials such as cattle dung, poultry dropping, pig dung and refuse compost have been recommended to subsistence farmers in West Africa as soil amendments for increasing crop yield. Sobulo and Babalola (1992) reported that poultry dropping and cattle dung increased root growth of maize and the crop extracted soil water more efficiently for increased grain yield.

Stefan (2003) indicated that fresh poultry dropping contain 70% water, 1.4% N, 1.1% P2O5 and 0.5% K2O while dried poultry manure contains 13% water, 3.6% N, 3.5% P2O5 and 1.6% K2O. Among the different sources of organic manure which have been used in crop production, poultry manure was found to be the most concentrated in terms of nutrient content (Lombin*et al,* 1991).

Kostchi*et al,* (1989) observed that application of poultry manure improved the availability of some minerals in the soil, and especially the transfer of nutrients from rangeland to the crop plant. Izunobi (2002) reported that poultry manure, especially those produced in deep litter or battery cage house are the richest known farmyard manure supplying greater amounts of absorbable plant nutrient. Fabiye and Ogunfowora (1992) noted that poultry dropping play significant roles in enhancing yield of crops in the southern part of Nigeria. Amujoyegbe*et al,* (2007) reported that poultry manure increased the leaf area, total chlorophyll content and grain yield of maize and sorghum. According to Brady and Weil (1999), poultry manure mineralizes faster than other animal manure such as cattle or pig dung; hence it releases its nutrients for plant uptake and utilization rapidly.

Sharply and Smith (1991) reported that poultry manure contains basic nutrients required for enhancing growth and yield of crops. Application of poultry manure increases carbon content, water holding capacity, aggregation of soil, and decreases bulk density (Egerszegi, 1990).

It also increases the water soluble and exchangeable potassium and magnesium which enhance crop yield (Jackson *et al,* 1999). Ibeawuchi*et al,* (2007) reported that 8 t/ha of poultry manure resulted in significantly higher grain yield, dry matter and increased leaf area of maize. Fagimi and Odebode (2007) reported that poultry droppings applied at the rate of 10 t/ha and 20 t/ha, increased plant height, number of leaves and fruit yield of Pepper, while the incidence and severity of Pepper Veinal Mottle Virus (PVMV) was reduced.

At present, there are no recommended standards with respect to rate of poultry manure or other soil amendment material for enhancement of maize yield in the study area.

Problem Statement

Maize (*Zea mays*) is currently produced on nearly 100 million hectares in 125 developing countries and is among the three most widely grown crops in 75 of those countries (FAOSTAT, 2010). Although much of the world's maize production (approximately 78%)

is utilized for animal feed, human consumption in many developing and developed countries is steadily increasing. Maize has now risen to a commercial crop on which many agro-based industries depend on as raw materials (Iken and Amusa, 2010). Maize is a major important cereal crop being cultivated in the rainforest and the savannah agro ecological zones of Nigeria and it has been in the diet of Nigerians for centuries. It is one of the important grains in Nigeria, not only on the basis of the number of farmers that are engaged in its cultivation, but also on its economic value (Ogunlade et al., 2010; Olaniyi and Adewale, 2012).

The numerous uses of maize notwithstanding, yield in Africa has continuously declined to low as 1 t/ha due to such factors as rapid reduction in soil fertility and negligence of soil amendment materials. (DIPA, 2006, Enujeke, 2013). The decline in the production is not unconnected with the inability of the small scale farmers to purchase the recommended quantity of fertilizer required by the crop due high cost of the inorganic or chemical fertilizers. As such,Sonetra (2002) suggested that subsistence farmers should apply organic manure directly to the soil as a natural means of recycling nutrients in order to improve soil fertility and yield of crops. Izunobi (2002) reported that poultry manure, especially those produced in deep litter or battery cage house are the richest known farmyard manure supplying greater amounts of absorbable plant nutrient.Therefore this study is undertaken to examine the effects of poultry manure on the growth parameters in maize, which could invariably reflect on the yield of maize plant.

We want all our maize (*Zea mays*) farmers/producers to meet with the demands of maize, which is increasing rapidly in our society.

Today we have too many improper growth experience by maize farmers and this may result to how production of maize annually from other to meet the demand of the consumers.

We have decided to carry out this research in other to know the influence of poultry manure on the growth of maize, which will improve the growth rate, the income of the farmers and also the availability of maize throughout the year round.

Objectives of the Study

The broad objective of this study is to determine the influence of poultry manure on the growth of maize variety (*Summaz 31.)* in the study area.

The specific objectives were to:

   i.   Ascertain the effects of poultry manure on the plant height of maize.

  ii.   Ascertain the effects of poultry manure on number of leaves of maize.

 iii.   Ascertain the effects of poultry manure on leaf area of maize.

Methodology:

Study area

Field experiments were carried out at Kaduna Polytechnic Tudun Wada area of Kaduna state (10.1590°N, 8.1339°E). The experimental site is located within 10.5216° N, 7.4146°

E of the equator. The experiment was conducted during the months of 2020/2021 cropping seasons.

Rainfall

Rainy season is usually from April, to October with less rain as you move northwards. On the average, the state enjoys a rainy season of about five months. Rainfall ranges from 800mm to 1500mm from North to South respectively, BUBA, T. J. (2005).

Method of Data Collection /Material used
1. Maize seeds.
2. Sacks.
3. Sample of loamy soil.
4. Water.
5. Tape rule.
6. Hoe/shovel.
7. Poultry manure.
8. Weighing balance.

Sampling Technique

The experiment was carried out in a randomized complete block design (RCBD) with three replicates. Rate of poultry manure in kg/sack were 0, 0.5, 1.0, 1.5.

Area of the land:
$0.3m \times 0.28m = 0.84m^2$.
Size of the land in hectare is:
$0.084m^2 \times 0.0001 = 0.000084ha$.

Seed Collection and Planting

The seed (*Sammaz 31)* was collected from a farmer at Mando Igabi local government area of Kaduna state and sown into the sack at the rate of 2 seeds per hole at a depth of 2-3 cm.

Weeding

Weed control (weeding) is the botanical component of pest control, which attempts to stop weeds, especially noxious or injurious weeds, from competing with desired flora and fauna.

Generally, a weed is a plant grown where it is not wanted. A plant is often termed a "weed" when it has one or more of the following characteristics:
• Little or no recognized value (as in medicinal, material, nutritional or energy)
• Rapid growth and/or ease of germination

- Competitive with crops for space, light, water and nutrients

Methods of Weeds Control

Weed control plans typically consist of many methods which are divided into physical/mechanical, biological, cultural, and chemical control. These are:

- Physical/mechanical method- Manual: This is by pulling the weeds out of the ground using hand or hoe, making sure to include the roots that would otherwise allow them to sprout.
- Cultural method- Crop rotation.
- Biological method- Animal grazing.
- Chemical method- using herbicides.

Method Used for Weeding

Weed was controlled by physical method (manual), this is by pulling the weeds out of the ground using hand or hoe, making sure to include the roots that would otherwise allow them to sprout.

Data Collection

Data collected were plant height, number of leaves, leaf area. Plant height was measured with tape rule from the base of the first tassel. Leaf area measured also with tape using Number of leaves obtained by direct counting.

Analytical tools

Descriptive statistic was used to achieve all the objectives.

Result and Discussion:

Effects of Poultry Manure on Plant height of Maize

The response of plant height of maize of poultry manure in A and B is shown in Table 1. There were gradual increases in plant height of maize from 2-8 weeks after sowing. In A, plants that received 1.0kg of poultry manure had the highest height at 2nd week after sowing (23cm), while plant in the control which is grown without poultry manure had the lowest plant height (18cm). In B, the trend change, plants that received 0.5kg had the highest plant height (24cm) while 1.0kg in B had the lowest height (16cm) and plant without poultry manure had the height of 20cm. At 4th week after sowing in A sample, plant that received 1.0kg of poultry manure also had the highest height (54.5cm) while plant in the control had the lowest height (41.5cm). In B sample, plant that received 0.5kg of had the highest height (52.5cm) while plant that did not receive poultry manure had the height of 44.5cm which is the lowest in in B sample.

During the 8th week of both sample A and B, the plants grow taller. In A sample, plant that received 1.0kg has the height of 114cm and the plant without manure is the shortest with the height of 97cm while in B, plant that received 1.5kg is the superior and tallest with 121cm height and that of 0.5kg is the shortest with 82cm height.

Table 1: Effects of Poultry Manure on Plant Height of Maize

	2nd week	4th week	8th week
	Mean Average	Mean Average	Mean Average
Rate of application (kg/ha)			
0.0	19	43	93.5
0.5	22.5	40.8	91.5
1.0	19.5	49.9	108.5
1.5	21	50.5	116

Means with the same letter(s) under the same column are not significant using Duncan Multiple Range Test (DMRT).

Effect of Poultry Manure on Number of Leaves of Maize

The effects of poultry manure on number of leaves is shown in Table 3. Number of leaves consistently increased from 2 – 8 weeks after sowing. There was significant difference in number of leaves with respect to rates of poultry manure applied. During the 2nd week, plants that received 1.5kg of poultry manure were outstanding with mean number of 5.8 in A and B sample. Plants in control sample had the lowest mean number in both samples (2). At 4th week after sowing, mean number of leaves of plant that received 1.5kg of poultry manure was also highest (7.8) while mean number of lowest plants in the control samples was lowest (4.3).

During 8th week of A and B samples, mean number of leaves of plants that received 1.5kg of poultry manure was highest (15), while plant that did not receive poultry manure had the lowest mean number of leaves (11.3).

Table 2: Effect of Poultry Manure on Number Leaves of Maize

	2nd week	4th week	8th week
	Mean average	Mean average	Mean average
Rate of application (kg/ha)			
0.0	2	4.3	11.3
0.5	3.3	6.5	13.5
1.0	3.5	7.5	13.5
1.5	5.8	7.8	15

Means with the same letter(s) under the same column are not significant using Duncan Multiple Range Test (DMRT).

Effect of Poultry Manure in the Leaf Area of Maize

The response of leaf area of maize to rates of poultry manure in A and B samples is shown in table 2. There were significant differences in mean leaf area of maize in both samples of evaluation. During the 2nd week, the mean of leaf area of plants that received 1.5kg was 71cm^2, while the plants that received 0.5kg of poultry manure had mean leaf area of 18.5cm^2 which is the lowest. At 4th week after sowing, mean leaf area of plants that received 1.5kg of poultry manure was (233.3cm^2). plants with 0.5kg has the lowest mean area of 141cm^2.

During the 8th week, plant in A sample that record 1.5kg is the superior with a leaf area of (740cm^2) and plant that had 0.0kg of poultry manure has the lowest leaf area while in B sample, plant that received 1.5kg of poultry manure had the highest leaf area (639.5) and that with 5% that has 420cm^2 is the lowest.

Table 3: Effect of Poultry Manure in the Leaf Area of Maize

Rate of Application (kg/ha)	2nd week Mean	4th week Mean	8th week Mean
0.0	30	160.5	539
0.5	18.5	141	420.5
1.0	68.5	229	635.5
1.5	71	233.3	639.5

Means with the same letter(s) under the same column are not significant using Duncan Multiple Range Test (DMRT).

Discussions

Effects of Poultry Manure On Plant Height of Maize

Plants that received 1.0kg and 1.5kg of poultry manure, maize grew taller than other plants possibly because more concentrated nutrients or minerals were made readily available and easily absorbable by the receiving plants leading to faster growth and development. This is in harmony with the findings and reports Izunobi, (2002). It is also similar to the findings of Fagimi*et al* (2007) who reported increased plant height and number of leaves of pepper resulting from application of higher rate of poultry manure. It is also similar to the findings and report of Enujeke, (2008 and 2009) on the increased plant height and number of leaves of maize resulting from application of higher rate of poultry manure.

Effects of Poultry Manure On Number of Leaves of Maize

Application of 1.5kg of poultry manure was superior to other rates applied with respect to producing higher number of leaves of maize. This could be attributed to the fact that 1.5kg was compatible with the requirements and growing characteristics of the crop. This is in consonance with the findings of Dipa, (2006) which recommended that manure be applied

at rates that are compatible with the nutrient requirements and growing characteristics of the crops for growth and yield enhancement. It is also compatible with the result and findings of Enujeke, (2008 and 2009).

Effects of Poultry Manure On Leaf Area of Maize

Poultry manure application rate of 1.5kg increased leaf area higher than other application rates investigated possibly because that rate was most suitable or appropriate for increasing carbon content, water holding capacity, aggregation of soil and decrease of bulk density, all of which interplay to increase leaf area and total chlorophyll content of maize. This is consistent with the findings of Amujoyegbe*et al*, (2007) and Enujeke, (2008 and 2009) who reported that increased application rate of poultry manure enhanced lead area, total chlorophyll content, carbon content, water holding capacity, and decrease bulk density of soil which culminate and interplay to promote yield.

Summary and Conclusions

The indicate that poultry manure application has positive effect in the growth parameters considered for the study and also the crop yield, soil health, and farm economics. Yield increase is expected, which can be as a result of improved soil property such as increase infiltration, and also increase soil water-holding capacity. Poultry manure is an organic fertilizer source that benefits yield, soil health and overall farm income, and thus can be view as viable substitute for expensive inorganic fertilizer under the current hard economic situation for the farmers.

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THE EFFECT OF ENTREPRENEURIAL ORIENTATION ON THE SURVIVAL OF SMALL AND MEDIUM ENTERPRISES IN NIGERIA

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Abstract
Entrepreneurial Orientation has significant influence on firm performance more so for small and medium firms operating under globalization and internationalization and regional integration regimes. Globalization results in expanded markets, characterized by increased number of competition, and shrinking market size. This global competition, increasing interdependence, rapid technology development, unstable environments, and many other factors exerts greater pressure on small and medium firms accustomed to operating under a domestic market set-up. To overcome the challenges associated with globalization, eminent scholars in other parts of the world have recommended that firms adopt entrepreneurial orientation as a solution to the challenges brought about by globalization. It is on this basis that this study sought to determine the influence of entrepreneurial orientation on the performance of small and medium enterprises in the information and communications technology sector. The study used descriptive statistics such as mean, standard deviation, median and proportions using the Statistical Package for Social Sciences (SPSS) version 24 and Microsoft Excel. Regression analysis and correlation analysis were used to determine the direction and strength of the relationship between the independent and the dependent variables.. The questionnaires were administered among the seventy (234) management staff members of the one hundred and seventy two (162) selected SMEs in Nigeria through purposive sampling method, and this was done personally by the researcher. Descriptive and inferential statistics was use to analyze and interpret the data use in this research. The study reveals that entrepreneurial orientation is a major challenges that help SMEs to grow and achieve its stated objectives in global competitive environment The study sought to answer the question of what shaped entrepreneurial orientation in SMEs in a developing country context and to answer the question of what contributed to performance for SME. The findings of the study revealed that employee relations showed a positive but insignificant effect on the performance of manufacturing companies in Nigeria. The study recommends the enhancement of employee relations through health and safety, training and development, and staff welfare to maximize employee productivity. It recommends the promotion of customer satisfaction through product information, quality assurance and customer feedback to enhance customer loyalty and firm's reputation to survive in the highly competitive market place.

Keywords: *Entrepreneurial Orientation, Manufacturing companies, SMEs*

INTRODUCTION

Entrepreneurial orientation refers to infusing the enterprise with innovative behaviors' as a means to achieve such thinking (Schindehutte, Morris, & Kuratko, 2000). While Morris and Kuratko (2018) refers to this mix as firm entrepreneurship with a managerial approach that will encourage innovation and reenergize employee. Furthermore, other scholars refer to firm entrepreneurship as starting innovative management, firm level entrepreneurship, and entrepreneurship management (Stevenson & Jarillo, 2017; Ngotze, Bwisa, & Sakwa, 2019; Covin, 2018). Three situations that can be viewed as firm entrepreneurship therefore emerge as: An individual or individuals developing new products and services in an established enterprise, an entrepreneurial thinking that infuses the whole enterprise operations, and lastly, an enterprise entering new business for instance diversification, a situation where employees act in ways described as entrepreneurial. However, entrepreneurial decision making is affected by cognitive and environmental variables (Hindle, 2019). He further observes that, this compares well with the earlier suggestions on the relationship between performance and the entrepreneurial potential and environmental constraints where Wagner (2017) and Zarr (2018) have shown that almost 80% of small businesses fail within 10 years of launching. The same research also show that those businesses that fail follow the same paths to destruction when these issues could be avoided by just some understanding factors that determine the formation and growth of enterprises, and a little help from experts and consultant (ROK, 2019).

Kuratko and Hodgets (2017) perceive today's enterprise environment to be characterized by a rapid growth of new and sophisticated competitors and a need to improve efficiency and productivity. Mokaya (2018) on the other hand emphaizes firm entrepreneurship as a response strategy to realize competitive advantage in the turbulent and hostile enterprise environment. Similarly this agrees with, Cole (1959) who alludes that for enterprises to survive, they need to continually create an emphasis on firm entrepreneurship as a source of discontinuous innovation that alter rules of competition in their favor. Continuous innovation could imply entrepreneurial orientation by co-operative firms engaging in the component of newness in running their routine activities.

Anderson, Dodd, and Jack, (2018) acknowledges that entrepreneurial opportunities in a country could be affected by access to resources, markets, land, basic infrastructure, skills, traits, knowledge, and culture could affect performance of enterprises. Enterprise culture could result in the development of negative attitudes towards certain enterprises, hence poor enterprise performanc. Performance of co-operative enterprises in Kenya vary a great deal (Wanyam, 2019). The co-operative enterprises operate in the same economic environment like Small and Medium Enterpries where they are confronted with a hostile political, social, economic and institutional environment. These environment equally

hinders cooperative sector's ability to participate effectively in development (Naituli, 2017; ILO, 2019). For entrepreneurial orientation and dynamism in the co-operative sector to work, it demands low barriers to entry, effective guarantees for property rights and access to finances in order for the enterprises to perform at optimum.

Accordingly co-operatives require among other things appropriate physical infrastructure, access to technology, market, sources of assistance and a favorable legal and regulatory environment (Wanyama, 2008; International Co-operative Agency, 1995;World Bank, 2006). However, as earlier observed there is a gap between policy formulation and implementation in developing countries (Cooperative Alliance Agency, 2018: ROK, 2017). This could also be a factor that could effectively hinder the co-operative enterprise performance in Uasin Gishu County in Kenya. Entrepreneurial strategy was once considered mainly a focus on the individual innovator and risk taker, but has now branched into other areas of interest including organizational and environmental interface effectively (Brizek, 2003). Triggering events seem to occur faster than expected (Morris et al., 2008) and as suggested by Drucker (1958), the only constant thing in business is change. The fact that the changing enterprise environment and rule of competition are becoming part of life in most enterprises means that this is a requirements for staying on business. Change being the only thing that endures.

Firm entrepreneurship focuses on the culture within an enterprise to become more entrepreneurial in nature in order to compete in the turbulent enterprise environment (Das, 2018). Literature indicates, firm entrepreneurship as the managerial process of enterprise creation (Davies, & Morris, 1991). However, current literature indicates facets of corporate entrepreneurship such as the analysis of the managerial process of firstly: the birth of new business within existing enterprises, either through joint venturing or internal innovation (Guth & Ginsberg, 1990). Secondly, the transformation of enterprises through strategic regeneration, which means the creation of new wealth through the combination of resources as a result of entrepreneurial activities (Gail, 2018).

Therefore, for co-operative societies to meet their objective, they need to establish competitive advantage through continuous innovation, whether related to the creation of new product and services, production and business models (lumpkin, 2010; Mokaya, 2012). Wanyama, (2018) suggests that co-operatives need to adapt with speed, aggressiveness, determination, boldness and innovativeness, where Lumkin and Dess (1999) refers to all this as entrepreneurial orientation.

In the current co-operative framework, members are undecided in their desire to make employees and enterprises more entrepreneurial (Herbert & Brazeal, 2017; Develtere, Pollet, & Wanyama, 2018; 2019). According to ICA, (2018) the task is to create an enabling environment that fosters, motivates, attracts and retains entrepreneurial employees within co-operative enterprises. Facts which Gamal (2018) agrees to and emphasizes the instilling and enhancing of an entrepreneurial culture of innovation where

employees can pursue entrepreneurial events and fail without being punished, rather rewarded for them to continue engaging in entrepreneurial activities. . A point worth noting is that entrepreneurial orientation outcomes includes new entrepreneurial events such as innovativeness, risk taking, proactiveness, competitiveness that could improve and enhances co-operative performance too (Lumpkin & Dess, 2018).

Statement of the Problem

The Micro, Small and Medium Establishments report (RoK, 2018) indicates that there is high mortality rate of SMEs in Nigeria with a total of 2.2 million businesses having closed from 2012 to 2016. Small and Medium enterprises in Nigeria have been experiencing setbacks which led poor performances after the collapse of manufacturing companies between 2000-2008 whereby 20 companies shut down or suspended production due to economic recession (Ayodeji, 2017) It is argued that in Nigeria, just like in other country, the survival rate of SMEs is only 10-20% (Adeji, Ngugi & Wale, 2018). The SME sector has great potential as we realize that while many SMEs fail, others survive beyond infancy and adolescence, becoming major success stories, creating wealth for their founders and jobs for the communities they serve (Vijay & Ajay, 2019).

For instance, in Spain entrepreneurial competencies have not only direct impact, but also indirect impact on SME firm performance via the mediating effect of organizational capabilities (Sanchez, 2017). In Tanzania, Madatta (2019) found out that entrepreneurial competencies are directly associated to business success. Since each market and economy has its own features that provide a unique environment for SMEs to develop and operate, the Nigeria scenario requires its own analysis. In Nigeria, most studies relating to SMEs failure rate have mainly concentrated on the growth aspect (Abdul & Ngugi, 2017; Bernadette, 2019;. Manufacturing sector is a key driver of global trade and is highly espoused in Vision 2030 economic blueprint, 2013). The government of Nigeria has initiated programmes to shift into mass industrial production of higher value-added goods that are competitive in the export market through development of a favourable business environment and infrastructure , 2016; , 2014), hence the need to study the manufacturing sector in Nigeria.

Research Objectives

The general objective of the study is to determine the effect of entrepreneurial orientation on the survival of small and medium enterprises in Nigeria

Specific objective;

The specific objective is to ascertain the effect of entrepreneurial orientation on the survival of small and medium enterprises in Nigeria

Research Question

1. How does entrepreneurial orientation influence the survival of small and medium enterprises in Nigeria
?

Research Hypothesis:

H_{02} Entrepreneurial orientation has no significant influence on the survival of small and medium enterprises in Nigeria

Justification of the study

Managers without strategic understanding of Entrepreneurial orientation are prone to postponing costs that later escalate when the company is later judged to have violated its entrepreneurial orientation. The study is important to start-ups so that they can be able to evaluate their competencies that will enhance their chances of survival and eventual growth. It will serve as a resource for personal decision-making as a self-evaluation aid that can be used to increase prospective entrepreneur's awareness of their strengths and weaknesses with regard to future business endeavors. Having the right idea early on about which competencies are necessary, a person can focus more effectively on developing them and thus avoid the unproductive wondering where to concentrate the so valuable personal time and efforts. These professionals would thus be more aware of the competencies which the entrepreneurs need to master and be trained on thereby be able to offer proper guidance and assistance. As for existing SMEs, it is time to re-look at their competencies and in the event of any deficiency then think of how to enhance the same either through training or education. Knowing which of their personal competencies (existing and to be developed) might positively affect their business, entrepreneurs can thus act with greater accuracy and confidence towards the accomplishment of their goals. The study would therefore help policy makers formulate policies that are geared towards ensuring SME's survival based on what would increase their entrepreneurial competencies.   Research interest in manufacturing sector stems from the consequences of factories on the environment and society in which they are located, and the significant impact on the economy of a nation since it is the basis for determining a nation's economic efficiency

LITERATURE REVIEW

Concept of entrepreneurial orientation (EO)

Entrepreneurial orientation (EO) is described as a firm-level tactical orientationwhich captures a firm's strategy-making exercise, managerial philosophies, and behaviours that are entrepreneurial (Anderson et al., 2019). Firms are said to having EO when they support and exhibit entrepreneurial behaviour to become a distinctive organizational attribute

(Covin & Wales, 2019). One of the similarities among past EO research is the inclusion of proactiveness, innovativeness, and calculated risk-taking as central aspects or dimensions of the orientation (Wales, 2016, 2018). In the past, EO has largely been measured using a nine-item psychometric instrument developed by Dennis Slevin & Jeff Covin (Wales, 2019).

The idea that SMEs and economic growth are very closely and positively linked together has undoubtedly made its way since the early works of Schumpeter (Adeoye, 2018). They are considered as the engine of growth and development of countries due to their immense contributions to the manufacturing subsector, diversification of output, and reduction of unemployment (Iorun, 2019). They create employment not only to the business owners but also to others since the sector is characterized by ease of entry, small scale operations, adaptive technology, and are found in every part of a country.

The SME sector is expanding fast and wide to include entrepreneurs bent on solving societal problems. These new crop of entrepreneurs are thus widening the importance of SMEs beyond what is traditionally known (Lam, & Harker, 2019). Ormiston & Seymour (2017) noted that within the last decade more and more entrepreneurs through their SMEs are focusing their work on resolving social problems. Whether it is poverty or climate change, these important issues deserve the efforts of these eager entrepreneurs, and their work benefits the society not just through the jobs they create or the sleek product they deliver, but by the people they help. In doing so, they often act with little or no intention of gaining personal profit.

There is arguably high mortality rate of SMEs within the first three years of operation. Efforts directed towards enhancing their survival and eventual growth has been a concern to researchers, policy makers and governments. Many SMEs encounter problems that limit their survival. Ng and Kee (2020) argue that in order to survive and become successful in today's competitive and rapidly changing market environments,

SMEs need to continuously acquire and enhance their entrepreneurial competencies. They believe that entrepreneurial competencies play a pivotal role in ensuring survival and success of business. The focus here is on the entrepreneur because it is him who makes the difference: he sets the conditions, the boundaries, the characteristics and ultimately the value creating ability of the enterprise (Sanchez, 2018).

Small and Medium Enterprises (SMEs) cover a variety of enterprises providing goods and services. They encompass sole proprietorship or entrepreneurship, family business and partnerships, and may be incorporated or unincorporated. Small and Medium Enterprises come in many different shapes and sizes; however, in today's complex business environment they may have close financial, operational or governance relationships with other enterprises. These relationships often make it difficult to precisely draw the line between an SME and a larger enterprise. Small and medium enterprises are named by adjectives indicating size, thus economists tend to divide them into classes according to

some quantitative measurable indicators. The most common criterion to distinguish between large and small businesses is the number of employees (Hatten, 2019).

The definition adopted by regulators recognizes the number of employees, sales and/or turnover size. The commonest among the three is the number of employee's criterion. European Commission lends support to this as the main criterion (Ardic, Mylenko & Saltane, 2019). In Kenya, SMEs are officially defined according to employment size: Micro enterprises (1-9 employees), Small Enterprise (10-49 employees), Medium Enterprise (50-99 employees). Use of the term "employment" here does not necessarily imply partially or fully paid employment; but refers to the total number of people working in the business whether they are partially, fully paid or not (RoK, 2016). This study is therefore restricted to firms with less than 100 employees.

It is estimated that SMEs make up more than 90% of all new business establishment worldwide. They have been identified by the Western economies as a significant strategy of job and wealth creation. In the developing countries, interest in the role of SMEs in economic growth is considerably high, regeneration in general and the creation of employment opportunities in particular. They are widely recognized the world over for their role in the social, political and economic development (World Bank, 2018).

Empirical studies show that SMEs contribute to over 55% of GDP and over 65% of total employment in high-income countries. SMEs and informal enterprises account for over 60% of GDP and over 70% of total employment in low-income countries, while they contribute over 95% of total employment and about 70% of GDP in middle-income countries (Nyagah, 2020). The relative importance of SMEs and the informal sector are inversely associated with economic development. In the least developed economies, the contribution of SMEs to employment and GDP is less than that of the informal sector, where the great majority of the poorest of the poor make a subsistence level of living (Okpara, 2018).

The contribution made by SMEs does vary widely between countries and regions. Nevertheless, although they play particularly key roles in high-income countries, SMEs are also important to low-income countries, making significant contributions to both GDP and employment (Dalberg, 2011). When combining the data for those countries for which reasonably good data are available, SMEs account for 52% of private sector value added, this provides a reasonable estimate for the sector's global economic contribution. The contribution of SMEs to economic fundamentals nonetheless varies substantially across countries: from 16% of GDP in low-income countries (where the sector is typically large but informal) to 51% of GDP in high-income countries (ACCA 2010). Though SMEs played an important role in national economy and provide the majority of job opportunities, the survival of SMEs are not optimistic around the world. Previous researcher has shown that 68% of all SMEs in the United States of America (USA) made their exit from business within 5 years, 19% survived from 6 to 10 years, merely 13%

survived in excess of 10 years while in Europe, only 65% of SMEs survived for more than 3 years, and 50% survived for more than 5 years (Cao, 2018).

Theoretical Framework

This section examines theories and business models used to establish the theoretical foundations of the study. A theory is a set of concepts or constructs and the interrelations that are assumed to exist among them, which contains generalizations and hypothesized principles which can be scientifically tested. It provides the basis for establishing the objectives and hypotheses of the study. Theories are analytical tools for understanding, explaining, and making predictions about a given subject matter. They form the base on which research is founded by providing prior expectations (Gujarati & Porter, 2010). This study was based on stakeholder theory, resource based theory, social contract theory, social identity theory and slack resources theory.

Stakeholder Theory

Stakeholder theory suggests that a firm's obligation is not only to maximize profits but also to increase stakeholder satisfaction. It argues that organizations should balance a multiplicity of stakeholders' interests. It recognizes that firms have obligation to a wide and integrated set of stakeholders (Harrison & Wicks, 2013; Sweeney, 2009). It posits that organizations should treat all stakeholders fairly to improve their performance and competitiveness in the marketplace (Tilakasiri, 2012; Yin et al., 2013).

The major limitation of the stakeholder theory is that it proposes fair treatment of all stakeholders, which conflicts with the major business profitability objective. The major strength of this theory is that it imposes responsibility on firms beyond regulatory requirement which assures firm's long term success and sustainability (Tilakasiri, 2012).

Resource Based Theory

The resource-based view (RBT) contends that the possession of strategic resources provides an organization with a golden opportunity to develop competitive advantages over its rivals (Freeman et al., 2010). RBT provides an assessment of the resources that the firm requires to possess and dispose of a bundle of distinctive capabilities and competencies to be competitive. The RBT suggests that the firm, in competitive business environment, needs to leverage its unique resources, capabilities and competencies and perform tasks efficiently and expeditiously to capture new opportunities, expel threats and to meet customer needs (Al-Ansari, 2014).

It posits that a firm's unique capabilities, competencies and management abilities to marshal its resources to produce superior performance, determine its competitive advantage. The firm's resources are classified as tangible (financial reserves and physical resources; plant, equipment, and raw materials), intangible (reputation and technology),

and personnel-based (expertise, commitment and loyalty). Whereas sustained competitive advantage is based on the attraction, accumulation and retention of resources which are unique and hard to copy, employees are nowadays acknowledged as valuable assets (Sweeney, 2009). Freeman et al. (2010) argues that, for a firm's resource to be a source of sustained competitive advantage, it must be unique, rare, valuable, inimitable (hard to copy) and non-substitutable. It supports employee, and customer relations, and also firm characteristics as sources of competitive advantage.

This theory supports the coordination of tangible and intangible resources for higher performance and competitive advantage. Its major weakness is that many firms have limited bundle of strategic assets and capabilities and are easily copied by competitors (Al-Ansari, 2014). The major strengths of RBT is that it is the driving force in strategic management literature and complements the stakeholder theory in that firm competitiveness requires effective management of both organizational resources and stakeholder relations (Freeman et al., 2010).

Social Contract Theory
Social contract theory declares that society has "the mandate" or the "viability of business". This is also referred to as "licence to operate", the "iron law of responsibility" and the "legitimacy theory" (Hilson, 2014). Organizations exist and act by permission of society at large, hence obliged to be sensitive to various stakeholders. If organizations act in ways that are not consistent with society's expectations, they will eventually face externally imposed controls over their behavior. Thus, firms are obliged to preserve their image of a legitimate business with legitimate aims and methods (Sweeney, 2009).

Social contract is mutual trust and relationship between the organization and stakeholders, with a set of rules and assumptions about behavioural patterns. Stakeholder management is grounded in the concept of the social contract which focuses on the relationship between the business and stakeholders (Sweeney, 2009). Formal social contract defines a firm's explicit responsibilities, including generating returns for shareholders, obeying laws and regulations, creating jobs, paying taxes and honouring contracts.

On the other hand, informal social contract reflects society's implicit expectations that are not explicitly stipulated by the law such as adherence to global labour and environmental standards, triple bottom-line reporting, industry norms and codes of conduct, fulfilling brand promises and philanthropy to the community (Galbreath, 2019).

According to social contract theory, businesses must act in a responsible manner in line with society expectations as they pursue their commercial interests (Mwangi & Oyenje, 2013). Social contract theory defines relationships with shareholders, employees, creditors, suppliers, consumers, the government, the community and various stakeholders. Internally, employees become more productive when the working conditions, interests and benefits are guaranteed in the corporate internal contract. Externally, ensuring the quality

of products, abiding to law and protecting the environment will help firms to establish a good corporate image and reputation, which creates and sustains competitive advantage (Fu & Shen, 2016).

The social contract recognizes that the firm has to seek favour from the society in which it operates. Its weakness is that the extent of corporate social contract is constrained by several factors such as laws, policies, morals, self-discipline and the preference of investors, government and community. Its key strength is that firm performance is based on the outcome of a collection of contracts with the various stakeholders; shareholders, employees, creditors, consumers, suppliers, government, community and other stakeholders (Fu & Shen, 2017; Sweeney, 2018).

Empirical review

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In middle-income countries, formal SMEs contribute about 20% more to employment and GDP than the informal SMEs (Nyagah, 2019). Thus, in these countries, eliminating factors that discourage informal enterprises from entering the formal SME sector would also bring

about gains in economic terms. This is witnessed by the fact that SMEs as compared to informal sector contribute over 3 times both in total employment (approximately 65%) and GDP (approximately 55%) in high-income countries and that these countries are also taking initiative to bring as many informal enterprises as possible into the formal sector (IFC, 2006; Ngugi & Bwisa, 2019).

In Africa SMEs play a momentous role in the macro economy. There has been an obvious rise in the widespread emergence of SMEs in Sub-Saharan Africa (Okpara, 2020). In considering the SMEs' economic contribution in some selected Africa countries, the Department of Trade and Industry (DTI, 2012) of South Africa indicates that there are more than 800,000 SMEs and has estimated that total economic output of SMEs in South Africa to be 50% of GDP. It is also estimated that they provide employment to about 60% of the labour force. In Nigeria, SMEs are extremely imperative and contribute significantly to economic growth, principally in the manufacturing sector. Small and Medium Enterprises constitute between 70% to 90% of the business establishment in the manufacturing sector (Eniola & Ek. Kuratko and Hodgets (2017) perceive today's enterprise environment to be characterized by a rapid growth of new and sophisticated competitors and a need to improve efficiency and productivity. Mokaya (2018) on the other hand emphaizes firm entrepreneurship as a response strategy to realize competitive advantage in the turbulent and hostile enterprise environment. Similarly this agrees with, Cole (1959) who alludes that for enterprises to survive, they need to continually create an emphasis on firm entrepreneurship as a source of discontinuous innovation that alter rules of competition in their favor. Continuous innovation could imply entrepreneurial orientation by co-operative firms engaging in the component of newness in running their routine activities.

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Methodology

Research Design: The study adopted a descriptive research design. The researcher used a cross sectional research design with both qualitative and quantitative methods. The

design was appropriate in investigating the empirical and theoretical relationship between the variables.

Sample Size and Population

80 members of staff and 20 members of customers constitute the respondents for this research work. A total of 100 questionnaires were sent out and 70 were fully answered and returned and used for the analysis.

Methods of Data Collection

Data needed for this work was collected through the use of primary and secondary source.

Primary Sources of Data

The research uses personal interviews amongst staff of the company and few customers, all selected at random. Also, questionnaires were used to collect necessary information to avoid bias.

Method of Data Analysis:. Regression Analysis was used to test the hypotheses.

Descriptive Results
Table 2.2: Employee Relationship Descriptive Results

Statements	SD	D	N	A	SA	Mean	Std Dev
Organizations are frequently subjected to entrepreneurial orientation	5.7%	4.3%	22.9%	35.7%	31.4%	3.83	1.10
Employees' orientation enhances job satisfaction and organizational commitment which leads to greater productivity and low employee turnover	5.7%	10.0%	28.6%	35.7%	20.0%	3.54	1.10
Organizations need to strategize and guarantee rights, interests, benefits and working conditions of workers to realize employee job satisfaction	2.9%	4.3%	37.1%	34.3%	21.4%	3.67	0.96
entrepreneurial orientation is a tool used to attract, motivate and retain a productive workforce by improved working conditions and labour practices	7.1%	4.3%	24.3%	32.9%	31.4%	3.77	1.16
To ensure accountability and focus in entrepreneurial orientation	5.7%	4.3%	30.0%	30.0%	30.0%	3.74	1.11

The results showed that 35.7% and 31.4% of the respondents agreed and strongly agreed respectively. The findings further showed that the statement in respect to entrepreneurial orientation had a mean of 3.83 and a standard deviation of 1.10. The study also intended to establish whether the percentage of entrepreneurial orientation had significantly

improved SMEs performance. The results in Table 4.6 showed that 35.7% and 20.0% of the respondents agreed and strongly agreed respectively. The findings further showed that the statement had a mean of 3.54 and a standard deviation of 1.10.

Regression Model

SMEs survival $= \alpha + \beta 1_{x1} + \mu$

Where the variables are defined as:

SMEs- small and medium scale enterprises

X_1 – Entrepreneurial Orientation

α - regression output(constant)

μ - Error term.

Results and Discussion

Correlation Analysis Results

According to Kothari (2014), the correlation coefficient can range from -1 to +1, with -1 indicating a perfect or negative correlation, +1 indicating a perfect positive correlation, and 0 indicating no correlation at all. Kothari (2014) further stated that the importance of correlation is to determine the extent to which changes in the value of an attribute is associated with changes in another attribute.

Hypothesis One

There is no significant relationship between entrepreneurial orientation and the SMEs survival

Entrepreneurial orientation and the SMEs survival

The first objective of this study was to establish the relationship between entrepreneurial orientation and the survival of small and medium enterprises in Nigeria**.** The results are presented in Table 4.4:

Table 2.2: Correlation Results for entrepreneurial orientation and the survival of small and medium enterprises

		Entrepreneurial orientation	SMEs survival
	Pearson Correlation	1	.263**
Entrepreneurial orientation	Sig. (2-tailed)		.000
	N	170	170
	Pearson Correlation	.263**	1
SMEs survival	Sig. (2-tailed)	.000	
	N	170	170

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

The correlation results revealed a positive and significant association (r=0.263, p=0.000) between entrepreneurial orientation and the survival of small and medium enterprises. The findings implied that when entrepreneurial orientation is positive and then *SMEs survival*
will also be positive and showing significant association. Therefore, null hypothesis that stated no significant relationship between entrepreneurial orientation and *SMEs survival* is rejected. This means that there is significant but weak relationship between entrepreneurial orientation and *SMEs survival*.

Conclusion and Recommendation
Specifically, the study sought to determine the effect of entrepreneurial orientation on the *SMEs survival* in Nigeria. The study concludes that there is a positive relationship between entrepreneurial orientation and the survival of SMEs in Nigeria. Based on the finding of the study, the study concludes that entrepreneurial orientation is important in *SMEs survival* of Nigeria.

Recommendations of the Study
Based on the findings of the study, the researcher recommends that manufacturing firms should enhance entrepreneurial orientation because entrepreneurship are the most valuable business in the country. The empirical evidence from this study infers that the success of firms depends on the level of entrepreneurial orientation determines job performance and the quality of products and services. Also based on the empirical evidence that training and education of employees enables them to be more skilled and productive, this study recommends that manufacturing firms in Nigeria develop skills and capacity of employees so as to enhance innovation and creativity hence create and sustain competitive advantage. This study also recommends that manufacturing firms need to offer the much required customer orientation support in terms of product information, quality assurance, and handling customer feedback. Considering the highly competitive market place, firms need to be clearly visible and provide the best offering to the customer. This would ensure customer satisfaction for enhanced customer loyalty and firm's reputation. This study further recommends that manufacturing firms should be highly sensitive to the customer who nowadays has easy access to information, variety of choices and ecologically sensitive.

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REGIONAL ESTIMATION OF CURIE POINT DEPTH, GEOTHERMAL GRADIENT AND HEAT FLOW INFERRED FROM HIGH RESOLUTION AEROMAGNETIC DATA OVER SHELLENG AND ENVIRONS, NORTH-EASTERN NIGERIA

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ABSTRACT

A regional estimation of Curie-point depths (CPDs), geothermal gradient and heat flow from high resolution aeromagnetic (HRAM) data over Shelleng and environs, North-Eastern Nigeria was carried out using Oasis Montaj (7.5version), Microsoft excel, Matlab (2016 version) and Surfer8 software and spectral centroid analysis method. The HRAM data were divided into 64 overlapping blocks, and each block was analysed to obtain depths to the top, centroid, and bottom of the magnetic sources. The depth values were then used to assess the CPD, geothermal gradient and subsurface crustal heat flow in the study area. The result shows that the CPD varies between 4.95 and 7.69 km with an average of 6.69 km, the geothermal gradient varies between 47.23 and 86.57 °C km^{-1} with an average of 58.73 °C km^{-1}, and the crustal heat flow varies between 21.13 and 216.43 mWm^{-2} with an average of 166.72 mWm^{-2}. This study showed that geodynamic processes are mainly controlled by the thermal structure of the Earth's crust and therefore important for appraisal of the geo-processes, rheology, and understanding of the heat flow variations in the area, North-eastern Nigeria.

KEYWORD: *Aeromagnetic data, Curie point depth, Geothermal Gradient, Heat flow, Thermal structure and Spectral centroid.*

Introduction

This present research study is concerned with regional estimation of Curie point depth, geothermal gradient and heat flow inferred from High Resolution aeromagnetic data over Shelleng and environs, North-Eastern Nigeria, which has not been given adequate attention in the recent past by geologists and geophysicists. This may be due to lack of immediate geologic and economic values even though it is fast becoming an important study area for geoscientists. There are increased efforts to explore for new and more energy locations, being part of Cameroon Volcanic Line in Nigeria. However, geophysical study in the area is minimal, with no records of crustal thermal studies, Curie point depths, heat flow, oil and gas prospecting. The knowledge of Curie point depths, geothermal and

heat flow assessment would significantly compliment the geophysical information of the area to bridge the gap of lacking crustal studies information.

The study area is located between latitude 8° 30' and 10° 30' N and longitude 11 00' and 13 00' E, North -Eastern Nigeria and it covers an area of approximately 48,224 km^2. The area is characterized by rugged terrain. It is one of the crystalline pre-Cambrian basement blocks in Nigeria. The study area was subjected to periods of regional metamorphism, tectonism and magmatism which led to the development of fractures and faults as well as the emplacement of intrusive and dyke like structures (Ofoegbu, et al, 1992; Kasidi and Nur, 2013).

Several studies have shown that regional magnetic data can be used extensively to determine the thermal structure of the Earth's crust in various geologic environments (Spector and Grant, 1970; Bhattacharyya and Leu, 1975, 1977; Byerly and Stolt, 1977; Blakely and Hassan zadeh, 1981; Okubo et al., 1985, 2003; Blakely, 1988, 1995; Maus et al., 1997; Tanaka et al., 1999; Chiozzi et al., 2005; Eppelbaum and Pilchin, 2006; Ross et al., 2006; Ravat et al., 2007; Trifonova et al., 2009; Gabriel et al., 2011, 2012; Bansal et al., 2011, 2013, 2016; Nabi, 2012; Hsieh et al., 2014; Nwankwo and Shehu, 2015; Nwankwo and Sunday, 2017 etc.). Studies showed that dominant magnetic minerals in the Earth's crust pass from ferromagnetic to paramagnetic state at temperature commonly called Curie-point temperature (CPT). Magnetite (Fe_3O_4) is the most common magnetic material in igneous rocks and has an approximate CPT value of 580 °C (Stacey, 1977). At temperature above CPT, the thermal agitation causes the spontaneous alignment of the various domains in the mineral to be destroyed (or randomized) to the extent that the ferromagnetic minerals become totally paramagnetic (Langel and Hinze, 1998; Nwankwo and Sunday, 2017). Curie point depth is defined as the depth at which CPT is reached within the subsurface, can be considered as an index of depth to the bottom of magnetic sources (DBMS) and can consequently be calculated from geomagnetic anomalies (Bansal et al., 2011, 2013; Hsieh etal., 2014). However, in some circumstances DBMS can be caused by contrasts in lithology instead of CPT and may not necessarily coincide with CPT in detail (Bansal et al., 2011; Trifonova et al., 2009). For instance, Trifonova et al., (2009) opined that even if the spectral method provides a good estimate of DBMS there is no assurance that it represents the CPD. They reasoned that a variety of geologic reasons exist for truncated magnetic sources that are unrelated to crustal temperatures; for example, a sequence of relatively non-magnetic sediments below young volcanic material may limit the depth of magnetic sources regardless of the CPT, and another reason is the variety of magnetic minerals like titanomagnetite ($Fe_{3-x}Ti_xO_4$), is the most important iron oxide in crustal magnetic sources; it has a CPT that is strongly influenced by the amount of titanium and ranges from 150 to 580 °C. In some geologic environments, alloys of iron with CPTs in excess of 620 °C may be significant contributors to magnetic anomalies. In spite of these limitations, many studies (Tanaka et al., 1999; Trifonova et al., 2009; Bansal

et al., 2011; Hsieh et al., 2014; etc.) have reasonably used DBMS as an estimate of CPD and therefore serve as a proxy for temperature at depth. Again, Trifonova et al. (2009) pointed out that several studies have identified low-titanium titanomagnetite as the dominant magnetic phase, and CPTs at these depths are estimated to be between 575 and 600 °C. This confirms the estimated value of 580 °C by Stacey (1977) as the case in this study. Another important justification is that DBMS/CPD estimations can similarly be used to complement geothermal data in regions where deep boreholes are unavailable (Chapman and Furlong, 1992; Ross et al., 2006; Bansal et al., 2011, 2013).

Shelleng and Environs is one of the least studied in North-Eastern Nigeria. Up to date, the area under study has no information on seismicity, no exploratory wells penetrated its sequences, and deep crustal data are limited. The present work employs spectral analysis method to estimate the Curie point depths, geothermal gradient and heat flow of the region and is expected to contribute immensely to a better understanding of the geothermal structures and geodynamic processes in the entire north-east, Nigeria.

Location and Geology of the Study Area

 Shelleng and environs is located within the Northeast Basement Complex of Nigeria. The geology of the study area is made up of the Precambrian Basement complex rocks, which are considered to be undifferentiated basement consisting mainly of migmatites-gneisses complex, Older Granite rocks, Cretaceous sedimentary rocks and Tertiary to recent volcanic rocks (Fig.1).
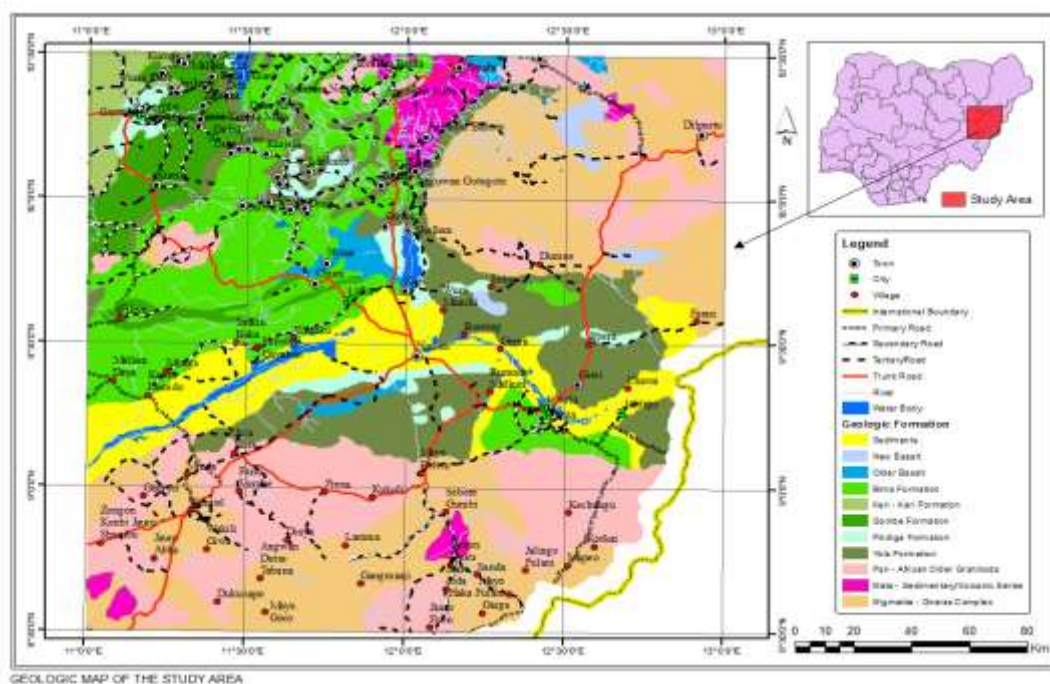
Fig 1 Geologic Map of the Study Area

The oldest rocks of the area, the gneisses which are believed to be of birrimian age (Oyawoye, 1970) are overlain by recent alluvium, resulting from the weathering and erosion of hills and decomposed rock material. They cover a large part of the crystalline basement rocks. The migmatite gneisses exhibit great variation in the percentage of light and dark mineral components that resulted from the protolithic they were derived under pressure and temperature conditions which they were formed. The older granites of Nigeria intrude the basement complex and are seen within great part of the studied area. They outcropped at the northern part. They are banded, foliated with felsic and ferromagnesian minerals forming the light and dark bands respectively. The mineral differentiation imparts the foliation to the rocks. The older granites which are younger are intrusive to the gneissic and magmatic rocks (Adebayo, 2010).

Data Acquisition and Analysis:

The high resolution aeromagnetic data of parts of North- Eastern Nigeria used for this study were obtained from the Nigerian Geological Survey Agency (NGSA) using a 3 x Scintrex CS2 caesium vapour magnetometer. Fugro Airborne Surveys carried out the airborne geophysical work in 2009. The survey was flown at 80m elevation along flight lines spaced 500m apart and nominal tie line spacing of 2 km. The flight line direction was 135° while the tie line direction was 225°. The data was generally plotted using Universal Transverse Mercator (UTM) projector method. WGS1984 Spheroid and WGS 1984 datum were also used. Grid mesh size was 125 metres. The geomagnetic gradient was removed from the data using International Geomagnetic Reference Field (IGRF).

The materials used for this study include sixteen digitized half degree aeromagnetic sheets namely:Gombe (sheet152), Wuyo (sheet153), Shani (sheet 154), Garkida (sheet 155), Kaltingo (sheet 173), Guyuk (sheet 174), Shelleng (sheet 175), zummo (sheet 176), Lau (sheet 194), Dong (sheet 195), Numan (sheet 196), Gerei (sheet 197), Jalingo (sheet 215), Monkin (sheet 216), Jada (sheet 217) and Mapeo (sheet 218) on a scale of 1:100000 superimposed on residual total magnetic intensity map of the study area shown in fig 2. Software applications used include: Oasis Montaj (7.5 version), Microsoft excel, Matlab (2016 version) and Surfer8 etc.
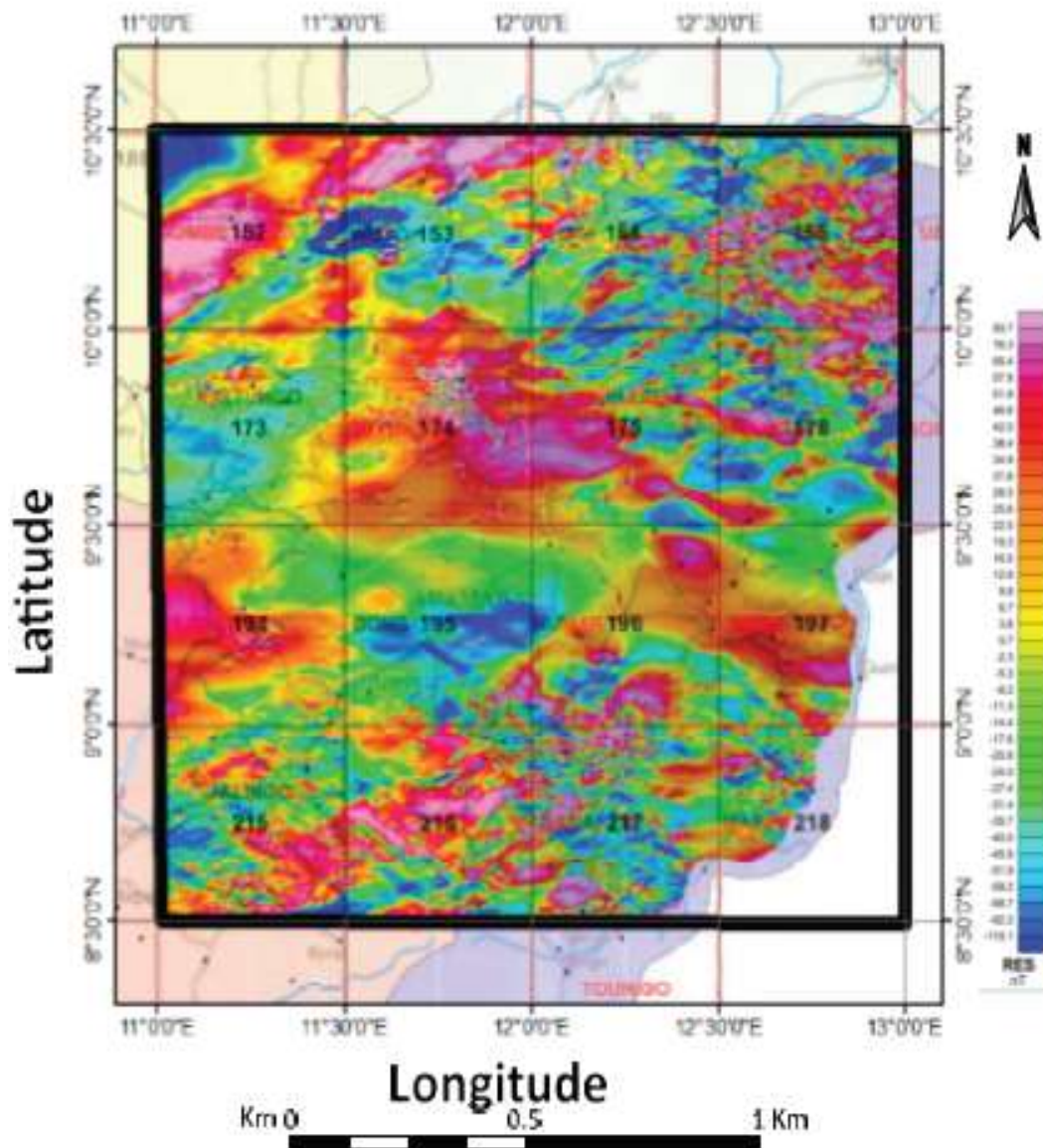
Fig.2 **Residual magnetic intensity map of the Study area with superimposed federal survey half-degree sheets and showing major towns flown over.**

To carry out Spectral analysis, the study area was divided into eight overlapping blocks. Each block covers a square area of approximately 55 by 55km, which represent a square grid of 32 by 32 data points except for the last empty block which fall out into republic of Cameroun. In doing this, it was ensured that no essential part of the anomaly was cut-off by the blocks, each block was continued upward to eliminate shallow source (short wavelength and enhance the deep seated magnetic sources).

Fig.3 Residual Magnetic Intensity Map of the Study Area superimposed on the Topographic Map of the study area showing towns and villages.

Estimation of Curie-point depth

Curie point depth is estimated in two steps (Bhattacharyya and Leu, 1975, Okubo et al., 1985, Kasidi and Nur, 2012, Kamurayina and Nur, 2021): to perform the analysis the first step is to estimate the depth to the centroid (Z_o) of the magnetic source from the slope of the longest part of the wave length spectrum.

$$In[\frac{p(s)^{½}}{/s/}] = InA - 2\pi/s/Z_o \qquad (1)$$

where $p(s)$ is the radially average power spectrum of the anomaly, $/s/$ is the wave number and A is a constant. The second step is the estimation of the depth to the top boundary (Z_t)

of that distribution from the slope of the second longest wave length special segment (Okubo et al., 1985).

$$Inp[(s)^{½}] = InB - 2\pi/s/Z_t$$

(2)

where B is the sum of the constants, the basal depth independent of $/s/$.

Then basal depth (Z_b) of the magnetic source is calculated from equation (3)

$$Z_b = 2Z_o - Z_t$$ (3)

The basal depth (Z_b) of the magnetic source in the area is assumed to be the Curie point depth (Bhattacharyya and Leu, 1975, Kasidi and Nur, 2012 and Okubo et. al., 1985). Some few examples of graphs of the logarithms of the spectral energies verses wave numbers obtained for blocks 13 - 18 using the Oasis Montaj software, from which table 1 was extracted are shown in Figure 4 below.
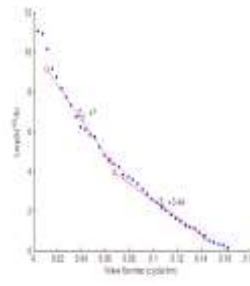
BLOCK13   BLOCK 14   BLOCk 15
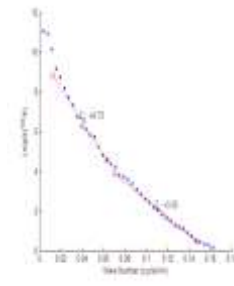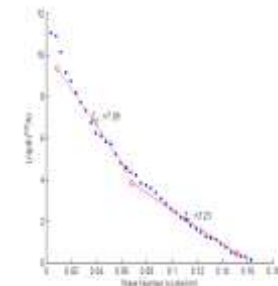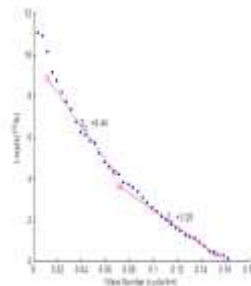
BLOCK 16   BLOCK 17   BLOCK 18
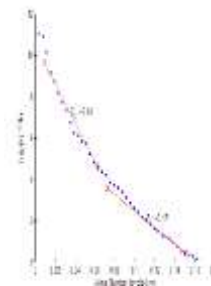
Fig. 4 Graphs of the logarithms of the spectral energies verses wave numbers of Blocks 13 to 18

Heat flow and geothermal gradient

Heat flow is the movement of heat (energy) from the interior of earth to the surface. According to Tanaka et al. (1999), the basic relationship for conductive heat flow is the

Fourier's law. The estimation of heat flow and thermal gradient is calculated using the Fourier's Law with the following formula:

$$q = \lambda\left[\frac{\partial T}{\partial Z}\right] \tag{4}$$

In order to relate the Curie point depth (Z_b) to Curie point temperature variation, the vertical direction of temperature variation and the constant thermal gradient was assumed. The geothermal gradient $\left(\frac{\partial T}{\partial Z}\right)$ between the earth and the Curie point depth (Z_b) is defined by the equation:

$$\frac{\partial T}{\partial Z} = \frac{580°C}{Z_b} \tag{5}$$

where 580^0C is the Curie temperature at which ferromagnetic minerals are converted to paramagnetic minerals. Furthermore, the geothermal gradient is related to heat flow (q) using the formula:

$$q = \lambda\left(\frac{\partial T}{\partial Z}\right) = \lambda\left(\frac{580°C}{Z_b}\right) \tag{6}$$

where λ is the coefficient of thermal conductivity. A thermal conductivity of 2.5 Wm^{-1}^{0}C^{-1} was used (Abdulsalam, et al., 2011, Nwanko, 2007, Popoola and Ojo, 2010, Tanaka, et al., 1999 and Stacey, 1977) as the average for igneous rocks, was used to compute the subsurface heat flow. Equation (6) shows that the Curie point is inversely proportional to the heat flow (Tanaka et. al., 1999 and Stamploids et. al., 2005).

Equations (5) and (6) were used in computing values of geothermal gradients and heat flow of the study area respectively. These values ate presented in table1 below.

Table 1: Calculated Curie point depths, geothermal gradient and heat flow of the study area with their corresponding Spectral Block N0S, longitudes and latitudes.

| Spectral Block N0	Longitude	Latitude	Depth to the top Z_t (km)	Depth to Centroid Z_o (km)	Depth to bottom Z_b (km)	Geothermal gradient (°C km^{-1})	Heat flow (mWm^{-2})
1	11.125	10.375	3.11	7.52	11.93	48.62	121.50
2	11.375	10.375	3.03	6.49	9.95	58.29	145.73
3	11.625	10.375	3.03	6.49	9.95	58.29	145.73
4	11.875	10.375	3.41	6.80	10.19	56.92	142.30
5	12.125	10.375	3.65	6.73	9.81	59.12	147.80
6	12.375	10.375	3.37	7.38	11.39	50.92	127.30
7	12.625	10.375	3.28	6.44	9.60	60.43	150.75
8	12.875	10.375	3.17	7.51	11.85	48.95	122.38
9	11.125	10.125	3.08	6.63	10.18	56.97	142.25

10	11.375	10.125	3.08	5.63	11.26	51.51	128.78
11	11.625	10.125	3.12	6.49	9.86	58.82	147.05
12	11.875	10.125	3.37	5.50	7.63	76.02	190.05
13	12.125	10.125	3.44	7.00	7.63	76.02	190.05
14	12.375	10.125	3.65	6.73	9.81	59.12	147.80
15	12.625	10.125	3.37	7.38	11.39	50.92	127.30
16	12.875	10.125	3.23	7.09	10.95	52.96	132.40
17	11.125	9.875	3.28	6.44	9.60	60.42	150.50
18	11.375	9.875	3.17	7.57	11.97	48.45	121.13
19	11.625	9.875	3.15	6.89	10.63	54.56	136.40
20	11.875	9.875	3.67	7.42	11.17	51.92	129.80
21	12.125	9.875	3.22	5.83	8.44	68.72	174.80
22	12.375	9.875	2.87	6.36	9.85	58.88	147.20
23	12.625	9.875	3.40	7.24	11.08	52.34	130.85
24	12.875	9.875	3.37	7.07	10.77	53.85	134.63
25	11.125	9.625	3.46	6.99	10.52	55.13	137.83
26	11.375	9.625	3.61	7.34	11.07	52.39	130.98
27	11.625	9.625	3.23	7.36	11.49	50.48	126.20
28	11.875	9.625	3.36	5.29	7.22	80.33	200.83
29	12.125	9.625	3.46	7.18	10.90	53.21	133.03
30	12.375	9.625	3.26	6.54	9.82	59.06	147.65
31	12.625	9.625	3.61	6.33	9.05	64.09	160.23
32	12.875	9.625	3.33	7.60	11.87	48.86	122.15
33	11.125	9.375	3.60	6.89	10.18	56.97	142.43
34	11.375	9.375	3.37	7.00	10.63	54.56	135.40
35	11.625	9.375	3.38	7.06	10.74	54.00	135.00
36	11.875	9.375	3.09	6.56	10.22	56.75	141.88
37	12.125	9.375	3.09	6.73	10.37	55.93	139.83
38	12.375	9.375	3.42	6.69	9.96	58.23	145.58
39	12.625	9.375	3.26	6.63	10.00	58.00	145.00
40	12.875	9.375	3.09	4.93	6.77	86.57	216.43
41	11.125	9.125	3.22	7.33	11.44	50.70	126.75
42	11.375	9.125	2.84	5.54	8.24	70.39	175.98
43	11.625	9.125	3.56	7.09	10.58	54.82	137.05
44	11.875	9.125	3.49	7.21	10.93	53.06	132.65
45	12.125	9.125	3.11	5.96	8.81	65.83	164.58
46	12.375	9.125	3.49	6.73	9.97	58.17	145.43
47	12.625	9.125	3.33	6.73	10.13	57.25	143.13

48	12.875	9.125	3.47	5.86	8.25	70.30	175.75
49	11.125	8.875	3.25	5.48	7.71	75.23	188.08
50	11.375	8.875	3.18	7.45	11.72	49.49	123.73
51	11.625	8.875	3.07	4.95	6.83	84.92	212.30
52	11.875	8.875	2.96	6.73	10.50	55.24	138.10
53	12.125	8.875	3.42	7.66	11.90	48.74	121.85
54	12.375	8.875	3.33	6.93	10.53	55.08	137.70
55	12.625	8.875	3.23	6.98	10.73	54.05	135.13
56	12.875	8.875	3.02	5.36	7.70	75.32	188.30
57	11.125	8.625	3.23	6.98	10.73	54.05	188.30
58	11.375	8.625	3.33	6.12	8.91	65.10	162.75
59	11.625	8.625	3.24	7.76	12.28	47.23	118.08
60	11.875	8.625	3.26	6.19	9.12	63.60	159.00
61	12.125	8.625	3.56	7.08	10.60	54.72	136.80
62	12.375	8.625	3.38	6.33	9.28	62.50	156.25
63	12.625	8.625	3.17	6.73	10.29	56.37	140.93
64	12.875	8.625	-	-	-	-	-
Average			3.29	6.69	9.88	58.73	166.72

Fig.5 Map showing depth Centroid (Z_O) of the study area

Fig.6 curie Point Depth Map (Z_b) of the study area

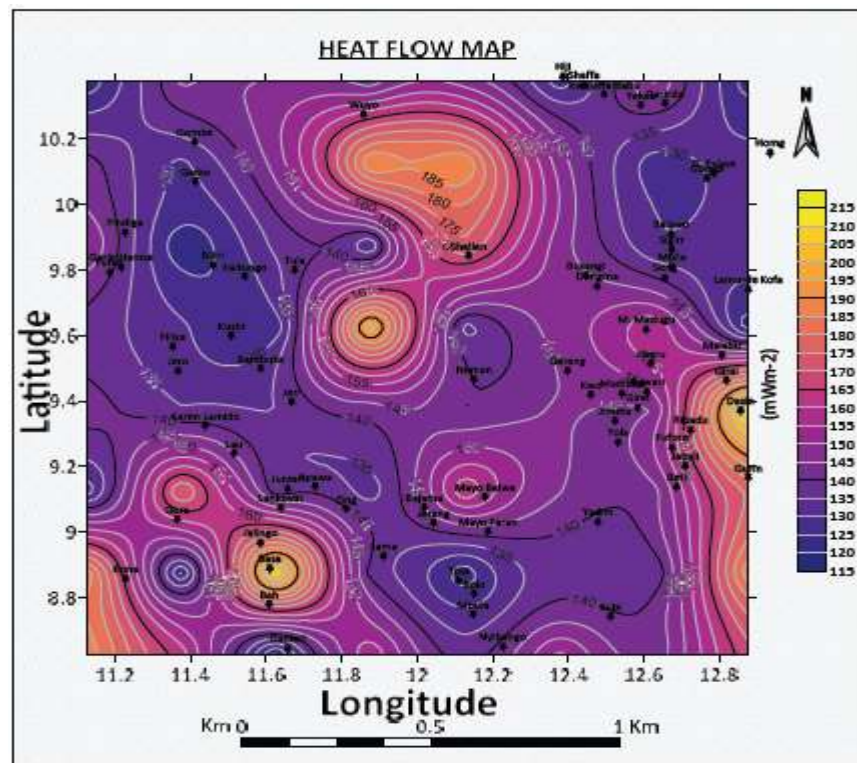Fig.7 Geothermal gradient Map of the study area

Fig.8 heat flow Map of the study area

Results and Discussion:

Figure 3 showed the residual magnetic data (RMD) map of the study area superimposed on the Topographic Map of the study area showing towns and villages after values of the regional field have been removed. This map was obtained using Oasis montaj (7.5version) Computer software. Magnetic values from the RMD map ranges from -110.10 to 93.70 nT. The magnetic high of magnitude 93.7 nT is observed in North-Western (NW), North-Eastern (NE), Central parts with a spatial occurrences at the Southern Part of the study area which include, areas southwest and north east of Gombe, Wuyo, Guyuk, Gombi Fulani, Dongma, Ba'awo,northeast and southeast of Tula, Gereng, Jabali, Mayobelwa, Zing, Lama, Mbula, and Ganleri. This could be as a result of presence of basaltic rocks belonging to Eastern arm of Cameroon Volcanic Line (CVL). Intermediate magnetic values occurin areas aroud Gombe, Garkida, Yola, Bambuka, Lau, Sigirr, Fufore, Numan, Yadim and M. Madugu while magnetic low values are observed at Kwajaffa Babu, Pindiga, Garin Hamse, Biliri, Kaltingo, Shelleng, Girei, Song, Apawa. Bolo, Kona, northwest of Filya and Jaling.

Figure 4 showed some few examples of graphs of the logarithms of the spectral energies verses wave numbers of Blocks from which the results in table 1 for Z_0 and Z_t were obtained.

Graphs of the logarithms of the spectral energies versus wave numbers, from which Curie point depths were estimated (Table 1), showed that the depth to the Centroid (Z_o) ranges from 4.95 to 7.16 km with an average value of 6.69 Km. The depths to the top boundaries (Z_t) of magnetic sources ranges from 2.84 to 3.67 km and an average value of 3.29 Km below sea level (b.s.l).The corresponding calculated curie point depths (Z_b) ranges from 8.25 to 12.28 km and an average value of 9.88 Km (b.s.l). These results are shown in figures (5) and (6) respectively.

CPD varies greatly with different geological settings (Tanaka et al., 1999; Salk et al., 2005). Tanaka et al. (1999), after a compilation of CPD results from several researchers across the globe, inferred that volcanic, tectonic, and associated geodynamic environments have CPD shallower than 10 km, while CPDs ranging between 15 and 25 km are as a result of island arcs and ridges, and deeper than 25 km in plateaus and trenches.

Using a Curie point temperature of 580°C and the estimated curie depths, geothermal gradient and heat flow variations in the study area were calculated as given in Table 1. Table 1 show that the geothermal gradients in the area vary between 47.23 and 86.57 °C km^{-1} with an average of 58.73 °C km^{-1}, while the crustal heat flow varies between 121.13 and 216.43mWm^{-2} with an average of 166.72mWm^{-2}. These results are depicted in figures (7) and (8) respectively. The lowest value for the geothermal gradient of 47.23 °C km^{-1} was found in the south-western portion of the study area. The north-westward trend of gradient increase was found to result in a maximum value of 86.57 °C km^{-1} in the north-western part. The minimum heat flow value required for considerable generation of geothermal energy is approximately 60mWm^{-2}, whereas values ranging from 80 to 100mWm^{-2} and above indicate anomalous geothermal conditions (Jessop et al., 1976). Crustal heat flow in the area under study also exhibits NE–SW trending, while the calculated amounts increase from the central portion towards the north-west, with maximum value of 216.43mWm^{-2} observed in the north central portion. This portion signifies an anomalous crustal thermal state and, therefore, is recommended for further investigations.

Generally, the units that comprise of high heat flow values correspond to Volcanic and metamorphic regions since the two rock units have high heat conductivities (Nwanko et al., 2011). This makes the study area to have geothermal potentials.

CONCLUSION

The newly acquired high resolution aeromagnetic data over Shelleng and environs, north eastern Nigeria have been analyzed to estimate the Curie-point depths, geothermal gradients, and near-surface crustal heat flow. The result shows that the CPD varies between 4.95 to 7.16 km with an average of 6.69 km, the geothermal gradient varies between 47.23 and 86.57 °C km^{-1} with an average of 58.73 °C km^{-1} and the crustal heat flow varies between 121.13 and 216.43mWm^{-2} with an average of 166.72mWm^{-2}. Regions

are observed in the area of study with shallow Curie-point depths (below 15 km) and corresponding high heat flows (above 80mWm^{-2}), thus suggesting anomalous geothermal conditions (Jessop et al., 1976). Hence, further detailed studies are recommended in such regions. Finally, oftentimes, direct crustal temperature measurements may not be too feasible for regional studies; hence, the derived geothermal gradients suffice for the entire area. Moreover, geodynamic processes are mainly controlled by the thermal structure of the Earth's crust; therefore this study is anticipated to contribute significantly to the quantitative appraisal of the geo-processes, rheology, and understanding of the heat flow variations over Shelleng and Environs in North-eastern Nigeria.

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ECONOMIC ANALYSIS OF FRESH TOMATO MARKETING IN NASSARAWA LOCAL GOVERNMENT AREA OF KANO STATE

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ABSTRACT

This study analyzed the marketing system of fresh tomato in Nassarawa local government of Kano State. A multi-stage sampling method was employed to select eighty (80) tomato marketers. The main objective is to analyze tomato marketing in the Yankaba market, while the specific objectives are to describe the socio-economic characteristics of tomato marketers in the study area, to identify and describe the marketing channel of fresh tomato, to determine the efficiency of fresh tomato marketing, to determine the profitability of fresh tomato marketing, and also to describe constrains associated with tomato marketing in the study area. The data obtained were analyzed using Descriptive Statistics, Marketing Efficiency and Marketing Margin. Findings revealed that 26% of fresh tomato retailer's marketers fell within the age bracket of 25-34 and 35-44 years of age, while 40% of fresh tomato wholesaler's marketers fell within the category of 45-54 which were the majority in study area, only 2% and 3.3% of retailers and wholesalers respectively were within the category of 75-84 years in the study area. The gender representation is 100% dominated by male gender of both retailers and wholesalers respectively in the study area. The result revealed that the majority 94% of retailers and 96.7% of wholesalers of tomato marketers were married, and only 6% of retailers and 3.3% of wholesalers of tomato marketers were single in the study area. Fresh tomato marketers in the area had one form of education. Majority of retailers have Qur'anic education, while Majority of wholesalers have primary education. The result also revealed that Net Marketing Margin of 7.29 N/kg and 4.09N/kg for 1kg for retailers and wholesalers respectively. The analysis also revealed that tomato marketing is a profitable enterprise with BCR of greater than one (with 1.2044 for retailers and 1.1390 for wholesalers). The marketing efficiency of fresh tomato was found to be 273.34% and 168.24% on retailers and wholesalers respectively. The major challenges to fresh tomato marketing were seasonality nature of tomato, perishability nature of tomato, absence of processing industries, and supply problem during wet season. It was therefore recommended that tomato processing industries should be establish by private entrepreneurs was recommended to make resolving perishabilty of tomato produced.

Keywords: Marketing channel, efficiency, profitability

INTRODUCTION

Tomato is the one of the widely grown vegetable in the world. Egypt together with India account for more than one-fifth of world total, Turkey and Nigeria are other world producing countries. Asia and Africa account for 79% of the global tomato area, with about 65% of the world output (FAO, 2008).

Unlike cereals, the marketing of horticultural crops, in general; and vegetables and fruits in particular, is more complex and risky because of the special characteristics like highly perishable nature, seasonality, bulkiness etc. and needs special care and immediate disposable (Gandhi *et al*, 2002.). As a result, the supply of vegetables is subjected to various problems including wide fluctuation in prices. Because of the imbalance in distribution system and lack of organized marketing system there is always a market glut of fresh tomato during the on-season and scarcity of fresh tomato during the off-season in the study area.

The fresh tomato marketers as well as intermediary middlemen even though perform greater role in the income flow of farmers, but they are faced with problems of transporting farm products to the ultimate consumers, thereby leading to delays in supply. Other problems in the study area were supply problem during wet season, lack of cooling facilities as well as absence of processing industries. In order to solve or reduce the problems, it is necessary to provide empirical information on costs and returns associated with marketing of tomatoes of the study area.

This main objectives of this study is to analyze tomato marketing in the Yankaba market

REASERCH METHODOLOGY

This study was conducted at Yankaba Market in Nassarawa local Government Area, Kano State, Nigeria. Multi-stage sampling was used for this research. The first stage was purposive sampling, because it is the only market in Nassarawa local government that has highest number of tomato marketers. The second stage was also purposive sampling of Kasuwar Yan Gwari, due to the fact that, it has the highest number of wholesalers and retailers of tomato. The third stage was random selection 80 fresh tomato marketers.

RESULT AND DISCUSSION

Table 1: Socio-economic Characteristic of Respondent

	Retailers		Wholesalers	
Variables	Frequency	Percentage	Frequency	Percentage
Age (years)				
25-34	13	26	2	6.7
35-44	13	26	10	33.3
45-54	11	22	12	40

55-64	7	14	2	6.7
65 and above	6	12	4	13.3
Gender				
Males	50	100	30	100
Marital Status				
Married	47	94	29	96.7
Single	3	6	1	3.3
Level of Education				
Primary	17	34	12	40
Secondary	12	24	9	30
Tertiary	1	2	1	3.3
Qur'anic	20	40	8	26.7
Marketing Experience(years)				
1-9	11	22	1	3.3
20-19	22	44	9	30
20-29	13	26	13	43.4
30-39	2	4	6	20
40-49	4	2	-	0
50-59	-	-	1	3.3
Household size				
1-9	19	38	3	10
10-9	19	38	17	56.7
20-29	9	8	8	26.7
30-39	3	6	2	6.7
Main Occupation				
Tomato	29	58	30	100
Vegitables	15	30	-	0
Civil Services	6	12		

Source: Field survey, 2022.

As presented in table 1, majority (26%) of fresh tomato retailers-marketers fell within the age bracket of 25-34 and 35-44 years of age, while 40% of fresh tomato wholesaler's marketers fell within the same category. However, only 2% and 3.3% of retailers and wholesalers respectively were within the category of 75-84 years in the study area. This implies that majority of retailers and wholesalers of tomato marketers are young and energetic, which shows that the youth in the study are engaged in economic activities for self-employment and sustenance. This agrees with findings of Atman *el al,* (2009), and Adamu (2009). Atman *el al,* (2009) reported that youth dominate the marketing of tomato

in Yamaltu/Debo Local Government Area of Gombe State. Adamu (2009) reported that youth dominate the marketing of tomato in Kano metropolis, Kano state.

Table 1 also reveal that gender representation is 100% dominated by male gender of both retailers and wholesalers respectively in the study area. This means that all the tomato marketers interviewed were male. This implies that tomato marketing is a male dominated business in Yankaba market. This may be related to socio-cultural feature of the study area which restricts women from outdoor activities. This agrees with the findings of Adamu (2009) that tomato marketing is a male dominated activity in Kano metropolis.

Table 1, shows the distribution of respondent according to marital status. The result revealed that the majority 94% of retailers and 96.7% of wholesalers of fresh tomato were married, and only 6% of retailers and 3.3% of wholesalers of tomato marketers were single in the study area. This indicates that tomato marketing in Yankaba market was mostly engaged in by married men, this has to do with culture people of the study area.

Table 1 futher revealed that fresh tomato marketers in the area are educated in one form or the other. Majority of retailer's have Qur'anic education, while Majority of wholesalers have primary education. This indicates that 40% Qur'anic education respectively, while 40% of wholesalers have primary education. This does not agree with Adamu (2009) finding that there is low level of formal education that only 45% had formal education.

Table 1 also shows the marketing experience of the respondent in fresh tomato marketing. Results reveals that 44% of retailers were in range of 10-19, while wholesalers on other hand shows that 43.4% were in range 20-29 years. Years of experience are an important socio-economic characteristic in any business. This indicates that the marketers have been into tomato business in the study area for reasonable period.

As shown in table 1, 38% were in range of 1-9 and 10-19 household size for the retailers, while for wholesalers, the result shown that 56.7% were in range of 10-19. This indicates that only 6% and 6.7% had house hold size ranging from 30-39 of retailers and wholesalers respectively. This indicates that majority of both retailers had household size ranging from 1-9 and 10-19, while majority of wholesalers had household size ranging from 10-19. This revealed that majority of the marketers contained with high household size, therefore they need to improve profitability of their business. Household is another socio-economic characteristic in tomato marketing. A member in household can be assign to run business when the household head is not available, thus, save the cost of employing caretaker.

Lastly, table 1 shown in table 8, 58% of retailers have tomato marketing as their main occupation, while on the other hand, 100% of wholesalers have tomato marketing as their main occupation. As indicated in the table 9, almost more than half of retailers have tomato marketing as their main occupation, while on the other hand all wholesalers have tomato marketing as their main occupation. The result also shows that 30% of retailers have vegetables marketing as their main occupation. Civil servant constitute of only 12% of retailers as their main occupation.

Marketing channel of tomato

This channel in the area start from producer, farm commission agent, rural assemblers, urban commission agent down to urban wholesaler and then to retailer to final consumers. Figure 1 shows the marketing channel of tomato in the study area. This agrees with Aminu and Musa (2007), whom reported that the main channel of tomato starting from producers through commission agents, assemblers or regional wholesalers, urban wholesalers, retailers and finally ending with the consumers.

Producer

⇩

Farm commission agent

⇩

Rural assemblers

⇩

Urban commission agent

⇩

Wholesaler

⇩

Retailer

⇩

Consumer
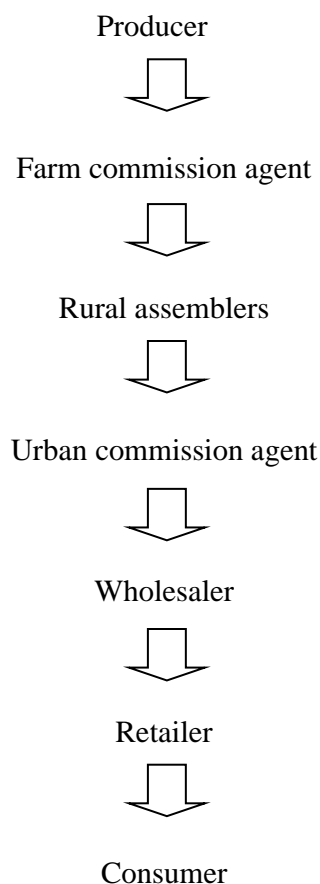
Figure 1. Marketing channel for fresh tomato in the study area

In figure 1, very important channel in which the produce moves from the producer through the farm commission agent, rural assemblers, and urban commission agent and to the urban wholesaler via retailer and to the end user consumers. Also urban wholesaler went directly to producer in the rural area to purchase the produce through the commission agent to the retailer and the end user consumer needed to create the utilities of time, place, form and possession.

Profitability

Table 2. Estimation of cost and return from marketing of fresh tomato

Variables	Retailers Cost(₦)	% of total	Wholesalers Cost(₦)	% of total
Purchase cost	2046	88.2	1521.67	79.63
Transportation cost	-	-	242	12.66
Cost of loading	-	-	43.33	2.27
Local government charges	10	0.43	10	0.52
Cost of levy	5	0.22	5	0.26
Cost of offloading	-	-	28.67	1.5
Commission charges	198	8.54	40	2.09
Labor	30.4	1.31	20.33	1.05
Cost of water	15.1	0.65	-	-
Polythene bags	15	0.65	-	-
Total marketing cost	**2319.5**	**100**	**1911**	
Selling price	2793.6		2176.67	
Net marketing margin per basket (65kg)	474.1		265.67	
Net marketing margin per kg	7.29		4.09	
Benefit cost ratio per basket	1.2044		1.1390	

Source: Field survey, 2022.

Estimation of net `return is simple total less total cost. The profitability of tomato marketing was assessed by estimating the difference between net return from sales of tomato and the costs component involved in tomato marketing. The results are presented in table 12 the net return of fresh tomato per kg was found to be N7.29 and N4.09 respectively.

Cost analysis

Market costs are the actual expenses incurred in the performance of the marketing functions as commodity moves from the farm to ultimate consumers. It includes the cost of transportation, commission charges, loading cost, offloading cost and others costs such as taxes and union duties.

- **Transportation cost**
  This is the cost incurred in moving the commodity from one location to another. The average transportation cost of fresh tomato per basket on wholesalers was ₦242 and

account for 12.60 % of total cost of tomato. This means that wholesalers have higher transportation cost.

- **Commission charges**

  These are charges paid to commission agents for their intervention in marketing process. Every fresh tomato basket was charged ₦198, on retailer side, accounting for 8.54 % of total cost. While on wholesaler side, fresh tomato basket was charged ₦40, accounting for 2.09% of total cost.

- **Loading cost**

  This is the cost paid for loading of tomato per basket. It is only incurred by wholesalers. Fresh tomato cost ₦ 43.33 per basket and accounting for 2.27% of the total cost on wholesaler side.

- **Offloading cost**

  This is the cost paid for offloading of tomato per basket. It is also only incurred by wholesalers. Fresh tomato cost ₦ 28.67 per basket accounting for 1.5 % of total cost.

- **Tax**

  This is cost paid for marketing of tomato to the local government area, per basket. Fresh tomato cost ₦10 per basket accounting for 0.43% and 0.52% of the total cost on retailers and wholesalers respectively.

- **Union dues:**

  This is the amount paid to marketers association per basket. Both retailers and wholesalers paid the same amount per basket as ₦ 5 accounting for 0.22% and 0.26% of total cost on retailers and wholesalers respectively.

- **Small polythene bags**

  This is small polythene bags usually called leather bag which is used to package the tomato for consumer by the retailers. Fresh tomato cost ₦15 accounting for 0.65 % of total cost.

- **Labor cost**

  This is the money spent in all marketing process or activities. The amount paid for labor by the fresh tomato marketers is ₦ 30.4 accounting for 1.31% of the total marketing cost on retailer's side. While on wholesaler's side, the labor cost is ₦ 20.33 accounting for 1.05% of total marketing cost.

- **Net Marketing Margin**

  This is the difference between revenue and cost generally it is calculated as selling price of an item less the cost of goods sold.(Farris *et al*, 2010). As presented in table 11, the net marketing margin of retailers and wholesalers of fresh tomato was 7.29 ₦/kg and 4.09 ₦/kg respectively.

It can therefore be inferred that for every basket, there is ₦ 474.1 return for fresh tomato on retailers side, while on wholesalers side was ₦265.67. Generally fresh tomato

marketing is profitable, which agrees with Atman (2006) whom reported that tomato marketing was found to be profitable in Yamaltu/Debu local government area of Gombe state. It also agrees with Adamu (2009) who reported that tomato marketing is profitable in Kano metropolis.

Benefit cost ratio
This can be defined as ratio of total revenue to total market cost. (Jennifer *et al*, 2007). As presented in table 11, the benefit cost ratio of fresh tomato was found 1.2044 and 1.1390 per basket (65kg) on retailers and wholesalers respectively.

Marketing efficiency
Table 3: Marketing Efficiency of Fresh Tomato in Yankaba Market.

Cost component (₦)	Retailers	Wholesalers
Cost of marketing	273.5	389.33
Purchase price	2046	1521.67
Selling price	2793.6	2176.67
Value added by marketing	747.6	655
Marketing efficiency	273.34%	168.24%

Source: Field survey, 2022.

Marketing efficiency can be defined as the maximization of the ratio of output to input in marketing. As presented in table 13, the marketing efficiency was found to be 273.34% and168.24% for retailers and wholesalers respectively. This implies that marketing of fresh tomato is efficient for both retailers and wholesalers, but is more efficient for retailers.

Constrains of fresh tomato marketing
Table 4. Constrains of fresh tomato marketing in the study area.

Retailers				Wholesalers		
Constrains	Frequency	Percentage*	Rank	Frequency	Percentage*	Rank
Supply problem during wet season	42	84	5	4	13.3	10
Inadequate storage facilities	34	68	6	27	90	3

Poor transportation facilities	25	50	7	22	73.3	7
Seasonality nature of tomato	50	100	1	29	96.7	1
Perishability nature of tomato	50	100	2	29	96.7	2
Inadequate capital	22	44	9	23	76.7	5
High cost of Transportation	23	46	8	25	83.3	4
price fluctuation	31	62	4	23	76.7	6
Absence of processing industries	50	100	3	19	63.3	9
Security problems	20	40	10	20	66.7	8

Source: Field survey, 2022.

* Percentage more than 100 due to multiple responses.

In Yankaba market tomato marketer's face with a lot of problems. The result presented in table 14 shows that retailers of fresh tomato marketers in Yankaba market were constrained by seasonality nature of tomato 100%, perishability nature of tomato 100%, Absence of processing industries 100% which ranked as first, second, and third respectively. Other constrains includes   price fluctuation as indicated by 62%, poor transportation facilities 50%,supply problem during wet season as indicated by 84%, inadequate storage facilities 68%,transportation facilities 50%, cost of transportation 46%, inadequate capital 44%, and insecurity problems 40%.

Table 13 also revealed that wholesalers were constrained by seasonality nature of tomato 100%, perishability nature of tomato 96.7%, and inadequate storage facilities 90% which ranked as first, second and third respectively. Other constrains includes high cost of transportation 83.3%, inadequate capital 76.7%, price fluctuation 76.7%, poor transportation facilities 73.3, insecurity problems 66.7%, absence of processing industries 63.3% and supply problem during wet season as indicated by 13.3%.

Conclusion

Based on the finding of this study, it was concluded that fresh tomato marketing is profitable in Yankaba market. The retailers have higher profits than the wholesalers in the study area, with net revenue of 7.29 N/kg and 4.09N/kg for 1kg on retailers and wholesalers respectively. However, there are many problems associated with the marketing of fresh tomato which must be address which were seasonality nature of tomato, perishability nature of tomato as major problem, followed by price fluctuation, absence of processing industries, and supply problem during wet season.

Recommendation

Governmental and non-governmental organization as well as private sector should establish tomato processing industries so that the surplus can be processed. Governmental and non-governmental organization should set program that will assist in providing credit facilities to tomato marketers. Insecurity problems should tackled seriously by government, because security stabilization attracts more customers and foreign investors into tomato marketing.

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ASSESSMENT OF BUSINESS PERFORMANCE TOWARDS FINANCIAL RATIO ANALYSIS IN THE HOSPITALITY MANAGEMENT AND TOURISM OPERATIONS

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Abstract
It has been observed that managers in the hospitality and tourism industry assess the performance of their business based on operational activities rather than scientific analysis of financial figures. The implication of such approach is shallow understanding of the strengths and weaknesses of the enterprise which could easily culminate into naïve as against pragmatic decisions. This paper examines the types of financial ratios and their relevance for objective assessment of business operations and decision making for sustainability in the face of competition. It is recommended that tourism services providers should employ ratio analysis as tools for measuring trends and relationships in trade.

Keywords: Financial ratios, Business performance, Sustainability, Tourism industry

Introduction

Often times, the managers in the hospitality and tourism industry assess the performance of their organizations based on volume of trade or the number of customers they record within a certain period. How many customers and guests ate in the restaurant? How many guests lodged in the rooms or how many rooms were occupied? How many tourists were received? How many units or covers were ordered? Some other times, they look at the financial statements prepared at the end of a trading period to judge the contribution by various departments. Are there more profits this year than last year? Is the profit from housekeeping greater than that from Food and Beverage departments? Hence, they emphasize triviality over pragmatism thereby undermining true indicators of business success. One objective way of assessing the performance of a business is to subject operating statements and financial reports to critical analysis. Economic decisions are better made with the aid of analytical tools that are able to provide insight into the present status and future potentials of the business. Financial ratios are very useful tools for assessing business performance and determining direction and the chances of success or otherwise.

Financial ratios are guides that are useful in evaluating the financial position and the operations of a company from scientific facts. It helps in comparison of changes in static data from previous years to current year and with the comparison of other companies as well. Ratios are actually regarded as the real test of earning capacity, financial soundness and operating efficiency of business concern (Bragg 2012).

Financial Ratio Analysis is the calculation and comparison of main indicators – statistics, which are derived from the information given in a company's financial statements, including income statement and balance sheet. It involves methods of calculating and interpreting financial ratios in order to assess a firm's performance and status. Financial analysis is primarily designed to meet informational needs of investors, creditors and management through comparative measurement of financial data to facilitate wise investment, credit and managerial decisions (Brealey, Meyers and Allen 2013). Depending on the manager's information needs, this analysis may be based on a year- to-year comparisons, common size analysis or cross-sectional (inter-firm) comparisons where industrial averages and benchmarks play vital roles.

Types of Financial Ratios

The most common and attractive categories of financial ratios proposed in literature which are useful to the hospitality and tourism industry include the profitability ratios, activity or efficiency ratios, liquidity ratios and investment ratios(Brigham & Ehrhardt 2013, Higgins 2012, Adejoh & Dauda 2015) .

The profitability ratios are calculated to determine the financial performance for a given period, showing how well capital is utilized to yield returns and sales are made at profits. They provide indications of how profitable a firm has been over a period of time. Profit is the ultimate objective of a company and a company will have no future if it fails to make sufficient profit. These ratios include gross profit ratio (gross profit to sales), operating profit ratio (net profit to sales) and return on capital employed or return on equity (PBIT or Net income to capital)

The efficiency ratios are activity- based ratios which measure the operating performance of the business, usually over a short term period of time (Higgins 2012). They describe how well the firm is using its investment in assets to produce sales. These ratios include

- Inventory Turnover Ratio (Cost of sales/ Average stock) – i.e. no. of times.
- Account Receivable Turnover Ratio (total revenue / average debtors)). Average debtors = debtors at beginning + debtors at end / 2. – no of times
- Average Collection Period (Debtors / credit sales x 365days) – no of days
- Fixed Asset Turnover Ratio (Sales / Fixed assets) – i.e. no of times
- Total Asset Turnover Ratio (Sales / capital employed or Av. Total assets) – no of times

- Paid Room Occupancy (Paid rooms occupied / Available Rooms X 100). It measures the management's success in selling its rooms. It is a measure of facilities utilization.
- Seat Occupancy or Turnover (No of Guests Served / No of Seats Available X 100).It is calculated by meal session. The higher the ratio the higher the facilities utilization

The liquidity ratios describe the ability of a firm to meets its current obligations, i.e. the ability to pay short term bills as they fall due (Adejoh and Dauda 2015). Among them are Current Ratio (Current asset : current liability), Quick Ratio (Current asset less stock : current liability) and Cash Ratio (Cash + Cash equivalent : Current liability)

The investment ratios describe the potentials of a company to attract financing (Lee, Lee & Lee 2009). The ability of a business to survive depends on its capability to attract additional equity capital when required. This capacity is measured in the relationships between the earnings available for ordinary shareholders and the other attributes of the ordinary shares. These ratios include

(a) Earnings per share (EPS): This is of considerable importance in estimating the value of a share. It is arrived at as Net income / Number of ordinary shares

(b) Price/Earnings (P/E) Ratio: This is the comparison of the market price of an ordinary share with the earnings per share; calculated as: Market Price per Share / Earnings Per Share. All things being equal, this ratio indicates the number of years within which the investors' capital outlay will, at the present level of earnings, be recouped either in the form of dividend received or capital growth or by virtue of retained earnings.

(c) Earnings Yield: This is the reciprocal of the price earnings ratio which compares the Earning per Share with Market Price per Share. It gives the capitalization rate, which is the rate at which the stock market is apparently capitalizing the value of the current earnings.

(d) Dividend per Share: This is that part of earnings per share which is received by the shareholders as dividend. It is computed as: Ordinary share dividend divided by the Number of ordinary shares

(e) Dividend Yield: This, also known as the yield ratio, is based on dividend declared during the year in respect of any type of share. It is calculated as: Annual Dividend Per Share / Market Price Per Share. The dividend yield indicates how the capital employed is being efficiently utilized in comparison with the past years or with alternative investments or returns from other companies in the same industry.

(f) Dividend Cover: Indicating the relationship between earnings and dividend per share, dividend cover shows how many times dividend per share is covered by earnings per share. A higher dividend cover indicates that only a small portion of

the earnings has been distributed as dividends while a substantial portion has been ploughed back into the business. A lower dividend cover will indicate the reverse situation. It is calculated as: Earnings Per Share divided by Dividend Per Share

Shim & Siegel (2008) describe investment ratios as the tripod stand on which the fate of a firm hangs. Constant review of these ratios will help managers and their organizations stay alert and keep secure in the market.

Ratio Analysis as Indicator of Business Performance
Ratios are useful guides for evaluating the financial performance and position of a tourism enterprise from scientific points of view .For the purpose of accounting and financial management, as observed by Adejoh and Dauda (2015), ratios are regarded as the real test of earning capacity, financial soundness and operating efficiency of business concern.
The importance of ratio analysis to hospitality and tourism operations can be appreciated in the following dimensions:
- **Clear Understanding of Accounting Figures**: Simply preparing income statement and balance sheet is not adequate to understand the direction of an operation. Ratios help to reduce figures to simple statistical indices that point to the direction and state of affairs (Shim & Siegel 2007, Shim,, Siegel & Shim 2011). Considering the fact that most operators of hospitality and tourism outfits are not accountants, ratio analysis simplifies the accounting figures in much easier way by which anyone can easily understand.
- **Determination of Operational Efficiency:** Ratios are useful tools in the hands of management for evaluating the firm's performance over a period of time by comparing the present ratios with the past ratios. Such ratios as stock turn over, account receivable turn over and other activity ratios are very useful for measuring the operational efficiency of the firm by investors, suppliers and financers (Temnent 2008, Subramanyam & Wild 2013).
- **Measure of Profitability:** Both the management and owners of a firm are primarily concerned with the overall profitability of the business. Profit and loss account merely reveals the profit earned or loss incurred during a period, but does not convey the capacity of the firm to earn in terms of sales, investment or assets. Such profitability ratios as net profit ratio, return on capital employed, return on investment and return on fixed assets are the best measures of earning capacity and profitability (Wahlen., Baginski & Bradshaw 2010). Most lodging companies that failed were mistakenly measuring their successes on raw figures of profits obtained from financial statements.
- **Measure of Liquidity Position:** Profit figures and bank balance do not convey adequate information about the liquidity of a business. Liquidity position of a firm

is said to be the capacity of the firm to meet its current maturing obligations, spanning over a period of one year (Adejoh and Dauda 2015). A firm's liquidity position is said to be satisfactory only, if it has sufficient liquid funds to pay its short- term obligations. Liquidity is measured by the amount of cash and cash equivalents available to the business. The business creditors are particularly interested in the liquidity position of the business.

- **Evaluation of Long-term Solvency:** Ratio analysis is equally important in evaluating the long- term solvency of the firm. The firm's capital structure actually provides the basis for this analysis. The capital gearing or leverage ratios are helpful to long-term creditors, security analysts and present and prospective investors, as they reveal the financial soundness or weakness of the firm (Axson 2010). For instance, a ratio of debt to equity capital of 2:1 is considered too high to give interest parties the confidence of long term survival and chances of dividends.

- **Trend Analysis:** One reasonable way of assessing a firm's performance as asserted by Albrecht., Stice, Stice & Swain (2010) is to compare results over successive periods. Ratios allow for trend analysis. It is possible for trend analysis of ratios to reveal whether financial position of an enterprise is improving or deteriorating over years because it enables the firm to take the time dimension into account.

- **Inter-firm and Intra-firm comparisons:** Ratio analysis makes it possible for various companies in the hospitality and tourism industry to compare their operational efficiency with one another, even as it is possible for a firm to assess its efficiency at various divisions of the firm (Walker 2009). Absolute figures are not suitable for this purpose, but accounting ratios are the best tools. Hence, ratio analysis is the best measure of comparison among operators or owners which is capable of provoking healthy competition.

Points to Consider when Using Ratios

The application of ratios is subject to some limiting factors of which managers must take note (Stringer & Shantapriyan, 2011, Weil, Schipper & Francis 2012, Zimmerman 2010). One ratio is not adequate for economic decision; it must be used in combination with other ratios. Since ratios are based on past or historic data, they do not reflect the future perspectives of a firm. The ability of the manager to use ratios as predictive indices for the future depends on the relative stability of the business environment.

Also, managers must watch out for any likelihood of window dressing in accounting figures that may distort the relevance of interpretation of ratios.

Inflation and other seasonal factors may distort comparisons and lead to inappropriate conclusions. Therefore, the analyst must make provision for this variation when ratios are used for financial analysis.

It must also be borne in mind that different accounting and operating practices can distort comparisons. Companies that share common characteristics are capable of being compared when using ratios. Therefore, it will be a misplacement to compare a small sole trade with limited liability company in terms of revenue and cost statistics.

Conclusion

The role of financial ratio analysis in assessing business performance in the tourism industry cannot be overemphasized. If appropriately applied, ratios can be used as a tool to assist financial analysis. They help to focus attention systematically on important areas and summarize information in an understandable manner and assist in identifying trends and relationships. Rational interpretation of ratios leads to objective forecasting and control which can help strengthen the business.

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LOCALIZATION OF TEXTILE INDUSTRY IN NIGERIA

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Abstract

Petroleum resource dependent Nigerian economy along with poor governance, challenges the Nigerian textile industry. Moreover, there is a sheer lack of political will to formulate policies directed at industrial growth by the Nigerian political class. The growth of textile industry is essential if Nigeria is to foster structural change and translate its potentials. This article examines how poor policy implementation stunted the development of the Nigerian textile industry from 1985 to 2015. The textile industry's decline reflects internal challenges and the failure to provide supportive policy measures and critical infrastructure for the growth of the sector. This is also related to Nigeria's overreliance on petroleum at the expense of other economic sectors. This article focuses on the neglect faced by the textile industry. Our findings indicate that overreliance on petroleum resources emboldened imports of foreign made products especially from China. It calls for the application of an industrial policy to increase the competitiveness of the Nigerian textile industry globally. The article provides an understanding into the reasons for the collapse of the textile industry. It also contributes to the need for industrial policy consideration for resource dependent economies.

Keywords: Industrial policy, Dutch disease, Manufacturing, Petroleum, Textile, Infrastructure

Introduction

For decades Nigeria has experienced an upsurge in the global production of petroleum resources. Petroleum resources have become the mainstay of the economy while manufacturing and other sectors suffer (Odularu 2008). The opportunities provided by an increase in oil revenues to transform the economy came to nought. Government effort to diversify the industrial sector of the economy is relatively weak. The neglect of the textile subsector is due to the government's overreliance on the oil sector. The manufacturing sector on the whole suffered as the country shifted attention and focussed on oil as the main revenue source. The non-oil export industry (manufacturing) stagnated while the dominantly export-oriented petroleum sector thrived (Otaha 2012; Ilegbinosa, Uzomba and Somiari 2012). Dependence on the petroleum resources increasingly became stronger by the day as the world experienced an oil shock that triggered a sharp upsurge in oil prices. Huge petroleum earnings made the government ignore other buoyant sectors in

preference to the petroleum industry. This phenomenon is encouraged by the government's concern in developing the petroleum sector that is seen as a more lucrative sector compared to the manufacturing sector (Luqman and Lawal 2011) which requires heavy investment in infrastructure development. Although many countries around the world continue to provide direct support to their manufacturing industries, it is believed that the best form of defence against global competition is efficient infrastructure facilities and result oriented government policies.

Worthy of note, textile factories in Nigeria are increasingly stripped of government support. Thus, the defining challenge for the sector to remain competitive has shifted, especially in the wave of continued shrinkage of international borders from comparative advantage to competitive disadvantage (Porter 1990). In this context, the motivating questions for the article are how can textile manufacturing in Nigeria improve its position in the global textile sector? In particular, the recent developments notwithstanding, is there a policy gap in the development of the Nigerian textile sector? Is the major development challenge in the country the result of overreliance on the petroleum sector, the financial crisis, or infrastructure deficiency? These questions are important because of the policy linkages between supporting the manufacturing sector (textile production) and economic development. The article therefore focuses on the failure of policy to contribute to economic development due to the neglect of the textile sub-sector. UNIDO (2003) report shows how many developed and developing countries have announced varying stimulus plans to reinvent the manufacturing industries. Those are countries without power failure and exorbitant interest rate regimes. Loans from the Bank of Industry and other similar institutions are not forthcoming. Where they are obliging, the interest rate is always very high. The high cost of transporting industrial goods and other materials from the Lagos port to Kano is of equal importance. In addition to that, it is evidently clear that lack of good governance and political will to redress the situation of the dwindling manufacturing activities had adverse effects on textile production and commerce. This assertion is substantiated in the statement of Budina, Pang and van Wijnbergen (2007), which contends that Nigeria's petroleum resources failed to enhanced growth and development in the country's non-oil sector.

There are diverse empirical literature that discusses the Dutch Disease phenomenon and the neglect of the manufacturing sector (Fardmanesh 1991); poor governance (Otaha 2012) and immiserizing growth syndrome (Hassan 2015; Onyeiwu 2015). Humphreys, Sachs and Stiglitz (2007); Onyeukwu (2007); Van der Ploeg (2011); and Frankel (2010) identified oil and other natural resources as a source of riches, which often crowd out other economic sectors especially manufacturing and cause job loss. Inflow of oil revenue often leads to currency appreciation, a phenomenon that encourages corruption. Earlier studies including that of Otaha (2012); Budina, Pang, and van Wijnbergen (2007); Ucha (2010) identified abundance of natural resources as the primary reason for poor governance and

conflicts in Nigeria. Nevertheless, Sanusi (2010); Luqman and Lawal (2011) claimed that the government failed to implement growth-enhancing reforms that will ensure the provision of critical infrastructure for industrial development. They pointed out that the phenomena persist because of corruption; rent-seeking enterprises, recurrent unrest, and erosion of social capital as some of the reasons associated with it (Stevens and Dietsche 2008). Greater emphasis on government accountability and institution-building is the possible way out of the resource curse.

Another argument from Balogun (1997) and Remi Aiyede (2003) indicated that Nigeria is experiencing imperious governance from the colonial period to date. They argued that colonial rule dislocated the economic system by reorganising the economy to suit the economic interests of the colonial power. Thus, the previously prosperous textile industry was stifled by colonial economic policies. This provided avenue for foreign merchants to take full control of economic activities. Britain undoubtedly dominated the economy with resource extraction and local industries suffered due to imports of British goods especially textile. At independence with the discovery of oil in commercial quantity, governance continued as it was during the colonial period (Omeje 2001). The manufacturing sector was ignored by the government in preference for easy money from petroleum resources. Scholars including Ojameruaye (2004), Fardmanesh (1991), Ezeala and Harrison (1993), and Davis (1995) argued that the best possible explanation for the neglect of the manufacturing sector was the deindustrialization process. The outcompeted sectors include textile, rubber, cocoa and other manufacturing industries. Ilegbinosa, Uzomba, and Somiari (2012) maintain that the value and quantum of non-oil exports drastically declined. It has been established that the traditional manufacturing sector provides more efficient growth opportunities better than the extractive industry.

Previous studies have not provided a detailed rundown on the multivariate evidence that spurs the wanton neglect of the textile manufacturing industry. Moreover, little attention has been paid to the dominance of the petroleum industry and its concomitant effects contributing to the poor performance of the textile industry. Certainly, many a times and in different circumstances, natural resource affluence has unleashed economic disorder. Our article seeks to reposition the textile industry by making recommendations to the government on a number of measures that could be carried out. It is about consistency in policy implementation by government agencies, reduction in an influx of smuggled goods, adequate supply of energy and LPFO, fiscal policy incentives, support to cotton production and revamping the textile industry. The article is also of value to academia and to policy makers who are interested in studying China-Africa relation.
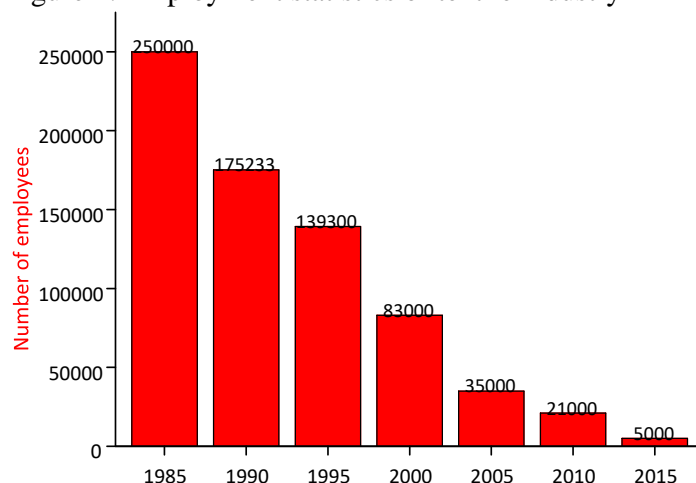
The Nigerian Textile Industry
Nigeria, Africa's second biggest economy had once a prosperous textile industry till the mid 1980's. Before 1985, the export of textile products, just as other manufactured exports

in Nigeria was remarkable. The textile sector had an annual growth rate of 67 percent. Its labour force in 1985 was 25 per cent in the manufacturing sector (NTMA 2009). The inability of the Nigerian textile industry to compete is chiefly due to its failure to produce at lower cost. The causes of the textile industry's decline are predominantly caused by policy neglect besides that a range of local and global policy measures also contributed to the situation it is in today. Neoliberal reforms and changing trade agreements, inadequate infrastructure for providing electricity and water, reduced cotton production and increased textile imports have all contributed to the industry's decline.

The early independence years of the 1960s to the mid-1970s came to be known as the industrial development period aimed at converting abundant raw materials to manufactured goods. Encouraging traders to convert and become manufacturers was the single most significant impetus to the growth of the textile industry in the country. 112 factories were involved in spinning, weaving and garment production by 1980. The domestic manufacturing sector could have surged if not for the impediment experienced because of the introduction of Structural Adjustment Programmes in the mid-1980s. It is irrefutable that when right policies are implemented the textile sector has the potential to contribute to economic growth for Nigeria's development.

By 1985, the textile industry had become the largest employer of labour after the government. These factories have a direct 250,000 unionised workers, millions of cotton farmers as well as suppliers and traders (Aremu 2005). Direct employment afterwards declined to 175,233 in 1990, 83,000 in 2000 and 21,000 in 2010 respectively (see Fig. 1). The industry's share of jobs and value addition was placed at 20 per cent in the mid 1980's. Textile and weaving apparel was the leading industry contributing 19 per cent of total consumer commodity industry employment in 1983. The textile industry is followed by beverages, food, as well as the tobacco industry (Brandell 1991).

Figure 1: Employment statistics of textile industry

Year

Source: Central Bank of Nigeria and Field Survey

Considerably, the industry's turnover has been placed at N8 billion meters per year. On replacement basis, the installed textile manufacturing capacity was set at N420 billion, and US$3 billion investments in 1990 (UNIDO 2003). With a population over 180 million, Nigeria has the prospect of generating 1.2 billion meters of cloth per annum.

When the ECOWAS sub-regional market is factored, Nigeria is a strategic textile location in the world. The industry can engage 3 million people. 26 out of the 36 Nigerian federating units grow cotton of long and short stable lengths. From this sound and solid context, the textile industry in Nigeria began to decline since the mid-1980s.

As Nigeria takes on more economic liberalisation, the manufacturing industries got weaken with a reduction in aggregate demand, which dampens domestic production and manufacturing output. It also reduces the level of income and the level of employment. The rapid decline in government expenditures has continuously reduced aggregate demand within the economy. It has created serious underutilisation of industrial capacity in the economy. Gross Domestic Product increased by only 1.3% with the annual population growth rate at 2.1%. Aggregate index of industrial production declined by 5.1%, which was more severe in the manufacturing sub-sector that fell by 8.1% as it contributed only 0.9% to the GDP from its 0.5% contribution of 1991 (CBN 2000).

The Central Bank of Nigeria in its annual statement for 1999 reported that the local textile industry suffered from cheaper foreign textile dumping and the sector recorded persistent output contraction or outright closure (CBN 2000). As at April 2000, President Obasanjo observed that the characteristics of the Nigerian industrial sector include low capacity utilisation, which averages 30% in the last decade. The industrial sector had a low and declining contribution to national output, which averages 6% from 1997-1999. This contributed to declining growth rates; dominance of light assembly type consumer goods, low value-added production due to high import dependence for inputs and the prevalence of unviable state-owned enterprises. Overall, the fiscal narratives of the year 2000 showed that the country's economic performance was largely below average (OPS 2001). The long-standing constraints to manufacturing activities have not abated. Thus, the sector was still characterised by the crippling effects of past policy mistakes and undue competitive pressures due to the economic liberalisation policies of the country.

1985 was the most boisterous year in textile production with over 175 big, medium and small textile factories. By the year 2000 three years into the endorsement of the liberalisation policy, thirty-five textile factories closed down leaving behind 89 factories. Within the span of five years by 2005 the number of factories fell to 32. The effect eventually manifested itself in continued unabated dumping reducing the factories to 25 and 16 in 2010 and 2015 respectively (see Fig. 2). Other challenges include reduction in

capacity utilisation; absence of investment in the industry and the situation deteriorated by the day. The factories could not compete with comparatively affordable materials from East Asia. The challenge was further worsened by increased smuggling as the government did nothing to stop the illegal imports. There was also a problem of undeclared products and non-payment of duties even by legitimate importers. Nigerian market was flooded with imported textiles. Total textile imports into Nigeria were estimated at USD 1.7 billion most of which entered through porous borders. All these denied the local manufacturers the essential competitive advantage (NUTGWTN 2005).

Figure2: Number of textile factories in Nigeria1985-2015

Year
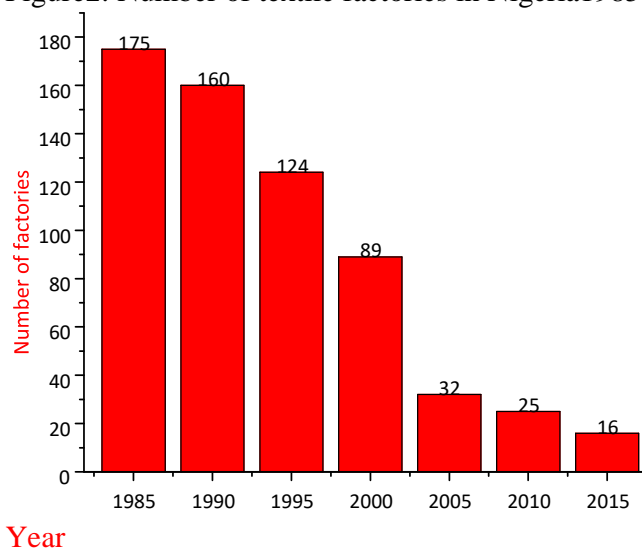
Source: Central Bank of Nigeria and Field Survey

The overall performance of the textile industry in Nigeria is in a state of crises. Average capacity utilisation rates fell from 79.7 percent in 1976 to an all-time low of 48.0 percent in 2005 (CBN 2005). By 2008, over 160 textile companies were closed. Capacity utilisation was estimated at less than 20% with ten factories employing barely 18,000 workers. Senator Walid Jibrin asserted that over two million Nigerians whose jobs were attached to the industry, such as traders, contractors, cotton farmers and the textile workers lost their means of livelihood due to the challenges facing the industry (Muhammad 2011). As of 2010, there were less than forty textile units in Nigeria out of the close to 200 in existence formerly (Aremu 2015). The distress the closures caused in the communities where the factories were located are enormous. According to NUTGTWN, more than one million persons whose means of livelihood are tied to the industry were adversely affected including traders and cotton farmers. The socio-economic consequences were colossal.

With the fall of Kano, Kaduna and Lagos textile sector, imported textiles from China and other core trading partners from India, Indonesia and the UK dominate the market (see Fig 3).

Figure 3: Volume and Country of Textile Imports to Nigeria

Year
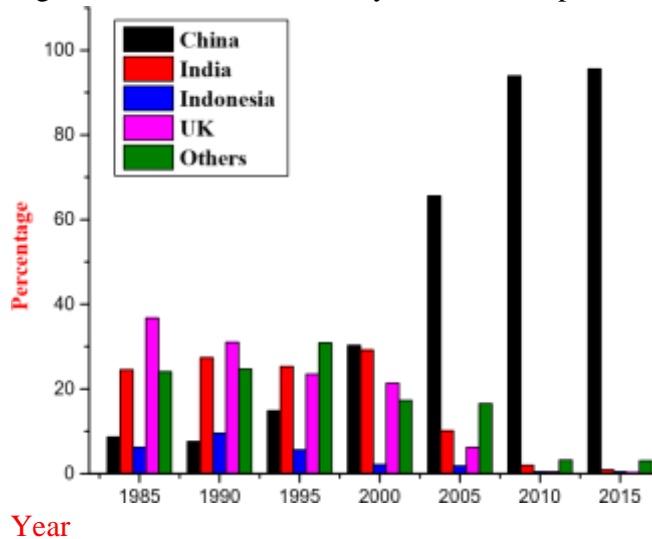
Source: Central Bank of Nigeria and Field Survey

In a way, textile manufacturing has returned to the condition it was in during colonial times in the 1950s when Nigeria imported finished textiles from the United Kingdom. Chinese textile companies and retail companies with foreign offices in Nigeria now distribute to local wholesale and also retail textiles directly to consumers.

Nigerian Industrial Policies
Industrial and economic development in Nigeria is facing enormous challenges due to the lack of policy and also poor implementation of critical infrastructure development. Several policies including industrial policy, trade policy, export and import policy, fiscal and monetary policy, have been promulgated. Not much success was achieved on policy implementation. Nonetheless, evaluation on the performance of the country's economy by looking at its many policies over the years suggests that the country is still battling to achieve industrial development. These policies are not home-grown policies made to suit the unique traits of the local economy. Industrial policy and development policies in Nigeria are interwoven and carefully knitted from the colonial era to contemporary times. Structural Adjustment Programme (SAP) was introduced in the mid-1980s to the late 1990s. The policy emphasises the role of the private sector and discourages government interventions through subsidy, regulations, restrictions or control. Measures launched include the introduction of foreign currency domiciliary accounts, abolishing of import licensing and the introduction of Second-tier Foreign Exchange Market (SFEM) (Oviemuno 2007). Other measures include scraping commodity boards and the significant reduction in the items on the list of banned imports. Like most developing countries,

Nigeria had encountered severe balance of payment crisis caused by the cumulative consequences of the oil crisis. The country also witnessed a decline in commodity prices and the growing import needs of domestic industries. In response to the crisis, IMF and the World Bank described the crisis and the lack of industrial development mainly as the result of poor national policies. The 1986 - 1994 policy prescription was based on the findings of the Berg Report on Accelerated Development in Sub-Saharan Africa published by the World Bank in 1981. The report contended that Africa's economic and industrial performance was weak because of policy inadequacies. Thus, the policy domain came in contrast to widely accepted view among African policymakers that industry should be promoted through strategic government intervention.

To fully realise SAP objectives, Export Oriented Strategy of Industrialization (EOI) was unveiled to diversify the productive and export base of the economy. However, the EOI has put Nigeria on a low-growth course, crippling the economic diversification attempts. It triggered a crisis in the textile industry especially in northern Nigeria (Tsauni 2009). Specifically, the emphasis on liberalisation of markets coupled with the rapid withdrawal of several forms of interventionist policies promoting manufacturing drove many domestic firms out of contention. Cases of the closure of industries and operation below capacity utilisation become evident. To chart a course and move away from SAP failure, Guided Deregulation Policy also known as Vision 2010 was introduced from 1994 to 1998. The policy was adopted to continue with the neoliberal measures of privatisation, deregulation, and commercialization along with the withdrawal of government intervention in the economy. Specific government interventions were later returned, and a properly designed vision for the growth of the country was enunciated with lessons from the industrialised Asian Tigers. Structural adjustment strategies hampered the development of the manufacturing industry most specifically in the textile sub-sector. The continued weak performance of the economy starting from the 1980s through 1990s along with the WTO entry of both China and Nigeria prepared the ground for China's textile dominance.

On the return to democracy after almost two decades of military intervention, the government re-launched market-oriented reform strategies which was the National Economic Empowerment and Development Strategy (2003 -2007). Others were the 7-point Agenda (2007 – 2010) and the Economic Transformation policy (2011 - 2015). These measures were the reinvention of SAP driven strategies which have impaired sustained growth and development in Nigeria over the years (Aremu 2015). These policies were promoted with the aim of addressing unstable exchange rate, weak fiscal and monetary policy coordination. It was meant to develop the wherewithal to counter the threats to industrial competitiveness. Most importantly, the past policy measures were not tailored to suit Nigeria's conditions but rather, they adhere to universal approaches which in most cases is not in conformity with the local circumstances. These measures have not

focused on the country's distinct economic difficulties that are the main elements to sustained industrial growth. The measures are inappropriate, and typically they do not usually stand the test of time as they were regularly revised, adjusted, or entirely discarded. Additionally, corruption and indiscipline contributed profoundly in the non-implementation of some policies over the years. Others could be due to inadequate institutional capacity, political instability, insufficient energy supply, poor infrastructure and bad governance. To put it succinctly, the overall marginal performance of the Nigerian economy and the lack of industrial and economic development could be attributed to neoliberal policies.

Evidence of Policy Neglect of the Nigerian Textile Industry

Nigerian textile industry has experienced and is witnessing major challenges coming as a result of neglect. Concisely, for lack of policy direction to attain industrial and sustainable economic development to overcome global competitiveness the economy has been slowly turned into a mono-cultural economy by successive regimes. Despite abundant resources to gain the desired goal of manufacturing development easy revenue is sought from oil. The general performance of the government to transform the textile industry is very poor. Moreover, key infrastructural provision is neglected. On the whole, industrial, trade, fiscal and monetary policies promulgated suffer from government inaction (Harvey 2005).

Overreliance on the Petroleum Sector

The phenomenon of overreliance on the Petroleum sector causes the manufacturing sector to fall from a towering 7% and 10% in 1967 and 1970 to a mere 3.8% and 3.4% in 2002 and 2006 respectively in terms of its contribution to the nation's GDP (World Bank 2000). By 1975, the manufacturing sector's contribution to the GDP was 9.5% which decreased in 2007 to 3.52% and rose in 2009 to 4.0%. From a huge 80.0% capacity utilization in 1975, it declined to 47% in 2009 (MAN 2011). In contrast, the petroleum sector's contribution to GDP increased from 2% to 29.1% in 1960 and 1980 (Utomi 2008). The growth and the increased revenue from the oil industry caused manufacturing's GDP share to decline. However, the oil revenue is never stable from the 1980s (Ross 2003). In addition, petroleum seriously dominated government revenue and export earnings. Summarily, in 1970 and 1975 oil revenue accounted for 63% and 83% of total revenue earned. Moreover, it was 96%, 73.2%, 71.1% and 83% in 1980, 1990, 2000 and 2010 respectively (see Fig. 4). The macroeconomic challenges were so damming that structural adjustment strategy was reintroduced to overturn it (Interview Ismail 2015; Ezeala and Harrison 1993). This measure did not arrest the dwindling growth in the industry instead it stifled growth and development of the textile industry (Interview Kano 2015). The economy instead of recovering further returned to a descending spiral.

Figure 4: Percentage of Oil Revenue to Total Revenue Earned

Year
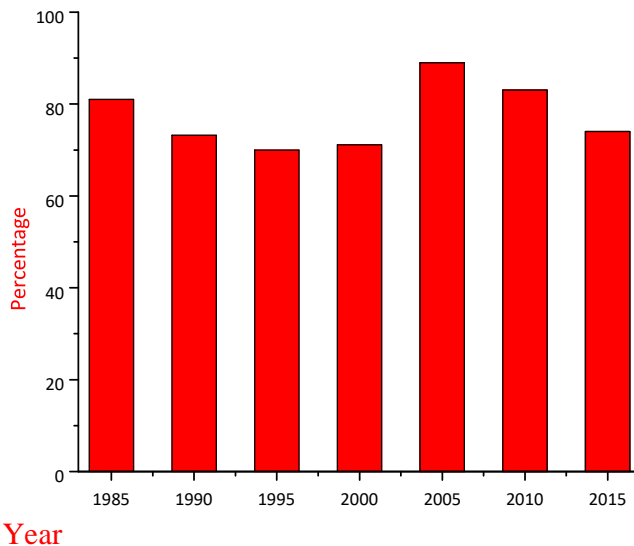
Source: Statista (2016)

Evidently, heavy reliance on the petroleum sector at the expense of critical manufacturing sector did not augur well on the economy (Ross 1999). It harmed employment in the textile industry. Moreover, it gave room for mismanagement and misapplication of resources to fester. Investment in critical infrastructure was not made to push the textile industry to grow. These elements wrecked the growth potential of the local textile industry while fuelling the dominance of imported Chinese textile (Interview Sagagi 2015). Despite the promised diversification of the economy, more focus was put on the petroleum sector to bolster the oil reserves and to earn more from the sector.

The Manufacturing Sector and the Financial Crisis
Nigeria found itself in a financial crisis forcing the government to borrow from the international financial market. This is as a result of the spending spree of the government and the consumption habit for foreign manufactured goods, which led to mounting import bills. Additionally, the government sourced for foreign loans pushing the economy into the abyss of external borrowing whenever the oil revenue falls short of earmarked output or price. The administration of President Goodluck Jonathan (2010-2015) and Muhammadu Buhari (2015-Date) did not pursue a strategy of an exchange rate that could have improved the competitiveness of the manufacturing sector (Sala-i-Martin and Subramanian 2012; Interview Adhama 2015). Furthermore, the government allowed the local currency to depreciate thereby wrecking the manufacturing sector competing for space in the domestic economic landscape with the petroleum sector. Petroleum prices was at $27.01, $16.86 and $49.49 in 1985, 1995 and 2015 respectively (see Fig. 5). The price was the highest in 2010.

Figure 5: Petroleum Price, 1985-2015

Year
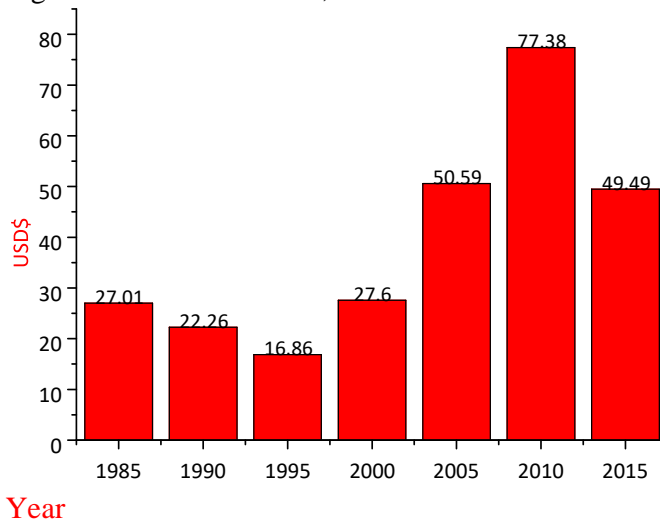
Source: Statista 2016

Trade liberalisation altered the operating conditions of the manufacturing sector. The implications were massive shut down of factories from across the country. Factories could not cover average variable costs. Factories could not afford high lending rates from banks resulting from the liberalisation of interest rates leading to high production cost, higher consumer prices and weak demand. Most factories experienced a financial squeeze. Indeed, the market-based economic reforms planned to promote domestic production proved incongruous for the nascent industrialisation in the country. Moreover, given the raw materials import dependent nature of most manufacturing industries, the huge depreciation of the local currency affected the cost of imported raw materials, which contributed to an increase in the cost of production (Obansa et. al. 2013). This directly affected the levels of production, capacity utilisation and employment in the sector. Hence, unless the national macroeconomic structure is corrected, the economy was generally affected.

Furthermore, the exchange rate was fixed at N21.8861 between 1994 and 1998 despite the fact that the country was witnessing soaring inflation rates (see Fig. 6). In most of these periods, the petroleum prices were at its low ebb. High inflation is typical of Dutch Disease troubled countries. Large capital inflows raise the money supply and therefore cause inflation as more money will increase demand and consequently prices. Another inflation causing factor is the increase in liquidity which is as a result of the increase in petroleum earning (Joseph 1978; Odularu 2008). For example, the price of petroleum was $17.89, $16.21, $17.34, $20.7, $19.4 and $12.77 per barrel in 1993, 1994, 1995, 1996, 1997 and 1998 respectively. By the turn of the century when democracy was restored the country enjoyed yet again increase in the price of oil which was not adequately managed. The oil

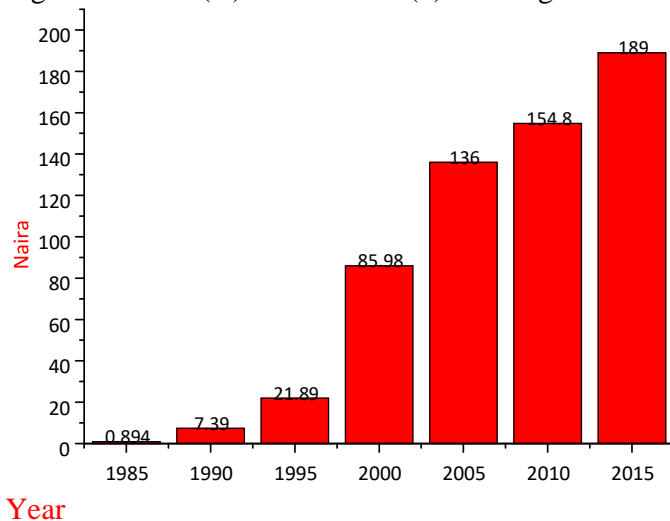price was $18.07, $27.6, $24.50, $25.15 and $28.67 in 1999, 2000, 2001, 2002 and 2003 while the official exchange rate fell greatly from 0.894 in 1985 and 7.39 in 1990. The exchange rate too fell further from 1995 to 2015 (see Fig. 7).

Figure 6: Inflationary Rate, 1985-2015
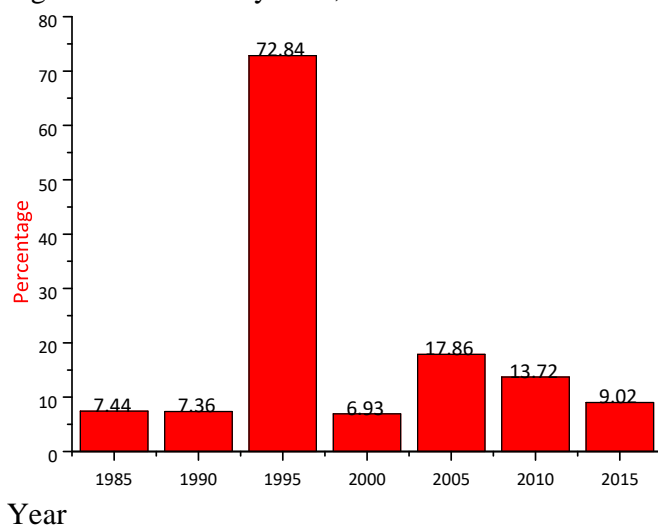
Source: Central Bank of Nigeria, World Bank, OECD

Figure 7: Naira (N) to US dollar ($) exchange rate

Source: Central Bank of Nigeria

Policy Inconsistencies and the Nigerian Textile Industry

Manufacturers in Nigeria saw government policies as punitive and constituting the bulk of factors responsible for de-industrialization (Interview with respondents Tofa 2015; Adhama 2015; Sani 2015). Neoliberal policies forced factories to source for inputs including machinery and raw materials. These inputs were non-existent locally as the local factories are import-dependent. Moreover, the low exchange rate of the local currency made it difficult to replace obsolete plants as a result of the exorbitant cost of imports. This made several factories to fail throughout the country. Washington consensus influenced liberalisation policies such as deregulation and the relaxation of government restrictions, and the high-interest rate had adversely affected the growth and competitiveness of the textile industry. Sadly, some banks gave the scarce foreign exchange for use in unproductive ventures. The lack of banking and financial support to manufacturers also led to many withdrawing from manufacturing and partaking in trading in foreign made goods (Interview with respondent Nabegu 2015).

It is common knowledge that privatisation, deregulation and liberalisation of the economy are central in the economic policy landscape. Market forces determine production, supply and purchase in the industry. These policies triggered other challenges (Interview Ismail 2015; Tsauni 2015) where businesses could only thrive in an environment where there are fewer policy challenges (Interview Solomon 2015). Unsteady policies and deregulation also encourage smuggling and dumping of cheap goods. The only thing constant about industrial policies in Nigeria are frequent policy changes which in turn discourages long-term planning for industrial and business development. For example, between the late 1980s and 2004, industrial policies have been altered more than five times (Tsauni 2009; Interview Tsauni 2015; Nabegu 2015). In 2003, based on recommendations made by UNIDO the government announced certain key fiscal measures to boost fresh investment in textiles and encourage exports. These measures include an export incentive in the form of Export Expansion Grant (EEG) and a prohibition on the import of all textiles. These measures were to be sustained for four years from 2003 till 2007. However, there were several policy changes in the next two years, ranging from suspension of export incentives to waivers.

There have also been a series of waivers even after the official ban. Policy inconsistency facilitated the collapse of many textile factories, as it undermined planning by investors. For instance, the waiver was given to lace manufacturers to import polyester filament yarn, viscose yarn and base fabric (Interview Bello 2015). Earlier a government committee set up by the Minister of State of Finance to assess the capacity of various textile mills at Lagos and Kano had discovered that there was adequate local capacity for polyester filament yarn. Given the importance of policy stability, it must go pari passu with economic discipline. It is equally important to note that adopting result oriented policies to changing circumstances is vital to sustained industrial growth and development.

Nigerian policy makers must be aware that no single economic path is appropriate to all economies irrespective of their location, and level of development. Economic policies must take cognizance of the history, politics and culture of the country. The careful design and implementation of specific economic policies must be context appropriate. That is why it is wrong to design World Bank/IMF medium-to-long-term economic packages for all of Africa from Cape to Cairo, from Swaziland to Zanzibar, or even from Lagos to Kebbi (LaRouche 2001). The problems of poor leadership in all its ramifications and lack of patriotism contribute significantly to policy inconsistency and this should be researched and understood in order to address the economic problems faced by Nigeria. Furthermore, the policy of the government is being dwarfed and undermined by the internal collaborators who believe that they earn more by undermining the country through shortcuts rather than to follow the rules (Interview Kwaru 2015).

The relationship between policy consistency and industrial growth is very easily identifiable. Where there are consistent policy guidelines, industries can plan production and enhance efficiency. Where consistency is absent, industries cannot plan production and where they do, implementation becomes a serious problem. In the last three decades or so, Nigeria's import procedure guidelines have been changed about five times from Pre-Shipment Inspection to Destination Inspection or 100% Examination. Even though ports are concessioned, but instead to bring infrastructure and equipment to bear on cost and efficiency, importers, especially manufacturers are trapped in the midst of these sudden and frequent policy shifts – thereby putting them in tight corners. This has seriously affected industrial production; some of these industries had to close down. In addition to import policy, multiple taxations on raw material imports and infrastructural deficit are the major challenges facing the industry.

Unfavourable Import Policies

The deregulation of the economy has made a maw out of the country for huge capital flight through imports, thereby wielding pressure on the local currency. Many local producers discard production activities for imports (Aremu 2005). Exports of textile products became difficult because of the high selling price as a result of high cost of production. Capacity utilisation remains very low in the manufacturing sector while being import dependent. On import waivers, Nigeria has forfeited a huge sum of N1.4 trillion in the last three years (Aremu 2015). Moreover, more than 65 per cent of stimuli on export were for non-productive ventures. Hundreds of billions of naira that will accrue to the government account are being lost as government carelessly grant import and export stimuli on the unproductive venture, with no significant bearing on the economy (Interview Tofa 2015; Nabegu 2015). Nigeria has for a decade, and a half become a "container economy" with the manufacturing sector contributing less than four percent in value addition (Aremu 2015). The country has become textile imports hub rather than an investment destination.

As indicated in Figure 8 from the data obtained from harmonized commodity description and coding system UN Comtrade, China has substantially increased its textile exports on annual basis to the Nigerian market. This mass influx of textile products deprive the local industry its competitive advantage. Moreover, imports from China to Nigeria dominate the trade relations between the two countries when compared with meagre or nonexisting exports from Nigeria to China in the 1980s and throughout the 1990s. The volume of trade between the two countries increased substantially from the year 2000 to 2006 as indicated in Figure. 9.

Figure 8: Import of Textile Items to Nigeria from China
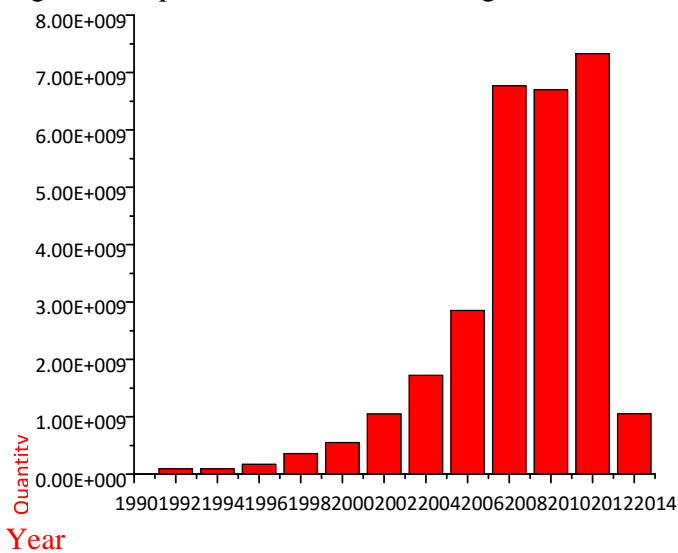
Source: UN COMTRADE

Import duties assumed unique influence when neo-liberal deregulation takes centre stage. The industrialisation agenda was abandoned. It is bad enough that productive economy was replaced with an importing economy. The economy is managed in the fashion of the colonial system more than five decades after independence. Huge imports of finished foreign goods are firmly operated while exporting raw materials (Aremu 2015). It is however clearly a disservice that these imports are not taxed under the regime of waivers. These imports are clearly not taxed which gave an advantage to the importers to further wreak havoc to the manufacturing sector operating at a high cost of production (Interview Tofa 2015). The phenomenon of wholesale waivers regime has inadvertently legalised the status of Nigeria as a non-productive corrupt economy that is avoidably loosing scarce revenue, jobs and local goods and services to waivers (Sandbakken 2006). One of the policies that undermined most local textile factories apart from wholesale smuggling and

lack of electricity is the waivers for imports of finished textile products at a time when local manufacturers could not break even (Akinrinade and Ogen 2008).

Figure 9: Sino-Nigerian Trade, 1986-2006
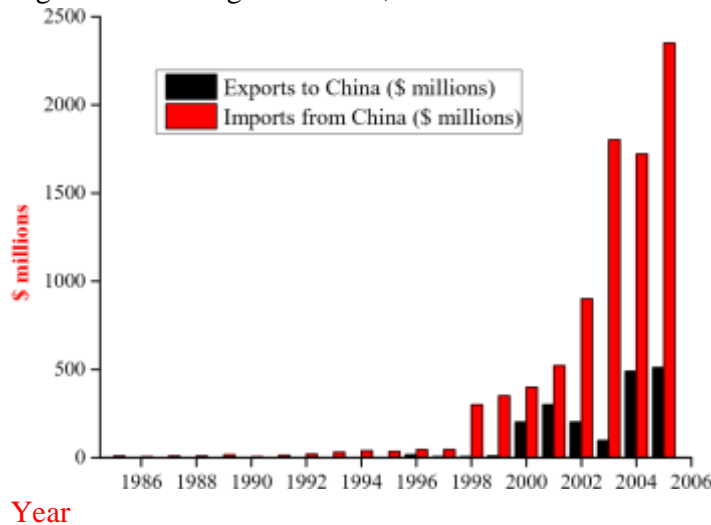
Source: IMF (2006) Gulliver's Troubles page 348

Multiple Taxations

Taxes have been recognised as impediments to investment growth especially where the taxes are too many.

Unfortunately, from 17 to 40 different taxes are currently being paid by textile factories and commercial outlets (Salami 2011). Uncoordinated tax administration manifested in multiple taxations is one of the major challenge faced by the textile sector (Odusola 2006). The committee set up by Kano state government on industrialisation listed 39 different taxes manufacturers are subjected to (Interview Audu 2015; Tofa 2015; Adhama 2015). Taxes are the most important sources of revenue by the three tiers of government (central, state and local governments). The determinant of multiple taxations in Kano is varied and multiple in nature. These include but not limited to usage of unfair revenue formula by the federal government to generate revenue. There is poor definition of powers of each level of government and attendant overlapping of tax demands on businesses by the three tiers of government. There were even mounting road blocks to collect taxes using hoodlums (Interview Audu 2015; Bello 2015). Tax legislation is never reviewed as at when necessary by retaining obsolete laws which do not reflect realities. There are unhealthy rivalries between the tiers of government. There is an absence of political will to stop multiple taxes by the government. Moreover, there is no laid down procedural guidelines

from the tax authorities. Poorly equipped and inadequately trained revenue agencies staff and greed on the part of tax officials are also impediments to investment growth.

Multiple taxes are unfriendly to investments, and as such it reduces economic growth. It does not help business to grow; rather it destroys the image of the country within the international business community. Moreover, it brings about uncoordinated tax systems because each tier of government will be competing with one another to raise a new form of taxation. Anyanwu (2000) submitted that the presence of multiple taxes distorts production, consumption, investment and employment. On the same note, Odusola (2006) insist that multiple taxes are fatal to small, medium and large scale industries. These taxes are also collected by many government departments including NAFDAC, NESREA, CPA, SON, and others. This is in addition to corrupt and embarrassing treatment against industries by various levels of revenue collectors. Too many taxes force manufacturers to increase prices of the manufactured goods which have the effect of discouraging consumption. In addition, too many taxes lead to lean profits and sometimes even loss (Interview Kwaru 2015). The end result was that some industries found it unbearable and therefore moved out. In other words, multiple taxes are a disincentive to industries.

Conclusion

Our study succinctly presented an in-depth analysis of the neglect experienced by the Nigerian textile industry. This is as a result of huge reliance on the petroleum sector and the total disregard of the manufacturing sector. Consequently, this phenomenon is also related to the lack of investment in critical infrastructure, poor governance and corruption. Our results show that there is complete policy neglect for the growth and competitive ability of the Nigerian textile industry. We discussed critical elements that are neglected including the absence of a diversified economy away from over-reliance on petroleum resources. The overreliance on the petroleum sector is manifested in the neglect of the manufacturing sector which breeds corruption and frivolous spending attracting spontaneous financial crisis. There is a lack of good support and sound government policy on the development and maintenance of infrastructures which are vital for the success of the industry. Other inadequacies that are as a result of poor governance include lack of long-term finance; high interest rates on short-term loans; lack of adequate electric power supply; rampant smuggling; wrong policies adopted by the government on import of foreign goods; non-availability of petroleum products; shortage of water to the industrial estates; poor road networks in industrial areas; high cost of transportation due to lack of railway service; multiple taxation by different tiers of government; high cost of importation of machineries, spare parts and chemicals and high foreign exchange rate.

By and large, there are remarkable evidence of neglect to the industry. This makes it unprofitable for manufacturers to invest in the industry. Other challenges encountered include raw material crisis, shortages and outages of the power supply, high cost and non-

availability of LPFO, AGO, HPFO and an efficient transport system. This study is a call on the government to develop a policy framework to allow the industry to compete. However, this work has explained some of the challenges confronting the industry. Nigerian textile industry will succeed if right decisions and policies are put in place. The revival of the industry will go a long way in revamping the ailing economy in job creation and improved Gross Domestic Product. The article discussed elements which would stand on their own as areas of further extensive study.

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Audu, S. R. 2015. Public Relations Manager, African Textile Manufacturers, Kano, Interviewer: M. Muhammad, PhD Fieldwork.

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EFFECTIVENESS OF TEACHING METHODS IN ENGLISH LANGUAGE ON ACQUISITION OF ENGLISH LANGUAGE SKILLS IN PUBLIC SECONDARY SCHOOLS IN NAIROBI COUNTY, KENYA

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ABSTRACT

The study sought to establish the effectiveness of the various teaching methods on the acquisition of the English language skills. The study was carried out in public secondary schools in Nairobi County. The objectives sought to find out the various teaching methods used in English language, the effectiveness of the lecture methods on acquisition of English language skills; the role of role playas a teaching method in promoting acquisition of English language skills and the effectiveness of questions and answer methods on acquisitions of English language skills. Four research questions were formulated to guide the study. The questions sought to identify the various method used in English language in Nairobi County, and their effectiveness. The data was collected using three instruments. The student's questionnaire sought to find out whether the like or dislike English, the methods that are mostly used by their teachers during the English lessons and the skills acquired using those methods. The teacher's questionnaire sought to find out the methods that they used mostly the reasons that they used them and the skills that are acquires when the methods are used. The observation schedule sought to get the real classroom experience in terms of the teaching methods used during the English lessons, the skills acquired and the supplementary materials used by the teachers during the English lesson. After an analysis of how the method promotes the acquisition of the English language skills, it was established that each of the methods enhances acquisition of the English language skills. The four skills in English namely: writing, listening, reading and speaking form the core of the English language. The researcher suggested that in view of delimitation of the study further research in a wider and different area preferably the rural areas. That further research be conducted to investigate other factors that contribute to acquisition of English language skills.

INTRODUCTION
Background of the study
English as an international language is spoken in many countries both as native language and as a second or a foreign language. It is taught in schools in almost every country on earth. It is a living and vibrant language spoken by over three hundred million people as a native language. Millions more speak it as an additional language. (Bowen J. 1979)

Secondary schools in Kenya enroll students of varying Nationalities and social backgrounds (Okwara et aI, 2009). Okwara et al further says that besides adding to the diversity of learners population, their social cultural settings expose them to varied experiences and values that positively or negatively impact on learning.

Teaching methods refer to a broad set of teaching styles, approaches, strategies or procedures used by teachers to facilitate learning (Curzon, 1990). Teaching methods that enable learners to actively participate in their learning should be adopted instead of those that reduce them to passive recipients of knowledge (Okwara et ai, 2009). In cases where the teaching methods adopted are not consistent with learners preferred learning styles, discomfort sets in and interferes with the learning process hence acquisition of the desired English knowledge is impaired. Use of teaching methods should take cognizance of the learner's preferred learning styles and balance them with the less effective but popular methods of learning (Okwara et ai, 2009). The selection and arrangement of elements of the curriculum and the various ways in which they are introduced to the studies is the more specialized meaning of teaching method (Hoyle, 1969).

Teachers of English can use various teaching methods depending on preference or type of skill the learner is expected to acquire after instruction. According to (Micheal, 1987), the lecture method is probably the most popular and widely used teaching method. However lecture method limits the chances of asking questions (Castello, 1991). Other teaching methods in English include demonstration; which stimulates students thinking, small group discussion, this gives learners opportunities to express their opinions, role play, reading, research and writing are also used to provide a nourishing learning environment. Discovery methods are known to keep students motivated and aroused, aid cognition and enhance retention. These methods are not to be used in every lesson but, rather, the teacher should choose the most appropriate methods in line with the topic and the pupils. The choice of teaching methods depends on the strategy used, whereas the strategy depends on the content and objectives of the lesson (Bowen J, 1985). Ineffective teaching occurs when one uses inappropriate method that results to reduced motivation, increased negative attitudes to learning and yields lower achievement (Doff, 1988). Methods enhance acquisition of the various skills in English.

Statement of the problem

English has become an essential entity in our daily life though not a mother tongue. In Nairobi County, where there is infusion of many languages various trends have come up in the use of English as a language. Being a culturally and linguistically a pluralistic society, the many languages spoken in Nairobi has led to a interesting feature of Kenya's multilingualism. Being a metropolitan city the linguistic features of

English language have been corrupted by development of sheng and this has penetrated the school system. This corrupted structure has exposed students to corrupted language

structure thus hampers the acquisition of the skills in skills. Teachers of English therefore have the task of using appropriate teaching methods that promote the four skills in English: writing, speaking, listening and reading. The researcher seeks to establish the effectiveness of teaching methods of English on acquisition of English language skills in Nairobi County, Kenya.

The feeling is that the most effective methods are those which give students the greatest opportunity for participation and allow them to relate their experiences. The teaching methods that allow students to be more involved in the classroom process, the more likely they are to master the various language structures

Purpose of the study

The purpose of this study was to investigate the effectiveness of teaching methods on English acquisition of English language skills in public secondary schools in Nairobi County, Kenya.

Objectives of the study

The objectives of the study were;
a) Identify various teaching methods used by teachers of English in Nairobi County.
b) Determine the effectiveness of lecture method on acquisition English language skills.
c) To establish how role play promotes acquisition English language skills in Nairobi County.
d) Establish the effectiveness of questions and answer method on teaching of English on acquisition of English language skills.

Research questions

The following research questions guided this study;
i) What are the various teaching methods used by the teachers of English in Nairobi County?
ii) To what extent does the lecture method contribute on acquisition of English language skills?
iii) How does role playas a teaching method promote acquisition of English language skills?
iv) How effective is the question and answer method in teaching of English in acquisition of English language skills?

Significance of the study

The study focused on the teaching methods used by secondary school teachers of English. lts aim was to collect data on the methods used and their relation, if any, on

the acquisition of English language skills. The effectiveness of each method was analyzed and the most effective method in the acquisition in the English language skill highlighted. The findings of the study are meant to give feedback to curriculum developers at the KIE on the appropriateness of the present teach ing methods; there effectiveness on the four skills in English namely; listening, speaking, reading and writing. The study would also give feedback to the Ministry of Education for the enforcement of teaching methodologies in public secondary schools in Kenya. This study would go a long way in the diagnosis of the problem of acquisition of the English language skills among students and the youth. It recommended appropriate mitigation for improved acquisition of English language skills in Nairobi County.

Limitations of the study
Limitations of the study are constraints that a researcher has no control over during the research and which can prevent or hinder him/her from achieving the objectives of the study. They are conditions beyond the control of the researcher that could restrict the conclusion of the study. The researcher has no control of the attitudes of the respondents which can affect validity of responses. At times the respondents gave acceptable but not honest answers, wrong interpretation by respondents can also affect the responses. (Mugenda & Mugenda, 2003).
The limitations of study include dependence on respondents' co-operation. Another limitation is the dependence on the teaching methods as a measure of appropriate acquisition of English language skills. Implicit in the study is the premise that success of any learning is in the use of the appropriate teaching methods.

Delimitations of the study
Delimitation is a process of reducing the sample population and areas to be surveyed to a manageable size (Mulusa, 1988). Delimitation of the study is the scope of the study in terms of geographical location of the area covered by the study. This research was conducted in public secondary schools in Nairobi County. The study was to find out the effectiveness of teaching methods in English on acquisition of English language skills. However, it did not consider aspects that impact on acquisition of language such as the learners' level of motivation and the learning environment. The methods discussed are not exhaustive.
There are several other methods that are used in the teaching of
English subject.

Assumptions of the study
An assumption is "any important fact presumed to be true but not actually verified" (Mugenda &

Mugenda, 2003). Assumptions of this study are stated hereafter,
and justify the study and its findings.

I.   That the respondents (teachers and students) were honest, truthful and willing to cooperate.

II.   That appropriate teaching methods were necessary for learners' acquisition of English language skills.

LITERATURE REVIEW

This chapter deals with the review of available literature on teaching methods used by the Teachers of English in secondary education. The chapter starts with the various teaching methods used by teachers of English. The chapter covered Introduction, Teaching methods used by teachers of English, English Language teaching methods, Lecture method by teachers of English, Challenges of lecture method in teaching English as a subject, Role playas a teaching method in English, Question and answer dialogue as a teaching method in English, Reading as a teaching methods in English,

Writing as a key issue in performance in English subject, Summary, Theoretical framework and

Conceptual framework. The effectiveness of the various teaching methods on the acquisition of English language skills was explored.

2.2. Meaning of language acquisition competence

The present language competences are summarized as containing linguistic competence, creative competence and strategic competence. Linguistic or grammatic competence is the basic component of language acquisition and entails the ability to attain a Language (Bowen et ai, 1985). This includes the ability to use forms of a language: sounds, words, and sentence structure. Therefore, to know a language means the mastery of the forms of a language which include size of vocabulary and correctness of a language. Creative competence is the actual acquisition. It is the capacity to use a language in a way that it is a appropriate to the situational and verbal constraints operating at a given time (Broomfit, 1995).

A normal child acquires knowledge of sentences not only as grammatical but as appropriate. She acquires the competence as to when to speak, when not to, when to talk, where and in what manner. Creative competence is the ability to reorganize a language system with the existing new rules. Language competence in the first and the second language include creativity of language use. It covers automatic knowledge and unconscious acquisition of language (Brown, 2002). Language acquisition includes the verbal and non verbal communication strategies that may be used to compensate communication breakdown.

Good language users use contextual cues, certain tricks and manners to communicate especially when they want to fill in their own acquisition. In the learning and teaching

activity, language acquisition forms the foundation of any language. There are other important issues in assessing language acquisition that is teaching methods, difference in teaching goals, individual differences among teachers and students and teachers mastery of subject content.

Theoretical framework

Promoting proficiency in any language in the school curriculum in any country with diversified linguistic identities is influenced by political, socio-cultural, economical, environmental, situational, pedagogical considerations, and colonial carryovers, among others. Therefore, the study was guided by the "Dynamic Model of Multilingualism" developed by Herdiner and Jessner [2002]. In the dynamic model, language is viewed to be in a constant flow; and so are the language systems in a multilingual depending on the various factors in the language acquisitions process. The Model illustrates that one thing affects everything else; and has two key factors, namely:

I. Gradual language loss which can take place among speakers 111 form of intrapersonal systematic variation; and

II. Language maintenance which is required to guarantee homeostasis within a linguistic system which increased the accumulation of linguistic knowledge.

Factors that slow down language growth are language interference and language maintenance. lnterference factors include politics, societal issues, previous language background and resources.

Maintenance factors include teaching methods, teaching materials and testing methods. Aspects of this theory guided the researcher identify factors that influence choice of teaching methods among teachers of English. Language loss and language maintenance aspects are not directly linked to each other in the model. Language maintenance is however the key factor in the dynamic model and enabled the researcher to study maintenance skills e.g. presentation skills used and their effectiveness.

RESEARCH METHODOLOGY

This chapter describes the design of the study: target population, sample size; sampling procedures; research instruments; validity and reliability of research instruments; data collection procedures and data analysis techniques.

Research design

Research design is the procedure used by researchers to explore relationships between variables, to form subjects into groups, administer measures, apply treatment conditions and analyze data. The study was conducted using descriptive survey design. Descriptive

survey research is a process of collecting data in order to test hypothesis or answer questions concerning current status of the subject in the study. It determines and report the way things are. In this proposal data was collected using questionnaires and observation schedule. The questionnaires were both open ended and close ended items. This gathered information that described the effectiveness of the teaching methods 111 English subject at acquisition of English language skills in Nairobi County.

Target population

Target population refers to a set of people that a researcher will focus on and to which the results obtained are generalized as representing the geographical area of the study (Orodho, 2004).

Study targeted 71 public secondary with a total student population of 39,370 (thirty nine thousand three hundred and seventy). (Ministry of Education PDEs Office Nyayo House, 2012). The schools were classified as national, provincial (County) and District (CDF). The study focused on teachers of English in public secondary schools in Nairobi County which is 270 (two hundred and seventy). The first target group was teachers of English in public secondary schools that use the various methods to promote acquisition of English language skills. The teachers were believed to be in a position to indicate the teaching methods each of them uses, the reasons for using the methods and evaluating the effectiveness of the method in acquisition of English language skills. The second target group was students in form two and three. The group was chosen because it is assumed that form two students have been exposed to the preliminary English language at secondary school and they could assess the different methods used in learning and their effectiveness in acquisition of English language skills. The form three students were believed to have been exposed to the various methods and were able to assess the effectiveness of the methods in acquisition of English language skills.

Sample size and sampling techniques

A sample is a representative part of a population. According to Mulusa (1990), a sample size is a smaller population carefully selected to represent all the main traits of the whole population. **In** this study the researcher used stratified purposeful sampling to select the schools. The schools were classified according to their category that is (i) National (ii) Provincial (County) (iii) District (CDF).

For example from the six national schools in Nairobi county 2 were selected which was 33% of the total national schools from 40 provincial schools 8 were selected which was 20% and from the 31 district schools 6 were selected which was 25%. This is guided by Mugenda & Mugenda (2003) that the larger the population the smaller the sample size and the smaller the population the larger the sample size. Students in form two and three class were selected through simple random sampling and this gave each student equal chance

of being selected. The teachers in the selected schools were given the teachers questionnaires. The researcher observed seven of the selected teachers in class.

Research instruments

The study used two categories of questionnaires. These were students' questionnaires and the teachers' of English questionnaires, and each consisted both structured and unstructured questions. Questionnaires were more efficient in that they required less time and were cheap. Section A in both questionnaires had questions on respondent's personal information. Section B had structured questions where respondents were expected to tick their suitable responses, and open ended questions where respondents used their own words to answer. The focus in Section A was about the teachers' and students' perception of the teaching and learning process, interest and motivation; whereas the focus in

Section B was on the teaching methods and the effectiveness **in** acquisition of English language skills. Various teaching methods were listed and interviewees views captured on the appropriate approaches and how they promote acquisition of English language skills. There was also an observation schedule used on the teacher of English during the actual teaching.

Validity of instruments

Validity is the extent to which an instrument measures what it is supposed to measure. It refers to the appropriateness of the interpretation of the results of a test or inventory, and it is specific to the intended use. Validity, according to Mugenda and Mugenda (2003), is the accuracy and meaningness of inferences which are based on the research results. Results from the study enabled the researcher to measure what was supposed to be measured in finding out the effectiveness of teaching methods on acquisition of English language skills. To determine validity a pilot study was conducted. This ensured that the instruments measured what they were intended to measure and any ambiguities removed. In this study content validity was measured. The instruments captured the content of the various teaching methods and their effectiveness on the acquisition of English language skills. The teaching methods were explored and the most appropriate for effective acquisition of skills recommended.

Reliability of instruments

Reliability is defined as the consistency of the instrument in measuring what it is intended to measure. It is further defined as the measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). The research used the test-retest technique; this was administer the questionnaires twice to the participants in the pilot study. The researcher assessed the consistency of the

responses on each pair of the pilot questionnaires to make judgment on their reliability. A time lapse of 2 to 3 weeks between first and second test eliminated chance error which could arise by testing once. A correlation coefficient was calculated to indicate the relationship between the 2 sets of scores. Correlation coefficient which indicates the relationship between the first and second test was calculated using the Pearson Product co- relation formula. The value of the formula varies between -1.00 and + 1.00 which is acceptable to any test. Pearson product moment correlation establishes the extent to which the instruments were consistent in eliciting the same responses every time the instrument was administered.

Pearson product moment is calculated with the formula

NIxy - (Iy)(Ix)   r=

2

rN[Ix - (IX)2][Iy2 - (Iy)2]

it correlates the scores from both tests

Where   x = First test

y = Second test   r = Degree ofreliability

L = summation sign

N = is the number of scores within each distribution The pilot test was done on two secondary schools: one boy and girl schools were selected. From each school, to test for reliability, 30 students were served with questionnaires. The pilot study enabled the researcher to be familiar with research instrumentation and its administration procedure as well as identifying items that require modification. The result helped the researcher to correct inconsistencies arising from the instruments; thus, ensured that they measure what is intended. Thereafter, the data was collected using questionnaires that were hand delivered to the respondents.

Data collection procedures
This is the process that is followed to ensure data collection tools are applied correctly and efficiently. A research permit was obtained from National Council for Science and Technology (NCST). The researcher reported to District Commissioners Office and the District Education Office **in** order to obtain the necessary authority to proceed with the study. Principals of secondary schools were contacted prior to the actual research. This helped the principals understand the nature and purpose of the visit and agree appropriate day and time to administer questionnaires. Thereafter, the researcher administered the instruments to the respondent **in** person on dates agreed upon **in** the respective schools. After data collection the researcher analyzed the data and got the findings from the various stakeholders.

Data analysis techniques

Analysis of data started with editing to identify errors made by the respondents for example spellings, expressions. Quantitative data derived from the demographic sections of the questionnaire and other closed questions was analyzed using descriptive statistics that is percentages and frequencies. Qualitative data generated from the open ended questions in the research instruments was organized into themes and themes categorized through content analysis and then tabulated data computed using Statistical Package for Social Sciences (SPSS). The themes and sub themes were arrived at through content analysis presented in tables and then analyzed using descriptive statistics.

DATA ANALYSIS AND INTERPRETETATION OF FINDINGS

This chapter presents analysis of data findings and analysis of the effectiveness of teaching methods on acquisition of English language skills in public secondary schools. The data collection was done in Nairobi County whereby students and teachers in the public secondary schools irrespective of the type were targeted by the study. At the time of the study there were 71 public secondary schools within the County. However, the study sampled 2 national schools; 8 provincial schools; and, 6 district public secondary schools. From each school, a total of 30 students were chosen making a total of 480 students. One English teacher was also selected per school.

Response Rate

From a sample of 480, 355 students filled-in and returned the questionnaires. However, 11 questionnaires were unusable as they were inadequately filled-in reducing the response to 344. This, thus, made a response rate of 71.7%. Besides, out of the 16 teachers sampled, 13 responded by filling-in the questionnaire making a response rate of 81.3%.

This response rate was excellent for statistical inference as it conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting, a rate of 60% is good and a response rate of 70% and over is excellent. The commendable response rate was only feasible after the researcher distributed the questionnaires and gave the respondents 30 minutes to answer the questions, besides explaining the importance of the study.

Teachers were asked to explain why they used the various teaching method. The table indicates that the main method is question and answer method. It enables teachers to get immediate feedback (is evaluative and interactive) and reviewing a lesson to find out if students understand the concept.

Reading teaching method was adopted by teachers owing to its effective in studying set-books. Reading was also adopted as it avails a wide range of knowledge to the learner and vocabulary acquisition (comprehension). Writing teaching method was used to enhance

writing skills and for future reference and for the teacher to get feedback from students. Lecture teaching method was used when explaining concept such as grammar.

Teaching Method and Acquisition of English Language Skills
The study sought to establish the skills acquired from the teaching methods used. The results are presented in Table 4.11 to 4.14 below.

Lecture Method and English Language Skill Acquisition
The study also sought to establish the skills acquired from English methods used with regards to lecture method which is presented in Table 4.5. According to the data findings, 94.8% of the respondents had acquired listening skills, 3.5% had acquired writing skills while l.8% had acquired commenting skills. On responses from teachers, Figure 4.6 indicates that lecture method imparts on students listening skills (23.1 %) while other felt that the method imparts both listening and speaking (30.8%) or listening and writing skills (46.2%). This illustrates that lecture method is good for both listening and writing skills.
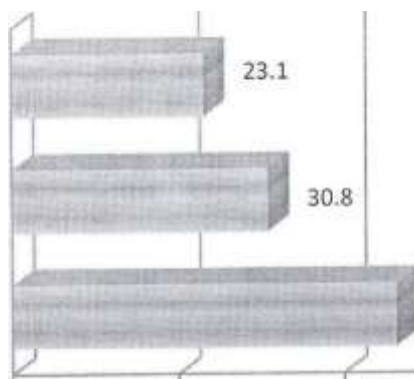
Role Play and English Language Skill Acquisition
Speaking
Listening; Speaking; Reading
46.2

Listening; Speaking
Teachers were asked to indicate that English Language skills that role playas teaching method effects. Figure 4.7 indicates that role play would instills on students speaking skills (23.1 %); listening and speaking skills (46.2%); and, listening, speaking and reading skills (30.8%). This illustrates that role playas teaching method is effective for listening, speaking and reading skills.

Table 4.12 Skills Acquired - Question and Answer

	Frequency	Percentage
Listening	17	9.9
Speaking	45	26.2
Writing	76	44.2
Reading	19	11.0
Comment	15	8.8
Total	**172**	**100.0**

The study further asked the respondents to indicate what skills they had acquired from the use of question and answer as teaching method. The findings of are presented in Table 4.12. The findings show that 44.2% of the respondents had acquired writing skills; 26.2% had acquired speaking skills; while, 11.0% had acquired reading skills and 9.9% had acquired listening skills. This indicates that skills; and, 5.3% had acquired speaking skills. This indicates that reading skills are acquired from reading teaching method.

Teacher responses indicated that listening and reading skills (30.8%); listening and speaking skills (30.8%); speaking and reading skills (15.3%); and, reading (23.1 %). The results, thus, indicate that reading teaching method is effective for listening and reading or listening and speaking skills.

Effectiveness of the Teaching Method in Acquisition of English Language Skills
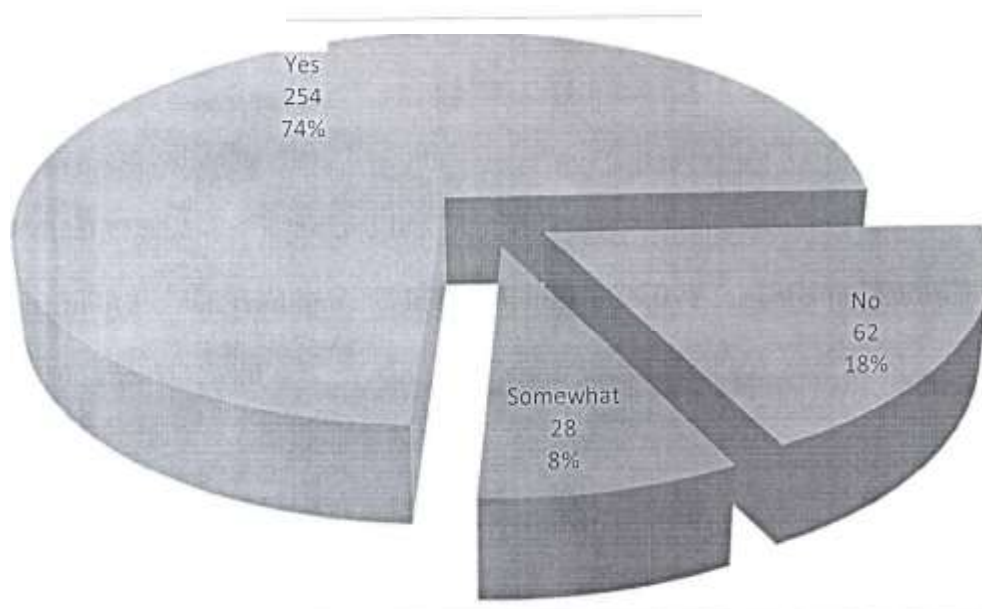

Figure 4.10 Effectiveness of the Teaching Methods Used - Teacher

The study sought to establish whether the teaching methods that the teachers used improved the acquisition of the English language skills. Figure 4.10 indicates that 74% of the respondents' responses were affirmative; 18% of the respondents felt that the methods were in effective; while, 8% stated that it was somehow effective. This underscores the eaching methods used having had improved the acquisition of the English language ski lis.

Table 4.14 Effectiveness of the Teaching Methods Used- Students

Method	Most Effective	Fairly Effective	Effective	Least Effective	Mean	STDEV
Lecture Method	17	43	64	48	2.17	0.947
Role play	57	81	17	17	3.03	0.908
Question and answer	82	50	28	12	3.17	0.942
Reading	53	52	51	16	2.83	0.973

The study sought to establish the effectiveness of the various teaching methods (lecture method, role play, question and answer and reading) used. The study applied the use of a 4-point Likert scale in collecting data and analyzing the same by determining the weighted mean in the responses from the factors (teaching methods) analyzed. Four points were most effective; 3 = fairly effective; 2 = effective; and, 1 = least effective. From Table 4.14, question and answer had a mean of 3.17; role play had mean of 3.03; reading had a mean of2.83; and, lecture method had a mean of2.17. This depicts that, according to students, questions and answer teaching method was the most effective followed by role play. 53

Table 4.15 Effectiveness of the Teaching Methods Used - Teachers

Method	Most Effective	Fairly Effective	Effective	Least Effective	Mean	STDEV
Lecture method	0	10	0	" .:1	2.54	0.843
Role Play	4	2	7	0	2.77	0.890
Question and answer	6	0	7	0	2.92	0.997
Reading	0	8	5	0	2.62	0.487

Table 4.14 shows that question and answer had a mean of 2.92; role play had mean of 2.77; reading had a mean of2.62; and, lecture method had a mean of2.54. Like responses

from students, teacher regarded question and answer and role playas the most effective teaching method for English Language.

The students indicated that talking/speaking English in class has improved their English speech while reading has improved their writing skills. Some students felt that their teachers use a mix of methods which has enhanced their listening, reading, writing and speaking skills. Others felt that question and answer and role play method enables the involvement of all students as it makes students alert in class and promotes critical thing with the latter enhancing comprehension of the language. Besides, role play helps one to gain self confidence; one can stand and address others. Promotes listening and articulation. Question and answer teaching method also gives one the opportunity to express themselves and gives one the ability to answer questions in exams through question and answer method. It also enables one to learn new things. Reading teaching method promotes reading fluency and understanding through teachers' explanations of new words in their context. However, some stated that some of the teaching method can get monotonous besides being irrelevant and boring.

On what skill is acquired mostly in teaching of English, the students indicated that they acquired listening, speaking, reading or writing skills. Others felts they mostly acquired a combination of two skills: listening and speaking; listening and writing; reading and listening; reading and speaking; reading and writing; speaking and writing while others acquired three skills such as speaking, reading and writing. Asked the methods promotes acquisition of such skills, the students indicated that enables one know how to be fluent in speech and know spellings which helps in examination answering; one gets to understand new vocabulary which helps in speaking as most part of English teaching involves speaking and writing. Some students stated that lecture method makes students attentive while reading promotes fluency. They also stated that students are allowed to read passages in class and writing composition often which promotes reading and writing skills. The students were further asked to recommend on the teaching method they find effective in improving the acquisition of English language skills. Table 4.10, shows that 32.0% preferred role play teaching method; 19.2% of the respondents preferred question and answer teaching method; and, 15.7% of respondents preferred reading method.

A variety of different topics were covered in classes. Out of the seven cases four were grammar which shows that grammar was the domain of the teachers. During the grammar lessons, two integrated oral skills (pronunciations). This enhanced the speaking skills of the students during the lesson. There was writing during the lesson which was used as an evaluation of what the teacher had covered during the grammar lesson. Two of the lessons were set text reading, where the teacher incorporated aspect of culture and current events. Writing was also incorporated during reading lesson. It is evident that writing was integrated in **all** the observed lessons.

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary of the findings obtained from responses of teachers of English and students through questionnaires. The chapter also highlights the conclusion of the study, recommendations derived from the findings and suggestions for further research.

Summary of the study

The purpose of this study was to establish the effectiveness of the teaching methods used in English subject on the acquisition of the English language skills in Nairobi, Kenya. Four research questions were formulated to guide the study. Research question one sought to identify the various methods used in English language. Question two determined the effectiveness of lecture method in acquiring the English language skills. Question three established the effectiveness of questions and answer methods in promoting acquisition of English language skills. Question four examined the role of role playas a teaching method in enhancing acquisition of English language skills.

The study adopted a descriptive survey design and targeted 16 public secondary schools in Nairobi County out of 71 public schools. It sampled 15 teachers of English and 480 students.

The findings indicated that all the students liked English subject and language; 47% of the respondents liked English much while 41 % of the respondents liked English very much. Justifying their liking for English, it was established that most of them liked English because it is easy to learn (26.2%); enjoyable subject (27.3%); universality of language (19.2%); careers development as many require mastery in English (11.0%) and being the official language in Kenya (8.1%). Other also liked English since it promoted National Cohesion and integration. However, distributing the students' liking for English along gender, it was established that gender differences does not influence liking for English language (p = .807).

On the teaching method adopted for English language, the findings shows that writing and question and answer methods were always used (mean of 4.69 and 4.38); reading method was adopted very often (3.85); role play which was used often (2.62); while, lecture method was rarely used (2.46). Reasons for using the various methods were that question and answer teaching method enabled teachers get immediate feedback owing to its evaluative and interactive nature and for reviewing a lesson to find out if students understand the concept.

Teaching reading method was adopted by teachers owing to its effective in studying setbooks and as it avails a wide range of knowledge to the learner and vocabulary acquisition (comprehension). Teaching writing method was used to enhance writing skills and for future reference. On the other hand, lecture teaching method was used when. It was established that various skills were acquired during the questions and answer teaching

methods. Writing skill was highly promoted followed by speaking skills, reading skill and listening skill least acquired. It was evident from students that writing and speaking skills are effectively acquired during the questions and answer method.

The teachers also indicated that questions and answer instilled on students a mix of listening and speaking skills. This is evident that writing and speaking skills were effectively acquired during the questions and answer method. It was established that teaching reading method is effective for listening and reading skills. Reading promotes acquisition of internal listening very effectively.

Conclusion

The study concludes that English teachers in Nairobi frequently use question and answer; reading teaching methods to pass English skills to learners or students. Question and answer teaching method was used for its effectiveness in getting immediate feedback from students which is useful in gauging whether the students have understood a concept or not and in wrapping up a chapter or reviewing a lesson. Question and answer was also adopted for its interactive nature; a teacher is able to correct a student in case he/she misunderstands a concept. Teaching reading method is adopted by English teacher as it fosters comprehensiveness, thus teachers are able to cover a wide range of texts or chapter. The Nairobi schools found it effective for passage reading or during set-books.

Role play and lecture teaching method, on the other hand, were sparingly used. Role plays were used to enhance students understanding of a passage or literature where by students perform various roles. This is mostly, used in English literature such as plays and poetry besides the reading teaching method that is adversely used in the same. Lecture teaching methods were used by English teachers to explain or introduce a concept such as grammar, or cascade through large amount of ideas generated from text.

The study also concludes that these four teaching methods were effective for English language acquisition. Lecture method was effective for listening skills though it also promoted speaking skills. Role playing highly developed speaking skills on students. Question and answer teaching method promoted speaking and writing skills though it also developed listening skills. Reading as a teaching method was mostly used to develop reading skills. Reading also enables to be fluent in speech and know spellings which help in examination answering; one also gets to understand new vocabulary which helps in speaking as most part of English teaching involves speaking and writing. Read passages in class and writing composition promotes reading culture. Question and answer method makes students attentive and also enhances the students, examination tackling skills.

The study establishes that an integration of all methods is effective on acquisition of the various language skills. Each of the methods complements the other in the acquisition of the various skills. The teachers felt that a smaller work load would effectively promote their promotion of the various language skills. The content was viewed as too broad to

promote effectively the acquisition of the four skills. Students felt that more participatory methods would effectively promote the various skills **in** English. The various methods used during the English lessons were important in promoting English language skills. The methods encourage group's participation in the class and therefore enhances active participations of the students.

Recommendations

Based on the research findings the researcher made the following recommendations:-

I.   That the methods used **in** teaching English be more reinforced to promote the four ski lis of the Engl ish language.
II. That the Ministry of Education provides more supplementary materials 111 teaching of the English language.
III. That the training of teachers incorporates other teaching techniques such the use of projectors and computers be used to boost on the other teaching methods.
IV. That schools train students and teacher with the online pronunciations of English to boost their speaking and writing skills.
V.   That the KNEe incorporates all the four skills of English in examinations from primary to university levels.

Suggestion for Further Research

Based on the findings of the study the researcher makes the following suggestions for further research;

(i) In view of delimitation of the study the researcher suggest further research in a wider and different area preferably the rural areas.
(ii) That further research be conducted to investigate other factors that contribute to acquisition of English language skills.

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REVIEW ON IDENTIFICATION AND CHARACTERIZATION OF SALMONELLA SPECIES ISOLATED FROM DOMESTIC CHICKEN SOLD IN KURE ULTRA MODERN MARKET MINNA, NIGERIA.

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Abstract

Salmonella as a group of microorganisms has long been recognized as an important zoonotic pathogen of worldwide economic significance in animals, birds and man. They are intestinal bacteria which give rise to enteritis and typhoid-like disease. The prevalence of *Salmonella* differs depending upon sample types, collection and handling methods, detection techniques and geographic regions and management systems. These differences may mask the impact of other factors such as raising practices, seasonal patterns and processing procedures that are actually causing true changes in the distribution of the bacteria. Salmonella infection causes not only decreased production performance and even death of poultry, but also contamination of the human food chain, leading to serious economic losses in the poultry business, as well as being a threat to public health. This review recommends that: The best preventive and control strategy is vaccination.

Keywords: Identification, Characterization, *Salmonella*, Domestic, Market.

INTRODUCTION

Salmonellae are Gram-negative facultative anaerobic rod-shaped bacteria that measure 0.7-1.5 by 2.0-5.0 μm, non-sporogenic. All are motile with long, peritrichous flagella except two serovars, *Salmonella* serovar *pullorum* and *gallinarum* (Scheleton, 2018). *Salmonella* as a group of microorganisms has long been recognized as an important zoonotic pathogen of worldwide economic significance in animals, birds and man. They are intestinal bacteria which give rise to

enteritis and typhoid-like disease. The early observation of the disease was made by Ebert 1880 who described the typhoid bacillus in the tissue of a dead patient, and the organisms was isolated by Salmon in 1885 (Merchant & packer 2006) and named after him.

Preliminary *Salmonella* research is dated back to 1880, when the bacteria were isolated from a person who died from typhoid fever. Subsequently, in 1886, Daniel E. Salmon and colleagues isolated from swine the organism currently known as *Salmonella choleraesuis*, which was believed to be the causative agent for hog cholera (Le Minor, 2005).

Salmonella is an important zoonotic pathogen that causes infectious diseases in animals and humans. Salmonella infection causes not only decreased production performance and even death of poultry, but also contamination of the human food chain, leading to serious economic losses in the poultry business, as well as being a threat to public health. Although various prevention and control measures, including eradication programs and vaccine and drug use, have been carried out, Salmonella infection is still one of the most important problems worldwide.

Classification:

The scientific classification of *Salmonella* was described by Hafez (2005) as follows:
Domain: *Bacteria*
Kindom: *Monera*
Phylum: *Proteobacteria*
Class: *Gamma Protobacteria*
Order: *Enterobacteriales*
Family: *Enterobacteriaceae*
Genus: *Salmonella*

Recent advances in *Salmonella* taxonomy divide the genus into two species: *Salmonella bongori* and *Salmonella enterica* (Le Minor 2005). *S. bongori* contains less than 10 serovars while *S. enterica* contains more than 2500 serovars and are divided into six subspecies namely *enterica, salamae, arizonae, diarizonae, houtenae and indica.* All centers of disease control and prevention recommended that *Salmonella* species should be named by their genus and serovar e.g. *Salmonella typhi* instead of *Salmonella entrica subspecies enterica serovar Typhi.* Most commonly, the *Salmonella* are classified according to serology. The main division is first by the somatic (O) antigen and by the flagellar (H) antigen. (O) Antigen is of a lipopolysaccharide nature and (H) antigen of protein nature (Kauffmann White Scheme 1960). The genus *Salmonella* can roughly be classified into 3 groups (Hafez and Jodas 2005). Group I includes highly host adapted and invasive serovars such as *S. gallinarium, S. polurium* in poultry and *S. typhi* in human. Group II includes non-host adapted and invasive serovars such as *S. typhimurium, S. arizonae* and *S. entertidis.* Group III contains non-host adapted and non-invasive serovars, most of these serovares are harmless for animals and human.

Cultural characteristics:

Salmonella are facultative anaerobic. The optimum growth temperature is 37ºC, but some growth is observed in a range from about 5 to 45ºC. *Salmonella* can grow within a pH range of approximately 4.0 to 9.0, with an optimum pH around 7.0. The organisms grow in selective enrichment media such as selenite-F-broth and tetrathionate broth, and on

differential plating media such as MacConkey, bismuth sulfite, and brilliant green agars. The optimum incubation times for *Salmonella* enrichment cultures were obtained by inoculation of enrichment broth onto plating media after 24 hours incubation at 37ºC, after 48 hours at 37ºC, after a 3-day delayed secondary enrichment (DSE), and after a 5-day DSE procedure. Inoculations of the enrichment broth onto plating media after 24 hours incubation followed by 5-day (DSE) enable the detection of 96-98% of *Salmonella* positive samples and were the best combination of condition. The *Salmonella* colonies appear with different shapes and colours on different media. On nutrient agar they appear small, smooth, circular and translucent while *S. gallinarum* colonies are blue gray. On macConky agar they are colourless, smooth, round, shiny and up to 2mm in diameter. *S. gallinarum* produce colonies larger than *S. pullorum* and have a characteristic odour. On selenite-F- broth the growth is turbid with heavy flocculent sediment. On desoxycholate citrate agar (DCA) the colonies are slightly opaque, dome shaped with central black spot. *S. pullorum* is a lactose ferementer producing pink colonies with a precipitate in surrounding media. On triple sugar iron agar (TSI) *S. pullorum and S. gllinarum* produce a red slant with a yellow butt that show delayed blackening from H2S production. The objectives of this research are to:

I.   To find out Prevalence of *Salmonella* in domestic chickens.
II.   To isolate and identify *Salmonella* organism from commercial layers by biological methods and molecular characterization.
III.   To determine antibiotic resistance profile of organisms isolated from the fowls.

Methodology
This review was carried out in Niger State, the focal point was mainly Kure Ultra-Modern Market, Minna.

Review on Prevalence of Salmonella, in Domestic Chicken at Kure Ultra-Modern Market, Minna
The major prevalent serotypes of *Salmonella* originating from 2 duck slaughterhouses and 13 chicken slaughterhouses tested were *S. typhimurium* and *S. enteritidis*, respectively (Bawa *et al.,* 2013). (Lawal *et al.*, 2013) identified 165 *Salmonella enterica* isolates from 382 samples taken from conventional farms, abattoirs and retail from Kure Ultra-modern market from 2010 to 2011. Among these isolates, *S. enterica* serotypes Derby (76 isolates, 46%) and *S. typhimurium* (16 isolates, 10%) were the most prevalent. A comparison on the prevalence of *Salmonella* infection in layer hens from commercial layer farms with high and low rodent densities was investigated. Out of 280 laying hens sampled from three commercial 6 layer farms with high rodent densities, *Salmonella enterica subsp. enterica serovar Enteritidis* (Salmonella Enteritidis) was isolated from 20 (7.14%) hens and

Salmonella enterica subsp. enterica serovar Infantis (*Salmonella Infantis*) from three (1.07%) hens. *Salmonella* infections from contact with live poultry (chickens, ducks, turkeys, and geese) continue to be a public health problem. In 2011, two clusters of human *Salmonella* infections were identified through Pulse Net, a molecular subtyping network for foodborne disease surveillance. Standard outbreak and traceback investigations were conducted. Most patients or their parents reported purchasing chicks or ducklings from multiple locations of an agricultural feed store chain that was supplied by a single mail-order (Centre for disease control and prevention, 2012). Isolated strains of *Salmonella spp.* from poultry products in Niger state, Nigeria by (Ahmed *et al.,* 2009). A total number of 114 samples were collected from 63 broiler carcasses derived from two processing plants and two supermarkets and 51 extra samples were collected in broiler farms located in the State which used three live production stages. Each excreta sample considered of a fresh excreta pool from 100 birds. Samples were submitted to microbiological analysis and the isolated Salmonella strains were tested for antimicrobial sensitivity. No *Salmonella* was isolated from excreta samples, while broiler carcass samples showed a high contamination rate of 11.8%. Three serotypes were identified: *S. enterica serovar enteritidis* 50%, *S. enterica serovar panama* 33% and *S. enterica serovar newport* 17%. Studies was carried out on the sero prevalence, isolation and characterization of *Salmonellae* from layer chickens during the period from January to May 2006. The used materials were blood sample, cloacal and liver swabs from live and dead birds respectively and visceral organs (liver, lungs, spleen and intestine). The detection methods used were serum plate agglutination (SPA) test; necropsy and histopathology; cultural, morphological and biochemical test. The overall prevalence was 43.4%. A total of 33 (21.02%) Salmonellae from live and dead birds were isolated. The isolation rate of Salmonellae was higher in seronegative (31.6%) group than seropositive (3.2%) group. Out of 33 Salmonella isolates, 25 were *S. pullorum*, 3 were *S. gallinarum* and the rest 5 were motile Salmonellae (Islam *et al.,* 2006).

Review on Isolation, Identification and cultural characteristics of *Salmonella spp.*

Salmonella organisms' shows different cultural characteristics in different media. These are turbidity in Tetra Thionate broth, pink white color colonies in Brilliant Green agar, gray white colony in Nutrient agar, slightly grayish color colonies in Salmonella Shigella agar, black color colony in Tripple Suger Iron agar, pale color colonies in MaConkey's agar, well defined glistening colonies in Blood agar and pinkish colonies in EMB agar. Islam *et al*., (2003) reported that the liver of chicken was found to be the most suitable organ for isolation of *S. gallinarum*. Use of pre-enrichment media was better than conventional media for the successful isolation of the bacteria. Isolates revealed moist, pin-sized, circular, non-lactose fermenting colonies on MacConkey, S-S, BGA, and BHI agar media.

Two different selective broths, and two different selective and differential agars should be used in culture isolation of *Salmonella spp.* Tetrathionate broth with 24 hours incubation is not a reliable medium for *Salmonella spp.* isolation from the faeces (Habrun and Mitak 2003).

Molecular Characterization of Salmonella spp.

To assess diversity of *Salmonella enterica* serotypes present in poultry and their environment from Kure Ultra-modern market, the Kauffman-White-LeMinor (KWL) scheme was used to serotype a total of 155 isolates. Isolates were then re-examined with nested PCR and sequencing of the dkgB-linked Intergenic Sequence Ribotyping (ISR) region that assesses single nucleotide polymorphisms occurring around a 5S ribosomal gene. Serotypes identified were Heidelberg (40.6%), Enteritidis (34.2%), Hadar (8.4%), Typhimurium (3.9%), Gallinarum (3.2%), Agona (1.3%), Cerro (1.3%), Livingstone (1.3%), Infantis (0.6%), Isangi (0.6%), Mbandaka (0.6%), Montevideo (0.6%), and Senftenberg (0.6%), (Pulido-Landínez *et al.,* 2013). (Temelli *et al.,* 2012) evaluated the capability of the Vitek immunodiagnostic assay system easy *Salmonella* (VIDAS ESLM) method and a specific real-time PCR system (Light Cycler), in detecting Salmonella from a total of 105 naturally contaminated samples comprised of poultry meat and poultry meat products. Twelve (33.33%), 11 (30.55%), and 18 (50.00%) out of 36 poultry meat samples were positive for Salmonella by ISO, VIDAS ESLM, and LCPCR, respectively. *Salmonella* detection rates from poultry meat products were 5.80% for ISO and 8.69% for LCPCR, whereas none of these products tested positive by VIDAS ESLM.

Primer was used speF for the detection of *S. gallinarum.* A forward primer, s*pe*F-1 (5'-TTA GCC GTC ATT GCC CGG ATT -3') and a reverse primer, s*pe*F-4 (5'- ACG AGG TTT AAT GAC GTA GC -3') were used. Amplification reaction mixtures contained 30 μL X-mix (916 μL H2O milli-Q, 120 μL 10X buffer, 120 μL dNTP (2 mM), 36 μL MgCl); 0,5 μL of each primer 1 e 4 (*spe*C or *spe*F) and 0,4 μL taq DNA polymerase (Invitroven 10342-020).

Review on Antibiotic Susceptibility test

Reports shows that **o**ver the years 2007-2011, the reports of salmonellosis caused by *Salmonella enterica* serovar has significantly increased. A high prevalence of multidrug-resistant isolates, mainly showing an ampicillin-streptomycin-sulfonamide-tetracycline resistance pattern (ASSuT), was observed. In addition, four extended spectrum beta lactamase (ESBL) (CTX-M- 55)-producing isolates were found, Gallati *et al.,* (2013). A total of 165 *Salmonella enterica* isolates from 382 samples taken from conventional farms, abattoirs and retail markets from 2010 to 2011 in Kure Ultra-modern market were identified. Among these isolates, *S. enterica* serotypes *derby* (76 isolates, 46%) and *typhimurium* (16 isolates, 10%) were the most prevalent, and high antimicrobial resistance

observed for tetracycline (77%), nalidixic acid (41%) and spectinomycin (41%). Li *et al.,* (2013). Generally, resistance for 13 different antimicrobial drugs was recognized. The most common resistance was to streptomycin (24/32, 75%), ampicillin (19/32, 59.4%), tetracycline (15/32, 46.9%). Imad *et al.,* (2012) collected 150 chickens from eight retail markets in minna, and 90 (60%) tested positive for *Salmonella*. The isolates were tested for their susceptibilities to amoxicillin, amoxicillin/clavulanic acid, cefoxitin, cefotaxime, gentamicin, streptomycin, tetracycline, chloramphenicol, sulfonamides, nalidixic acid, ciprofloxacin, and trimethoprim/sulfamethazole by disk diffusion assay. Minimum inhibitory concentrations of ampicillin, streptomycin, tetracycline, sulfonamides, and nalidixic acid were determined for the resistant strains by agar dilution method. Eleven isolates (10.7%) of the 103 tested were susceptible to all antimicrobials. Resistance was most observed to tetracycline (84.5%), streptomycin (44.7%), and nalidixic acid (34%). Forty-one isolates (39.8%) were multidrug resistant (resistant to three or more antimicrobials from different classes).

CONCLUSION AND RECOMMENDATIONS

The prevalence of *Salmonella* differs depending upon sample types, collection and handling methods, detection techniques and geographic regions and management systems. These differences may mask the impact of other factors such as raising practices, seasonal patterns and processing procedures that are actually causing true changes in the distribution of the bacteria. This review recommends that:The best preventive and control strategy is vaccination.

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ASSESSMENT OF THE IMPACT OF SOME SELECTED QUARRY SITES ON THE ATMOSPHERIC AIR QUALITY IN ABUJA MUNICIPAL AREA COUNCIL, FCT, NIGERIA

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Abstract

Abuja Municipal Area Council is one of the locations in Nigeria that is generally associated with environmental degradation resulting air quality depletion from unsustainable natural resources exploration activities like quarrying. Quarrying in some part of the study area is intense with a lot of associated gases released into the atmosphere. The aim of this paper is to assess the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The sources of data used include primary and secondary. The primary data include air pollutants samples, reconnaissance survey, questionnaire administration and oral interview. Secondary data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library with regards to the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The methods of data analysis used include both qualitative and quantitative data analysis methods. The result shows that during the dry season, Wumba district ranked the highest in edges sample data with 900µg/m³ and the least was located in Garki village with 400 µg/m³. In 750m away from the quarry sites, Wumba district and Dutse ranked the highest with 270 µg/m³ while Garki village ranked the least with 120 µg/m³. This revealed that PM$_{10}$ values in dry season tends to decrease with distance away from the quarry sites of the study area. While during the rainy season, Guzape ranked the highest in edges sample data with 300µg/m³ and the least was located in Garki village with 180µg/m³. In 750m away from the quarry sites, Dutse ranked the highest with 70µg/m³ while Garki village ranked the least with 20µg/m³. This revealed that PM$_{10}$ values in rainy season tends to decrease with distance away from the quarry sites of the study area. The finding also shows that decrease agricultural yields ranked the highest with 40%, yellowish of some agricultural plant leaves ranked second with 29.3%, destruction of farmlands ranked third with 21.3% and inadequate germination of agricultural seeds ranked the least with 9.4% of the respondents. This shows that the major impact of quarry air pollutants on agricultural activities was decrease agricultural yields. An understanding of the source of the air pollutants is very important in the control and prevention of atmospheric emissions especially from point sources. The paper discovered that there was significant disparity in the observed concentrations of the atmospheric

pollutants under consideration at different times within the study location. The study observed remarkable spatial and temporal variations of PM_{10}, CO, VOC, SOx and NOx across the study area. The values of PM_{10}, CO, NOx and SOx showed elevated concentrations of these pollutants in the dry season when compared with rainy season, indicating significant anthropogenic inputs which may include higher vehicular movement, quarrying activities and emissions due to industrial activities within the study area.

Keywords: *Quarry sites, Air quality, Quarrying and AMAC*

Introduction

The process of getting useful stone from a quarry is known as quarrying. The methods and equipment used in quarry depend on the purpose for which the stone is extracted. Different quarrying activities have different impacts on air quality (Alaturca, 2012). The process of making holes in rock, limestone or overburden with the aid of a drilling machine (drilling process) may be treated as a point source of pollutant emission. Shattering the drilled limestone or overburden in a bid to loosen the mass in smaller fragments (blasting process) may be treated as an instantaneous point source for suspended particulate. Also, the loading and movement of dumper trucks on haul routes would generate suspended particulates while the crushing of ore and transferring it to a belt conveyor (ore processing) would be a potential source of dust generation. Loading and movement of vehicles may be treated as point and line sources (Daramola *et al.,* 2014).

Mineral exploration, mining and processing have resulted in environmental damages including ecological disturbance, destruction of natural flora, pollution of air, land and water, instability of soil and rock masses, landscape degradation and radiation hazards (Aigbedion & Iyayi, 2017) . Dust is the main source of air pollution in quarry industry. The extent of pollution by dust depends on the local microclimate conditions, the concentration of dust particles in the ambient air, the size of the dust particles and their chemistry (Hsin-Yi, 2012). Dust has effect both on human health and the natural environment. It can lead to chronic health effects for instance decreased lung capacity and lung cancer resulting from long-term exposure to toxic air pollutants (Sunyer, 2011). However, it blocks and damages the internal structure and abrasion of leaves and cuticles (Hsin-Yi, 2012). The number of quarrying industries in FCT, Nigeria is kept on increasing. Although it contributes to the internally generated revenue, there is need to look at its effect on the neigbouring communities and the environment in general. Work has been done on the levels of heavy metals in soil and vegetation of a quarry site and on the level of suspended particulates in the ambient air and around selected quarry sites (Oguntoke *et al.,* 2015).

Environmental pollution mainly resulting from atmospheric emissions has become a major and serious environmental issue of great concern in most Nigerian cities. This has become more worrisome due to the increase in sources and the diverse nature of the anthropogenic and fugitive atmospheric pollutants from quarrying activities. The level of these atmospheric pollutants in an area is generally influenced by various factors such as concentration, circulation of the local emission sources as well as environmental and the prevailing meteorological factors (Ogba, 2016). The emission of these pollutants increases the overall toxic burden of the environment, as well as deteriorate the ambient air quality (Opara *et al.,* 2016). The tendency for the release of toxins from atmospheric emissions to the environment is therefore influenced by these factors mentioned above. There is need therefore to carry out regular monitoring and analysis of these atmospheric emissions in the study area. The need for this paper was necessitated by the fact that Nigeria like most developing counties have inadequate continuous air quality monitoring stations, hence inadequacy of air quality data base. There is paucity of air quality reports on atmospheric emissions in the study area. This is because there is a dearth of data on atmospheric emissions in FCT Abuja in particular and Nigeria in general. The need for regular monitoring of the air quality of this area is not only crucial for air quality protection but also very important for accurate planning and execution of environmental pollution mitigation policies. Abuja Municipal Area Council is one of the locations in Nigeria that is generally associated with environmental degradation resulting air quality depletion from unsustainable natural resources exploration activities like quarrying. Quarrying in some part of the study area is intense with a lot of associated gases released into the atmosphere. There are other potential sources of gaseous emission in the study area which includes emissions from quarrying activities within Abuja Municipal Area Council (AMAC) of FCT, high vehicular traffic mainly from fairly used vehicles, power generating sets, unsustainable agricultural practices like bush burning as well other anthropogenic activities. The aim of this paper is to assess the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria.

AMAC is an area council which falls within latitude 8° 56'44 N and 9° 06'18 North of the Equator and longitude 6°40'13 E and 7°42'41 E. The Abuja Municipal Area Council is the local government responsible for administration of the city and has a population of about 776,298 in the year 2020. It is bound to the north by Bwari Area Council (AC), to the east by Karu AC, to the south by Kuje AC, to the west by Gwagwalada AC, and southwest by Nasarawa LGA in Nasarawa State. This region has an area of approximately 1456 km^2. It is regarded as the Capital City and is the centre of most commercial and governmental

agencies.
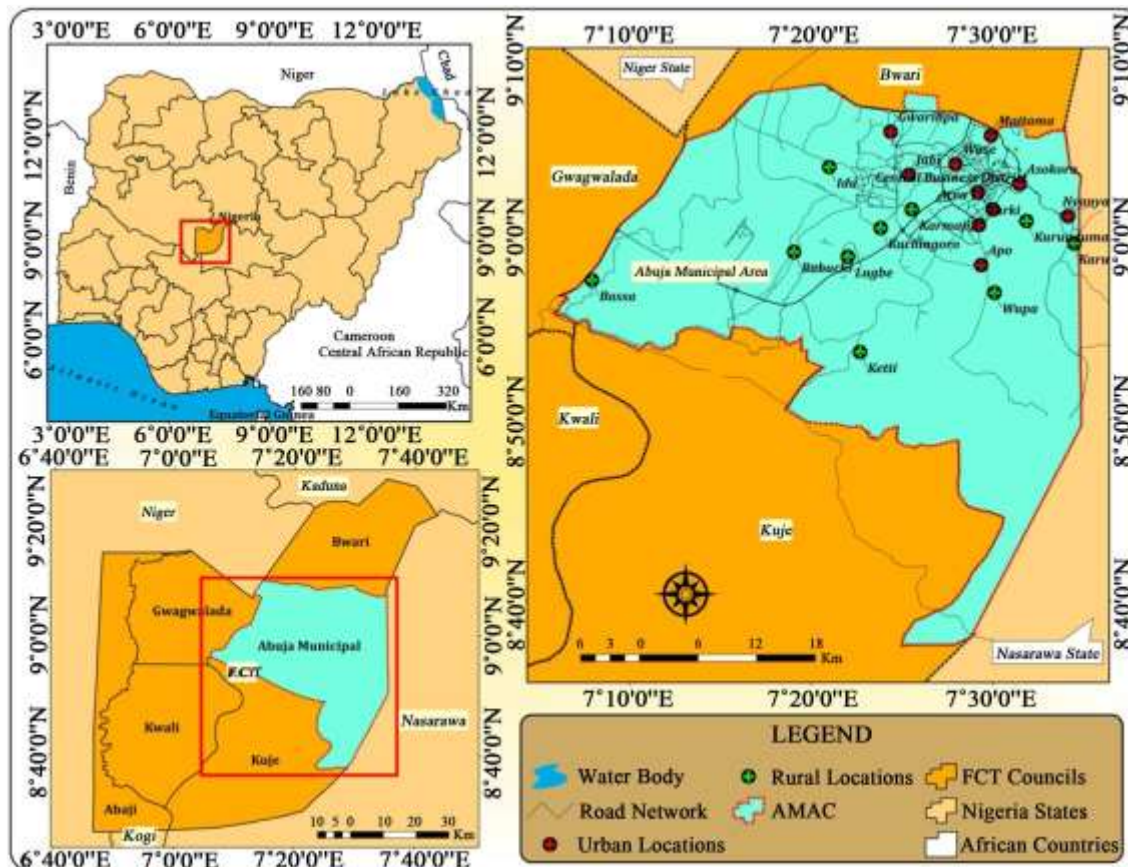
Figure 1: Location of Abuja Municipal Area Council (FCT, Nigeria)
Source: Federal Capital Development Authority (2022)

Materials and Methods

The sources of data used include primary and secondary. The primary data include air pollutants samples, reconnaissance survey, questionnaire administration and oral interview. In order to develop detailed and comprehensive literature review, the information were obtained from written documents. To achieve this therefore, data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library with regards to the impacts of quarry sites on the atmospheric air quality in Abuja Municipal Area Council, FCT, Nigeria. The methods of data analysis used includes both qualitative and quantitative data analysis methods. The Data analysis was analysed utilizing SPSS 20.0.

Results and Discussion

The ranges for samples collection were the edge of the sites, 250m, 500m and 750m away from the sample sites. Wumba district ranked the highest in edges sample data with 900µg/m³ and the least was located in Garki village with 400 µg/m³. In 750m away from

the quarry sites, Wumba district and Dutse ranked the highest with $270 \, \mu g/m^3$ while Garki village ranked the least with $120 \, \mu g/m^3$. This revealed that PM_{10} values in dry season tends to decrease with distance away from the quarry sites of the study area.

Figure 2: Dry Season PM_{10} values across the Sample Communities

Figure 3 shows the rainy season PM_{10} values across the sample communities. Guzape ranked the highest in edges sample data with $300 \mu g/m^3$ and the least was located in Garki village with $180 \mu g/m^3$. In 750m away from the quarry sites, Dutse ranked the highest with $70 \mu g/m^3$ while Garki village ranked the least with $20 \mu g/m^3$. This revealed that PM_{10} values in rainy season tends to decrease with distance away from the quarry sites of the study area.

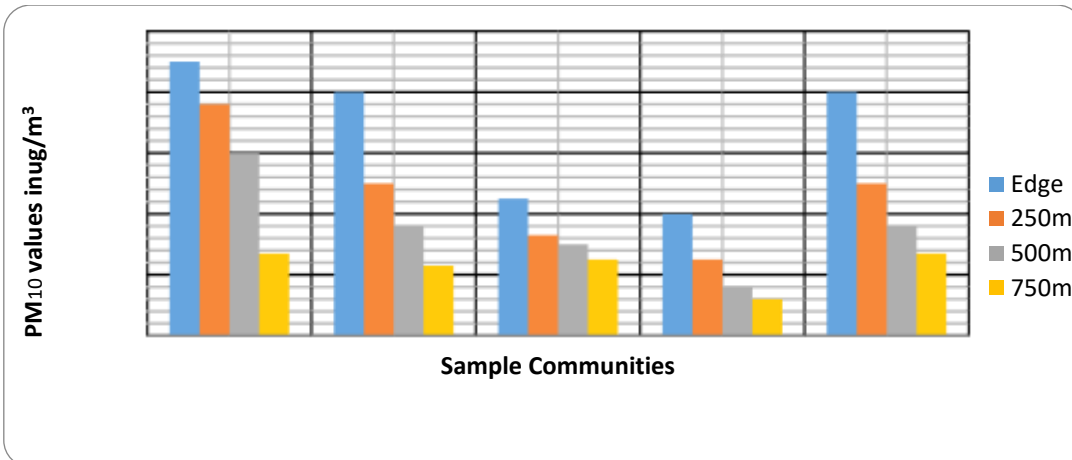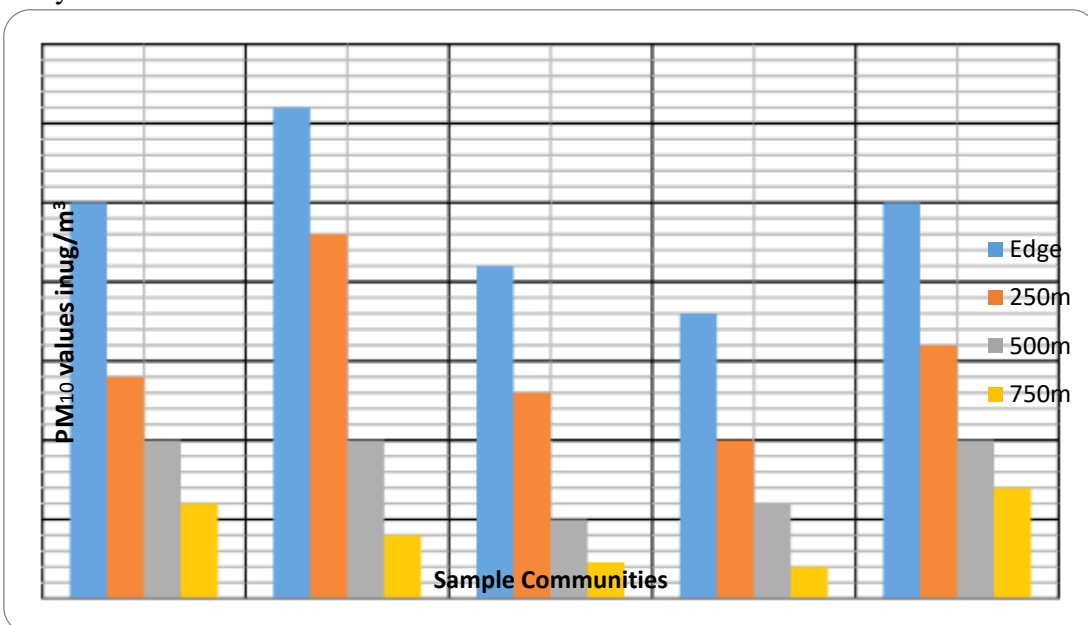**Figure 3: Rainy Season PM_{10} values across the Sample Communities**

The PM_{10} values in dry season were much higher when compared with that of rainy season as revealed in Figure 2 and 3 of the study. The major reason behind the difference was strength of the wind speed.

From Table 1, 24.7% reported prevalence throat infections, 46.3% of the respondents clamor the prevalence of cough/catarrh, 6.5% of the total respondents reported the issue of heart diseases, 19.0% reported chest aches and 12.8% reported the prevalence of Skin infections. The pollution produced from quarry activities affect the health of people living very close to the site thereby making live difficult to the residents.

Table 1: Health Challenges Associated with Quarry Activities in the Study Area

Health Challenges	Frequency	Percentage (%)
Throat infections	87	24.7
Cough/catarrh	163	46.3
Heart diseases	23	6.5
Chest aches	67	19
Skin infections	45	12.8
Total	352	100

Source: Field Survey (2022)

As revealed in Table 2, decrease agricultural yields ranked the highest with 40%, yellowish of some agricultural plant leaves ranked second with 29.3%, destruction of farmlands ranked third with 21.3% and inadequate germination of agricultural seeds ranked the least with 9.4% of the respondents. This shows that the major impact of quarry air pollutants on agricultural activities was decrease agricultural yields.

Table 2: Impacts of Quarry Air Pollutants on Agricultural Activities in the Study Area

Options	Frequency	Percentage (%)
Inadequate germination of agricultural seeds	33	9.4
Yellowish of some agricultural plant leaves	103	29.3
Destruction of farmlands	75	21.3
Decrease agricultural yields	141	40
Total	352	100

Source: Field Survey (2022)

Conclusion

An understanding of the source of the air pollutants is very important in the control and prevention of atmospheric emissions especially from point sources. The paper discovered that there was significant disparity in the observed concentrations of the atmospheric

pollutants under consideration at different times within the study location. The study observed remarkable spatial and temporal variations of PM_{10}, CO, VOC, SOx and NOx across the study area. The values of PM_{10}, CO, NOx and SOx showed elevated concentrations of these pollutants in the dry season when compared with rainy season, indicating significant anthropogenic inputs which may include higher vehicular movement, quarrying activities and emissions due to industrial activities within the study area.

The pollutions affect the health of the people living very close to the sites thereby making live difficult to the residents. It was discovered that majority of all that are residing within jurisdiction of less than 1km are vulnerable to different types of pollution such as, Noise, Air (Dust), Water and Land pollution which is one of the root cause of the health challenges faced by the residents of the study area. The assessment results revealed that the concentration of PM_{10} of some locations were above air quality index (AQI) limits set by WHO especially at the business district. This results from the assessment indicates that most the population leaving around the business district are exposure to high level of pollution. The research outcome demonstrates that the particulate matter pollution situation is not favorable in the study area as there exhibit a wide gap between assessment result of particulate matter concentration and the WHO set standards. The health risk indicates some locations in the study area are unsafe for sensitive, unhealthy and very unhealthy for agricultural practices. It's recommended that the regulatory and enforcement agency needs to reexamine current regulation on air quality monitoring as well as develop a more robust monitoring mechanism, regulations and enforcement to determine the most effective and efficient way to improve the air quality.

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AN ASSESSMENT OF STUDENTS' SATISFACTION WITH FACILITIES MANAGEMENT PRACTICE OF PROVIDED SERVICES IN ABUBAKAR TAFAWA BALEWA UNIVERSITY BAUCHI

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Abstract

Facilities management are activities carried out with the key role of integrating people, process, place and technology to minimise costs and maximise value and competitive advantage. In Abubakar Tafawa Balewa University (A.T.B.U) Bauchi, provided services such as libraries, information technology centres, laboratories, hostels, green areas, shops, retail outlets, services, facilities, environment, are provided and are managed in ensuring that those provided services do not impede the activities and outcomes of students and staff of A.T.B.U. Bauchi. This academic work examined the level Students' Satisfaction with Facilities Management Practice of Provided Services in A.T.B.U. Bauchi. Research survey was conducted using questionnaire with close-ended questions, open-ended questions and Likert-scaled questions. Data analysed with S.P.S.S © package version 25, revealed that students of A. T. B. U. Yelwa Campus in Bauchi were more satisfied with facilities management pactices employed in managing Electricity supply, security services, Computer Business Centres, Food Canteens, Internet Services, which were ranked 1st, 2nd, 3rd, 4th and 5th respectively.

Introduction

The International Facility Management Association (IFMA, 2009) defines facilities management (FM) as "a profession that encompasses multiple of disciplines to ensure functionality of the built environment by integrating people, process and technology". Several studies have examined the benefits of strategic facilities management. It has been confirmed that strategic FM offers an integrated approach to maintaining, improving and adapting the building and other infrastructure of an organization in order to create an environment that strongly supports the corporate objectives (SFMS, 2006; Barret & Baidry, 2003; Alexander, 2003) while constantly adding value to the stakeholders (Alexander, 2003). It is in this perspective that strategic facilities management contributes to the achievement of organisational strategic goals through effective and efficient management of facilities, involving cost and waste minimization, enhancement of

business process, creation and maintenance of workplace and delivery of superior value (Kamarazaly & Mbachu, 2010).

Furthermore, FM adds value to organizations from a number of other perspectives: recognising and maximising facilities' values and gaining competitive advantage (Alexander, 2003 & Hamilton, 2004), generating persistent corporate values through dynamic facilities policy and efficient response to issues pertaining to space allocation and changing, environmental control and protection, as well as direct and contract employment (Amaratunga, Baldry & Sashar, 2000). FM creates best value in delivering best value in delivering to customer satisfaction (Atkin & Brooks, 2005) by contributing in integrated management of workplace (Tay & Ooi, 2001), which being a prime source for management of infrastructure resources and services to sustain and support the operational strategy of an organisation in both long-term and short-term (Nutt, 2004 & Chotipanich, 2004).

Abubakar Tafawa Balewa University (A.T.B.U) is a citadel of learning with two campuses in Yelwa and Gubi composed of people, facilities, system and buildings put in place to achieve specified objectives. These are not limited to offices, housing units, classrooms, workshops, libraries, information technology centres, laboratories, hostels, green areas, shops, retail outlets, services, facilities, environment, etc. for provided for both staff (teaching and non-teaching) and students, where they carry out their respective obliged responsibilities. They are expected not to impede the activities and outcomes of students and staff through their adequate management thereby, to providing qualitative services and to as well meet up with social responsibilities that add value to the lives of the employees, students, stakeholders and the public individuals in proximity to A.T.B.U campuses.

However, this paper assessment of students' satisfaction with facilities management practice in Abubakar Tafawa Balewa University Bauchi.

Statement of research problem

Facilities are needed for the enhancement of operation processes and to create a safe and conducive workplace for improved productivity and competitiveness. Consequently, investment in the organizational facilities and infrastructure constitutes a significant part of any organizational expenditure (IFMA, 2009). Strategic facilities management contributes to the achievement of organizational strategic goals through effective and efficient management of the facilities, involving cost and waste minimisation, enhancement of business processes, creation and maintenance of workplace and delivery of superior value.

Without a doubt, organizations can achieve high levels of competitiveness and success by leveraging the potentials of strategic facilities management (Kamarazaly & Mbachu, 2007). However, the full potentials of strategic facilities management role may not be

optimally leveraged due to internal and external challenges that hinder the effectiveness and efficiency of strategic facilities management.

The management of university attracts a plethora challenges that cut across all spheres of FM. The unique nature of university facilities and the role of university facilities managers include catering for diverse and demanding customer groups who carry out a wide range of complex processes that require in diverse range of facilities, a significant number of which must be specialised in some ways. University facilities therefore, provide an ideal case study for gaining insights into the comprehensive range of issues faced by facilities managers in general.

Several other studies have investigated the challenges facing university facilities managers. However, there is a lack of clear indication of the risk levels associated with these challenges. In another words, these challenges unfortunately are not prioritised in terms of their relative levels of impact and frequencies of occurrence. Bajaj (2003) affirms this by stating that there is lack of research or little mention of risk ranking in the literature of managing risks in FM.

This paper investigated facilities provided in Yelwa Campus of Abubakar Tafawa Balewa University Bauchi for students and assesses the level of students' satisfaction with facilities management practice in Abubakar Tafawa Balewa University Bauchi.

Materials and Methods
Design and setting
The research design was survey research and the primary sources of data was employed. A set of questionnaire (with close-ended, open-ended and Likert-scale questions) was as the instrument for data collection. Two-stage sampling technique (i.e. the stratified sampling method and random sampling method) was employed to assess the students' satisfaction with facilities management practice in Abubakar Tafawa Balewa University Bauchi.

Sample/participants
The target population included all students of Abubakar Tafawa Balewa University Bauchi in Yelwa Campus. As at the year 2021, has 3,269 Students (A. T. B. U Student Affairs Unit, 2021), which is this research's sample frame. The sample unit was three hundred and forty-two (342) students (Krejcie & Morgan, 1960) which is 10.50% of the sample frame. They are students of A. T. B. U in Yelwa campus that were recruited the aforementioned (stratified and simple random) sampling methods.

The inclusion criteria included were undergraduate students from 100level through 500level (in the faculty of Science and Faculty of Environmental Technology) and students of School of Postgraduate Studies. They all students in departments of Applied geology, Biochemistry, Biological Science, Chemistry, Ecology, Mathematical Sciences,

Microbiology, Physics, Architecture, Building, Environmental Management and Technology, Estate Management and Valuation, Industrial Design, Quantity Survey, Surveying and Geo-Informatics, Urban and Regional Planning and School of Postgraduate Studies. These students have lecture halls in Yelwa Campus.

Data collection
Pilot survey was conducted to ensure data reliability and data validity. Data reliability was conducted using retest method of 10 questionnaires. In this retest method, five (5) questionnaires were first shared to five (5) students' class representatives and retrieved, while the same five (5) students' class representatives. The validity test was content validity. The researcher gave the four (4) proposed questionnaires to four (4) professionals in the field of Estate Management and Valuation to assess the worthiness of the questionnaire before pilot survey and research survey. All the observations were corrected before the questionnaire was administered for the pilot and field survey.

Data collection was performed using a two-section questionnaire. The first section collected the participants' demographic characteristics including which includes the gender, age of respondents, academic level of respondents, academic department of respondents and the respondent's faculty. The second section has the major services Provided in Yelwa Campus of A. T. B. U., Bauchi and the level of satisfaction of students with provided services in Yelwa Campus of A. T. B. U., Bauchi, Bauchi State.

Ethical concern was also given a priority by avoidance of ambiguous questions and none of the questionnaires has means of identity. The respondents remain confidential and anonymous throughout to avoid any problem that may be detrimental to these Abubakar Tafawa Balewa University Bauchi.

Statistical analysis
Data were analysed via SPSS version 25 using descriptive statistics (frequency, percentage, mean and standard deviation).

Results and Discussion
Results
Table 1 shows that 342 questionnaires were administered to Students in Yelwa Campus of Abubakar Tafawa Balewa University in Bauchi while 299 questionnaires that is 87.43% were retrieved.

Table 1: Administered and retrieved questionnaires

Questionnaire	Frequency	Percentage (%)
Administered	342	100.00
Retrieved	299	87.43

	Non-Retrieved	43	12.57

Table 2: Demography of the respondents

Variables	Options	Frequency	Percentages
Gender	Male	224	74.92
	Female	75	25.08
Age of Respondents	20years and below	88	29.43
	21 – 30 years	127	42.48
	31 – 40 years	37	12.37
	41 – 50 years	31	10.38
	51 – 60 years	12	4.01
	Above 60 years	4	1.34
Academic Level	100	32	10.70
	200	54	18.06
	300	88	29.43
	400	52	17.39
	500	43	14.38
	600	19	6.35
	700	7	2.34
	800	4	1.34
Academic Department	Applied Geology	13	4.35
	Biochemistry	22	7.36
	Biological Science	25	8.36
	Chemistry	15	5.02
	Ecology	10	4.34
	Mathematical Sciences	27	9.03
	Microbiology	12	4.01
	Physics	10	4.34
	Architecture	19	6.35
	Building	12	4.01
	Environmental Management and Technology	29	9.70
	Estate Management and Valuation	11	3.68
	Industrial Design	21	7.02
	Quantity Survey	26	8.70
	Surveying and Geo-Informatics	22	7.36
	Urban and Regional Planning	25	8.36
	Environmental Technology	121	40.47

Academic Faculty	Sciences	148	49.50
	Postgraduate Studies	30	10.03

Source: Field Survey (2021)

Table 2 shows the gender of the respondents in the study area. Male respondents are 224, which is 74.92% while 75 respondents, which is 25.08% are females. This shows that male respondents dominated the students Abubakar Tafawa Balewa University in Yelwa Campus, Bauchi. It was discovered that 88 of the respondents are of ages of below 20years which is 29.43%. Ages of 21 – 30years, 31-40years, 41-50years, 51-60years, 61 and above years have respondents 127, 37, 31, 12 and 4 respectively. This also signifies 42.48%, 12.37%, 10.38%, 4.01% and 1.34% respectively. The dominating age group among the respondents is 21-30years.

Also, it was discovered that 32 of the respondents are in 100level of studies, which is 10.70%. Students in 100level, 300levels, 400level, 500level, 600level, 700level and 800level have respondents 54, 88, 52, 43, 19, 7 and 4 respectively. This also signifies 18.06%, 29.43%, 17.39%, 14.38%, 6.35%, 2.34% and 1.34% respectively. The dominating students' level among the respondents is 300level. The academic department of respondents reveals that students in Applied Geology department are 13, which is 4.35% of the respondents. Biochemistry, Biological Science, Chemistry, Ecology, Mathematical Sciences, Microbiology and Physics have 22respondents, 25respondents, 15respondents, 10respondents, 27respondents, 12respondents and 10respondents, which 7.36%, 8.36%, 5.02%, 4.34%, 9.03%, 4.01%, and 4.34% respectively. Meanwhile, Departments of Architecture, Building, Environmental Management and Technology, Estate Management and Valuation, Industrial Design, Quantity Survey, Survey and Geo-Informatics, and Urban and Regional Planning Department has 19 respondents, 12 respondents, 29 respondents, 11 respondents, 21 respondents, 26 respondents, 22 respondents, and 25respondents. These signify 6.35%, 4.01%, 9.70%, 3,68%, 7.02%, 8.70%, 7.36%, and 8.36% respectively. This reveals that students of Environmental Management and Technology dominated the group.

Meanwhile, the Academic Faculty, which respondents belong to indicated that respondents from Faculty of Environmental Technology are 121 students, which is 40.47%, respondents from Faculty of Sciences are 148, which is 49.50% while respondents from Postgraduate Studies are 30 and it is 10.03% of the respondents. This reveals that students from the Faculty of Sciences dominated the group.

Table 3: Major Services Provided in Yelwa Campus of A. T. B. U., Bauchi

Services	Mean	Standard Deviation	Rank
Electricity Supply	3.9049	0.98721	1
Security services	3.7772	1.15987	2

Computer Business Centres	3.7717	1.03459	3
Food canteen	3.6440	1.20214	4
Internet services	3.5571	1.17976	5
Electric Power supply generators	3.3478	1.48881	6
School bus	3.3397	1.30868	7
Trade/Retail outposts	3.2011	1.32993	8
Toilets and bathrooms	3.1033	1.40656	9
Audio-visual units	3.0163	1.44273	10
Portable Water supply	2.8859	1.34226	11
Banking services	2.8777	1.44612	12
Lighting systems	2.3940	1.19475	13
Fire Fighting Units and Appliances	2.3016	1.25227	14
Waste disposal units	2.1332	1.06527	15
Wheel chairs walk way for handicaps	1.7636	1.20899	16

Source: Field Survey 2021)

The above Table 3 shows those major facilities provided in A. T. B. U., Bauchi. Electricity Supply has a mean score of 3.9049 and a standard deviation of 0.98721, Security services has a mean score of 3.7772 and standard deviation of 1.15987. Computer Business Centres are of mean score 3.7717 and standard deviation of 1.03459, Food canteens are mean score of 3.6440 and standard deviation of 1.20214.

However, Internet service was of mean score of 3.5571 and standard deviation of 1.17976, Power supply generators were of mean score of 3.3478 and standard deviation 1.48881, School buses were of mean score of 3.3397 and standard deviation of 1.30868, Trade/Retail outposts were of mean score of 3.2011 and standard deviation of 1.32993.

Meanwhile, Toilets and bathrooms were of mean score of 3.1033 and standard deviation of 1.40656. Audio-visual units have mean score of 3.0163 and standard deviation of 1.44273. Portable Water supply have mean score of 2.8859 and 1.34226 as standard deviation. Banking services were of mean score of 2.8777 and standard deviation of 1.44612.

Also, Lighting systems have mean score of 2.3940 and 1.19475 as standard deviation. Fire Fighting Units and Appliances have mean score of 2.3940 and 1.25227 as standard deviation. Waste disposal units have mean score of 2.1332 and 1.06527 as standard deviation. Wheel chairs walk way for handicaps have mean score of 1.7636 and 1.20899 as standard deviation.

Table 4:   Level of Satisfaction of Students with Provided Services in

Yelwa Campus of A. T. B. U., Bauchi

Services	Mean	Standard Deviation	Rank
Electricity Supply	3.3044	0.98721	1
Wheel chairs walk way for handicaps	3.3021	1.15987	2
Internet services	3.2717	1.03459	3
Computer Business Centres	3.2523	1.20214	4
Portable Water supply	3.2501	1.17976	5
Trade/Retail outposts	3.2478	1.48881	6
School bus	3.2397	1.30868	7
Toilets and bathrooms	3.2011	1.32993	8
Banking services	3.1033	1.40656	9
Lighting systems	3.0163	1.44273	10
Fire Fighting Units and Appliances	2.8723	1.34226	11
Power supply generators	2.7712	1.44612	12
Waste disposal units	2.3822	1.19475	13
Audio-visual units	2.2014	1.25227	14
Security services	2.1236	1.06527	15
Food canteens	1.0633	1.20899	16

Source: Field Survey 2021)

The above Table 4 illustrates level of satisfaction of students with provided services in Yelwa Campus of A. T. B. U., Bauchi. Electricity Supply has a mean score of 3.3.044 and a standard deviation of 0.98721, Wheel chairs walk way for handicaps has a mean score of 3.3021 and standard deviation of 1.15987. Internet Services are of mean score 3.2717 and standard deviation of 1.03459, Computer Business Centres have a mean score of 3.2523 and standard deviation of 1.20214. However, Portable water was of mean score of 3.2501 and standard deviation of 1.17976, Trade/Retail Outposts were of mean score of 3.2478 and standard deviation 1.48881, School buses were of mean score of 3.2397 and standard deviation of 1.30868, Toilets and Bathrooms have a of mean score of 3.2011 and standard deviation of 1.32993.

Meanwhile, Banking services were of mean score of 3.1033 and standard deviation of 1.40656. Lighting systems have mean score of 3.0163 and standard deviation of 1.44273, Fire Fighting Units and Appliances have mean score of 2.8723 and 1.34226 as standard deviation. Power supply generators were of mean score of 2.7712 and standard deviation of 1.44612.

Also, Waste Disposal Units have mean score of 2.3822 and 1.19475 as standard deviation, Audio-Visual Units have mean score of 2.2014 and 1.25227 as

standard deviation. Security Services have mean score of 2.1236 and 1.06527 as standard deviation while Food canteens have mean score of 1.0633 and 1.20899 as standard deviation.

Discussion

The survey research conducted revealed that the major services provided in Yelwa campus of Abubakar Tawa Balewa University Bauchi are Electricity supply, security services, Computer Business Centres, Food Canteens, Internet Services, Electric Power Supply Generators and they were ranked the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th respectively. This is opposing the findings of Bagonza, Itaaga and Mugagga (2019) that the major facilities of Education in University in Uganda are Lecture room space, Library space and books, Laboratory Facilities and Computer and Internet Access, which were ranked the 1st, 2nd, 3rd and 4th respectively. The findings also not the same with the findings of Ekpoh (2018) that the major services provided in universities are library services health service delivery, transportation services, ICT service and hostel service delivery. However, the findings of this research is sustained.

Meanwhile, the level of satisfaction of A. T. B. U Yelwa campus Bauchi on facilities' management of services provided indicated that Electricity Supply was rated 1st, Wheel chairs' walk way for handicaps was rated 2nd, Internet Services was rated 3rd, Computer business centres was rated 4th and Portable water supply was rated 5th in ranking.

Conclusion

This academic research revealed from data collected and analysed the major services provided in Yelwa campus of Abubakar Tafawa Balewa University Bauchi and the level of students' satisfaction with the facilities management with the provided services.

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INVESTIGATING COLLEGE LECTURER'S COMPETENCY IN THE CONSTRUCTION OF MULTIPLE CHOICE ITEMS (MCI) AT AD RUFA'I COLLEGE OF EDUCATION, LEGAL AND GENERAL STUDIES MISAU, BAUCHI STATE

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ABSTRACT

The research was on investigating lecturer's competence on constructing Multiple Choice Items (MCI).The research design employed was descriptive survey as well as ex-post factor design. The population of the study was lecturers at AD Rufa'i college of Education, Legal and General Studies, Misau. The sample encompasses those teaching at General Study's unit. Three research objectives with corresponding hypotheses were formulated to guide the study. Beside past question papers, the researcher developed a questionnaire tittle College Lecturer's Competence in the Construction of Multiple Choice Items (CLCMCI). The instrument has face validity and a reliability of internal consistency established using Cronbach alpha value of 0.853 was obtained. The data collected were analyzed using descriptive statistics: Frequency counts, percentage and inferential statistics; chi-square cross tabulation The hypotheses were tested at 0.05 level of significance. Findings indicated that: Multiple choice items (MCI) are considered because it measure various cognition hence has a very high content validity, Those that write items in negative form didn't capitalized or underline the items, but while constructing item, the stem of their item clearly formulate a problem, similarly, table of specification are not put into consideration before planning the MCI. The chi-square cross tabulation revealed that: The null hypothesis which states that, there is no significant difference toward frequent used of MCI in relation to Gender is retained, likewise, The null hypothesis which states that, there is no significant difference on awareness toward writing MCI in relation to Qualifications is retained. Lastly. The hypothesis which stated that there is no significant difference among lectures on been acquainted with the characteristics of test items in relation to Experience is rejected. Hence significant different existed between experience and in-experience lecturers. The study recommend that: The college authority should organize workshop or seminar specifically on test development and other related issue, especially on multiple choice items, Experience lecture's should at departmental level guide the un-experience on skill needed for competency in handling item development planning prior to dispatch level. Lastly,

Lecturers should consider use of items format based on cognitive demand in-relation to content coverage.

Keywords: *Assessment, Multiple Choice Items, item Construction, Teacher's competence,,*

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INTRODUCTION

The importance of assessment in the overall quality of teaching and learning in education has been widely acknowledged, White (2012) describes assessment as an engine that drives learning noting that a well-designed assessment has the potential of setting clear expectations, establishing a reasonable workload and providing opportunities for students to self-monitor, rehearse, practice and receive feedback, while a poorly designed assessment has the potential of hindering learning.

Test Construction Competence involves theoretical and practical skills that teacher or test constructor adapt to accomplish testing. However, it is an art that only few people seem to master (Nunnally & Bernstein 1994; Osadebe 2001). The competences are the skills needed to develop appropriate item format that measures the instructional objectives most directly and efficiently as stipulated by experts. According to Chidolue in (Agu, Onyekuba & Anyichie 2013) the competences for classroom test construction is of paramount important, hence care should taking,

However, the quality of the teacher-made tests is related to the qualification and the experience of the teacher. For them to function effectively, teachers should possess and apply requisite skills in constructing good items for class assessment (Ololube 2006).

Constructing test items for class-room consumption and decision making, is a task of vast position that one oppressed with difficulty. The task is important because test items being frame are the foundation of written tests, for test of achievement the ideas they express must be articulated precisely and concisely. If a test's scores are to yield valid inferences about an examinee's mental attributes, its items must reflect a specific psychological construct or domain of content. Without a strong association between a test item and a psychological construct or domain of content, the test item lacks meaning and purpose, Interpretability of a test's scores flow directly from the quality of its items and exercises. In a test item, every word counts. Gordon Stobart (2008), is on the opinion that the item writer, unlike the storywriter or essayist, cannot rely upon a larger context to assist in conveying the meaning of a word, sentence, or passage. Limitations of expression are rarely possible in the brief wording of most test items. The examinee must derive from the sentence stem the exact meaning intended by the item writer, and in the response alternatives the examinee should be able to realize distinct and reasonable solutions. Communication between the item writer and the examinee is crucial if a measure of the particular construct is to yield valid score interpretations.

The multiple choices item has been chosen as the main focus of this study. It is an assessment method that is now heavily relied upon in many schools and driven by the effectiveness and efficiency argument. Research however indicates that not all students and lecturers are fond of multiple choice tests. Zeidner (1987) conducted a research which indicated that about 25% of the student respondents preferred constructed-responses test over multiple-choice items. Also many college teachers and faculty members have expressed their concern over the difficulty of constructing multiple choice items. This has raised the concern that poorly written multiple choice items may not permit students to really exhibit what they know (Dufresne, Leonard & Gerace, 2002).

Multiple-choice questions (MCQs) continue to be relied upon for the efficient assessment of students' learning in higher education. However, the use of MCQs has not been without criticism. Poor design of MCQs, testing only lower-level learning outcomes such as information recall, and encouraging students to focus on these rote and reproductive approaches to learning are among the criticisms. Nevertheless, the MCI has been selected for three reasons. First, it is very versatile; it could be used to measure students' performance at any level and in any subject area as well as all levels of learning from knowledge to evaluation. Second, multiple choice items can be very useful for diagnostic purposes, for helping students realize their strengths and limitations. Third, because of the recent rise in students numbers in colleges and universities, multiple choice items are often used; it is therefore important that lecturers learn to write the items well.

Researchers on items type are on the opinion that, the multiple choices could be the most powerful assessment tool provided the teacher constructs the items well. Multiple choice testing is an efficient and effective way to assess a wide range of knowledge, skills, attitudes and abilities (Haladyna, 2002). The multiple-choice test (MCT) is perhaps the most extensively-used format in the assessment of student knowledge today. Globally, it is used, in part or in whole, in classroom tests, as well as in standard admission, placement and certification tests. Individuals encounter it throughout their academic (from primary, secondary, to tertiary levels of education) and professional career. Louisa and Nwadinigwe (2013), accomplish that MCI are a commonly preferred format for large-scale testing because they have been found to give valid and reliable results. They can be effectively used to assess large number of test-takers, to cover a wide range of content area (Downing, 2002, cited in Tarrant, Ware & Mohammed, 2009), as well as a wide range of learning objectives (Okoli, 2005), leading to valid results. They can be objectively, easily and accurately scored (Linn & Gronlund, 2000), and they contain a relatively large number of test items, leading to a high degree of reliability. Multiple-choice items are used in educational testing because they permit the measurement of diverse types of knowledge, skills, and competencies (Haladyna, 2004; Downing, 2006; Popham, 2008). Multiple-choice items are efficient to administer; they are easy to score objectively; they can be

used to sample a wide range of content; they require a relatively short time to administer (Haladyna, 2004; Haladyna and Rodriguez, 2013; Rodriguez, 2016).

Downing (2006, p. 288), in his seminal chapter in the Handbook of Test Development, claimed that selected-response items, like multiple choice, are the most appropriate item format for measuring cognitive achievement or ability, especially higher-order cognitive skills, such as problem solving, synthesis, and evaluation. He also stated that this item format is both useful and appropriate for creating exams intended to measure a broad range of knowledge, ability, or cognitive skills across many domains.

Structurally, MC questions or items, have two parts: a stem - the question, problem, or task to be answered or solved; and a set of response options or alternatives - possible answers or solutions to the question. The options comprise of the correct answer, called the key; and one or more incorrect or less appropriate answers called the distracters or distractors (Onunkwo, 2002). While the stem is an important part of a multiple-choice item (MCI), the options are no less relevant. No matter how well-written a stem, a single flawed option can invalidate the item. As a rule, well-written options are critical for an MCI to be adjudged as valid**.**

PROBLEM OF STUDY

One of the most used tools which are to assess students' achievement in classroom is tests. These tools are highly fall into select(objectives) or supply(essay) item format (Susana,2014), both of them are often fraught with reliability and validity problems as the process for constructing such tests is often not followed or misunderstood, and this leads to significant measurement error into the measurement process. Inaccurate data-based inference as a result of poor measurements will lead to bad decision making, with this there is a need of competency from the side of lectures on test item development. It has already been pointed out that poorly designed tests could make the students loose interest in a particular subject (Osadebe, 2001). When the test instrument does not possess the necessary characteristics it ought to, this means that the test is not valid and reliable, and the effort to achieve the instructional objectives will be in futility.

This perhaps attract the researcher's interest on conducting the research on lectures competency on developing of MCQ ,particularly those teaching General Studies Section at the AD Rufa'i College of Education, Legal and General Studies, Misau, Bauchi State.

OBJECTIVES

The objective of the study is in three-folds.

1- To find out lecturers' motives for using the multiple-choice test items.

2- To find out the extent to which lectures follow the guidelines in the construction of the MCI as outlined by measurement and evaluation experts.

3- To find out about common errors lecturers' made in constructing multiple choice items.

RESEARCH QUESTIONS

The study aims at finding answers to the following questions:

1- What are the motives behind lecturers frequent used of MCI in measuring learning outcomes of the Courses they teach?

2- To what extent do lecturers' plan their multiple choice test items?

Research Hypotheses

The following hypotheses were tested at 0.05 level of significance:

HO_1- There is no significant difference toward frequent used of MCI in relation to Gender

HO_2- There is no significant difference on prior knowledge toward writing MCI in relation to Qualifications

HO_3- There is no significant difference among lectures on being **conversant with the characteristics of test items** in relation to Experience

METHODOLOGY

The research design employed for the study was a survey and ex-post-factor design, in which the researcher designs a questionnaire solely to get lectures response to some question regarding constructing or developing MCQ item, whereas ex-post design was employ in collecting a sample of last semester questions for content analysis.

The instruments used for the collection of data for the study were copies of multiple choice (pass question paper) constructed by the lectures from General Studies Unit (GSU), students' marked answer scripts at the end of 2020/2021 academic session. . Beside past question papers, the researcher developed a questionnaire tittle College Lecturer's Competence in the Construction of Multiple Choice Items (CLCMCI). The instrument has face validity and a reliability of internal consistency established using Cronbach alpha, the value of 0.853 was obtained. Three specialists having post-graduate research experience, one of which from test and Measurements unit including the researcher labeled - rater 1, rater 2 and rater 3, rated the content-related validity evidence of the tests (past question papers) using a 10-point scale. A rating of 1 indicates very low content validity and a rating of 10 indicates very high content-related validity.

RESULTS

Table one: Demographic information

Variables	Categories	Frequencies	%
Gender	Male	34	85.0
	Female	6	15.0
	Total	**40**	**100.0**
Teaching	1-5 years	4	10.0
Experience	6-10 years	13	32.5

	11-20 years	9	22.5
	Above 20 years	14	35.0
	Total	**40**	**100.0**
Qualification	B.Sc./M.Sc.	15	37.5
	BA/MA	14	35.0
	PhD	11	27.5
	Total	**40**	**100**

Table 1.0 shows summary of the Demographic information of the sample variable, from the table 85% of them are Male lecturers, while only 15% are female, their teaching experience ranges from 14 lecturer (35%) are having more than 20 years, 32.5% making 13 of them have experience ranges from 06-10 years. Similarly, 9 academic staff (22.5%) has experience of 11-20 years, finally 10% are having experience below 6 years. On qualification, 37.5% of them possess either M.Sc. or B.Sc., 14 lecturers (35%) have M. Art or B.A, and lastly, 11 of them making 27.5% possess PhD.

Research Question one: What are the lecturers motives behind frequent used of MCI in measuring learning outcomes?

Table 2: Summary of Descriptive Statistics for lecturers' motives behind frequent used of MCI in measuring learning outcomes of the Courses they teach?

S/N	Statements	OPTION	FREQUEN	PERCENTAGE	OPTION	FREQUEN	PERCENTAGE	OPTION	FREQUEN	PERCENTAGE	OPTION	FREQUEN	PERCENTAGE
	Reasons for using multiple choice items (MCI)	SA			A			D			SD		
1	I consider MCI because it measure various cognition at a time	20	50.0		14	35.0		6	15.0		00	00	

2	Iam conversant to writing MCI	20	50.0	13	32.5	7	17.5	00	00
3	I teach large classes	20	50.0	15	37.5	5	12.5	00	00
4	It is easy to construct the MCI	3	7.5	23	57.5	9	22.5	5	12.5
5	It is easy to score the MCI	18	45.0	14	35.0	5	12.5	3	7.5
6	The MCI has a very high content validity	28	70.0	00	00	12	30.0	00	00
7	My students prefer the MCI to any other test format	15	37.5	13	32.5	9	22.5	3	7.5

The table 2.0 above recaps lecturers' motives behind frequent used of MCI in measuring learning outcomes of the Courses they teach. **50 % of the respondents are on the view that, they consider MCI because it measure various cognition** at a time, whereas on 15% strongly disagree. 17.5% thus making up to 7 respondents are on the opinion that they are not conversant to writing MCI, whereas the remaining 80.5 % agree that they are conversant to writing MCI. Regarding construction of questions item 20% of them (14 respondents) are against the opinion that it is easy to construct the MCI, in that 7.5% strongly agreed with the statements. **28 out of 40 respondents making up to 70% strongly agreed that The MCI has a very high content validity,** but 30% are a not in support with the statements. Lastly, 28 respondents (70%) are on the view that one of the reasons for using MCI was that their students too prepare for it than other format.

Research Question two: To what extent do lecturers' plan their multiple choice test items (MCI)

Table 3: Summary of Descriptive Statistics for determining respondents' expertise on planning of the MCI

S/N	Statements	OPTION	FREQUENCY	PERCENTAGE	OPTION	FREQUENCY	PERCENTAGE	OPTION	FREQUENCY	PERCENTAGE	OPTION	FREQUENCY	PERCENTAGE
	planning of the test	SA			A			D			SD		
1	I possess technical skills required for constructing test items		14	35.0		13	32.5		10	25.0		3	7.5
2	I prepare the table of specification		12	30.0		3	7.5		14	35.0		11	27.5
3	I write the items throughout the semester		14	35.0		3	7.5		15	37.5		8	20.0
4	I write the item after official request		16	40.0		7	17.5		8	20.0		9	22.5
5	I consider item analysis before writing the item		21	52.5		16	40.0		00	00		3	7.5
6	My items format are appropriate to the goals of the test		12	30.0		12	30.0		16	40.0		00	00

| 7 | I avoided use of unambiguous concepts | 28 | 70.0 | 8 | 20.0 | 4 | 10.0 | 00 | 00 |

Table 3 above display respondents' view on their expertise on planning of the MCI, 32.5% of the respondent did not possess the technical skills; on the other hand **28 out of 40 respondents possess the necessary skills.** On preparing table of specification, 25 respondents (62.5%) **did not consider making of table of specification before planning the MCI. On items banking, 57.5% of the respondents** write their item after official request from authority concern, where only 41.5% adopt items banking system. 24 respondents (60 %) agreed that their items formats are appropriate to the goals of the test, whereas 40% (16 respondents) disagree with the statements. Lastly, 90 % of them (36 respondents) are trying to avoid the use of unambiguous concepts while planning MCI.

Hypotheses Testing

HO$_1$- There is no significant difference toward frequent used of MCI with relation to Gender

Table 4: Summary of Descriptive statistics and Chi- Square Cross Tabulation Analysis frequent used of MCI in relation to Gender

Statements	Determinant	Category of Respondent	Frequency of Responses		p-value	Decision
			A	DA		
I consider MCI because it measure various cognition at a time	Gender	Male	28	6		
		Female	02	4	.176	Accepted
		Total	30	10		

Table 4 above depicts the descriptive statistics on the frequency count of respondents as well as the result for chi-square cross tabulation. The summary for the frequency count of the respondents indicated that 30 out 40 **(75%) agree with the statements that they consider MCI because it measure various cognition at a time** whereas only 10 out of 40 (25%. disagree. Similarly, the analyses for chi-square (cross tabulation) result indicate that the calculated p-value obtained was of 0.176 with a degree of freedom 2. This detected

that the p-value 0.179 is greater than *alpha* value of 0.05. Thus, There is no significant difference toward frequent used of MCI with relation to Gender is retained. The chart below further illustrates the differences.
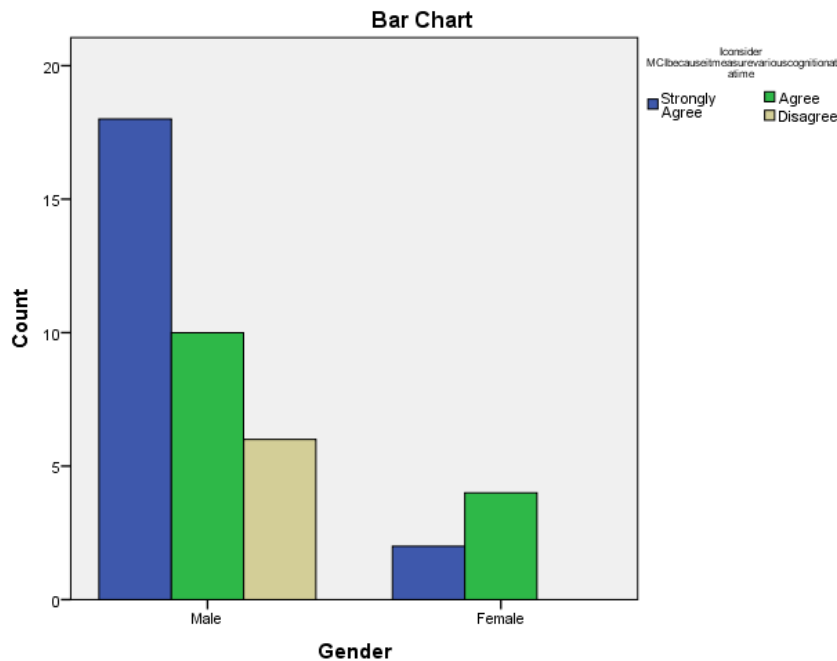

Figure 1: frequent used of MCI VS Gender

HO2: There is no significant difference regarding prior knowledge on proficiency toward writing MCI in relation to Qualifications

Table 5: Summary of Descriptive statistics and Chi- Square Cross Tabulation Analysis on expertise toward writing MCI in relation to Qualifications

Statements	Determinant	Category of Respondent	Frequency of Responses		p-value	Decision
			A	DA		
am acquainted toward writing MCI	Qualification	Bsc / Msc	13	2		
		B.A /M.A	11	3	.059	Accepted
		PhD	09	2		
		Total	33	7		

Table 5 above, describes the descriptive statistics on the frequency count of respondents. The summary for the frequency count of the respondents indicated that 33 out 40 **(82.5%) agree with the statements that they are conversant toward writing MCI** whereas only 7 out of 40 (17.5%. disagree. Similarly, the analyses for chi-square (cross tabulation) result

indicate that the calculated p-value obtained was of 0.059 with a degree of freedom 2. This detected that the p-value 0.059 is approximately greater than *alpha* value of 0.05. Thus, **the null hypothesis which states that** there is no significant difference regarding prior knowledge /proficiency toward writing MCI in relation to Qualifications is retained. **,.** The chart below further illustrates the differences.
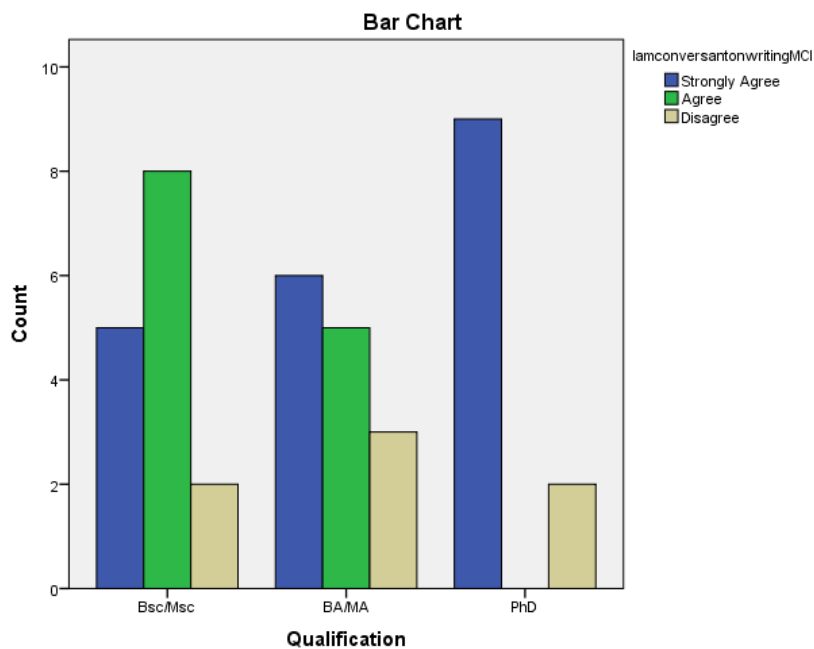

Figure 2: Awareness toward writing MCI in relation to Qualifications

HO$_3$- There is no significant difference among lectures on been **acquainted with the characteristics of test items** in relation to Experience

Table 6: Summary of Descriptive statistics and Chi- Square Cross Tabulation on been conversant with the characteristics of test items in relation to Experience

Statements	Determinant	Category of Respondent	Frequency of Responses		p-value	Decision
			A	DA		
Iam acquainted with the characteristics of test items	**Experience**	1-5 years	02	2		
		6-10 years	11	2	.001	Rejected
		11-20 years	09	0		

Above years	20	11	3
	Total	33	7

Table 6 above, reveals the descriptive statistics on the frequency count of respondents. It was clearly shown that a 50 – 50 responses was obtained on those that have 1-5 years, similarly 100% on those having 11 – 20 years agree with the statements "Iam conversant with the characteristics of test items". 11 out of 14 respondents that have an experience of more than 20years agreed with the statements in that only 3 disagree. On the other hand, the analyses for chi-square (cross tabulation) result demonstrate that the calculated p-value 0.01 with a degree of freedom 2 was obtained. It can be observed that the p-value which is 0.01 is less than the *alpha* value of 0.05. Thus, the null hypothesis which states that, **there is no significant difference among lectures on been conversant with the characteristics of test items in relation to Experience is rejected. Hence significant different exist.** Experience teachers possess necessary skill than jn-experience.
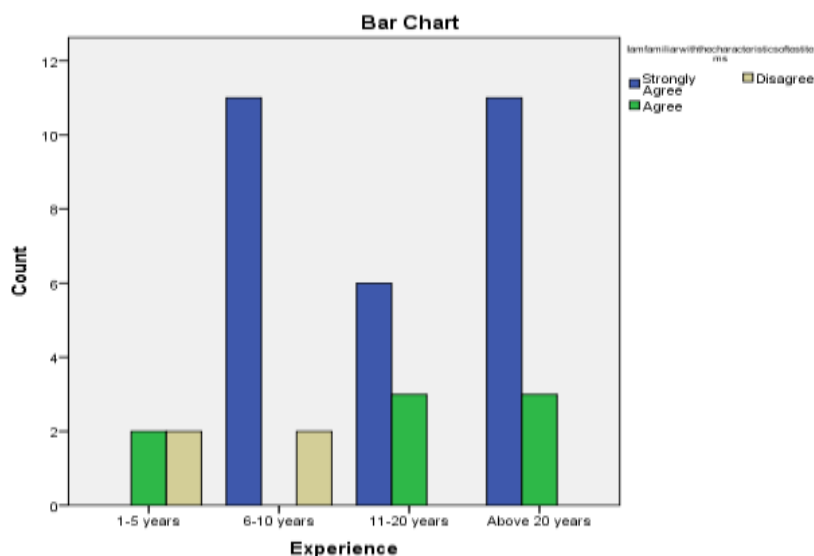

Figure 3: Respondents conversant with the characteristics of test items in relation to Experience

Result from Content Analysis of Selected End-Of-Semester Multiple Choice Test Items

In order to gain first-hand information as to the extent to which lecturers' follow the guidelines laid down by measurement and evaluation experts in writing multiple choice items, a sample of end-of-semester examination which has multiple choice items were

selected for content analysis. A random sample of fifty 50 examination questions from the 2020- 2021 academic years were selected.

-From the content analysis, the following were seen as the major faults lecturers' made while constructing the MCI.

i- Options (answers) are arranged in an order that will make scoring easier. In that smart student will at time determine the pattern,

ii- There is less use of unambiguous concepts while planning MCI

iii- Best on their item placement, some lecturers did not consider or make use of table of specification before planning

iv- Some lecturers arrange their items without considering order of difficulty level

v- Most of the items that were negatively written, the words are not underlined, italiced or bold

vi- There were words in the stem which serve as specific determiners that can aid the unapprised student to get the answer

DISCUSSION OF FINDINGS

The focus in this study was to determine lecturers competency on the developments of Multiple choice items (MCI) at AD Rufa'i College of Education Legal and General Studies ,as well as finding out the degree of their competency in relation to qualification , experience as well as gender.

The table 2.0 above recaps lecturers' motives behind frequent used of MCI in measuring learning outcomes, **50 % of the respondents are on the view that, they consider MCI because it measure various cognition,** likewise **28 out of 40 respondents making up to 70% strongly agreed that The MCI has a very high content validity.** This finding is in agreement with that of Bamidele and Oluwole (2014), there finding determined the content and cognitive validity of the selected undergraduate multiple choice tests used in Obafemi Awolowo University, Ile Ife, Nigeria and found that contents validity exist but only one course has a very high content coverage. similarly, Amajuoyi, Eme and Udoh (2013) in their study assessed the content validity of May/June West African Senior School Certificate Examination (WASSCE) questions in Chemistry from 1999-2002 and found out that some topics were over-emphasized, under emphasized or totally ignored and the questions emphasized more of lower levels of the cognitive domain as knowledge and comprehension.

Table three **displayed respondents' view on their expertise** on planning of the MCI, **28 out of 40 respondents possess the necessary skills.** This finding is in accordance with that of Marmah and Impraim (2013). They investigated University lecturer's competence in the construction Of Multiple Choice Test Items; they suggest that there is much to be

done to raise the competence level of the lecturers' with regards to the writing of multiple choice test items,

On preparing table of specification and item analysis (62.5%) **did not consider making of table of specification or doing item analysis before planning the MCI. This finding uphold that of** Downe (2008) and that of Marmah and Impraim (2013), Downe suggest that on item analysis, aid in providing a basis for remedial work as it brings to light general areas of weakness acquiring more extended attention. Whereas Marmah and Imprain discovered that a significant majority of the respondents are not planning table of specification and item analysis on their multiple choice items.

- Table 4 above, depicts the descriptive statistics on the frequency count of respondents. 28 out of 36 male participants agreed that, **they consider MCI because it measure various cognition at a time, whereas only 2 out 4 female disagree. This finding uphold that of Othman (2018), the research was based on cognitive demand in mathematics teacher- made test, the result revealed that experience teacher set their item to measure higher cognition where in-experience set their item to measure low cognition.** On the other hand, the analysis for chi-square (cross tabulation) result shows the calculated p-value of 0.18 with a degree of freedom 2 . It can be observed that the p-value which is 0.18 is greater than *alpha* value of 0.05. **Thus, the null hypothesis which states that, there is no significant difference toward frequent used of MCI in relation to Gender is retained.** This indicated that both male and female lecturers **frequently used MCI; similarly, they** construct their MCI by measuring both low and high cognition

Table 5 above, describes the descriptive statistics on the frequency count of respondents. The summary for the frequency count of the respondents indicated that **82.5% agreed that they are conversant toward writing MCI,** this finding contradict that of Esomonu (2002) and Paulson,(2003), they affirm that Lack of test construction skills by teachers might result from incompetency which originated from lack of necessary knowledge in test construction by teachers, this serve as a as a major cause of malpractice in school examinations by both teachers and students in Nigerian secondary schools.. Similarly, the analyses for chi-square (cross tabulation) result indicate that the calculated p-value obtained was of 0.06 with a degree of freedom 2. This detected that the p-value 0.06 is approximately greater than *alpha* value of 0.05. Thus, **the null hypothesis which states that, there is no significant difference on awareness toward writing MCI in relation to Qualifications is retained.** This indicated that the entire respondent talk less of their difference on qualification are aware of the skill of writing MCI.

Table 6, reveals the descriptive statistics on the frequency count of respondents. It was clearly shown that 50-50 response was obtained from those that have 1-5 years' experience, whereas, 100% on those having 11 – 20 years teaching experience agreed with the statements "Iam conversant with the characteristics of test items". 11 out of 14 respondents that have an experience of more than 20years agreed with the statements in

that only 3 disagree. This finding is similar with that of **(Ebinye, 2001). His research was on t**est **construction skill among teacher with respect to years of service, he found test construction to be a major source of anxiety among many teachers in Nigerian schools, especially, less experienced ones. This anxiety stems majorly from lack of test construction skill by these teachers.**

On the other hand, the analyses for chi-square (cross tabulation) result demonstrate that the calculated p-value 0.01 with a degree of freedom 2 was obtained. It can be observed that the p-value which is 0.01 is less than the *alpha* value of 0.05. Thus, the null hypothesis which states that, **there is no significant difference among lectures on been conversant with the characteristics of test items in relation to Experience is rejected. Hence significant different exist.** This finding disagree with that conducted on investigating the cognitive demand on Teacher Made- Mathematics test in relation to Experience, conducted by Othman (2018), his finding revealed that there is no significant difference on measuring lower or higher cognition with reference to experience.

Conclusion

Based on the preceding discussion, the following conclusions were drawn:

1- Multiple choice items (MCI) are considered because it measure various cognition hence has a very high content validity,
2- Table of specification are not put into consideration before planning the MCI.
3- The null hypothesis which states that, there is no significant difference toward frequent used of MCI in relation to Gender is retained.
4- The null hypothesis which states that, there is no significant difference on awareness toward writing MCI in relation to Qualifications is retained.
5- There is no significant difference among lectures on been conversant with the characteristics of test items in relation to Experience is rejected. Hence significant different exist**.**

RECOMMENDATION

Based on the findings of this study, the following recommendations are put forward for consideration

1- The college authority should organize workshop or seminar specifically on test development and other related issue, especially on multiple choice items
2- Lecturers should consider the use of items format based on cognitive demand in-relation to content coverage.

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AN ASSESSMENT OF THE PERFORMANCE OF PRIVATE HOUSING ESTATE DEVELOPERS IN KWARA STATE.

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ABSTRACT
This study examined the contribution of Private Real Estate Developers in housing provision in Kwara state. The study addressed the ineffectiveness of the private sector to deliver housing to the citizen. The aim of the study examined both the contribution as well as the problems confronting PHED in Kwara State. Some of the objectives of the study were to examine the relationship between the profile of PHED in Kwara State and their performances, assess their effectiveness of the delivery process and to examine the satisfaction of occupiers of the private estate. The research methodology revealed the quantity of housing units developed by the PHED and allowed in evaluating their contribution to the housing provision in the study area. In the study, 255 housing units were selected out of the total 2,547 housing units in the developers' estates. Primary data was collected through questionnaires administration and secondary data were collected from related documents, publications, textbooks, journals, research works, seminars/conference papers and internet. The findings revealed that PHED have established their business with some years of involvement in housing provision in the study area. It was also discovered that the PHED delivery process is very costly because housing provision is capital-intensive and their delivery process could not take place without availability of capital resources. Their performances have been found out not to be effective as it is supposed to be due to certain factors which instigate their effective participation in housing delivery. It was also found out that despite the limited housing provision, the occupiers expressed satisfaction with the quality of the developed estates both in terms of structure and function.

KEYWORDS: Housing, Developers, Private Developers, Housing Development, Housing Delivery, Participation, Housing Provision.

Introduction
One of the major challenges facing cities in the world is the provision of adequate housing for its teeming urban population. Housing which is more than shelter touches human welfare and environment. Its importance cannot be underestimated because it is one of the

basic necessities of life. However despite this importance, provision of adequate housing especially in the urban areas has posed serious challenges to nations. Between 1950 and 1990, the world's urban population grew from 730 million to 2.3 billion. Between 1990 and 2010, it increased to 4.6billion. Between 2010 and 2025 it is likely to double again to cover 9.2billion, 93% of which is expected to occur in the developing world (UNHPF). At present about 43% of the world's population live in urban areas. In the developing world, it is about 73% and 34% in the less developed countries (Akujuru, 2004).

In Nigeria, provision of housing over the years has been bedeviled with inefficiency that has resulted in acute shortage of accommodation. Rapid growth of cities and the drift of people from rural areas to towns in search of greener pasture coupled with the shortage of manpower have dampened such efforts as have been made to solve the housing problems in the country. Then the structural adjustment policy that was formulated to tackle broad economic problems was drawn up with little regard to the adverse effects on the housing provision. Aina et al (1994) observed that economic and governance crisis was responsible for deficiencies in qualitative housing while UNDP (1997) noted that 70% of Nigerians are poor. Also, the Global Report on Human Settlements 1996 observed a remarkable decline in the supply of adequate housing and basic urban infrastructure.

From a shortage of only a few hundred units in the 60s, the deficiency has expanded into a frustrating size of between 8-10 million units while the annual housing requirement is given to be between 700,000-800,000 units in 2004 (Lich, 2004). The shortage of housing stock has resulted not only in high cost of both the rental and home ownership; but also many Nigerians especially in the urban centers have remained homeless (Agbola, 2003). The Federal Government's proposal with the sector cooperation to facilitate the construction annually of about 40,000 housing units as a way of solving the problem of housing shortage may at best be said to be a good starting point. It is rather not clear whether the annual housing units of 40,000 can off-set the 8-10 million housing units deficit plus the 700,000-800,000 annual housing requirement. It was further estimated that by the year 2020, unless otherwise happened, the housing shortage may be in the region of 75million (Agbola, 2003).

According to Sulyman (1997), more Nigerians are tenants or squatters in other people's houses than those who are owner- occupiers. Sulyman further stated that Nigerians in urban areas pay between 40-60% of their income on housing which is far more than United Nation's 20-30% standard.

The various efforts by the government to increase housing supply in Nigerian cities have had very limited impact and in some cases it was a failure. For example, Kwara State being one of the old nineteen states of the Federal Government was favoured with lion share of housing production in the various National Development Plans over the years. However, the ever- increasing influx of migrants into the state (being one of the gateways from the north to the west) and the expansion of the state seems to beat all demographic ingenuity

(Afolayan, 2017). The occupancy rate was given as 10 persons per room as opposed to 2 persons per room, which is the appropriate standard (Park 2017). The resultant effect of this overcrowding is the creation of slums, substandard housing, homelessness and hazardous environment.

The poor performance in housing provision according to Agbola (1998) was due to numerous socio-economic problems and political instability that disallowed sustainability. Hence, the dream of attaining full shelter for everyone by the government cannot be realized without the involvement of the private housing estate developers in the planning and execution of housing policies. This is one of the reasons why the national policy emphasizes the private sector as the major player in national housing provision. This new philosophy has led to the inauguration of the Real Estate Developers Association of Nigeria (REDAN) and the re-engineering of the Federal Mortgage Bank of Nigeria (FMBN) to the apex bank position on housing provision, among others.

The involvement of private estate developers in housing delivery is expected to reduce the increasingly difficult burden of government to meet the housing need of its citizens. The private estate developers are expected to mobilize private funds to enhance housing delivery in a more efficient manner. Therefore, private estate developers are expected to enhance efficiency, accountability and transparency in housing delivery; which should aid accessibility and affordability.

Statement of Research Problem

This paper seeks to examine the contribution of private real estate developers to housing provision in Kwara State.

The problem this study addresses is the seemingly ineffectiveness of the private sector to deliver housing to the citizen despite the federal government's mandate that places this responsibility to them.

Housing was given low priority which has led to non-performance of government agencies responsible for housing development. This has created a problem for the citizens of the state because it has led to scarcity in housing accommodation and increase in rent within the state thereby making Nigerians in urban areas and especially within the study area to pay between 40-60% of their income on housing which is far more than United Nation's 20-30% standard.

It is important to ascertain the contribution of the private sector in housing programs, and in doing so, identify factors that limit a stronger performance. Moreover, if problems associated to low performance of the private sector remain unsolved, housing demand in Kwara State would outstrip supply resulting into attendant problems or resort to substandard self-construction, overcrowding in existing housing and slum proliferation. This can only exacerbate the housing situation in Nigeria and Kwara state in particular. This study therefore intends to address this problem by examining the contribution of

private housing estate developers as well as the problems confronting them with a view to improving on their efficiency in housing provision.

Aim and Objectives of the Study

The aim of this study is to examine the contribution as well as the problems confronting private housing estate developers with a view to improving on their efficiency in housing provision in Kwara State.

In order to achieve this aim, the specific objectives of the study are to: -

i. Examine the relationship between the corporate profile of private housing estate developers in Kwara State and their performance.

ii. Assess the effectiveness of the delivery process of private housing estate developers or understand the delivery process commonly used by private housing estate developers in the study.

iii. Examine the satisfaction of occupiers of private housing estate in the study area.

iv. Examine the factors or government policies which influence the performance of the developers.

v. Develop a strategy for enhanced performance of the private housing estate developers in the study area.

Scope of the Study

The study area is also limited to Kwara State. This study specifically targets Private Housing Estate Developers that registered with the Federal Mortgage Bank of Nigeria. The reason for this choice is to improve accessibility for data collection as well as providing access to corporate organisations that are active in housing development.

Significance of the Study

This study will be beneficial to a wide range of stakeholders in Kwara State and Nigeria as a whole. The corporate profile of private housing estate developers in Kwara State vis a vis their performance will enable the private housing estate developers know how well or otherwise they have performed and also know areas where they need to put in more effort.

Secondly, understanding the delivery process commonly used by private housing estate developers will also make the stakeholders like governments, other cooperate organisations involved in housing development know the rigorous processes involved in housing development and the cost implication. This will make them prepare fully as to look elsewhere for fund to finance their project apart from their personal savings.

Understanding the satisfaction of occupiers of private housing estate will also enable private housing estate developers to maintain or improve on their performance and even

Government both at the state and the federal levels to be aware of the roles played so far by the private housing estate developers and their prevailing challenges and whether the initiative is worth improving upon or not.

The factors or government policies which influence the performance of the developers will enable government to know areas where they have to come in so as to assist the private housing estate developers in the delivery process.

Developing a strategy for enhanced performance of the private housing estate developers will make the private housing estate developers and other cooperate organisations involved in real estate development understand that there is a need to synergise with some professionals in the built environment, especially the Estate Surveyors and Valuers for effective housing estate management.

Conclusively, this study is expected to contribute to the existing body of knowledge in the area of private housing estate development

METHODOLOGY

In this research, the following methodologies were adopted:

1. Making reconnaissance survey of the study area. This is to give an overview of the areas to be covered.
2. Visit to head offices of the Private Housing Estate Developers within Kwara State.
3. Interviews conducted on some:

- Private developers and other relevant bodies in the study area.
- Occupies of the private housing estates in the study areas to gather relevant information.
- Government officials in relevant Ministries and Government Agencies in Kwara State.

4. Literature review of relevant books, journals, past thesis, past conference papers, etc. were also carried.

LITERATURE
Conceptualisation of the Key Terms.

The housing shortage in Nigeria today is estimated to be between 8-10 million units while the annual housing requirement is given to be between 700,000- 800,000 units (Lich 2004). The shortage of housing stock has resulted not only to high cost of both rental and home ownership but also leaving many Nigerians especially in the urban centers homeless. The federal government's recent proposal with the private sector co-operation to facilitate the construction annually of about 50,000 housing, units as a way to solving the problem of housing shortage, may at best be said to be a good starting point, but we are not sure whether the annual housing units of 50,000 can off-set the 8-10 million housing units deficit plus the 700,000-800,000 annual housing requirement (Iseh, 2014).

Concept of Housing.

Housing is more than provision of shelter; it covers the process of producing houses beginning from the acquisition of land for housing development to the sub-division of the layout in which reconnaissance is taken for all the ancillary services and community facilities. It also includes factor of housing production, like architecture design, finance material and labour among others (Efobi, 2002). In other words housing covers all social and accepted ways by which a man acquires a territory, the price he pays for it and manner in which the stock of the houses are maintained and enlarged.

Many scholars and key players in the housing sector within and across Nigeria have defined housing from various perspectives. Irrespective of the perspectives, the central focus of definition are the same, the centrality of their definition could be seen in the aspect of the fact that housing goes beyond being a brick and mortar, the presence of adequate infrastructure is also essential.

However, it is a fact that the performance of government through all the agencies in housing delivery has been critical from all indicators around us. No wonder why slogans like "housing for the poor" housing for all in year 2000 and others ceased to see the light of the day, even implementation of 1991 housing policy has been a mirage. It could be concluded that if not the remarkable effort of private sector, there could have been a great pandemonium between the rich and the poor, which could have led to a revolution in Nigeria, (Olatunbosun, 2003).

Concept of Housing Scheme in Nigeria.

Among the three necessities of life is housing, others being food and clothing. The need for shelter is as old as man himself. Studies have shown that right from the stone-age even up till today, the need of man for shelter cannot be over-emphasized. Man needs shelter at least to protect him from physical and weather elements such as sun, rain, wind and even from wild animals and also for other protective reasons.

Housing can be defined as a residential environment which man uses for shelter and the environs of the structure needed or designed for his physical and mental health as well as the social well-being (Omole 2005). In a civilized society, it is an inherent right of every family to live in a decent home at a reasonable cost.

Types of Housing.

Housing is of different types and it is classified in different ways depending on the part of the world one is in.

1. Housing types based on location or settings:
    i. Rural housing: These are usually characterized by simplicity in design, structure and use of local building materials (Agbola 2000).

    ii.   Urban housing: These are houses located in urban areas made with modern building materials (Olatunbosun 2004).

2. Housing types based on ownership structure:

    i.   Private individual housing: These are houses owned and managed by private individual in the society and this forms the larger bulk of housing stock in most economy (Omole 2005).

    ii.   Public housing: These are houses constructed and owned by public outfit such as government house, ministries, departments, and agencies. (Alabi 2002).

    iii.   Co-operative housing: Theses are houses owned and managed by co-operative and social societies. They are products of private co-operative efforts (Kuye 2002).

    iv.   Community housing: These are housing owned by traditional or local communities. Most of these houses are constructed through community efforts.

    v.   Condominium houses: These are the different individuals owned apartments with same title to the apartment and financial responsibilities of the house owners of such house have joint interest (Oluwande 2007).

3. Housing types based on structure, design and layout:

    i.   Single detached housing: These are houses which are completely independent of any structure. A garage may be located within the house or in the separate structure; detached houses are generally owners-occupier (Adetunji 2001).

    ii.   Semi-detached housing: These are houses of one or two families with a common wall between houses for economy purpose. They are usually characterized by independent entrance. It is similar to a single detached house but they are usually located on a small plot of land and the construction is cheaper (Omole 2001).

    iii.   Tenement housing: This is a type of building shared by multiple dwellers of single rooms typically sharing the same entrance and common facilities like toilets, bathroom and kitchen etc. (Wikipedia). Agbola (2004), also refers to this type of housing as multi row housing: These are rooming apartments found in many cities and rural settlements in Nigeria. They are narrow in shape to maximize the number of units in a row and are very cheap to build. They contain 8 to 14 rooms i.e. 4 or 7 on each side and separated by narrow lobby.

4. Housing types based on internal composition and height:

    i.   The bungalow housing: These are the types of houses which is all on one level or one floor. It is characterized by low laying structure on the ground without upper floor (Arugbola 2005).

    ii.   Low rise housing: These are single floor rooms' 2 to 3 storey building which may be detached or roomy apartment (Orukobi 2000).

    iii.   High-rise housing: These are normally constructed in built up area of urban center, e.g. CBD due to large shortage and cost of land and height ranging from 5 to 10 storeys or more. They are characterized by the use of elevator (lift) to ease up and town movement (Uche, 2007)

5. Housing types based on building materials:

    i.   Wooden housing: These are houses constructed with woods.

    ii.   Bricks houses: These are houses constructed with bricks.

    iii.   Block houses: These are houses constructed by hollow sandcrete block.

    vi.   Mud houses: These are houses constructed with muds. (Alabi 2002).

Private Sector Participation in Housing Delivery: Issues and Challenges.

Nigeria does not lack housing policies or programs, yet the nation's housing problems remain unsolved. These are manifested in acute housing shortage, overcrowding and unhealthy living condition, exorbitant rent relative to income and the exploitative tendency of shylock landlords; the high rate of homelessness especially in urban areas and high rate of substandard housing both in the rural area and in the urban fringes. (Agbola & Olatubara, 2003) further stated that if housing units are to be provided in large quantities in Nigeria to cater for the different tastes across the socio-economic spectrum, then there must be an understanding of the private sector and an enduring relationship between the actors within the sector creditably in the production of houses. This is why most countries have used the private sector creditably in the production of houses. Some, like El Salvador, established private foundation as the executing agency for the nation's housing programs. Others like the Philippines set aside a special purpose fund to promote private developers' interest in the sites and services programs. Similarly, Korea's rapid economic growth since the 1960s has been government- directed but in which the principal engine has been the private sector (Westphal, 1981). Nigeria cannot be an exemption. If the many problems of land, finance, materials and construction industry that impaired the capacity of the private sector could be ameliorated or removed and strategies aimed at actively involving the participation of the Nigeria private sector are evolved and pursued with determined vigor, then the many housing problems of the country would have been significantly addressed.

Housing Delivery Process

This involve the process that brings about the construction of new housing units or the process of improving or upgrading the state of the existing stock of housing as well as the

process of distributing the available housing stock to the consumers through the housing market. Agbola (1998) stated that "Housing involves series of processes by which housing resources such as land, labour, finance and building materials are combined to produce new housing. It involves also the upgrading of the existing units as well as the distribution of both the new and existing housing demanders". Furthermore, housing delivery system encompasses the process that allocated housing units to households in a particular country and that this system is stimulated and sustained by the demand and supply mechanism. Summarily, the housing delivery processes identified in this study were those tasks that involved:-

1. Identification of site with the potential for profitable development.
2. Acquisition of the site and payment of compensation.
3. Seeking planning permission and other statutory approval.
4. Raising finance to pay for the site, construction and other development cost.
5. Appointment of specialists (i.e. professionals involved in building activities) and
6. Letting/sales of completed development.

The Private Sector and Housing Delivery in Kwara State.
As being aware of the challenges posed by housing, in 2003 the Bukola Saraki-led government has pledged to increase the state's housing stock. To this end, the government has considered proposals from about 50 private developers out which 16 have been approved by the state government. The government also pledged to create an easy mortgage facilities to assist prospective house owners achieve their heart desires. The state ministry of housing said the government is determined to ensure that the housing sector becomes more vibrant by redefining the role of the government in the delivery process and enhancing the role of private sector players.

The state ministry of housing has re-evaluated the operational environment with the aim of removing bottleneck thereby strengthening private sector participation. In addition to facilitating an enabling environment conducive for business to thrive, the state government said it will make equity contribution in terms of providing land for genuine investors. The ministry of housing has developed a template for appraising interested private developers as well as facilitating necessary sign-off from relevant ministries and government agencies on behalf of the developers. The state government gives land as equity, provides subsidy on government fees and stamp duty and building plan approval and occasional subsidies on cost of infrastructure.

The provision of infrastructure is treated as a social responsibility. The past administration considered proposals from over 50 developers out of which 16 were approved. It is also worthy of note that the public private partnership in the state is already yielding fruit as 9 out of the 16 approved developers have recently been re-assessed by the ministry of housing and are already registered with Federal Mortgage Bank of Nigeria. It must

however, be re-emphasized here also that the ministry of housing is determined more than ever to collaborate and work with genuine investors within and beyond the state to ensure that mass housing is delivered to the people of Kwara State.

Findings

Based on the data collected and analysed in this chapter, the following findings were here under stated.

A. Profile of the (PHED)

There are many Private Housing Estate Developers in Kwara State out of which only nine (9) studied are registered with Federal Mortgage Bank of Nigeria. Failure of public sector in its direct housing construction policies has paved way for the private sector involvement in housing delivery especially in the study area. The studied PHED have established their business with some years of involvement in housing provision. This explains the fact that without the presence of the PHED in the study area, the issue of housing shortage would have been more pronounced because more people would have remained homeless.

B. Delivery Process of the PHED

Housing delivery process implies the procedure or steps taken to bring housing units to would-be users or occupiers. We found that the PHED process also adopted the same delivery process found in the literature. The adopted steps are:

 i. Site identification and its acquisition

 ii. Seeking planning permission (statutory approvals)

 iii. Sourcing finance (for site acquisition, compensation, approval/building permit and building construction)

 iv. Appointment of building team to undertake design, costing, supervision and management of the project works.

 v. Letting/Sale of completed project

The above steps were found to be very costly because housing provision is a capital-intensive venture and none of the steps itemized above could take place without availability of capital resources. The private sector has accounted for about 80% of Nigerian's housing supply but current socio-economic realities present a disincentive to housing investment due to the increasing cost of construction and a decreasing spendable income. This is as a result of the cumbersome housing delivery process, which for every step requires high capital from the inception of site acquisition to its disposal or letting stage at the end.

C. Factors Influencing PHED Performance

The Private Housing Estate Developers performances have not been effective as it is supposed to be. This was due to certain factors, which instigate their effective participation in housing delivery in Nigeria. The major factors found were:

- ➢ Accessibility to financial facilities and to land
- ➢ Hindrances from government through their policies
- ➢ Infrastructural provision
- ➢ Both cost of labour and building materials
- ➢ Inflation during life of a project
- ➢ Government agents, among others.

Those listed factors have significantly limited the PHED performances thereby resulting to provision of few houses in the study area. Access to residential plot is still a hindrance to housing development in Kwara State, particularly to low income households and PHED. The cost of building materials and labour is capable of hindering PHED housing. Housing specifications in the State cannot be said to be consistent with the income profile of majority of residents of the study area. Although the Federal Mortgage Bank of Nigeria is to supposedly enable the PHED to have access to finance for the purpose of developing their estates, it has so far not promoted housing provision. This is as a result that accessibility to financial facilities though, occupies the highest positions, other factors need to complement it.

D. Response of the Occupiers of PHED Estates

The study was conducted on educated and matured people in the community most of whom are active working population. Thus, the study was perhaps carried out on those that were believed to know the importance of housing. Several occupiers' status was observed together with their family sizes thus planning for several categories of people is a probable solution to their housing problem. In the same sense, the occupier is a very important role player in the development process and their requirements should be researched right at the very beginning of the process to ensure that the right buildings are constructed for the right segment of buyers at prices that are within their economic capability. Thus housing demand is a reflection of man's status and flits probably influence the performance of the PHED in either ways.

In view of the above findings, one will notice that the various existing policies are to be addressed by the government e.g., land acquisition, source of funding, cost of building materials, various regulatory policies etc. Without this, the performance of the PHED shall be facing set back and insufficient housing supply shall continue to be witnessed at the study area. Also since housing is more than the physical building, the availability of service improves livability of such residential areas while its unavailability will make such an area unlivable and unattractive.

Conclusion

From our findings in this research work, it is accepted that housing remains a critical, personal and governmental problem in virtually developed and developing countries. For

example in Nigeria, the unimpressive performance of the public provider-oriented housing strategies between 1970s and to recent years and the fact that the private sector performance in housing delivery had been given little or no attention in the literature, this study endeavours to fill this gap by assessing the performance of the private housing estate developers in housing provision in Kwara state.

Based upon the discussions in the previous chapters and the fact that government policy admits that private housing estate developers needs to be mobilized, organized, encouraged and motivated; other factors that have been identified as militating against effective participation of the factor in housing delivery should be looked into. The government should ensure its policy that emphasises the private sector as a major player in national housing provision (i.e. the inauguration of the Real Estate Developers Association of Nigeria and the re-engineering of the Federal Mortgage Bank of Nigeria to the apex Bank position on housing provision). In view of the above, it will be agreed that the PHED cannot solely satisfy all the housing need in Nigeria hence the government has two fold functions; it must act to facilitate the efficient operation of the private sectors and to act as a catalyst in housing delivery.

Recommendations

In view of the failure of many housing policies towards solving the housing shortages in Nigeria and in the light of the policy implications highlighted in this research cum the problems associated with the private housing estate developers, it is imperative that for any meaningful progress to be made in housing provision in Kwara state, the following specific recommendations are suggested.

i.   Government should endeavour to work more closely with the private housing estate developers, encourage them for better effectiveness through giving incentive such as land allocation when demanded for and create a conducive atmosphere for investors assuring security of tenure over land and allowing a free flow of land in the market. The above fact is recommended because the magnitude of real estate deficit is so great that the resources from the government alone cannot solve real estate finance and development problems.

ii.   Also government should encourage and foster the establishment of financial institutions to offer credit for housing development and a large portion of the national wealth is made available for housing sector and this can be done by making lending sufficiently attractive to the investors. The government should encourage the banks to determine competitive lending rates for housing and by controlling rents so as to permit private housing estate developers into borrowing to build to earn sufficient income to repay their loans. All the existing Private Mortgage Institutions should merge to form one or two or few formidable

companies with a strong capital base. The question of guaranteeing security of title to land for developers is also fundamental to this issue.

iii. On the aspect of cost reduction, government should encourage the local production of building materials within the country and discourage its importation. This effort by the government shall increase the production of cheap building materials. Other issues connected with this cost reduction realization are the provision of serviced land, more realistic planning approaches that will maximize the use of available land resources and also reduce the land input per dwelling unit.

iv. There is the need for the government to appoint a committee that will review the Land Use Act and make useful recommendation on how to make the provision more effective and to facilitate easy acquisition of land, especially by private housing estate developers. Above is relevant because the system and processes for securing title to land are unsatisfactory and cumbersome. Developers that are interested in housing delivery should be exempted from capital tax for the first few years (say five years), to allow them invest more in housing development.

v. Every state government should be encouraged to establish a mortgage institution, which should work closely with the private housing estate developers for effective delivery of affordable houses to the citizen of their states. In addition to this, the Federal Mortgage Bank of Nigeria should step up their enlightenment campaign to make contributors more aware of their rights under the scheme and encourage them by ensuring that loan applications are promptly appraised and disbursed. Furthermore, the private housing estate developers should be fully involved towards the realisation of an ending National Housing Finance and production system

vi. To enhance production of more housing, government should make housing policy a part of urban and regional planning policy by reducing its cost through encouraging development of smaller and medium-sizes cities. In these smaller cities, land costs would be less significant and hence would lower the overall costs of housing. Such housing policy should be more than creation of new housing units but part of a policy of environmental improvement i.e. solid waste collection, sewage disposal, electricity and water supply. Hence, site and services scheme must be encouraged.

vii. Since government too has a role to play in the housing delivery by the private housing estate developers, such as the registration, provision of infrastructure facilities, I am also recommending that there should be interaction between the private and public sectors. Qualified professionals should be involved in housing delivery process to avoid building slum. This is very necessary in the new dispensation because the role of Estate Surveyors and Valuers in the investment decision-making process will guide the private housing estate developers to

identify better investments and reduce the risks of failure. Remember that the era of gambling or speculation is over and such investment should be soundly based on the available resources for effective utilization of the epoch period of economic malaise.

viii. On general items: The government should introduce and establish:
   a. Occupants' participation in performance based policy such as preparation and evaluation of planning policy,
   b. Assessment survey of occupants' satisfaction,
   c. Building maintenance manuals to occupants,
   d. Encouraging our professionals in the building industry to develop innovative design and process to be spotlighted and tested,
   e. Housing Loan Board in each state. With this, the end user of housing can easily be reached,
   f. Programme to encourage formation and legitimization of Cooperative Housing Societies with ability to act as developer,
   g. Facilitate growth in housing production through improvement in production capacity and efficiency of the private housing estate developers. This could be aided by establishing extended university-based building research programme to explore and document practical ways of improving labour and materials productivity in housing development and finally more indigenous housing designs, which utilize local building materials, mesh with cultural traditions and adhere to the environmental restraints of tropical climate.

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