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LIPOLYTIC ACTIVITIES OF ISOLATED MOULDS ON PALM OIL DURING STORAGE

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ABSTRACT
Palm oil samples from a mechanized oil processing factory (NIFOR) and a locally manufacturing depot at Aisegba – Ekiti, Ekiti State were investigated and the lipolytic activities of the moulds isolated were studied. Aspergillus flavus , A. fumigatus, A. niger and Rhizopus stolonifer were isolated from both locally and mechanically produced palm oil. A. flavus is more lipolytic than any other fungi with respect to the fatty acid content, peroxide value and moisture content. The ffa for locally produced oil ranged from 11.50 to 21.00 from initial value of 4.00%.The mechanically produced oil increased from1.0% to between 1.7 to 4.00 after 14 days of storage. The peroxide values for both the locally and mechanically produced oil increased from initial values of 5.0 $M_{Eq}Kg$ to between 12.96 and 19 20 fort locally produced oil and between 4.00 and 6.30 for mechanically produced oil after 56 days in storage.

Keywords: *Palm oil, rancidity, peroxide value, fungi, inoculation, biodeterioration*

INTRODUCTION

Palm oil is used worldwide as cooking oil, medical and cosmetic products. It is reddish in colour, the colour being due to its high of carotene. Carotene is the precoursor of vitamin A.

Composition of palm, oil fatty acid are myristic (0.5 – 2.5%), palmitic (36 – 42%) stearic (1 – 6%), oleic (30 – 50%), linolenic (2 – 14%) and linolenic (0.1 – 0.4%). Edible oil from plant sources are of important interest in various food and application industries. They provide characteristics flavour and textures to food as integral diet component (Odoemelam, 2005) and can also serve as oleochemicals (Movrison, et al., 1995). Oleochemical are completely biodegradable. Vegetable oil had made an important contribution to the diet in many countries, serving as a good source of protein, lipid and fatty acid for human nutrition including the repair of worn out tissues, new cells formation as well as a useful source of energy (Grosso et al., 1999). Oil quanlity and its stability are therefore very important for the consumers and application industries (Jambunathan et al., 1993). The traditional method of oil extraction in part of West Africa is to cook the flesh pulp with a large volume of water, the oil floats on the surface and is skimmed off.

However technology of palm oil production has improved and new technology and innovations are being introduced yearly. The quality of mechanically processed palm oil was compared with traditionally processed ones by Denenu and Eze (1985). They reported that mechanically processed oil had relatively low free fatty acid content of 3 – 5%, moisture content 0.09 – 1.70% and impurities 0.46 – 2.26%. The traditionally processed oil samples were characterized by high free fatty acid greater than 18%, impurities above 5% and moisture content above 3%. The important quality parameters of palm oil include free fatty acid, moisture content, impurities, peroxide value, rancidity and bleachability (Denenu and Eze 1983).

Oils in general are known to be susceptible to microbial attack. The composition of the various oils determines the extent and types of organisms likely to thrive in them (Okpokwasili and Williams, 1991). Palm oil is known to support the growth of fungi and bacteria especially when it contains moisture. Their lipolytic enzymes are so active that even under unfavourable conditions palm oil is seldom produced with free fatty acid content (FFA) of less than 2% and under favourable conditions of processing, the FFA content of this oil reaches 20% and higher. When the fruit is bruised, lipolytic action occurs and a near maximum FFA (8-40%) is reached within 40mintes. The FFA of un-bruised fruits may increase only 0.2% or less in the course of 4 days. The smell, taste, colour, texture, and chemical composition of the food may be sufficiently altered by the micro organisms growing on it which could make the food inedible (Williams and Shaw, 1992). The moisture content in food, its location, and availability is one of the most important factors influencing

microbial growth. One of the major changes taking place in lipids is generally referred to as rancidity.

Moulds are known to cause biochemical changes in oils. These changes can take the form of decrease in bleachability or increase in free fatty acid. The moulds which are capable of increasing the free fatty acid contents of oils are referred to as lipolytic moulds and they contain enzymes known as lipases (Price and Steven, 1990). Moulds constitute the largest groups of spoilage micro organisms in all varieties of food and materials (Abba-kareem et al, 1990). This study is aimed at examining the biodeteriogenic effects of isolated moulds from locally and mechanically produced palm oil.

MATERIALS AND METHODS

Freshly milled samples of palm oil were collected from Nigerian Institute for Oil palm Research (NIFOR) Benin, Edo – State and a local manufacturing depot at Aisegba – Ekiti, Ekiti State. The two samples were collected into plastic containers and closed instantly to prevent contamination. The samples were stored at 28±2°C and relative humidity of 76 ± 5%.

Microbiological Analysis

One milliliter of oil sample was aseptically withdrawn from each container and mixed with nine milliliter of sterol peptone water medium. The mixture was vigorously shaken to dislodge the microbial propagates from the palm oil samples into the peptone water medium. One milliliter of the aqueous fraction was aseptically transferred into sterile petridish after which molten sterile Potato Dexrose Agar was aseptically poured into the plates. Sterile streptomycin 50µg/ml was added to the agar to suppress bacteria growth. The plates were gently rocked on the bench to allow proper mixing of the content. The plates were allowed to set and incubated at 28 ± 2°C for five days. The moulds were allowed to grow and were sub-cultured unto fresh sterile potato dextrose agar medium until pure cultures were obtained.

Identification of Fungi

A small piece of mycelium free of medium was transferred using inoculating needle on to a glass slide containing a drop of cotton built-in-lactophenol. The mycelium was spread properly with another sterile needle. The preparation was covered with a coverslip and observed under the microscope using (X10) and later high power (X40) objectives. Details of the hyphae, spore colouration, shape and surface marking were studied. The types of fungi present were finally identified by reference to Barnett (1960).

Inoculation of Samples

Sixty milliliters of hot palm oil was measured aseptically into the sterile bottles. The samples were further sterilized in an oven at 160°C for fifteen minutes.
About 200 spores of the following isolated and identified fungi:- Aspergillus

flavus, A. niger, A. fumigatus and Rhizopus stolonifer were inoculated into 60mls sterilized palm oil and incubated at 30°C. The effects of the inoculated moulds on the chemical attributes of palm oil sample were determined at fourteen, twenty eight, and fifty six day's interval respectively.

Determination of free fatty acid content

The free fatty acid content of fat/oil is the number of milligrammes of KOH required to neutralize 1g of FFA present in ft/oil sample. The free fatty acid contents of the palm oil types/samples were determined according to the method described by reason 1976. The acid value is the number of mg of KOH necessary to neutralize the free acid in 1g of sample. The acid value is given by T-B X 5.61/W0.1M KOH contains 5.66mg/ml or 5.6/1 where T= Titre value of the sample; B = Titre value of a blank. The blank was provided as a control by titrating 2.5ml of the neutral alcohol without sample. The free fatty acid (FFA) is normally determined as oleic acid where by the acid value = 2x FFA.

NaOH may be used and a generalized formula may be used (for palm oil fractions): 25.6 x MNaOH X v/w WHERE v = Volume of NaOH solution used in ml; W= weight of sample.

Determination of peroxide value

The peroxide value was determined by the method described by Pearson 1976 as the mg weight of iodine, which is formed by 1kg of fat/oil sample. When potassium iodine was subjected to the oxidation effect of peroxide forming iodine at room temperature, the iodine, which was liberated, was titrated against standard sodium thiosulphate solution (0.02N Na_2 S_2O_3). The peroxide value was reported as the volume of 0.02N $Na_2S_2O_3$ used in the titration

Rancidity test on stored samples

The test for rancidity of oil was carried out according to Pearson (1981). Ten milliliters of oil sample was poured into a dry conical flask. Then ten milliliters of 0.1 percentage phloroglucinol solution in ether were added and the mixture was shaken vigorously to mix the content properly. Ten milliliters of concentrated hydrochloric acid were added and was again shaken vigorously for twenty seconds, until pink colour persistently appeared.

The samples that changed to pink at exactly twenty seconds were termed rancid.

Results and Discussion

The findings contained in this report showed that Aspergillus flavus was more lipolytic than other fungi. From figure 1 the locally produced palm oil with initial 4.00% free fatty acid content increased to 16.00, 21.00, 14.00 and 11.50 percentages with Aspergillus niger, A. flavus, A. fumigatus and Rhizopus stolonifer contaminated oil respectively after 14 days. This order of increase was maintained till the last day of storage. The mechanically produced palm oil with initial value of 1.00% FFA increased to 2.00, 3.10, 4.00 and 1.7% after inoculating with Aspergillus fumigatus, A. niger, A. flavus and Rhizopus stolonifer respectively after 14 days of storage.

The locally produced palm oil showed higher initial free fatty acid percentage of 4.00 which eventually reflected in more free fatty acid formation with length of incubation. Post-processing local method of oil preparation increase the free fatty acid in most cases as a result of microbial activities that infect the bruised palm oil fruit and this occurs in the presence of enough moisture and dirt content which allowed micro organisms to multiply freely. The free fatty acid of palm oil may be formed by the action of lipolytic enzymes.

The peroxide values of 5.00Meqkg in locally produced palm oil increased to 16.80, 19.20, 12.96 and 14.40 Meqkg for Aspergillus niger, A. flavus, Rhizopus stolonifer and Aspergillus fumigatus respectively for 56 days in storage as shown in figure 2. The mechanically produced palm oil had its peroxide values increased from initial value of 3.25Meqkg to 5.90, 6.30, 5.10 and 4.00 for same organisms with locally produced palm oil for 56 days in storage.

In both types of oil, it was generally noticed that the peroxide values increased with the increase periods of incubation. During storage, peroxide formation is slow at first during induction period, which may vary from weeks to several months according to the particular oil or fat and the temperature (Yeah and Chooi 1977). The increase in the peroxide value may have been due to the increase in the oxidation of unsaturated fatty acid that form peroxide and this frequently leads to oxidative rancidity.

All the moulds species inoculated into mechanically produced palm oil did not make the oil rancid at the end of 56 days of incubation. The reason may be due to low peroxide value development because according to Mehlenbacher (1960), oil begins to show incipient rancidity when peroxide value ranges between 15 – 20 Meqkg. In locally produced palm oil, Rhizopus stolonifer and Aspergillus fumigatus did not make the oil rancid even at 56 days incubation periods while palm oil inoculated with both Aspergillus niger and A. flavus showed little rancidity and this showed that these two fungi were more biologically active in palm oil than the other inoculated mould species.

The initial moisture content of locally produced palm oil before inoculation was 4.20% and with inoculated moulds the value increased to 4.80, 5.10, 4.90 and 4.20 for A. niger, A.flavus A.fumigatus and Rhizopus stolonifer respectively for incubation period of 56 days. For mechanically produced palm oil, the initial content of 0.09 increased to 0.30, 0.50, 0.90 and 0.29% for A. fumigatus, A. niger and A flavus and Rhizopus stolonifer after inoculation and incubated at 30°C for 56 days as shown in figure 3.

Olie and Tjeng (1994) recommended 0.08 – 1.00% moisture content for safe storage. The initial high moisture content of locally produced palm oil was as a result of the processing methods involved which include pounding in mortal and then put in a drum where large volume of water was always used for cooking before oil content that float are skimmed off.

In conclusion, mechanically processed palm oils are more stable to oxidative rancidity that are caused by moulds because of its low moisture content and the processing is done under hygienic condition contrary to locally produced palm oil.

TABLE 1: Result of rancidity test on locally and mechanically produced palm oil after inoculation and incubation at 30°C

Mould species	Period of incubation (days)			
	14	28	56	
Control	-ve	-ve	-ve	
Aspergillus niger (LPPO)	-ve	-ve	+ve	
Aspergillus niger (MPPO)	-ve	-ve	-ve	
Aspergillus flavus (LPPO)	-ve	-ve	+ve	
Aspergillus flavus (MPPO)	-ve	-ve	-ve	
Rhizopus stolonifer(LPPO)	-ve	-ve	-ve	
Rhizopus stolonifer(MPPO)		- ve	-ve	-ve
Aspergillus fumigatus (LPPO)	-ve	-ve	-ve	
Aspergillus fumigatus (MPPO)	-ve	-ve	-ve	

LPPO= Locally produced palm oil
MPPO= Mechanically produced palm oil
-ve= Negative (Not rancid)
+ve= Positive (Rancid)

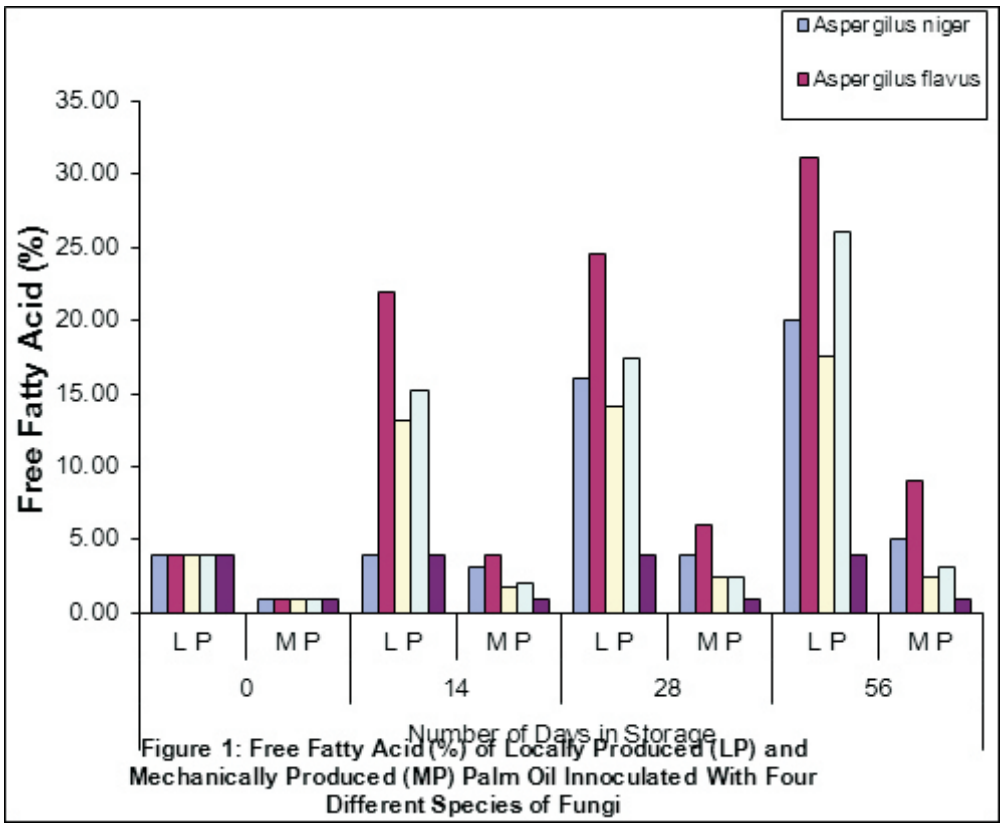

Figure 1: Free Fatty Acid (%) of Locally Produced (LP) and Mechanically Produced (MP) Palm Oil Innoculated With Four Different Species of Fungi

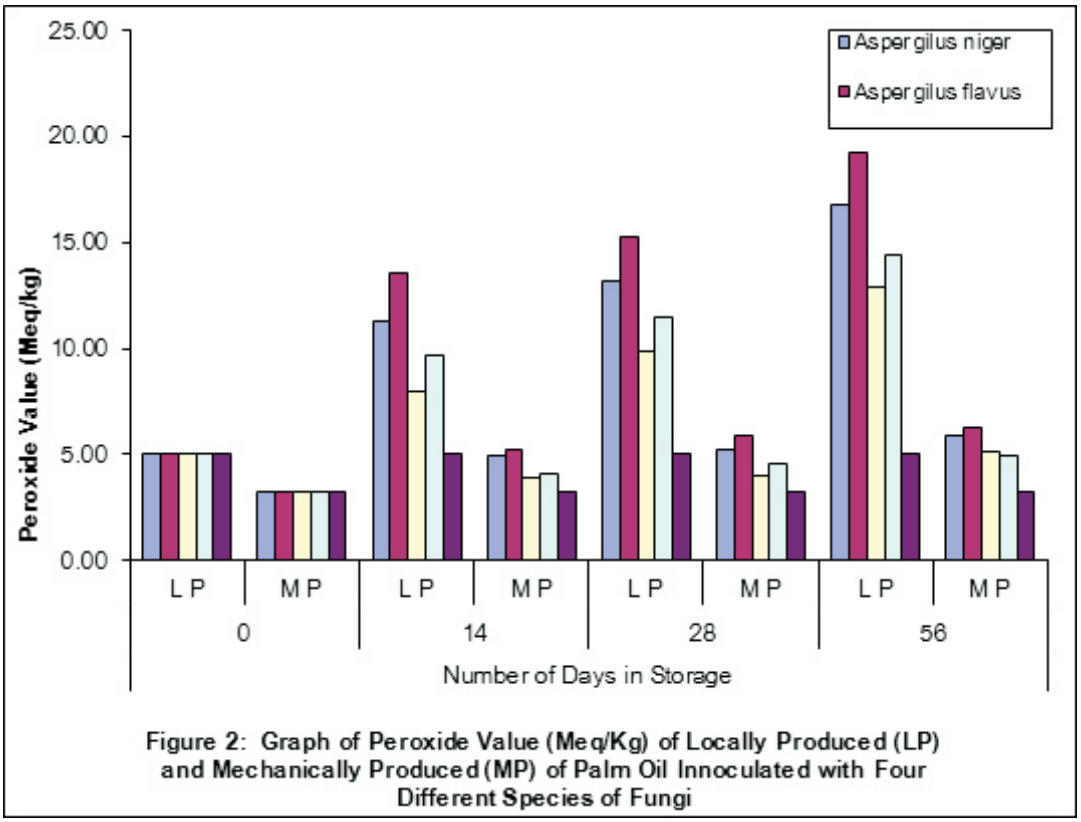

Figure 2: Graph of Peroxide Value (Meq/Kg) of Locally Produced (LP) and Mechanically Produced (MP) of Palm Oil Innoculated with Four Different Species of Fungi

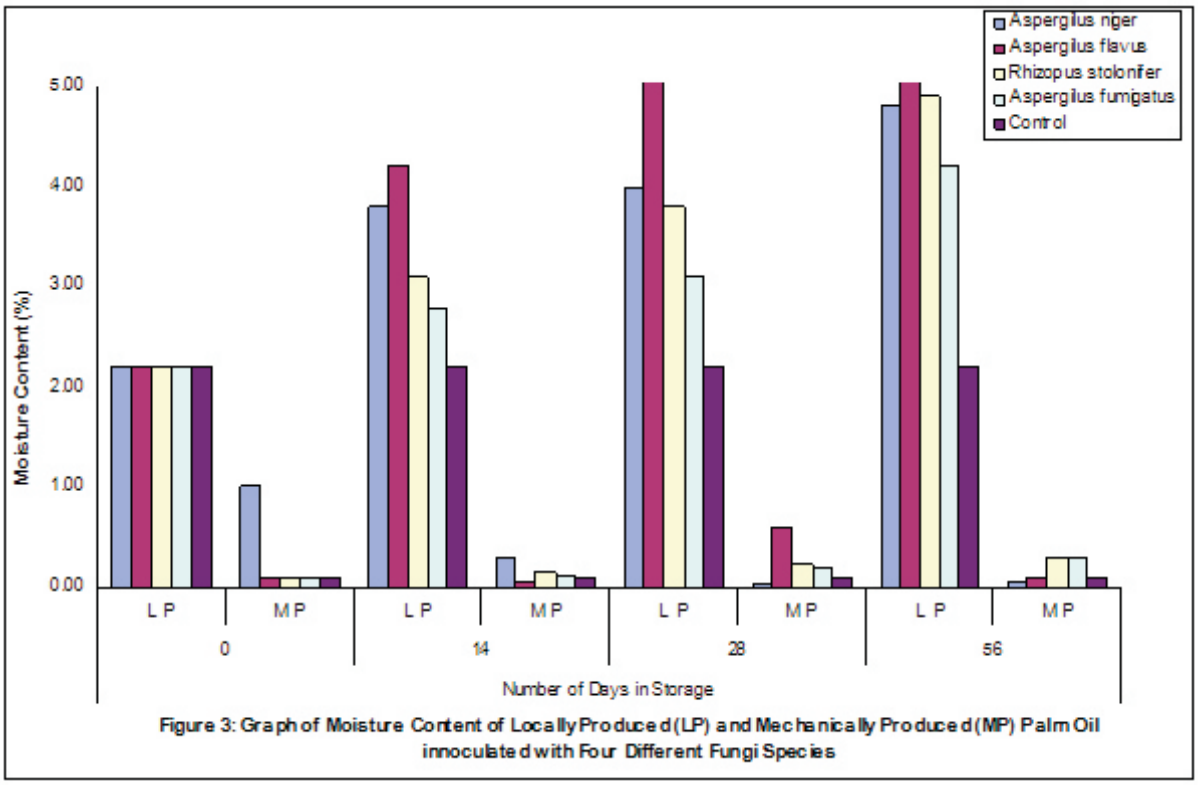

Figure 3: Graph of Moisture Content of Locally Produced (LP) and Mechanically Produced (MP) Palm Oil innoculated with Four Different Fungi Species

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ASSESSMENT OF ENVIRONMENTAL SUSTAINABILITY USING SEDIMENT ORGANIC CARBON AND PERSISTENT, BIOACCUMULATIVE AND TOXIC ORGANIC MICROPOLLUTANTS (PBTs) CONTENTS OF LAGOS LAGOON

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ABSTRACT

An important way of evaluating the trends in nonpolar organic compounds, such as Persistent, Bioaccumulative, and Toxic (PBT) organic micropollutants is the assessment of the effect of organic carbon on their concentrations. Being the only sorptive phase present in sediment, organic carbon is used in the traditional form of the Biota-Sediment Accumulation Factor (BSAF) model for chemical bioavailability study. In this study, total organic carbon contents, along with the PBT concentrations of the Lagos lagoon sediments, were spatially and temporally assessed. A steady increase in organic carbon content, with corresponding increase in sum PBTs, such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides (OCs), was observed in the lagoon sediments in Feb., 2004, Dec., 2006, and May, 2007. Very positive correlations ($R^2=1$) were obtained. The sum of the % organic carbon contents of the sediments in those three years were 61.81, 82.105, and 85.31%, and the sum of the mean PBTs were 316.34, 383.41, and 705.17ng/g respectively. High organic carbon content and PBT levels were obtained at locations close to urbanized areas, and vice versa. Low PBT levels were obtained from sandy sediments as their organic carbon contents were equally low. Organic carbon normalized concentrations revealed salient peaks of PAHs at the Mouth of Ogun River, a fluvial source; highest peaks of PCBs at Iddo, a location close to a disused power station; and highest peaks of OCs at Mouth of Ogun River, Iddo (a highly crowded area) and Okobaba (a slum settlement). Organic carbon fraction of Lagos lagoon sediment greatly influenced the partitioning capacity of the PBTs. This could result in reduced the quality of marine life, loss of biodiversity, negative human health effects and other conditions that could hinder sustainable development.

Keywords: Environmental sustainability, Organic carbon, Organic micropollutants, Sediments, Lagos lagoon

INTRODUCTION

Most of the wastes (say about 80%) generated in Lagos are mainly organic. These wastes are either dumped directly into the lagoon, or water channels, or openly incinerated at different locations without control. One of such locations is a sampling site (Okobaba) in this study, where there is an incessant burning of sawdust and other domestic wastes just at the lagoon shore.

Lagos lagoon is also a recipient of urban wastewater which contains large quantities of nutrients (phosphorous and nitrogen) and oxygen demanding substances, i.e. organic matter. In the water column most PBTs tend to absorb to particles and to be deposited to the underlying sediments. In addition to sorption to sediment, PBTs in aquatic environments bind to dissolved humic material. Sediments represent an association between mineral particles, organic matter, and resident organisms. It was reported by Gobas et al (2004) that a direct relationship exists between the hydrophobicity of PBTs and the affinity for binding to dissolved humic material.

Sediment organic carbon contents vary with variation in sediment type, and subsequently influence contaminants distribution pattern and bioavailability (Pazdro, 2002 & Leeuwen et al., 2007). The typical approach of adjusting for variations in organic carbon in sediment samples therefore is to normalize concentrations with organic carbon. Organic carbon partition coefficient K_P of organic chemicals is often proportional to the organic matter content of solid phase. For comparative reasons, the solids-water partition coefficient (K_P) is often adjusted with respect to organic carbon content (f_{OC} = %OC/100) and an organic carbon partition coefficient is thus defined:

$K_P = K_{OC} * f_{OC} = C_s/C_w$ (Leeuwen et al., 2007).

Where K_{OC} is the OC-normalized K_P, and C_s and C_w are the chemical concentrations in sediment and water respectively. The standard value for f_{OC} in sediment is set at 0.05. For neutral organic chemicals K_{OC} is often estimated from K_{OW} using $\text{Log } K_{OC} = \text{Log } K_{OW} - 0.21$ (Schorer, 1997).
Typical values of Organic carbon content (OC) in sediment are in the range of 4 to 6%. (Schorer, 1997).

Total organic carbon was determined by Harwell et al (2003) in 21 surficial sediment samples from Lake Worth Sediment, Fort Worth, Texas and found to range from 0.91 to 2.85 percent by weight with a median of 2.38 percent. Two predominately sand samples had 0.91 and 1.09 percent total organic carbon while the remaining 19 samples were relatively homogeneous with respect to total organic carbon, ranging from 2.24 to 2.85 percent.
PBTs that are bound to sediment or particulate matter in the water column can exhibit slow desorption rates, rendering them essentially unavailable to aquatic biota. As noted by Thorsen, (2003), BSAF values in *E. complanata for petrogenic*

PAHs were less than one for pyrogenic PAHs (PAHs of combustion origin). This signifies that the organism metabolized the PAHs and therefore they were not bioavailable.

PCBs have a high affinity for suspended solids, especially those higher in organic carbon. This is supported by their low water solubility and high octanol/water partition coefficients (calculated Log Kow values range from 3.76 for biphenyl to 8.26 for decachlorobiphenyl) (CCME, 1992).

Lagos lagoon, the study area, is impacted by industrial, agricultural, municipal and oil related activities that keep increasing with the ever growing population of Lagos, the most highly populated city in the country, presently harboring not less than 15% of the total population (100 million) and about 80-85% of the industries in Nigeria. Sediments from the lagoon receive inputs of organic material from a wide variety of sources. Web (1958) observed that there is a high variation in sediment quality as a result of the variations in Lagos lagoon sediment sources, (Fig. 2). According to Agyeman, et al., (2005), environmental sustainability focuses on the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems. This study therefore seeks to assess as the spatial and temporal variability of PBT contents in relationship with the organic carbon contents of surficial sediment of the lagoon and also assess the level of environmental sustainability in relationship with sediment organic carbon of Lagos lagoon.

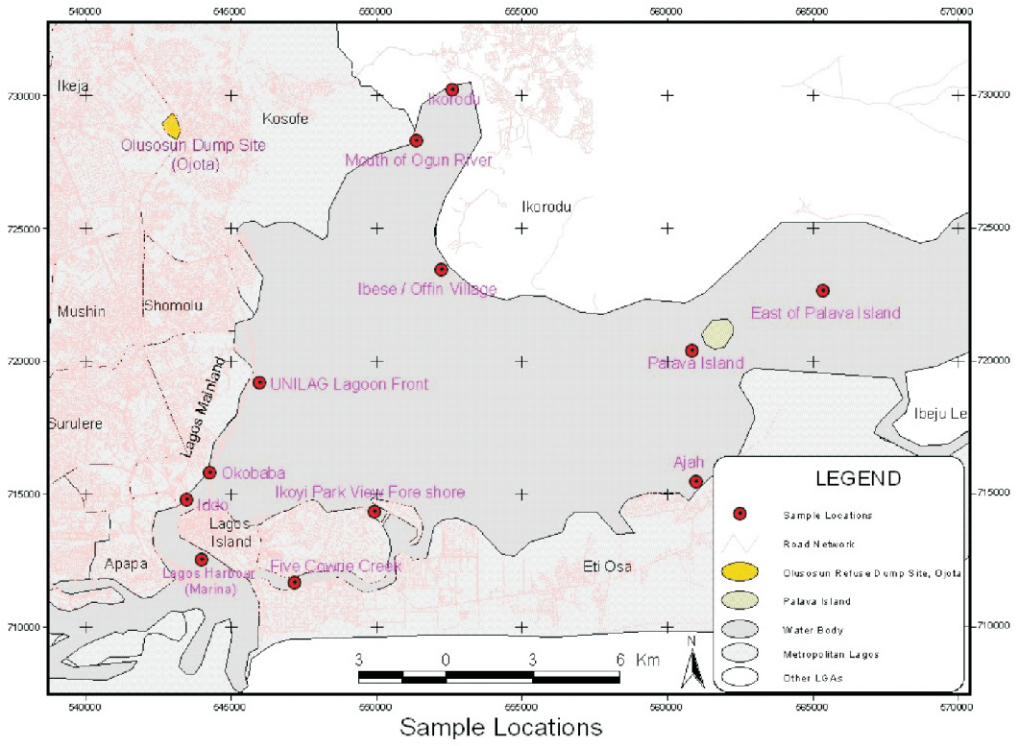

Fig. 1: Map of Lagos lagoon showing sample locations and a dumpsite

Fig. 2: Sediment variation at different locations of the Lagos lagoon (from top row left are sediment samples from locations A, A2, A3, B, B2 and B3; from bottom row left are C, C2, D, D2, E, and E2 samples)

Table 1: Sample locations on the Lagos lagoon

LOCATIONS	DESCRIPTION	COORDINATES
A	Iddo	N6°28" 2.4', E3° 23" 2.9'
A2	Five cowrie creek	N6°26" 2.7.7', E3° 24" 16.3'
A3	Lagos harbour at Marina	N6°26" 48.9', E3° 23" 26.6'
B	University of Lagos lagoon front	N6°31" 7.5', E3° 24" 11.9'
B2	Ibesse and Offin villages	N6°33" 5', E3° 28" 17.2'
B3	Okobaba	N6°28" 48', E3° 23" 31.3'
C	Ikoyi park view fore shore	N6°27" 30.2', E3° 27" 8.9'
C2	Ajah	N6°28" 24.3', E3° 33" 29.2'
D	Mouth of Ogun river near Ikorodu	N6°36" 13.9', E3° 28" 35.8'
D2	Ikoordu	N6°36" 21.3', E3° 28" 47.9'
E	Palava Island	N6°30" 47.4', E3° 33" 41.4'
E2	East of Palava Island	N6°31" 38.5', E3° 33" 41.9'

Experimental

Sampling and sample preparation

Sampling locations (Fig. 1 & table 1) were selected based on accessibility, and areas close to or far from high municipal, shipping, and industrial activities. Sampling was carried out on 12 selected locations between February 2004 and May 2007.

Sediment samples were collected using a Van Veen Grab sampler operated from a speedboat at the depths of 0.5 - 10m. The samples were air-dried in aluminium wrapped trays for about a week, sieved through a 2mm mesh screen, and packed in 100ml amber glass bottles with aluminium sealed caps prior to soxhlet extraction. Moisture and organic carbon contents of the sediments were determined according to Lazar et al (1992). Sediment extraction was by soxhlet method (EPA method 3540C), using Acetone/Hexane (1:1) (v/v) as extraction solvent. Samples mixed with clean anhydrous sodium sulphate were extracted for 24 hours and extracts concentrated by rotoevaporation and back extraction was carried out where necessary, before florisil clean up of extracts. Sulphur cleanup was then carried out using activated copper for sulphur removal before GC analysis.

Sample analysis

Sample preparation and analysis were performed at the analytical laboratory of the Great Lakes Institute for Environmental Research (GLIER), University of Windsor, according to the Canadian Association for Environmental Analytical Laboratories (CAEAL) requirements. The reference material used for sediment was NIST SRM 1944, with certified values for some PAHs, PCBs, and OCs. Sample extracts obtained after florisil cleanup were combined and rotoevaporated to approximately 2ml (or as appropriate) and analyzed for Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) and Organochlorine pesticides (OCs) by gas chromatography [Hewlett-Packard (Avondale, PA) Model 5890/5970 Gas Chromatograph with a mass selective detector (quadrupole mass analyzer, 70eV) equipped with a Hewlett-Packard 7673A autosampler and a 30m x 0.25mm. I.D. X 0.10 µm DB-5 film thickness column] 1µl sample was injected using a splitless injection mode at 250°C injection temperature and GC-MSD interface temperature of 280°C.

Results and discussion

The Organic carbon contents of the Lagos lagoon ranged between 0.28 and 28.02 (Fig. 3). The values compare well with the carbon contents of the sediments (ranging from 0.15 to 21.23 %) of the Gulf of Gdansk of the Baltic Sea reported by Pazdro, (2002). In Fig. 3, organic carbon contents of the lagoon sediments were high at locations A, B2, B3, C, C2, & D2 and they increased over the years, possibly as a result of regular organic inputs at these locations.

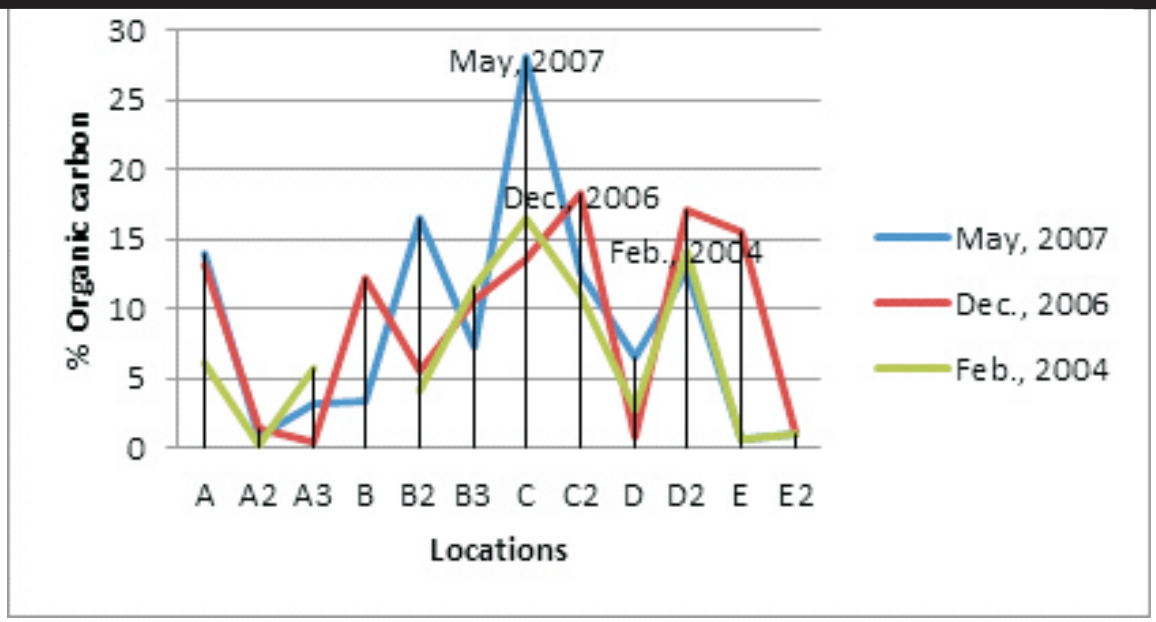

Fig. 3: Organic carbon content of Lagos lagoon between Feb., 2004 and May 2007

Low organic carbon contents were obtained at locations A2 (5 cowrie creek) and A3 (Lagos harbor) because of the nature of sediment (sandy) at those locations (see Fig. 2). Organic matter – poor, sandy sediments are less contaminated than organic matter rich muddy sediments (Pazdro, 2002). The results obtained in the present work confirmed this statement, as the PBT levels were lowest at locations A2 (five cowrie creek) and A3 (Lagos harbor) even though these locations were within the areas of high anthropogenic activities, (Figs. 1, 2, 3 & table 2).

Table 2: Sum PBTs (ng/g) in Feb., 2004 to May, 2007 sediments of Lagos lagoon

	Feb., 2004			Dec., 2006			May-07		
Locations	PAHs	PCBs	OCs	PAHs	PCBs	OCs	PAHs	PCBs	OCs
A	1093.06	1.96	10.41	647.84	214.05	8.13	1339.13	149.52	64.32
A2	149.99	0	0.26	46.23	4.32	0	85.95	0	0
A3	189.17	66.13	1.29	37.61	1.15	0	142.13	34.72	3.70
B				346.94	15.04	2.78	498.48	20.86	8.65
B2	118.26	1.43	7.61	287.22	27.76	12.72	113.97	0	0.83
B3	509.45	134.42	30.27	955.51	0.17	17.68	860.21	105.52	12.83
C	151.07	14.46	0	75.51	4.59	1.20	85.68	35.84	6.98
C2	70.24	4.21	0.37	104.79	2.09	23.72	170.10	6.71	3.71
D	670.13	0.13	0.66	286.03	3.73	22.05	4473.80	2.71	1.31
D2	198.41	41.25	5.33	352.35	2.61	15.03	207.46	17.01	0.49
E	3.46	0	1.27	28.65	0	4.14	2.20	0.04	0.45
E2	3.48	0.43	1.01	12.32	0.11	2.40	6.25	0	0.48

In Dec., 2006, the lowest total PAH concentrations, 12.32, 28.65, 37.61, and 46.26ng/g (Figs. 16 & 17, and table 2), were from East of Palava Island, Palava Island, (locations far from Urban activities), Lagos harbour (shipping and oil related activities), and 5 Cowrie creek (which are predominately sand) respectively. The organic carbon contents at these four locations in Dec., 2006 sediments were 0.96, 15.43, 0.42, 1.29%, respectively. PAHs and other nonpolar organic compounds are strongly associated with the organic fraction in sediments (Smith et al., 1998). Therefore, low total PAHs in high organic contents at locations far from urban activities agrees with the report by Van Metre et al., (2000), that the largest concentrations of PAHs generally are found in urbanized areas, where the potential sources include atmospheric deposition, surface runoff, municipal wastes, sewage effluents, industrial effluents, and spills and leakage of fossil fuels. From Fig.4, the sum of the mean PBTs in Feb., 2004, Dec., 2006, and May 2007 reflected a steady increase (316.34, 383.41, and 705.17ng/g respectively).

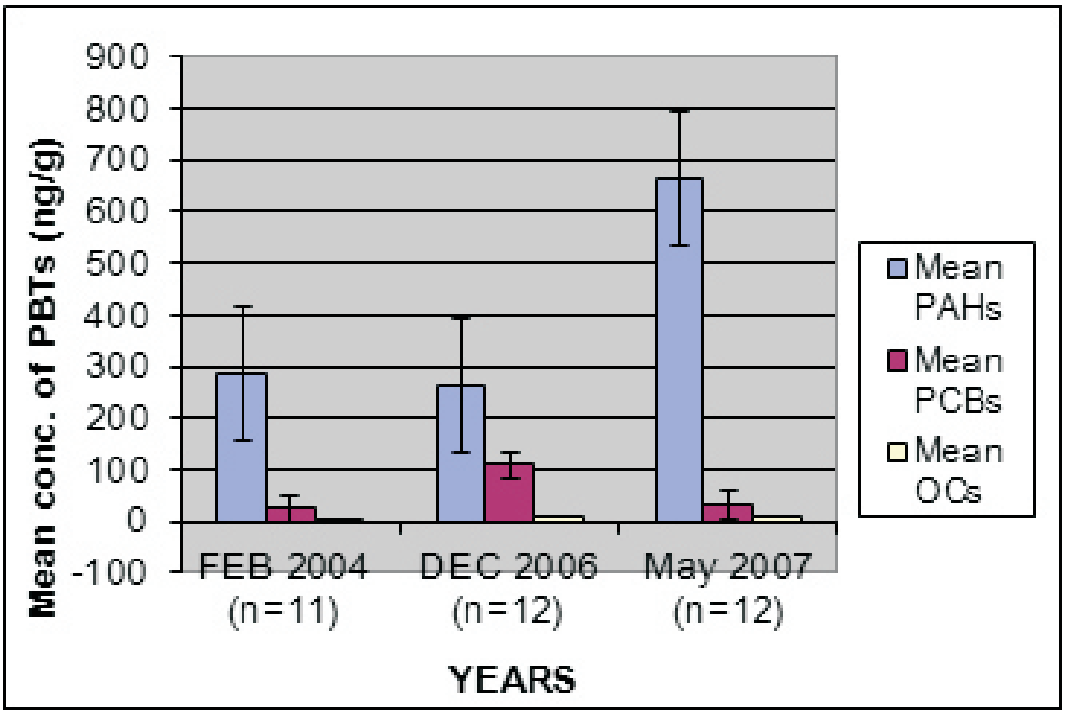

Fig. 4: Mean concentrations of PCBs in Feb., 2004, Dec., 2006, and May 2007 sediments

Comparing Fig. 4 (PBT levels) and Fig. 3 (organic carbon contents), same pattern of steady increase was observed in the sum of the % organic carbon contents of sediments in Feb., 2004, Dec., 2006, and May 2007 (61.81, 82.11, and 85.31%). This showed that the PBT levels increased with corresponding increase in organic carbon contents of the sediments within the study period.

According to Drouillard et al (2006), organic carbon fraction also influences the partitioning capacity of the chemicals in the sediments. This was in agreement with the results obtained in Lagos lagoon (Figs. 3, 4, & 5).

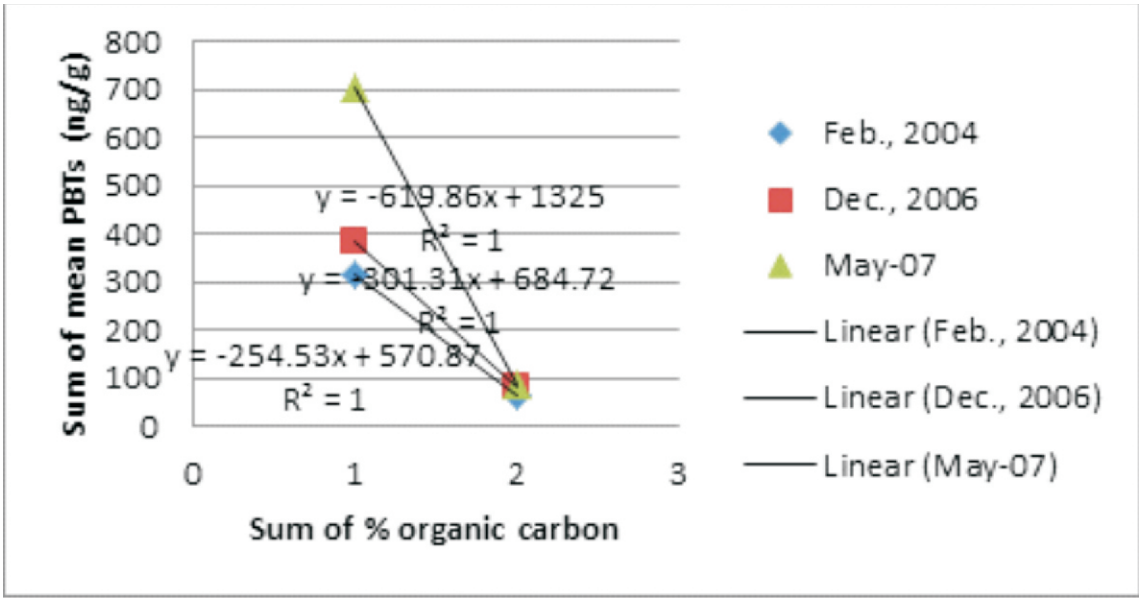

Fig 5: Correlation of organic carbon with PBTs in Lagos lagoon sediments

Very positive correlations (R^2=1) were observed between the total organic carbon contents and PBTs (PAH, PCB, OC) levels of the Lagos lagoon sediments, Fig. 5. This result compared well with the work of Pazdro, (2002), whose set of data from the study on Persistent Organic Pollutants in Sediments from the Gulf of Gdańsk, yielded a positive correlation between total and individual PBTs levels and organic matter content (r>0.65). Sediment organic carbon content and grain-size distributions are main parameters influencing contaminants pattern and bioavailability (Pazdro, 2002). *Evidence by Leeuwen et al (2007) suggests that the bioavailability* of PBTs in sediments can be a function of different matrices (i.e., soil and organic carbon type) and time.

As shown in Fig. 2, variation in sediment type at different locations lead to a high variation in the organic carbon contents of the Lagos lagoon. To adjust for variations in organic carbon in sediment samples PBT concentrations were normalized with organic carbon. In Feb. 2004, carbon-normalized trends in total PAH indicated salient peaks at 5 Cowrie creek (A2), the mouth of Ogun River (D), and a little peak Okobaba (B3) (Fig. 6). In Dec., 2006, carbon-normalized trends in total PAH indicate salient peaks at the mouth of Ogun River (D), Lagos harbour near Marina (A3), and Okobaba (B3) (Fig. 7).

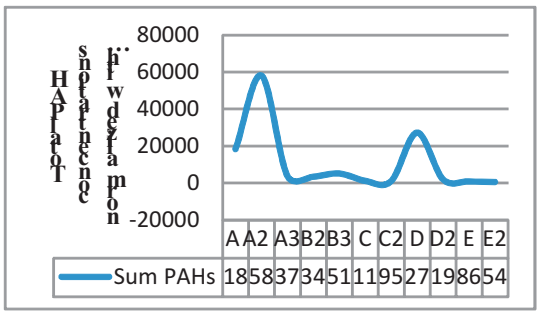

Fig. 6: Sum PAHs in Feb., 2004 sediment

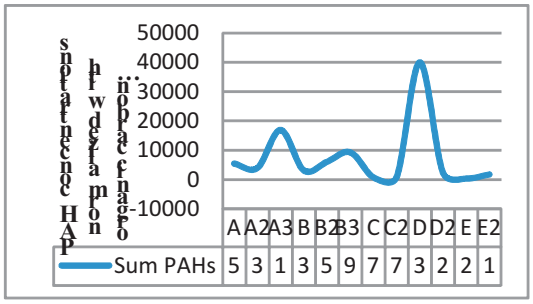

Fig. 7: Sum PAHs in Dec., 2006 sediments

In May 2007, carbon-normalized trends in total PAH indicated salient peak at the mouth of Ogun River (Fig. 8). A regular growth of total PAH input was noticed at the mouth of Ogun River from Feb., 2004, through Dec., 2006 to May 2007 (Figs. 6, 7 and 8). This reflected additional PAH inputs from intervening urban development.

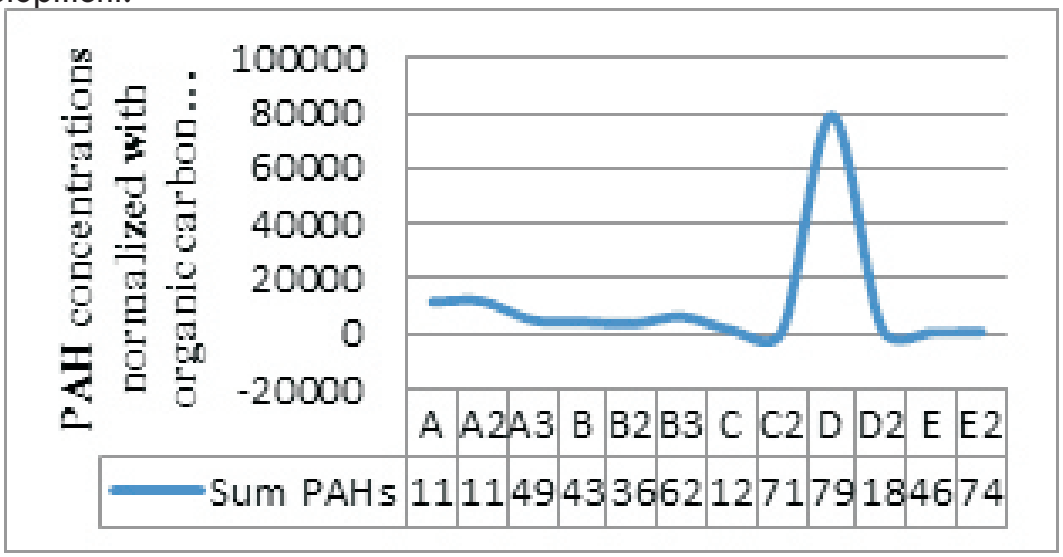

Fig. 8: Sum PAHs in May 2007 sediments

This was in agreement with the report by Kowalewska et al (1997) which showed that in coastal areas, direct deposition of atmospheric PAHs may be relatively minor compared to fluvial inputs, but in open ocean areas it can dominate.

For total PCBs, prominent peaks were obtained at Okobaba and Lagos harbour (Fig. 9) in Feb., 2004; at Iddo, Ibesse & Offin, Mouth of Ogun River, and Lagos harbour (Fig. 10) in Dec., 2006; and at Iddo, Lagos harbour, Okobaba, and Ikorodu (Fig. 11) in May 2007.

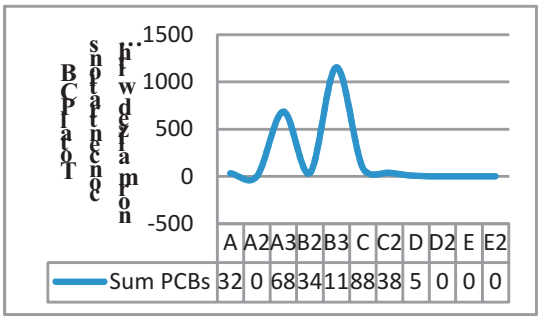

Fig. 9: Sum PCBs in Feb., 2004 sediments

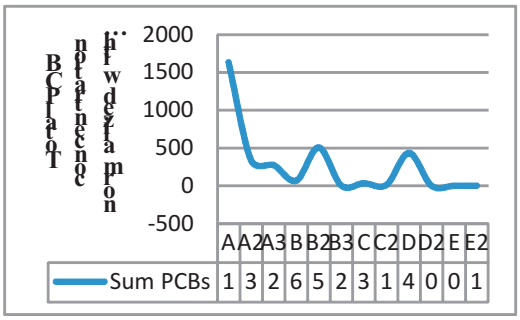

Fig. 10: Sum PCBs in Dec., 2006 sediments

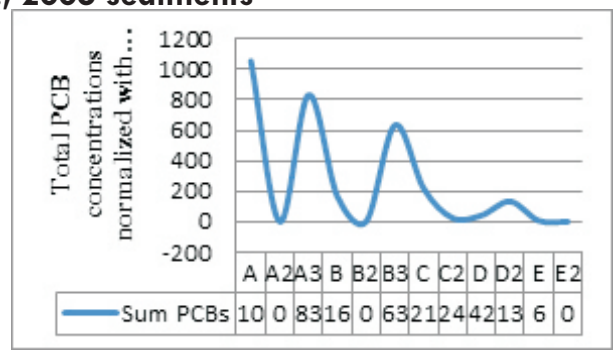

Fig. 11: Sum PCBs in May 2007 sediments

Total PCB was most pronounced at Iddo (Fig. 9, 10, & 11), and so Iddo contributed more PCBs than the other locations.

OCs were found to spread and also increase in concentrations across the different locations on the lagoon from Feb., 2004 to Dec., 2006. A tremendous decrease was observed by May 2007, (Figs. 12, 13 & 14) though an increase was noticed at Iddo.

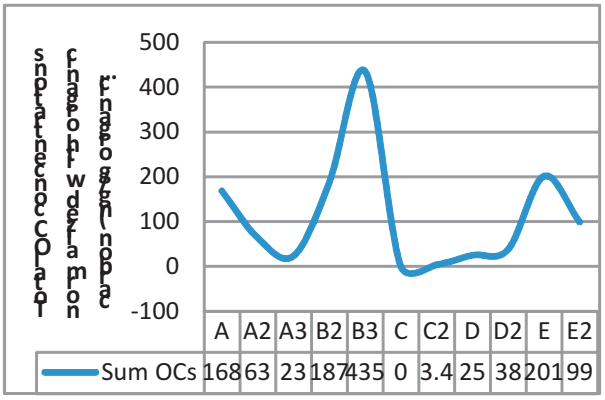

Fig. 12: Sum OCs in Feb., 2004 sediment samples

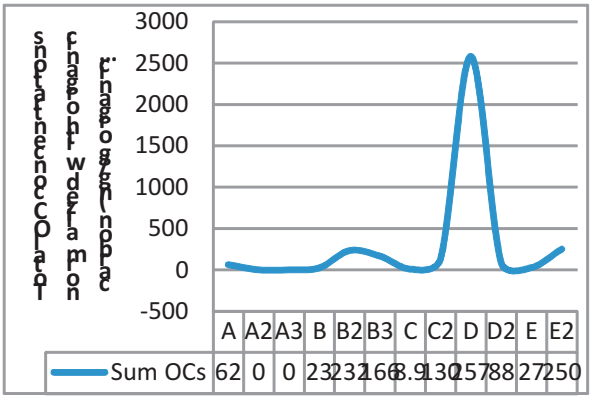

Fig. 13: Sum OCs in Dec., 2006 sediment samples

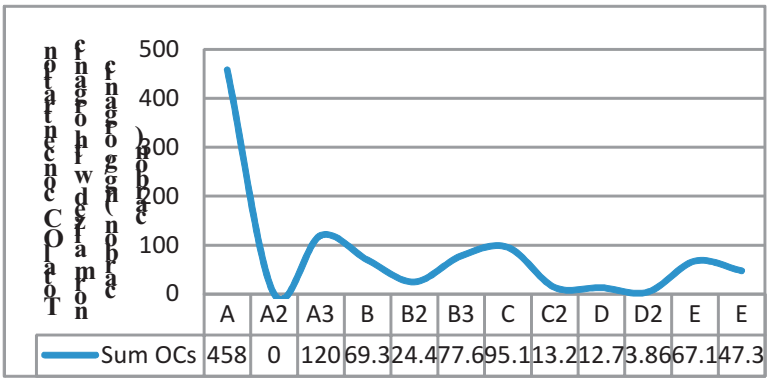

Fig. 14: Sum OCs in May 2007 sediments

Total OCs were found to be contributed from almost all the locations and their concentrations also increased over the time, due to the pattern of use. This agreed with Mackay et al (1997) which stated that one of the factors responsible for variation in the concentrations of OCs in the environment is the pattern of use. Different locations seemed to use OCs in varying concentrations in the different years. In Feb., 2004, two slum settlements, Ilaje community by Unilag lagoon front (B2) and Okobaba (B3) used more OCs. In Dec., 2006 Ikorodu community near location D (Mouth of Ogun River) used OCs most, but in May 2007, Iddo community used it most.

A direct relationship therefore was found to exist between the hydrophobicity of PBTs and the affinity for binding to dissolved humic material. So in agreement with Gobas et al (2004), the sediment partition coefficient (Kp) for PBTs was directly related to the organic carbon content of the sediment.

CONCLUSIONS:

PBT levels increased with corresponding increase in organic carbon contents of the sediments within the study period. Very positive correlations (R^2=1) were observed between the total organic carbon contents and PBTs (PAH, PCB, OC) levels of the Lagos lagoon sediments. PBT and organic carbon contents were high at locations close to high human activities. **Therefore it can be concluded that heavy loads of organic wastes, which result in high concentration of very toxic organic micro pollutants, are increasingly being generated and introduced over time into the Lagos lagoon, where the people of Lagos and its environs depend upon as their major source of sea foods. The activities carried out in our society are life threatening and so urgent action is required.**

RECOMMENDATIONS:

Policies that address proper waste management procedures are necessary. Awareness should be created amongst all stakeholders, individuals, communities, corporate bodies, etc. Government and all regulatory bodies have important roles to play in working towards the reversal of the present state of degradation of our environment in order to achieve environmental sustainability.

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CHALLENGES AND CONTRAINTS TO AGRICULTURAL DEVELOPMENT IN ZANGON KATAF LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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Kaduna State University, Kaduna

ABSTRACT

Agriculture is the most important form of human activities in the whole world. In Zangon Kataf Local Government Area, it is the most important occupation, major source of income and source of food. Yet it is still at the primary level. The paper examines the factors militating against the agricultural development and coping strategies for the development of agriculture in the area. Data were collected through observation and focus discussion using standardized questionnaires on sixteen (16) villages which were randomly selected. This is because most of the inhabitants of the local government are farmers. 180 hundred copies of questionnaires were produced and administered randomly to the farmers. Simple descriptive statistical analysis using tables and percentages was employed. The study found out that agricultural development in area is been limited by the occurrences of drought, bush burning, pest and diseases, lack of enough capital to expand their agricultural production, lack of feeder roads to transport food produced to the market, high cost of labour, poor storage facilities, low prices on food produced, and poor and ineffective management of government policies and programmes towards improving agriculture. It is therefore, recommended that the government programmes should be phased into immediate short and long terms. The short terms should include: development of agro-allied industries especially in processing, provide rural infrastructure, provide agriculture extension services, provides incentives for inputs in agriculture, development and encourage the use of simple agricultural implements, develop effective mechanisms to facilitate movement of food crops, improve food preservation, reduce pre and post-harvest losses. The long terms programmes include: provision of agricultural fund, harmonization of research institutions, incentives for agricultural loan, pricing, enhanced supply of agricultural inputs, rural infrastructure and agricultural products protection policies.

Keywords: *Agriculture, Policy, Constraints, Strategies, Factors.*

INTRODUCTION

Agriculture is the most basic form of human activities in the whole world. It includes the cultivation of crops as well as rearing of animals for human uses. Today in Nigeria, about 70% of its population are engaged in this activity (Aagbe, 2007). Despite the large number of people engaged in this activity in this country and the whole world in general, the activity is not 100% successful.

Agriculture is the mainstay of the economy. This is because agriculture represents a strategic asset to the overall national economy (Rogers, 2000). In Nigeria, the importance of agriculture is manifested in the provision of employment opportunities to over 60% of the Nigerian work force including the under-aged who are not yet of working age. The widespread prevalence of poverty has been linked to the level of the development of agriculture in Nigeria as over 40% of Nigerians live below poverty line.

Babalola, 2003, have noted that Nigeria is a nation richly endowed with abundant natural resources that are conducive to agricultural development. Right from the colonial era, there had been significant emphasis by various governments on how to develop agriculture. In the past few years, government has been making reference to poverty alleviation in budget pronouncements without concrete and special emphasis in agriculture. it is difficult to perceive the type of policy measure that could be put in place to surmount poverty, without making agriculture a central focus.

In Nigeria, the contribution of agriculture to natural development has waned considerably. In the 1960s and 70s, Nigeria was a major exporter of agricultural commodities such as cocoa, groundnut, cotton, etc. at that time, agricultural exports accounted for over 70% of both total export earnings and proportion of GDP making the country self-sufficient in food production (Oguniela and Ogungbile 2006). This development is not unconnected with the increase in oil output and prices beginning from the first half of the 1970s, government macro-economic policies which did not favour agriculture, including urban-blased infrastructural development, and inconsistent foreign policies.

THE STUDY PROBLEM

Despite the large number of the people engaged in agricultural activity in the study area, yet agriculture is still at the primary level. In Zangon Kataf Local government, most of the farmers are subsistence farmers and only a few can if at all can sufficiently support and maintain their families throughout the year. The area is into the farming of cereal crops like Maize, G/corn, millets and few tuber crops like Yams, Cocoa yams and Cassava. The crops in the area have been showing low output of production. These sometimes show a total failure of some crops in certain years. This result to constant rural depopulation.

Owing to the afore mentioned problems, it is clear that a new approach is needed for the development of agriculture in the area. The programme that aim at having an overview of the government policy in agricultural development and new strategies for the development of agriculture in the study area.
It is noted that similar research have been done in some part of the country. But, no research of this nature has ever been done in Zango Kataf Local Gorvenment Area.

There is, therefore the need to undertake an in-depth study on the factors that militates against the development of agriculture in Zangon Kataf Local Government Area.

In light of the above situation, the paper, therefore, focus on the strategies for coping with the constraints against agricultural development in the study area.

AIM AND OBJECTIVES

The main aim of this paper is to examine the various constraints in relation to the development of agricultural and the coping strategies in Zangon Kataf Local Government Area.
The aim would be achieved through the following objectives:

1. To examine the factors militating against the agricultural development in Zangon Kataf Local Government area.
2. To have an overview of the government policy in agricultural development in Zangon Kataf Local Government area and,
3. To proffer coping strategies for the development of agriculture in the study area.

THE STUDY AREA

Zangon Kataf Local Government Area is situated in the southern part of Kaduna state. It is situated between latitude Latitudes 10^{0} 18' and 10^{0} 30'N and Longitudes 7^{0} 15' and 7^{0} 45' (fig.1) It is one of the largest local governments in terms of landmass in the state. Bounded in the east by Kaura Local Government Area, in the south by Jema'a Local Government Area, in the west by Kachia Local Government Area and in the north by Kauru Local Government Area. The 2006 head count revealed a population of 2,508,300. It is made up of four Chiefdoms; Atyap, Ikulu, Angan and Bajju . The people of the study area are predominantly agriculturalists.

The study area is situated on the central highland of northern Nigeria and the region consists of a rolling terrain extended to the Jos Plateau. The climate of the area is part of the tropical wet and dry climate of Nigeria. It is characterized by wet and dry seasons. The wet season begins in April and ends in October, though; there is fluctuation in the beginning and the ending of wet season from year to

year. In some years, it begins early May (Ajayi, 2007). The wet season which is characterized by high humidity throughout last for six to seven months with its maximum rainfall in the month of August (Ajayi, 2007). The main annual rainfall ranges from 1204 to 1567mm. the study area is dominated by the dry dusty cool hamattan wind, migrating from the Sahara desert November to March. The average temperature is between 24^{0}C to 38^{0}C (Ajayi, 2007).

The area is located in the slightly thicker wooded vegetation of the north guinea savannah zone, the activities such as overgrazing, bush burning, over cropping, tree felling for fire wood have generally modified the vegetation to wooded shrub like-vegetation.

The soils fall within the tropical ferruginous soils, the topsoil is coarse sandy soils (Adetola, 1990), though the southern part of the study area is slightly acidic. The soils has lost its fertility that no crop can grow successfully without the use of artificial fertilizer.

The area is drained by three rivers that flows throughout the year; the Zonzon river taken its source from Jos plateau and empty its water in river Kaduna. The river Kaduna itself which flow westward of the study area taken its source from Jos Plateau and the Gurara river taken its source from Kagoro hill to join the river Niger. These rivers only reduce in volume during the dry seasons. There are also some seasonal rivers distributed all over the study area, these rivers dry up in the dry season and fill in volume during the rainy season.

METHODOLOGY

Zangon Kataf Local Government **area** is made of four chiefdoms, **namely:** Atyap, Bajju, Kamattan and Ikulu. A multistage sampling technique was adopted where two districts were purposively selected from each district (Zonzon, Ung/Gaya, Zonkwa, Ung/Rimi, Kamatan, Kangun Ashafa, and Kamuru district for Atyap ,Bajju, Angan and Ikulu chiefdom respectively). Two villages were selected at random from each district making a total of 16 villages. A sample of 180 farmers was taken proportionally to the population of each district and villages sampled.

The data required for the study was collected primarily by the use of questionnaire administration. The variables that were investigated are those that were used to determines the coping strategies for constraints to agricultural development of Zangon Kataf Local Government Area.
The questionnaire sought information on the respondents personal data, factors militating against agricultural development, the overview of the government policy and strategies employed to improve agriculture in the area. A total of 180 questionnaires were administered to the respondents in each chiefdom in the study area randomly. Simple descriptive statistics analysis using tables and percentages was employed to analyzed the data.

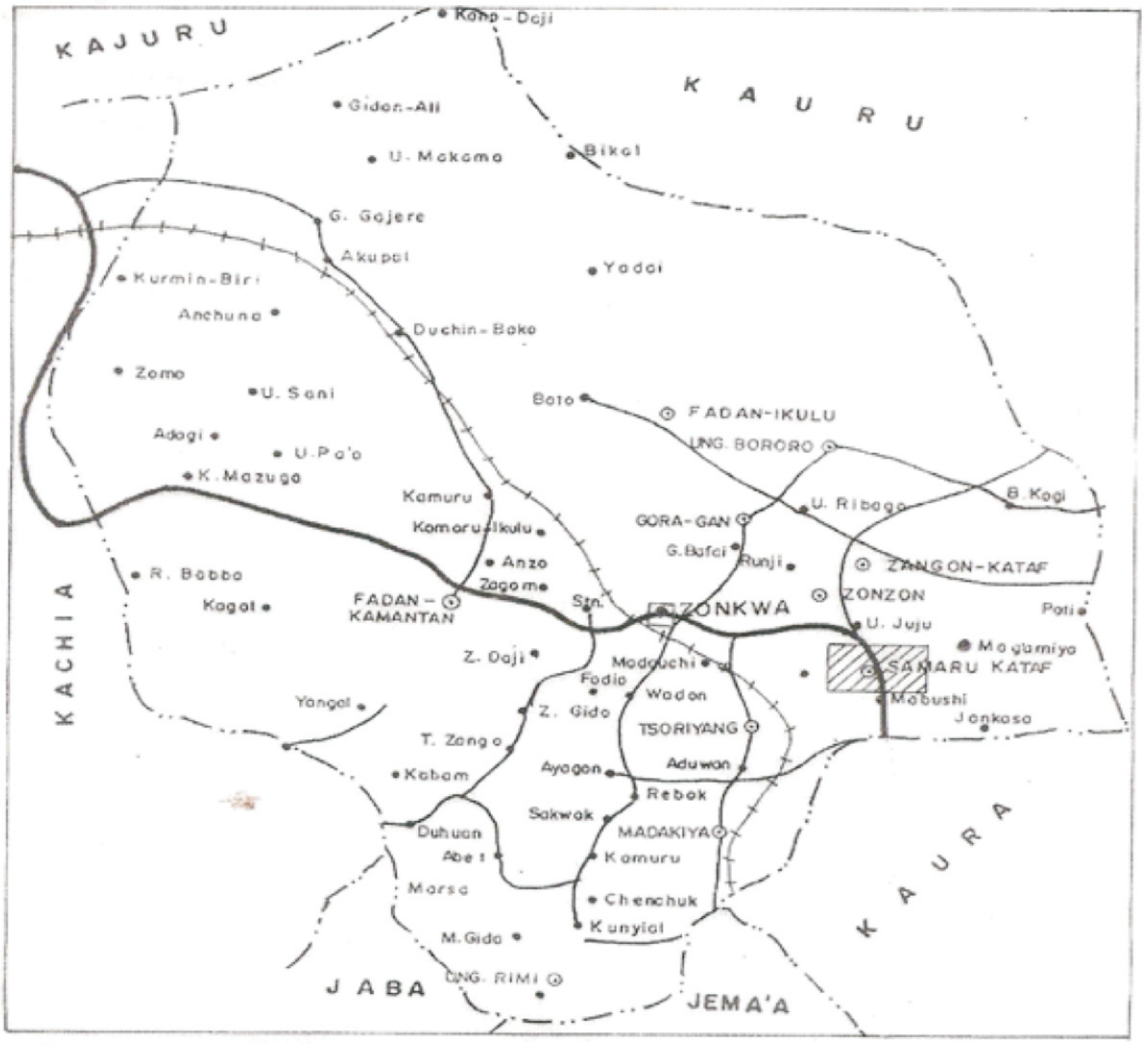

Fig. 1 MAP OF ZANGO KATAF LOCAL GOVT. AREA SHOWING SAMARU KATAF.

RESULTS AND DISCUSSION

1. Age Distribution of Respondents

The mean age of the respondents was 44.7 years with the majority of farmers (34.10%) in the age group of 25 to 45 years. The respondents in the age bracket of 15to 25years constituted 19.34%, that of 25 to 45 years constituted 20.34%, the group of 45 to 65years and years made up of 20.33%. Respondents in the age of 25 to 45 years were energetic and very active for farming. These respondents fall within the age range of 15 to 64 years defined by FAO (2001) as economically productive. The age of a farmer determines the effects of the type of farm operation he or she could undertake. Young farmer could embark on more demanding farm operation such as land tilling and free felling than older farmers, while the aged engage in less energy demanding tasks as planting, land clearing, thinning and harvesting.

Table1: Age of Respondents

Farmers Age (years)	No. of Respondents	Percentage (%)
15 – 25years	48	22.66
25 – 45years	82	45.56
45 – 65years	50	27.78
TOTAL		**100**

1. Educational Background of Respondents

Education enables individuals to gain knowledge and skills and thus increases their power of understanding (Goning et al 1998). The educational background of a farmer is an important determinant of his adoption behavior and managerial ability. It helps him to understand government policies and agricultural programmes and the problems of agriculture.

In table below, it indicates that 38.89% of the respondents had secondary education, 23.89% had primary education. About 19.44% of the respondent did not attend any formal educational institution while about 17.78% of the respondent had post secondary

education. In all about 93% had one form of formal education or the other while only 7% of the respondents did not school. It is obvious that the educated respondents had really gone into farming and would have studied the effects of the effluents discharged by the refinery into their farmlands and would be able to contribute much in this study.

Table 2: Education level of Respondents

Level of Education	No/. Respondents	Percentage (%)
No formal education	35	19.44
Primary education	43	23.89
Secondary education	70	38.89
Tertiary education	32	17.78
TOTAL		**100**

1. Farming Experience of Respondents

The farming experience of the farmers to a large extent influences how the farmers understand the factors affecting farming in the area over time. Table 45 presents the results of the number of years of farming experience of the respondents. The results show that 50.5% of the respondents have been farming their land for over 30 years and above. This is followed by 22.3% who have 20 to 30years of farming experience of their land. The next is 16.1% of the respondents who have been farming their lands for 10 to 20years. From the results presented 30years and above constitutes the majority of the farming experience in the area. With this fact, the farmers could be categorized as experienced in the farming process as they would be able to explain the situation of the Romi area before and after the establishing of the refinery.

Table3: Farming Experience of Respondents

Farming experience	**No. of respondents**	**Percentage (%)**
1 – 10years	20	11.1
10 – 20years	29	16.1
20 – 30years	40	22.3
30 years and above	91	50.5
TOTAL		**100**

1. Climatic Condition of Zangon Kataf Local Government Area.

The table (4) clearly shows that out of the 180 respondents, 89% complained that the rainfall fluctuates from year to year and 10.6% have it that the rainfall do not fluctuate

Table 4: Rainfall Regime of the Zangon Kataf Local Government Area

Rainfall Regime	**No. of Respondents**	**Percentage (%)**
Fixed	19	10.6
Fluctuates	161	89.4
TOTAL	**180**	**100**

3. Occurrence of Drought in Zangon Kataf Local Government Area
It is observed in the table below that 66% of the respondents experience drought in their own locality for 3 – 6weeks every year. 21.7% experience of drought for 1 – 3 weeks and 11% of the respondents experienced it for over 6 weeks.

Table 5: Drought occurrence

Drought occurrence	No. of Respondents	Percentage (%)
1 – 3weeks	39	21.7
3 - 6weeks	120	66
6 weeks and above	21	11.6
TOTAL	**180**	**100**

1. Nature of the Soil of Zangon Kataf Local Government Area
The table (6) reveal that 77.8% of the respondents interviewed complained that their soils are not fertile. 13.9% observed that their soils are averagely fertile and 8.3% of the respondents have it that their soils are fertile.

Table 6: Fertility of the Soils of the Respondents

Soil Fertility	No. or Respondents	Percentage (%)
Not fertile	140	77.8
Averagely fertile	25	13.9
Fertile	15	8.3
TOTAL	**180**	**100**

1. Effects of Field and Stored Pests, and Wild birds

The table below indicated that 93.9% of the respondents suffers from field and stored pest and birds on their crops, while 6.1% of the respondents do not have such experience on their crops

Table 7: Effects of Field and Stored, and Wild birds on the Respondents Farms

Field and Stored, and birds	No. of Respondents	Percentage (%)
Yes	169	93.9
No	11	6.1
TOTAL	**180**	**100**

1. Sources of Capital of the Respondents of Zangon Kataf Local Government Area.

The results in the table below shows that 83.3% of the respondents used their money to buy all the Agricultural inputs for production. 11.1% of the respondents get their loan from Agricultural Banks and 5.6% of the respondents get their loan from Community Banks.

Table 6: Sources of Capitals of the Respondents

Sources of capital	No. Respondents	Percentage (%)
Loan from Agric Bank	20	11.1
Loan from Community Bank	10	5.6
Personal income	150	83.3
TOTAL	**180**	**100**

1. The Mode of Transportation of Farm Produce to Markets

As observed from table (7), 59% of the respondents transport their farm produce to the markets by head. 40% uses motor cycles to transport their farm produce to the markets and 1% uses pickups to transports their farm produce.

Table 7: Mode of Transportation of Respondents to Markets

Mode of transportation	No. of Respondents	Percentage (%)
Motor Cycles	72	40
Animals	0	0
Heads	99	59
Pickups	9	1
TOTAL	**180**	**100**

1. The Type of Labour Used by the Respondents

It is clearly noted that the table below shows that 60.1% of the respondents uses personal labour on their farms. 27.8% uses communal and 11.1% of the respondents uses hired labour.

Table 8: Type of labour used by the Respondent.

Type of labour	No. of Respondents	Percentage (%)
Communal Labour	50	27.8
Hired labour	20	11.1
Personal labour	110	60.1
TOTAL	**180**	**100**

1. The Method of Storage Facilities by the Respondents

The table below reveal that 42.2% 0f the respondents stored their farm produce in barns. 22.2 of the respondents stored their farm produce sacks.16.7% uses huts to stored their farm produce and 2.2% stored in the ground.

Table 9: Method of storage by the Respondents

Storage facilities	No. of Respondents	Percentage (%)
Barning	76	42.2
Hut	30	16.7
Sacks and apply Chemicals	40	22.2
Ground storage	4	2.2
Large pots	30	16.7
TOTAL	**180**	**100**

1. Market Prices of Farmers' Produce of the Respondents

In the table below. 98.9% complaint that prices of farm produce fluctuates daily while 1.1% of the respondents have prices of their farm produce fixed.

Table 10: Nature of Market Prices of Farm Produce of the respondents

Market prices	No. of Respondents	Percentage (%)
Fixed prices	2	1.1
Fluctuate prices	178	98.9
TOTAL	**180**	**100**

1. Government Involvement in Provision of Social Amenities

The table below indicated that 66.4% of the respondents complained that they do not enjoy any social amenities of any kind and 33.6% of the respondents enjoysocial amenities.

Table 11: Provision of Social Amenities in Zangon Kataf Local Government Area.

Social amenities	No. of Respondent	Percentage (%)
Yes	64	33.6
No	116	66.4
TOTAL	**180**	**100**

DISCUSSION

The analysis of the data collected reveals that the rainfall regimes in Zangon Kataf Local government area vary from year to year as complained by the respondents. In normal years the rain comes as early as April, while in abnormal years it may even come as late as in May. Hence with such an unpredictable situation we find that yields tend to fluctuate with low yield in the bad years.

From the interview conducted, majority of the farmers complained of the occurrence of drought from time to time that affects the agricultural production in the area.

As complained by most of respondents that the fertility of the soils of the study area are poor. The soils have become exhausted and the rate of productivity in the area have decreases seriously unless the use of traditional or chemical fertilizers which the farmer complained that the government do not make it available to them and this have made the farmers in the area to have little yield in their annual farm production.

Field and stored pest have been discovered to be great constraint to agricultural crops in the area. Most of the respondents complained that the common pests that affects the crop grown in the field include the weevils, laver of butterflies and moths. They feed on the leaves, stem, flowers and the fruits of the plants. Some bore into the stems and woody tissue, while some suck out the nutrients contained in the water. By this they destroyed the plants to such an extent that the yield of the crops affected are substantially reduced. Weaver birds, sparrow and quells as complained by the respondents are known to cause severe destruction to agricultural crops in the area. The birds do not only eat the seeds of these crops, but also takes the leaves for nest building. Ward, (2007), stated that the economy of a country can be affected by destruction caused birds. Hence the extent of destruction in some part of this area has become a constraint to agricultural development as these birds from year to year cause severe destruction to some crops.

The farmers, during the interview complained of lack of capital to expand the agricultural production. In the local government little or no loan is provided to the

farmers by the government for agricultural expansion. In most cases even where such little provisions are made necessary, it does not reach all the rural farmers at right time. The farmers complained that some times in years of poor harvest, they are force to borrow money, and successive bad year may increase their debts to levels from which they can never free themselves. According to FAO and IFAD, (2005), that for any agricultural development, capital is very important. Capital inform of money to purchase inputs like fertilizer, insecticides, pesticides, land, machineries and labour. Since the farmers in this area are generally poor, some could not even produce enough food to feed their families, the possibility of getting extra profits to buy agricultural inputs for expansion and improvements in agricultural productions and development become less successful.

As reported by most of the respondents, that their rural roads are seasonal that its only function during the dry seasons and in some part there are no even the feeder roads. Most farmers transport their farm produce to the markets on their heads. in some cases, farmers trek or cycled about 7km and above with their goods to the markets. With the lack of such sufficient facilities of transport network in some part of this area, it has become a considerable constraint to agricultural development in the area. The situation agreed with Erhoyema, (2003), that transportation system is one of the determinant of agricultural productions, where the system is not adequate, low return of production is expected that will not reach market at desire time.

It was also observed in the study area that majority of the farmers uses family labour in the agricultural system. This is too small to produce much even for the families what more of to have extra for market. Therefore, less labour in the farm results to less produce and consequently low level of agricultural development in the area.

In the study area, most of the farmers use traditional method of storage such as Barning, hut and sacking. These are inadequate storage facilities. In years of bumper harvest large amount of crops use to get damaged under these storage conditions. Most of the storage products are damaged by weevils especially guinea corn, maize and cowpea.

Majority of the respondents complained that the little of the products set aside for selling by farmers are sold at a give away price in the early time of the harvest. As observed in table 10, there is no fixed price of certain commodities. The prices may either go up or down. In the case where the price comes down, the farmer will be reluctant to sell his products at the price. He may prefer to store it. Since he did not have the adequate storage facilities, the products may get damaged. This make the farmers not to produce more for his family and for market, since the prices does not encourage him. With this price fluctuation, agricultural productivity remains always low and this really affects the development of agriculture in the area.

As complained by the respondents, the study area suffers from lack of social amenities especially in the rural areas such as electricity and pipe borne water. The farmers suffers from getting enough drinking water during the long dry season.

The consequences of these agricultural constraints in the study area has resulted to low income per farmer, shortage of food for the people from time to time, and rural depopulation.

The effort of the government towards improving agriculture in the study area has been very poor over the past decades. The government agricultural policies over the years have been unsuccessful.

Beginning from the era of Commodity Board in the 1960s,the country has witnessed a myriad of policies and programmes ostensibly introduced to address perceived problems in the agricultural sector. Among these programmes is the National Accelerated Food Production Programme in 1972, a campaign to grow more food. The next is the Nigerian Agricultural Bank in 1973, with an initial paid up capital of N20 million. This is to make credit available for the development of agricultural development. In 1976, the Operation Feed the Nation (OFN) programme was launched with the objectives of increasing food production, attaining self-sufficiency in food supply, encouraging all sections of the Nigerian to grow food, encouraging balanced nutrition and by extension a healthy nation. The Land Use Decree in 1978. The focus of the decree was to reform the land tenure system. This constitute a formidable obstacle to the development of agriculture in Nigeria.

In 1986 when the Structural Adjustment Programme was introduced, the focus had been on returning Nigeria to self-sufficiency and enhancing the contribution of agriculture to foreign exchange earnings.

Part of the programmes over the years is the establishment of relevant institutions. Thus there were agricultural research institutes like the National Cereal Research Institute, the National Agricultural Extension and Research Liaison Service and other.

In 1980s, the Federal Government also established Universities of Agriculture, School of Agriculture, faculties of Agriculture in conventional Universities and the Polytechnics. there were also the National Agricultural Land Development Authority, the River Basin Development Authority and Agricultural Development Programmes. There were also the International Institute for Tropical Agriculture.
These programmes and schemes of successive governments have varying level of commitment to agricultural development. This accounted for the uncoordinated and stunted growth in this sector of the Nigerian economy.
One major problem that has become the bane of our policy is the lack of continuity

associated with government programmes. The effect of this on agricultural development has been far-reaching. Successive governments came in to introduce new programmes, schemes and institutions, which in most cases do not represent continuity and complimentary of the existing ones. Policies are therefore abandoned midway, in most cases, before their effects become manifested.
The second is the uncoordinated manner in which agricultural programmes and schemes have been handled. Policies are pronounced and institutions set up that are in most cases either the negation of existing facility, or a duplication of it. A cursory look at the institutions mentioned above shows duplication and overlapping of functions and activities in the operations of most of them. It is therefore clear that there are issues of inconsistent policies and lack of will in policy implementation that would need to be addressed.

There are also problems at the micro (individual) level that borders on management of farm, sources of finance, supervision, etc. in Nigeria, farmers are the most impoverished and backward amongst all types of businesses and professions. This is not the case in developed countries of the world, where farmers are among the richest and most successful entrepreneurs.

Another reason is the level of the extension services has not succeeded in meaningfully changing the orientation of an average farmer, especially, where there is conflict with culture and tradition. Furthermore, for medium scale farmers they have to contend with serious issues of management, financing, preservation and weather. These are part of the problems that should lend themselves for urgent resolution in the early years of this administration.

RECOMMENDED POLICY FOR THE AGRICULTURAL DEVELOPMENT IN THE STUDY AREA

The short and long programmes designed to address the constraints to agricultural development should include the following:

a. To enhance the quality of life of the rural poor.
b. Develop agro – allied industries especially in processing
c. Provide rural infrastructure
d. Provide agriculture extension services
e. Provide employment for array of school leavers and graduates
f. Provide incentives for inputs in agriculture
g. Development and encourage the use of single agricultural implements.
h. Develop effective mechanisms to facilitate movement of food crops.
i. Improve food preservation/storage.
j. Reduce pre and post – harvest losses.
k. Develop and encourage the use of simple agricultural implements.

The immediate programs that could be implemented are as follows:

1. Provision of Agricultural Fund. This is to facilitate medium scale agricultural production. The credit is to be granted to a farmer who is already or willing

to embark on medium scale farming that will provide employment for not less than 25 people.

2. Harmonization of Research Institutions. it is widely accepted that research are the vehicles on which agricultural development move forward. The focus of the institutions should be to enhance yield in agricultural production through continuous research that would in new seedlings and others.
3. Incentives for Agricultural Loan. A package of incentives should therefore be worked out for the financial institutions and the farmers such as moratorium, advisory services, tax exemption price incentives and other forms of protection.
4. Pricing. This to help farmers have a fair prior idea of the prices to expect from their productive activities
5. Enhanced supply of Agricultural Inputs. Government should associate with noble policies with respect to the distribution of inpaired seedlings, fertilizers, pesticides, chemicals etc.
6. Rural Infrastructure. This would improve the level of retention of skills in the rural areas, and stem the preponderant rural – urban drift, reduce cost of production and encourage use of semi- mechanized system of production.
7. Agricultural Products Protection Policies. Government should go a step further by giving some sort of protection to local agricultural products, against foreign competition.

CONCLUSION

The constraints of agricultural development in the study area has lead to many effects in the area and the country at large. Until the results obtained in this paper is taken into consideration and recommendation been implemented, agricultural department will remain in the primary level. Therefore, the need to develop agriculture in this area should not be taken lightly both by the farmers and the government.

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SUSTAINABLE ENERGY DEVELOPMENT IN NIGERIA: CHALLENGES AND IMPLEMENTATION

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Abstract

Energy system is made up of an energy supply sector and energy end – use technologies and the objective of the system is to deliver to consumers the benefits that energy offers for various commercial and industrial activities. Sustainable energy development can be understood as a holistic approach to minimizing the negative environmental impact of production and consumption of energy resources used for producing energy services and a practical implementation strategy for achieving sustainable development. Thus to be considered sustainable, energy systems must efficiently use resources, clean production processes and provide timely development of inexhaustible supply options.The objective of this study is to access the sustainable energy development programmes of the Nigerian government in the light of the Sustainable Energy for All (SE4ALL) initiative of the United Nations of 2012, considering the various policy documents that drive energy development in the country including the National Energy Policy (NEP), the Renewable Energy Master Plan (REMP) amongst others.

Keywords: Sustainable Energy, Energy Policy, Nigeria

Introduction and Conceptual Framework

Energy, the capacity to do work is an essential ingredient for socio – economic growth of all nations. Energy is central to sustainable development and poverty reduction. It affects all aspects of development – social, economic and environmental – including livelihoods, access to water, agricultural production, education and poverty – related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services available to development countries.

An energy system is made up of an energy supply sector and energy end-use technologies. The object of the energy system is to deliver to consumers the benefits that energy offers. The term *energy services* is used to describe these benefits, which in households include illumination, cooked food, comfortable indoor temperatures, refrigeration, and transportation. Energy services are also required for virtually every commercial and industrial activity. For instance, heating and cooling are needed for many industrial processes, motive power is needed for agriculture, and electricity is needed for telecommunications and electronics.

The structure and size of the energy system are driven by the demand for energy services. Energy services, in turn, are determined by driving forces, including economic structure and activity; demographics; Technology base; natural resource endowment and access; lifestyles; national policies; laws, institutions and regulations. The structure and level of demand for energy services, together with the performance of end-use technologies, largely determine the magnitude of final energy demand. The final energy demand mix, the structure and efficiency of energy supply (resource extraction, conversion, transmission, and distribution), domestic resource availability, supply security, and national energy considerations then determine primary energy use.

Although energy's potential for enhancing human well-being is unquestionable, conventional energy production and consumption are closely linked to environmental degradation. This degradation threatens human health and quality of life, and affects ecological balance and biological diversity. Today's choices about how energy is produced and used will determine the sustainability of the future energy system and thereby of socio – economic progress.

The linkage between energy, economy and environment makes the integration of policies affecting the three sector imperative. Hence to provide energy systems that are simultaneously affordable, stable and environmentally sensitive is the universal aspiration. Energy must be accessible and affordable, contribute to the well – being of the people and the environment, and enhance economic growth now and the future. This is the major objective of a sustainable energy system.
Sustainable energy development can be understood as a holistic approach to minimizing the negative environmental impact of production and consumption of

energy resources used for producing energy services in society, and can be considered as a major practical implementation strategy for achieving sustainable development. The objective of the concept is to promote the development of energy resources and provision of energy services within the carrying capacity of the ecosystem and the decoupling of economic growth from environmental degradation. Figure 1 shows the interrelations between sustainability dimensions of the energy system.

Thus, to be considered sustainable, energy systems must not overload the carrying capacity of ecosystems; nor should the use of finite resources compromise the ability of future generations to meet their energy service requirements. Efficient use of resources, clean conversion processes, and the timely development of inexhaustible supply options —such as renewable forms or nuclear energy based on breeding or fusion — are therefore the principal strategies for sustainable energy development.

In furtherance to the challenges of sustainable energy development, the UN Secretary General launched the global initiative – Sustainable Energy for All (SE4ALL), following the declaration of 2012 as the international Year for Sustainable energy. The SE4ALL is expected to provide access to energy as a necessary precondition to achieving many development goals that extend far beyond the energy sector, such as eradicating poverty, increasing food production, providing clean water, improving public health, enhancing education, creating economic opportunities and empowering women.

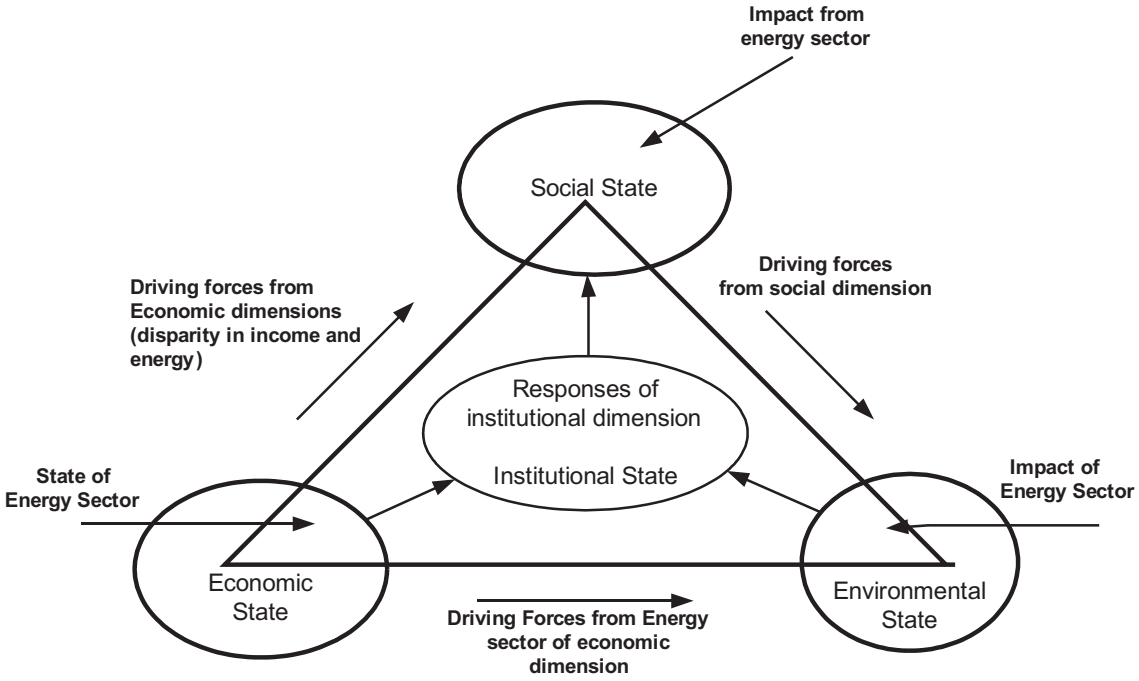

Figure 1: **Interrelations between the sustainability dimensions of the energy system**

The objective of this study is an exploratory assessment of the Nigerian energy sector within the broad objectives of the SE4ALL and identifying the current challenges towards achieving sustainable energy development in Nigeria. Based on identified challenges, the paper suggests various broad implementation strategies that will enable the country achieve the global SE4ALL initiative.

The paper is divided into five sections; the first section encompasses the introduction and background to the study, while section 2 examines broadly the SE4ALL initiative highlighting its goals, objectives and overall action plans. Section 3 gives an overview of the theoretical framework for assessing sustainable energy systems, while section 4 discusses the energy development challenges and implementation strategies for SE4ALL in Nigeria. Section 5 concludes.

The Sustainable Energy for ALL (SE4ALL) Programme

The UN secretary General launched the SE4ALL global initiative to catalyze all stakeholders – governments, private sector and civil society groups to take concrete action towards three critical objectives to be achieved by 2030. These objectives (figure 2) are: universal access to modern energy services; doubling the share of renewables in the energy mix and doubling the rate of improvement in energy efficiency (UN, 2012).

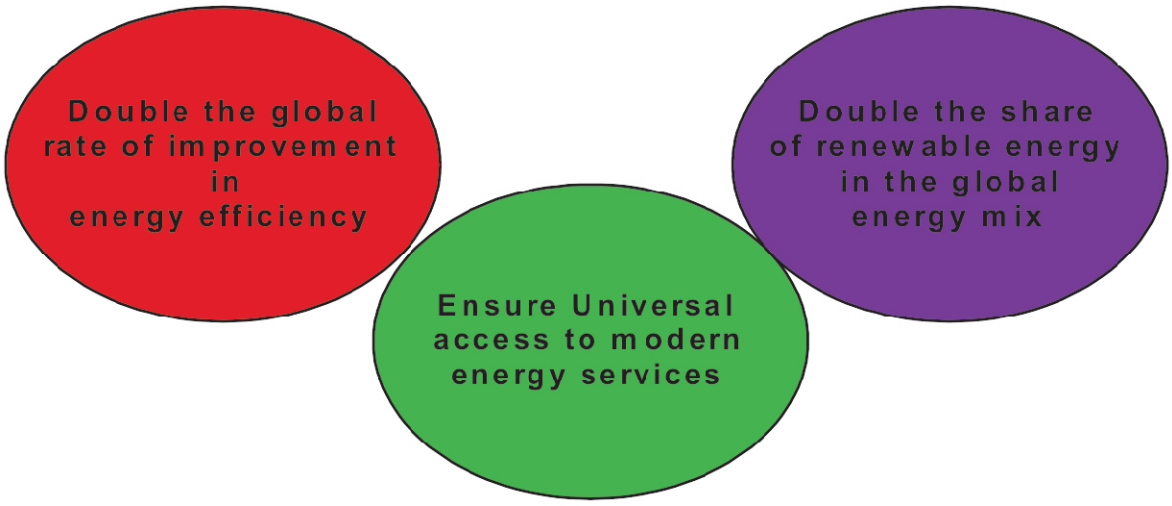

Figure 2: SE4ALL 2030 goals.

Universal access to modern energy services would facilitate a giant leap in human wellbeing and economic development, enhancing the life of the poor in countless ways. Electricity extends the day, enabling children to study after dark and for working hours to be extended. Modern cook stoves, which is expected to replace cook stoves and open fires saves women and children from daily exposure to smoke that damage their health and from the time – consuming drudgery and danger of travelling long distances to gather woods. Refrigeration allows local clinics to keep needed medicine on hand. Access to energy provides consumers with the means to generate income and improve productivity, which in turn creates

wealth and new wealth. Thus, expanding access to modern energy services can yield significant economic returns, especially when integrated with efforts to promote the efficient use of limited energy resources and the harnessing of locally available renewable energy sources.

Many countries have demonstrated that it is possible to provide universal access to modern energy. China has made electricity available to hundreds of millions of people in rural areas and is expected to achieve universal electrification by 2015. Brazil has provided access to electricity to almost 15 million people in the last 8 years. It now reaches 99% of the population with electricity services and is expected to achieve universal access by 2014. Vietnam has increased the proportion of the population with access to electricity from below 5% to 98% in the last 35 years and many other countries have scored similar successes. The provision of universal access to modern energy services is a daunting challenge that must be accomplished with the right energy mix, which is economically, socially and environmentally sustainable as much as possible.

Doubling the share of renewable energy and the rate of energy improvement globally would fundamentally change the energy landscape throughout the world. It would reduce energy demand by roughly 30% and greenhouse gas emissions by roughly 60% compared to a business – as – usual trajectory and would contribute to stabilizing climate change at a temperature increase of $2^{0}C$ or less. In this transformed energy system, more reliance on local renewable energy sources and emphasis on energy efficiency would increases the diversity of supply, and have the potential to energize the world economy through a wave of innovation and job creation.

How countries work towards these two objectives will be determined by their capacities (natural and other resources), geography, level of economic development and ambitions. Countries can learn from the success of early movers in these areas; Brazil grew its renewable (primary) energy supply by over 50% between 2000 and 2009, and in 2009 almost 50% of its primary energy supply was from renewable sources. The European Union, which produced 12% of final energy from renewable energy sources in 2009, has targeted a 20% contribution by 2020; according to its recently published energy roadmap, the EU is currently on track to overshoot this objective. China has more than doubled its low – carbon (renewable and nuclear) energy in the last five years and plans to reach a 15% low – carbon contribution by 2020.

The three core objectives of SE4ALL are built around a complementary vision of universal access to renewables, efficient, secure and low – cost energy with benefits at the household, village, and community, national and global scales. Achieving the SE4ALL efficiency objective would mean that the same goods and services we consume today could be produced using only 70% as much energy as we currently do. This can happen through a combination of changes that are

technological (e.g. increasing the fuel efficiency of vehicles), structural (e.g. telecommunication to cut down on travel), and behavioural (e.g. living closer to work to reduce the length of commutes). Progress is needed in all of these areas to achieve the overall efficiency objectives. Bringing about each of these types of changes requires sector – specific and cross – sector efforts.

The successful implementation of the three core objectives of SE4ALL by 2030 according to the UN secretary general will be based on strong partnerships, the encouragements of common action and forging of lasting commitment among all the stakeholders groups across many relevant sectors of the economy. The stakeholders are National governments; the private sector and civil society organizations.

To make the core objectives of the SE4ALL achievable, the core objectives have been disaggregated into eleven (11) action areas (Figure 3). The 11 action areas have been further grouped into two categories – sectorial action areas and enabling action areas (Figure 4). From Figure 4, it is seen that the seven sectorial action areas address both power generation (40% of total primary energy demand in 2009) and the three principal sectors of energy consumption; industry and agriculture; transport and building, each of which accounts for roughly a third of total energy consumption. The International Energy Agency (IEA) projects that each of these sectors will account for a similar share of total primary energy demand in 2030 (IEA, 2012).

Figure 3: SAE4ALL from Vision to Initiatives

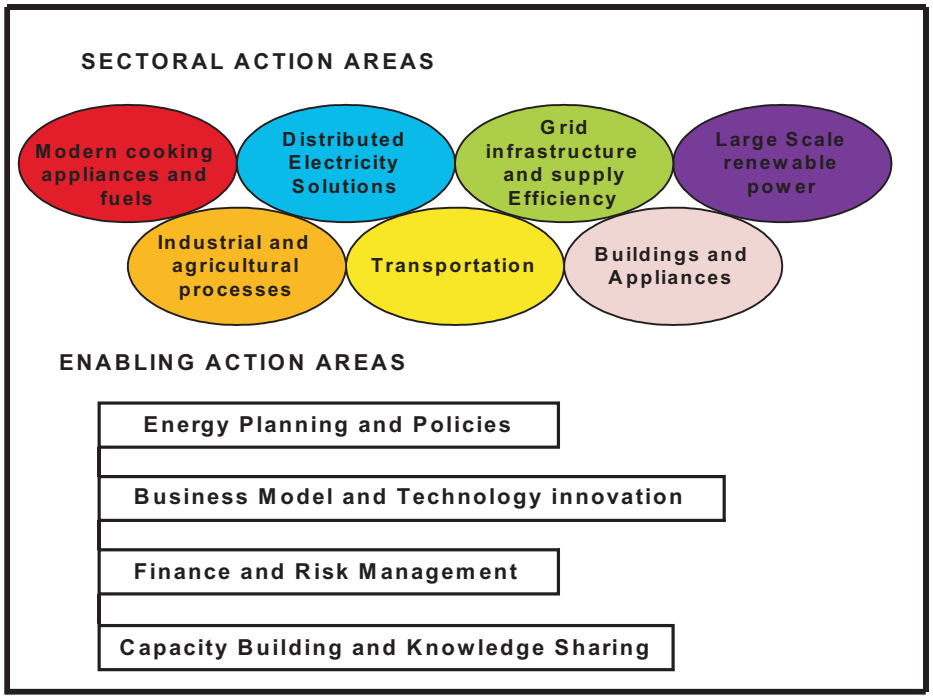

Figure 4: SAE4ALL ACTION AREAS

The four enabling action areas include cross – cutting mechanisms that support effective sectorial Action Areas and address existing obstacles and catalyze rapid scaling at the country, regional and local levels. The four enabling action areas are: Energy planning and policies at all levels; Business model and technology innovation; Finance and risk management and capacity building and knowledge sharing.

Theoretical Framework for Assessing Sustainable Energy Systems

In order to assess progress towards sustainable energy future, the energy indicators proposed by the World Energy Council (WEC) in 2008 will be adopted (WEC, 2008). The WEC indicators are the 3A's of Accessibility, Availability and Acceptability all within the context of the social, economic and environmental circumstance of the nation.

Accessibility means that a minimum level of commercial energy services (in the form of electricity, stationary uses and transport) is available at prices both affordable (low enough to meet the needs of the poor) and sustainable (prices reflect the full marginal costs of energy production, transmission and distribution to support the financial ability of suppliers to maintain and develop these energy services).Availability relates to the long – term continuity of supply as well as the short – term quality of services, while Acceptability addresses public attitudes and the environment, covering many issues such as deforestation, land degradation or soil acidification, indoor or local pollution, greenhouse gas emissions and climate change issues, waste management and proliferation and the

possible impacts of large scale energy development projects.
The 3A's assessment approach is based on the understanding that sustainable energy development must be based on three core dimensions – energy security, social equity and environmental impact mitigation. The development of stable affordable and environmentally sensitive energy systems defies simple solutions. The three goals entail complex interwoven links between public and private actors, governments and regulations, economic factors, national resources, environmental concerns and the behaviour of individuals.

The Nigerian Energy Development Process:
Resource Endowment
Table 1 presents information on both fossil fuel and renewable energy resource endowment in Nigeria. These include coal/lignite, 2.74 billion tones, tar sand, 31 billion barrels, hydro–large, 11,250 megawatts, hydro –small, 3,500 megawatts, solar radiation, 3.5 – 7.0 kilowatt-hours/m2/day or 485.1 megawatt-hour/day using 0.1% of Nigeria's landmass, wind at 2-4 m/s at 10 m height and biomass (fuel-wood), 11 million hectares of forest and woodlands. Nuclear energy resources exist but are yet to be quantified. (15)

According to the International Energy Agency, total primary energy consumption in Nigeria in 2007 was 4 Quadrillion BTU or 107,000 kilotons of oil equivalent. Fuel-wood dominates the structure of primary energy consumption constituting about 75% of energy consumed, oil and gas 9.4 and 9.9 percent respectively and hydro 0.5 percent. However, hydrocarbon resources dominate the structure of commercial energy consumption. The share of natural gas is growing rapidly boosted by new gas-fired power plant and water flow problems in hydroelectric plants.

Energy Challenges
Tables 2 and 3 highlight an important dimension of Nigeria's energy challenge, namely, the poor access to both modern fuels and electricity in both urban and rural areas. However, rural energy access problem is more acute than in the urban areas. As shown in Tables 2, Nigeria ranks at the lower end of the global modern fuels ladder. For example, in 2007 for which comparable data exists, the proportion of the population with access to modern fuels in Nigeria was 24.3% compared to 83.2% in South Africa, 98.4% in Tunisia, 99.6% in Egypt and almost 100% in South Korea. The proportion of the rural population with access was only 7.6% compared to 57.3% in South Africa, 97% in Tunisia, 99.2% in Egypt and 99.5% in South Korea.

Table 3 provides comparative figures for access to electricity in African countries. The key observation is the abysmally low electricity access status in Nigeria compared to most other African countries. Most North African countries had almost universal electricity access in both urban and rural areas compared to Nigeria with 69% urban electricity access and 26% rural electricity access. Rural

electricity access in Nigeria is mainly through grid-extension supplemented by diesel generators and a few isolated solar-based systems. The environmental and social costs of extensive use of generators as substitute for failed public electricity supply are enormous.

Summing up, poor access to modern energy services in Nigeria constitutes a major constraint on the exploitation of economic opportunities, and consequently sustained economic growth, achievement of higher living standards and sustainable development. This strongly suggests that the issue of adequate, reliable and expanded access to modern energy services should be given greater policy focus and urgency. Since improved energy access is widely recognized as a key factor in achieving MDGs and sustainable human development, achieving vastly improved access to modern energy services on a sustainable basis is imperative.

In addition, adequate, reliable and efficient supply of energy services (electricity and petroleum products), has been elusive over the past four decades despite being a world leading exporter of crude oil and gas, and vastly endowed with renewable and non-renewable energy resources. Nigeria has paradoxically been challenged by two long standing energy crises, namely, fuel market shortages and unreliable and poor quality electricity supply. Nigeria experienced persistent crisis in meeting domestic demand for gasoline, diesel, kerosene and liquefied petroleum gas (LPG) though she has exported more than 2 million barrels of oil per day since the early 1970s. More remarkable is the large fuel importation to meet domestic demand despite having four refineries with capacity of 455,000 barrels a day. Also, she is a world ranking exporter of liquefied natural gas (LNG), electricity power shortages are frequent linked to inadequate gas supply.

Arguably, Nigeria faces a range of energy and development challenges, including low modern access to energy services and low electricity consumption per capital and the dominance of traditional energy sources (biomass) in domestic energy demand; yet five reasons provide optimism not only concerning sustainable energy development, but more specifically concerning expanded rural electricity access.

1. The steady implementation of the Power Sector Road Map which is culminating in significant progress towards effective unbundling of the sector (into six generating companies, Gencos, one Transmission company, Transco and eleven Distribution companies, Discos) in the past year despite occasional administrative challenges. The recent significant improvement in electricity supply nationwide driven by more capacity supplied by NIPP and IPP projects and the expected take-off of Gencos, Transco and Discos in 2013 provide some support for optimism regarding improvement in electricity energy access. Effective implementation of the core reforms in the EPSRA would ensure industry

operation based on global best practices.

2. The establishment of the multi-year tariff (MYTO) by the Nigerian Electricity Regulatory Commission (NERC), coupled with attractive Power Purchase Agreement and Gas Purchase Agreement frameworks have removed the major obstacles to private sector participation in the electricity sector. Power pricing that would guarantee an attractive rate of return to investors adjusted for industry risk and security of investment and input are two key considerations in private sector investment in the industry.
3. The restoration of the Rural Electricity Agency (REA) and Rural Electricity Fund (REF).
4. For almost a decade, the economy has been growing robustly at over 6% per annum. Encouraged by sustained macroeconomic stability and improving business environment, Nigeria is becoming one of the important and attractive destinations for private investment in Africa.
5. Nigeria has the largest economy and consequently the largest market for renewable energy technologies in Sub-Saharan Africa excluding South Africa in the quest for clean and low carbon energy.

Table 1: Fossil, Solar and Wind Energy Resources in Nigeria

	Resource Type	Reserves		Production	Domestic Utilization
		Natural units	Energy Units (Btoe)		
1.	Crude Oil	35 billion barrels	4.76	2.5 million barrels/day	445,000 barrels/day
2.	Natural gas	187 trillion SCF	4.32	7.1 billion SCF/day	3.4 billion SCF/day
3.	Coal and Lignite	2.734 billion tonnes	1.92	Insignificant	insignificant
4.	Tar Sands	31 billion barrels of equivalent	4.22	-	-
5.	Large Hydropower	11,250MW	1.11(over 38yrs)	1,938MW (167.4 million MWh/day)	167.4 million MWh/day
6.	Small Hydropower	3,500MW	0.25 (over 38yrs)	30MW (2.6 million MWh/day)	2.6 million MWh/day

7.	Solar Radiation	3.5 – 7.0 kWh/m^2/day (485-1 million MWh/day using 0.1% of Nigerian land area)	15.0 (38yrs and 0.1% of Nigerian land)	Excess of 24.0kwp of solar PV or 0.001 million Mwh/day.	Excess of 0.01million MWph/day of Solar PV
8.	Wind	2 – 4m/s at 10m height	-	-	-
9.	**BIOMASS**				
	Fuelwood	11 million hectares of forest and woodland	-	0.11million tonnes/day	0.120 million tonnes/day
	Animal waste	245 million assorted in 2001	-	0.78million tonnes/day in 2001	Not Available
	Energy crops and Agric residues	72 million hectares of agric land and all waste lands	-	Excess of 0.256million tonnes of assorted crops residue/day in 1996	Not available
10	Nuclear Elements	Not yet quantified			

Source: REMP, 2005

Table 2: Access to Modern Fuels in % of Population

Country	Year	% of the national population with access to modern fuels	% of the rural population with access to modern fuels	% of the urban population with access to modern fuels
Algeria	2006	98.7	97.1	100
Angola	2006-07	52.1	10.6	86.1
Botswana	2006	56.2	25.1	78.3
Cameroun	2006	21.4	2.6	39.9
Cape Verde	2006	62.5	27.6	86
Cote d'Ivoire	2006	13.8	0.3	31.4
Egypt	2005	99.6	99.2	99.7
Ethiopia	2005	4.2	0.2	28.1
Gabon	2006	68.3	22.6	79.6
Ghana	2006	11.1	2.3	23.7
Kenya	2005-06	17.3	3.6	58.4
Libya	2009	95.6	>95	
Mauritius	2004	95.8	95.9	96
Morocco	2003-04	91.2	78.1	99.2
Nigeria	**2007**	**24.3**	**7.6**	**57.7**
Senegal	2006	41.1	12.1	74.4
South Africa	2007	83.2	57.3	86.2
Sudan	2006	6.9		
Tanzania	2007-08	2.8	0.4	10.2
Tunisia	2006	98.4	97	99
Uganda	2006	0.4	0.1	2.6
Argentina	2001	94.8	67.1	97.8
Brazil	2003	87.2	47	95.4
Chile	2007	95.6		64.3
China	2007	42	25.5	
India	2005-06	28.8	9.5	68.3
Korea S.	1998	99.9	99.5	100
Malaysia	2003	96.7	95.3	97.4
Mexico	2003	85.6	55.1	96.1

Source: UNDP/WHO Energy Access in Developing Countries.

Table 3: Access to Electricity in % of Population

		ELECTRICITY ACCESS (% of Population)		
COUNTRY	HDI	National	Rural	Urban
Algeria	0.754	99.3	98	100
Angola	0.564	26.2	10.7	38
Botswana	0.694	45.4	12	68
Cameroun	0.523	29.4	9	45
Cape Verde	0.708	70.4	44.9	87.5
Cote d'Ivoire	0.484	47.3	18	78
Egypt	0.703	99.4	99.1	100
Ethiopia	0.414	15.3	2	80
Gabon	0.755	36.7	18	40
Ghana	0.526	54	23	85
Kenya	0.541	15	5	51.3
Libya	0.847	99.8	99	100
Mauritius	0.804	99.4	99	100
Morocco	0.654	97	96	98
Nigeria	0.511	46.8	26	69
Senegal	0.464	42	18	74.7
South Africa	0.683	75	55	88
Sudan	0.531	31.4	19	47.5
Tunisia	0.769	99.5	98.5	100
Uganda	0.514	9	4	42.5

Source: UNDP/WHO (2009) Energy Access
op. cit.

Environmental Challenge

For most Nigerians, cooking is the most important energy need. Sixty-seven per cent of the population uses wood or charcoal as a cooking fuel. Wood fuel cooking is inefficient and is believed to be responsible for about 79,000 deaths annually from indoor air pollution (WHO, 2007). Kerosene is also used for cooking, but is polluting, hazardous and expensive. People also tend to prefer the taste (and experience) of food cooked on a fuel wood stove. In urban areas, the cost of fuel wood is increasing and in rural areas, fuel wood gathering takes 3-6 hours per day.

Unsustainable use of fuel wood also contributes to deforestation. Unsustainable fuel wood harvesting has put Nigeria's forests under pressure, particularly in the north. This has led to desertification, drought, arid land and a decline in crop production. These combine with the regional effects of climate change: a drop in the water table and a decline in rainfall. According to the Food and Agriculture Organization of the United Nation's State of the World's Forests report (FAO 2005), between 1990 and 2005, Nigeria lost 35.7 per cent of its forest cover.

On the average, about 60 per cent of Nigeria's population has no access to electricity (70 per cent in rural areas). Kerosene lamps provide poor lighting and are expensive, inefficient, highly polluting and dangerous. Contaminated and low quality kerosene is widely available on the black market. Kerosene prices fluctuate with the price of oil. Small diesel generators are an option for those with sufficient cash, but these carry high fuel costs and require maintenance. They produce polluting fumes and noise and they often generate excess unused power. For small and medium enterprises (SME), generator costs can represent a major portion of overheads, which is stifling the development of small-scale enterprise in the country. The cost of energy is blamed for the collapse of the textiles and auto manufacturing industries in Northern Nigeria. Firms have relocated to Lagos where power supplies, though intermittent, are more reliable (Malik et al. 2004).
Gas flaring is one of the most serious of the negative environmental impact of oil and gas exploitation from the global perspective of sustainable energy development and carbon emission induced climate change. Nigeria is the world's leading gas flaring country and accounts for more than 25 percent of total global annual flaring. Gas flaring also has significant negative impacts on the environment, not least due to its climate change impacts. Associated gas has been flared since the start of oil production in the Niger Delta. Nigeria contributes to greenhouse gas emission through oil and gas production. Nigeria flares about 2.5 billion cubic feet (over 70 million m3) of gas per day (or 40 per cent of its annual gas production, which is 12.5 per cent of all globally flared gas). Apart from the huge financial loss the environmental impact is significant at local and global levels. This amounts to about 70 million tonnes of carbon dioxide.

At the local level, the heat from constant flaring adversely affects plants, wildlife and human activity. Living in many oil-producing communities is challenging because of the negative environmental externalities of oil and gas production. The economic and health cost of heat emission from the flares and destruction of vegetation are part of the negative externalities of the wasteful flaring of oil-associated gas.

Oil spillages and leakages which occur either through accidental or deliberate rupturing of the crude and products pipelines or blowouts of oil wells constitute the next major form of energy related environmental pollution in Nigeria. Between 1976 and 1990, there were 2,796 spillages in Nigeria involving 2.1 million barrels of crude oil. In 1998, 40,000 barrels of oil spilled into the sea at the Mobil-operated Qua Iboe oil terminal in the south eastern part of the country spread oil pollution along the coastline as far west as Lagos and beyond to Ghana. On September 17 1999 it was reported that 100,000 barrels of oil spill occurred in Ekakpamre well owned by Shell. These spillages, leakages and blowouts, have had adverse effects on both human activity and livelihoods. The environmental cost of oil extraction is implicit in the loss of economic activity and economic deprivation by environmental degradation associated with oil and gas

exploration, production and transportation activities. This has exacerbated conflict in oil company-community and government-community relationships.

Overall, degraded forest and soils lead to loss in soil fertility, polluted waters make drinking water unsafe and result in species extinction, constant flares, and other oil-related effluents combine to assault the livelihoods of most oil communities and kindle the agitation for more compensation in terms of a greater share of the economic rent from oil accruing to these affected areas. The joint effect of this state of affairs is the increasing alienation of the people in these communities and the increase in resource control conflict in oil producing areas in more recent times. The impact of the negative environmental effects of petroleum exploration, production and distribution on the livelihoods of the majority of the population in this relatively environmentally fragile region has been striking.

From the foregoing it is obvious that the SE4ALL programme is important, if the country is to transit from its current energy crisis. However, meeting the challenges of providing adequate, reliable and widely accessible electricity service involves more than summing up numbers (the mega-watts and the size of investment) and getting other technical things right. The fundamental question is: what should be done, given the resource endowment, political, institutional, economic, financial, technological, environmental constraints in Nigeria? The SE4All framework provides a useful policy framework to address some of these problems from the perspectives of sustainable energy, environment and human development.

SE4ALL Implementation Strategy

In order to promote the institutionalization of the SE4ALL programme in Nigeria, the following implementation strategies are suggested:

1. Establish and maintain an enabling policy, legal, regulatory, and institutional frameworks that provide level playing incentives that will maximize investment by stimulating private sector investment and public-private partnership.
2. Harmonize the policy frameworks to ensure integrated energy sector planning.
3. Put in place the required implementation mechanisms and systems to support sound institutional competencies; frameworks; partnerships; databases and resources that will enable the industry to perform core functions and essential services efficiently.
4. Implement policies that encourage local private sector to participate in investing the electricity value chain as part of the strategic intervention of the government and development partners to support SE4All and also make Nigeria the regional market hub for technologies focused on clean and low carbon energy.
5. Provide a framework for greater local participation in the industry either as investors or rural energy service provider.
6. Facilitate public/private sector participation in technology acquisition and

transfer.

7. Invest in technology databases and informatics to provide information on key green energy products, production costs, economics, as well as key technology partners for these products.
8. Support and promote the development of skills and competitive competencies necessary for the country's entrepreneurs and other stakeholders to participate in the delivery of goods and services required for SE4All
9. Identify the training skills required for the sector and plan for their development through both formal and industrial training to include training for both core skills and ancillary skills.
10. Implement environmental policies as affects the electricity industry development.
11. Design energy strategies and measures to support environmental sustainability.
12. Invest in environmental planning and management and incident reporting Identify and implement appropriate responses to the human resources and skills development needs of local population.
13. Set up a framework of community investment that will support rural electricity access in the context of local economic growth and development.

Conclusion

The paper has highlighted the new paradigm in energy development, which is the concept of sustainable energy development and the UN initiative of the Sustainable Energy For All (SE4ALL) programme, which has the focus of universal access to modern energy services; doubling the share of renewables in the energy mix and doubling the rate of improvement in energy efficiency. This initiative is expected to be achieved universally by the year 2030. The paper has also highlighted the energy resource endowment of Nigeria, as well as the energy and environmental challenges of achieving the SE4ALL initiative in Nigeria and concludes by highlighting various implementation strategies for implementing the initiative in Nigeria.

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Effects of Tractor Power, Tyre Inflation Pressure and Speed of Tractor on Drawbar Pull and Soil Resistance to Cone Penetrometer Pressure

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ABSTRACT
The research work examined three tractor speeds (i.e. 4km/hr, 8km/hr and 11km/hr) powers, (i.e. 19kN, 40kN and 47kN) and tyre inflation pressure (i.e. 83kPa, 97kPa and 110kPa) with different implement load attached while tractor drawbar pull and soil resistance to cone penetrometer pressure were measured. It was observed that both drawbar pull and soil resistance to cone penetrometer pressure were found to increase from 0.72kN to 1.42kN and 0 to 163kPa (i.e. within 5 to 10cm soil depth) when the tractor power was increased from 19 to 47kN respectively. Similarly, the drawbar pull was found to decrease from 9.7kN to 7.7kN when the tyre inflation pressure was increased from 83kPa to 110kPa but both tyre inflation pressure and speed of tractor with different implement loads attached did not have any effect on soil resistance to cone penetrometer pressure.

Keywords: Tractor Power, Tyre Inflation, Pressure, Speed, Drawbar Pull, Soil Resistance, Cone Penetrometer , Pressure.
KEYWORDS: Political Leadership, Gross Domestic Product, Sustainable Development Challenges, Transformational/Charismatic Leadership.

Introduction

Soil tillage can be described as the practice of modifying the state of the soil mechanically or otherwise in order to produce condition favourable to crop growth. It can also be the application of energy to change the soil physical condition from its present condition to that which is desired to achieve certain objectives e.g. preparation of suitable seed bed or root bed so as to facilitate rapid infiltration, good retention of moisture, provision of adequate air capacity, reduction of soil resistance to root penetration, minimize weed competition, check run-off, destruction of insects as well as their eggs, larvae, breeding places and optimize soil temperature. Other objectives include maintenance of soil productivity or fertility over a long period of time through soil and water conservation by maintaining soil organic matter at high level, preserving soil structure and pore stability (Anazodo, 1983).

Tillage in agriculture is further referred to as the mechanical stirring of soil to provide the soil conditions favourable for crop growth (Makanjoala, 1983). Vasey and Naylor (1958) compared six commercially available tyres of the same size in variety of field conditions and hardened surface. It was found that smooth tyre and industrial tyre types with low and closed centre thread design developed higher pull than all other tyres type on hardened surface. On the other hand increasing the height lugs beyond 20mm decreased tractive performance under poor and average soil condition (Gee-Cload and Mc Allister, 1977).

Drawbar pull which is a force available at the drawbar can either be measured using a suitable instrument like the spring or hydraulic dynamometer or it can be estimated using such known variables like soil parameters, dynamic soil reaction on the drive wheels and tyre area of contact with the ground surface. At constant travel reduction, a decrease in tyre inflation pressure resulted to an increase in drawbar pull (Burt *et al*, 1982).

Cone penetrometer pressure of the soil was used as a means of testing strength of the soil. Cone index which is a term that indicates the strength of soil is simply a force per unit base area required to force a cone shaped probe into the soil at a steady rate. Gabrillides and Alexidedes (1963) on their study on soil resistance to cone penetrometer pressure, found out that the higher the moisture content of the soil the less the cone penetrometer pressure. It was found out that there was no significant difference in cone index due to soil type at a given depth but there was a measurable difference in cone index with depth for a given soil type (Hayes *et al*, 1981).

The aim of the study was to investigate the effect of tractor speed, power and tyre inflation pressure on tractor drawbar pull and soil resistance to cone penetrometer pressure while the objective was to determine :

The measured drawbar pull

Soil resistance to cone penetrometer pressure under different

implements load (i.e. an MF off-set disc harrow of 8.5kN, John Holt 3 – Bottom disc ridger of 6kN and John Holt 2m – wide tiller of 3.5kN) attached.

Methodology

In this study, a complete randomized block designed was employed with each treatment replicated four times. The variables investigated were the tractor powers, (i.e. 19HP Kubota, 40HP Fiat and 47 John Deere), speeds (i.e. 4km/hr, 8km/hr and 11km/hr), tire inflation pressure (i.e. 83kPa, 97Pka and 110kPa) and type of implement load (i.e. 8.5kN off-set disc harrow, 6kN John Holt 3 – Bottom ridger and 3.5kN John Holt 2m-wide tiller) attached.

The experimental site was located at the Ahmadu Bello University Farm. The land was initially ploughed using a disc plough with three discs. The large soil clods formed were further reduced using an off-set disc harrow with seven discs per gang on a loamy soil of moisture content 12.6% dry basis.

For influence of tractor power on drawbar pull and soil resistance to cone penetrometer pressure of each of the tractor power at 19,40 and 47kW were selected with tyre inflation pressure as recommended was initially operated at full throttle and a selected gear with and without an implement load attached on a selected length of 50m on the field. Soil resistance to cone penetrometer pressure was measured on the selected 50m length of the field before and after operating each of the tractor power with and without an implement load attached. An even pressure was applied on the handle of the cone penetrometer pressure to measure the soil resistance to cone penetrometer pressure, while the cone advanced steadily into the soil up to the required depth on the soil and readings on the scale were recorded. Four readings were taken randomly on the selected 50m length of the field.

The drawbar pull was measured using a spring dynamometer . The tractor power and the spring dynamometer was connected between two tractors while the implements were attached to the rear tractors. The measurement gave the approximate pull of the implement and the rear tractor. The difference in pull when the load on the rear was disconnected gave approximately the required pull. The process was repeated four times and the results recorded.

The influence of speed and tyre inflation pressure on tractor drawbar pull and soil resistance to cone penetrometer pressure determined by selecting a 40kW tractor. At each tractor speed (i.e. 4km/hr, 8km/hr and 11km/hr) and tyre inflation pressure (i.e. 83kPa, 93kPa and 110kPa) the tractor was operated with and without an implement load attached and drawbar pull as well as soil resistance to cone penetrometer pressure were measured before and after treatment. The results were then recorded.

Results and Discussion

Table 1 - 6 showed the variation in soil resistance to cone penetrometer pressures with depth using different speed, power and tyre inflation pressure with different implement load attached. Table 1 and 2 showed that at high tractor speed, the implements load attached were operating at shallow soil depths. This might probably be traced to higher soil resistance to cone penetrometer pressure at higher tractor speed as compared to lower tractor speed. This was particularly true within the first 15cm soil depth.

Table 3 and 4 revealed that as the rear tyre inflation pressure increased, the contact area of tyre with soil decreased, hence resulting in higher cone penetrometer pressure. This was particularly true at shallow soil depth with no implement load attached to the tractor. It was shown that for a given range of soil depth, the resistance to cone penetrometer pressure was higher for higher tractor power than lower tractor power. Table 5 and 6 reveal that the higher values of cone penetrometer pressure could be due to the higher static or dynamic load associated with higher tractor power. Large tractors developed more pull than smaller tractors as shown on Table 7. This increase in drawbar pull could be attributed to an increase in static load and area of contact of rear tyre with the soil as the tractor power increased. On the other hand as the tractor speed increases, the drawbar pull was observed to increased as observed on Table 8. This increase in drawbar pull could be due to the fact that at higher tractor speed, the implements were operating at shallow soil depth often less than 5cm.

Table 9 showed a decrease in drawbar pull as rear tyre inflation increases. This reduction in drawbar pull could be as a result of an increase in slippage as rear tyre inflation increased. Since there was reduction in the area of contact of rear tyre with soil as the inflation pressure increased. This could have been the cause of the reduction in drawbar pull. The findings if this study has a relationship with Shebi, (1984) who reported that the performance of three agricultural tractors indicated a decrease in drawbar pull as the tractor inflation pressure was increased.

Conclusion and recommendation

It was concluded that increasing the power of tractor from 19 – 47kW, the drawbar pull increased from 0-72 to 1.42kN. On the other hand the soil resistance to cone penetrometer pressure was increased by about 163kPa especially with no implement load attached. However, with implement load attached the result was different. Lower values of soil resistance to cone penetrometer was observed at soil depth of 5 – 10cm as compare to higher values observed at deeper soil depths of more than ten (10) cm.

With increase in tractor speed from 4 – 11km/hr, the measured drawbar was found to increase from 7.77 to 7.92kN while soil resistance to cone penetrometer

pressure recoded a remarkable difference in readings.
The rear tyre inflation pressure was increased from 83kPa to 110kPa, the measured drawbar pull decreased from 9.7 to 7.7kN while soil resistance to cone penetrometer pressure was not affected by an increase in tractor tyre inflation pressure. It was recommended that different soil types and grassy surface as well as new tractors and implements be use to validate the findings of this research.

Table 1: Effects of Tractor Speed and Type of Implement attached on soil resistance to cone penetrometer pressure

Type of Implement Load Attached	Soil Depth (cm)	Average Cone Penetrometer Pressure kPa		
		4km/hr	8km/hr	11km/hr
No Implement	5	560	350	900
	10	725	606	1120
	15	AR	790	AR
	20	AR	AR	AR
	25	AR	AR	AR
Off-set Disc Harrow	5	0	97	78
	10	17	208	317
	15	232	642	562
	20	431	792	569
	25	649	724	632
3-Bottom Mould board Ridger	5	4	39	29
	10	34	69	100
	15	10300	174	606
	20	378	606	947
	25	558	AR	AR
2m-Wide Tiller	5	0	35	69
	10	23	52	327
	15	300	635	AR
	20	718	726	RA
	25	AR	334	R

Source: Field survey, 2012

Table 2: Effect of Tractor speed and type of implement load attached on Soil resistance to Cone Penetrometer pressure at 5 percent soil depth

Source of Variation	Sum of Square	DF	Mean Square	F- Value	Significance
Mean effects	308.611	4	77.153	1.559	NS
A	227.556	2	113.778	2.299	NS
B	81.056	2	40.528	0.819	NS
AB	73.444	4	18.361	0.371	NS
Explained	382.056	8	47.757	0.965	
Residual	1336.250	27	49.491		
Total	1718.318	35	49.094		

Table 3: Effect of Tyre Inflation Pressure and Implement load attached on Soil resistance to cone penetrometer pressure

Type of Implement Load Attached	Soil Depth (cm)	Average Cone Penetrometer Pressure (kPa)		
		83kPa	97kPa	110kPa
No Implement	5	252	287	272
	10	906	516	367
	15	AR	AR	AR
	20	AR	AR	AR
	25	AR	AR	AR
Off-set Disc Harrow	5	0	14	0
	10	83	25	115
	15	880	172	AR
	20	AR	723	AR
	25	AR	627	AR
3-Bottom Mould boar Ridger	5	0	0	0
	10	69	126	0
	15	321	264	115
	20	872	847	255
	25	AR	AR	356
2m-Wide Tiller	5	0	23	0
	10	69	388	184
	15	805	AR	663
	20	AR	AR	1102
	25	AR	AR	AR

Table 4: Effects of tyre inflation pressure and type implement load attached on Soil resistance to Cone Penetrator pressure at 5cm Soil depth

Source of Variation	Sum of Square	DF	Mean Square	F- Value	Significance
Mean effects	1111869.833	5	222373.967	40.613	*
A	8478.712	2	42390.361	7.742	*
B	1027089.111	3	342353.037	62.528	*
AB	301620.339	6	50270.065	9.181	*
Explained	1413490.22	11	128499.111	23.468	
Residual	131409.330	24	5475.309		
Total	1544899.556	35	44139.989		

* = Significance at 5 percent confidence level

A = Tractor tyre inflation pressure

B = Type of implement load attached

Table 5: Effect of tractor power and type of implement load attached on soil resistance to cone penetrometer pressure

Type of Implement Load Attached	Soil Depth (cm)	Average Cone Penetrometer Pressure kPa		
		19kW	40kW	47kW
No Implement	5	781	578	408
	10	AR	AR	499
	15	AR	AR	752
	20	AR	AR	972
	25	AR	AR	1293
Off-set Disc Harrow	5	18	77	272
	10	109	207	422
	15	216	525	487
	20	AR	499	732
	25	AR	677	AR
3-Bottom Mould board Ridger	5	43	17	663
	10	121	34	AR
	15	516	305	AR
	20	AR	878	AR
	25	AR	AR	AR
2m-Wide Tiller	5	166	34	556
	10	523	236	AR
	15	AR	508	AR
	20	AR	792	AR
	25	AR	AR	AR

Table 6: Effects of tractor power and type of implement load attached on Soil resistance to Cone Penetrator pressure

Source of Variation	Sum of Square	DF	Mean Square	F- Value	Significance
Mean effects	12116.29	5	2423.258	3.223	*
A	8838.875	2	4419.437	5.378	*
B	3277.417	3	1092.472	1.453	NS
AB	9828.958	6	1638.160	2.179	NS
Explained	21945.250	11	1995.023	2.653	
Residual	27068.00	36	751.889		
Total	49013.23	47	1042.835		

* = Significance at 5 percent confidence level

NS = Not Significant at 5 percent confidence level

A = Tractor power

B = Type of implement load attached

Table 7: Effect of tractor power on measured drawbar pull

Type of Implement Load Attached	Averaged Measured Drawbar Pull (kN)		
	19kW	40kW	47kW
Off-set Disc Harrow	9.73	10.32	10.4
3-Bottom Mouldboard Ridger	6.69	7.35	7.40
2m-Wide Tiller	4.8	5.4	5.4

Source: Field survey, 2012

Table 8: Effect of Tractor speed on Measure Drawbar Pull

Type of Implement Load Attached	Averaged Measured Drawbar Pull (kN)		
	4km/hr	8km/hr	11km/hr
Off-set Disc Harrow	10.22	10.23	10.22
3-Bottom Mouldboard Ridger	7.06	7.36	7.46
2m-Wide Tiller	5.02	5.26	5.09

Source: Field survey, 2012

Table 9: Effect of tyre inflation pressure and Measured Drawbar Pull

Type of Implement Load Attached	Averaged Measured Drawbar Pull (kN)		
	83kPa	97kPa	110kPa
Off-set Disc Harrow	17.06 2	10.52	10.34
3-Bottom Mould board Ridger	8.06	7.98	7.61
2m-Wide Tiller	5.52	5.25	5.17

Source: Field survey, 2012

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ROAD-SAFETY RISK FACTORS AND CRASH PROPENSITY ANALYSIS: RESULTS FROM NIGERIA

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Abstract
A cross-sectional study was crafted to research a gamut of unique, potential traffic risk factors that are linked with crash propensity in a stretch of busy interstate dual-carriage highway spanning 525 km east to west of southern Nigeria. The method adopted entailed: collection of 41-year road traffic accident data from governmental sources, and undertaking of a survey involving questionnaire administration to 532 well-informed respondents drawn from seven of the 36 constituent states of Nigeria. The 41-year accident data were graphed, and the respondents' scores, transposed into 532 x 25 data matrix, was analyzed with Principal Component Analysis (PCA) version of Factor Analysis contained in StatistiXL software. The scree plot and computed eigenvalues justified the adequacy of nine factors extracted by varimax rotation. Our findings suggest that, although road traffic accidents (RTA) rates, which peaked at 11,320 deaths in 1983 from a threshold value of 1000 in 1960, is already on the decline. Nevertheless, serious effort should be made to curtail and whittle down the strong influence of the identified potential risk traffic factors in an attempt to reduce or prevent further accidents. A general substantial pay rise granted to civil servants in 1999, as part of dividends of the then-nascent civil democracy, prompted the injection of a great number of used cars (with the concomitant mechanical unreliability) into Nigerian roads. This unfettered mass action, which was both compounded and exacerbated by the effect of other traffic risk factors, generated a backlash in the form of surge of increased number of vehicle crashes and deaths. The results of this study address the causes and panacea to the perceived resurgence of the epidemiological problem. It is suggested that, as a primary prevention measure, annual revalidation of vehicle road worthiness. as well as strict enforcement of penalties for low level of altruism, extraversion, macho attitude and self reported risky driving behaviours, among others, should be instituted by Federal Road Safety Corps (FRSC) as means of exerting firm control and regulation on the identified factors.

Keywords: *middling, white noise, varimax rotation, epidemiological transition, misattribution.*

1.0 Introduction

Previous studies suggest that road traffic injuries and fatalities are the leading cause of death in both developed and developing countries; see, for example, Yang and Kim (2003); Afukaar, Antwi and Ofosu-Amaah (2003); Hancock and Ridder (2003). In 1999, about 750,000 people were killed all over the world as a result of road traffic accident, and the following year (2000) over 1.2 million people were killed due to the same reason (UN, 2003).

Until a few years ago, road traffic accidents in Nigeria, which had spiked in world records, appeared to be a major cause of death to the citizens more than any other causes. For example, whereas USA is reported in 1985 to record 4 deaths per 10,000 vehicle kilometre traveled, Nigeria recorded 240 deaths that same year (Asalor, Onibere and Ovuworie, 1985). Since independence in 1960 and until 1988 when Federal Road Safety Corps (FRSC) was established, Nigeria accident record had shown exponential growth. In particular, there was a phenomenal rise in road accidents in 1981 in Nigeria amounting to 55,966 cases. This figure compared fairly with 1980 correlate of 30,862 representing 81% rise over the previous year. The 1981 figure was said to represent 300% increase within 10 years period of 1971 to 1981 as reported in Agunloye (1990) and Hauer (2006). And between 1982 and 1984, average accident severity index was 21%; higher figures (between 30% and 36%) were recorded in eight of the 36 constituent states of Nigeria during that period.

The establishment of FRSC coupled with the institution of several intervention policies have tremendously assisted in stemming the trend of RTA rates. Surprisingly, as the chances of the average Nigerian being involved in road traffic accident are getting smaller, corresponding chances of getting killed or injured whenever a commuter is involved in an accident are on the increase. This irony sharpens the focus of the current research question. The research plan, in part, is set afoot to identify these factors, ascertain their correlation and subsequently devise ways and means to achieve monitoring and curtailment of these putative agents of accident causation.

The literature on road traffic accident and prevention is vast. The study Hauer (2006) reported on the concept of frequency-severity indeterminacy. It stated that generally and everywhere, not all cases of reportable accidents are reported, stressing that severity of accident greatly influences reportability. Arising from this situation, the authors note that this omission or commission leads to misattribution, misrepresentation and inherent misinterpretation by researchers. The authors also gave a stipulative definition of road traffic accident by quoting from American National Standard (ANS, 1996). According to the source, motor vehicle accident is an unstabilized situation that arises when a transport vehicle in transport is out of human control to the extent that it can result to harmful event, by which it is meant an occurrence of injury or damage.

Further, a body of research papers has addressed a catena of factors which encapsulated drivers behaviour, for example Mirza et al. (1998); Hakkert et al. (2000); Petridou and Moustaki (2000); Wouters and Bos (1998); Hakkanen and Summala (2000); groeger and Rothengatter (1998) and Rochlitz (2004). Also, past studies have identified animal-vehicle crashes as another crucial risk factor in road traffic accidents (Dickerson, Peirson and Vickerman, 2000; Philcox, Gregan and Macdonald, 1999; Andreas, 2005). Two persons lost their lives along Benin end of Benin-Sapele Road, Benin City, Edo State, Nigeria, as a result of uncontrolled movement of a cow into the highway on April 28, 2013. The vehicle was severely damaged.

Moreover, Evans and Smith (1999) reported on the method of estimating vehicle speed on highway by measuring the pedestrian throw distance from point of impact. Also, Vasconcellos (1999) discussed the impact of urbanization in road traffic accident. The accident features reported appear to be a ballpark of the Nigerian situation which this study discusses.

A recent study carried out in South Africa showed that defective tyres and brakes are the two most dominant components that contribute to accident causation with overloading as an additional factor to consider. The source claimed that such mechanical failures account for 3% of road accidents and that the same 3% is common to developed countries as well (van Schoor, van Niekerk and Grobbelaar, 2001). In London, the paper Dixey (1999) studied the empirical relationship between accident externality (self-reported behaviours) and traffic volume estimated by traffic count. The econometric model developed suggested that a strong relationship exists between road traffic accident and traffic flow. Also, Dickerson, Peirson and Vickerman, 2000) studied road traffic fatalism in relation to causes in south west of Nigeria; a highway near Igbo-ora. The researcher discovered that culture, predestination, fatalism, superstitions and generally belief, tend to hamper health promotion initiatives that would have been a panacea for rehabilitating road traffic accident victims.

Furthermore, so many papers have addressed RTA and their management: see Leanne and Macarthur (2006); Mao et al. (1997); King et al. (1994); Svenson, Nypaver and Calhoun (1996a); Lord, Manar and Vizioli (2005); Trinidad and Javier (2005); Kennedy, Isaac and Graham (1996); Wells-Parker and Snow (2001); Baker (2002); Richard (2005); Thomas, Tove and Peter (2005) for sources of excellent, relevant reference materials on road traffic accident and their management. Other studies on accident causative factors had been conducted in Nigeria (see, for example, Ehikhamenor and Obianwulo (2006) which reported on Blood Alcohol Concentration (BAC), of drivers in a southern Nigeria City). Similar BAC studies had been conducted in Mexico and Spain (Hijar et al., 1998; Carmen del Rio and Javier-Alvare, 1999).

The study Igboanugo and Ekhuemelo (2006) on intervention analysis of road traffic accidents in Nigeria from 1993 to 2001, it was reported that the establishment of Federal Road Safety Corps helped to stave off the snowballing rate of accident occurrence in Nigerian roads. The subject matter of the present study has been examined at an international conference on development studies (Igboanugo and Omoregie, 2007). The ideas garnered in the conference helped to enhance the quality of this study.

Researching the contextualization of traffic risk factors to the Nigerian situation had been infrequently undertaken. Previous studies by Ehikhamenor and Obianwuho (2006) and Dixey (2000) had considered few factors such as BAC and health promotion for accident victims for a particular Yoruba community in Southern Nigeria. Recent studies on road traffic accidents are found in Akpoghomeh (2012); Atubi (2010); Aworem, as well as Abdul-Azeez and Olabode (2010).

One of the goals of this study is to identify important traffic risk factors that are associated with road traffic accident causation in Nigeria. Another goal is to discover how these factors do individually and collectively interact to cause accident in Nigerian roads. The study also intends to carry out a comparative analysis of the international impact of these factors and assess the effectiveness of the approaches adopted by other countries in dealing with similar problems.

2.0 Method

Accident data from 1960 to 2002 were obtained from the Nigerian Police and FRSC records. The information is presented as graph (see Figure 1).

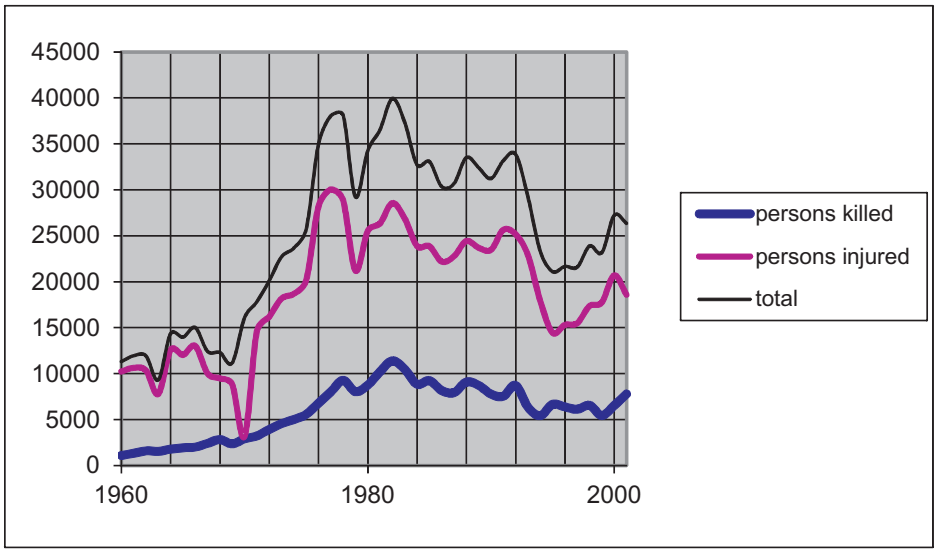

Fig 1: Fatalities and Serious Accidents on All Roads in Nigeria (1960-2001);

Source: Nigerian Police Force & FRSC

Oral interviews of some drivers plying the route under investigation and the personnel of Federal Road Safety Corps (FRSC) as well as police were undertaken. In particular, a survey of 532 well-informed respondents, comprising majorly of the group stated therein, was undertaken too. The research instrument used is the questionnaire. The sentences of the questionnaire were couched with identified scale items (25 potential traffic accident risk factors). Rensis Likert's attitudinal 5-point nominal scale was adopted in scaling the response options, namely: completely agree (5), Agree (4), Undecided (3), disagree (2), and completely disagree (1). Pre-questionnaire administration briefing and post-adm inistration debriefing of subjects were undertaken. The respondents' score were collated as data matrix and the Principal Component Analysis (PCA), as furnished by StatistiXL software, was used to extract 9 (nine) factors whose adequacy was confirmed by the use of scree plot and eigenvalue criteria.

Purposive sampling technique was used in selecting the twenty-five (25) specific factors. Thirty six constituent states of Nigeria comprised our sampling frame and the sampling technique used is that of purposive typology.

An assortment of literature on accident analysis and prevention consulted guided in the selection of the twenty-five factors depicted in Table 1.

The extraction of factors was by varimax orthogonal factor rotation. The term rotation means exactly what it implies. Specifically, the reference axes of the factors are turned about the origin until a modal position has been reached. Rotation of factor matrix helps to redistribute the variance from earlier factors to later ones to achieve a simpler, theoretically more meaningful factor pattern. Varimax rotation also causes shift in explanatory power because of the aforesaid redistribution. It is also desirable because it reduces ambiguity, simplifies factor structure and facilitates factor interpretation. It should be noted that percentage of squared factor loading denotes the amount of variance explained by the factor in question. For instance 25 which wields 0.90 factor loading in the last column of Table 6) accounts for $(0.90)^2$ x 100% = 81% of variance of X_{25} shared among the nine factors extracted. And the total contribution of the nine (9) factors to the explained variance is 0.909 which is termed the communality; it is a squared-row-sum.

Table 1: Selected twenty-five (25) accident causative factors

S/N	VARIABLE	SCALE ITEM DESCRIPTION
1	X_1	Traffic Volume/Road Capacity Relativity
2	X_2	Adequacy of Highway Road Sign
3	X_3	Road Curvature and Banking
4	X_4	Lighting System
5	X_5	Road-stream-Dividing Slabs
6	X_6	Drunk-Driving
7	X_7	Fatigue
8	X_8	Drinking and Driving
9	X_9	Nose-to-Tail Driving
10	X_{10}	Drug
11	X_{11}	Over-speeding
12	X_{12}	Drugging and Driving
13	X_{13}	Distraction
14	X_{14}	Traffic Congestion
15	X_{15}	Bad Weather Condition
16	X_{16}	Poor Brake
17	X_{17}	Bald Tyres
18	X_{18}	Faulty Headlight
19	X_{19}	Defective Steering
20	X_{20}	Dangerous Parking
21	X_{21}	Road Traffic Rules
22	X_{22}	Road Traffic Sanctions
23	X_{23}	Overtaking
24	X_{24}	Overloading

Figure 2 which is on varimax rotation is demonstrative.

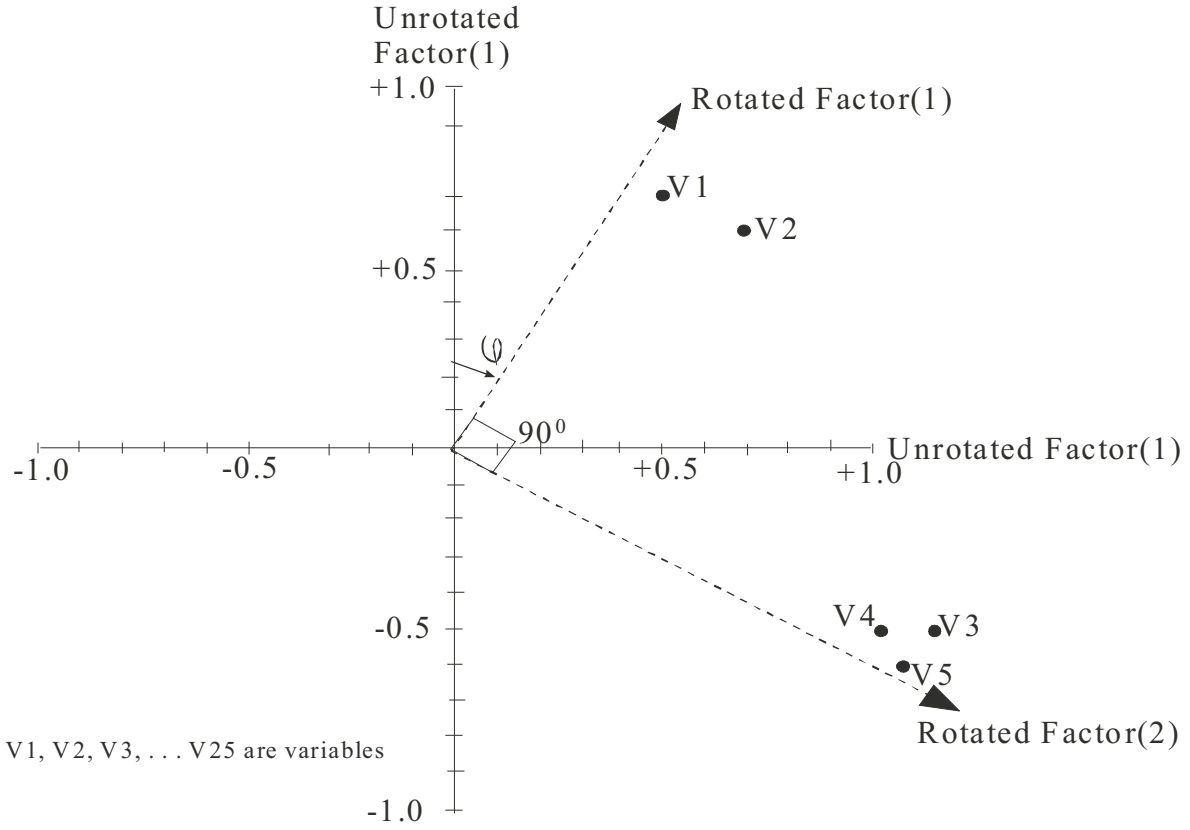

Fig.2 Varimax Orthogonal Factor Rotation.

The threshold value for acceptable factor loading was set at ± 0.50; lower values are considered to be below the minimum acceptable level of significance. The eigenvalue (λ) is the sum of squared factor loadings on a factor (column). Furthermore, the higher the factor loading, the more influencive is the variable considered.

In sum, this investigation is not only a cross-sectional study of major causes of road traffic crashes in Nigerian roads but also a longitudinal survey. Factor Analysis, a statistical tool for discerning similarity in dissimilarity, was used in analyzing 532 respondents' scores on identified scale items used in structuring the questionnaire. Knowledgeable respondents, mainly from the personnel of the Nigerian police, FRSC and fully licensed active vehicle drivers at Enugu, Asaba, Benin, Ore, Ijebu-Ode, Shagamu and Lagos which are major towns along the highway studied, were the research subjects.

3.0 Results and Discussion

The outcome of this study will be presented in two aspects namely:

3.1 presentation and analysis of RTA records obtained

3.2 presentation of results of Principal Component Analysis (PCA) of survey data.

We shall take them seriatim.

3.1 Presentation and analysis of RTA data

3.1.1 Crashes, fatalities and injuries, 1960 – 2001

Until independence, deaths resulting from road traffic crashes were comparatively low, less than 1,000 persons for the whole country of about 55 million then.

As it is evident from Figure 1, the phenomenon mushroomed to 11,382 reported deaths per annum in 22 years (1982). Thereafter the tide abated gradually over time following some intervention policies. However, the increase in salary of public servants by Obasanjo administration in 1999 economically empowered them to purchase, albeit, second hand cars that were imported mostly from Belgium. The Nigerian roads then became awash with the unreliable cars with an untoward consequences which reflected in resurgence of the erstwhile abating trend in road traffic crashes.

Table 2 summarizes some accident records from selected states of Nigeria for a particular period.

Table 2: Accidents Results in Some States of Nigeria (1981 – 1984)

	State	Severity Index (%)	Deaths per 100 accidents	Injuries per 100 acciddnts
1	Rivers	15	-	-
2	Bauchi	36	> 30.7	131
3	Niger	54	>30.7	-
4	Sokoto	-	>30.7	-
5	Edo/Delta	-	-	74
6	Anambra/Enugu	-	-	77
7	Benue	-	-	117
8	8 states	> 30	-	-
9	Nigeria	21	31.3	71.7

Source: Nigerian Police Force & FRSC

Table 3 compares road traffic accident figures for Nigeria and Britain.

Table 3: Comparative Fatality and serious Accidents on all roads in Great Britain and Nigeria.

Year / Location	1991	1994 – 1998 (average)	2001
Great Britain	47,931	40,481	34,764
England	40,650	34,859	30,276
London	7,279	6,082	5,584
Nigeria	**33,150**	**22,295**	**26,345**

Sources: Department for Transport; the Police service of Northern Ireland and FRSC in Nigeria

3.1.2 Population

The figure for Nigerian population by 1963 census was 55,000,000. By 1991 figure, national population figure was 88.9 million, almost equally divided between both sexes. Since 1991, population growth rate came to 2.9%.

In 2003, the population figure rose to 126 million. However, in 2007, the figure soared to 140,003,542, made up of 71,709,859 males and 68,293,683 females, Vanguard Newspaper (2007).

Deaths stemming from RTA spiked to a value of 11,382 in 1982. Values before and after this date are 10,202 and 10,462 which correspond to those of 1981 and 1983 respectively, all in close neighbourhood. On the basis of population, the average death per 100,000 persons, on national level, is 11 during the period (1981-1983). When this analysis was conducted on state basis, Ogun state had the highest rate of 23 persons per 100,000 population, and was followed by (Edo/Delta), formerly known as Bendel state before the split in (1989), with rate of 22 deaths per 100,000 persons (Agunloye, 1990). Figure 2 depicts the map of Nigeria with the component states delineated.

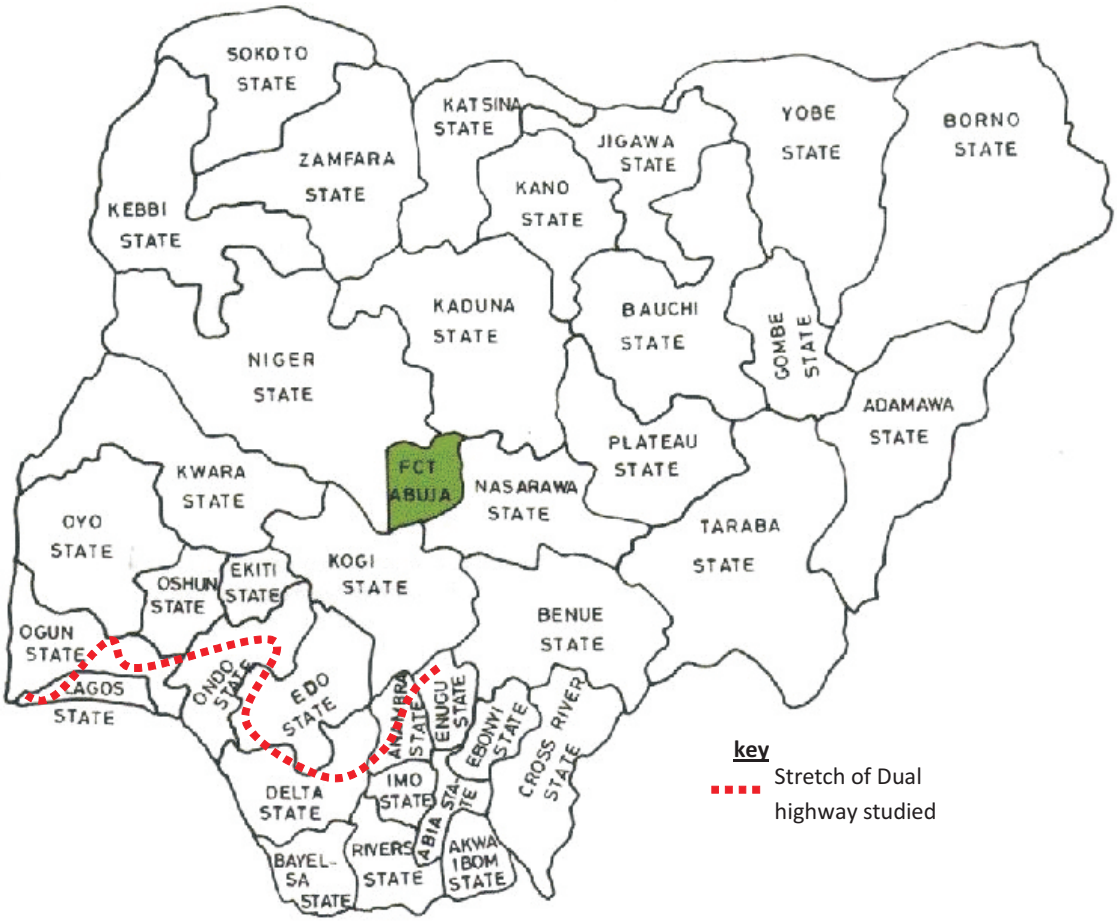

Fig 3: Map of the Federal Republic of Nigeria.

3.2 Presentation of results of PCA of Survey data

In what follows we present, analyze and interpret each of the factor matrix as obtained with the PCA.

3.2.1 Defects-spatiality Concern

Table 4 shows the bipolar (mixed signs) cluster which consists of middlings and mediocre. It deals with safety under condition of hampered visibility and mechanical defects. It is a general factor. The five variables share similar characteristic concern towards emerging hazards which the vehicle is prone to with respect to space and time.

Table 4: Defect-spatiality Cluster Loaded

Creative Label / Variable	**Defect-Spatiality Concern**	**Factor Loadings**
X_4	Lighting system	-0.753
X_9	Nose-to-tail driving	-0.736
X_{14}	Traffic congestion	-0.603
X_{16}	Poor brake system	0.649
X_{17}	Bald tyres	0.762

The first three variables vary inversely with the other two by virtue of their oppositeness in signs.

The cluster suggests worries about the integrity of tyres, visibility and effective braking distance. Variables X_4, X_9, and X_{17} which are middlings explain barely 50% of the variance while X_{14} and X_{16} (mediocres) account for about 36% (below average).

3.2.2 Infractions and Stimulants Concern

The next cluster depicted in Table 5 is concerned with infractions and stimulants cluster. The survey suggests that, at best, majority of the road users have moderate knowledge of road traffic rules and that record of infringements pertaining to the use of stimulants are not very common on the highway studied. Moreover, all the variables wield negative signs signifying that they covary and conjoin. The first three variables have meritorious factor loadings. The last variable wields middling factor loading that explains less than 25% of the observed variance of X_{21}.

Table 5: Infractions and Stimulants Cluster Loaded

Creative label / Variable	Infractions and Stimulants Concern	Factor Loadings
X_6	Drunk-driving	-0.861
X_8	Drinking and driving	-0.822
X_{12}	Drugging and driving	-0.886
X_{21}	Knowledge of road traffic rules	-0.549

3.2.3 Self-reported risky driving behaviour

Table 6 addresses self-reported risky driving behaviour. The three variables wield positive factor loadings implying that they move together and influence each other.

Table 6: Inapposite Driving behaviour Cluster

Creative label / Variable	Inapposite Driving Behaviour Concern	Factor Loadings
X_{11}	Over-speeding	0.898
X_{23}	Overtaking	0.720
X_{25}	Reckless and Careless driving	0.900

The three factors share a common characteristic which can be called macho attitude or self-reporting risky driving attitude. Although the variables (X_{11} and X_{25}) are meritorious because they wield high factor loading, they are however meretricious because they are highly risky factors of road traffic accident causation; X_{23} is mediocre and meretricious. The higher the factor loading, the more risky the factors.

3.2.4 Veering Tendency Concern

The next cluster depicted in Table 7 deals with factors (drug as well as wet slippery road condition) influencing veering tendencies towards the road median strip. They relate to extraversive attitudes and the concomitant sanctions. The first variable (X_5) which is negatively loaded in the group is strongly opposed to the influence of X_{10} and X_{15} which are both positively loaded on the factor.

Table 7: Veering Tendencies Cluster

Creative label / Variable	Inapposite Driving Behaviour Concern	Factor Loadings
X_5	Road-Stream-dividing Slab	-0.755
X_{10}	Drug	0.587
X_{15}	Bad weather condition	0.848

This cluster accommodates two risky variables that can cause vehicles to veer off road or cross median strip. Drug intake is a personality trait but weather condition is climatically induced. The influence of drugs has been analyzed and interpreted above. Adverse weather condition is acknowledged as RTA risky factor (Hijar et

al., 1998; Washington and Mannering, 2000).

3.2.5 Non- Observance Oriented Penalties Concern

Table 8 deals with extraversive attitude and the attendant sanctions.

Table 8: Non- Observance Oriented Penalties Cluster

Creative label / Variable	Non-observance Oriented penalties	Factor Loadings
X_{13}	Distraction	-0.894
X_{22}	Sanctions on road traffic abuses	0.868

This bipolar regime wields high factor loadings thus pointing up the high influence the factors exert. The duo exercise opposing effects. The result from Murray et al. (2001) helps to situate this cluster in the broader context of cognitive challenges while driving. In countries where sanctions are not enforced with strictness, distractions and other extraversions are bound to encourage reinforcement. The study by Wouters and Bos (1998) suggest that one way to control this behaviour is for Road Safety personnel to use in-car data recorders to monitor the highway. The study noted that the control is based on the philosophy that people who are aware that they are being observed tend to modify their behaviour.

3.2.6 Thoroughgoing Concern

The next platoon (bipolar) shown in Table 9 is creatively labeled thoroughgoing concern; obviously, under murky situations, obstructions become imperceptible with poor lighting. As in the immediately previous analysis, the effect of X_1 is opposed to those of X_{18} and X_{20} because of the opposite signs.

Table 9: Thoroughgoing Cluster

Creative label / Variable	Thoroughgoing Concern,	Factor Loadings
X_1	Traffic volume/Road Capacity Relativity	-0.747
X_{18}	Faulty headlight	0.649
X_{20}	Dangerous parking	0.883

One aspect of our analysis showed that this stretch of dual carriage highway is quite busy. The study by Dictson et al. (2000) in University of Kent, noted that accident externality is typically close to zero for low to moderate traffic flows, and that it increases substantially at high traffic flows.

3.2.7 Forces and Road Geometry Concern

Next, factor analysis model points up, in Table 10, the connection between road geometry and over-loading. The two factors are inversely related by virtue of the opposite signs the variables wield.

Table 10: Forces relativity Cluster

Creative label / Variable	Forces relativity Concern	Factor Loadings
X_3	Road curvature and Banking	-0.793
X_{24}	Over-loading	0.695

The two factors are moderately loaded (middlings) with road geometry being more offending. Ockert van Schoor (2001) corroborated the hazardousness of overloading in road safety analysis.

3.2.8 Optimal Use of Road Signs

Table 16, a lone factor, is concerned about the readability and existence or otherwise of road signs at the places they are expected to be. It has negative loading because it signifies caveat to potential hazardousness in a thoroughfare. It is the most meritorious variable thereby highlighting the importance of signing potential risky factors, as well as the need for people to be mindful of what particular message they portray or convey.

Table 11: Suitable Road Sign

Creative label / Variable	Suitable road sign concern	Factor Loadings
X_2	Adequacy of Highway road signs	-0.976

Failure to heed road signs could result to road accident. The PCA trumps it as the most influencive factor in RTA analysis by virtue of its highest factor loading of the 25 factors considered. Its significance is further emphasized and buttressed in the works Jorgensen and Wentzel-Larsen (1999) and Washington and Mannering (2000).

3.2.9 Control Concern

Finally, our analytical model stresses that either drivers fatigue or mechanical failure in steering or both can lead to loss of vehicle control. Both variables are loaded negatively because they work conjunctively to adversely affect vehicle control on the road.

Table 12: Control Cluster

Creative label / Variable	Control Concern	Factor Loadings
X_7	Driver fatigue	-0.695
X_{19}	Defective steering	-0.874

The two risky factors contribute substantially to road traffic crashes as supported by the results of the following studies from Finland and Greece respectively Hakkanen and Summala (2000), and Petridou and Moustaki (2000). The PCA model employed clustered the two factors based on the fact that they can work in sync to adversely affect vehicle control.

3.3 Primary Prevention Measures

In the light of the preceding analysis of results and discussion, the following multiple policy interventions are suggested.

i. Intensification of road safety education programme.
ii. Correction of accident black spots in existing roads.
iii. Enforcement of penalty for self-reported driving attitude.
iv. Use of vehicle data recorders as a means of providing drivers behavioural feedback. This scheme has been experimented in Netherlands with good results (Wouters and Bos, 1998).
v. Mediacy of adequate consideration for citizens who reported traffic infractions.
vi. Introduction of road safety evaluation scheme.

vii. Undertaking of field observations

viii. Introduction of digital breath analyzer for checking suspected drivers who are driving under the influence of alcohol.

ix. Adoption of concentrated general enforcement policy on the highway studied. This approach was successful on 700 km inter-urban roads in Israel (Hakkert et al., 2000)

x. Detailing FRSC personnel to check the following:

a) Turning performance of drivers under covert observation.
b) Signaling while turning.
c) Compliance with stop and yield signs.
d) Stricter enforcement of the use of seat belt by drivers and front seat passengers.
e) Compliance with keeping to the right on dual carriage roads.
f) Not crossing of the median strip at single carriage way.

xi. Finally, annual revalidation of vehicle road worthiness as well as enforcement of stiff penalties for low level of altruism, macho attitude, and self-reported risky driving behaviours should be instituted by Federal Road Safety Corps (FRSC) as a means of exerting control and regulation on the identified factors

It is envisaged that strict penalties for the above violations should serve as deterrent factor for the perceived accident trend. Taken together, sensitization of drivers on the potential hazardousness of these factors can assist in curtailing and whittling away these strong influences which the aforesaid factors wield on drivers.

4.0 Conclusion

Arising from our findings, analysis and interpretation of results, we can shape our viewpoints in the following conclusive statements.

1. Principal Component Analysis techniques applied has reduced the 25-variable structure into 9 specific dimensions. Accident analysis and prevention measures can now revolve around these nine areas instead of having to deal with the individual variables
2. Signing of potential traffic hazards is very crucial to road traffic accident control and prevention.
3. The 25 traffic risk factors identified in the PCA have been positioned and contextualized in the broader perspective of global accident studies.
4. The data used in this study have evidently shown that reported cases for injuries and fatalities rose from low threshold (1000) at independence (1960) to an alarming proportion (11,382 deaths) in 1983 before declining to about 6,000 deaths in recent years. Demographic changes, urbanization and changing life style appear to have accounted for this development. The various road safety intervention policies introduced by

the Federal Government of Nigeria helped to stem the gangrenous trend. The introduction of Federal Road Safety Corps in 1988 appears to be one of the best health promotion interventions aimed at epidemiological transition.

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THE EFFECTS OF NON DELEGATION BY SENIOR QUANTITY SURVEYORS AS AN AGENDA FOR STRESS

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ABSTRACT
Not only does poor delegation fail to take advantage of the potential benefits to both individual quantity surveyor and quantity surveying organization, but it can also be a potential source of work stress. Poor subordinates, supplanting, lack of training, poor delegation skills, fallacy, lack of confidence in subordinates, were some of the reasons managers failed to delegate. Similarly, back pain, heart disease, sleeplessness, aggression towards employees, taking longer over tasks, waist pain and repetitious of tasks were the symptoms of stress complained by individual quantity surveyor and quantity surveying organization. The downsizing in staffing levels and the increased need of effective cost management have placed greater pressures on senior quantity surveyors. Research into senior quantity surveyors registered / unregistered practicing in private organizations, government organizations, academia, consultants and contractors in Niger State showed that delegation of responsibility to middle surveyors require great skill, which was too seldom present. Replies from 50 senior surveyors in 10 organizations using primary and secondary data derived from review of related textbooks, journals, internet on quantity surveying service, delegation and stress related issues indicated a clear correlation between lack of autonomy and stress at work in some quantity surveying organizations. Stress was often caused by the hierarchical structure of the organization not permitting sufficient autonomy. As a result, there was delay in construction production leading to cost and time overruns as well as undermined of senior surveyors' authority within their own departments. Providing training and seminar on delegation and stress management will increase the awareness level and its effects in Nigeria

Keywords: *Delegation, Senior Quantity Surveying, Organization, Work Stress, Autonomy, Management, Niger state.*

INTRODUCTION

Management is concerned with the effective use of resources so that work is done efficiently and objectives are met within the prescribed time scale. Of prime importance among these resources is the management of people. It is not just a question of using a person's skills and aptitudes for the benefit of the firm or other employing organization, but also of providing encouragement and motivation for the people concerned. One very effective method of achieving this aim is by delegation of duties and responsibilities, but having full regard to the abilities, strengths and weaknesses of the staff concerned. The manager can then concentrate on management activities while leaving the subordinate free to undertake his new assignments within the limits of his authority and subject to a monitoring system (Muir, 1983). The style a manager adopts often reflects his attitude to others. Negative attitudes will lead to a more autocratic style – the manager believing that people are basically lazy and need firm control. The democratic manager has a more positive attitude to the team. He sees them as responsible, keen and capable of initiative and self control. He listens to their ideas and encourages them to become involved in the decision making process (Fryer, 1983). In practice many organizations tend to adopt a middle course, combining encouragement of initiative and a corporate spirit with some measure of overall control, (Seeley, 1997).

The role the constructors' quantity surveyors play is crucial to the success of their organization and the reputation of companies is built. To this effect, there is a consensus on the important influence quantity surveyors exercise in ensuring the success of a project (Lovell, 1993; Matthews, 1993; Wakefield, 1985). Moreover, the leadership qualities and interpersonal skills of quantity surveyors in contracting firms have been recognized as a prime key to achieving good performance (Bresnen *et al*., 1986; Mustapha, 1990; Djebarni and Lansley, 1995). Quantity surveyors have proved themselves to be adept in a diverse range of skills, often over and above their technical knowledge, with which they serve the needs of their clients, (Cartlidge, 2006). Quantity surveyors engaged in contracting organizations will be well versed in latest management techniques and their applications for programming and progressing, network analysis, risk analysis, forecasting costs, budgeting and other control mechanisms, (Seeley, 1997).

BACKGROUND OF THE STUDY

The current Role of the Quantity Surveyors in the preparation of traditional BOQs in Niger State, were the product of questionnaires sent to all practicing quantity surveying firms in March 2013; typically, the survey resulted in a mere 20 per cent response rate as the rate of senior quantity surveyors who were willing to give maximum amount of delegation and 79 per cent response rate as the rate of senior quantity surveyors who complained of stress. The report paints a picture of a state where the quantity surveyor produce bill of quantities without delegation by subdividing the activities of the BOQ despite the job related stressors involved.

As a result, there was delay in construction production leading to cost and time overruns as well as undermined of senior surveyors' authority within their own departments, (Cartlidge, 2006). The downsizing in staffing levels and the increased need of effective cost management have placed greater pressures on senior quantity surveyors. Indeed, the report comes to the conclusion that the service of quantity surveyor is characterized by a high work overload, long working hours, and many conflicting parties to deal with including the management, the subcontractors, the subordinates, the client, etc. This trait of the job makes it very prone to stress. One very effective method of achieving this aim is by delegation of duties and responsibilities, but having full regard to the abilities, strengths and weaknesses of the staff concerned, (Mullins, 1996).

This paper therefore, reports on the results of a research study 'the Effects of Non Delegation by senior quantity surveyors as an Agenda for Stress with a particular focus on both individual senior quantity surveyor and quantity surveying organization using traditional method of procurement in Niger State, March 2013. Response from respondents depicted hierarchical structure, supplanting, poor subordinates, lack of training, poor delegation skills, fallacy, lack of confidence in subordinates were some of the factors indicated to be responsible for non- delegation and back pain, sleeplessness, aggression towards employees, taking longer over tasks, waist pain, repetitious of task, etc were also some of the symptoms of stress complained by individual quantity surveyors. Sources of stress were selected on the basis of literature review. These include among other things inadequate information, inadequate resource plan, inadequate time plan, improper pre-contact actions, inadequacy/inconsistency of communication flow, site visits, too much paperwork to work with, preparation of schedules, writing of query sheets where required, scaling where discrepancies occurred between/among drawings, constant use of BESMM, cracking of brain for description, etc. These led to the following objectives: (1) to investigate whether senior quantity surveyors were aware of delegation of duties and responsibilities in Niger State; (2) to examine the association between delegation and stress; (3) to show that sources of stress is contingent upon delegation; (4) to examine the reasons for lack of delegation; (5) to examine the symptoms of stress. Nevertheless answers would be provided for the following questions: (1) were the senior surveyors aware of delegation of duties and responsibilities in Niger State? (2) Was there association between delegation and stress? (3) Does stress dependent on delegation? (4) What were the reasons for lack of delegation in Niger State? (5) What were the symptoms of stress due to lack of delegation? (Mullins, 1996; Djebarni, 1996; Chiktara, 2003).

As building work grows in size, so the extent of delegation increases. Delegation involved the passing on of authority and responsibility to various levels throughout the organization which may be established on the basis of “tash” or element functions of the organization. Delegation provides a means of training and development, and of testing the subordinate's suitability for promotion. It can be

used as a means of assessing the likely performance of a subordinate at a higher level of authority and responsibility, (Peter and Hull, 1970). Delegation can encourage the development of specialist expertise and enables specific aspects of management to be brought within the province of a number of specialist staff for greater efficiency. Another reason for delegation is where a branch office is located some distance away from the head office; the branch manager will need an adequate level of delegation in order to maintain the day-to-day operational efficiency of the office. Delegation is matter of sound economics as well as good organization. Delegation should lead to an improvement in the strength of the workforce. It should give subordinates greater scope for action and opportunities to develop their aptitudes and abilities, and increase their commitment to the goals of the organization (Vinton, 1987). Delegation can lead to improved morale by increasing motivation and job satisfaction. It can help satisfy the employee's higher level needs.

Stress according to Oxford Advanced Learners Dictionary (2006) has been defined as pressure or worry caused by the problem in somebody`s life. Stress is also a pressure put on something that can damage it or make it lose its shape. However, Health and Safety Executive (2001) equally defined occupational stress as adverse reaction by people to excessive pressure or other types of demand placed on them. It further affirmed that occupational stress or work place stress is that which is experienced as a direct result of a person`s occupation. Workplace stress is the harmful physical and emotional responses that can happen when there is a conflict between job demand on the employee and the control an employee has in meeting these demands. Stress reaction is seen as an individual response to a given stress; which can be behavioural, perceptual, physiological, emotional and cognitive, or signs and symptoms of illness or disorders such as back pain, boredom, sleeplessness, aggression towards employees, taking longer over tasks, waist pain, neck pain, boring repetitious, fatigue, gnawing in the gut, etc. It is also common place for people to complain that stress negatively affects their functioning systems. It impairs concentration ability, problem-solving ability, decision-making ability and the ability to get work done, (Djebarni, 1996).

STATEMENT OF THE PROBLEM

There are many factors that can lead to the effect of non delegation and stress. The extent of decentralization and divisionalisation provides the basic structural pattern of the formal organization. Within the structure of the organization the various activities that have to be undertaken must be distributed among individual members of the workforce. This could probably be that the projects cost was of specialized type – mechanical and electrical services, cost benefit studies, refurbishment, urban renewal or small in nature. There are distinct advantages in using staff that specialize in these classes of work, as each requires its own specific approach and the building up of a body of knowledge and expertise. However, all systems need periodic review to take account of changing circumstances, employers' requirements, the training of junior staff and many other related

matters. Also the surveyors may tend to specialize in certain types of project such as health projects, educational buildings, commercial schemes, and residential projects, (Seeley, 1997) as well as fear of duplication or omission when several surveyors are employed in taking off and billing one project. The manager may again fear that the subordinate is not capable of doing a sufficiently good job. Conversely, the manager may fear that the subordinate might supplant him and as construction works are difficult to come about might show the manager in a bad light. In addition, Managers may not have been 'trained' themselves in the skills and art of delegation. They may lack an awareness of the need for and importance of effective delegation, or what it entails.

Newman (1956) has identified some of the main obstacle to effective delegation in terms of the attitudes of the manager, and reasons why the subordinate shrinks from accepting new responsibilities. Reasons for reluctance to delegate are: (i) The 'I can do it better myself' fallacy; (ii) Lack of ability to direct; (iii) Lack of confidence in subordinates; (iv) Absence of selective controls which give warming of impending difficulties and (v) A temperamental aversion to taking a chance. Subordinates avoid responsibility because: (i) They find it easier to ask the boss to make decisions; (ii) They fear criticism for mistakes; (iii) They believe they lack the necessary information and resources to do a good job; (iv) The subordinates may already have more a work than they can do; (v) They lack self-confidence; and (vi) Positive incentives may be inadequate, (Mullins, 1996).

Assumptions about human nature and behavior: A reluctance to delegate might arise from the manager's belief in, and set of assumptions about, human nature and behavior. The Theory X manager believes that people have an inherent dislike of work, wish to avoid responsibility, and must be coerce, controlled, directed, and threatened with punishment in order to achieve results. Such a manager is likely; therefore, to be interested in only limited schemes of delegation, within clearly defined limits and with an easy system of reward and punishment. On the other hand, the Theory Y manager believes that people find work a natural and rewarding activity, learn to accept and to seek responsibility, and they will respond positively to opportunities for personal growth and to sympathetic leadership. Such manager is more likely to be interested in wider schemes of delegation based on consultation with subordinates, and with responsibility willingly accepted out of personal commitment, (Mullins, 1996).

THE REVIEW OF LITERATURE

Despite the stress involved in the preparation of bill of quantities on large projects, over 50% of the value of all building work in the UK is still let using lump-sum contracts with firm or approximate quantities. Most other procurement routes, such as design and build and management contracting in its various forms, also involve quantification of the work in some form or other, either by the main contractor, subcontractor or package contractor, and therefore the measurement process

continues to be of importance. Computerized and other alternative measurement systems have become more and more widely used (Lee *et al.*, 1998). Latack, 1986) concluded that the quantity surveyors' jobs (particularly the preparation of bill of quantities) are potentially high stressors and in most cases inherently stressful. Inadequate information, inadequate resource plan, inadequate time plan, Inadequacy/inconsistency of communication flow, site visits, taking off of quantities, too much paperwork to work with, scaling where discrepancies occurred between/among drawings, preliminary calculations and collections, constant use of BESMM, lack of autonomy, etc, has placed a lot of stress on the senior surveyors, (Chiktara, 2003).

Traditional Bill of Quantities

A bill of quantities is a schedule which when priced can provide a total for a project. The traditional preparation of a bill of quantities divides itself into two distinct stages: (1) the measurement of the dimensions and the compilation of the descriptions from the drawings and specification. This process is commonly known as taking-off. (2) The preparation of the bill. This involves the calculation of volumes, areas, etc (squaring the dimensions). Traditionally, this was followed by entering the descriptions and the squared dimensions on an abstract (abstracting). From this abstract the draft bill was written (billing). The bills of Quantities comprise two main elements which complement each other, namely items and quantities. To produce accurate and useful bills, both elements must be carefully prepared in a logical sequence to avoid missing anything of importance. Good item writing requires the skills of interpreting drawings, understanding how the work will be carried out including the operative skills and plant involve, communication in concise technical language and knowledge of the applicable rules of BESMM3, (Lee *et al.*, 1998; Seeley and Murray, 2001).

Calculation of the quantities for items requires the skills of mensuration, construction, interpretation, etc. Two main methods of bill production have developed within the quantity surveying profession. **Abstracting:** When the items on the dimension sheets after squaring cannot conveniently be transferred direct to the appropriate section of the bill, they may be grouped in an abstract, where they will be suitably classified and rescued to the recognized units of measurement preparatory to transfer to the bill to collect similar items together and present them in a recognized bill order. **Direct Billing:** This is the traditional approach, tracing its roots back to the original trade-by-trade measuring of completed building work; the surveyor takes off one work classification at a time and works steadily through the work, producing a draft bill usually with fully developed items and headings as well as the quantities. Once this document is calculated and checked the bill can be typed directly from this draft, (Seeley and Murray, 2001).

Delegation

A particular feature of work organization is the need for delegation. The various

activities of the professional Q/S organization have to be distributed among its members. Management involves getting work done through the efforts of other people. This entails the process of delegation and the creation of an execution of work, the manager needs to understand how best to implement the process of delegation, (Mullins, 1981). Successful delegation will help to overcome Greslam's law of planning which states that programmed activity tends to drive out non-programmed activity. Programmed activity involves decisions which are repetitive and routine; non-programmed activity involves decisions which are novel and unstructured, (Simon, 1977). Successful delegation frees managers from day-to-day routine duties and enables them to concentrate more of their time on non-programmed activities. This simple, but important, point was made many years ago by Hamiton, sir lan (1921) in a study of the organization of military units.

It is sometimes the practice on large projects to subdivide the taking-off work between different quantity surveyors or even separate groups. The subdivision could, for instance, take the form of (1) structure of the building(s); (2) joinery and finishes; and (3) services and external works. Another and probably better alternative is for the whole or the taking off work to be undertaken by a single group of staff under the supervision of a senior surveyor or team leader, the group consisting of possibly three to six staff according to the size of the project. Furthermore, there are distinct advantages in arranging for this group o undertake all the work from inception to completion of the project, encompassing cost planning, contract document preparation, tender assessment and post contract work. This procedure enables the staff to obtain wider and more interesting experience and is likely to result in improved efficiency through greater familiarity with all the details of the scheme. With very large schemes it may be necessary for separate groups to work together to rationalize resources and use them more effectively. After the draft bill is prepared, the important task of examining and editing it by a partner or senior surveyor follows. The proof bill from the printers also requires thorough checking, particularly with regard to quantities and descriptions, preferably involving two members of staff, (Seeley, 1997).

A question of balance

Authority, responsibility and accountability must be kept in parity through out the organization. The manager must remain in control. The manager must be on the lookout for subordinates who are more concerned with personal empire building than with meeting stated organizational objectives. The manager must prevent a strong personality exceeding the limits of formal delegation. We have said that delegation creates a special manager-subordinate relationship. This involves both the giving of trust and the retention of control. The essence of the delegation problem lies in the trust-control dilemma. The dilemma is that in any one managerial situation, the sum of trust + control is always constant. The trust is the trust that the subordinate feels that the manager has in him. The control is the control that the manager has over the work of the work of the subordinate. Control

is, therefore, an integral part of the system of delegation. But control should not be so close as to inhibit the effective operation or benefits of delegation. It is a question of balance, (Mullins, 1981).

Managerial Stress

Various researchers equally made us understand that spending hours on work or on work related-issues will not only leave us to deal with work pressures, but also reduce the productivity level as well as increase proportion of our finance expended in keeping healthy. In fact, modern day living can be incredibly stressful and could impose high physical demand on our bodies as well as emotional costs on our lives Cohen (2002). It is also common place for people to complain that stress negatively affects their functioning systems. It impairs concentration ability, problem-solving ability, decision-making ability and the ability to get work done. Many research studies have been focusing on the behaviour and performance of construction workers as building production management maintenance, management and estimating tasks are largely unstructured and relying on subjective judgment which the problem solving ability and performance of the construction workers could be affected by job stress. Stress can either be managed or reduced; this is because stress cannot totally be eliminated from the life of an adult human being. Stress management therefore describes strategies of coping, recovering, reinterpreting, refraining and cognitive restructuring adopted by an individual who is under stress, making changes that can reduce stress or taking actions that can alter stress impacts.

Victor *et al*. (1991) found stress to be as much of a problem for the construction industry as almost any other profession, but noticed that individual in the industry felt that admitting to stress was a major sign of weakness. Stress has always been an integral part of our daily life since prehistoric times. Stress was there when our predecessors were required to fight or flight for their survival. In modern times, stress plays an important role in how successful or unsuccessful we are in our productive work activity, and in general, in enjoying our live. Stress is not necessarily negative for our performance. Some levels of stress are desirable to generate enthusiasm, creativity, and productivity. However, excessive levels of stress could become counterproductive if the situation does not require this elevated level of stamina (Davidson, 1997).

RESEARCH METHODOLOGY

The scope of this study was limited to quantity surveyors practicing in private organizations, government organizations, academia, consultants and contractors in Minna and Bida of Niger State. For easy identification, the organizations were grouped into two sectors – the client's quantity surveyors and the contractor's quantity surveyors. The aim of this study was to assess the effects of lack of delegation by senior Q/S as an agenda for stress in Minna and Bida of Niger state, March 2013. The downsizing or organization reduction in staffing levels and the increased need of effective cost management have placed greater pressures

on senior quantity surveyors. A structure questionnaire was employed to elicit information from quantity surveyors practicing in 10 organisations about their personal information, reasons for non delegation, types of stress encountered for non delegation as well as sources for stress. The developed questionnaires were pre-tested on a random sample of 20 senior quantity surveyors and were then modified to incorporate appropriate suggestions made by the pre-testing sample, prior to its distribution to sample population. A total number of 85 questionnaires were sent to quantity surveyors practising in those organizations. The 50 questionnaires returned, were useful for the research and they provided the database for the analysis. Quantity surveyors' personal data, reasons for non delegation, types of stress encountered for non delegation as well as causes of stress were measured on an interval basis using a five-point Likert Scale and ranking in ascending order. These considerations were taken as ordinal variable.

The method of analysis used in this study included both descriptive and inferential statistics. The descriptive statistics used included cross tabulation frequency counts and percentages method. Tabulation is the arrangement of data involved in tabular form. It forms the basis of reducing or simplifying the details in a mass of data into such a form that the main features would be brought out to make the assembled data easily understood. It equally helps to condense the data and to ease comparison of data. The inferential statistics used included the use of likert scale for the qualitative assessment of the data.

RESULTS AND DISCUSSIONS

This section focuses on the analysis of the data collected and the presentation of the results. It also explains the method of measurement used and the type of analysis carried out. From these analyses, different conclusions and recommendations were made. In this research, a total number of 85 quantity surveyors questionnaires were administered and 50 were retrieved. The characteristics of the respondents are shown below:-

Personal Profile of the Respondents

Table 1

Respondents were asked to indicate the procurement approach adopted by employers in executing contract works in Niger State. They all mentioned that since all the estimates they prepared were based on the traditional method of measurement, it then implies that employers have only used the lump sum method of contracting in executing their projects. Implying that the new method of procurement design & build, manage contract, etc were yet to be adopted in this part of the country, (Niger State). From table 1, lump sum contract had the whole 100%, lump sum (spec and drawings) 0%, design and build 0%, construction management 0%, partnering 0% and others 0%. The table showed that Minna had the largest number of quantity surveyors of 66% while Bida had the remaining 34%. The reason could be that there were more quantity surveying organizations and a sizeable number of individual quantity surveyors in those

organizations in Minna than Bida. Again, examination of year of experience of surveyors was also considered. It was gathered from the table that quantity surveyors that have worked within 1-5 years were 16.47%, 6-10 years were 22.35%, and 11-15 years were 40%, 16-20years 17.65% while the remaining 3.53% was 20 and above 25. This is an indication that the years of experience of the respondents in construction industry would offer them good and reasonable understanding of how to manage their business in an environment where the cultural behavior and its related issues of the people were negative. The table also depicted client Q/Ss were larger with 70%, 30% amount of delegation and 46% of magnitude of stress than contractor Q/Ss 30% with 10% amount of delegation and a high amount of stress of 26%. This could be that more clients had more quantity surveyors than contractor's. From the results obtained it is indicated that client Q/S delegated and complained less of stress than contractor's. The implication is that as bill of quantities preparation is stressful, the contractor Q/S was going to face the challenge of stress. No wonder when (Latack, 1986) concluded that the quantity surveyors' jobs (particularly the preparation of bill of quantities) are potentially high stressors and in most cases inherently stressful. The report observes that regardless of the workload attached to bill preparation, senior surveyors response rate in relation to delegation was as low as 40% as the rate of senior surveyors who delegated their duties and responsibilities and this as resulted to serious stress of 72% but which did not have immediate negative effects on the senior surveyors' business. All the quantity surveyors administered were aware of delegation of duties and responsibilities. Client Q/S was 70% awareness while contractor Q/S was 30% awareness. Again, senior Q/S mentioned that employers complained of delay in production of BOQ. 52% of client Q/S said that there was cost and time overruns in production of BOQ while contractor Q/S complained of 26%. However, 23% of surveyors worked on bills of quantities from inception to completion, 4% only carried out the taking-off, and 10% prepared the draft bill, 10% the examination and editing of BOQ, 12% proof bill from printers while thorough checking was 18%.

Respondents were asked to indicate the factors responsible for the lack of delegation despite the good reasons for delegation. They ranked (1) Hierarchical structure has the mean highest score of 4.40. Many of Q/S works are mechanistic in nature; Q/Ss service is a more rigid structure and is characterized by specialization. (2) Dependence upon other people has a mean score of 4.28 which was ranked second. (3) Lack of training with a mean score of 4.24 was ranked third. The managers may not have been 'trained' themselves in the skills and art of delegation. (4) Fallacy (I can do it better myself) with a mean score of 4.08, (5) Absence of selective controls with a mean score of 3.52, (6) Assumptions about human nature and behaviour with a mean score of 3.24, (7) Lack of ability to direct with a mean score of 2.52, (8) Lack of confidence in subordinates with a mean score of 2.50 and (9) A temperamental aversion to tasking advance with a mean score of 1.68 respectively were indicated as obstacles to delegation.

Inadequate information e.g. Drawings and lack/insufficient specification with the highest mean scores of 4.92 and 4.90 could lead to serious stress. Inadequate resource plan ranked third with a mean score of 4.86, inadequate time plan had a mean score of 4.84, improper pre-contact actions had a mean score of 4.80, inadequacy/inconsistency of communication flow had a mean score of 4.76, site visits had a mean score of 4.70, too much paperwork to work with had a mean score of 4.68, fair of errors had a mean score of 4.60, preparation of schedules also had a mean score of4.60 as well as writing of query sheets had a mean score of 4.60, scaling where discrepancies occurred between/among drawings had a mean score of 4.58, preliminary calculations and collections had a mean score of 4.50, constant use of BESMM had a mean score of 4.40, too much of sitting and too much of paper ruling had mean scores of 4.34 each, cracking of brain for description had a mean score of 4.31, continuous writing of headings had a mean score of 4.28, Lack of use of computer and software packages had a mean score of 4.26, Inadequate number of staff to do the job properly had a mean score of 4.20, typed proof had a mean score of 4.12, Examination and editing BOQ had a mean score of 4.08, general final check had a mean score of 4.02 and working long hours had a mean score of 3.94. No wonder when (Latack, 1986) concluded that the quantity surveyors' jobs (particularly the preparation of bill of quantities) are potentially high stressors and in most cases inherently stressful.

Respondents indicated that they felt serious stress when measuring and billing. Back pain ranked first with a mean score of 4.98, followed by neck pain and aggression towards employees with mean scores of 4.82 each. Similarly, sleeplessness had a mean score of 4.42, boredom had a mean score of 4.24, taking longer over tasks 3.84, conflict of boundary situations 3.68 while repetious had the least of mean score of 3.32.

CONCLUSION

The downsizing in staffing levels and the increased need of effective cost management have placed greater pressures on senior quantity surveyors. Indeed, the report comes to the conclusion that the service of quantity surveyor is characterized by a high work overload, long working hours, and many conflicting parties to deal with including the management, the subcontractors, the subordinates, the client, etc. This trait of the job makes it very prone to stress. Stress was often caused by the hierarchical structure of the organization not permitting sufficient autonomy. Findings showed clear correlation between lack of autonomy and stress at work in some quantity surveying organizations. From the collation of the questionnaire, client Q/Ss were70%, while contractor Q/Ss 30%. Client Q/S only allowed 30% of amount of delegation and 46% amount of stress while contractor Q/S had 10% amount of delegation and as high amount of stress of 26%. The result also showed that all the senior Q/Ss were aware of the important of delegation. Awareness was 100%. Also, 78% of senior Q/S had cost and time overruns causing delay of BOQ production. Probably, because 23% of surveyors worked on bills of quantities from inception to completion, 4% carried out taking-

off, and 10% prepared the draft bill, 10% the examination and editing of BOQ, 12% proof bill from printers while thorough checking was 18%. From the outcomes, it could be inferred that sufficient delegation was not allowed.

RECOMMENDATION

(1) Within the structure of the organization the various activities that have to be undertaken must be distributed among individual members of the workforce.
(2) The need for management control
(3) Authority, responsibility and accountability must be kept in parity through out the organization.
(4) A systematic approach to delegation: Setting up a successful system of delegation involves the manager examining four basic questions. What tasks could be performed better by subordinate staff? What opportunities are there for subordinate staff to learn and develop by undertaking delegated tasks and responsibilities? How should the increased responsibilities be implemented and to whom should they be given? What forms of monitoring control system would be most appropriate?
(5) Reliance on other people
(6) Confidence and trust
(7) Confidence and trust
(8) Training and learning experience
(9) Consideration of computer and computer software package

There must be stress management

The scope of the study: The scope of this study was limited to quantity surveyors practicing in private organizations, government organizations, academia, consultants and contractors in Minna and Bida of Niger State. For easy identification, the organizations were grouped into two sectors – the client's quantity surveyors and the contractor's quantity surveyors. The aim of this study was to assess the effects of lack of delegation by senior Q/S as an agenda for stress in Minna and Bida of Niger state, March 2013.

Limitation of the study: The researcher experienced difficulty in collating the distributed questionnaires from the respondents as such there was delay in the completion period of the study. However, out of the 85 questionnaires distributed, only 50 questionnaires were retrieved and useful.

Abbreviations used in the study are: Q/S - Quantity Surveyor; Q/Ss - Quantity Surveyors and BOQs - Bill of Quantities

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APPENDIX

Table 1.1. Percentage Distribution of Respondents by methods of procurement

Type of procurement	Frequency	Percentage
Lump sum – firm	50	100.00
Lump sum (spec and drawings)	0	0.00
Design and build	0	0.00
Construction management	0	0.00
Partnering	0	0.00
Others	0	
Total	50	100.00

Source: RICS Contracts in Use 2003.

Percentage Distribution of Respondents by location

Location		
Minna	33	66.00
Bida	17	34 .00
Total	50	100.00

Percentage Distribution of Respondents by Years of Experience

Years of Experience		
1-5	7	16.47
6-10	11	22.35
11-15	14	40.00
16-20	15	17.65
21-25	3	3.53
Above 25	0	0.00
Total	50	100.00

Percentage Distribution of Respondents by delegation awareness

Delegation awareness		
Client Q/S	**35**	**70.00**
Contractor Q/S	**15**	**30.00**
Total	50	100.00

Percentage Distribution of the Respondents by sector

Sector		
Client Q/S	**35**	**70.00**
Contractor Q/S	**15**	**30.00**
Total	50	100.00

Percentage Distribution of Respondents that delegated part of preparation of BOQs

Delegation		
Client Q/S	15	30.00
Contractor Q/S	5	10.00
Total	20	40.00

Percentage Distribution of the Respondents that complained of stress

Stress		
Public sector	**23**	**46.00**
Contracting sector	**13**	**26.00**
Total	29	72.00

Percentage Distribution of the Respondents that complained of cost and time overruns

Cost and time overruns		
Public sector	**26**	**52.00**
Contracting sector	**13**	**26.00**
Total	29	78.00

Percentage Distribution of the Respondents by subdivision of **preparation of BOQ**

Subdivision of BOQ		
Inception to completion	23	46.00
Taking-off	2	4.00
Preparation of draft bill	5	10.00
Examining and editing	5	10.00
Proof bill from the printers	6	12.00
Thorough checking	9	18.00
Total	50	100.00

Percentage Distribution of the Respondents that used software package to prepared BOQs

Software

Public sector **0** **0.00**

Contracting sector **0** **0.00**

Total 0 0.00

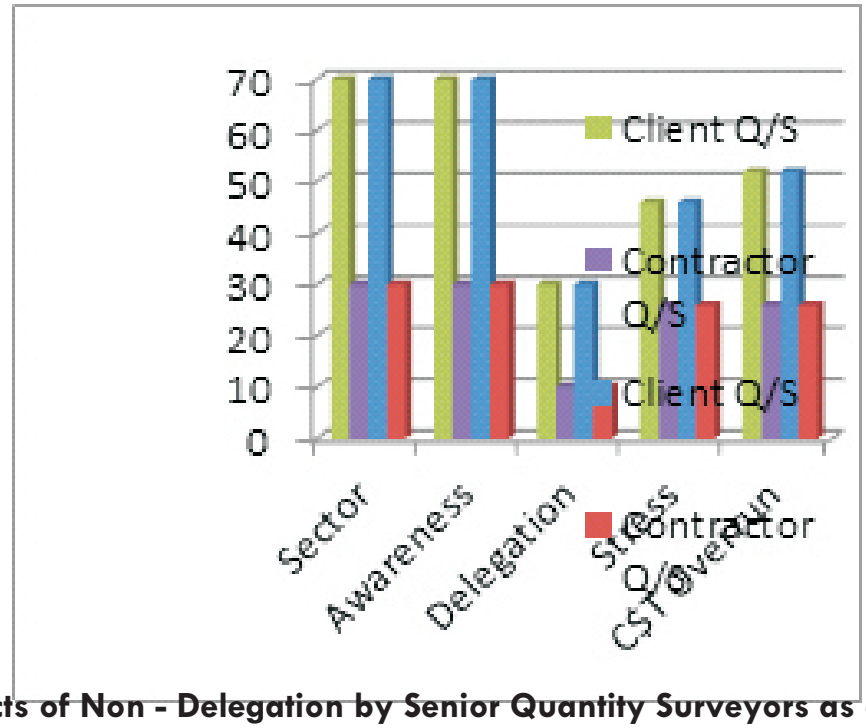
Percentage Distribution of Respondents by Sex

Sex

client Male 32 64.00

Female 18 36 .00

Total 50 100.00

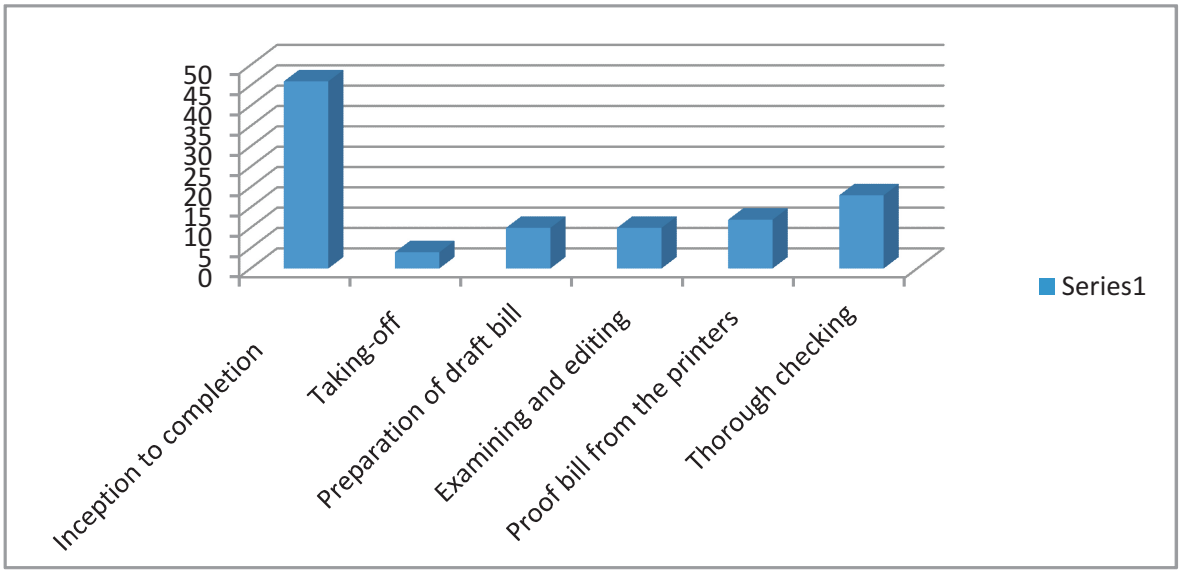


The Effects of Non - Delegation by Senior Quantity Surveyors as an Agenda for Stress

	Client Q/S	Contractor Q/S	Total %
Sector Awareness	70	30	100.00
Delegation	70	30	100.00
Stress	30	10	40.00
C$T Overrun	46	26	72.00
	52	26	78.00

Percentage Distribution of the Respondents by Subdivision of Preparation of BOQ

Percentage Distribution of the Respondents by Subdivision of Preparation of BOQ



Percentage Distribution of the Respondents by subdivision of **preparation of BOQ**

Subdivision of BOQ		
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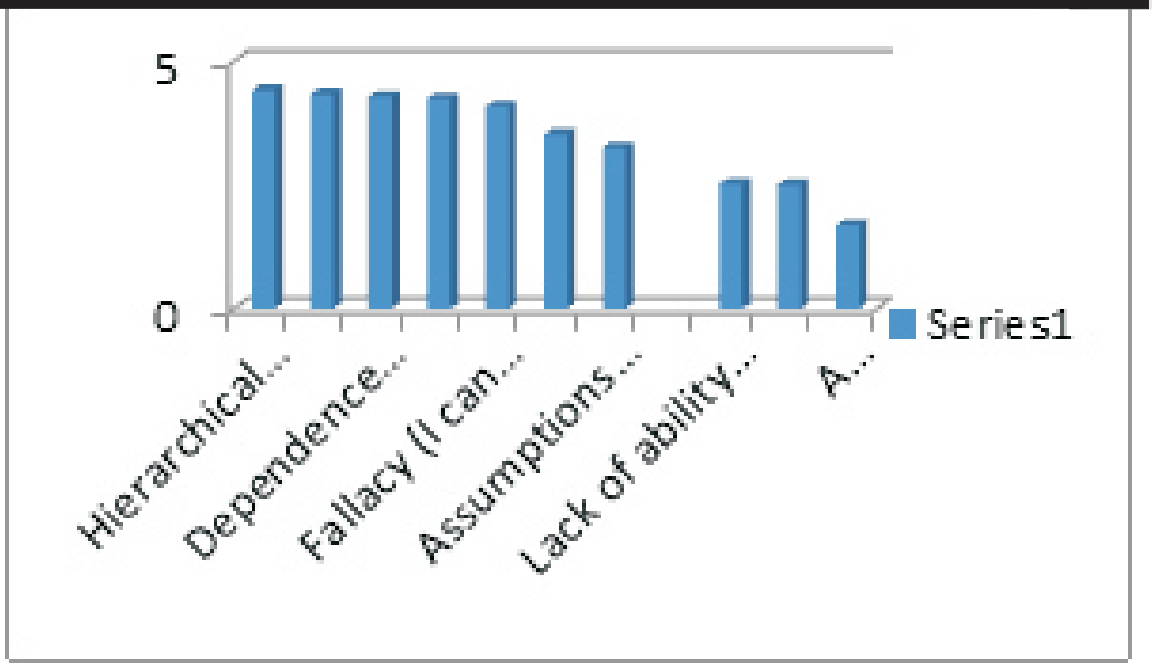
Taking-off	2	4.00
Preparation of draft bill	5	10.00
Examining and editing	5	10.00
Proof bill from the printers	6	12.00
Thorough checking	9	18.00
Total	50	100.00

Distribution of Respondents by reasons for lack of delegation

Distribution of Respondents by Symptoms of Stress


5
0
Hierarchical...
Dependence...
Fallacy (I can...
Assumptions...
Lack of ability...
A...
Series1

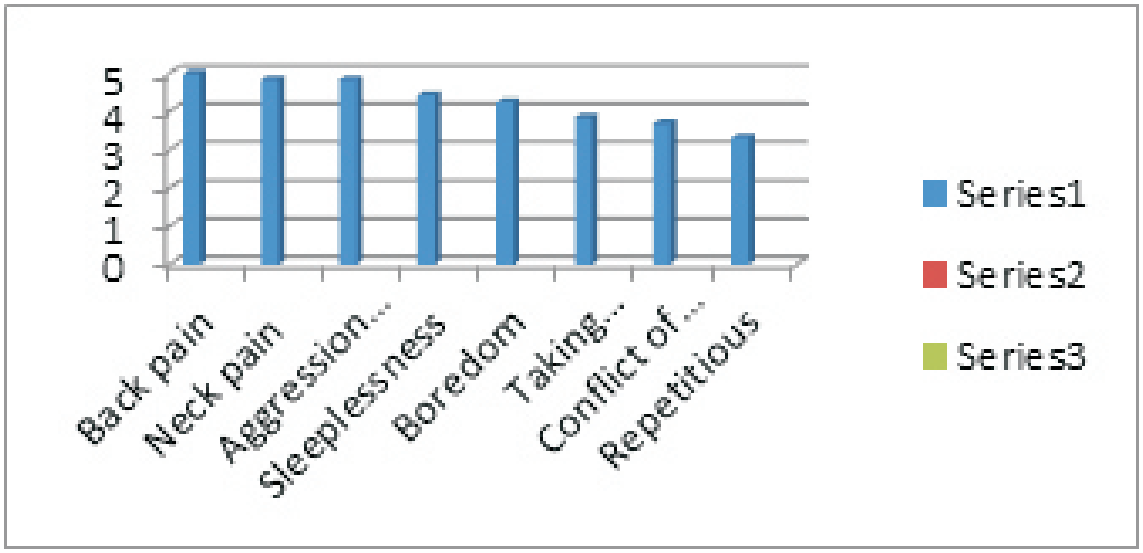

5
4
3
2
1
0
Back pain
Neck pain
Aggression...
Sleeplessness
Boredom
Taking...
Conflict of...
Repetitious
Series1
Series2
Series3

Table 2: Profile of Respondents

Distribution of Respondents by reasons for lack of delegation Complained of Symptoms of Stress							
Hierarchical structure	1	2	7	6	34	4.40	1
Supplanting	2	6	0	8	34	4.32	2
Dependence upon other people	3	0	4	16	27	4.28	3
Lack of training	1	1	3	21	23	4.24	4
Fallacy (I can do it better myself)	3	1	0	31	15	4.08	5
Absence of selective controls	7	9	5	9	20	3.52	6
Assumptions about human nature and behaviour	11	6	7	12	14	3.24	7
Lack of ability to direct	16	18	2	2	12	2.52	8
Lack of confidence in subordinates	13	21	0	10	6	2.50	9
A temperamental aversion to tasking advance	22	24	3	0	1	1.68	10

Table 3: Distribution of Respondents by Rating of Job- Related Stressors

Causes of Strain		1	2	3	4	5	Mean Score	Overall Ranking
Drawings not detailed	0	0	0	4	46	4.92	1	
Lack/insufficient specification	0	0	0	5	45	4.90	2	
Inadequate resource plan	1	0	0	3	46	4.86	3	
Inadequate time plan	0	0	2	4	44	4.84	4	
Improper pre-contract actions	1	0	1	4	44	4.80	5	
Inadequacy/inconsistency of communication flow	0	2	0	6	42	4.76	6	
Site visits	1	0	0	11	38	4.70	7	
Too much paperwork to work with	1	1	2	5	41	4.68	8	
Fair of errors	1	2	2	6	39	4.60	9	
Preparation of schedules	2	2	0	6	40	4.60	9	
Writing of query sheets where required	1	1	4	5	39	4.60	9	
Scaling off where discrepancies occurred between/among drawings	2	2	1	5	40	4.58	10	
Preliminary calculations and collections	5	1	0	2	42	4.50	11	
constant use of BESMM	0	7	4	1	38	4.40	12	
Too much of sitting when measuring	1	4	1	0	41	4.34	13	
Too much of paper ruling	0	6	0	15	29	4.34	13	
Cracking of brain for description	5	3	1	3	38	4.31	14	
Continuing writing of headings	0	0	0	36	14	4.28	15	
Lack of use of computer and software packages	5	0	1	0	41	4.26	16	
Inadequate number of staff to do the job properly	0	10	0	10	30	4.20	17	
Proof bill from printers	7	0	1	11	31	4.12	18	
Examination and editing BOQ	10	2	0	0	38	4.08	19	
General final check	3	3	3	22	19	4.02	20	
Working long hours	5	2	6	15	22	3.94	21	

Table 4: Distribution of Respondents by Symptoms of Stress

Back pain	0	0	0	1	49	4.98	1
Neck pain	0	1	3	0	46	4.82	2
Aggression towards employees	0	3	0	0	47	4.82	2
Sleeplessness	2	7	0	0	41	4.42	3
Boredom	5	4	0	6	35	4.24	4
Taking longer over tasks	9	6	1	2	32	3.84	5
Conflict of boundary situations	4	12	6	2	26	3.68	6
Repetitious	7	9	7	15	12	3.32	7