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ASSESSMENT OF LABOUR-ONLY SUBCONTRACT ARRANGEMENT IN THE BUILDING CONSTRUCTION INDUSTRY IN NIGERIA

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Abstract

The recruitment of labour through intermediaries is a long established practice in the construction industry in many developing countries, although they may take on varying levels of responsibility, their function is essentially the same. The growing interest in internalization of labour, reduction in overheads while securing to maximize profits has resulted in a growth in the application of labour-only subcontract. The study assessed labour-only subcontract arrangement in the building construction industry through the administration of 40 (20 to the firms employing labour-only subcontractors and 20 to labour-only subcontractors) structured questionnaires. These were analysed using simple percentages and relative importance index. It was discovered that delay in project completion was the major problem encountered by the firms (employers) in the utilization of labour-only subcontract arrangements. Also, the results showed that delay in payments to labour-only subcontractors to be their major challenge. The study concluded that labour-only subcontract arrangement is influenced by fluctuation in work load of the construction contracting sector thereby presenting firms flexibility in the engagement of labour without legal responsibility when there are no jobs. However, this advantage is often being offset by the problem of delay in project completion of labour-only subcontractors, since in most cases, they often possess low educational background. It was recommended among others that an industry wide training system be devised and funded by levies generated from statutory deduction made from firms and labour-only subcontractors.

KEYWORDS: *Labour-only, Subcontractor, Construction Industry, Outsourcing*

INTRODUCTION

The construction industry is the tool through which a society achieves its goals of urban and rural development. However, it is becoming increasingly more complex partly because the complexity of the construction process itself and the large number of parties involved including clients, users, designers, regulators, contractors, suppliers and others. The industry's fortunes tend to fluctuate with the general economy, and it has a cyclical nature and quick response to the changes in the economy (Olomolaiye et al., 1998).

For the most part, the construction industry thrives on the work of subcontractors. On building construction projects, it is common that 80–90% of the work is to be performed by subcontractors. On highways or other

infrastructure projects, the portion subcontracted is generally less but a significant amount of the work is still performed under subcontract agreements (Hinze, 1997).

Construction relies heavily on subcontractors and their workers who are employed by prime contractors. Subcontractors are the wheels which carry the project to completion (Shimizu and Cardoso, 2002) and therefore, are the dynamic of the construction industry. The quality of subcontractors is significant as it has a direct bearing on how well tasks are performed for the general contractors. As a result, the quality of specialist subcontractors is even more important because it has a direct bearing on the performance of the prime contractor on key elements of the work (Sohail, 1999).

Wells (2006) stated that the practice of employing labour through subcontractors (often referred to as the "outsourcing" of labour) is both long established and widespread in the construction industries of developing countries.

The functioning of the construction labour market (the source of labour, the basis on which it is employed and the way it is treated) has profound implications for skill development, productivity and quality in the construction industry. These are issues which are of immediate concern to construction managers.

This paper sought to assess labour-only subcontract arrangement in the building construction industry.

AIM AND OBJECTIVES

The aim of the study is to identify the current practice in the use of labour-only subcontract arrangement in the execution of building projects within the construction industry in order to establish the basis for the use.

The objectives are:

- i. To articulate the basic concept of the usage of labour-only subcontracting in the construction industry.
- ii. To identify and classify the factors that contribute to the usage of labour-only subcontract and its level of participation.
- iii. To determine the problems encountered in the administration of labour-only subcontracting
- iv. To suggest possible solutions for improvement in the use of

labour-only subcontract arrangement.

EVIDENCE OF THE PREDOMINANCE AND GROWTH OF LABOUR SUBCONTRACTING

The recruitment of labour through intermediaries is a long established practice in the construction industry in many developing countries. Although they may take on varying levels of responsibility, their function is essentially the same. They bring labour to the construction site when it is needed and take it away when it is no longer required. Thus they constitute a bridge between the labourers seeking work and contractors or subcontractors who can offer work (Vaid, 1999).

It is shown that the practice is deeply embedded in India (Vaid, 1999), Malaysia (Abdul-Aziz, 1995), Korea (Yoon and Kang, 2000), Nigeria (Idoro, 2000), Philippines (Yuson, 2001), Egypt (Assaad, 1993), Brazil (Saboia, 1997) and Mexico (Connolly, 2001).

English (2002) established that sub-Saharan Africa show a decline in the permanent, directly employed workforce and a corresponding increase in the number of workers employed through subcontractors and intermediaries. Further evidence of contractors having recently shed their directly employed labour in favour of outsourcing lay in the fact that many of the employers of labour had previously been employed themselves in larger construction companies and had been retrenched. They are now supplying labour to their previous employers.

ADVANTAGES OF LABOUR CONTRACTING

The persistence and growth in the construction industry around the globe of the practice of outsourcing labour through subcontractors can be explained by the significant benefits it offers to contractors. First and foremost is flexibility in the recruitment of labour. Outsourcing enables contractors and subcontractors to get the labour they need when they need it and to pay for it only when needed (Vaid, 1999). Hence labour becomes a variable rather than a fixed cost. This kind of flexibility is particularly important in construction due to fluctuating labour requirements, which stem in part from variations in the contractor's workload, but also from changes in the product mix. Neither construction products nor skills are homogeneous. Building construction in particular requires a wide range of skills with frequent, often daily, variations.

In addition to offering flexibility in the employment of labour, the outsourcing of labour offers contractors an opportunity to further reduce their labour costs. They do this by avoiding the overhead costs associated with the employment of labour, but also (and more importantly) by evading the "on-costs" associated with legal employment. One of the additional advantages to contractors is the delegation of responsibility for supervising the labour force (Bresnan et al., 1985; Debrah and Ofori, 1997; Leonard, 2000;).

Construction work in developing countries is labour intensive, and labour productivity is a key factor in total cost and hence the contractor's profit. It is important that contractors are able to control the output of labour in order to

maintain productivity. Control over output can be exercised directly through close supervision, or indirectly through a contract with a supplier that has appropriate incentives written in. Supervision by the main contractor may still be needed to ensure the quality that is required, but supervision to maintain labour output is the responsibility of the subcontractor (Bresnan et al., 1985).

Associated with the delegation of responsibility for supervision is the offloading of risks, namely the risk that the item of work may not be completed for the given price in the given time due to inclement weather or other factors. The availability of a firm price for a given area of work also considerably simplifies the estimating process, saving further on overhead costs (Leonard, 2000).

DISADVANTAGES OF LABOUR CONTRACTING

One disadvantage that is sometimes put forward is loss of control over the work (Debrah and Ofori, 1997) particularly in relation to the achievement of quality standards. However there are many different forms of labour contracting, with differing degrees of delegation of risk and associated control over labour (Yoon and Kang, 2000). If the contractor considers direct control of the labour force to be important, for example if quality is a key factor, then he can adopt an arrangement whereby the labour is sourced through a labour supplier but paid and supervised by the main contractor. This seems to be a common practice in many countries, particularly in African countries where labour contracting is not yet well developed or entrenched. Even when all of the risk is passed over to the labour contractor with a fixed sum paid for a package of work;

Bresnan et al 1985 have shown that the site manager, who is employed by the main contractor, can still exercise a considerable degree of control. Control can be enhanced further through the use of known subcontractors with whom the main contractor has a long standing relationship or through the employment of subcontractors with specialist skills. The authors argue that through these measures main contractors can enjoy all of the benefits of outsourcing labour without any detrimental effect on the quality of work.

Tan (1987) pointed out that a rather more serious problem for the future development of the industry is the effect of outsourcing labour on the development of skills. Most construction workers in developing countries are trained on the job through an informal apprenticeship system and specialised labour contractors are instrumental in the process of training. This has worked well in many countries and proved to be an effective, cheap and self sustaining way of passing on skills from one generation to the next.

RESEARCH METHODOLOGY

The field survey involved the administration of two sets of questionnaire. 20 questionnaire were administered to the firms/organizations (medium sized construction companies under categories B, C and D as defined

by Federal Works Registration Board guidelines in Abuja) that employ labour-only subcontractors and another 20 questionnaire were administered to labour-only subcontractors in various trades such as plumbing, electrical installations, masonry etc. Part of the questionnaire for the firms and the labour-only subcontractors were ranked on a 4 point Likert scale from 'always' (4) to 'never' (1) were analysed using relative importance index to determine which factor influences most significantly the parameter being considered. Other questions were analysed using simple percentages. These formed the basis for the conclusions reached and the recommendations made. 16 questionnaires were returned by the firms that employ labour-only subcontractors while 18 questionnaires were returned by the labour-only subcontractors.

RESULTS

$$\text{Relative Importance Index} = \frac{\sum af}{AF}$$

where

a= value assigned variable (i.e. 1-4)

A= highest value assigned to variable

F=f; frequency of occurrence

- i. **Presentation of responses from firms using Labour-only subcontractors (LOSC)**

Table 1.0: Frequency of usage of LOSC by firms

Response	No. of Responses	Percentage
Always	5	31.25
Often	7	43.75
Rarely	4	25.00
Never	-	0.00
Total		100

Source: Field survey, 2006

From the table above, majority of the respondents (75%) often make use of LOSC on their projects.

Table 2.0: Ranking of value of subcontracted jobs undertaken by LOSC

Response	No. of Responses	Percentage
Less than 10%	7	43.75
11-30%	4	25.00
31-60%	1	6.25
61-90%	3	18.75
Greater than 90%	1	6.25

Source: Field survey, 2006.

From the results in Table 2.0, 56.25% of the respondents outsource more than 10% of their subcontracted jobs to labour-only subcontractors.

Table 3.0: Ranking of frequency of the use of LOSC in various trades

Trade	Always	Often	Rarely	Never	Relative Index
Plumbing	9	5	1	1	0.84
Exc/Earthwork	9	3	2	2	0.80
Landscaping	8	3	4	1	0.78
Painting	7	2	4	1	0.77
Iron bending	6	5	4	1	0.75
Tiling	5	6	4	2	0.75
Electrical installation	5	5	3	3	0.72
Roofing	5	5	3	3	0.69
Masonry work	3	6	5	2	0.66
Concrete work	4	5	3	4	0.64
Terrazzo	2	6	5	3	0.61
Glazing	3	3	6	4	0.59
Carpentry	4	2	4	6	0.56
Metal work	2	0	10	4	0.50
Ironmongery	0	1	7	8	0.39

Source: Field survey, 2006

The result in Table 3.0 shows that the construction trade frequently outsourced to labour-only subcontractors is plumbing with relative importance index of 0.84 and the least undertaken by labour-only subcontractors is ironmongery (0.39).

Table 4.0: Ranking of problems encountered in the administration of labour-only subcontracting

Problems	Always	Often	Rarely	Never	Relative Index
Delay in project completion	8	4	4	0	0.81
Poor workmanship	8	4	2	2	0.78
Material damage & wastage	7	3	5	1	0.75
Supervision & control	7	4	2	3	0.73
Damage to equipment/plant	5	3	5	3	0.66
Truancy of LOSC	1	2	6	7	0.44

Source: Field survey, 2006

The problem mostly encountered was that of delay in project completion (0.81), followed by poor workmanship (0.78) and the least problems encountered were damage to equipment/plant and truancy of labour-only subcontractors.

Table 5.0: Reasons for use of labour-only subcontracting arrangements

Reasons	Always	Often	Rarely	Never	Relative Index
Fluctuation in workload	10	4	2	0	0.86
Flexibility	8	3	4	1	0.78
Non availability of specialised labour	6	6	3	1	0.75
Time pressure	6	5	4	1	0.61
Activities of the union	1	1	5	9	0.41

Source: Field survey, 2006

The result above indicates that the common reason for the use of labour-only subcontracting is fluctuation in workload of firms, followed by flexibility which implies that flexibility in engagement of labour without legal responsibility when there is no job. The least reason for outsourcing is the activities of the union, which in Nigerian context is nonexistent as the unions are usually muzzled by their employers especially in the private sector.

Table 6.0: Control over working hours of LOSC by employer

Response	No. of respondents	Percentage
Yes	12	75.00
No	4	25.00

Source: Field survey, 2006

The result showed that the firms that engage labour-only subcontractors have control over their working hours hence monitoring can be ensured to a large extent.

ii. Presentation of results from the labour-only subcontractors

Respondents were randomly selected among the various trades in the construction process so as to ensure wide spectrum of responses.

Table 7.0: Experience of labour-only subcontractor

Years of experience	Frequency	Percentage
Less than 5	7	38.90
6 – 10	3	16.67
11- 15	4	22.22
16 – 20	3	16.67
Greater than 20	1	5.56

Source: Field survey, 2006

The result indicates that majority of the respondents (61.12%) have been into labour-only subcontracting for over five years hence they have sufficient experience in the process and practice of labour-only subcontracting arrangement.

Table 8.0: Educational background of the LOSC

Qualification	Frequency	Percentage
First school leaving certificate	8	44.44
Senior school certificate	4	22.22
Trade test	1	5.56
OND/HND	3	16.67
BSC	2	11.11

Source: Field survey, 2006

The result shows that the educational background of majority of the respondents (44.44%) is first school leaving certificate.

Table 9.0: Method of skill acquisition

Skill acquisition	Frequency	Percentage
Informal training	12	66.67
Formal training	6	33.33

Source: Field survey, 2006

From Table 9.0, it shows that 66.67% underwent informal training, which could be inferred that both on the job training and apprenticeship methods were adopted as a result of the educational background acquired by the respondents.

Based on Tables 8.0 and 9.0, the labour-only subcontractors are essentially tradesmen who engage in labour-only subcontracting, those with formal training and higher educational background engage the services of these tradesmen and operate as general labour-only subcontractors in all the various trades.

Table 10.0: Experiences on work delivery due to shortage in materials supply

Response	Frequency	Percentage
Always	2	11.11
Often	6	33.33
Rarely	2	11.11
Never	3	16.67
No response	5	27.78

Source: Field survey, 2006

44.44% stated that delay in the supply of materials affects the timely delivery of the work which is obvious and this may lead to the whole work being delayed especially if the activity falls within the critical activities.

Table 11.0: Employer supplying equipment and tools

Response	Frequency	Percentage
Yes	2	11.11
No	10	55.56
Supplies some	6	33.33

Source: Field survey, 2006

The result shows that the average respondents do not get supply of equipment and tools from their employers supporting the fact that firms transfer machinery logistics to labour-only subcontractors. However, some firms make certain type of equipment available to the labour-only subcontractors to facilitate their production.

Table 12.0: Requirements for securing contracts

Requirement	Frequency	Percentage
Quality of workmanship	7	38.89
Reputation	5	27.78
Work experience	4	22.22
Trade test certificate	2	11.11

Source: Field survey, 2006

Quality of work is ranked the highest as a prerequisite for securing contracts while trade test certificate is rarely considered.

Table 13.0: Problems encountered by LOSC

Problem	Always	Often	Rarely	Never	Relative Index
Payment problem	10	5	3	0	0.85
Delay in material supply	9	5	4	0	0.82
Scheduling problem	8	6	3	1	0.79
Incomplete technical details	5	6	3	4	0.67
Incomplete technical information	2	1	10	5	0.50

Source: Field survey, 2006

The problem mostly encountered by the labour-only subcontractors is that of delay in payment. In most cases, the main contractor will have to rely on the client's payment before the labour-only subcontractor is paid hence if the client defaults; the effect is felt by the labour-only subcontractor. Incomplete technical information is the least of the problems of the labour-only subcontractors.

CONCLUSIONS

Based on the study, the following conclusions could be made

- i. One of the characteristics of the building construction industry- fluctuation in

workload and uncertainty created an avenue for the flourishing of labour-only subcontracting arrangement as labour becomes a variable cost rather than fixed cost.

- This arrangement offers flexibility in the engagement of labour without legal responsibility when there is no job.
- ii. Labour-only subcontracting offers advantage in transferring manpower, equipment and planning problems to the labour-only subcontractors thereby minimizing an organization's manpower and equipment and reducing time pressure.
 - iii. Labour-only subcontracting is driven by the need for limiting overhead costs and liability exposure.

RECOMMENDATIONS

- i. Construction firms should diversify by way of forward

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and backward integrations so that the fluctuation in workload and uncertainty normally experienced in the construction industry will be reduced and as such labour will be employed on a permanent basis, hence, workers source of income will be guaranteed.

- ii. An industry wide training system be devised to cater for skill certification and training needs. This can be achieved by Federal Government
- iii. delegating a statutory body which will be funded from levies paid by firms and labour-only subcontractors to administer and support the skill certification scheme.

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RENTAL HOUSING AND CRIME PERCEPTION IN BOSSO TOWN OF MINNA METROPOLIS, NIGER STATE

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Abstract

The problems of rental housing extend beyond tenure security and rental disputes. It includes the incidence of crime, aggravated by the prevailing environmental situations. The study examines crime perception of renters in relation to existing physical measures. Using the instrument of questionnaires, crime perception data was obtained based on renter's experiences and fears particular to their local environmental conditions. Using the descriptive survey method and scatter diagrams, the results elicited that offenders exploit local conditions such as poor light and water supply to perpetrate criminal acts. The greatest crime against property faced by renters is mobile phones theft, which is intensified by the absence of light. In addition, there is very little trust placed on the local police by the respondents. As such, the most dependable means of security at the disposal of renters is evidenced by the application of physical measures such as fences, security lights, gates and private guards. Given that Bosso town is not free from the incidence of crime; the study concludes that the attraction to live in Bosso is based on quietness as well as proximity and convenience factors.

Key words: Crime, Environment, Perception, Physical Measures, Rental Housing

1.0 Introduction

At the core of housing tenure lie both home ownership and rental housing. It is indisputable that rental housing cannot be erased from the Nigerian urban fabric since it has considerably balanced housing demand arising from migration. Rental housing is seen as a vital component in accommodating large number of families in both developed and developing countries. In Benin City, 65% of the populace live in rented houses Ballesteros (2004). In Lagos state, the quantity of rental housing equals that of home ownership at about 49% apiece (UN-HABITAT, 2003). Despite the substantial significance gained by rental housing as a major carrier of residential mobility, it is still fraught with problems of crime.

Except for the development of forms of self-defence and new social practices, the consequences of crime are negative,

evidenced by the creation of insecure feelings; which result in the abandonment of certain neighbourhoods, development of an "architecture of fear", stigmatisation of districts or communities and withdrawal or refusal to invest in some cities (Vanderschueren 2000). Specific to renters, these tendencies begin with feelings of discontentment about environmental features that erode their confidence with regards to safety. Finally, crime perception becomes prominent in the way the built environment is designed and demarcated. For instance, the prevalence of huge fences capped with barbed wires is indicative of a security conscious environment, but not necessarily a crime free environment.

Notwithstanding the causes, effects and interventions against crime perception, it is observed that there is a high attraction for renters towards residing in Bosso town of Minna, Niger state. More so, the

structure of rental housing in Bosso town presents numerous kinds of environmental and social conditions. These tendencies leave more to be desired as to whether renter's attraction to Bosso is based on the perception that it is a crime free environment. It therefore becomes necessary to isolate rental

housing in order to determine incidences of crime. This paper is therefore aimed at carrying out a survey on crime perception of renters in Bosso town, with the purpose of using the results to discuss relationships between crime rate and existing physical measures.



1.1 Brief Description of the Study Area

Fig.1.1: Layout map of Bosso town indicating linear arrangement of streets; adapted from Minna Base Map

Source: URP Dept. Federal University of Technology, Minna

Bosso town is located within Bosso Local Government Area of Minna, the capital city of Niger state. It lies between longitudes $6^{\circ}30'0E$ and $6^{\circ}33'0E$ and

latitudes $9^{\circ}98'30''N$ and $9^{\circ}100'00''N$. Its strategic location along the major traffic routes account for a spill of some major business facilities from the city centre

into its environs. This serves as a good attraction for the working class and business men. The town is arranged mainly in a linear pattern and is connected to the city centre via a major traffic spine. On the right flank of the major traffic spine there are slightly organized layouts; poor structural and social amenities; relatively uneven population distribution and clusters of residences accompanied by relatively low rental rates. Some noteworthy features present on this flank are the chief's palace, a small market and few public schools. Its expansion possibilities are limited since it abuts with large rock outcrops. Conversely on the left flank of the major traffic spine, there are better planned linear streets with relatively good roads, having about 70% of its major streets lined with street lights. There are better social amenities (for example, hospitals and schools); there is more even population distribution and better housing conditions accompanied with relatively high rents. Some of its noteworthy features are the Government House, Police Headquarters, the temporary campus of the University and a large Federal housing estate which were sold on owner occupier. Expansion possibilities are more feasible on this part of the town, because its peripheral features abut at with a major ring road and vast virgin land.

2.0 Literature Review

Among several investigations centred on rental housing, only few researchers have pointedly addressed the subject of crime perception. One of the most explicit surveys that isolated rental housing was carried out in UN-HABITAT (2003). Based on the concept of ontological security, UN-HABITAT (2003) following Hiscock et al. (2001) and Saunders (1990) inferred that people need more than just adequate sustenance and shelter to live happy and fulfilled lives. The home, which satisfies the purposes for a secure base is expected to guarantee among others a place against trouble or fatigue and it has been argued that home owners are supposed to feel safe and secure while renters are not. Conversely in crime survey carried out in Dar Es Salaam, Robertshaw et al. (2000) found that renters are not the most vulnerable in all cases of crime (table 2.1), and he posits that dealing with perceptions of crime, particularly anxiety and fear of crime, is as important as reducing crime levels. Thus, subverting the adequacy of rental housing in safeguarding against crime is as limiting to renters as the incidence of crime is limiting to the suitability of residential neighbourhoods.

Table 2.1: Victim profile for home burglary in Dar Es Salam

Victim Characteristics	High risk (% people in each category that were victimised)	Low risk (% people in each category that were victimised)
Home Ownership	Home Owners (47.2 %)	Non-home Owners (35.3 %)
Age	Over 40 (45.5 %)	15-25 (31.6 %)
Employment Status	Informal employ. (45.8 %)	Income Depend. (38.7 %)
Educational Status	Post High School (48.3 %)	Secondary (39.4 %)
Area of Residence	Established Sub. (53.7 %)	Rural Area (26.0 %)
	New Suburb (51.0 %)	Inner City (28.2 %)

Source: Robertshaw et al. (2000)

Crime perception and safety have been measured among residential dwellings in (Minnery and Veal 1981; Evans 1992, Butterworth 2000; Robertshaw et al 2000; Bello et al. 2008; Khalil and Nassif 2009). Through various analytical methods, they have converged on the idea that satisfaction with features of the local built environment, degenerative infrastructure or a total lack of infrastructure leading to neighbourhood deprivation serve as strong indicators for crime perception. Using the instrument of questionnaires for data collection and regression analysis, a similar conclusion was drawn in Ojikutu (2008) while studying neighbourhood deprivation and self rated health in Lagos state. He found that 72.9% of the respondents lived in rented apartments and felt insecure mostly at night. This suggests that local environmental conditions around rental housing still compromise the expectation of intervening urban structures designed to control crime.

Invariably, individuals (or households or firms) will maximize their resources subject to a stated constraint; whereby an increase in crime rate accounts for a corresponding decrease in property value and will thus exert negative influences on renter's willingness to pay (Bello et al.

2008). However, it is not quite certain if willingness to pay on the part of renters may be effective in reducing crime levels as compared to restoring proper environmental situations. Meanwhile, it is assertive that crime perception is spatially coincident with the most common indicators of urban deprivation, and that a prompt refurbishment of the environment through designs is inevitable in order to control crime (Minnery and Veal 1981; Herbert and Darwood 1992 following Hope and Shaw 1988; Kaltho 2008).

In view of Jane Jacobs' mechanism of natural policing: security through the presence of others (Hillier 2004a); defensible spaces of Oscar Newman that favoured enclosed private space with limited access to strangers to create a sense of community (Khalil and Nassif 2009); and gated communities or fortified enclaves that characterize residential developments by physical security measures (Grant and Mittelsteadt 2004); Hillier (2004b) proposes a holistic set of approach based on urban design and crime prevention strategies. According to Hillier (2004b), one way of envisaging how particular configurations of existing and planned features in a location might affect crime is to think how criminals

might react to, or exploit the use, of layout and development of land. This strategy is flexible in the sense that it pays attention to local situations peculiar to differing environments. As such it can be used to create or modify existing

layouts to suit safe and sustainable groups of residences. In order to accomplish these set of goals, Hillier (2004b) proposes a set of underlying questions (table 2.2).

Table 2.2: Think criminal

Questions that planners can ask or seek advice on:

- Who is the local offender — given the features of the locality, what types of crime are most likely to be committed?
- How much effort does it take the offender to commit the crime — and how can we use planning decisions and advice to increase the perceived effort and discourage the offender — e.g. making buildings physically more secure?
- How much risk does the offender perceive when contemplating a particular crime — and how can we heighten that perceived risk and deter the offender — e.g. by increasing natural or other forms of surveillance, and empowering preventers to identify and challenge potential offenders?
- How much reward does the offender anticipate — can we reduce this and discourage crime, e.g. removing graffiti quickly so the offender gets no kicks, or cut down on the value of materials such as piping stolen from buildings?
- What resources does the offender have for committing crime (tools, weapons, modus operandi, time) — and how can we deny access or use of those resources (for example by restricting availability of tools, or designing security features to standards which anticipate their misuse)?

Source: Hillier (2004b)

Finally, the questionnaire form of gathering data on crime perception is highly reliable and would be useful in gathering data for the purposes of the study. In terms of assessing and reducing crime levels based on the situation of the environment, a lot depends on strengthening local conditions through environmental design. Thus in addition to victimisation survey based on renter's experiences and fears of crime, perspectives from Hillier (2004b) on how offenders may react to exploit existing built environmental conditions will in turn consolidate the basis to further discuss crime perception and controls around rental housing.

3.0 Materials and Methods

Description of Data

A survey based on renter's experiences and fears of crime was initiated to gain an understanding of the levels of crime in Bosso town. The cluster sampling technique was used to obtain primary data: whereby Bosso town was subdivided into six neighbourhoods. Thirty questionnaires were randomly distributed within each neighbourhood subdivision. This amounted to 180 questionnaires; out of which 160 were completed and returned. The instrument of data collection was divided into two major sections. The composition of questions in the first section placed

emphasis upon the victims, their experiences and fears. In addition to questions about sex, age and occupation; information was sought on the duration of stay in Bosso, mode of acquisition of dwelling, reason for accepting present dwelling, number of tenants within each compound, pattern of dwelling arrangement and annual rent paid. The second section comprised questions on how offenders may react to exploit existing built environmental conditions. The questions were modified to fit the description of the study area. Consequently, findings were limited to only the categories of crimes analysed in the surveys.

4.0 Results

This study adopted a descriptive analysis to elicit salient features of the population under study. This provided information with which to consider relationships between existing features and frequency of incident crime.

4.1 Demographic Characteristics of Bosso Town Data

A total of 160 individuals participated in the study. Out of these, 6.25% were below 17 years, 18.75% were between 17 - 24 years of age while, 75% were in the 25 – 54 years age old group. It is to be noted that about 62.5% of the respondents were in the working class group in various income categories. The others (37.5%) were predominantly students, petty traders and business people. There was apparently more

access to male respondents (62.5%) than females (37.5%).

Residential Mobility and choice of dwelling

The survey reveals that 68.75% of the respondents had moved into Bosso town, while 31.25% had not. Among those who had moved, convenience factors and better housing conditions (27.5% apiece) were mostly responsible for their choice of present dwelling (see Table 4.1).

Perception of crime levels

Based on the general assessment of crime, 25% of the respondents concluded that the incidence of crime in Bosso town was serious, while 75% observed that it was less serious. On the whole, 25% based their opinion about crime perception on reports from within the neighbourhood and friends, 12.5% based their fears on the basis that others had been affected, 6.25% on the fact that family had suffered and 56.25% based their opinion on having no experience of crime.

Greatest crime problems

The greatest crime problems in Bosso town were differentiated as 'crime against person' and 'crime against property'. When respondents were asked to rate the greatest crime problems against persons, spying ranked highest (18.75%) and assault least (6.25%). In the case of crime against property, theft ranked highest (56.25%). In addition, majority of the respondents (49.75%) considered mobile phones theft to be the greatest form of theft (Fig 4.1).

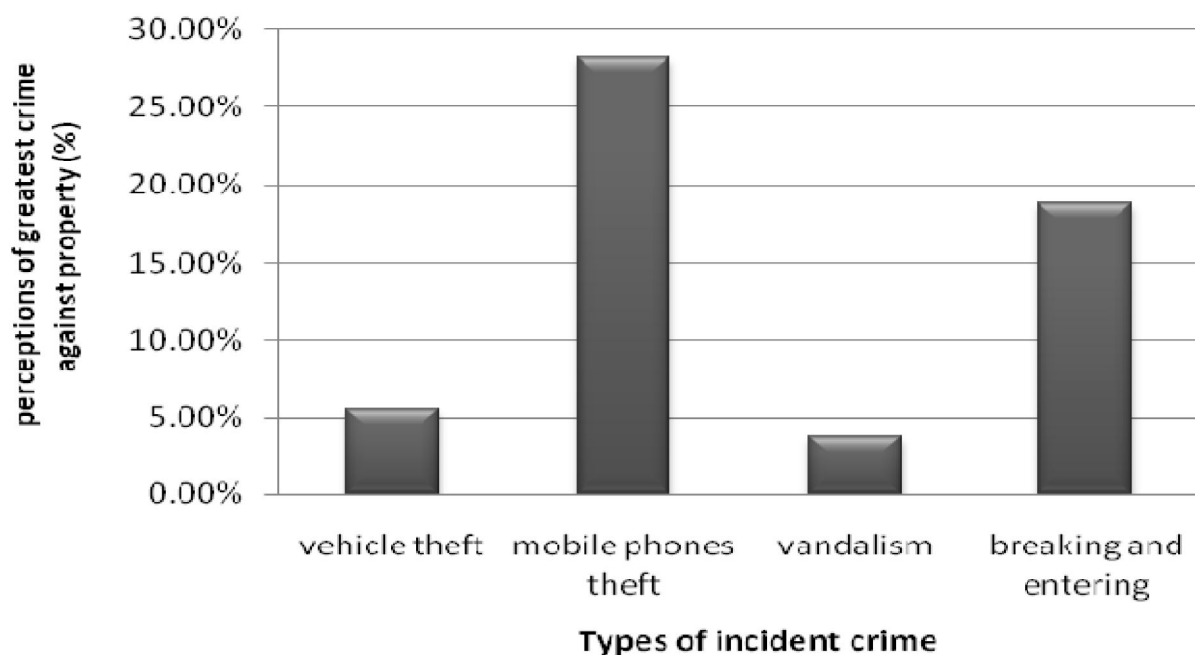


Fig 4.1 Perceptions of greatest crime against property

Physical measures and Perceptions of safety

When the respondents were asked to rate how many hours of light supply was available between 6pm and 6am, 50% went for 6-7hours, 0.75% went for 10-11 hours and none went for 12-13 hours. On the whole, a quarter (25%) of the respondents had their feeling of a more secure environment strengthened by the presence of street lights. Also, 37.5% of the respondents acknowledged the introduction of street signage out of which 6.25% equated this with having a sense of community. 65% of the

residences were fenced and as a result, 56.25% of the respondents felt more secure. The fences were differentiated according to their characteristics as follows: High fence with sandcrete block (32.5%), high fence with barbed wires (3%), dwarf fence with barricades (18%) and dwarf fence without barricades (9.75%) Also, 6.25% felt secure with the refurbishment of their gates while 6.25% had no assurance of more secure environment; the reason being that none of these facilities were made available to them.

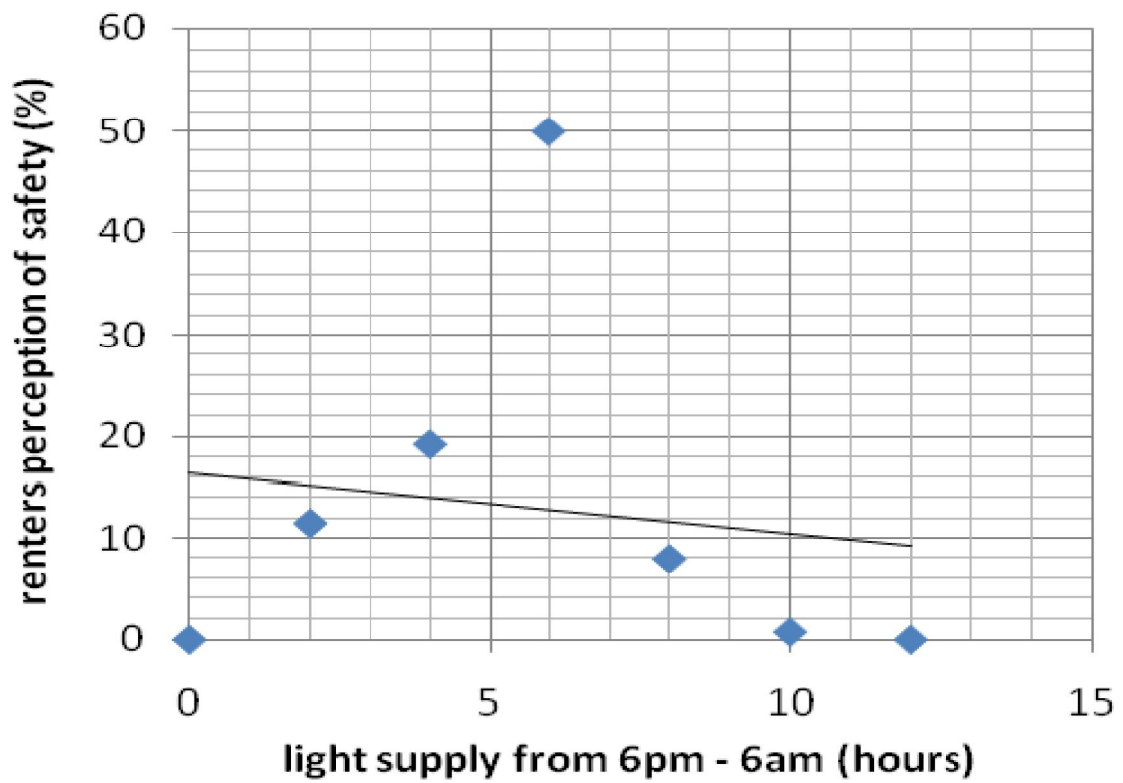


Fig 4.2: scatter diagram showing relationship between renter's perception of safety and hours in which there is light supply

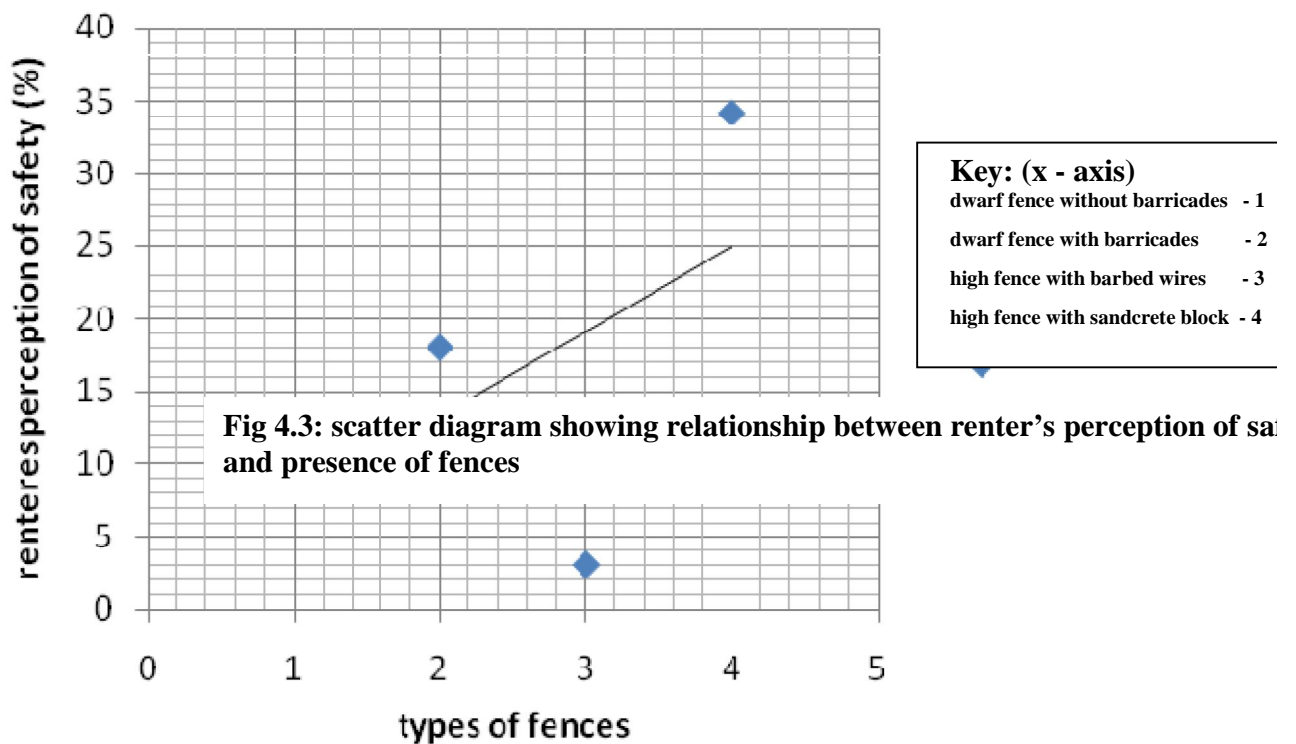


Fig 4.3: scatter diagram showing relationship between renter's perception of safety and presence of fences

Building clusters and configurations

With regards to the cluster of families or rented buildings within most compounds, 37.5% had four buildings, 6.25% had six buildings, 18.75% had seven buildings and two buildings apiece and 6.25% were completely single detached buildings. Although most of the compounds were fenced (65%), residential clusters having four buildings and above (mostly configured as double rows, U-shape and L-shape) considered the incidence of theft to be a great problem arising from people who were familiar with their environment. In addition, they had common entrance and exit points that were relatively visible to majority of the occupants.

Reporting to the police

Vehicle thefts (5.5%) followed by breaking and entering (18.75%) were the offences against property most likely to be reported to the police. Although theft

ranked highest (56.25%), out of these, 31.25 % had no trust in the police and 25% saw no reason why the police should be involved. Furthermore, when asked about alternative security arrangements, majority had more confidence in communal vigilante groups and partook in contributing towards engaging them.

Attractive and Unattractive Elements

Lastly, respondents were asked to mention positive things and negative things about Bosso town. Quietness (31.25%) and proximity and convenience (20.62%) rank the highest as positive things in Bosso town while lack of regular water supply (33.15%) and erratic power supply (26.25%) rank the highest as negative things in Bosso town. The tables below provide the summaries of their comments.

Table 4.1: List of positive things about Bosso town

S/n	Issues	No of responses	% of responses
1	Amenities	5	3.12
2	Character of the built environment	25	15.62
3	Planning	13	8.12
4	Quietness	50	31.25
5	People and community feeling	27	17.0
6	Proximity and convenience	33	20.62
7	Public transport and access	7	4.37
Total		160	100

Source: Authors' survey (2009)

Table 4.2: List of negative things about Bosso town

S/n	Issues	No of responses	% of responses
1	Characteristics of the population	10	6.25
2	Obnoxious begging	8	5.0
3	Erratic power supply	42	26.25
4	Lack of regular water supply	53	33.15
5	High rental rates	37	23.12
6	Recreational facilities	7	4.37
7	No bad points	3	1.87
Total		160	100

Source: Authors' survey (2009)

5.0 Discussion and Conclusion

The study found that Bosso town is not completely free of crime. However, based

on the fact that vandalism rates (6.25%) and other heinous crimes against persons are quite low, majority of the respondents

who live in rental housing consider the environment to be relatively peaceful and do not see violence as a potential threat to their stay in Bosso. Furthermore, the attraction to live in Bosso is largely determined by quietness (31.25%) as well as proximity and convenience factors (20.62%) and not necessarily by their perception of incident crime.

One of the greatest crime problems in Bosso town is mobile phones theft. It occurs both at home and on the streets. Majority (56.25%) of the respondents felt a lot safer with the presence of fences (fig 4.3). Although consistent light supply is expected to increase surveillance and make crime a high risk activity, there is a weak relationship between the introduction of street lights and renter's perception of safety (fig 4.2). This is due to the fact that light supply is inconsistent and paths leading to residences are not properly lit by the street lights. Hence, it is probable that offenders capitalize on

dark alleys to perpetrate criminal acts. Comparing the import of introducing streetlights and fences, respondents feel safer with the introduction of fences.

The lack of trust in the local police contradicts the presence of police outfits within Bosso town and this was responsible for majority of the respondents' recourse to other means of ensuring safety. These include the engaging private and or communal security outfits. The efficacy of natural security outfits. The efficacy of natural surveillance resulting from patterns of building configurations and clearly defined entrance and exits are compromised. The reason is that offenders come under the cover of water peddlers to get as close as possible to houses. These are indications that provision of pipe borne water and light supply including other basic amenities should become major priorities for the Government

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BIO-MIMICRY: - AN INSPIRATION TO DESIGN AND ENVIRONMENTAL PROBLEMS.

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Abstract:

Human activities have gradually and continuously been a source of the degradation of the environment especially through construction activities. Building construction and its related activities has been the major consumer of between 30 to 40% of the global energy consumption according to the studies carried out by United Nations Environmental Programme (UNEP). Although building Construction can be seen as a necessary human need in order to provide shelter, however this essential need can be attained with minimal impact to the environment through the science of bio-mimicry, (the conscious copying of nature to resolve human problems either directly or indirectly).

Bio-mimicry looks into nature as a teacher, as it looks at human being not to be the only creative inventor but rather, it tries to look at other species that have survived with the environment through a symbiotic relationship, where they have sustained themselves not by destroying the surroundings, but by adapting to them and enriching it through cleaning of the air as can be seen in plants and also through the production of organic matter which enriches our soils. However Man has unconsciously been distancing itself from the wonderful teacher (nature) as a lot of problems facing man can be copied directly from it. This paper takes a look at the science of biomimicry and how it has been applied in the various fields of science and technology. It also draws attention to the various concepts adaptable from the science of biomimicry and how the professionals in the building industry can draw some inspirations into creating environmentally friendly developments.

Keywords. *Bio- mimicry, Construction, Environment, Nature, Technology.*

INTRODUCTION

The name biomimetics was coined from two Greek word 'Bio' meaning 'life' and mimetic –meaning 'imitation'. It can sometimes also be referred to as Bionics or Bio mimicry. The Microsoft Encarta (2006) defined bio mimicry as the application of biological methods and systems found in nature to the study and design of engineering systems and modern technology.

The study of bionics emphasizes implementing a function found in nature rather than just imitating biological structures. It involves conscious copying

of examples and mechanisms from natural organisms and ecologies in a form of applied case-based reasoning. Nature itself is treated as a database of solutions that already works. The selective pressure placed on different living organisms forces the development of solutions to the challenges placed upon them.

The evolutionary forces usually forces living organisms including plants to become highly efficient and adaptive to the environment upon which they live in. A classical example is the development of dirt- and water-repellent paint from the observation that the surface of the lotus

flower plant is practically un-sticky for anything. The core idea is that nature, imaginative by necessity, has already solved many of the problems that are being grappled with. Animals, plants, and microbes are the consummate engineers. They have found what works, what is appropriate, and most important, what lasts here on Earth. What surrounds us is the secret to survival.

The science of biomimetics has been asking questions such as, how energy can be harnessed efficiently, how materials

can be produced sustainably and also how to live healthy within the environment.

THE PRINCIPLES OF BIOMIMICRY

Biomimicry is based upon two basic principles, the principles of nature and the principles of the qualities of successful organisms. These principles are summarised by Nick (2008) as shown in the table below.

Table 1. The principles of biomimicry

PRINCIPLES OF BIOMIMICRY		
SN	PRINCIPLES OF NATURE	QUALITIES OF SUCCESSFUL ORGANISMS
1	Nature banks on diversity	Uses waste as a resource
2	Nature demands local expertise	Gather and use energy efficiently
3	Nature curbs excesses from within	Diversify and cooperate to use habitat
4	Nature taps the power limits	Optimise rather than maximize
5	Nature is beautiful	Uses material sparingly
6	Nature runs on sunlight	Don't foul their resources
7	Nature fits form to function	Don't deplete their resources
8	Nature uses only the energy it needs	Remain in balance with the biosphere
9	Nature rewards cooperation	Run on information
10	Nature recycles everything	Shop locally

Source: The Lotus Live Guide to Biomimicry (2008)

BIOMIMICRY INSPIRATIONS.

There are a lot of natural inspirations around, by looking at nature for natural, non-toxic solutions to environmental problems, all of these are done with the aim to free the environment from the negative impacts and also to put man's activity on the road map of becoming a productive member of the earth community.

The holy Quran enjoins man to reflect upon the environment and what is

contained in it as there are signs for those who reflect. Quran (2:164).

Sean (2004) is of the opinion that Design solutions can draw inspiration from many sources, including the anatomy, physiology, and behaviour of living systems. It is a well known fact that the Wright brothers were avid bird watchers, and their airplane wing design was modelled after birds (Microsoft Encarta 2005). The development of planes wouldn't have been possible without the

study of birds and copying them as was rightly done by the Wright brothers.

I. Inspirations from termites.

Living organisms such as termites have been a source of inspiration to some wonderful creations. Termites are found to be able to regulate and maintain the

internal temperature within their mound. They do it by venting breezes in at the base of the mound, down into chambers cooled by wet mud carried up from water tables far below, and up through a flue to the peak (Abigail 2009)



Plate 1: Showing the east gate building interior and the termite mound. Source: www.inhabitat.com/author/abigail

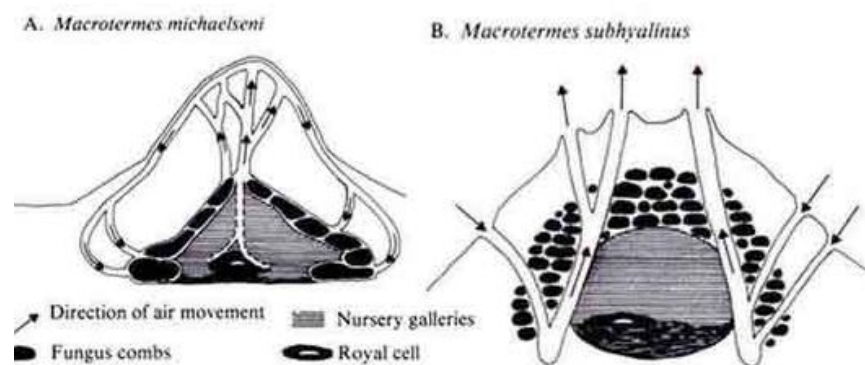


Plate 2. Air movement in a termite mound. Source www.inhabitat.com/author/abigail

This principle of temperature regulation was adopted by Architect Mick Pearce in the construction of the East gate Building in Harare, Zimbabwe (Scot and Rupert

2008). The energy consumption of the building was reduced to less than ten percent of a conventional building its size. Here the principle of bio mimicry applied here is that of a process copying.

The average size of a termite is 12.7mm and they could construct their mound up to the height of 8.4meters which is 661 times their size, while on the other hand the tallest building in the world the Khalif towers in Dubai commissioned in 2010 with a height of 800 meters is just 500 times taller than the average height of man (1.6meters). Even though throughout the world the Khalif tower is seen as an ultimate achievement, we still have a long way to go considering what has been achieved by ants.

Termites are observed for their ability to build magnificent nests out of the ground more skilfully than a human being could (Harun 2009). The skill of these tropical architects (termites) is undisputed in building cities that seem to appear out of nowhere. Their ease in finding building materials and technical skills are amazing. Every species of termite builds different kinds of nests suitable to their needs. These nests can be found inside trees, on or under the ground. Nests that are shaped like mountains are architecturally very complex. The construction of all the nests begins

underground, where compartments become more spacious as they approach the surface.

Termites like man live on almost every continent, except in Polar Regions. Sudden rain storms and ensuing floods, high temperatures and other negative conditions make their life a struggle, no matter where they live. But despite all this, they live in these regions in perfect harmony with their environments in what can be called a cooperative comfort.

II. The spider web inspiration.

Biomimetics is explored towards the development of different biomaterial, most notably spider silk as well as robots based on animal models. Spider silk is one of the most sought after biomaterial, This material, produced by special glands in a spider's body, has the advantage of being both light and flexible, and has been found to be three times stronger than steel (Sean 2004). The incredible properties of spider silk are attributed to its unique molecular structure as shown in figure 1.

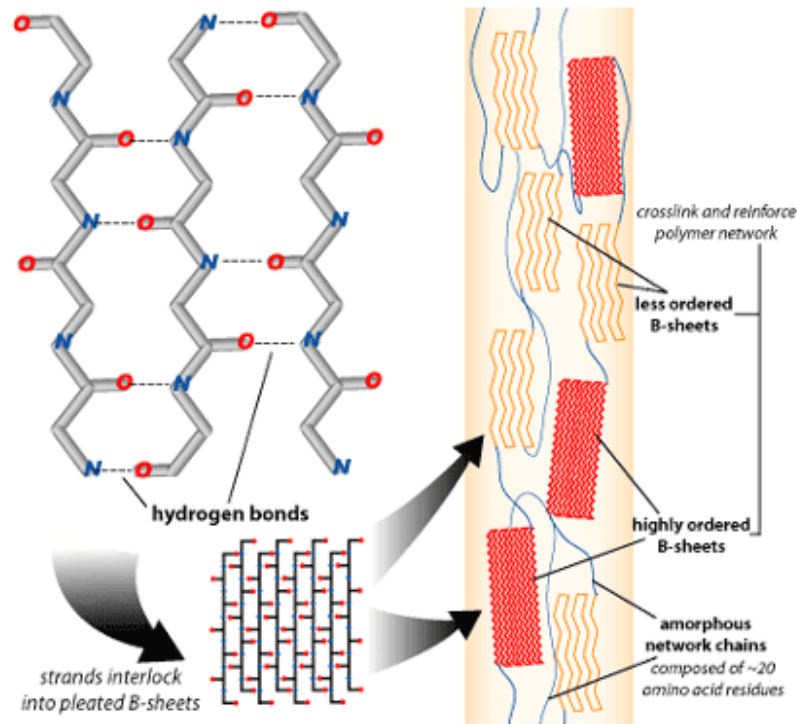


Figure 1. The structure of a strand of silk.

Source: science creative Journal 2004.
 The study of the molecular structure of the spider web had inspired the generation of similar material for applications in the field of medicine, to create a new form of strong, tough artificial tendons, ligaments and limbs that are equally light weight. Spider silk could also be used to help tissue repair,

wound healing and to create super-thin, biodegradable sutures for eye or neurosurgery, as well as being used as a substitute for Kevlar a material used for the production of bullet proof vests

III. The cockroach leg inspiration.

The legs of the cockroach has also been an inspiration toward the creation of robotic legs

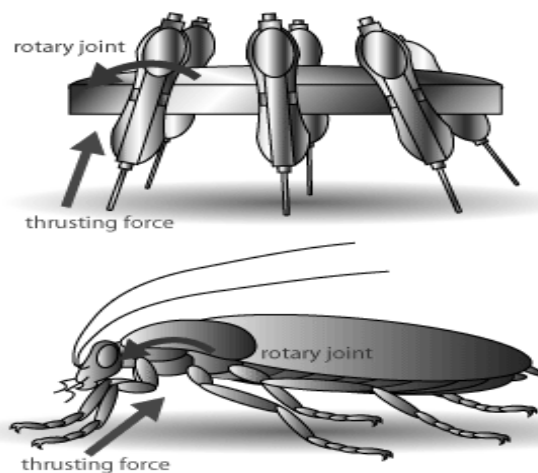


Figure 2. The cockroach leg as a prime candidate for biomimicry. Source :science creative journal 2004.

This was done by the mimicry of the leg and joint structure of the cockroach. The study of the ground reaction forces in cockroach locomotion, the direction of the forces relative to the hip joints, and the different movements of the individual legs was mimicked, to design and build sprawl legged robots that can move very quickly and also be able to manoeuvre in changing terrains.

IV. The Box Fish Inspiration.

When Mercedes-Benz engineers were trying to design a new aerodynamic concept car they focused on the

obstruction cubicus, also known as the boxfish for inspiration (designboom 2009). This fish has a rather large body, but is able to swim very fast because of its low co-efficient of drag and rigid exoskeleton. By identifying the similarities between cars and the boxfish, the designers began modelling a new vehicle after the boxfish. Their final design had an unusual form that looked like a boxfish and after testing proved to have one of the lowest co-efficient of drag that had ever been tested. The plates 3 and 4 show the similarities of the physical structure of the fish and that of the Mercedes car. The concept of bio mimicry applied here is that of the physical appearance.

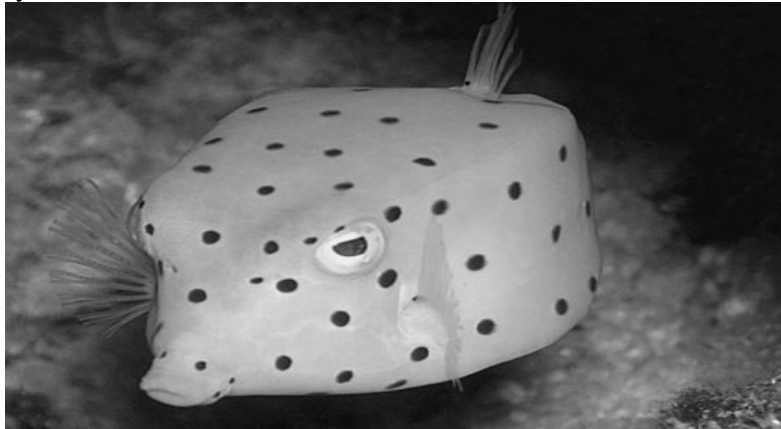


Plate 3: the box fish (ostracion cubicus) source: [www//designboom.com](http://www.designboom.com) (2009)



Plate 4: Mercedes-Benz bionic concept vehicle. Source: [www//designboom.com](http://www/designboom.com) (2009)

V.The dragons fly inspiration. The Munich Olympic Stadium.

Dragonfly wings are one three-thousandth of a millimetre thick. Despite being so thin, however, they are very strong since they consist of up to 1,000 sections (Harun 2008). This is as a result of the compartmental structure of the wings which do not tear, and are able to withstand the pressure that forms during flight. The roof of the Munich Olympic Stadium was designed along the same principle of compartmentalisation

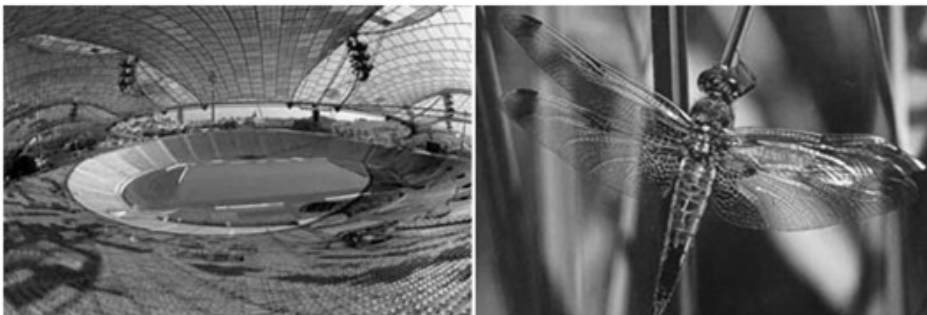


Plate 5.The Munich Olympic stadium and the dragon fly: source www/harunayaha.com:

APPLICATION OF BIOMIMICRY.

The application of bio mimicry using Carl Hastrich, design spiral as explained by bio mimicry institute's website (2009) gave the following illustration (fig3)

THE CHALLENGE TO BIOLOGY DESIGN SPIRAL

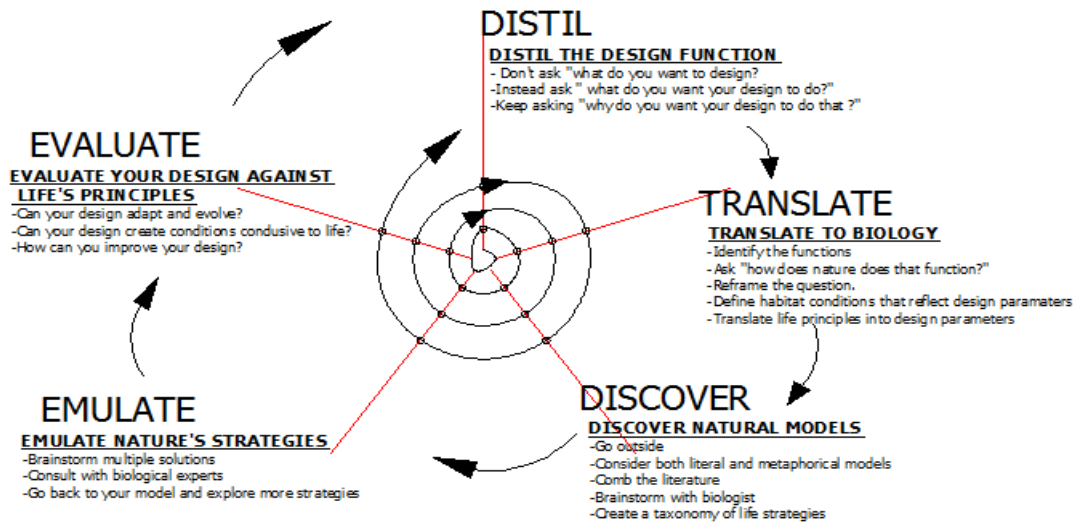


Fig 3. Carl Hastrich design spiral. source: www/biomimicryinstitute.org (2009)

The design spiral explains how the science of bio mimicry can be applied to solve any design problem. This is distinctively divided into six steps.

1. Identification of problems.
2. Translation of problems.
3. Observation from nature.
4. Abstract.
5. Application
6. Evaluation.

1. Identification of problems.

This involves the development of a design brief of the human need, and it constitutes the following steps

- i. Development of a design brief with specifications about the problem to be resolved
- ii. Breaking down of the design brief to identify the core of the problems and the design specifications
- iii. Identification of the function that the design wants to accomplish.
- iv. Definition of the specifics of the problem:

2. Translation of problems

This involves looking at nature to solve the problem raised by the design brief, here the problems are interpreted to see how nature

carries out such functions and the following conditions are also taken into consideration, location of the subject, the Climate conditions, Nutrient conditions, the Social

conditions and the Temporal conditions

3.Observation.

This involves looking at nature for answer to resolve the challenges and finding organisms that are most challenged by the problem at hand and are unfazed by it.

4.Abstract

This involves the uncovering of repeated patterns and processes within nature that had achieved success. This is further broken down into:-

- i. The creation of nomenclature of life's strategies
- ii. The selection of the champions with the most relevant strategies particular to the design challenge.
- iii. Collation from the lists of repeating successes and principles that achieved success.

5.Application

This stage involves the use of ideas and solutions based on the natural models. This is enumerated as follows.

a) Mimicking Form: This principle can be seen to have been applied by the manufacturer of Mercedes Benz manufacturers that mimicked the box fish to achieve an aerodynamic shaped vehicle.

b) Mimicking Function: This principle can be seen to have been applied in the construction of the east gate

building in Zimbabwe where the principle of venting the termite mound was applied in ventilating the structure naturally.

c) Mimicking Ecosystem: This concept involves the study of the eco system as a whole and how the various individual units relate with each other in perfect harmony.

6. Evaluation

This is the stage at which the ideas generated are compared to life's principles. It also involves an assessment of the design in comparison with life principles. It is at this stage that the design can be judge to be good or not and whether it will require going through another circle of design spiral.

CONCLUSION

Biomimicry aims at revolutionizing the process which natural system employs to accomplish a perfect co existence. The mimicry of a biological system in all its totality is neither feasible nor attainable, but the selective application of a process can lead to a lot of innovative solutions to a long standing problems. As noted earlier, the design by Architect Pearce who designed the East gate building using the ventilation principles found in termite mound, helped in reducing the energy consumption that would have been required in ventilating the structure. On the other hand a deep study of the possibility of mimicking the secretion generated from the termites may lead to the improvement of mud as a local building material which is found to be readily available. There are a lot of such

natural models out there to be explored. Biomimicry holds the natural models for the sustainable and eco-friendly developments of the future. All that is required is the study of the natural models in the environment. The paper hopes to be a window for present and future designers into looking at the modern approach of imitating nature to tackle environmental challenges.

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AN EXAMINATION OF THE SPATIAL LOCATION AND DISTRIBUTION OF PERIODIC MARKETS IN NORTHWESTERN NIGERIA

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ABSTRACT

This paper examines the factors which determine spatial location pattern and distribution of periodic markets in North-western Nigeria. The primary and secondary methods were used to collect data for this study. The lists showing the number of registered periodic markets were obtained from ministry of commerce and industries in the nineteen Northern states. The first three states which are top on the list; Kaduna, Katsina and Jigawa were selected as study areas. The density index and nearest neighborhood analysis was performed to determine the density of periodic markets per 100 square kilometers and to explain the distribution pattern of periodic market centres in the study area. The study revealed that periodic markets play major role in development of rural and urban economy in Nigeria. The result also revealed that accessibility and threshold population are major factors of their location. Other factors identified to have contributed are political motive, historical reasons, population size and good purchasing power. It is also found out that the spatial distribution patterns of periodic markets are purposive, with three distinct hierarchical order of distribution. It is recommended that planners should use the existing spatial distribution pattern and hierarchy of periodic markets in the process of planning in order to enhance rural development and interregional trade in Nigeria.

INTRODUCTION

The role of periodic markets in rural development and in economic growth has long been acknowledged (Filani, 1976, Gana 1976 and Howe 1984.). The transaction, which take place in the periodic market centres and in which they interact with the hinterland as well as other places has an integrative function in the society (Berru, 1967; Hodder and Ukwu, 1969; Vagale, 1972 and Whetman, 1973). The periodic market centres play this role by being a major source of the fresh agricultural products, point of exchange of goods and services, generators of rural employment opportunities, terminal for rural freight

transportation and channel rural goods distribution. (Vagale, 1972; Jacoby, 2000 and Musa, 2007).

The above perhaps is the reason for earlier interest among scholars to investigate different aspect of periodic marketing. Some scholars like (Gana 1976; Hodder 1969 Idachaba and Onakomaiya 1980) who submitted that periodic market evolved through three-stage model; which they referred to as self sufficient economy, rudimentary division of labor economy and economic diversification. Also, Berru (1967) and Smith (1971) in their study of market evolution of West Africa asserted that rural markets are primarily included by

external exchange of complementary products with an alien population. Apart from market evolution, the spatial and temporal organizational structure of periodic markets in Nigeria is another issue of concern (Fliani 1976; Gana 1976 and Onerkehoraye 1985;). Their studies informed on timing, periodic systems, marketing structures and distribution methods in regions of b Nigeria.

In other Geographical studies of markets centres and retail distribution, Bery, (1967), Smith and Hill (1972) hypothesized that spatial proximity of periodic or rural market location is likely to be compensated for by temporal distance. The needs to empirically confirm this hypothesis led Filani (1976) to examine time-space ordering distribution of rural market centres using neighborhood analysis. He discovered that the maximum distance the local farmers in a rural community in south Western Nigeria are willing to travel is 11km while the minimum distance is 3km and this is not influenced by the temporal sequence of the market system. Alan and Robert (1985) also observed that the pattern of periodic market space in different societies is not a determinant of the market location and distribution. Gana (1976) explained the location and function of periodic markets; He revealed

Whereas Hay (1976) in a similar study in northern Nigeria identifies three distinctive spatial organizational structure of agricultural marketers namely; isolated rural markets, accessible rural market and regional and inter-regional urban markets. According to him, isolated rural markets are mostly markets centers that are not accessible to motor traffic, serve village and local community needs. This

that they integrated with their location and spacing and there is a close relationship between market provision and population density. The gap identified which is addressed by this study is to examine the spatial location of periodic markets in north-western Nigeria and to explain how temporal and spatial competitions of the periodic market system influence their distribution. This is because they are important mechanism for growth of rural-urban economics and the development of rural areas in north-western Nigeria.

THEORETICAL REVIEW

According to Onokerhoraye (1985 : 166) and Udo (1982 :192) markets can be categorized based on their timing or periodicity, location, areas of influence and using the structure of their marketers.

In this study they were categorized in to three, the Local rural market, Periodic market and Inter-regional rural market.

They are local rural markets because the marketers in these markets come from within the state or within localities. The periodic markets attract marketers outside their state or localities where they are located. The Interregional markets attract traders beyond their localities or regional boundary.

type of markets fall into the first classified as a rural market in the study. The second groups, which are being studied, are classified as periodic markets. They serve the village and other local communities or towns; in addition they are located on or near a motor able road. These types of markets often serve as focal point for collecting mostly agricultural products to be transported to urban area.

The third group can be classified as inter-regional rural markets. This type of markets is defined as those relatively big markets, which serve their immediate geographical region as well as other area outside the regions. Apart from the geographical distinction, the function and features of the inter-regional rural markets are similar. This third group is similar to what Hay (1976) classified as regional and inter-regional urban markets in Nigeria. It is clear from the above, that, the result emanating from this study agrees with Hay's identification of market structure in northern Nigeria. However, his classification seems to limit the channel of regional and inter-regional flow of goods to only urban markets. This study has proved that, this is not entirely true. The analysis presented in this study shows that there are periodic markets centers that serve beyond the regional boundaries and serve other areas that are not producers of goods. Some examples found in this study are Makarfi, Galadimawa and Laban zango markets in Kaduna state; Sundu, Danja, Jibia and kankara markets in Katsina state and Sara and Maigatari periodic markets in Jigawa, in northern Nigeria.

METHODOLOGY

Considering the large area extent of north-western Nigeria as the study area, the nature and types of data for the study, the coverage was therefore limited to only three states, which were used as basis for generalization; (see fig 1). The three states (Kaduna, Jigawa and Katsina) were selected from a list obtained from the Federal Ministry of Commerce and Industries because they have highest number of periodic markets. A

reconnaissance survey of the sampled states was also carried out to determine the names, number and the location of the existing periodic markets. This survey was complemented with the review of available states and local government publications from the ministries of commerce and the revenue boards or sections, which provide information on market days and locations and major commodities of trade.

The extract from the review and the outcome of the survey revealed that Katsina state has 78 periodic market centres; Kaduna state has 68 while Jigawa state has 102 making a total of 248 in the three states (see table. 1). This number does not include the numerous urban market canters in area of the study, because the actual location of some of the periodic markets could not be ascertain. The purposive sampling method was used to select only periodic markets which were located not more than 2km from motor able roads for the administration of questionnaires. By doing this, fifteen percent representing thirty-seven periodic markets were used as sampling points where respondents were interviewed. In this study twelve (12) rural markets were selected in Katsina state, ten (10) were selected in Kaduna and fifteen (15) were selected in Jigawa state. To elicit information from respondents', one thousand six hundred and twenty three structured questionnaires were designed. In each of the selected periodic markets forty three questionnaires were administered to marketers using a purposive sampling procedure. In this study the marketers are those who come to the periodic markets places to buy or sell goods.

Table 1: Showing States, Names of Periodic Markets and Sample Size

State	No of periodic markets identified	No of period markets sampled	Names of p/markets studied	No of Qstn administered
Kaduna	68	10	Giwa,Soba,T/saibu,Kidandan,Saminaka,L/zango,Kenyi, Jere,Kubacha,Makarfi,Kachia,Galadimawa	Disproportionate
Katsina	78	12	Charanchi,Danja,Bakori,Dankama,,Kaita,Sheme,Jibia, Sabuwa,Kurfi,Ingawa,Jikamshi,Kankia	Disproportionate
Jigawa	102	15	Gujungu,Sara,Maigatare,Birnin-kudu,Shiwarin,Hadejia, Jahun,Kazaure,Babura,Kiyawa,Garki,Garko,Badume, Gumel,Roni,Dutse	Disproportionate
Total	248	37/ 15%		1623

Sources: Field work 2009

The whole of 248 periodic markets were used for the analysis and density index and nearest neighborhood analysis methods were employed. In this study locations of these markets were obtained through secondary sources and the density index was used to measure the relations between numbers of existing periodic markets to the geographical area in kilometer square. While the nearest neighborhood analysis (NNA) is used to determine pattern of periodic market centers' distribution, which is be used as basis for generalization for northern Nigeria.

Nearest neighborhood analysis (NNA) is a test of statistics, which compares observed point patterns against theoretical derived random patterns. The averages of the distance between each point and its nearest statistics R_n whose value ranges form 0 (clustered) through 1 (random) and 2 (uniform grid) to 2.14 (uniform triangular). The formula for theoretical mean distance of a randomly distributed set of point is given as.

$$(r_e) = (1/2)^{1/2} = 2\sqrt{}$$

Where r_e = theoretical means distance

= the density of points (i.e. number of points divided by area in square kilometers or meters). The observed

mean distance to nearest neighborhood formula is given as:

$$(r_a) = \sum r/N$$

(r_a) = observed mean distance

N = total number of points in the area of study the nearest neighborhood statistics, in this case, 'N' represent the total number of markets in each sampled state.

r = distance of every point to its nearest neighbor, that is the straight line distance separating any point from its nearest neighbor. Nearest neighborhood (R_n) = ratio of r_e and r_a (i.e. r_e/r_a)

The calculated values using the neighborhood analysis of the sampled periodic markets for the three states are as indicated in table 3.

STUDY AREA

This study area covered three states in the savanna region, northern part of Nigeria; (see fig 1). Formal jobs, farming, trading and commerce and small scale industries are the important occupation of the people in the area. The study area is located in the savannah region which

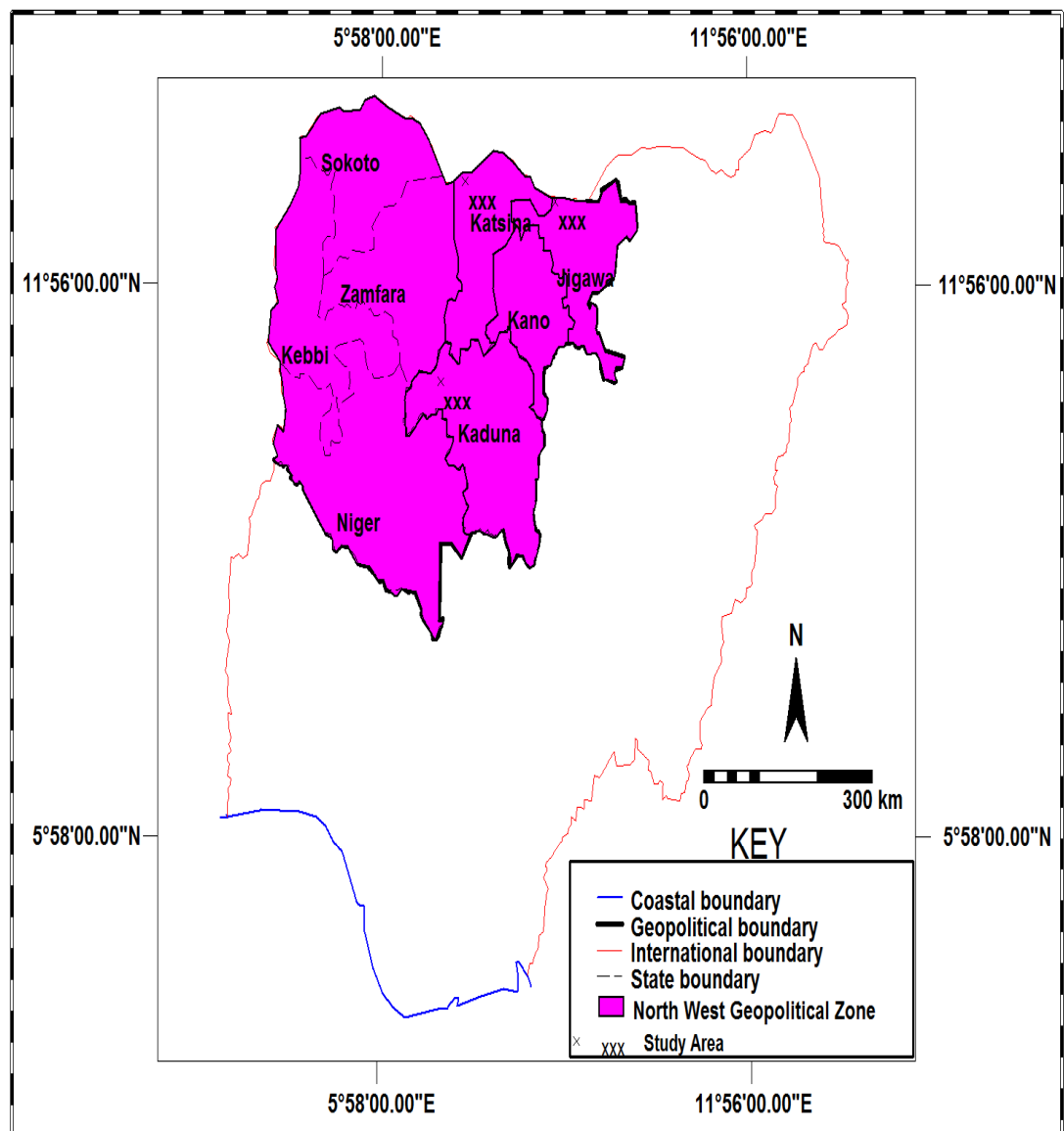


FIG. 1: THE SIX GEO - POLITICAL ZONES IN NIGERIA SHOWING THE STUDY AREAS

Source : Adapted and modified from 36 States of Nigeria by Bureau for Lands and Surveys Kaduna

has AW type of climate good soil which allows for intensive multiple cropping and production of varieties of grain and cereals like maize, millet, sorghum, groundnut, rice; vegetables and other cash crops like tomatoes, pepper and tubers like potato and cassava (Musa, 2007). These commodities are produced for home consumption and commerce. Other industrial goods and those produced by artisans are also distributed for sale from the periodic markets to regional or urban markets.

DISCUSSION

Findings revealed that the relationship between types and quantity of commodities available in these markets, existence of bulking or good loading places, threshold population and patronage are crucial to the survival of periodic markets. While prompt availability of transport modes, usability roads, the temporal and spatial competitions among periodic markets influence their locations and distribution. This is supported by the findings of Saidu

(1999) and Ihedigbo (2005) that the availability and effectiveness of roads are important in market location and patronage. The number of markets selected based on road types are as presented on Table 1 and their spatial distribution is shown on figure 1.

The result show that more markets are located on trunk B and C roads in Kaduna and Katsina states, where as in Jigawa state more of the periodic markets are located on trunk C and minor roads. It was also found out that majority of these markets hold once a week (Galadimawa, Makarfi, Giwa, Soba, Samunaka, Anchau, Ikara and Lanban zango in Kaduna state; Sabuwa, Danja, Kafur, Dayi, Chararchi, Sheme, Dandume, Jibia, Kankara in Katsina state and Sara, Maigatari, Badume, Hadejia, and Shiwarin in Jigawa state). They have wide catchment areas from within and attract large number of patronage from distant places like Kaduna, Kano, Maiduguri, Lagos, Portharcourt, Calabar and even from Niger Chad and Cameroon republic.

TABLE 2: LOCATION OF MARKET ALONG DIFFERENT CLASSES OF ROADS

State	No of markets on trunk (A) express way (double carriage)	%	No of markets on trunk (B)	%	No of markets on trunk (C)	%	No of markets on minor rural road	%	No of markets on other road	%	Total No of markets
Katsina	6	2.4	39	15.7	27	10.8	6	2.4	0	0	78
Kaduna	9	3.6	24	9.6	18	7.2	17	6.8	0	0	68
Jigawa	3	1.2	39	15.7	48	19.3	12	4.8	0	0	102
Total	18	7.2	102	41.1	93	37.5	35	14.1	0	0	248

Source: field survey, 2008

The result on table 2 show that 41 percent of the periodic markets are located by trunk 'B' roads and 38 percent are by trunk 'C' road, while majority of the periodic markets as is represented by 14 percent are located by minor roads in This study revealed that the location pattern of periodic markets in northern-western Nigeria has a good fit to the existence of motor able roads, most especially trunk B, trunk C and minor

This recent location pattern of periodic markets along trunk A road, which includes the double carriage road in northern-western Nigeria is appearing because it is meant to provide link for intercity movements. These roads also attract settlements, agricultural production and marketing and other commercial activities which act as impetus for the growth of periodic markets.

Thus, these findings are an improvement on earlier studies which reported that such class of road does not favor the

This may not be so in this economy because the size of the periodic market and level of access, the types and quantity of goods available and prompt availability of transport have effect on patronage of the markets.

Spatial Distribution of Periodic Markets

Alokan (1987) used quadratic analysis to determine the pattern of distribution of

Jigawa state. This finding is not in agreement with earlier finding which ascribed higher number and size of periodic markets to the quality and efficiency of roads.

roads. We also found out that recently periodic markets are being established along the trunk A roads constructed for intercity movements, as is represented by 7.2%, (Table2).

location of rural market centers on it because most of marketing activities that should take place in them are likely to pass them by in favor of a nearby town or city along the same route (Filani and Rachard (1979) and Oluwarewaju 1992). The findings also confirmed the Ullman (1956) theory of existence of intervening opportunity for alternative supply and demand goods and services between towns or regions. It also improves on the central place theory which states that higher order market center absorbs the lower order market center through the presence of intervening opportunitie

haulage companies in Nigeria. In this section the distribution pattern of periodic market centres is be examined using the density index and the nearest neighborhood analysis. In this work the density measure relates the number of existing periodic markets to the geographical area (in km²) density. The result presented on table 3, revealed that the higher the density the greater is the intensity of distribution in northern-western Nigeria.

TABLE 3: PERIODIC MARKET DENSITY

State	No. of Markets	Area in square Km	Market Density per 1000sq.Km
Jigawa	102	11,250	3
Kaduna	68	16,369	5
Katsina	78	28,215	6
Total	248	55,744	14

Source: field survey, 2008

Table 3 shows that Jigawa state has the highest number of periodic market centers and also the largest geographical area but records the lowest rural market density of 3 periodic markets per 100square kilometer. The same pattern is applicable to Katsina with second largest area and second highest number of rural market centers but records highest periodic markets density of 6. While Kaduna state that records the lowest number of rural market centers has the moderate periodic market density of 5 per

100 square kilometers. Many factors may have been responsible for this, some of which are the level of patronage it enjoys from border towns and the role it played in beef marketing. Other factors which affect the distribution of periodic markets include threshold population and good condition of road of which Katsina is ranked high, the density of the roads which correlated high in Kaduna state, the segregated settlement pattern which works well for Jigawa state population.

TABLE 3: NEAREST NEIGHBOURHOOD ANALYSIS OF THE RURAL MARKETS SPATIAL DISTRIBUTION

State	Re	Ra	R	Remark
Katsina	6.45	7.27	1.1	Highly random distribution
Kaduna	7.25	7.27	0.95	Fairly random distribution
Jigawa	7.87	7.87	1.0	Random distribution

The neighborhood analysis result show that the pattern of periodic markets distribution in these three states and generally in northern-western Nigeria is purposive, with little variation from one state to another. Katsina state has the highest level of randomness ($R = 1.1$) while Kaduna state has the lowest level

($R = 0.95$) meaning that periodic markets are fairly random, it is somewhat difficult to classify Kaduna state as having pure random distribution of rural market centres because its 'R' value is less than one. Jigawa state too has ' $R = 1$ ', also makes it categorically random distribution pattern of periodic market centres.

RECOMMENDATION AND CONCLUSION

The analysis presented above shows that periodic markets are very important in the nation's economy. An improvement in the periodic markets structure and organization will improve the economy of rural communities and the nation at large. Therefore, government should promote the building or establishment of more periodic markets. The study has shown that the periodic markets are spatially ordered by their sizes, threshold population, and the volume of freight and spatial area of influence. This can also be basis for the reorganization of markets for improved efficiency.

It is recommended that the bulk point areas should be upgraded to rural goods load center which should be introduced in the planning of periodic markets for regional development in Nigeria. Based on the existing number and classes of periodic markets discovered in the study area, some specific periodic market centers can be designated by the government as 'load center' where modern freight operational facilities are provided. This will serve as a major rural interchange point for distribution of goods among rural and urban centers in the country. The proposed periodic market load centers should serve as collection points for goods moved from other similar rural market centers to interregional or urban markets.

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IMPACTS OF URBANIZATION ON ENVIRONMENTAL QUALITY IN KADUNA AND ZARIA CITIES OF NORTH - WESTERN NIGERIA

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Abstract

This study examined the impacts of urbanization on the quality of the environment in Kaduna and Zaria urban centres. The primary data collection entailed the administration of structured questionnaire to residents of the urban centres. Seven hundred and fifty and two hundred and fifty copies of the questionnaire were administered in Kaduna and Zaria respectively using random sampling technique. Simple descriptive statistics were applied using Microsoft Excel 2003 and Statistical Product and Service Solutions (Formerly Statistical Package for Social Sciences). These were used in the analysis of the questionnaire. The results showed that the impact of urbanization on the quality of the environment in Kaduna and Zaria included air, water and noise pollution, solid waste disposal problems, flooding, erosion, and the development of slum and squatter settlements. It was concluded that the dynamics of urbanization in Kaduna and Zaria had affected the quality of the environment particularly in terms of environmental degradation caused by indiscriminate disposal of solid waste, air, water/noise pollution and slum/squatter settlement. Recommendations were made for sustainable growth and development of the urban centres.

Key words: Urbanization, Environmental, Urban growth, Solid waste, Pollution.

INTRODUCTION

The problems of environmental degradation resulting from rapid industrial development and largely unrestrained urban population growth have been unprecedented in many developing countries. Urbanization is the process through which towns and cities come to be. Rapid urbanization without proper physical planning leads to worsening of the environment resulting in degradation and lower quality of life. One of the foremost problems that any nation undergoing modernization has to contend with is the management of urban expansion. Rapid spatial growth of cities have been a global concern due to the attendant social, economic and environmental problems associated with such growth particularly in the developing world. A host of intractable problems often accompany rapid urban growth. Kasarda and Parnell (1993) noted that these problems include insufficient shelter, inadequate sanitation, inadequate

or contaminated water supplies, serious air pollution and other forms of environmental degradation. Cities now form a major source of environmental problems which have effects not only within their vicinity but, often times, of global significance. Kaduna and Zaria metropolis like other urban centres in Nigeria and the world at large are not static but they are dynamic in nature. They grow both numerically (in terms of population) and physically (in terms of areal extent/ coverage) as a result of several "pull factors" which include but not limited to natural increase, immigration and physical development which result primarily from the need of the growing population to occupy space for residential, commercial, transportation, institutional and recreational purposes to mention but some. The threat of global population growth in most urban centres like Kaduna and Zaria, if not properly monitored, may lead to a great threat to the dwellers in

terms of available resources and environmental quality. In the same vein, rapid population growth and the pace of urbanization in Kaduna and Zaria urban centres are mounting increasing pressures on the local and regional environment and these impacts have never been of greater concern. The paper seeks to assess the impact of urbanization on environmental quality within the study areas and proffer ways by which the impacts could be mitigated or ameliorated so as to ensure sustainable growth and development.

STUDY AREA

Kaduna metropolis bounded by latitudes $9^{\circ}03'N$ and $10^{\circ}32'N$ and longitudes $7^{\circ}25'E$ and $7^{\circ}36'E$. Kaduna Metropolis comprise of four Local Government Areas namely Kaduna North and Kaduna South and parts of Igabi and Chikun, Local Governments (Fig.1). Kaduna metropolis has a population of 1,582,102 (NPC,2007). On the other hand, Zaria as

an urban centre comprises of Zaria and Sabon Gari Local Government Areas. Zaria Metropolis is located at latitude $11^{\circ}3'N$ and longitude $07^{\circ}40'N$ and is presently one of the most important cities in Northern Nigeria. As at 2006 Census, it had a population of 975,153 (NPC, 2007).The Urban Zaria Area is made up of sub-settlements that are existing in the neighbourhood pattern. They are Zaria City, Sabongari, Muchiya, Chikaji, Kwangila, Palladan, Tudun Wada, Tudun Jukun, Wusasa etc (fig. 2) . Other major land uses are educational, health, industrial, commercial, residential and agricultural.

Like many cities in Nigeria, Kaduna and Zaria face problems of environmental sanitation such as improper disposal of refuse near residential areas; poor refuse collection and handling, etc. For example, it is a common feature to find huge refuse dumpsites within residential areas and along some minor and major roads.

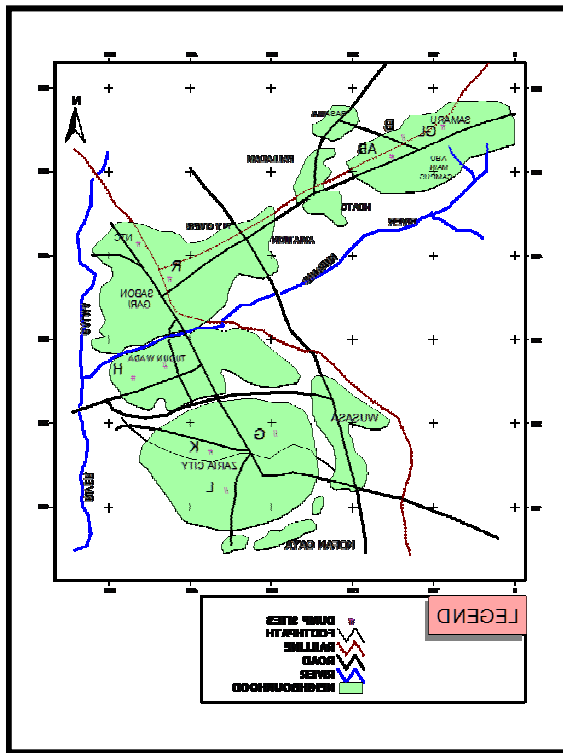


Fig. 1: Kaduna State showing the LGAs.
Source: Aiyejina, 2008.

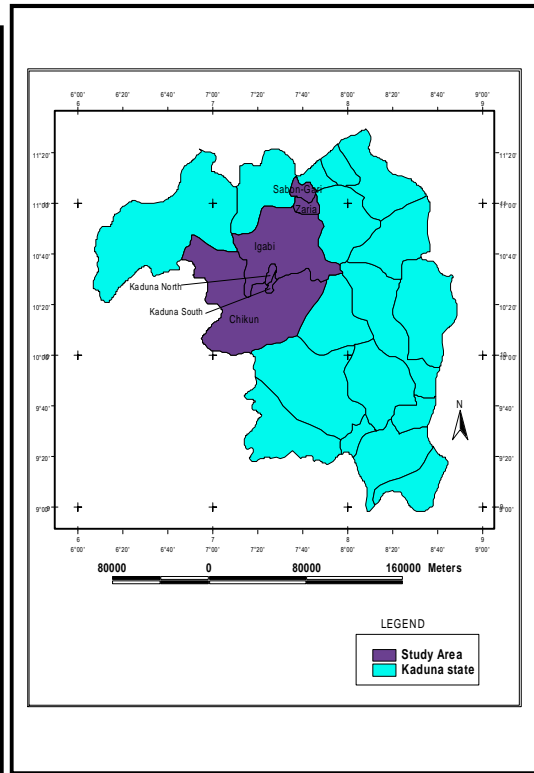


Fig. 2 : Zaria showing the Neighbourhoods.
Source: Aiyejina, 2008.

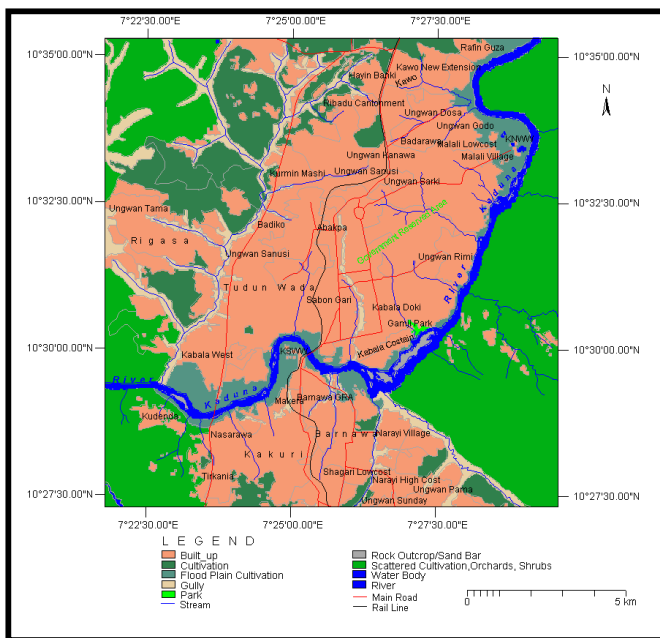


Fig. 3: Kaduna showing the Neighbourhoods.
Source: Aiyejina, 2008.

MATERIALS AND METHODS

Questionnaire Administration/ Sampling Technique

The Reconnaissance survey carried out employed the use of digital camera in capturing the environmental problems identified within the study areas. The primary data collection also entailed the administration of structured questionnaire within the study areas. Two types of questionnaire were administered. The first type numbering 1000 copies was administered to the residents within the wards of the Local Government Areas constituting the study areas as shown on fig. 1, 2, and 3 using systematic random sampling technique. Each ward was further segmented into high, medium and low residential areas.

It was recognized that it was impossible to achieve a full coverage of the urban centres within the available time frame and considering cost implications; therefore, a suitable sample frame was sought. The available and more reliable sample frame obtained in the study areas was the number of roads in each ward. The number of roads in each ward presents a more reliable and adequate sample population for the study. The number of roads in each ward was obtained and updated using topographic maps, landuse maps and satellite images

on the study areas. Kaduna metropolis was segmented into 25 wards while Zaria metropolis was segmented into 10 wards (fig. 2 and 3). The systematic random sampling was further used in selecting the residential units for the administration of the questionnaire using a sample frame of 2 percent. The field assistants were taught to select one in every 20 buildings between the selected street/ road and the adjacent street. The questionnaire were directed to the household heads for more reliable responses.

The second type of questionnaire numbering 100 copies was administered to the staff of the Kaduna State Urban Planning and Development Authority (KASUPDA), the Kaduna State Environmental Protection Agency (KEPA) Federal Ministry of Environment, Housing and Urban Development and Town Planning departments of the Local Government Secretariat, which are in charge of physical planning and environmental management in Kaduna and Zaria urban centres. The descriptive statistics were applied using Microsoft Excel 2003 and Statistical Product and Service Solutions (formerly Statistical Package for the Social Sciences). These were used in the analysis of the questionnaire.

RESULTS AND DISCUSSION

Environmental Problems Associated with the Growth of Kaduna and Zaria.

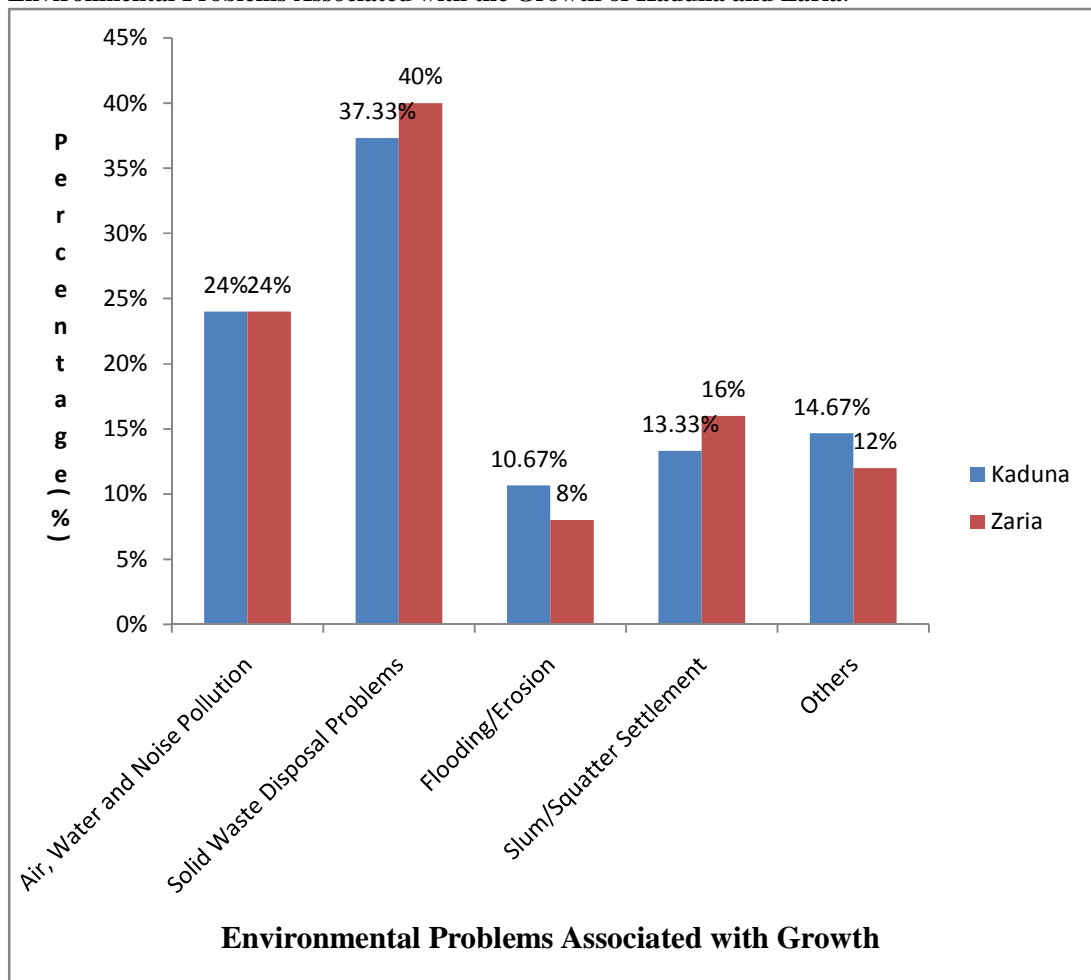


Fig. 1: Comparison of the Environmental problems Associated with the Growth of Kaduna and Zaria Urban Centres

Source: Authors' analysis of questionnaire

Fig. 1 shows a comparison of the major environmental problems associated with the growth of Kaduna and Zaria urban Centres.

An analysis of the questionnaire shows that air, water and noise pollution constitute about 24% of the environmental problems associated with the growth of the urban centres. A survey of the industrial areas in Kaduna and

Zaria reveals that the industrial areas are the major sources of air, water and noise pollution. Virtually every industrial facility in the urban areas is a source of pollutants which can adversely affect human health, the environment and human ecology. This is particularly so because, it was observed that industrial waste is not strictly controlled and most of the industries are located in close proximity to the residential areas (Ojo,

2004). While water bodies were observed to be polluted by domestic and industrial wastewater, internal combustion engines also contribute to the pollution of air, and land surfaces. This confirms the works of many scholars that rapid urbanization along sides the rising rates of industrilization are the causes of a great deal of environmental problems in our cities (Adedibu and Okekunle, (1989); Ahmed, 2000; Aderamo, 2000).

Environmental sanitation was observed to be very poor in most parts of the urban centres (See Plates). Figure 1 shows that solid waste problem constitutes the major environmental problem associated with the growth of the study areas. Solid waste constituted about 37.3% and 40% of the environmental problems in Kaduna and Zaria respectively. This is as a result of the attitude of the residents towards solid waste disposal, the failure of planning authority to provide organized dump sites at reasonable locations and the poor private sector involvement in solid waste management.

Many scholars have reported that the impact of urbanization is also felt in the generation of solid wastes by the inhabitants (Mabogunje, 1974; Ahmed, 2000; Aderamo, 2000 and Olatubara, 2004). The growths of Kaduna and Zaria urban centres have had significant negative impacts on the local environment in terms of solid waste generation. Due to the varied lifestyles and consumption patterns of the residents, the quality and the composition of waste has been more varied and changing. Rising quality of life and high rates of resource consumption patterns have had an unintended negative impact on the urban environment in terms of generation of solid wastes that go far

beyond the handling capacities of the agencies in charge of physical planning and environmental management within the study areas. This finding is supported by Adedibu (1987), who opined that “solid waste generation increases as income rises and as remarkable growth in population and income give rise to the production and consumption of goods and services.”

Hence, The Kaduna Enviromental Protection Agency (KEPA) is not only grappling with the problems of high volumes of solid waste, the cost involved, the disposal technologies and methodologies to adopt, but also with the impact of the waste on the local and global environment. The concern is not only in the quantity but also in the quality and composition of the wastes which are becoming increasingly non-biodegradable.

The major generators of solid waste are households, commercial and industrial operators. In addition to general refuse (household garbage and rubbish, residential ashes, commercial and institutional refuse, construction and demolition debris, dead animals, drain-clearing wastes and sanitation residues), human excrement and manure also constitute part of the solid waste which is dumped indiscriminately at unauthorized places, for example, along major streets, near dwellings and into street gutters and valley heads which eventually drain into the streams and rivers (Plates 1, 2,5,6, and 7).

Indeed, majority of the respondents expressed dissatisfaction with the present way of waste management in their communities. Apart from the ignorance on the implications of indiscriminate

dumping of solid waste, the shortage in the number and inappropriate location of the available dump sites could be traced to the proliferation of solid waste at undesirable locations in Kaduna and Zaria. For example, it was observed that the few available dump sites are not only located at sensitive areas, but over 90% of the surveyed dump sites were situated at over two kilometers from the residents. The residents therefore resort to either dumping their refuse at the nearest available open spaces, along the major streets or into drainage channels or waterways (Plates 1, 2, 5, 6, and 7).

Furthermore, the impact of the indiscriminate disposal of solid waste in Kaduna and Zaria is worrisome. There is general non-challant attitude displayed by the residents in the disposal of solid waste within the study areas as most of the residents either dump their solid waste at strategic points on major roads or into or around the existing drainage channels, streams and rivers in the neighbourhood. Apart from the blockage of these water channels and the resultant floods caused by this action, the sources of these surface and underground water supply are also contaminated. This has various health implications (Ojo, 2004). Other major environmental problems that have resulted from the lateral expansion of Kaduna and Zaria are flooding and erosion. These constituted 10.67% and 8% of the environmental problems within the study areas respectively (Fig. 1). Indeed, urban expansion may give rise to different types of geomorphologic problems (Olorunfemi, 1995; Olorunfemi and Jimoh, 2000). This is attributed to inappropriate urban land development such as farming or construction on steep slopes without providing proper contours. The results of erosion include polluted

rivers, clogged irrigation and drainage systems and frequent floods in other communities down streams. In addition, uncontrolled stripping of vegetation reduces the soil's capacity to retain moisture and causes rapid run off that exacerbate flooding (Lee, 1985).

Furthermore, slum development is another environmental problem that was observed within the study area. Slum development represented 13.33 and 16% of the environmental problems in Kaduna and Zaria urban centres respectively (Fig.

1). Urban decay has been variously described by many authors as a state of urban squalidness and over crowdedness, characterized by poor sanitary conditions, inadequate provision of amenities and general deterioration of urban environment (Abumere, 1985; Okoye, 1979 cited in Fabiyi, 1998). Some authors have identified urban decay as a stage in the cyclic process of urban growth, explaining that the same factors that induce urban growth also contribute to urban decay.

These assertions are true in some parts of Kaduna and Zaria urban Centres. While some parts of Kaduna and Zaria urban centres such as Narayi High cost, Gonigora and Romi New Extension in Kaduna and the Government Reserved Area in Zaria are experiencing growth in quality, other parts such as Makera and Nassarawa in Kaduna and Gellesu and Magume in Zaria are deteriorating in quality (Plates 4 and 5). These slum/squatter settlements which were observed both within the core and the peripheries of the cities were caused by the natural spatial changes in the urban system brought about by the influx of activities into the cities and the general over exploitation of urban infrastructure and

services. Apart from the irregular location of structures in these areas, there was also the erection of illegal structures on drainage channels (Plate 3).

Conclusions

This paper has highlighted the impact of urbanization on the quality of the environment in Kaduna and Zaria with emphasis on the effects of indiscriminate disposal of solid waste in the urban centres. The paper showed that Solid Waste constitute the major environmental problem in the study area which is as a result of the attitude of the residents towards solid waste disposal, failure of planning authority to provide organized dump sites at and poor private sector involvement in solid waste management.

Recomendations

There is therefore, an urgent need for the government and all concerned stakeholders to embark on appropriate measures that would reverse the despicable act. Some of the control measures include:

- (i) Intensive public enlightenment campaigns on environmentally and ecologically safe methods of solid waste disposal through community health workers and the electronic and print media.
- (ii) Enactment and enforcement of relevant environmental laws by the state House of Assembly and other stakeholders in order to safeguard the environment and ensure sustainability in the urbanization process with the imposition and enforcement of fine for defaulters.

- (iii) Provision of organized dump sites and refuse collection points at reasonable distances in the communities and the involvement of private waste collectors in the management of solid waste in the study areas. The National Environmental Standards Regulations Enforcement Agency (NESREA) should collaborate with the state and the local governments in order to ensure that waste collection and management in the State is properly organized. They should critically consider the allocation of dumpsites for different categories of waste such as biodegradable and non – biodegradable. This will ensure proper monitoring of waste and the conservation of our renewable resources through recycling of used products.
- (iv) The ‘waste to wealth’ initiative should be critically considered and explored.
- (v) NESREA should also critically appraise the impact of the existing industries in Kaduna and Zaria on the environment particularly as it relates to the emission of obnoxious gases into the atmosphere and the discharge of industrial waste water into the existing water ways.
- (vi) The role of indigenous and international non governmental organizations (NGOs) in the management of solid waste should be

critically considered and harnessed.

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Plate 1: Deposition of solid wastes into waterways in Kaduna.



Plate 2: Indiscriminate disposal of solid waste by residents in Sabon Gari, Zaria.



Plate 3: Construction of illegal structures on drainage channel at Sabon Gari, Zaria.



Plate 4: Urban slum in Zaria, an implication of urban growth.



Plate 5: Urban slum in Nassarawa neighbourhood, Kaduna.



Plate 6: Neighbourhood pond turned to community waste dump in Narayi, Kaduna.



Plate 7: Indiscriminate Solid waste disposal at Kaduna City Centre.

MEASURING THE INEQUALITY OF PUBLIC HEALTH FACILITY PROVISION IN BIDA TOWN, NIGER STATE

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Abstract

The capacity of an urban center to efficiently and effectively deliver its services is related to the availability, adequacy and efficiency of operation of its urban public infrastructure. Public health facilities are therefore the fundamental necessities of any community (Urban or Rural), because the health of people has a direct correlation with the productive capacity and labour efficiency. Urban facilities include all the supportive service required to maintain the urban system. They may be conceived of as medium or objects by which various urban services are delivered. The effective provision and efficient functioning vis-à-vis the population is an indication of general level of equality of life and entire environment; that's the provision of facility has to be in consonance with the population or demand of such facility. This paper therefore, assesses the adequacy of public health facilities in Bida town using Gini coefficient. Attempt was made also to identify the existing health facilities in the study area; their types, location and distribution. The Gini Coefficient (G) is one of the most commonly used indicators for measuring distribution. It is traditionally applied to the measurement of income inequality, but has also been applied to measure land inequality. The value of G ranges from 0-100, signifying that, the higher the G-value the greater the degree of inequality. The result reveals that distribution of public health facilities in Bida town are not guided by population distribution in the wards. The inequality level was assessed using Lorenz Curve; it is observed that about 50% of the public health facilities in Bida town are enjoyed by about 9% of the inhabitant. This implies that some areas in Bida are deficient in basic health facilities and quite a number of the inhabitants have no adequate access to these facilities. The field survey analysis however, reveals that the degree of inequality of public health facilities in Bida town minimal/low (Gini coefficient (G) = 42.8). The assessment of the adequacy of health facilities provision and level of patronages were also measured based on the field survey result using structured questionnaires. Total of 140 questionnaires were administered using systematic random sampling techniques. In this case, houses in the selected ward were chosen randomly to represent the entire houses in the area. 10 questionnaires each were assigned to 14 specified wards covering the entire Bida town. Therefore, the study analysis is based on the 140 surveys questionnaires processed representing 100.0% response rate. The result shows that public health facilities services delivery in Bida town is adequate 86 (61.4%) and the level of patronage is determined by their cost of service (47%), nearness to homes (17%), and existing equipment (15%). It therefore, recommends that the government and other stakeholders or sponsoring agencies must ensure that all health institutions provide high quality services.

Key Words: Gini coefficient, Health Facility provision, Inequality.

INTRODUCTION

Good health is basic to human welfare and fundamental objective of social and economic development. Therefore, knowing how fundamental health is to a particular citizen and how to access it becomes the next question that should cross the mind of an average citizen.

The capacity of an urban center to efficiently and effectively deliver its services is related to the availability, adequacy and efficiency of operation of its urban public infrastructure. Public health facilities are therefore the fundamental necessities of any community (Urban or Rural), because the health of people has a direct correlation with their labour productivity. Also, it provides an enabling environment for the people to live and engage in various complex activities in

search of better life quality. "The perception, promotion, protection and delivery of health care service must be demystified and diversified and made all embracing if the total spectrum of human well-being is to be captured (Mabogunje, 1991).

The National health care delivery system has spelt out the function of each health facility and this should be analyzed and assessed in terms of appropriate spatial organization, which facilitates its operational efficiency.

Urban facilities include all the supportive service required to maintain the urban system. It may be conceived of as a medium by which various urban service are delivered effectively and efficiently vis-à-vis the population as an indication of general level of equality of life and entire environment; that is the provision of facility has to be in consonance with the population or demand of such facility.

The need for planning in the national provision of facilities is a necessity in our urban centre because; the social, political, cultural and economic viability of a nation is usually made evident in its urban centre. By their nature, they are generative of economic and social development (Olajuyi et al., 1997).

The role of urban centre as an area of high innovative diffusion, political and economic transformation is the core factors that bring about and enhance national development cannot be over-emphasized. Therefore the provision and equitable distribution of public health facilities in urban centres has to assume prominence as well as constitute a challenge in any nation particular in a developing country like Nigeria.

Ayeni and Rustron (1986) stated that, for effective location of facilities, there must be equity in distribution. Thus they noted that efficiency and equity are very important concepts not fully understood by planners and analysts but which cannot be divorced in public facilities provision. This was further emphasized that theoretical works that emphasized issues of efficiency in isolation from equity have not done justice to such works (Norill and System, 1977).

Onokerhoraye (1982) mentioned that; this interpretation of equity becomes acceptable when it is borne in mind that the pattern of distribution of settlement is important both in the evaluation of equity as the assessment of ways in which distribution meets required threshold for facility provision.

In respect to the above point, Onokerhoraye and Okafor (1986) derived some principles to ensure equitable allocation and location of facilities for the general welfare of the society. Firstly, they mentioned that, in location of any facilities, efforts should be made to minimize travel cost of the consumers if the cost required for a consumer to travel and avail him of a service is too much he will rather prefer to stay put and continue with the usual life.

Another point is maximization of demand where by the service and facilities located in an urban area are fully utilized. They also emphasized on equity in distribution, to ensure that no group of person is favored in the location of these service and facilities. They stressed that it is the duty of planner to ensure that consumers, longest journey to any facility is reduced to the barest minimum. Lastly, is the case of the less privileged who are less mobile, but whose demand for such facilities needed to be satisfied.

Ayeni and Rustron (Opt.cit) also observed that, location theory ties and optimality interchangeable and described an efficient system as one where profits are on the increase in a perfectly competitive system. This means that any shift from optimum location reduces system profit and efficiency. In the perspective of public facility where profit are not sought on efficient location here would be one in which some is met at minimum total cost of operation travel.

This paper therefore, focuses on the adequacy of public health facilities in Bida town, their location, distribution and the associated problems.

AIM AND OBJECTIVES

This paper is aimed at assesses the adequacy of public health facilities in Bida town, with a view of proffering planning solution for effective public health service delivery in the State.

JUSTIFICATION OF THE STUDY

The need for assessment of adequacy of public health facilities to develop the urban area cannot be over emphasized. However, in Nigeria, the equitable distribution of facilities is always a problem, as evident by lopsided location of facilities in our town. The consequence of this is long distance by users to avail themselves of the health while on the other hand others facilities located in isolation are left underutilized.

This paper therefore, assess the adequacy of this health facilities provision in Bida town and its environs then involve effective recommendation toward improving the health facilities provision in the area

Urban facilities include all the supportive service required to maintain the urban system they may be conceived of as medium or objects by which various urban service are delivered the effective provision and efficient functioning vis-à-vis the population is an indication of general level of equality of life and entire environment; that is the provision of facility has to be in consonance with the population or demand of such facility.

The role of urban center as on area for high innovative diffusion, political and economic transformation that are all factors that bring about and enhance national development cannot be over – emphasized. Therefore the provision and equitable distribution of public health facilities in urban centers has to assume prominence as well as constitute a challenge in any nation particular only a developing counter like Nigeria.

METHODOLOGY

Sample Frame and Techniques

The assessment of the adequacy of health facilities provision and level of patronages were measured based on a field survey conducted using structured questionnaires. Total of 140 questionnaires were administered using systematic random sampling techniques. In this case, houses in the selected ward were chosen randomly to represent the entire houses in the area. 10 questionnaires each were assigned to 14 specified wards covering the entire Bida town. Therefore, the study analysis is based on the 140 surveys questionnaires processed representing 100.0% response rate.

The Gini Coefficient

The Gini Coefficient is one of the most commonly used indices for measuring distribution. It is traditionally applied to the measurement of income inequality, but has also been applied to the measurement of land inequality. As yet, it has not been applied to measure public health facilities $\sum(Y-YA)$

The Gini Coefficient can be displayed graphically as a plot of the distribution of the size fractions of ordered individuals.

This is in a perfectly equal society the Lorenz curve would plot as a straight line. This is termed the line of equality. In most cases, however, the Lorenz curve plots below this line of equality, showing the inequality in the distribution of income,

For computing the location quotient (L.Q) for a public health facility in a particular wards/neighborhood, the following formula was used.

$$L. Q = (n/p)$$

$n_1(N_1/P)$
Where,

If the value of the quotient for a particular facility in a settlement exceeds 1, indicated that the facility in the neighbourhood exceeds the fair share of health facilities provision based on population standard.

provision inequality. The Gini Coefficient is calculated from un-ordered size data as the “relative mean difference”, i.e., the Mean difference between every possible pair of individuals, divided by the Mean size and is defined as follows (Litchfield 1999):

Gini coefficient (**G**) = $\frac{1}{2}$
land or, now, public health facilities provision within Bida.

Location Quotient

This quotient does not require extensive data collection and processing. It is a device for comparing settlement percentage share of a particular facility with its population. The location quotient of different neighborhoods in Bida with respect to a particular facility will provide knowledge about the level of concentration of that facility in those settlements

n = number of facility in a given neighbourhood.

p = population of the concerned neighbourhood,

N_1 = number of facility i in a Bida town

P = total population of Bida

An indication of deficiency is given by a value less than 1 while a value of 1 or close to 1 indicates self-sufficiency.

THE STUDY AREA

Bida lies on between latitude $9^{\circ} 04'N$ and $9^{\circ} 06'N$ and longitude $5^{\circ} 59'E$ and $6^{\circ}01'E$ on the Nupe sand stone formation which consists of plains with iron stone capped hills or Mesas. The scenery is fairly uniform since lithology and rock structure are not greatly variable. Bida town is also bounded by Pichi in the west, Baddegi in the east, Gbazhi in the North and Doko in the south (Fig.1). The town is in the north east direction of the Federal Capital Territory Abuja which is about 89 kilometers from Bida. Bida has the total population of 188,181 people (Nigeria National Population Commission 2006 census).



Fig.1: Map of Niger State Showing Location of Bida

DATA ANALYSIS AND RESULT INTERPRETATION

Analysis of Distribution of Health Facility (Gini coefficient)

In assessing the inequality in the level of public health facilities in Bida town, Gini co-efficient was adopted to measure the data collected. However, the analyses have revealed that there is a low degree of inequality in the existing health facilities provision in Bida town (table 1).

Table 1: Distribution of Health Facilities

Ward	Pop (X)	No of Public Health Facility (Y)	(Y) %	Expected	Y-YA	Pop %
Kiari	27,181	-	0.0	0.9	-0.9	14.4
Wadata	21,954	-	0.0	0.7	-0.7	11.2
Baniyen	20,909	-	0.0	0.7	-0.7	11.2
Dokodza	18,818	1	16.7	0.6	16.1	9.7
Bariki	15,681	-	0.0	0.5	-0.5	8.3
Umaru Majigi "A"	14,636	1	16.7	0.5	16.2	7.8
Umaru Majigi "B"	13,068	-	0.0	0.4	-0.6	6.9
Masaba "A"	12,022	1	16.7	0.4	16.3	6.3
Masaba "B"	10,454	-	0.0	0.3	-0.3	5.6
Ndajiya	9,931	1	16.7	0.3	16.4	5.3
Messaga "A"	8,363	-	0.0	0.3	-0.3	4.4
Massaga "B"	7,318	-	0.0	0.2	-0.2	3.9
Landzu	5,227	1	16.7	0.2	16.5	2.8
Nasarafu	2,619	1	16.7	0.1	16.6	1.4
	188,181	6	100		85.6	

Gini coefficient (G) = $\frac{1}{2} (85.6) = 42.8$

The value of the Gini coefficient (G) ranges from 0-100, therefore, the higher the value of G the greater the degree of inequality. The G -value calculated based on the field survey analysis is 42.8%; indicating certain degree of inequality in the provision of public health facilities in Bida. It is observed that about 50% of the public health facilities in Bida town are enjoyed by about 9% of the inhabitant. This implies that some areas in Bida are deficient in public health facilities and quite

Assessment of Inequality in Distributional Health Facility (Lorenz Curve)

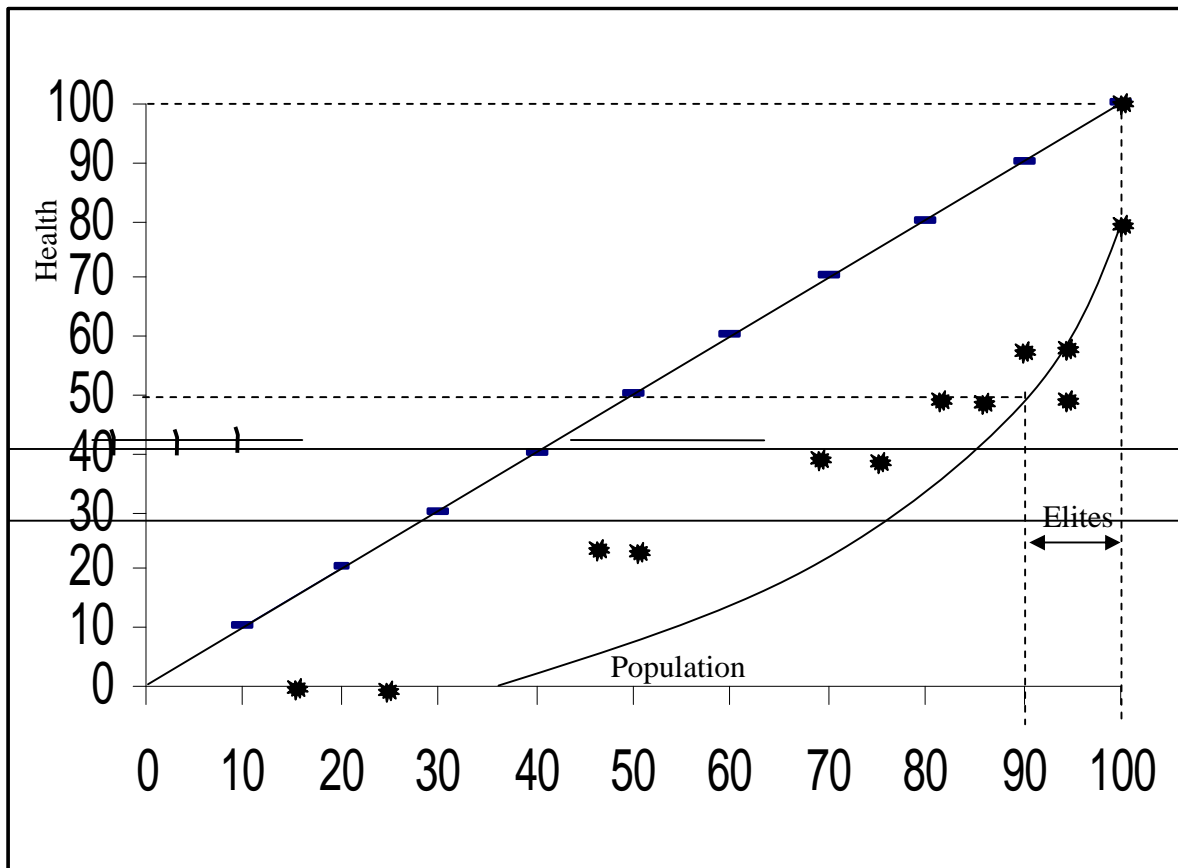
Assessing the extent population control in facility service delivery, the Lorenz curve was adopted to determine the health

number of the inhabitant has no adequate access to these facilities. Also the population concentration in various wards was not considered as a factor in the distribution of public health facilities in Bida town. The population and number of public health facilities distribution are in fair inequality level, as indicated by the relative Gini Coefficient value calculated(0.428).

facilities provision in Bida town (Table 2). The result has shown that about 50% of the public health facilities in Bida town are enjoined by about 9% of the inhabitant. (Fig.2).

Table 2: Extent population control facilities

Ward	Pop (X)	Pop (%)	Cum %	H/Facility (Y)	Y %	Cum %
Kiari	27,181	14.4	14.4	-	0.0	0.0
Wadata	21,954	11.2	25.6	-	0.0	0.0
Baniyen	20,909	11.2	36.8	-	0.0	0.0
Dokodza	18,818	9.7	46.5	1	16.7	16.7
Bariki	15,681	8.3	54.8	-	0	16.7
Umar Majigi "A"	14,636	7.8	62.6	1	16.7	33.4
Umar Majigi "B"	13,068	6.9	69.5	-	0	33.4
Masaba "A"	12,022	6.3	95.8	1	16.7	50.1
Masaba "B"	10,454	5.6	81.4	-	0.0	50.1
Ndajiya	9,931	5.3	86.7	1	16.7	66.8
Massaga "A"	8,363	4.4	91.1	-	0.0	66.8
Massaga "B"	7,318	3.9	95	-	0.0	66.8
Landzu	5,227	2.8	97.8	1	16.7	83.5
Nasarafu	2,619	1.4	100	1	16.9	100
	188,181			6		



As shown in table 3, Nasarafu which is the ward with the lowest population, has the highest concentration of public health facility location. The result revealed that Nassarafu (12.0), Landzu (6.0), Ndajiya (3.1), Massaba “A” (2.6), Umaru Majigi (2.1) and Dokoza (1.7), by implication had more than their fair share of health facilities distributed in Bida town.

Table 3: Concentration Assessment of the Distributed Health Facility

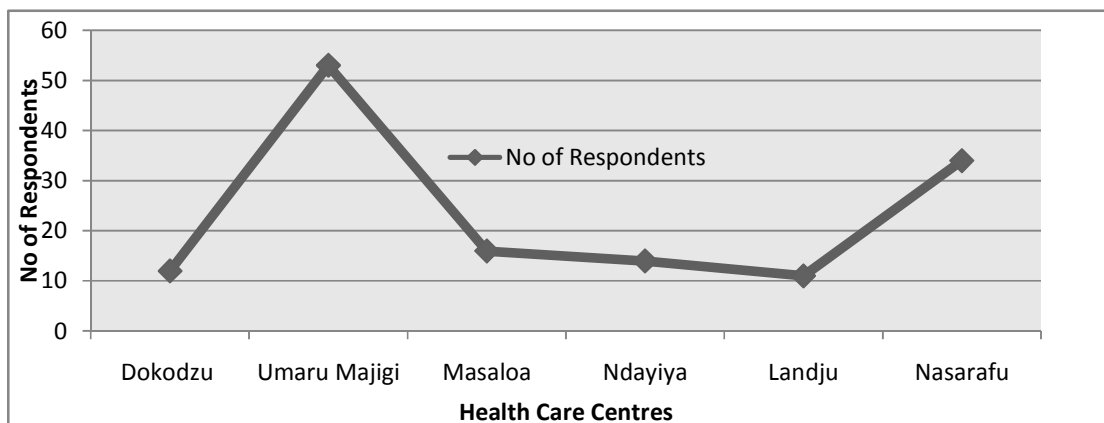
Ward	Population	No of health facilities	Locational quotient (LQ)
Kiari	27.181	-	0.0
Wadata	21.954	-	0.0
Baiyen	20.909	-	0.0
Dokodza	18.818	1	1.7
Bariki	15.681	-	0.0
Umar Majigi "A"	14.636	1	2.1
Umar Majigi "B"	13.068	-	0.0
Masaba "A"	12.022	1	2.6
Masaba "B"	10.454	-	0.0
Ndajiya	9.931	1	3.1
Massaga "A"	8.363	-	0.0
Massaga "B"	7.318	-	0.0
Landzu	5227	1	6.0
Nasarafu	2.619	1	12.0
	188.181	6	

Note: An LQ value of less than 1 means a condition of having less than a fair share of an activity, a value of 1 indicates a condition of having just a fair share and value greater than 1 refers to a condition of having more than a fair share.

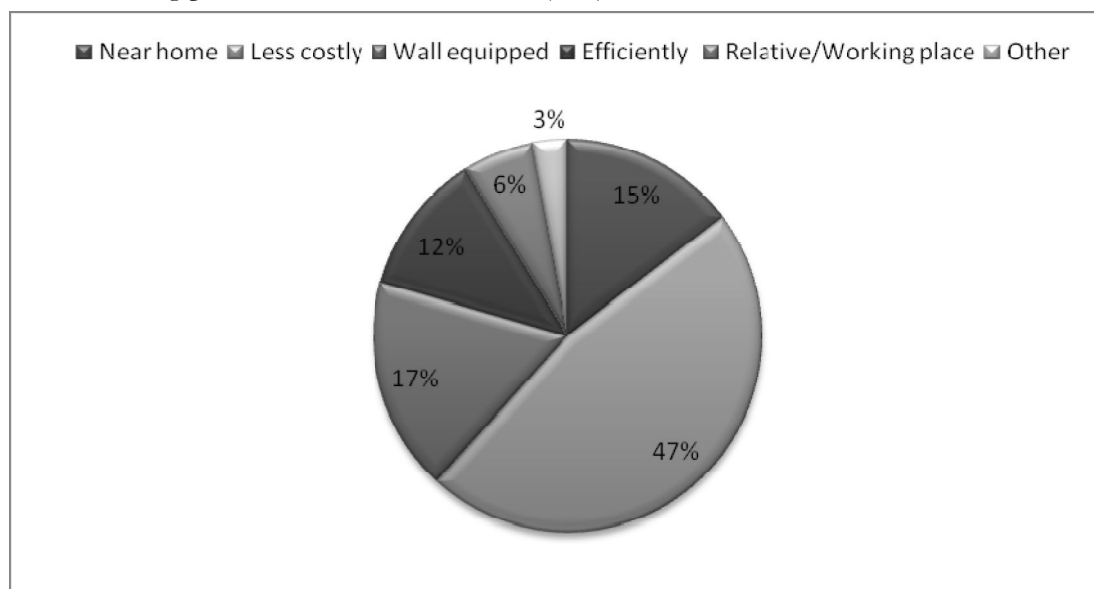
Existing Health Facility

In assessing the extent to which the existing public health facilities are patronized, the field data analysis result have shown that the public health centre at Umaru Majigi "A" ward with 37.9% respondents has the highest level of patronage, followed by Nasarafu ward health centre with 24.3% level of patronage, while 11.4% of the respondents attended Masaba health centre. Only 10.0% and 7.8% of the respondents attended Ndajiya and Landzu ward public health centres respectively (Fig.3).

Figure 3: Level of Patronage of Public Health Centres



However, from the field survey, various reasons (fig.4) were given by the respondents on the level of patronage of the existing health facilities in Bida. The analysis result have shown that majority of the people patronized the existing health centres in Bida because of their nearness to their home (17%), (47%) patronized because it less costly, (12.%) attended because is well equipped, (15%) attended because efficiency of the health personals, (6%) attended because it serves as working place of their relatives, while (3 %) are others.



QUALITY OF PUBLIC HEALTH FACILITIES IN BIDA TOWN

In assessing the quality of public health facilities service in Bida town, 54 (38.6%) respondent claimed that the public health services delivery is inadequate while 86 (61.4%) said is adequate.

Table 3: How adequacy of health facilities

Quality	No of respondent	Percentage (%)
Inadequate	54	38.6
Adequate	86	61.4
Total	140	100

CONCLUSION

Social services like health facilities are indeed to satisfy the needs of all the categories of people in the society. Therefore, in the distribution and allocation of health facilities, one is expected to see a very high correlation between the services provided and the population in that area. In the case of Bida town however, these facilities are not equitably distributed. This inequality

though to an extent has effect on health service delivery therefore; effort should be made to correct this inequality.

Similarly, since the underlying factor responsible for high patronage of a health facility in the study area is the personal resources, effort should be made to encourage patronage of health center in the study area. It therefore recommends that the government and other stakeholders or sponsoring agencies must

ensure that all health institutions provide high quality services. This will stop patients from moving from one part of the city to another for treatment. This suggestion does not mean the government should building hospitals of the same status. Instead, those available must ensure that high quality services are maintained so that patients will be attracted. By so doing, every patient will be expected to patronize health facility nearest to him.

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THE IMPACT OF COMMERCIAL MOTORCYCLE OPERATION ON URBAN ROAD SECURITY IN NIGERIA: A CASE STUDY OF MINNA, NIGER STATE.

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Abstract

This paper examines the increasing use of motorcycles as means of public transportation in Minna especially against the need to overcome delays and other problems associated with the urban bus transportation system and the high incidence of traffic snarls that have become a permanent feature of urban centres. The paper also examines the implications of this mode of transportation on the security of lives of commuters and other road users in the study area. In carrying out this study 250 questionnaires were administered on randomly selected motorcycle operators in the study area on different aspects of their operations. In addition, data were sourced from both the Nigeria Police and the Federal Roads Safety Commission in Minna on the rate of accidents involving commercial motorcyclists in the city. Data were also obtained from the General Hospital, Minna on the number of patients that have either died or treated for various injuries sustained from accidents involving commercial motorcyclists. Amongst others, the study revealed that increasing number of people are being killed, disabled or injured in accidents involving commercial motorcycle operation. Amongst others, the study recommends that the time and areas of operation of the commercial motorcyclists should be controlled and their operation regularly monitored by the relevant traffic management agencies.

Keywords: commercial motorcycle, lives, operators, security, urban roads.

1.0 Introduction

The high incidence of urbanization in the developing countries of Asia and Africa since the 1980s has brought with it several problems, particularly as it affects urban transportation and traffic management. According to Egunjobi (1999), the pace of urbanization has been dramatic showing extraordinarily high rates of between 5% and 10% per annum in Nigeria. Closely related to the trend of urbanization in these continents is the rapid and unprecedented increase in the level of motorization which has invariably led to increased traffic congestion. It is observed that this

increase in motorization is not accompanied by sufficient investment in road construction and other related infrastructure. In the opinion of Vasconcellos (2005), if current safety conditions in developing countries are already extremely serious, it will undoubtedly worsen in the near future in the face of rapid increase in the use of motorized means within the traveling and social environments that are not prepared to experience such changes. Poor road maintenance culture and ineffective road traffic management have further exacerbated the level of traffic congestion in many urban centres in these countries. To further compound the problem is the

poor, inefficient and grossly uncontrolled urban transportation system which has left many urban travelers frustrated and thereby forced to seek alternative travel means.

In order to overcome the delays, loss of productive time and frustration associated with poor urban transportation system and ineffective traffic management in developing countries, many urban travelers resorted to the use of motorcycles as public transport means. Although this means of transportation has saved time in some congested urban centres as well as provided increased accessibility to the more remote parts of the cities, their increasing use and patronage has created new set of problems. The influx of commercial motorcycle operators in many urban centres in Nigeria has further congested the few roads and constituted menace to many road users. Apart from this, many commercial motorcycle operators and their passengers are daily being killed and maimed due to the numerous accidents that involved this means of transportation. Olagunju (2008) wrote that, in Lagos State for instance, a total of 9,979 motorcycle accidents were reported within the last ten years. This figure is said to represent about 13.5% of total vehicles involved in various accidents in the State during the period in which about 40,706 persons were reported injured and 14,372 dead. These figures were even underestimations as Oyesiku (2003) observed that there is a gross underestimation and incomprehensiveness of data on accident cases, especially road accidents involving vehicles and motorcycles.

In Minna, Niger State, commercial motorcycle operation has become a more popular means of transportation

particularly given the increased demand for public transportation and the desire by the people for a more flexible and faster means. However, the level of road traffic accidents involving the operators and their passengers are on the increase on a daily basis. In recent times, more lives and limbs have been lost to several accidents involving the motorcycle operators. In addition to this, their mode of operation is becoming a public menace and a threat to other road users. This study, therefore, examines the socio-economic background of commercial motorcycle operators, nature and modalities of their operations as well as the threats posed by this means of transportation on the security of lives of the people of the study area, particularly the commuters and other road users.

2.0 The Study Area

Minna, the capital of Niger State is a relatively medium-sized city. It is located on latitude 9° 37' North of the Equator and on longitude 6° 33' East of the Greenwich Meridian. It is situated on a geological base of undifferentiated Basement Complex of mainly gneiss and magmatite (Max Lock Group Ltd., 1980). It is a predominantly Gwari settlement although it is equally home to diverse ethnic groupings from different parts of the country, especially, Hausas, Yorubas and Igbos. The city is a relatively warm settlement whose daily temperature ranges from 23°C during the harmattan season and a high temperature of about 38°C during the peak of the dry season usually between February and mid-May.

The city is one of those northern settlements that owe their rise to the construction of the railway in 1911. However, its status and developmental pattern changed in February, 1976 when

it became the capital of the then newly created Niger State. The present city is widely dispersed along the main arterial road from Chanchaga along Suleja Road in the south to Tudun Fulani in the north, a distance of about 16 Kilometers. The construction of both the Eastern and Western bye passes in the 1900s further dispersed the trend of its physical development. Apart from these, there are other several secondary roads that link the major residential quarters and commercial axis of the city.

Amongst other factors, the establishment of the Federal University of Technology and the location of the headquarters of the National Examination Council (NECO) in the city have further boosted its growth and development. The city

also has a relatively functional infrastructure in the medium and low densities neighbourhoods particularly electricity and good water supply system. Save for the neighbourhood and some secondary roads, majority of the roads are in relatively good condition as road maintenance and construction have lately been given increased attention.

Public transportation system in Minna is however, yet to be fully developed and this is one of the reasons that gave rise to the use of motorcycles as a means of public transportation. The inability of the buses and taxis to ply the inner and remote parts of the city has further aided the patronage of commercial motorcycles.

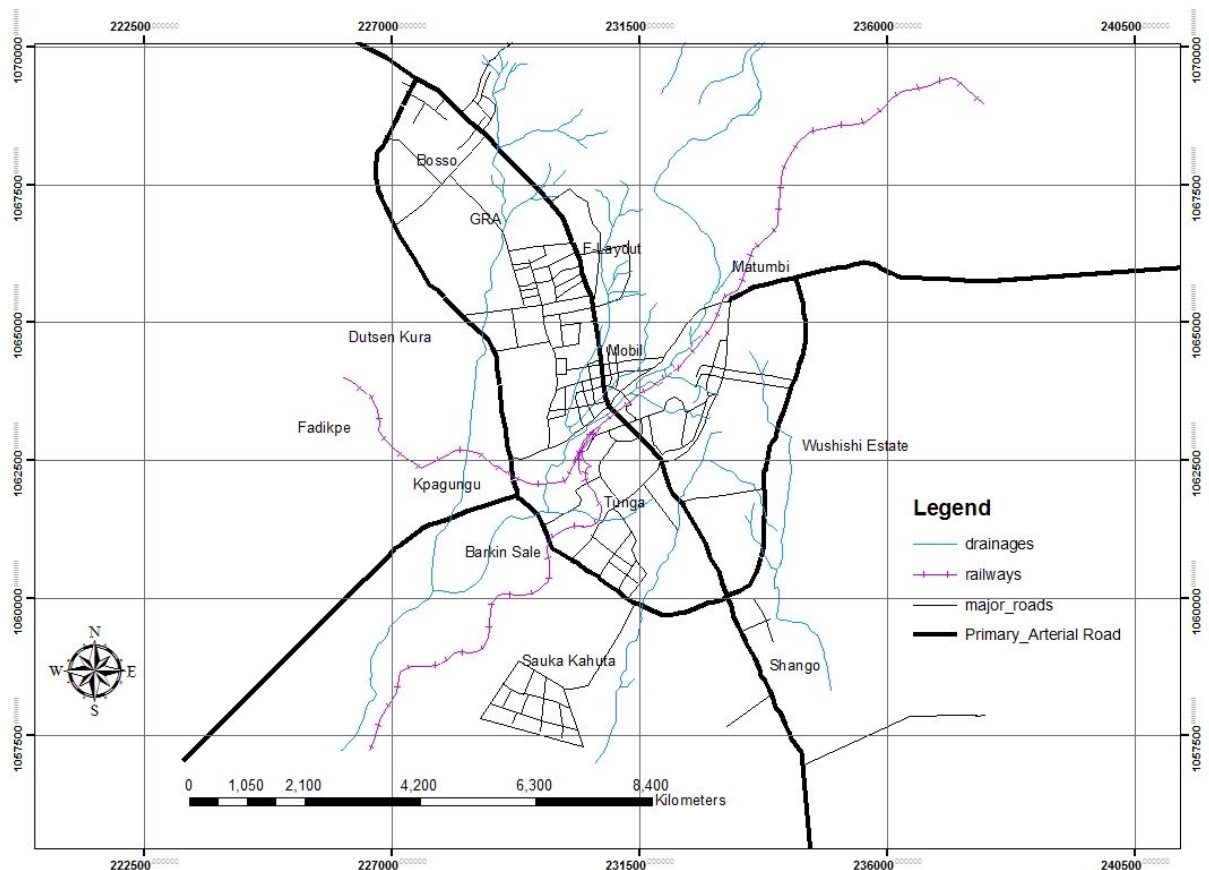


Fig 1: Map of Minna Showing the Major Road Network

3.0 Review of Related Literature

In Nigeria, the pace of urbanization has been very dramatic showing extraordinarily high rates of between 5% and 10% per annum (Egunjobi, 1999; Oyesiku, 2002a). As a result, it is observed that there has been a rapid expansion of Nigerian cities, which is sometimes said to be as much as ten times their initial point of growth. Oyesiku (2002) has attributed this trend to a situation where urbanization level far outpaces industrialization as well as the high rate of population growth. Similarly, the trend of urbanization in developing countries has been linked to road safety problem. According to Robert and Veeraragavan (undated), growth in urbanization and in the number of vehicles in many developing countries has led to increased traffic congestion in urban centres and increase in traffic accidents on road networks which were never designed for the volumes and types of traffic they are now required to carry. The authors further argued that unplanned urban growth has led to incompatible land-uses with high levels of pedestrian-vehicle conflicts.

However, it has been observed that all communities require accessibility to services, facilities and work opportunities. Accessibility however, depends on infrastructure, available and affordable modes of transportation for the movement of the people and their goods (Maunder et al, undated). The authors equally stressed that a variety of transport modes are used to carry passengers and/or freight and that these include trucks, pick-ups, buses, mini-buses, cars, motorcycles etc. They further stressed that these modes are utilized for both

private and commercial uses. Commercial transport services however, require users paying fares or hire charges and it is the combination of these components that comprise a system of transportation.

Owen (1986) has also observed that cities have become increasingly difficult places to live and work in due largely to difficulties associated with urban mobility pattern. He attributed this mobility crisis to the inability to overcome traffic congestion and to remove numerous other obstacles affecting urban transportation system. This trend is particularly so in developing countries where traffic control and management are paid little attention.

Adagbasa (2004), reviewing the nexus between urban land-use and traffic management in Nigerian cities, argued that the problem of efficient land-use and traffic management in urban centres has begun to assume profound and divergent dimensions due largely to rapid urbanization, increased car ownership and globalization. The author stressed that this has been further compounded by the fact that majority of the urban centres evolved by accretion therefore, paying no cognizance to the importance of traffic as a major land-use that makes others function effectively. Similarly, Oyesiku (2003) argued that the transportation system in intermediate cities in Nigeria can be described as a mixture of all kinds, positing that as a result issues involved in mobility difficulties have been the subjects of many studies by both local and foreign consultants as well as the World Bank agencies. The author therefore, emphasized that there is a consensus

among these consultants based on their studies particularly between 1985 and 1999 that the transportation problems in Nigeria can be categorized as : the emergence and use of tricycle vehicles and motorcycles for public transportation since the late 1980s; overcrowded public transportation system and use of road unworthy vehicles imported mostly from Europe and America; incessant traffic congestion and awkward parking system; sudden increase in level of motorization between 1999 and 2002 as well as increased scourge of road traffic accidents despite the appreciable role of government – established Federal Roads Safety Commission, amongst others. The author therefore, concluded that statistics has shown that about 50% of persons killed in fatal accidents between 1989 and 2002 in Lagos State and other major cities in the country are the commercial motorcycle operators and their passengers.

Eke (2001) is of the view that road traffic accidents constitute a major cause of untimely deaths in developing countries. According to the author, factors responsible for most road accidents are basically three. These are the person (driver), the machine (vehicle) and the road. He therefore, argued that most traffic accidents often involve the three.

Similarly, Vasconcellos (2005) posited that traffic accidents are a major problem in both developed and developing countries, although these are related to different historical reasons and circumstances. He however, argued that the single, clear and common feature is the impact caused by the use of automobiles, positing that traffic accidents are a major public health

problem all over the world. The author further emphasized that traffic accidents occur in built-up environments that are man-made and that both the way the city is constructed and the way the circulation structure is formed have a direct effect on the nature of traffic conflicts and , hence, the probability of traffic accidents occurring.

Olagunju (2008) has however, attributed the emergence of motorcycles as means of public transportation in Nigeria to the failure of conventional public transportation means such as buses, mini-buses and taxis especially given the yawning gap between transport demand and supply in the country. He therefore, argued that the commercial motorcycle riders are exposed road users who have become very vulnerable to accidents positing that chances of a rider dying in an accident is six times higher than those of drivers and passengers of motor vehicles.

Similarly, Wikipedia (2010) pointed out that commercial motorcycles (okada) were valued mainly because they were fast and readily available, although they have a higher rate of crippling and fatal accidents per unit than automobiles. It also observed that many commuters patronized them because they are left with few options despite the awareness of the risks involved in this means of transportation. It also reported that a study carried out in Yola, Adamawa State in 1993 showed that 88% of the riders of commercial motorcycles were aged between 18 and 30 years and only 47% of them received formal education of any form which made it difficult for them to understand the traffic codes and other road traffic regulations.

In a related work, Iribhogbe and Odai (2009) reported that in Benin City, Nigeria, majority of commercial motorcycle operators were young people between the ages of 20 and 39 years and that many of them engaged in this means of transportation as a last resort following unemployment. The authors pointed out that although about 70% of these operators possessed driver's licenses, majority of them did not undergo any form of training, evaluation, or road test before being issued licenses. They further observed that apart from uncertain driving skills, many operators were unaware of road rules, ethics and proper conduct on the road thereby tending to drive at breakneck speeds in order to maximize daily financial returns.

Odeleye and Bartiett (2006) emphasized that developing countries such as Nigeria are noted for their use of intermediate means of transportation (IMT), for public transportation and that despite the comparatively low safety and efficiency of this means, it enjoys huge patronage from commuters. The authors observed that the increasing demand for travel in cities of developing countries without a matching supply in public facilities such as comfortable, reliable and decent public bus system is probably one of the factors responsible for the prevalence of this means of transportation. It is however, observed that two of the interesting features of this means of transportation in Nigeria is that it is not only unregulated, it is also not effectively integrated into the existing urban transport system as there is no specialized road infrastructure provision which could enhance the safety of passengers and as well as those of operators.

4.0 Research Scope and Methods

The study covers the entire Minna metropolis comprising Bosso and Chanchaga Local Government Areas. It equally covers the age and other socio-economic characteristics of commercial motorcycle operators, their mode of operation as well as occurrence and frequency of accidents associated with the means of transportation and casualty level. Both primary and secondary data were sourced for this study. Two hundred and fifty questionnaires (250) were used in eliciting information from some commercial motorcycle operators about the various aspects of their operations, including accident trends. Twenty five (25) questionnaires each were administered on operators who were randomly chosen in ten major transport corridors and axis of the metropolis. These include Kpakungu, Bosso, Chanchaga, Paiko Road/ Tunga, Maitumbi and Kuta Road. Others are Ketere Gwari/Mobil Filling Station, Army Barracks, GRA/Airport Road and Tunga Low-Cost/Shiroro Road.

Secondary data were collected from the five police divisions within the metropolis and the Minna Headquarters of the Federal Roads Safety Commission about reported cases of accidents involving commercial motorcycle operators and casualty figures between 2005 and 2008. Data were also obtained from the Minna General Hospital about the number of patients brought to the hospital who are either dead or injured from road accidents involving commercial motorcycle operators. Both the primary and secondary data were analyzed using descriptive statistics such as frequencies and percentages.

5.0 Research Findings

5.1 Socio-economic Characteristics of Commercial Motorcycle Operators

To properly understand the relationship between the socio-economic characteristics of commercial motorcycle

5.1.1 Age of Operators

As shown in table 1, the study revealed that almost half (48.4%) of commercial motorcycle operators in Minna were within the age bracket of 18 and 25 years. This is closely followed by operators within age bracket of 26 and 35 years who constituted about 33.6%, while those

operators in Minna and the demands of the job, the study sought to know their average age, education, experience and other socio-economic backgrounds. These are discussed in this section.

within the ages of 36 and 45 years constituted 12.8%.

It can therefore, be inferred from the above pattern of distribution of the ages of operators that a considerable number of them are relatively young and are therefore, prone to the restlessness and exuberance of their ages which could make them impatient when driving on the Roads.

Table 1: Age of Operators

Age	Frequency	Percentage
Less than 18 years	6	2.4
18 – 25 years	121	48.4
26 – 35 years	84	33.6
36 – 45 years	32	12.8
Above 45 years	7	2.8
Total	250	100.0

Source: Fieldwork, 2008

5.1.2 Educational Characteristics of Operators

Table 2 shows the educational characteristics of commercial motorcycle operators in Minna. Operators without any formal education constituted 20.4%, those with either Primary or Arabic education constituted 29.6%, those with Secondary education constituted 41.6% and those with either a National Diploma (ND) or a National Certificate of

Education (NCE) constituted 8.4%. This shows that majority of operators are relatively educated and are therefore, expected to have a fair grasp of the traffic codes which are meant to help while driving.

Table 2: Educational Qualification of Operators

Level of Education	Frequency	Percentage
None	51	20.4
Primary/Arabic	74	29.6
Secondary	104	41.6
ND/NCE	21	8.4
Total	250	100.0

Source: Fieldwork, 2008

5.1.3 Experience as Operators

Table 3 shows the level of experience of commercial motorcyclists in Minna. The table shows that operators with between 1 and 2 years on the job constituted 22.8%, those with between 3 and 4 years experience constituted 28.4%, while those with between 5 and 6 years constituted 19.4%. While operators with

between 7 and 8 years constituted 15.6%, those with above 8 years constituted 13.6%. This trend therefore, shows that about half of operators had relatively few years experience and therefore, may be unable to fully understand the level of risks involved in their operation. At least over five years experience is required for effective operation.

Table 3: Experience of Operators

Experience	Frequency	Percentage
Between 1 and 2 years	57	22.8
Between 3 and 4 years	71	28.4
Between 5 and 6 years	49	19.6
Between 7 and 8 years	39	15.6
Above 8 years	3	13.6
Total	250	100.0

Source: Fieldwork, 2008

5.2 Reasons for Engaging in Motorcycle Operations

The operators sampled were asked to state the reasons for engaging in commercial motorcycle operation. Table 4 shows the various responses offered. Operators who were engaged because of lack of suitable employments were slightly more than half (54.0%), those

without education and basic skills that could make them sought other employment constituted 22.8%, while those who are involved to augment the income from their basic employment constituted 23.2%. This trend shows that majority of operators engaged do so for reasons of unemployment or underemployment and not out of interest

Table 4: Reasons for Involvement in Commercial Motorcycle Operation

Reasons	Frequency	Percentage
Lack of Employment	135	54.0
Lack of education/skill	57	22.8
Augment Income	58	23.2
Total	250	100.0

Source: Fieldwork, 2008

5.3 Period of Operation

The study equally sought to know the basic period of operation from the sampled commercial motorcyclists. Table 5 shows the different operational periods of operators. The table shows that 16.4% engaged in morning operation only, 8.4% in afternoon operation only, while 14.4% engaged in evening operation only. Operators engaged throughout the day

and occasionally constituted 56.4% and 4.4% respectively. This trend shows that slightly more than half of operators work throughout the day and could therefore, suffer from fatigue and thereby susceptible to accidents. However, the reasons why accidents are common among operators are discussed in another section of this paper.

Table 5: Period of Operation

Period	Frequency	Percentage
Morning operation only	41	16.4
Afternoon operation only	21	8.4
Evening operation only	36	14.4
Throughout the day	141	56.4
Occasionally	11	4.4
Total	250	100.0

Source: Fieldwork, 2008

5.4 Level of Operators' Involvement in Accidents

The research results revealed that 59.2% of commercial motorcycle operators in Minna have been involved in road accidents within the last three years. While 39.86% claimed to have been involved in only one accident within the period, 60.14% claimed to have had more than one accident. When asked if they or their passengers were injured in these accidents, 57.4% answered in the affirmative. When further asked if any passenger had ever died in these

accidents, only 7.4% answered yes. This poor response is however, not surprising given that matters relating to death are hardly disclosed openly in this part of the world. This further collaborate the opinion expressed by Oyesiku(2003) who observed that there is a gross underestimation and incomprehensiveness of data on accident cases, especially road accidents involving vehicles and motorcycles.

5.5 Causes of Accidents Involving Commercial Motorcyclist

Table 6 shows the various causes of road accidents involving commercial motorcycle operators. The study revealed that 30.8% of sampled operators believed that accidents involving commercial motorcyclists are caused by acts of recklessness such as drunkenness, impatience, over-speeding and thoughtlessness on the parts of operators. Another 15.2% attributed same to bad roads, while 37.6% were of the opinion

that recklessness of other road users, especially motorists is responsible. However, 16.4% of respondents were of the opinion that brakes failure or faulty machines of operators are sometimes responsible.

The study therefore, revealed that a total 68.4% of accidents are attributed to acts of recklessness of motorists including operators of commercial motorcycles.

Table 6: Causes of Accidents Involving Commercial Motorcyclists

Causes	Frequency	Percentage
Recklessness of Operators	77	30.8
Bad Roads	38	15.2
Recklessness of other Motorists	94	37.6
Brake failure/ faulty machine	41	16.4
Total	250	100.0

Source: Fieldwork, 2008

5.5 Commercial Motorcycle Operations and Security of Lives on Urban Roads

The records of the Nigeria Police in Niger State showed that level of casualty from accidents involving commercial motorcyclists is on the increase. While 24 deaths and 65 injuries were reported in 2005, these rose to 26 and 74 in 2006 and subsequently to 29 and 104 in 2007. The figures further rose to 47 and 213 in 2008. It should however, be stressed that these figures are just fractions of the

actual rates of casualties from accidents involving commercial motorcyclists as many were not reported. This poor level of reportage of such accidents was confirmed by the Police. Similarly, records obtained from the Federal Roads Safety Commission (FRSC) in Minna on the trend of casualty from accidents involving commercial motorcycle operators between the same period shows that level of casualty is equally on the increase.

Table 7: Police Reports for Commercial Motorcycle Accidents (2005 - 2008)

S/NO	YEAR	NO. OF INJURED	NO. OF DEATH	NO. OF ARREST	NO. OF COMMERCIAL M/CYCLE
1.	2005	65	24	45	51
2.	2006	74	26	50	76
3.	2007	104	29	57	111
4.	2008	213	47	78	157
	TOTAL	456	126	230	395

Source: Nigeria Police, Minna. (2009)

Records obtained from the authorities of the General Hospital, Minna about reported cases and death profile of commercial motorcycle accident victims shows a similar dimension of the problem of insecurity occasioned by the use of motorcycle for public transportation. Table 8 shows that while 505 cases and 27 deaths were reported in the hospital in 2001, the trend has since been on the upswing in subsequent years with the death toll reaching 133 and 187 in 2007 and 2008 respectively. These high figures

are even in the face of under-reporting and the fact that smaller other public and private hospitals abound in the city that could have recorded higher figures combined. It is therefore, apparent that accidents associated with commercial motorcycles are one of the sources of untimely deaths in the urban centres in recent times particularly on major routes and roads.

Table 8: Profile of Victims of Commercial Motorcycle Accidents in Minna.

S/NO	YEAR	REPORTED CASES	DEATHS REPORTED
1.	2001	505	27
2.	2002	723	28
3.	2003	800	51
4.	2004	863	66
5.	2005	NA	NA
6.	2006	NA	NA
7.	2007	935	133
8.	2008	993	187

Source: General Hospital, Minna, 2009.

6.0 Recommendations and Conclusion

In order to stem the worsening profile of insecurity associated with the use of motorcycles as means of public transportation in Minna and perhaps in

Nigerian cities' generally, government and its other agencies concerned with traffic and transportation systems control and management need to adopt new measures to address the problem. Unlike other means of public transportation, the

operations of the commercial motorcyclists are poorly regulated. It is therefore, suggested here that more regulatory framework for commercial motorcycle operations be evolved particularly in the urban centres of the country. Just as in the case of commercial vehicles, the Vehicle Inspection Officers (VIOs) should be made to carry out periodic inspection and certification of the motorcycles being used by operators.

In addition, operators need to be subjected to mental fitness test in view of the level of recklessness associated with this means of transportation. It is also necessary to restrict the operators to particular areas of the city where the volume of traffic is not only less but also safer to both operators and passengers for them to operate such as neighbourhood roads and more remote parts of the city. The time and areas of operations should be clearly spelt out and violators punished. There is also the need for an age limit of twenty five years to be set for operators of commercial motorcycles. Since it is observed that many of the accidents involving this means of transportation occurred on the major highways, it is therefore, suggested that they should be barred from further plying them.

While the promulgation of the law on wearing of crash helmets in some states of the country by both commercial motorcyclists and their passengers is commendable, its enforcement needs to be beefed up in Minna as they are hardly used regularly and particularly in the night. The enforcement of the use of crash helmets by commercial motorcycle operators and their passengers should be extended to cover the entire country and violators seriously punished.

There is no way the level of accidents generally in the country can be divorced

from the conditions of the roads. Therefore, to reduce road traffic accidents in the country to the barest minimum there is a need to give the roads, particularly in the urban centres more serious attention. It is observed that many roads in the urban centres are in deplorable conditions of disrepair and this is further causing traffic congestion.

In conclusion, the level of urban road insecurity occasioned by commercial motorcycle operations which has been on the increase in recent times can be severely reversed if the operation of this means of public transportation can be seriously regulated while paying increased attention, not only to traffic control and management, but also road construction and maintenance.

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WOMEN AS STAKEHOLDERS IN THE SUSTAINABLE MANAGEMENT OF URBAN ENVIRONMENT

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Abstract

The complex nature of urban environmental problems and the inability of the earlier management approaches to resolve them call for new partnerships in our cities. This paper examines the different ways in which women's micro economic activities impact on urban environment and the efforts of the women in managing the problems in Minna, Niger State. It was found out that woman's economic activities such as dressmaking, food\drink making and agricultural produce processing contribute to refuse generation, environmental littering and pollution. However, the women in micro economic enterprise in Minna were found to play less active role in environmental management besides the sweeping of their immediate business premises. The paper noted the potential roles of women in citywide environmental management and concludes with recommendations on environmental strategies such as education, formation of environmental groups and networking as priority issues for better involvement in urban environmental management.

Introduction

Cities of the 21st century face a myriad of unresolved environmental problems which include poorly managed solid wastes, littering, unserviceable drainages, pollution and general environmental degradation. In most of the developing countries, these problems have assumed greater complexities and efforts to resolve them have not yielded much positive results despite government's efforts and huge financial commitments. These problems have imposed heavy health burden on urban residents and they remain major challenges to the city managers worldwide.

The existing backlogs of unresolved environmental problems in most developing countries are great indications of the need for new partnership in environmental management. In response to this need, the United Nations Center for Human Settlements (UNCHS) launched the Sustainable Cities Programme (SCP) in 1990 to address urban environmental problem through capacity building and popular participation. The SCP encourages partnership among all interest groups in the city. The programme is built on the principle that urban environmental problems affect every individual, group and organization in the city in all ramifications. Hence, sustainable environmental management requires a broad-base, active

participation of all those who can contribute to solutions and all those whose cooperation are necessary for successful implementation of environmental management programmes. The SCP introduced the concept of stakeholders in the management of urban environment. Stakeholders are actors who have interests in cities and whose decisions and activities affect the urban environment. According to the UNCHS (1994), they are those whose interests are affected, those who possess relevant information and expertise and those who control relevant implementation instruments. These actors are diverse in their interest, the level of impact on the environment and their capability for involvement. They include persons and organizations from the public sector (especially at the local level), the private sector(especially the business community), and the popular sector (especially communities and NGOs).

Women, in all parts of the world, are considered as major stakeholders in the urban environment. They constitute a sizeable proportion of the urban residents. As members of the business community, women have interests in commerce and industry most especially at the informal sector level. Women constitute a large proportion of the urban informal sector operators (Mayra and Margnerre, 1990) and about 55.7% of the urban informal

sector activities are operated by women (Strassmann, 1987).

There is no doubt that the micro economic activities of women have considerable impact on the urban environment. In many of the developing countries, women's role has extended beyond the traditional house keeping to that of working in the fields. Thus, as women collect fuel, fodder, water, etc. they set up the process of environmental change. However, the questions that may be asked are: In what ways have women's economic interests affected the urban environment? What are their contributions in environmental problem management and what are the areas for possible improvement? Against the backdrop of the increased recognition of the roles of women in development, this paper addresses these questions and explores the avenues for better future involvement of women as stakeholders in the management of urban environment.

Research Methodology

The paper utilizes from both the primary and secondary sources. The secondary data were drawn largely from the literature on known cases of women participation in environmental management. The primary data were collected with the aid of structured questionnaire, which sought information on the micro economic activities of women, the waste generated, the impact on the environment and women's roles in the management of the problems. The questionnaires were administered on 830 micro enterprise operators and food processors drawn from eight residential wards in Minna, Niger State. The selected wards include Nasarawa wards I, II and III, Sabon Gari, Minna Central, Makera and Limawa wards I and II. Oral interviews were also conducted on women leaders in the neighbourhood and a woman NGO at the Federal University of technology, Minna. The data collected were analyzed using simple descriptive statistics and the results were presented in frequency and percentage score tables.

Review of the Roles of Women in Environmental Management

Women are globally acknowledged as a dynamic, industrious and resourceful gender that contributes positively to environmental management in all societies. Sayne (1991) observed that women have continued to play the primary role in taking care of the earth planet and its inhabitants. The advocates of cultural ecofeminism (a broad canvas of ideas and practices, evolving largely from Western women's participation in the women's ecology and peace movements) portrayed women as "natural" environmental carers due to their role in nurturing life.

The global debate on women and environment has gradually shifted away from viewing women as mere victims of environmental burden to the recognition of the roles they could play in natural resource management, arising from their knowledge and the privileged experience gained from working closely with their environment. Right from the 1985 Third Conference of Women held in Nairobi, Kenya (where the Nairobi Forward-looking Strategies for the advancement of Women were adopted) to the 1992 United Nations Conference on Environment and Development, opinion on women advancement and their key role in the preservation and management of the environment have aggregated over the years. Specifically, chapter 24 of Agenda 21 specifies the global action for women towards sustainable and equitable development and one of its objectives urged national governments to implement strategies for the advancement of women's participation in national ecosystem management and control of environmental degradation.

Several cases of women involvement in environmental upkeep have been documented in the literature. As the custodian of good house keeping, they see

to the basic hygiene of the family and the surrounding and this involves the sweeping and cleaning of the surroundings, seeking the efficient disposal of wastes etc (NEST, 1991). At the neighbourhood level, women in many parts of the world have made important contributions in the maintenance of shelter and infrastructure. In Africa for instance, women have traditionally carried out maintenance work within the house and the larger physical environment of their neighbourhoods (Agbola, 1990).

Few concrete examples could be cited here. First, in Kirillapone, women, through a voluntary unpaid labour called *shrmadana*, have participated in the maintenance of public facilities. (Fenando, 1985; cited in Agbola, 1990). The Mabati women group in Nyeri, Kenya were also involved in the improvement of shelter conditions and related services since the early 1960s (Together Foundation and UNCHS, 2001) while in Samoa, traditional women societies were responsible for the maintenance of domestic water resources and sanitation (UNCHS, 1985; cited in Agbola, 1990). In India, Rani Tyagi (1992) has reported how rural women in the mountain areas of Himalayas have actively maintained and managed the ecosystem. According to the author, the famous forest movement called '*Chipko Andola*' was involved in a campaign against forest destruction in the Himalayas. Women groups in the area have also taken many initiatives to regenerate the forest by planting trees and protecting them.

These traditional rudiments of women's environmental management activities have been augmented by recent efforts of organized women groups whose activities are facilitated by national governments, the United Nations development agencies and NGOs. In Morocco, for instance, women from the Maghreban Forum for Environment and Development organized a campaign on deforestation and launched a tree-planting project in 1990 (Together

Foundation and UNCHS, 2001). Over 500 women participated in the "One Woman, Two Trees" programme in which trees were planted in public areas and schools throughout the Rabat metropolitan area.

The activities of United Nations Population Fund (UNFPA) and UNIFEM have also enhanced women participation and their potentials in city management. A good reference point is the Women's Co-operative for Education, Family Health and Sanitation, which was established in the Coura district of Medina by these bodies. This organization involved secondary school graduates in organizing efforts to collect household garbage, clean up sewage ditches and carry out public enlightenment campaign. The general outcome of this effort is the increase environmental awareness and change in household behaviour (UNFPA, 1996).

In addition to the voluntary activities of women in environmental management, women empowerment programmes in India have also demonstrated the effectiveness of women-run waste management outfits in solid waste management. In 1998 for instance, solid waste management in Kukatpally, India was entrusted on women self-help groups (Together Foundation and UNCHS, 2001) The groups were organized, trained and supported financially through banking institutions and fund from government schemes. The women-run solid waste management outfits were affirmed to achieve regular and effective garbage clearance, road sweeping and de-siltation of drains that brought about a qualitative and visible improvement in the living environment of Kukatpally city. Also in 2006, the Global Environment Fund (GEF) reported the activities of the Phnentsholing Women Association (PWA), an NGO in Bhutan, in promoting conservation and sustainable use of resources. The association collaborated with the city corporation to conduct a cleaning campaign which

included clearing of drains, waste collection and disposal as well as grass cutting.

There are several other acknowledged but undocumented efforts of women in environmental management in many parts of the world. In Nigeria, for instance, the National Association of Women in Academics (NAWACS) has carried out a number of environmental management activities. The Federal University of Technology, Minna chapter of NAWACS carried out a research on campus waste litter pattern in the year 2001. With financial assistance from the University, it thereafter mounted over 50 waste disposal baskets on steel frames and provided about 12 refuse collection drums placed at strategic places around the campus. The association also carried out environmental cleanliness education programme on diseases transmitted through dirty environment in

Women's Micro Economic Activities in Minna: Environmental Problems and Management Efforts

Women constitute a large part of the urban population and that about 55.7% of the urban informal sector activities are operated by women. These economic activities of women generate certain environmental problems. A survey of the micro economic activities of women conducted in nine residential wards in Minna shows that the women are engaged in a wide range of businesses which could be categorized under four major sub-economic activities (table 1). These sub-activities include sewing\dress making, food and drink making, agriculture\food processing and product\material making.

2002 and trained the University cleaners on the proper use of toilet cleaning tools and materials. The environmental management activities of NAWACS also included campus beautification exercise in which 12 shade trees and over 100 shrubs were planted in Bosso campus of the University between July and August 2002.

The cases cited are few examples of the activities of women in environmental management and upkeep as there are several other documented and undocumented cases worldwide. The different cases point to the capability of women folk and the potential contributions they could make to sustainable management of urban environmental problems. The next section considers the impact of women's micro economic activities on the environment of Minna town and the efforts made to manage the problems.

The components of these sub-activity areas have varying impacts on the immediate work place and the general environments. As shown in table 1, the different micro economic activities of the women generate both solid and liquid wastes that are disposed directly into the environment and which generate certain environmental problems. As the principal food processors (e.g cassava, locus bean and melon processing), for instance, women generate harmful wastes, which degrade the immediate environment and pollute the urban streams. The nature of the environmental problems\impacts generated by the variety of wastes produced include environmental littering, land, water, air and noise pollution, local atmospheric heating and general land degradation.

Table 1: Economic Activities of Women and Related Environmental Problems

Economic\Production Activities	Types of Waste Generated	Environmental Problems\Impact
Sewing\Dress Making Knitting Tailoring Clothe weaving Tie and Dye	Pieces of threads Pieces of clothes and threads Pieces of threads Colored waste water	Environmental littering Refuse and littering Environmental littering Land pollution
Food and Drink Making Soya milk production Water packaging Kunu and Zobo drinks Yogurt drinks Fruit dinks Confectioneries (bread\cake)	Soya beans paste Polythene wastes Polythene wastes Plastic\paper cans, Plastic\paper can, fruit remnants Steel cans, polythene, crumbs	Refuse\ air pollution Refuse and littering Littering Refuse and littering Refuse and littering Refuse, atmospheric heating
Agriculture\food processing Poultry keeping Poultry feed making Rice\corn\millet milling Cassava processing Locust bean\melon processing Fish smoking Yam smoking\frying Food vending	Animal dung , feed wastes Dusty shafts, paper\polythene Shafts Cassava peels, cyanide acid Yellowish\brownish pasty dirt, chaffs Fish scales, smokes and black sooths Yam peels and ashes Food remnants, ashes, waste water	Refuse, noise and air pollution Refuse, air pollution Refuse, air pollution Refuse, land degradation Refuse, urban stream pollution Air pollution Refuse Refuse, aesthetic pollution
Products\Material Making Polythene bag making Stationeries production Soap making Candle making Pottery\ ceramics	Polythene wastes Pieces of paper Soap remnants Candle crump Pieces of mud, broken products	Littering, aesthetic pollution Littering, aesthetic pollution Chemical pollution Refuse, chemical pollution Land degradation, refuse

Source: Fieldwork, 2007

The survey findings shows that the wastes generated are managed by crude methods. As shown in table 2, majority (87.3%) of the 830 respondents interviewed dispose their refuse into any available open space in

the town. Only 10.5% of them use officially designated refuse dump sites while others dispose the refuse into open drainage\ nearby bush of even burn the refuse openly to cause air pollution.

Table 2: Methods of Wastes Disposal

Disposal Method	Frequencies	Percentages
Available open space	724	87.3
Official refuse site	87	10.5
Open drainage	7	0.8
Nearby bush	2	0.2
Open burning	10	1.2
Total	830	100.0

Source: Author's Analysis, 2007

Against the backdrop of the fact that economic activities of the women generate some wastes and environmental problems, the respondents were asked to mention the specific environmental management activities they are engaged in. The responses (table 3) show that the majority (78.2%) were merely involved in the sweeping of their business premises, another 13.8% were

engaged in occasional clearing of accumulated refuse while only 8.0% ever carried out general environmental sanitation. Generally, it was found out that all the respondents have poor perception of the negative environmental implications of their daily economic activities. Thus, no meaningful consideration is given to the proper management of the by-products of their businesses.

Table 3: Environmental Management Activities of Respondents

Management Activities	Frequencies	Percentages
Sweeping of business premises	649	78.2
Clearing of refuse	115	13.8
General environmental sanitation	66	8.0
Total	830	100.0

Source: Author's Analysis, 2007

The results of this research show that the women in Minna are urban stakeholders whose economic interest and activities affect the urban environment and who make little contribution to the management of the problems. The current management efforts are limited to the rudimentary cleaning of their immediate business environment. However, as stakeholders, the women have potentials for better involvement if given proper orientation and organization. What is required, therefore, is the creation of the necessary enabling environment. Achieving this however, requires the

identification of priority issues for better involvement.

Priority Issues for Better Involvement

The need for gender mainstreaming in urban environmental management cannot be over emphasized. Many global discourse and international conventions have stressed the need for tapping the potentials of women in environmental management. Specifically, Agenda 21 urges national governments to implement programmes that develop active participation of women, emphasizing their crucial roles in achieving the changes necessary to reduce or eliminate unsustainable pattern of consumption and production, in order to encourage investment in environmentally sound and

friendly productive activities. In order to achieve this feat, the following priority areas for better involvement of women are proposed.

(i) Environmental Education

Informed environmental care awareness and consciousness form the basis for understanding, co-operation and participation. In the Minna case study, women stakeholders have poor perception of the environmental problems arising from their socio-economic activities. Awareness raising through radio and television jingles, public drama, focused group sensitization and open air campaign is therefore necessary. The required environmental care awareness education and other awareness exercises could be channeled through the existing informal groupings in the community. Formal women associations such as the National Council of Nigerian Women (NCNW), Nigerian Army officers Wives Association (NAOWA), Police Officers Wives Association (POWA), Federation of Muslim Women Association of Nigeria (FOMWAN), National Association of Women Journalists (NAWOJ) and National Association of Women Academics (NAWACS) should redefine their roles and pay more attention to the mobilization of urban residents (most especially women groups) towards environmental upkeep and good management practices.

It is known fact that women enjoy soft spots and are often listened to when they care to speak. The existing women associations should exploit the current favourable gender policy environment to contribute to positive public discussions and act as environmental watchdogs. They should monitor and report cases of environmental mismanagement with a view to seeking redress. The associations should start a nationwide review of the management programmes of environmental agencies and municipal authorities with a view to making positive contributions.

(ii) Formation of Self-help Groups and Trade Associations

Self-help groups and trade associations are formidable platforms for meaningful environmental management involvement. Presently, the women micro enterprise operators in Minna are not organized into trade associations. The existing NGOs should help organize the women into trade associations to provide the necessary platforms for involvement and networking. Such associations will provide good avenues for mutual assistance, information dissemination and carrying out environmental management activities.

(iii) Networking

Women are known to form a network of social and economic support and co-operation both at the neighbourhood level and beyond. These avenues should be explored to form a citywide link among the formal and informal groups to review environmental problems and draw up local action plans on priority problems. Activities at this level could, also include sharing of experience and exchange of programmes among neighbourhoods within the town. For instance, the experience of the Minna chapter of NAWACS in solid waste management and tree planting should be shared among women NGOs within the town and beyond.

Conclusion

There is a growing consensus on the view that women are stakeholders in the management of the urban environment, whose activities should go beyond the traditional home cleaning. The current global discourse on women, environment and development as well as the documented cases of the roles and potentials of women in environmental management are all pointers to the need for their proper enlistment and full engagement in environmental management. Women appear to have great potentials in the management of urban environmental problems. However,

as revealed in the Minna case study, their level of involvement is currently low. Enlisting their full co-operation and

participation therefore requires positive actions in the priority areas identified.

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Impact of reworks on project delivery in the Nigerian construction industry.

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ABSTRACT

Rework may be induced either by errors or omission made during the design or as a result of poor workmanship at the construction stage. This research paper focuses on the effect of reworks on project time and cost in some selected building projects in Nigeria. A research schedule was designed and self administered along with structured questionnaires to professionals involved in those projects (25 building projects) to access the cost data of the selected projects and as well identify the influencing factors that are responsible for cost and time overrun as a result of rework. Analysis of the cost data was done using simple percentile table to identify projects that experience overruns and also analysis of the response from professionals was also carried out using relative importance index to identify factors leading to cost and time overruns as a result of rework. The findings revealed that some projects having cost overrun as high as 9.88% and 37.88% in the case of time overruns, and rework cost on average for the entire projects considered was 3.466%. The entire participants in the industry agreed that the most prominent effect of rework on projects is time and cost overruns, followed by quality.

Keywords: Reworks; Time overrun; Cost overrun; Nigeria; Construction industry

INTRODUCTION

The construction industry is very important in the economic development of any nation especially in an expanding economy like Nigeria (Ibironke, 2003). Some of the problems facing the Nigerian construction industry today include time and cost overrun as well as good quality work which meets client's requirement and thus gives value for money. In Nigeria, construction projects are known for over-running their initial cost limits which invariably also mean it is out of initial time schedule. Koushki, Al-Rashid and Kartam (2005) asserted that time-delays and cost overruns (increases) are among the most common phenomena in the construction industry – from simple to complex projects and the Nigerian construction industry.

Rework takes its name from defects identified in design or construction process or when certain parts of a building constructed or under construction fails to meet the client's requirement due to either quality deviation or error in the design and the work has to be done again to conform to project documents leading to waste of materials and labour. Rework represents a

relatively new terminology in the construction lexicon (Love, Edward & Smith, 2006). It becomes highly imperative either when an element of building works fails to meet customer requirement or when the completed work does not conform to the contract documentation and in either scenario; the product is altered to ensure conformity (Love, Edward & Smith, 2005). However, rework in a construction process has been termed a wasteful activity, because, it is an inefficiency that results in the use of resources in larger quantities than those considered necessary (Koskela, 1992; 1993). The Construction Industry Institute (2001), viewed rework as : "Activities in the field that have to be done more than once in the field or activities that remove work previously installed as part of the project". Rework may occur in any conceived project at both the design and construction stages and it may be in the form of variation, non-variation or design error or omission. Rework is significantly different from maintenance work as any work carried out after the expiration of

defect liability period could be referred to as maintenance work, but defects, quality deviation or omission in the drawings that may warrant redoing a work more than one time during construction stage is termed rework. Time and schedule overruns, quality deviations and poor safety are perennial problems in the construction industry (Love, 2002a; Walker, 1994) and Nigerian construction industry is not an exception.

Literature Review

Alarcon and Mardones (1998) argued that little interaction between the construction and design teams are the major causes of many problems during construction such as: incomplete designs, change orders, rework, construction delays, etc. Rework occurs when implemented design is found wanting or deficient, resulting on some of the implemented design being scrapped and reworked (hence the origin of the term). As it can be noted, rework generally derives from defect identification, although it can also result from changes in requirements, and defects should be captured from the start of the project. Important factors that can lead to rework are said to emanate from sub-systems of a whole project system that are either design or construction related (Love et al, 1999; Love & Edwards, 2004; Pheng & Huis, 1999).

Rework and cost overrun

Prior Findings on cost overrun

Completing building projects on time and within budget had been a chronic problem for Nigerian construction industry and the problem was worsening over time. Elinwa and Joshua (2001) asserted that time and cost overrun sounds simple but it is serious and complex for the Nigerian construction industry. In the review of previous literature it was established that, cost overruns were predominantly related to problems that occurred during the planning and design process prior to construction, including: (1) errors and omissions in

Although construction contracts specify the price to be paid and the amount of time allowed for a project to be completed, clients may agree to changes in contract provisions. These changes are generally made through supplemental agreements to contracts to vary the work.

Cost overruns and time extensions can be either avoidable or unavoidable. Overruns due to design plan or project management problems are avoidable because they could have reasonably been foreseen and prevented. However, some cost overruns are unavoidable because they cannot be reasonably prevented, such as those due to unanticipated events. Cost overruns may add value to projects by producing a better product. Rework may add value when extra work is done that produces a better building for the client, such as adding a column to stabilise a building project. Rework may also add value when they involve work that was omitted from original design plans but clearly needed to be done, such as adding an element of beautification to building to improve its aesthetic value. However, some rework may not add value and represent wasted money if they do not result in a better product. For example, no value is added when a contractor pull down a slab floor already constructed and replace it due to faulty design specifications.

design plans, (2) inadequate coordination with local governments and utility companies, (3) problems in identifying the scope of work to be done during project development, and (4) changes in project specifications after designs had been completed.

Rework and time overrun

Elinwa and Joshua (2001) viewed time overrun as the lapse between the agreed estimation or completion date and the actual date of completion. According to Kaming *et.al*, (1997) and Trigunarysah

(2004), time overrun is the extension of time beyond planned completion dates traceable to the contractors. It is evident that when defects occur in building, rectification is imminent and thus lead to an increase in the project duration or delay in project delivery. Project success is dependent on completion time and value given to the client in term of functionality and performance requirement.

Delay as a result of rework

Projects can be delayed for a large number of reasons, usually impacting project cost and schedule. Many variables causing delays such as inclement weather, lack of trade skill, poor planning and scheduling, delay of material delivery to site, design changes, and slow decision making could be responsible for rework. A delay to schedule was one of the most important variables affecting construction projects, contributing to non value-adding activities. This evidence is supported by previous research findings (Okpala and Aniekwu, 1988; Elinwa & Buba, 1993; Aibinu and Jagboro, 2002 and Ogunsemi, 2002). They stated that delays in project completion are a major problem leading to costly disputes and acrimonious relationships between the parties involved. In Nigeria, project delays were identified as the principal factors leading to the high cost of construction (Okpala and Aniekwu, 1988). Therefore, this research is in line with the ideas from previous studies, particularly within developing countries, that delay was identified to be one of the key factors affecting contractor performance, leading to reduced productivity levels.

Research aim and objectives

This paper identifies and examines the impact of rework on time and cost of building projects in Nigeria. The specific objectives are:

1. To identify and evaluate the impacts of reworks on building project execution in Nigeria.
2. To assess the effects of reworks on completion cost of building projects.
3. To assess the effects of reworks on completion time of building projects.

Research Methodology

The methodology of this research is twofold: data collection through research schedule and the structured questionnaires. In this phase cost data of the selected projects were sought for and their characteristics recorded appropriately. The second part consists of structured questionnaires are developed to specifically identify the causes of cost and time overruns as a result of rework in the selected building projects.

It is necessary to note that this research was limited to Federal Government building projects in Niger State, Nigeria executed between 1999 and 2008. Three questionnaires were administered on each project to the professionals involved directly in the project. The rating was based on a Likert scale of 1-5, where 1=Very low (where cost incurred is between 0- 1% of project cost) 2= Low (1-3%), 3= Medium (3-6%), 4= High (6-9%), 5= Very high (above 9% of project cost).

Analysis and results

Since the sourced data are two types: the cost data cum project characteristic and background information of the respondents was analysed using percentile while the rating of the factors on likert scale which were ordinals could not be meaningful if parametric statistics is adopted. Relative Importance Index and Frequency Index ranking was therefore used.

Table 1: Summary of Background Information on Respondents

Category	Classification	No	%
Profession of the respondents	Architecture	19	25.3
	Engineering	8	36
	Quantity Surveying	34	81.3
	Building	14	18.7
	Total	75	100
Academic Qualification	OND	2	2.7
	HND	14	18.7
	PGD	5	6.7
	BSC/BTECH	46	61.3
	MSC/MTECH	8	10.7
	Total	75	100
Professional Qualification	Graduate Member	10	13.3
	Probationer Member	45	60.0
	Corporate Member	20	26.7
	Total	75	100
Construction Experience (In years)	0 – 5	1	1.3
	6 – 10	48	64
	11 – 15	26	34.7
	Total	75	100
Type of Organisation	Public Client	25	33.3
	Private Client	2	2.7
	Contractor	24	32
	Consultant	24	32
	Total	75	100

Table 1: shows the summary of the background information and type of organisation of respondents. It is observable from the table that 25.3% of the respondents are practicing Architecture, 10.7% practicing Engineering (Electrical and Mechanical), 45.3% are Quantity Surveyors while 18.7% fall under Building profession. Also from the table 21.4% are diploma holders, 6.7% have post graduate qualifications while about 72% have minimum of first degree in their various fields of study. Furthermore about 73.3% of the respondents are either graduate or

probationer members of their respective professional bodies, 26.7% of them are also corporate members of their professional bodies. Moreover the 74 of the respondents have an average of above 6years experience in the construction industry and only fall in category of having between 0-5years working experience in the industry. Therefore, considering the above analysis it can be concluded that the data provided by the respondents can be relied upon for the purposes of analysis.

TABLE: 4.13 Relative importance indices (RII) and rank(R) of twelve effects of reworks as perceived by professional respondents on selected projects

	Effect of rework	Quantity Surveyors		Architect		Builder		Engineer		Weighted Average	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank	RII	Rank
1	Time overrun	0.46	2	0.39	4	0.38	5	0.50	4	0.43	2
2	Cost overrun	0.44	3	0.41	3	0.38	5	0.40	5	0.41	3
3	Contractor financial difficulties	0.42	4	0.35	6	0.46	1	0.40	5	0.41	3
4	Quality	0.47	1	0.65	1	0.4	4	0.40	5	0.48	1
5	Design team dissatisfaction	0.38	5	0.17	8	0.34	7	0.66	1	0.39	6
6	Inflation	0.37	6	0.45	2	0.3	7	0.25	8	0.34	7
7	client Dissatisfaction	0.24	8	0.36	5	0.46	1	0.56	2	0.41	3
8	contractor dissatisfaction	0.13	9	0.01	9	0.45	3	0.00	10	0.15	9
9	project abandonment	0.26	7	0.30	7	0.07	9	0.53	3	0.29	8
10	litigation/arbitration	0.12	10	0.00	11	0.05	10	0.00	10	0.25	10
11	poor contract management	0.12	10	0.01	10	0.04	11	0.03	9	0.21	11
12	Demotivation	0.09	12	0.00	11	0.02	12	0.00	10	0.18	12

From past research works literature on the construction industry in Nigeria and based on the preliminary investigation conducted by those researchers (Elinwa and Buba, 1993; Aibinu and Jagboro, 2002) while carrying out their studies, it was possible to identify certain major effects of rework on project delivery. Twelve effects rework is capable of causing on project process were identified but only nine of it were given prominence by the respondents, it include: time overrun, cost overrun, quality, inflation, project abandonment, client dissatisfaction and contractor dissatisfaction. From questionnaire drawn and administered, the effects of rework which focused on the twelve identified effects of construction reworks. The respondents were asked to rank the individual effects of construction rework based on frequency of occurrence according to their own judgment and local working experience in the Nigerian construction industry between 1999 and 2008. The researcher adopted a scale of 1–5 for the ranking exercise (Aibinu and Jagboro, 2002). The five point scale was converted to relative importance indices for each of the factors so identified. The factors were ranked as very low, low, and medium, high and very high. The questionnaires which were self administered were sent to the parties on the selected building projects in Niger state which involves the Quantity Surveyors, Architects, Engineers and Builders which are representing client, consultants or the contractors.

Based on the ranking (R) of the weighted average of the relative importance indices (RII) for the four groups of respondent, it was observed that the most frequent effects of rework on the selected building project delivery in Niger state were deviation in quality (RII=0.48), time overrun (RII=0.43) and cost overrun(RII=0.41). The high ranks assigned to time and cost overruns were not unexpected as asserted by Aibinu and Jagboro (2002) this is simply because when work is being

delayed the consequence most of the time is corresponding increase in cost of carrying out the work. Deviation in quality which forms the basis of rework has the highest relative importance index with the consequential effects of increase in time and cost of the projects to conform to the established requirement of the client.

From table 3, it could be deduced that virtually all the selected projects overrun its initial time except project “number 6” which was completed within time frame. Time overrun for all the projects as shown in the table indicated nine projects overrunning its initial time by 50% and above, while those ranging from 10-40% are thirteen leaving only 3 projects having less than 10% over its initial contract period. Cost and time overruns have been identified as major contributors to high cost of construction projects in Nigeria where Niger state is just a unit (Okpala and Aniekwu, 1988; Elinwa & Buba, 1993; Aibinu and Jagboro, 2002 and Ogunsemi, 2002). They continued by asserting that projects are known for overrunning its initial time and cost budget in many of the projects undertaken in the country which this research work is also corroborating. Furthermore, projects number; 7,9,12 and 25 exhibited high percentage of cost overrun of 37.98%, 23.66%, 23.08% and 25.02% respectively. Other have show less than 20% cost overrun. Rework which has been identified as one of the major contributors to high cost of building or construction works has not been widely reported in Nigeria despite the fact that it’s capable of causing overruns in term of cost and time. Egan report (1998) asserted that up to 30% of construction is rework, labour is used at only 40-60% of potential efficiency and at least 10% of materials are wasted. This research also finds out that cost of rework of project “number 21” was as high as 9.88% of the final contract sum; this is as a result of the source of cost data available for the research. Reworks instituted by the client through the consultant of whom the records are

available were used for this research work. It is worthwhile to note that only the direct costs of rework for the failures observed were estimated, the indirect rework costs such as site overheads and work undertaken for the site from head office

have not been included in estimates for rework of quality failures (Barber et al, 2000). This means that there is an underestimate of their full rework cost through the exclusion of overheads.

Table 3; percentage overruns and rework costs for 25 selected building projects in Niger State

Project number	Contract period(wks)		Overrun in time weeks	% Overrun in time	Contract sum(million)		Overrun In cost	% Overrun in cost	%of rework cost per project
	initial	final			initial	final			
1	32	34	2	6.25	111.4	117.03	5.63	5.05	1.15
2	40	60	20	50	122.38	125.64	3.26	2.66	1.19
3	40	72	32	80	119.8	127.8	8	6.67	2.5
4	40	76	36	90	104.4	127.4	23	22	6.67
5	8	10	2	25	4.56	5.15	0.59	12.9	5.24
6	3	3	-	0	7.4	8.03	0.62	7.73	2.87
7	12	14	2	16.67	8.11	11.19	3.08	37.98	3.84
8	4	5	1	25	4.5	4.75	0.25	5.56	2.31
9	12	14	2	16.67	9.72	12.02	2.3	23.66	4.74
10	40	64	24	60	113.93	128.78	14.85	13.03	4.38
11	4	6	2	50	6.77	8.05	1.28	18.91	6.83
12	12	15	3	25	12.48	15.36	2.88	23.08	5.08
13	12	19	7	58.33	17.89	18.77	0.88	4.92	1.23
14	16	20	4	25	29.88	31.18	1.3	4.35	1.25
15	12	16	4	33.33	21	23.06	2.06	9.81	1.78
16	40	52	12	30	60.89	63.53	2.63	4.32	1.24
17	12	16	4	33.33	35	37	2	5.7	1.14
18	24	32	8	33.33	33.17	35.4	2.23	6.72	2.54
19	24	36	12	50	16.74	19.14	2.4	14.34	4.08
20	40	48	8	20	26.35	28.13	1.78	6.75	3.7
21	26	30	4	15.39	109.94	129.45	19.51	17.75	9.88
22	24	26	2	8.33	53.06	56.33	3.27	6.16	2.15
23	28	31	3	10.71	116.31	124.47	8.16	7.02	1.15
24	40	72	32	80	67.36	80.65	13.29	19.73	5.75
25	40	76	36	90	70.71	94.31	23.6	25.02	3.96
Total			262	932.34	1283.75	1432.62	148.85	311.82	86.65
Average			10.917	37.294	51.35	57.3048	5.954	12.4728	3.466

Discussion of results

A total number of 25 selected building projects were considered and from the sought information on their characteristics and duly analysed virtually all the projects overrun their initial time and cost with an average percentage time-overrun of about 37.294% and 5.954% respectively. This was supported by the assertions of the previous researchers on time and cost performances of building projects in Nigeria, that projects are known for overrunning both their initial time and cost budget (Okpala and Aniekwu, 1988; Elinwa & Buba, 1993; Aibinu and Jagboro, 2002 and Ogunsemi, 2002). The final cost of the 25 selected building projects was ₦1, 432,620,000 and N49, 654,609.2 of the total cost constituted rework cost, corresponding to 3.466% of the estimated final construction cost of the whole selected projects. Egan's report (1998) that rework cost in building projects could be as high as 30% corroborated Burati et al. (1992) that posited that cost of quality deviation (rework) could be as high as 12.4%, Hammarlund et al. (1990) reported 11%, Harmmarlund and Josephson (1991) reported 4% of the total project cost, Love (2002b) reported 6.4% as the mean value of direct cost of rework, but from the analysis of the selected building projects, cost of rework was found out to be as high as 9.88% on a project and on average for the entire projects considered to be as low as 3.466%, this result was not too far from 2.3-9.4% of contract value as reported by (Harmmarlund and Josephson, 1991). This also explains why it is essential and necessary for the Nigerian construction industry to fully understand the menace and causes of rework to enable participants in the industry take preventive actions to reduce

the amount of rework in building projects. Love (2002b) asserted that refurbishment and renovation works experience higher rework costs than new construction due to complexity and uncertainty that surrounds such projects, but from the research carried out, the project that experiences higher rework costs was a new construction meaning that the design was either faulty or it was due to poor workmanship or inadequate supervision.

Summary of Findings

1. The entire participant in the industry agreed that the most prominent effect of rework on projects is time and cost overruns, followed by quality. Thus, cost and time overruns were the two most frequent effects of rework in the Nigerian construction industry.
2. It was also established that the cost of rework (direct cost) can be as high as 9.88 % or above in a project.
3. Thus, the analysed effects of rework on project performance by the research showed that rework is capable of causing time and cost overruns to the tune of approximately 3.47% and 37.29% respectively and these was done to give an insight into the likely final contract sum of projects if rework is identified.

Suggestions

Based on the findings of this research the following policies were suggested:

1. The Nigerian construction industry requires improving on her project delivery process by eliminating to a considerable level time and cost overruns in projects. The industry needs to improve service delivery with adequate attention on qualitative services.

2. If rework in construction has to be reduced or eliminated there is need for consensus to be reached on a workable mechanism to bring together the client, consultant and the contractor to minimize change orders and introduction of additional works during construction phase.
3. A quality assurance mechanism is also required to be established to enhance and ensure buildability of quality designs by encouraging early involvement of contractors at the design stages to reduce design errors or mistakes in the design with consequential effects of rework.
4. If rework in construction has to be reduced or eliminated there is need for consensus to be reached on a workable mechanism to bring together the client and the contractor to minimize change orders and introduction of additional works during construction phase. In the same vein, it essential to reduce to a bearable minimum continuous issue of design

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information/variation orders by the clients which often frustrate the acceleration process (fast tracking of projects). And also there is a need for an effective clients' project management procedure in Nigeria if project delivery process must improve.

Conclusion

In order to examine the impact of rework cost of selected building projects, the study has been able to explore archival data of completed building projects and the following conclusions were drawn:

1. The project delivery indices showed that projects are known for overrunning their initial time and estimated cost in Nigeria of which Niger State is a subset. This research reported 37.26% of time overrun and 9.88 % of cost overrun. The average percentage of rework costs of 3.47% was recorded on the entire project considered
2. Some of the participants in the industry agreed that the most prominent effects of rework on projects are quality, time overrun followed by cost overruns. Whereas the least effects were demotivation and poor contract management

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DETERMINANTS OF BUILDING CONSTRUCTION PROJECT COST IN NIGERIA.

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Abstract

A review of literature on the factors that estimators in building industry consider when estimating for building projects indicated that nature of clients, professionals involved in a project and their decision regarding design, function, duration, technology and implementation have significant effects on the overall project cost. The objective of this is to examine the importance of these factors in determining the costs of building projects. Data for the study were obtained through random sampling of public building projects completed in Nigeria after the year 1995. The study identified six major significant factors in project cost among the design related variables as: Level of design complexity; level of construction complexity; level of technological advancement; percentage of repetitive element; presence of special issues and scope of work. Among time/cost related factors, three most significant factors are; Importance for project to be delivered; time allowed by the client and his representative for bid evaluation; need for the project to be completed. Client, consultant and contractor's experience on similar project; adequacy of contractor's plants and equipments are most significant among project parties experience related factors. It is suggested that previous information on these factors can assist an experienced professional rating of those factors in making realistic estimate of building project cost. To achieve this, Government as the largest initiator of public projects should formulate policies that will make client's report on previously executed projects by contractors and consultants available to the construction professional associations and the general public. This, to a very large extent will ensure most realistic rating of contractors and consultants alike when estimating the probable cost of project and will also ensure quality work is being delivered by contractors and improvement on service by the professionals.

Keywords: Building; Cost; Determinants; Estimating; Project.

INTRODUCTION

One of the major problems that have bedeviled the Nigerian construction industry is that building contracts are completed at sums much higher than the estimated cost (Giwa, 1988). A successful project means that the project has accomplished its technical performance, maintained its schedule and remained within budgetary costs. However, there has been a greater awareness of cost prediction by prospective building clients because of the prevailing economic condition which has placed severe restrictions on the availability of capital and thus made it essential to ensure that resources are

judiciously utilised to secure the best economic advantage.

In these days of ever increasing costs, the majority of promoters of building projects are insisting on jobs being designed and executed to give maximum value for money. As building becomes more complex and clients become more exacting in their requirements due to rising in prices, restrictions on the use of capital and increases in interest rates.

A client is very much concerned with quality, cost and time and wants the building to be soundly constructed at a reasonable cost and within a specified period of time. For these reasons, it is imperative that the Architect, who may or may not be supported by Quantity

Surveyor, exercises the greatest care and skill in the design of the project with constant checks on cost (Achuenu, 1997). This research aims to (i) to identify the factors that contribute to project cost and (ii) to examine the importance of the identified factors based on the significance of their contribution. The subsequent sections review the previous work relating to the research title, present the data and discuss the results of the statistical analysis. Finally, conclusions were drawn from the results of the empirical study.

LITERATURE REVIEW

Cost is simply defined as what must be given or foregone to obtain something and can be classified into client's cost and contractors' cost and the difference between the two will be the profit or payment the contractor's will receive at the completion of the project (Achuenu 1999).

Lowe, Emsley and Harding (2006) asserted that the inappropriate nature of raw cost as a valid predictor of project cost can be demonstrated by comparing the results of a simple forward stepwise regression using raw cost with those obtained when using the other three variables.

Songer and Molenaar (1997) identified a list of metrics that measure and compare the performance of construction projects. Other studies (Akintoye 2000; Chan, Ho and Tam (2001) identified the determining factors and assessed their impacts on project cost.

A common finding of previous studies is that cost is affected by a large number of factors. This can be explained by the fact that construction is a multi-disciplinary

industry and its work involves many parties such as the owner, professionals, contractors and suppliers. Therefore integrated efforts of the various parties and their decisions regarding the design, technology and implementation of the project can have significant effect on the overall project cost. Chan and Park (2005) asserted that project cost depends not only on a single factor but a cluster of variables related to the characteristics of the project and the construction team. Technological and project design requirements preset by the client's desired level of construction sophistication play an important role in determining the cost of the project.

METHODOLOGY

This study was designed to investigate into the factors that determine cost of construction project. Random sampling technique was used to effectively capture the target population. From the existing literature on determinants of project cost, a total of 38 determinants (Table 1) relating to the project, the construction team and the contractor were identified to have impact on project cost. These determinants are qualitative variables expressed in the Likert scale of between a minimum of 1 and a maximum of 5. Appropriate methods of data analysis were very necessary to be able to accurately process the data collected from field survey. However, Principal Component Regression (PCA) was used for purposes of selecting a small number of principal components that contributes satisfactorily to variation.

RESULTS AND DISCUSSION

Table 1 below shows that 5%, 2%, 71% and 22% of the respondents were Architects, Engineers, Quantity Surveyor and Builders respectively. It also reveals

that an appreciable number (37%) of the respondents have between 11 to 15 Years working experience, while 46% of the respondents have earned bachelor degrees and 49% and 34% are engaged in

consultancy services and contracting work respectively. Thus the above revelation is a testimony that the responses were from a sample of qualified and experienced personnel.

Table 1: Characteristics of Respondents

RESPONDENTS		FREQUENCY	PERCENT
Profession	Architect	2	4.9
	Engineer	1	2.4
	Quantity Surveyor	29	70.7
	Builders	9	22
	TOTAL	41	100
Years of working experience	0 to 5yrs	6	14.6
	6 to 10yrs	14	34.1
	11 to 15yrs	15	36.6
	16 to 20yrs	6	14.6
	TOTAL	41	100
Educational Qualification	OND	-	0
	HND	8	19.5
	PGD	5	12.2
	BSc	19	46.3
	MSc	9	22
TOTAL	41	100	
Type of practice	Project Management	7	17.1
	Contracting	14	34.1
	Consultancy	20	48.8
TOTAL		41	100

Source: Author survey (2009)

As the quest to gather relevant data for the research continues, the respondents were required to score the identified factors that are been considered as a determinates of cost of building project using a Likart scale of 5 – 1 that is 5

denoting very important and 1 denoting not important'. Table 2 shows the aggregation of the respondent's responses as percentage of the total number of responses received on each of the questions asked on the questionnaire.

Table 2: Factors that Determine Cost of Building Project

Factors	Percentage				
	N.I	S.I	M.I	V.I	E.I
<u>DESIGN RELATED</u>					
X1-Level of design complexity	-	-	17	51	32
X2-Level of construction complexity	-	-	22	44	34
X3-Level of technological advancement	-	12	20	46	22
X4-Level of specialization required of contractors	2	-	27	44	27
X5-Percentage of repetitive elements	17	32	34	15	2
X6-Presence of special issues	10	22	29	32	7
X7-Type of specification	-	2	17	49	32
X8-Extent to which bid documents allow additions to scope	2	17	32	34	15
X9-Flexibility of scope of works when contractor is hired	-	10	42	39	10
X10-Project scope definition completion when bids are invited	5	7	34	39	15
X11-Design completion(by owner) when bids are invited	5	15	34	32	15
X12-Design Decision made (by owner) when bids are invited	2	24	20	34	20
X13-Design completion when budget is fixed	-	8	22	46	24
<u>TIME/COST RELATED</u>					
X14-Importance for project to be completed within budget	-	2	17	32	49
X15-Importance for project to be delivered	-	2	22	42	34
X16-Time given to consultant to evaluate bids	24	17	34	27	20
X17-Extent to which contract period is allowed to vary	-	17	44	24	15
X18-Importance for project to be completed on time	-	2	10	46	42
X19-Bidding environment	5	39	17	24	15
X20-Consultant's level of construction sophistication	-	24	27	46	24
X21-Owner's level of construction sophistication	5	10	27	44	15

Source: Author survey (2009)

Key: N.I (Not Important), S.I (Slightly Important), M.I (Moderately Important), V.I (Very Important), E.I. (Extremely Important)

Continuation of Table 2.

Factors	Percentage				
	N.I	S.I	M.I	V.I	E.I
<u>PROJECT PARTIES EXPERIENCE RELATED</u>					
X22-Consultant experience with similar project	-	2	22	42	34
X23-Owners experience with similar project.	7	15	29	24	24
X24-Consultant staffing level to attend to contractor	-	8	29	29	34
X25-Owners staffing level to attend to contractor	17	12	44	20	7
X26-Contractor's experience with similar type of projects	-	5	12	49	34
X27-Contractor's experience with similar size of project	2	7	17	49	24
X28-Contractors experience with project in Nigeria	2	5	29	44	20
X29-Subcontractor experience and capability	-	27	29	34	10
X30-Communication among project team	15	15	27	27	17
X31-Contractor's prior working relationship with the owners	12	17	37	32	2
X32-Contractor prior working relationship with consultant	7	15	39	24	17
X33-Contractor track record for completion on time	-	-	22	59	20
X34-Contractor track record for completion on budget	-	5	22	37	37
X35-Contractor track records for completion on quality	-	7	17	34	42
X36-Contractor staffing level	2	7	17	44	29
X37-Adequacy of contractor plant and equipment	-	-	36	32	32
X38-Magnitude of change orders in contractor past project	-	24	54	17	5

Source: Author survey (2009)

Key: N.I (Not Important), S.I (Slightly Important), M.I (Moderately Important), V.I (Very Important), E.I. (Extremely Important)

PRINCIPAL COMPONENT ANALYSIS OF PROJECT COST DETERMINANT

Factor analysis was employed to condense large number of variables with a view to identify the underlying variables that explain the pattern of correlation with a set of observed variables. The main objective of factor analysis is to describe the covariance relationship among a large number of variables in terms of a few groups. Factor analysis specifies that variables are determined by common factor (the factor estimated by the model) and unique factor (which do not overlap between observable variables) with the assumption that all unique factors calculated correlate with each other and with common factor.

INITIAL EXAMINATION

Principal Component Analysis (PCA) was employed to confirm the factors that determine cost of building project and to explore the structure of the data as regards their individual significant contribution to project cost. To use PCA technique, the data presented on table 2 was first tested for suitability, involving Kaiser-Meyer-Olkin (KMO) measures and Bartlett's Test of Sphericity, the KMO measure of sampling adequacy was estimated to be 0.515, 0.601 and 0.586 for Design related, Time/Cost related and factors relating to experience of parties involved in project execution respectively, and these values are greater than 0.50. The Bartlett's test of sphericity, to confirm the identity of matrix was found to be significant at 0.000 level with chi-square values of 130.994, 59.728 and 287.734, for Design related, Time/Cost related and factors relating to experience of parties involved

in project execution respectively. These measures confirmed the suitability of the data for proceeding with factor analysis.

EXTRACTING COMPONENTS

PCA was used in analysing the raw data for the purposes of extracting the factors that contributed significantly to cost of building projects. Kaming, Olomolaiye, Holt and Harris (1997) explained that the total number of factor estimated by the model (common factor) is equal to or less than the total number of variables involved which is shown in the result of analysis. Table 3, 4, and 5 below shows the extracted number of factor from PCA for design related, time/cost related and experience of project parties related factors based on their contribution to cost of building project. However, the most significant factors that contribute to project cost are those whose eigenvalues are greater than or equal to 1, because eigenvalues is a measure of the contribution of a variable to the principal components. However, the extraction sum of square loading of the factor analysis for design related factors indicates six (6) factors out of thirteen (13) factors with eigenvalues of 3.068 for factor 1 to 1.001 for factor 6, Time/Cost related factor indicates three (3) with eigenvalues of 2.394 for factor 1 to 1.074 for factor 3 and Experience of Parties to the Project factors indicates five (5) with eigenvalues of 4.357 for factor 1 to 1.301 for factor 5. Those factor with eigenvalues greater than or equal to 1 are considered in the extraction process.

Table 3: Total Variance extracted for Design related factors

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.068	23.603	23.603
2	1.64	12.614	36.217
3	1.442	11.089	47.306
4	1.429	10.996	58.302
5	1.14	8.765	67.067
6	1.001	7.702	74.77
7	0.877	6.749	81.519
8	0.777	5.976	87.495
9	0.476	3.659	91.154
10	0.381	2.934	94.088
11	0.305	2.343	96.431
12	0.272	2.092	98.523
13	0.192	1.477	100

Source: Author analysis of data (2009)

Table 4: Total Variance extracted for Time/Cost related factors

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.394	29.928	29.928
2	1.614	20.174	50.102
3	1.074	13.421	63.523
4	0.883	11.032	74.555
5	0.782	9.774	84.329
6	0.534	6.669	90.998
7	0.407	5.087	96.085
8	0.313	3.915	100

Source: Author analysis of data (2009)

Table 5: Total Variance extracted for factors related to experience of project parties

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.357	25.632	25.632
2	2.897	17.044	42.676
3	1.748	10.281	52.957
4	1.319	7.759	60.716
5	1.301	7.651	68.367
6	0.944	5.555	73.921
7	0.805	4.733	78.654
8	0.649	3.818	82.472
9	0.611	3.597	86.069
10	0.583	3.43	89.499
11	0.433	2.548	92.047
12	0.358	2.107	94.154
13	0.338	1.99	96.144
14	0.244	1.436	97.58
15	0.195	1.147	98.727
16	0.131	0.77	99.49
17	0.085	0.503	100

Source: Author analysis of data (2009)

The output in table 6, 7 and 8 shows the extraction factor loading greater than 0.500 and their respective communalities (h^2). The criterion for factor loading was that any variable with absolute value

in the component matrix belong to the component. Factor loading are simply the correlation coefficient between an original variable/determinant and an

extracted factor. Also, the average communalities (h^2) which explain the variance in the variables accounted for by the extracted factor is 75%, 64% and 69% for Design related, Time/cost related and Experience of Project Parties related factors respectively.

Table 6: Factor loading of design factors to cost of project - extracted

Variable		Factors						h ²
		DF1	DF2	DF3	DF4	DF5	DF6	
1	Level of design complexity	0.540						0.813
2	Level of construction complexity	0.520						0.788
3	Level of technological advancement	0.714						0.742
4	Level of specialization required of contractors	0.500						0.581
5	Percentage of repetitive elements		0.742					0.722
6	Presence of special issues		-0.603					0.906
7	Type of specification		0.659					0.620
8	Extent to which bid documents allow additions to scope			0.597				0.719
9	Flexibility of scope of works when contractor is hired			-0.507				0.847
10	Project scope definition completion when bids are invited				0.709			0.812
11	Design completion(by owner) when bids are invited				0.600			0.642
12	Design Decision made (by owner) when bids are invited					0.626		0.741
13	Design completion when budget is fixed						-0.569	0.736

Source: Author analysis of data (2009)

Table 7: Factor loading of Time/Cost factor - extracted

Variable		Factors			h ²
		TF1	TF2	TF3	
1	Importance for project to be completed within budget	0.67			0.618
2	Importance for project to be delivered	0.757			0.752
3	Time given to consultant to evaluate bids	0.793			0.698
4	Extent to which contract period is allowed to vary	0.508			0.622
5	Importance for project to be completed on time	0.612			0.707
6	Bidding environment		0.719		0.53
7	Consultant's level of construction sophistication		0.719		0.459
8	Owner's level of construction sophistication			-0.659	0.697

Source: Author analysis of data (2009)

Table 8: Factor Loading for Project parties experience factor - extracted

Variables		Factors					h ³
		EP1	EP2	EP3	EP4	EP5	
1	Consultant experience with similar project	0.537					0.577
2	Owners experience with similar project	0.703					0.780
3	Consultant staffing level to attend to contractor	0.589					0.783
4	Owners staffing level to attend to contractor	0.600					0.825
5	Contractor's experience with similar type of projects	0.536					0.774
6	Contractor's experience with similar size of projects	0.690					0.761
7	Contractors experience with project in Nigeria	0.694					0.611
8	Subcontractor experience and capability	0.520					0.677
9	Communication among project team		-0.650				0.781
10	Contractor's prior working relationship with the owners		-0.593				0.738
11	Contractor prior working relationship with the consultant		0.662				0.651
12	Contractor track record for completion on time		0.585				0.612
13	Contractor track record for completion on budget			0.510			0.591
14	Contractor track records for completion on quality			0.628			0.634
15	Contractor staffing level						0.502
16	Adequacy of contractor plant and equipment						0.693
17	Magnitude of change orders in contractor past project						0.633

Source: Author analysis of data (2009)

SELECTING PRINCIPAL COMPONENTS

Further to extraction of principal components, those components that contributed significantly to the factors must to be selected. However, the study adopts the criterion of selection used in (Kaming et al. 1997; Chan & Park 2005). This criterion include selecting the principal component whose eigenvalues and the percentage variance is more than the average eigenvalues and the percentage cumulative variance of the factor.

Based on the above criteria, from table 6, 7 and 8 above, six components are

extracted from 13 variables pertaining to Project Design. The cumulative percentage variance explained by the six components is 75% and percentage variance explained by each of the components are displayed on table 3. Taking the significance of contribution of each variable into account (based on their respective percentage variance) and in comparison with the average eigenvalues (1.314), the first two components contributed significantly (accounted for 36% of the variance), thus those variables with eigenvalues higher than the average eigenvalues were selected. Hence, 6 out of 13 variables were selected.

Within the component of Time/Cost factors, three components was extracted,

having a cumulative percentage variance of 64% the average eigenvalues (3.34), table 7 present percentage variance explained by the three factors. Thus only one factor with relatively higher eigenvalues than the average eigenvalues was selected and 3 variables out of 8 were selected. Among the factors relating to experience of project parties, five

components that amount to 69% of the variance are extracted and first two components whose eigenvalues are higher than average (1.748) account for 43% of the variance. Six out a total of seven variables are selected. The variables selected are presented on table 9.

Table 9: List of selected factors

Factor 1 (FAC1)	Level of design complexity
Factor 2 (FAC2)	Level of construction complexity
Factor 3 (FAC3)	Level of technological advancement
Factor 4 (FAC4)	Percentage of repetitive element
Factor 5 (FAC5)	Percentage of special issues
Factor 6 (FAC6)	Project scope
Factor 7 (FAC7)	Importance for project to be delivered
Factor 8 (FAC8)	Time allowed for bid evaluation
Factor 9 (FAC9)	Importance for project to be completed on time
Factor 10 (FAC10)	Client experience in construction project
Factor 11 (FAC11)	Contractor's experience on similar type of project
Factor 12 (FAC12)	Contractor's experience on similar size of project
Factor 13 (FAC13)	Communication among project team
Factor 14 (FAC14)	Contractor's prior working relationship with client
Factor 15 (FAC15)	Adequacy of contractor plant and equipment

Source: Author analysis of data (2009)

SUMMARY OF FINDINGS

Based on the information gathered from review of related literature and the analysis carried out the findings of the study are summarised as follows;

(i) Six most significant factors among the design related variables as major contributor to cost of public building projects, as Level of design complexity; level of construction complexity; level of technological advancement; percentage

of repetitive element; presence of special issues and scope of work.

(ii) The results of the analysis on the time/cost related factors indicated Importance for project to be delivered; time allowed by the client and his representative for bid evaluation by prospective bidders and need for the project to be completed within stipulated period as very significant factors.

(iv) The study also revealed that estimator's do take cognisance of the client,

consultant and contractor's experience on similar project as contributing factors to project cost. And adequacy of contractor's plants and equipments feature prominently among the factors that are categorised as project parties experience related factors.

CONCLUSION AND RECOMMENDATION.

The study has identified 15 most important factors that contribute significantly to project cost from analysis performed on variables identified as project general requirements.

It is suggested that, since these factors are related to project design, time and nature

of client, consultant and contractor's, previous information on them can assist an experienced professional (Quantity Surveyor, Builder and Architect) rating of those factors in making realistic estimate of building project cost. To achieve this, Government as the largest initiator of public projects should formulate policies that will make client's report on previously executed projects by contractors and consultants are available to the construction professional association and general public. This, to a very large extent will ensure most realistic rating of contractors and consultants alike when estimating the probable cost of project and will also ensure quality work is being delivered by contractors and improvement on service by the professionals

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