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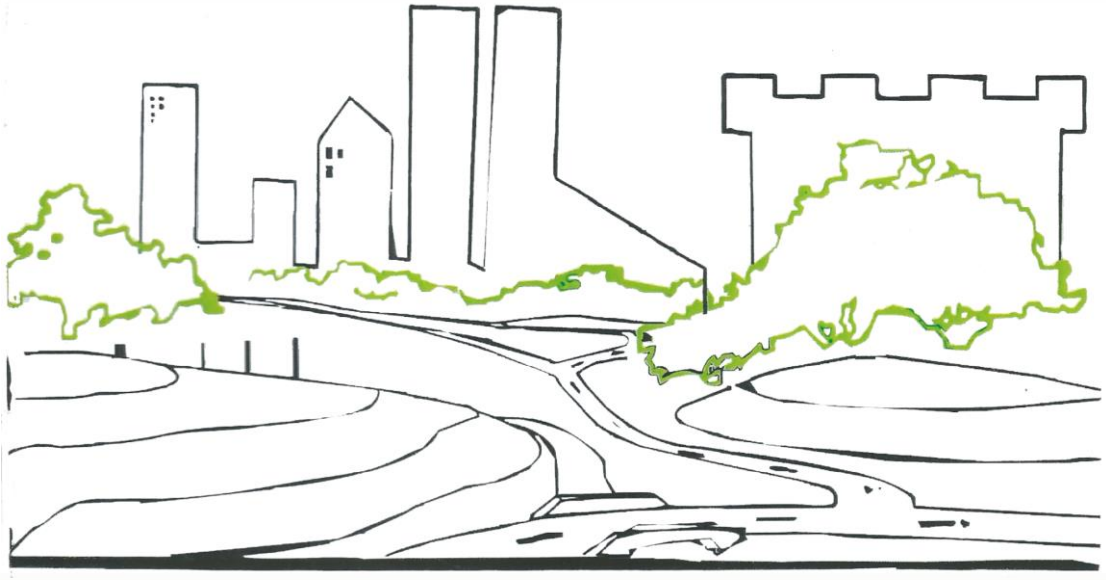

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EDITORIAL COMMENTS

Welcome to yet another volume of the Journal of Environmental Design. Volume 17 of the JED contains several thought-provoking well researched papers on the various dimensions of the built environment. It must be stated that environmental problems in general have become intricate phenomena requiring a wide range of interests and experts in their planning, management and design. The JED continues in its 17th volume to highlight the works of these experts and presents their informed views and cutting edge research findings for the benefits of policy makers and students of environmental studies. The papers have been peer-reviewed and carefully selected to ensure intellectual balance and intelligent discourse.

The views expressed in the articles published in this Journal (JED) are those of the authors and Journal of Environmental Design (JED) does not hold itself accountable for such.

Professor Ephraim E. Edem

EDITORIAL COMMITTEE

EDITORIAL STYLE GUIDE FOR AUTHORS

Please submit your manuscript double spaced in MS Word, Times new Roman (font 12). **Figures and Tables** should be put in the place where they are mentioned. Maps should be supplied in EPS format. Because manuscripts will undergo a blind review, submit two title pages; the first showing the title of the manuscript, author name, title, affiliation, telephone number, email address and the date of the manuscript. The second title page should contain only the title of the paper. Third-person style is always preferred. If appropriate, authors may make limited use of first-person singular, but a single author should not refer to himself or herself as "we."

Biography: The manuscript should include; on a separate page or the "first" title page described above a sentence listing each author's name, and affiliation.

Abstract: Include a one-paragraph abstract *not exceeding 2*50 *words* and place it on the first page of the text. The abstract describes the issue(s) or question(s) the paper addresses and states the major findings, conclusions and recommendations.

Keywords: To help users reference the JED published research, keywords are included with journal articles. Please suggest at least two keywords for your manuscript.

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Text Headings: Headings are not numbered and are placed to the left. First-level headings are bold; second-level headings are italicized; and third-level headings are italicized and lead directly into text.

Tables and Figures: Use Arabic numerals to number tables-and figures consecutively in separate series in order of appearance. Include a brief descriptive title at the top of each. **Figures and Tables** should be put in the place where they are mentioned. **Figures and Tables** should be in the body of the work. The text must contain a reference to each table or figure.

Equations: Make sure that all symbols in equations are clear and that all equations (except those in footnotes) are numbered. Single-letter variables should be italicized. Multiple-letter variables, abbreviations (e.g.,AGE) and functions (e.g., expo min. In) should not be italicized neither should be numbered. Parentheses or mathematical operations, vectors and matrices should be in bold (not italicized).

References: The manuscript must include complete and accurate citations of all materials referenced in the manuscript that are not of your original authorship. Please double-check your references to ensure that names and date are accurate, that Web pages are still active, and that there are no discrepancies between the text and the reference list. The APA style is strongly recommended.

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LEVELS OF CARBON MONOXIDE EMISSION IN ABA METROPOLIS, NIGERIA

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Abstract
Carbon monoxide (CO) emission in urban areas in Nigeria has been on the increase in recent times. In this study the levels of CO emission in Aba metropolis were assessed to ascertain if the emission levels are hazardous to health or otherwise, examine the environmental implication of observed emission level as well as the meteorological factors influencing the CO emission among other objectives. To achieve these objectives, experimental research design was used. Measurements were taken using Crowcon Gasman portable handheld monitor as well as meteorological instruments, to measure the ambient CO and weather parameters. The data were analysed using ANOVA to examine the variation of CO levels on temporal and spatial bases while Pearson correlation was used to examine the influence of meteorological factors on CO emission levels. The results showed that, the levels of CO were high during the dry season with values exceeding the threshold limits of WHO and NESREA in some communities such as Osisioma (57.77ppm), Mgboko-umuette(41.60ppm), Umuode(36.32ppm), Ariaria (31.09ppm) and Umuokpoji(28.78ppm). The results revealed that, the observed air quality of Aba metropolis was healthy during wet season whereas during the dry season, the observed CO ranged from unhealthy to hazardous levels. The result established that temperature (r= 0.652), wind direction (0.603) positively correlated with CO during wet season but inversely related with relative humidity (r= -0.539). However, during the dry season only temperature (r = 0.573) variable positively correlated with CO. Therefore, the ambient air quality within Aba metropolis during the period of study was poor during the dry season. From the results of this study, it is recommended that policies on CO emission be put in place not only in Aba, but in major urban centres. There is need to isolate communities with higher CO levels as flash points for health intervention measures.

Introduction

Carbon monoxide (CO) is a poisonous, colourless, unavoidable gas that has neither taste nor smell. It is formed when carbon is burned in a deficiency of oxygen i.e., incomplete combustion (Diribe, 2017). Carbon monoxide also called Carbonious oxide or Carbon (II) Oxide is very lighter than air. It is a deadly, colourless, odourless, poisonous gas, generated by the incomplete burning of many fuels, including coal, wood, charcoal, oil, kerosene, propane, and natural gas. Products, equipments and machines powered by internal combustion engines such as portable generators, cars, lawn mowers, and power washers also emit CO. It has a high affinity for haemoglobin in blood which replaces oxygen to form carboxyl haemoglobin (COHb), and this can cause dizziness, headaches and eventually death. Tobacco smoke, gas fires, burning candles are also common sources of CO in indoor air (Adike, 2012). The common sources of outdoor air pollution are emissions generated by combustion activities emanating from motor vehicles, solid fuel burning and industry. The ambient level of CO is measured in parts per million (ppm). Exposure to carbon monoxide and its poisoning is reported to be a leading cause of death in industrialised countries and nearly amount to one half of the fatal poisoning globally (Raub *et al.*, 2000). In the United State of America, almost four thousand people die annually due to CO poisoning most of which are accidental (Hampson and Stock, 2006). The incidence of CO poisoning is known to be high (when detected) at periods when alternative power sources are used such as generators and coal-based room heater(Bartlett, 2006). In Nigeria, almost every house runs multiple generators, and this creates health hazards that possibly lead to fatal consequences. The occurrence of the whole families dying from smoke intake is a habitual feature in the news media and in a particular case in Umuahia, 17 persons died at a religious gathering suspected to be from smoke inhalation(Osasona, 2017).

Despite having more power generating plants than automobiles, Nigeria has no infinite regulatory framework addressing efficiency standards, labeling procedure, emissions standards, usage and installation among other things (Osasona, 2017).The poisonous effects of CO emission from the exhaust of generators become more severe in a poorly ventilated environment. Over the years in Nigeria, electricity supply is highly inconsistent and epileptic therefore generators have become the dominant alternative source of electricity for overwhelming majority of households that are either experiencing acute or irregular power supply which consequently leads to higher probability of CO poisoning. Presently, in Aba as is the case in many other towns in Nigeria, there are daily incidences of traffic jams occasioned by ill maintained roads and unruly attitude of drivers. Again, the unreliable power supply system has led to the use of generator of different types and

quality in homes, offices and shops along the streets of Aba. Expectedly, no strong regulations are in place to control the use of these combustion engines. Hence, the emission of CO becomes inevitable and there are no means of controlling the level of emission or monitoring the exposure of humans to this gas. Also, many "unknown" backyard industries exist in Aba metropolis and its environs which produce diverse gaseous wastes and discharges same into the environment sometimes undetected. It is against this background that this study is undertaken to assess the levels of carbon monoxide emission in Aba; examine variation in carbon monoxide levels on temporal and spatial bases; and determine the meteorological factors that influence the emission of carbon monoxide.

Levels of CO in Ambient Air and Air Quality Standards

The Federal Ministry of Environment through the national agency accountable for setting and maintaining environmental standards in Nigeria, formally known as Federal Environmental Protection Agency (FEPA) now National Environmental Standards and Regulations Enforcement Agency (NESREA) has implemented a wide body of legislation which creates health-based standards for numerous pollutants in air.These standards are summarised in Table 1. These tenders vary over period because the detected health impacts associated with the many pollutants occur over different exposure times.

Table 1: Nigerian ambient air quality standard

Pollutants	Averaging time	Limits
Particulates	1 hour	250µg/m3
Sulphur dioxide (SO_2)	1 hour	0.01ppm
	24 hours	0.1ppm
Nitrogen dioxide (NO_2)	1 hour	0.04ppm
	24 hours	0.06ppm
Carbon monoxide (CO)	1 hour	10ppm
	8 hours	20ppm
Hydrocarbons	3 hours	0.6ppm
Photochemical oxidants	1 hour	0.06ppm

Source: NESREA (2015).

According to Okunola *et al.* (2012), pollutants emanating from mobile transportation are on the rise due to increase in per capita vehicle ownership, thus resulting in overcrowding of roads in cities of Nigeria and increase in the level of pollutants in the air. Even at that, study on CO level in Nigeria is relatively scarce compared with the volume of studies carried out in the developed world. Olamijulo and Ana (2013) recorded CO levels in two selected local government areas (Ibadan North and Ibadan Northeast) of South Western Nigeria, the value gotten from those local governments which is 38.6ppm and 22.2ppm exceeds the FEPA and WHO guideline limit of 10ppm for CO. A research study conducted by Ojo and Awokola, (2012), reported that CO was in the range of 1.79ppm- 51.38ppm which is outside of USEPA permissible limit for ambient air quality standards. Musa and Evuti (2012), displayed CO levels of three sampling locations in FCT-Abuja as; Tukpedi (17.33ppm), Kuje (9.33ppm), and Paseli (10.22ppm), where the CO level of 17.33ppm was above the FEPA and USEPA set standards. Research findings from Lagos metropolitan Area Authority (LAMATA) implied that the levels of NO, SO_2 and CO exceeded the WHO guidelines at most location for in Situ measurement and 24-hour exposure (Robert, 2015). Similarly, the mean range of 14.8 - 28.3ppm of CO levels was determined at several road junctions in Benin City (Ukpebor *et al.*, 2009). Ukpebor *et al.* (2009) findings implied that intervention programmes and policies for CO control and abatement are difficult to formulate, because available information on atmospheric outdoor and indoor levels of CO are not enough. But the newly established National Environmental Standard and Regulations Enforcement Agency (NESREA) is working on outlining the vision of ensuring a cleaner and better environment for all Nigerians.

Spatial and temporal variations in the levels of CO

The World health Organisation (2000) and United States Environmental Protection Agency (1993) regulatory limit for CO is 9.0ppm while the statutory limit of Nigeria is 10.0ppm (FEPA,2000). Asheshi (2012) measured the levels of CO, NO_2 and PM in Lafia metropolis at three different sampling sites during phases of traffic that is heavy, normal and light for three consecutive days (morning, afternoon and evening). The results obtained were found to be higher than the standard value given by Nigerian Ambient Air Quality Standard (NAAQS). This shows that levels of the pollutants are high in metropolis, implying that population along the

sample sites are more exposed to these toxic gases. Aliyu *et al.* (2014) reported a study in which ambient air hourly levels for CO, NO_2 and SO_2 at six major intersections in Abuja was monitored during morning low traffic hours and during afternoon, high traffic hours. The findings served as a model of exposure for traffic wardens who are high exposure group. The results showed that vehicle emissions are having a negative impact on air quality, and that traffic wardens have high prevalence of symptoms that are possibly related to and are exacerbated to vehicle emission. Akanni (2010) carried out research on spatial-seasonal analyses of traffic related pollutant level in Lagos metropolis and observed that the monitored pollutant values for wet season recorded are relatively lower in many cases than that recorded for the dry season monitoring and attributed this observation to lower air temperature witnessed during wet season (25 to 28.8^{0}C) and high wind speed (3 to 9 m/minute).A research study conducted by Ukpebor *et al.* (2009), at different sampling stations and at different times of the day at Agbor Park, simplifies that the threshold limits were violated. However, the degree of deviations from these limits varied for the different periods of the day. In Nigeria, it is usual to classify the day into three time zones – morning (from dawn to noon), afternoon (noon to 4 p.m.) and evening (4 p.m. to 7 p.m.). Study conducted by Ukpebor *et al.* (2009) at Agbor Park, intensifies that their classifications were upheld to identify the critical pollution period of the day and then summarise possible mitigation measures, almost all the sites have the highest CO level which were measured in the morning hours. At Agbor Park sampling area for example, the morning hours CO range was 9.0-45.3ppm, while the afternoon and evening ranges were 5.5- 8.3ppm and 6.0-18.3ppm, respectively. At the ring road sampling station, the morning, afternoon and evening CO ranges were 18.3-35.5ppm, 10.8-21.5ppm and 11.9-21.5ppm, respectively. Similar trends were observed for the other three sampling locations (Ukpebor *et al.*, 2009). It becomes worrisome that the observation of the mean CO level measured at different periods of the day and the different sampling sites exceeded all national and international CO statutory limits.

Utang and Peterside (2011) in their study estimated the emission of pollutants from vehicle during traffic peak period within parts of the city of Port-Harcourt in Nigeria. It estimated air pollutants CO, NO_X, SO_X and hydrocarbon in four sampling points. The level of variation in level of emission between locations was determined at all times and locations, while the levels of CO detected was higher than the FEPA limits at certain location, levels of hydrocarbon detected varied in space and time and NO_X was generally above the local and international standards in all the locations during peak traffic period. In their conclusion, they stated that although the study did not cover the whole city of Port-Harcourt, finding from the four sampling points suggest that the city is under the threat of traffic related pollution and possibly more susceptible giving increasing population influx and vehicle traffic. Okunola *et al.* (2012) conducted research in Kano, Nigeria using Crowcon gas sensor to collect emission levels of various gases. The study concluded that the levels of CO, H_2S, NO_2 and SO_2 measured, with few exceptions, at some sites were above the AQI stipulated by USEPA especially during dry seasons. This implies that traffic emission within Kano is not within the safe limits. According to Olamijulo (2013), CO emission levels recorded in the morning periods in all the 13 sampling points in the 2 LGAs (Ibadan North and North- East) were higher than the WHO guideline limit except at one location. All evening levels were higher than the afternoon levels and were all above WHO guidelines limit of 10ppm. The least level of CO was recorded at one location with the emission level ranging from 6.9ppm in the morning to 30.4ppm in the evening period and they were all above the WHO guideline limit. There was a significant difference in the level of CO determined at each of the sampling points at different sampling periods ($p<0.05$). Omenikolo *et al.* (2017) investigated the level of gaseous emissions (CO, NO_2 and SO_2) at four strategic places in Makurdi metropolitan area of Benue State using handheld Crowcon Gasman gas metres for a period of one month, during peak periods of traffic flow at the selected locations within the city. The level of emission recorded at the major road junctions in Makurdi showed CO with highest level (0.57 - 10.2ppm), followed by NO_2 (0.01 - 0.11ppm) and SO_2 (0.00 - 0.1ppm) in all the sampled sites. The results established that the emission levels in metropolis especially in the afternoon were slightly higher than the Nigerian air quality standard accepted safe limits of 10 ppm for atmospheric CO, 0.04 - 0.06ppm for NO_2 and 0.1ppm for SO_2, respectively.

Environmental Implication of CO emission in the environment

The environment is the complex of physical, chemical, and biological factors or processes which sustains life. Man is part of these components, which make up the planetary ecosystem. Science and history both agreed that environment existed before the advent of man. Thus, the environment proceeded man and by deduction it preceded human, technological and scientific development activities. It may be rightly said that this

environment before the advent of man was 'unspoiled', the earth's natural resources were not therefore given to man to destroy, pollute or degrade (Ogedengbe and Onyuanyi, 2017).

Air pollution is a basic problem in today's world. Ambient air pollution exposure has been linked to several different health outcomes, starting from modest transient changes in the respiratory tract and impaired pulmonary function, continuing to restricted activity or reduced performance, emergency room visits and hospital admission and to mortality. There is also increasing evidence of adverse effects of air pollution not only on the respiratory system, but also on the cardiovascular system (WHO, 2004).CO is one of the major occurring air pollutants, whereby many countries have set air quality limit values and it is brought into the atmosphere by two different means which comprises of emission of CO and chemical formation from other pollutants (Musa and Evuti, 2012).The emission levels of CO, SO_2, NO_2, PM_{10} and noise level were found to be highest where traffic intersections and traffic count were high. All the five monitored air pollutants when compared with Air Quality Index level (AQI) were in the range of poor to moderate for CO at different locations, very poor to poor for SO_2 and NO_2, PM_{10} and noise level was poor at all locations (Abam and Unachukwu, 2009). However, the overall levels of vehicular related air pollution in Nigeria from all studies conducted show an increasing trend and thus possess a potential hazard to the population.Ojo and Awokola (2012) reported the result of their investigation of air pollution from automobiles at intersections on some selected major roads in Ogbomosho, Southwestern Nigeria. The results of SO_2, NO_X, CO were in the range of 0.02-0.09ppm, 0.09-0.039ppm, and 1.79-51.38ppm respectively. The levels of the air pollutants SO_2, NO_X and CO were obtained highest at intersection with traffic congestion and traffic intersection, where long waiting time for vehicles was observed. They concluded that all the three monitored air pollutants when compared with AQI level were in the range of SO_2-very poor to good, NO_X from good to very good, CO- very good to moderate and moderate to poor in different locations. Hence, it has become quite important to understand the role of mobile source emissions on air quality through well- designed studies. The health effects associated with exposure to carbon monoxide at low level include fatigue and chest pain in people with heart disease (WHO, 2004). At high level, impaired vision and coordination, headaches, permanent damage to central nervous system, dizziness, confusion, nausea and death may occur. At a moderate level, impaired vision and reduced brain function may result and during pregnancy it may results to low birth weight and parental mortality (Ayodele and Emmanuel, 2007).

Meteorological factors that influence the emission of carbon monoxide

The levels of pollutants in the atmosphere are affected by wind direction, temperature, wind speed and the relative humidity (Oji and Adamu, 2020). The weather of a place represents the state of the atmosphere over a brief period of time (Aiyelabegan, 2014). The weather conditions of any given location are often described in terms of meteorological elements which include the state of the sky, temperature, winds, pressure, precipitation, and humidity; these factors initiate and influence atmospheric processes (Godson and Olusola, 2015). The atmosphere is affected by direct and indirect energy releases via human activities such as burning of fossil fuel, industrial emissions and another phenomenon like El Nino and La-Nina (Ogolo and Adeyemi, 2009). It is believed that synoptic weather is an important driver of air pollution episodes via certain physical and chemical processes such as turbulent mixing, long-range transport, photochemical production, and deposition (Godson and Olusola, 2015). Godson and Olusola, (2015) observed that there was a significant positive correlation between CO and temperature. This could be attributed to the fact that internal combustion engines of vehicles perform better in cold temperature and emit less CO but as temperature increases, the engine efficiency reduces, hence, releasing more CO into the motor park ambient environment. According to Yortor *et al.* (2017), the study revealed that air pollutants contained in an enclosed area affect by two major wind patterns, which influence the local meteorological conditions. The study further revealed that pollutants released from point source industrial facilities in the area will generally be dispersed along the northern direction in the rainy season and southern direction in the dry season. The degree of air pollution in the area varies according to two prevailing wind directions. The study indicated that CO slightly increases with wind direction and relative humidity and decreases with wind speed and temperature. The study showed a weak relationship between pollutant levels and meteorological parameter. Weli and Adegoke (2016) examined the levels of Carbon monoxide (CO) as influenced by both land use and meteorological parameters of wind speed, relative humidity, ambient temperature and rainfall in the industrial city of Port Harcourt. The study observed that the coefficient of determination value (22.9%) showed that jointly, the meteorological variable accounted for 23.9% of the variation in the level of CO during the wet season at the low-density residential areas. At the

rural areas, the correlation matrix shows that both rainfall (-0.117) and wind speed (-0.318) correlated inversely with CO during the wet season. But air temperature (0.005) and relative humidity (0.268) correlated directly with CO.

The Study Area and Methodology

Aba metropolis is located inside Abia State and the study location lies within Aba metropolis. The city is geographically located on latitude of 5° 0′ and 5°15′N and longitude of 7°10′and 7º 30′ E. It lies alongside the west bank of the Aba River, at the intersection of roads from Port Harcourt, Owerri, Umuahia, Ikot Ekpene, and Ikot Abasi (Opobo) (Nwoko, 2013). The city is highly accessible, and accessibility is one of the essential factors of industrial agglomeration in the city (Nwafor, 2002). It is connected by road to four major urban areas in Southern Nigeria namely: Owerri, Umuahia, Uyo and Port Harcourt. The three major roads linking Aba with these other urban areas are the Aba-Owerri, Aba-Port Harcourt and Aba-Ikot Ekpene roads. Aba is about 64km by road and 62km by rail to Port Harcourt. The study area is also 64km to Uyo and 59.4km to Umuahia by road (Nwafor, 2002). Purposive sampling technique was adopted in selecting the communities to be studied based on concentration of CO generating activities. At the sample points, the levels of CO were measured using CO Crowcon gasman meter, multipurpose hygro, baro and thermo equipment were used to obtained data for atmospheric pressure, temperature and relative humidity respectively, while portable wind vane was used for wind speed and digital compass for wind direction from various locations (table 2) and the coordinates of the station were determined using GPS. This involved direct reading of the values from the screen of the instruments. All samples were taken at different times of the day (morning, afternoon and evening). Morning readings were taken between 8am-11am, afternoon readings between 12pm-3pm and evening readings were taken between 4pm-7pm. Descriptive statistics in the form of tables, graphs and inferential statistics in the form of ANOVA and correlation were utilized in data presentation and analysis.

Table 2: Variables and Unit of Measurements.

S/N	**Variables**	**Unit of Measurement**
1	CO (ppm)	Parts per million (ppm)
2	Ambient Temperature	Degree Celsius (^{0}C)
3	Relative Humidity	Percentage (%)
4	Pressure	Millibars/hour of day. (mmHg)
5	Wind Direction	Degree
6	Wind Speed	Meters per second (m/s)

Researchers' compilation (2019)

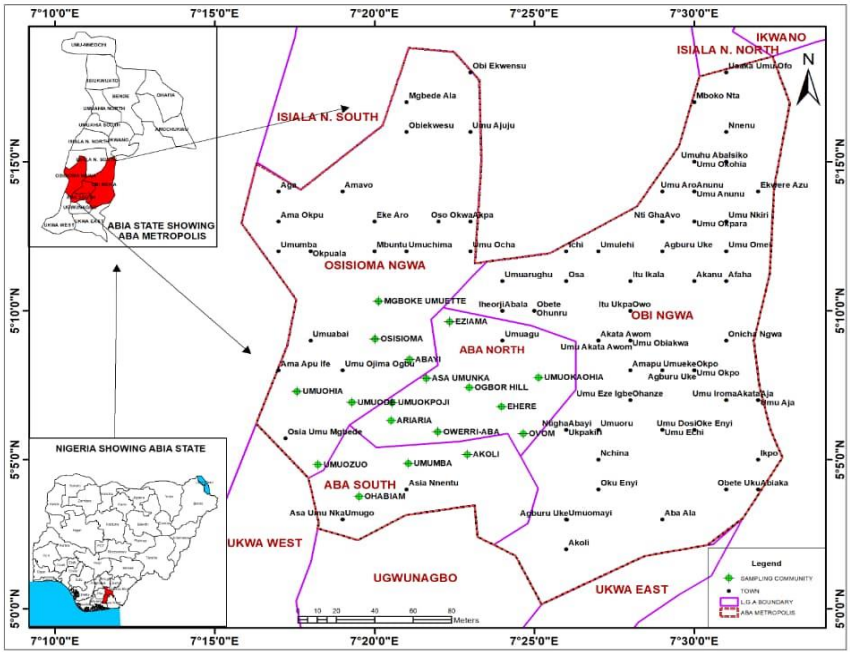

Figure 1: Aba metropolis showing sample locations.
Source: Abia State Ministry of Lands and Urban Development.

Levels of Carbon Monoxide Emission in Aba Metropolis

Data on CO emission levels was collected for both wet and dry seasons with a view to compare with regulatory standards. This is to help in detecting whether the emission levels are above the threshold levels at different seasons as shown in Table 3.

Table 3: Mean value of CO levels in Aba metropolis during the Wet and Dry Season (ppm)

Communities	Mean values for Wet Season			Wet season Mean	Mean values for Dry Season			Dry season mean	NESREA Limits (ppm)	USEPA/ WHO Limits (ppm)
	Morning	Afternoon	Evening		Morning	Afternoon	Evening			
Umuokaohia	1.41	3.56	3.38	2.78	9.86	14.69	15.22	13.26	10	9
Ovom	1.07	5.27	4.50	3.61	15.52	13.40	16.03	14.98	10	9
Ogbor Hill	1.27	5.20	5.07	3.85	13.58	12.33	13.49	13.13	10	9
Ehere	1.50	3.40	3.18	2.69	13.52	10.87	13.74	12.71	10	9
Umuokpoji	1.43	4.16	3.68	3.09	28.78	28.22	29.71	28.90	10	9
Eziama	1.45	6.28	5.16	4.30	15.68	19.75	18.05	17.83	10	9
Asa Umunka	1.12	5.29	4.61	3.67	15.93	14.06	17.02	15.67	10	9
Umumba	1.30	8.08	7.31	5.56	14.59	18.98	19.12	17.56	10	9
Ariaria	1.38	12.17	9.10	7.55	31.09	31.91	30.82	31.27	10	9
Umuode	1.30	10.75	8.21	6.75	36.32	37.76	38.74	37.61	10	9
Umuohia	3.33	8.83	7.43	6.53	23.06	24.29	27.88	25.08	10	9
Osisioma	4.43	11.20	9.21	8.28	57.77	55.96	52.83	55.52	10	9
Mgboko-Umuette	4.79	7.93	6.86	6.53	41.60	40.27	39.08	40.32	10	9
Umuozuo	2.58	6.74	5.69	5.00	27.12	27.10	25.98	26.73	10	9
Abayi	2.47	7.10	6.51	5.36	17.22	17.02	17.63	17.29	10	9
Owerre-Aba	3.57	6.13	5.37	5.02	20.64	20.89	22.63	21.39	10	9
Akoli	2.19	5.50	4.69	4.13	14.32	15.76	16.22	15.43	10	9
Ohabiam	2.42	9.10	8.05	6.52	13.67	13.90	14.27	13.95	10	9

Source: Field Survey (2019). NESREA Limits = 10 ppm; USEPA/WHO Limits = 9 ppm.

Table 3 shows the ambient levels of carbon monoxide in the selected communities for both wet and dry seasons. On the whole, precarious mean CO values were observed in Ariaria, Umuode, Osisioma and Mgboko-umoette communities both in wet and dry seasons.

Variation in Carbon Monoxide Level on Temporal and Spatial bases

The temporal and spatial variation of CO level is dependent on meteorological conditions as well as emission patterns. The mean CO levels determined for the different sampling sites are as given in Table 4 and figure 2 and 3.

Table 4: Mean value of CO in Aba Metropolis

S/N	**Communities**	**Mean values for Wet Season**			**Wet season Mean**	**Mean values for Dry Season**			**Dry season mean**
		Morning	**Afternoon**	**Evening**		**Morning**	**Afternoon**	**Evening**	
1	Umuokaohia	**1.41**	**3.56**	**3.38**	**2.78**	**9.86**	**14.69**	**15.22**	**13.26**
2	Ovom	**1.07**	**5.27**	**4.50**	**3.61**	**15.52**	**13.40**	**16.03**	**14.98**
3	Ogbor Hill	**1.27**	**5.20**	**5.07**	**3.85**	**13.58**	**12.33**	**13.49**	**13.13**
4	Ehere	**1.50**	**3.40**	**3.18**	**2.69**	**13.52**	**10.87**	**13.74**	**12.71**
5	Umuokpoji	**1.43**	**4.16**	**3.68**	**3.09**	**28.78**	**28.22**	**29.71**	**28.90**
6	Eziama	**1.45**	**6.28**	**5.16**	**4.30**	**15.68**	**19.75**	**18.05**	**17.83**
7	Asa Umunka	**1.12**	**5.29**	**4.61**	**3.67**	**15.93**	**14.06**	**17.02**	**15.67**
8	Umumba	**1.30**	**8.08**	**7.31**	**5.56**	**14.59**	**18.98**	**19.12**	**17.56**
9	Ariaria	**1.38**	**12.17**	**9.10**	**7.55**	**31.09**	**31.91**	**30.82**	**31.27**
10	Umuode	**1.30**	**10.75**	**8.21**	**6.75**	**36.32**	**37.76**	**38.74**	**37.61**
11	Umuohia	**3.33**	**8.83**	**7.43**	**6.53**	**23.06**	**24.29**	**27.88**	**25.08**
12	Osisioma	**4.43**	**11.20**	**9.21**	**8.28**	**57.77**	**55.96**	**52.83**	**55.52**
13	Mgbokoumuette	**4.79**	**7.93**	**6.86**	**6.53**	**41.60**	**40.27**	**39.08**	**40.32**
14	Umuozuo	**2.58**	**6.74**	**5.69**	**5.00**	**27.12**	**27.10**	**25.98**	**26.73**
15	Abayi	**2.47**	**7.10**	**6.51**	**5.36**	**17.22**	**17.02**	**17.63**	**17.29**
16	Owerre-Aba	**3.57**	**6.13**	**5.37**	**5.02**	**20.64**	**20.89**	**22.63**	**21.39**
17	Akoli	**2.19**	**5.50**	**4.69**	**4.13**	**14.32**	**15.76**	**16.22**	**15.43**
18	Ohabiam	**2.42**	**9.10**	**8.05**	**6.52**	**13.67**	**13.90**	**14.27**	**13.95**

Source: Researcher's Computation/Field Survey (2019).

Table 4 shows the mean levels of CO taken at the designated sample points in Aba for both wet and dry seasons. The measurements were taken in the morning, afternoon and evening periods. A closer look at Table 4 shows that the mean dry season levels of CO in the study area are higher for all communities than values obtained for the same communities during wet season. Figures 2 and 3 show the distribution of CO within Aba metropolis during the wet and dry seasons

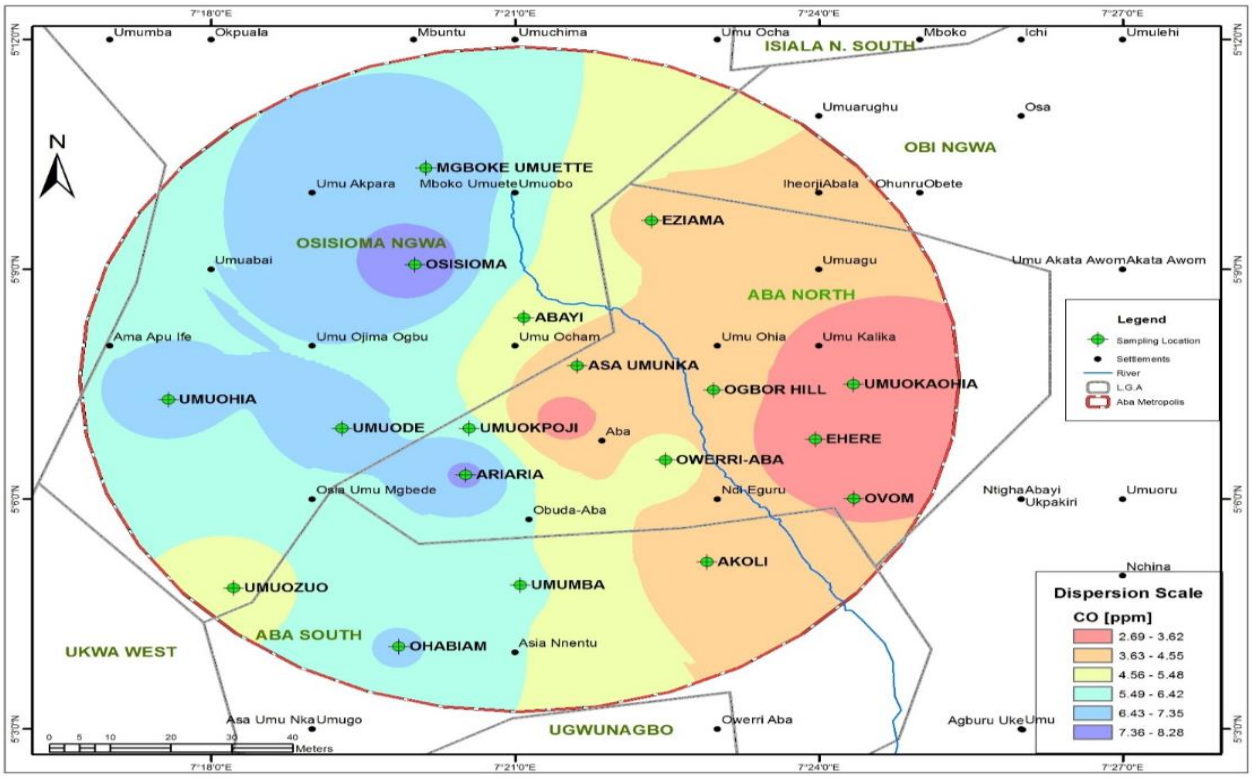

Figure 2: Spatial Dispersion Model of levels of CO (ppm) in Aba Metropolis during wet season

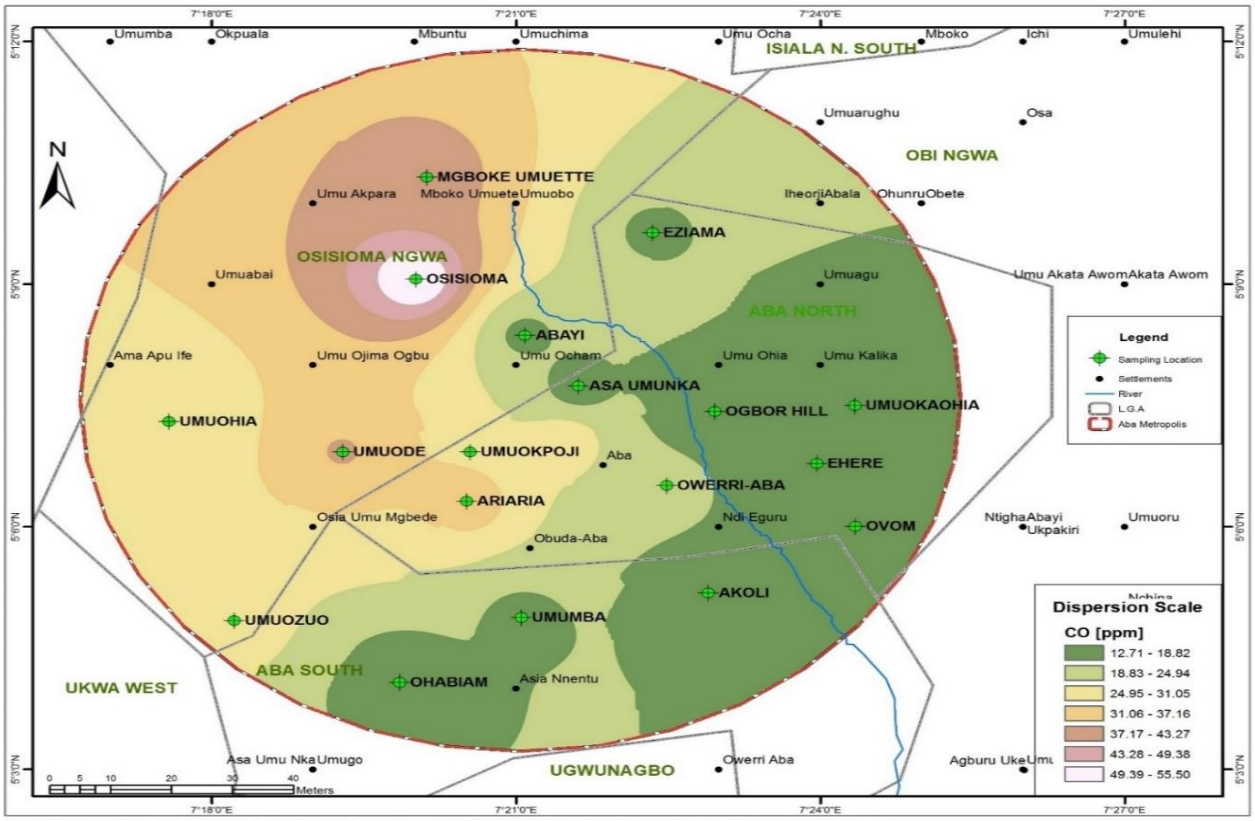

Figure 3: Spatial Dispersion Model of levels of CO (ppm) in Aba Metropolis during dry Season

Table 5: Result from Two-way ANOVA between Time and Season

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9323.044[a]	5	1864.609	25.340	.000	.554
Intercept	21976.374	1	21976.374	298.661	.000	.745
Time	172.202	2	86.101	1.170	.314	.022
Season	9059.973	1	9059.973	123.126	.000	.547
Time * Season	90.869	2	45.435	.617	.541	.012
Error	7505.466	102	73.583			
Total	38804.884	108				
Corrected Total	16828.510	107				

Source: Researcher's Analysis (2019). R Squared = .554 (Adjusted R Squared = .532)

Two-way ANOVA was adopted to test the hypothesis of no significant difference in the levels of CO in the study area, using two factors (independent variables) of the time of the day and seasons of the year. Tables 5 show the results of the analysis. The result revealed the F-calculated value of 123.126 with the probability value of 0.000 ($P<0.05$) for season, implying that there was a significant difference in the level of carbon monoxide on seasonal basis. Therefore, the seasonal variation in the level of carbon monoxide in Aba metropolis was significant. The dry season was observed to have the highest level of CO which was significantly higher than that recorded during wet season. On the other hand, time had F-value of 1.170 and the P-value of 0.314 ($P>0.05$), which mean that there was no significant difference in CO levels based on the time of the day. However, the interaction effect (the combine effect of time and season) shows an F-value of 0.617 with P-value of 0.541 ($P>0.05$) which indicates statistical insignificant effect.

Table 6: Result from Two-way ANOVA between Communities and season

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16394.494[a]	35	468.414	77.706	.000	.974
Intercept	21976.374	1	21976.374	3645.716	.000	.981
Communities	4444.156	17	261.421	43.368	.000	.911
Season	9059.973	1	9059.973	1502.982	.000	.954
Communities * Season	2890.365	17	170.021	28.205	.000	.869
Error	434.016	72	6.028			
Total	38804.884	108				
Corrected Total	16828.510	107				

Source: Researcher's Analysis (2019). R Squared = .974 (Adjusted R Squared = .962)

The result in Table 6 reveals the F-calculated value of 43.368 with the probability value of 0.000 which is lesser than 0.05 level of significant for the communities, implying that there is a significant variation in the levels of CO at community level. Similarly, the season factor had F-value of 1502.982 and the probability value of 0.000 which is lesser than 0.05 level of significant, implying that the level of CO differs significantly based on season. However, the interaction (combine effect of communities and season) shows F-value of 28.205 and P-value of 0.000 which again is below 0.05 level of significant, and thus indicates that there is a significant variation in the level of CO on the basis of season and community interaction.

Environmental Implications of the observed CO emission level in the study area:

With the aid of Air Quality Index (AQI), the environmental implication of CO emission levels in all the sampled communities during wet and dry seasons was assessed as shown in Tables 7 and 8

Table 7: Interpretations of the AQI values classification

Index Values	AQI Category	AQI Rating	CO (ppm)
0 -- 50	Good	A	0 -- 4.4
51 -- 100	Moderate	B	4.5 --9.4
101 -- 150	Unhealthy for sensitive groups	C	9.5 -- 12.4
151 -- 200	Unhealthy	D	12.5 -- 15.4
201 -- 300	Very unhealthy	E	15.5 -- 30.4
301 -- 500	Hazardous	F	30.5--50.4

Source: USEPA (2003).

Table 8: AQI result for samples in Aba Metropolis for wet and dry seasons

	Wet season					Dry season				
Communities	**Morning**	**Afternoon**	**Evening**	**Mean CO values**	**Mean AQI Category**	**Morning**	**Afternoon**	**Evening**	**Mean CO values**	**Mean AQI Category**
Umuokaohia	1.41	3.56	3.38	2.78	Good	9.86	14.69	15.22	13.25	Unhealthy
Ovom	1.07	5.27	4.50	3.61	Good	15.52	13.40	16.03	14.98	Unhealthy
Ogbor Hill	1.27	5.20	5.07	3.85	Good	13.58	12.33	13.49	13.13	Unhealthy
Ehere	1.50	3.40	3.18	2.69	Good	13.52	10.87	13.74	12.71	Unhealthy
Umuokpoji	1.43	4.16	3.68	3.09	Good	28.78	28.22	29.71	28.90	Very unhealthy
Eziama	1.45	6.28	5.16	4.29	Good	15.68	19.75	18.05	17.82	Very unhealthy
Asa Umunka	1.12	5.29	4.61	3.67	Good	15.93	14.06	17.02	15.67	Unhealthy
Umumba	1.30	8.08	7.31	5.56	Moderate	14.59	18.98	19.12	17.56	Very unhealthy
Ariaria	1.38	12.17	9.10	7.55	Moderate	31.09	31.91	30.82	34.27	Hazardous
Umuode	1.30	10.75	8.21	6.75	Moderate	36.32	37.76	38.74	37.60	Hazardous
Umuohia	3.33	8.83	7.43	6.53	Moderate	23.06	24.29	27.88	25.07	Very unhealthy
Osisioma	4.43	11.20	9.21	8.28	Moderate	57.77	55.96	52.83	55.52	Hazardous
MgbokoUmuette	4.79	7.93	6.86	7.19	Moderate	41.60	40.27	39.08	40.31	Hazardous
Umuozuo	2.58	6.74	5.69	5.00	Moderate	27.12	27.10	25.98	26.73	Very unhealthy
Abayi	2.47	7.10	6.51	5.36	Moderate	17.22	17.02	17.63	17.29	Very unhealthy
Owerre-Aba	3.57	6.13	5.37	5.02	Moderate	20.64	20.89	22.63	21.38	Very unhealthy
Akoli	2.19	5.50	4.69	4.12	Good	14.32	15.76	16.22	15.43	Unhealthy
Ohabiam	2.42	9.10	8.05	6.52	Moderate	13.67	13.90	14.27	13.95	Unhealthy

Source: Researcher's Computation (2019).

The air quality in Aba metropolis can be justified to be very unhealthy and hazardous for the people living within the vicinity under study. Air quality index values were used to classify each of the CO levels measured in different communities as shown in Tables 7 and 8. It was observed that the mean air quality category falls between "good" and "moderate" for wet season and between "unhealthy" and "hazardous" for dry season. An overall comparison of the air quality for both seasons indicated that the air quality during the wet season was relatively better compared to the dry season. This implies that during the wet season, the atmosphere is bound to be humid and saturated with water vapour, hence a substantial quantity of the pollutants would have been absorbed in the atmosphere unlike in the dry season where the atmosphere is dry and pollutants roam freely in the atmosphere. The implication is that those living or managing to survive in those areas are vulnerable to serious health risks.

Meteorological Factors Influencing Carbon Monoxide in wet and dry Seasons

Table 9 shows the mean of CO and meteorological parameters taken at different communities in Aba metropolis during wet and dry seasons.

Table 9: Mean value of CO levels and meteorological parameters in Aba metropolis during the Wet and Dry Season

Communities	**Mean CO and Meteorological values for Wet Season**						**Mean CO and Meteorological values for Dry Season**					
	CO	**Temp**	**RH**	**Pressure**	**WD**	**WS**	**CO**	**Temp**	**RH**	**Pressure**	**WD**	**WS**
Umuokaohia	2.78	28.8	73.3	1013.2	29.1	1.88	13.25	30.0	70.3	1019.2	45.1	4.68
Ovom	3.61	28.7	73.0	1012.2	231.3	1.12	14.98	30.0	70.3	1018.6	259.3	4.27
Ogbor Hill	3.84	28.9	72.3	1012.1	126.8	1.44	13.13	30.4	70.2	1018.7	144.8	3.88
Ehere	2.69	29.1	72.3	1011.5	135.6	1.14	12.71	30.9	70.8	1017.5	147	4.11
Umuokpoji	3.09	29.1	72.0	1111.2	157.1	1.22	28.90	30.6	70.6	1185.2	162.5	3.75
Eziama	4.29	29.3	71.6	1111.4	152	1.35	17.82	30.4	70.1	1138.5	162.8	3.81
Asa Umunka	3.67	29.2	72.0	1012.7	216.5	1.24	15.67	30.7	70.8	1018.3	228.3	4.04
Umumba	5.56	29.6	71.8	1012.8	310.6	0.92	17.56	30.8	70.4	1018.0	318.6	3.53
Ariaria	7.55	29.8	70.3	1011.8	233.3	1.07	34.27	30.8	69.7	1018.1	256	3.68
Umuode	6.75	29.7	71.3	1011.9	302.6	1.35	37.60	31.1	70.4	1017.3	315.6	4.41
Umuohia	6.53	29.2	70.7	1011.9	206.1	1.31	25.07	31.2	69.9	1017.2	224	3.78
Osisioma	8.28	29.3	70.9	1011.9	226	1.52	55.52	31.2	69.5	1018.2	247.6	4.42
Mgboko Umuette	7.19	29.5	70.6	1012.3	217.8	1.13	40.31	30.8	70.0	1018.7	229.8	4.27
Umuozuo	5.00	29.5	69.8	1011.9	206.8	0.86	26.73	30.8	69.2	1018.4	227.3	3.82
Abayi	5.36	29.5	69.3	1011.3	263.3	0.75	17.29	30.5	68.7	1017.5	284.6	3.59
Owerre-Aba	5.02	29.4	69.8	1011.3	215.5	1.24	21.38	30.5	69.1	1017.6	221.5	4.03
Akoli	4.12	29.6	69.2	1011.4	246.6	1.54	15.43	30.7	68.6	1017.4	262.8	3.87
Ohabiam	6.52	29.5	69.2	1011.4	326.8	0.94	13.95	30.9	69.9	1017.6	351.5	3.89

Source: Researchers' computation/ Field Survey 2019

Pearson correlation was carried out between CO and meteorological parameters as shown in Table 10 (Wet season) and Table 11 (Dry season). Table 10 shows that there was a significant positive correlation between CO and temperature ($r = 0.652$, $p=0.003$) and wind direction ($r = 0.603$, $p=0.008$) where there existed a

negative correlation between CO and the remaining three meteorological parameters such as relative humidity (r = -0.539, p=0.021), pressure (r = -0.302, p=0.223) and wind speed (r = -0.224, p=0.373). There existed a significant negative correlation between temperature and three other meteorological parameters namely relative humidity (r = -0.746, p=0.000), pressure (r = -0.144, p=0.570) and wind speed (r = -0.421, p=0.082) while temperature correlates positively with wind direction (r = 0.686, p=0.002).The finding is in line with Weli and Adegoke (2016), which stated that the correlation matrix shows that both rainfall and wind speed correlated inversely with CO during the wet season, but air temperature and relative humidity correlated directly with CO. During dry season, there was a significant positive correlation between CO and temperature (r =0.573, p = 0.013) whereas there existed a negative correlation between CO and the remaining four meteorological parameters namely: relative humidity (r = -0.123, p=0.626), pressure (r=-0.025, p=0.920), wind direction (r= 0.215, p=0.392) and wind speed (r=0.267, p=0.283). There was a significant negative correlation between temperature and three other meteorological parameters namely relative humidity (r= -0.058, p=0.820), pressure (r = -0.181, p=0.473) and wind speed (r = -0.152, p=0.548) whereby temperature positively correlates with wind direction (r = 0.484, p=0.042). These finding is in line with Godson and Olusola (2015), study which established that significant positive correlation exist between CO and temperature.

Table 10: Correlation matrix between CO and meteorological parameters in Wet season

Correlations		CO	Temp	RH	Pressure	WD	WS
CO	Pearson Correlation	1	**.652****	**-.539***	-.302	**.603****	-.224
	Sig. (2-tailed)		.003	.021	.223	.008	.373
	Covariance	2.957	.347	-1.204	-16.704	75.148	-.106
	N	18	18	18	18	18	18

**. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed).

Table 11: Correlation matrix between CO and meteorological parameters in Dry season

Correlations		CO	Temp	RH	Pressure	WD	WS
CO	Pearson Correlation	1	**.573***	-.123	.025	.215	.267
	Sig. (2-tailed)		.013	.626	.920	.392	.283
	Covariance	140.850	2.348	-.972	14.219	188.696	.998
	N	18	18	18	18	18	18

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

Conclusion and Recommendation

Based on the findings, it is important to conclude that the levels of CO in some communities in Aba metropolis were above Air quality index (AQI) limits set by NESREA, WHO and USEPA. This implies that, ambient air quality within Aba metropolis is poor due to high usage of power generating plants, abattoir, vehicular and other human activities. Hence, the continuous release of the carbon monoxide gas into the atmospheric environment is not circumvented. The level of this poisonous gas in certain communities of the study area exceeded threshold standards and thus could have negative impact on the health of the inhabitants. There is need to eliminate all the factors that are responsible for high levels of CO in Aba metropolis in order to make living more sustainable. It is recommended that policies on CO emission be put in place not only in Aba, but in other major urban centres. There is need to isolate communities with higher CO levels as flash points for health intervention measures.

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SPATIAL VARIATION IN THE LEVEL OF CONCENTRATION OF VEHICULAR AIR POLLUTANTS WITHIN OWERRI URBAN, IMO STATE, NIGERIA

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Abstract
This study investigated the levels of traffic related air pollutants concentration on the air quality in Owerri urban. The Gasman automatic sampler (Mx6 model) Emission Analyzer and particulate monitor was used to measure the concentration of Carbon monoxide (CO), Carbon dioxide (CO_2), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Solid Particulate Matter (SPM) for five days in six districts of 18 sampled location points. When the results for the air pollution levels were considered separately, SO_2, NO_2, and SPM pollutants had significantly higher values and above the NAAQ and WHO standards in the main town district than the other districts. The urban environmental implications of these pollutants concentration in the study area were considered which include risk to human health, fading, flaking and deterioration of the paints of buildings and corrosion of roofing sheets. Based on the findings, it is recommended that, there is need for improvement in mass transportation system to reduce increased consumption of fuel, traffic congestion and pollution. Secondly, the Government should encourage improvement in the traffic flow through proper maintenance of roads, updated traffic regulations, and strict enforcement of prescribed standards. Also, the use of vehicle Emission Control Technologies in reducing emission of pollutants should be encouraged.
Key words: Spatial, Variation, Urban, Air, Pollutant

Introduction

Air is a universal gas, without which existence of humans and other forms of life is not possible. Air quality is very essential to sustain life. Air pollution is generally the widest spread and obvious kind of urban environmental damage. According to the United States Environmental Protection Agency (USEPA), about 147million metric tons of air pollutants (excluding carbon dioxide and wind-blown soil) are released by human activities into the atmosphere each year in the United States (CEC, 1992). Total world emissions of these pollutants are around 2 billion metric tons per year (CEC, 1992). Air pollution due to human activities is an abuse to the urban environment thereby degrading air quality. Air pollutants associated with traffic-related emissions such as Nitrogen Oxides (NO_x), Carbon Monoxide (CO) and Particulates Matter (PM) have been recognized to have significant effect on human health (CEC, 1992; Ghbrani-Azam *et al*, 2016). Evidence abound suggesting casual association between elevated PM and mortality, due to air pollution problems have been well documented in Europe and United States with motor vehicles being the main contributors (CEC, 1992). In UK, the average concentration of NO_x was found to increase by 35% from 1986 to 1991 due to increase in vehicular emission (CEC, 1992).

Indeed, motor vehicles produced more air pollution than any other single human activity in urban areas (CEC, 1992). Nearly 50% of global CO, hydrocarbon and NO_x emissions from fossil fuel combustion come from gasoline and diesel-powered engines. In the city centres, especially on highly congested streets, traffic can be responsible for as much as 90-95% of the ambient CO levels, 80-90% of the NO_x and hydrocarbons, and a large portion of the particulates, posing a significant threat to human health and natural resources (Savile, 1993; Rumana *et al*, 2014).

Research Problem

The increasing rate of urbanisation is having a corresponding increase in vehicular transportation in most urban centres in Nigeria. The city of Owerri, the capital of Imo State like other capital cities in Nigeria has witnessed rising influx of second-hand motor vehicles which have brought social-economic problems like traffic congestions, increased emission, and air pollution.

The most worrisome aspect is that physical structures along traffic congested roads are fast fading and deteriorating due to oxidation coming from air pollution (Bhatia, 2006). Also, there are perceived associated health challenges of residents leaving along these routes. Acidic precipitation as a result of air pollution is causing degradation of metal works, and rapid corrosion of roofing sheets. In the light of the above, the ambient air quality of the entire Owerri urban area seems to have been affected as a result of vehicular

emission of public interest. Hence, the study is to assess the effects of vehicular emission on the air quality in Owerri urban area of Imo State and its implication on urban environment management.

The Study Area

Owerri urban is located between latitudes 5º30′ and 5º36′ North of the Equator and longitudes 7º00′ and 7º12′ East of the Greenwich meridian. It is bounded on the North by Amakohia, on the North-east by Uratta, on the East by Egbu, on the South-east by Naze, on the South by Nekede and on the North-west by Irete (Ministry of Information, Owerri, 2012) as shown in Figure 1. Owerri urban covers the following areas: World Bank, Ikenegbu, Aladinma, Prefab Housing Estate, New Owerri Industrial Layout, Nekede, Mechanic village, Shell camp and Works layout. This research covered all those major road intersections within Owerri capital city which are prone to vehicular congestion. Consequently, all major road intersections and roundabouts were covered in the study area. Figure 1 is the map of Imo State showing the study area. The status of Owerri as the capital of Imo State has increased its physical and economic growth. The most noticeable of the physical expansion of the city is its population growth and urban landmass. Many business and investment opportunities exist in the city because of its vantage position as the epicentre of all economic, social and religious activities in the state (Ministry of Information, Owerri Municipal, 2012). These activities have equally increased the number of vehicles and travel volume in the city as people travel from their homes to their business places.

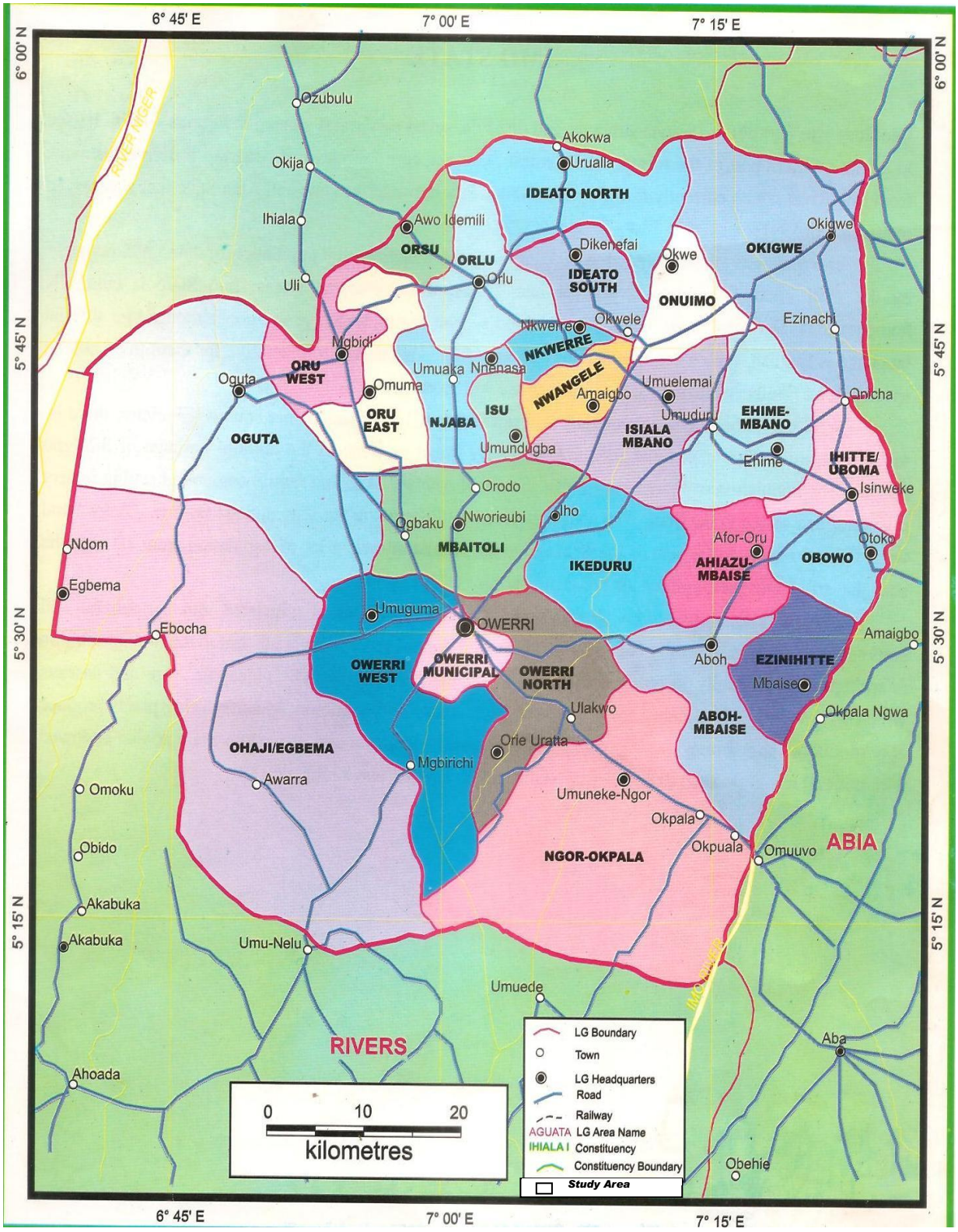

Figure1: Owerri Urban Area on the Map of Imo State
Source: Ministry of Information, Owerri, (2012)

Literature Review

Air Pollutants Associated with Vehicular Emission

Air pollutants are chemicals, particulate matter, or biological materials (both man-made and natural) that cause harm or discomfort to humans, other living organisms and damage to the built environment. The

presence of these gaseous and particulate contaminants in the atmosphere in quantities and duration more than acceptable levels could be injurious to human, plant and animal life; and property (Garg and Garg, 1996; Odigure, 1998; Anderson, 2005). Indoor air pollution and urban air quality were listed as two of the world's worst pollutions of human environment in the 2005 Blacksmith Institute World's Worst Polluted Places Report (Anderson, 2005).

The anthropogenic or primary pollutants contained in the atmosphere are: Carbon monoxide (CO), Oxides of sulphur (SO_X), Oxides of Nitrogen (NO_X), Lead (Pb), Hydrocarbons (HCs) like alkanes, alkenes, alkynes and aromatic hydrocarbon, some of which are carcinogenic. Allergic agents like pollens and spores; and radioactive substances. Others are hydrogen sulphide (H_2S), Hydrogen fluoride (HF) and other fluorides and methyl mercaptans (Anderson, 2005). These primary pollutants often react with one another or with water vapour, aided and abated by the sunlight, to form entirely new set of pollutants, called secondary pollutants. These new pollutants are often more harmful than the original basic chemicals that produce them. They include: Ozone (O_3), Sulpuric acid (H_2SO_4), Formaldehydes, Peroxy-acyl-nitrate (PAN) (Anderson, 2005).
Combustion of fuel (coal and oil) in automobile, ships, rail engines and air craft produces CO, smoke, particulate matter, hydrocarbon, lead, NO_x and many others (Vesilind, 1993).

Spatial Variation of Vehicular Air Pollutants

The concentration of air pollutants vary spatially causing the air pollution pattern to change with different locations due to changes in meteorological and topographical condition (Sengupta, 2003). The spatial variation in air pollution concentration is hinged on the space variation of source as well as atmospheric gradients which results in diffusion and transportation to areas outside the source of air pollution (Ogba and Utang, 2009).

Traffic related pollution shows marked differences in concentration at different distances from the road. These differences are a function of the physical and chemical properties of the pollutants, as well as external factors relating to meteorology. Therefore, traffic related pollution, especially Ultrafine Particles (UFPs) are characterized for having strong spatial gradients across urban areas. This is because they help to estimate exposure in unmonitored settings (Levy *et al.*, 2003). Many studies have been conducted to measure these gradients at different locations or to evaluate conditions at certain "hot spot" microenvironments. One way to assess the spatial profiles of traffic-related pollution is through direct measurements conducted from a mobile platform along roadway segments. This approach is useful in identifying multiple trouble areas within an urban area. Westerdahl *et al*. (2005) utilized a non-fossil fuel-powered vehicle equipped with specialized instrumentation to continuously measure UFPs, CO, PM, and NO_2 along a California freeway as well as some residential neighbourhoods. The research revealed that UFP and NO_2 concentration were up to 20 times higher along the freeway route than at the residential area, with the values increasing sharply in the presence of diesel trucks. On the other hand, PM showed little variation across the driven area.

Levy *et al*, (2003) measured UFPs and PM as well as traffic volume at nine roadside locations in suburb of Boston, Massachusetts. They observed substantial variation in UFPs across the sites with the pollutant correlated well against each other. Conversely, PM measurements showed less spatial variation across site and little correlation with other pollutants.

Similarly, in a study of New York, Patel *et al.* (2009) PM measurement at three urban high schools located within 50 metres of varying density roadways was conducted. In addition, they conducted measurements at two high schools located in suburban areas. No significant differences in PM concentrations were found among the concentration in suburban schools, whereas concentrations were 2-3 times higher at the urban schools compared to the suburban schools.

As literature search indicates, traffic-related pollution varies considerably from location to location in an urban setting. Therefore, the importance of assessing pollution levels at these microenvironments is essential to get a true estimate of potential exposure to people spending a significant amount of time in close proximity to roadways (Levy *et al.*, 2003).

Concentration of Vehicular Air Pollutants and Safety Standards

A comparative study of emission levels in Lagos and the Niger Delta (Port Harcourt and Warri) area was reported by Jerome (2000). The results obtained showed that the concentrations of TSP, NO_2, SO_2, and CO in

Lagos and the Niger Delta cities were above the FEDPA recommended limits. The CO levels for Lagos (10-250ppm) were higher than the levels of 5.0 – 61.0ppm and 1.0 – 52ppm recorded in the Port Harcourt and Warri respectively. The TSP concentrations were also high for both locations when compared to WHO standard. A similar traffic related emission study was carried out in Calabar, and the results indicated that the overall value of each pollutant was found to be in the following range: CO: 5.0 – 6.1ppm, NO_2: 0 – 0.05ppm, PM: 202 – 230µg/m^3 (Jerome, 2000).

The Effects of Air Pollution on Structures (Buildings and Monuments)

In cities throughout the world, some of the oldest and most glorious buildings and works of art are being destroyed by air pollution. The Parthenon in Athens, the Taj Mahal in Agra, the Colosseum in Rome, Frescoes and statues in Florence, Medieval Cathedrals in Europe, and the Lincoln Memorial and Washington Monument in Washington D.C, are slowly dissolving and flaking away because of acidic fumes in the air. Medieval stained glass windows in Cologne's gothic Cathedral are so porous from etching by atmospheric acids that pigments disappear and the glass literally crumbles away (Cunningham, 2005).

In Nigeria, air pollution damages ordinary buildings and structures. Corroding steel in reinforced concrete weakens buildings, roads and bridges. Paints and rubber deteriorate due to oxidization. Limestone, marble and some kinds of sandstone flake and crumble. The presence of acidified rain water in the environment increases the corrosion rate of roofing sheets, monuments, and other economic structures. In the Niger Delta area, there is glaring evidence of the impacts of corrosion on several building structures and art works and these cases have been observed to deteriorate at rather alarming rates (Awosika and Foluronsho, 2006).

Research Method

Empirical design was adopted in this study. Field measurements and observations were made to determine the level of pollution of the locations sampled. The Gasman automatic sampler (Mx6 model) Emission Analyzer and particulate monitor was used to measure the concentration of Carbon monoxide (CO), Carbon dioxide (CO_2), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Solid Particulate Matter (SPM) for five days in six districts of 18 sampled location points. The instrument traps air samples, analyses and produces results automatically. The population of study comprised 40 traffic flash points identified mostly along the major road intersections. The study area was divided into 6 districts of which 3 sampled points were picked from each. The purposive sampling method was used to select 18 traffic flash points among the 40 traffic points. The justification for this choice is that intersections along major roads are perceived to experience high traffic and are liable to generate more pollutants. Table 1 shows the indices measured at the traffic points while Table 2 presents the 18 selected traffic flash points. The road network and sampled locations are shown in Figure 2. Data were collected at the selected locations between 4.00 and 6.00pm (evening peak period) for five (Monday to Friday) working days of the week. The mean value for each location was calculated to determine the level of pollution.

Table 1: List of Indices

S/N	Indices	Definition	Units of Measurement
1	Nitrogen dioxide (NO_2)	This is a colourless, odourless, tasteless, relatively toxic and corrosive gas having a characteristics yellow colour	Ppm
2	Carbon monoxide (CO)	This is a colourless, odourless, tasteless gas that is slightly lighter than air.	Ppm
3	Sulphur dioxide (SO2)	This is a colourless gas formed primarily during the combustion of a sulphur containing fuel or sulphur containing industrial waste gases.	Ppm
4	Suspended Particulate Matter (SPM)	This is used to describe a mixture of solid particles and liquid droplets in air that varies in size, shape and density.	Ppm
5	Carbon dioxide (CO2)	This is a colourless, odourless, tasteless gas that is slightly lighter than air.	Ppm

Source: Researchers' field work (2020)

Table 2: The 18 sampled traffic flash points in Owerri urban

District	Sampled Point	Street/Road
A	SPA 1	Mcc Road by wethedreal road
Lkenegbu	SPA 2	Cherubim junction by Ikenegbu
	SPA 3	Govt house round about junction
B	SP B1	Lake Nwaebere street
Aladinma	SP B2	Mbano street by Aladinma mall
	SP B3	Nysc sectarian junction by mcc road
C	SPC1	Assumption round about by Onitsha road
World bank Area	SPC2	House of Assembly/state senate road
	SPC3	World bank market round about
D	SPD1	Emmanuel college round about by Aba
Main Town	SPD2	St Paul/old market road junction
	SPD3	Fire service junction by Mbaise road
E	SPE1	Amakohia Egbeada junction
Amakohia	SPE2	Akwakwuma round about junction
Shell camp	SPE3	Warehouse junction by bank road
F	SPF1	IMSU junction by Okigwe road
Work layout Orji	SPF2	Amawire flyoren junction
	SPF3	Hardel junction by Umudaju road

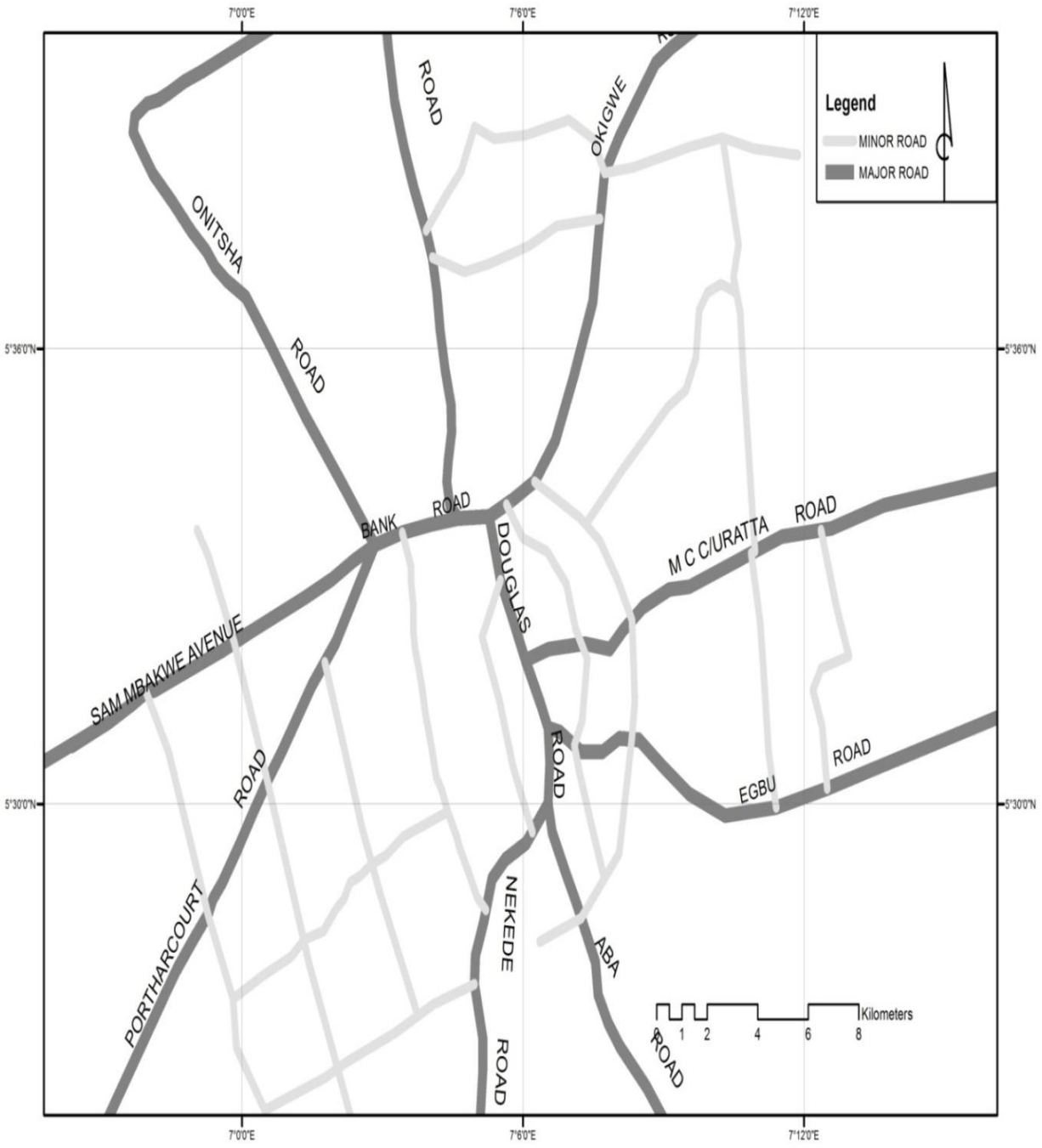

Figure 2: Spatial distribution of sampled points in Owerri urban
Source: Researchers' field work (2020)

Data Presentation, Analysis and Discussion

Mean Concentration of Pollutants at the District Level

Table 3 presents data on the comparative mean concentration of pollutants at the district level vis-a-vis WHO and NAAQS standards.

Table 3 Comparison of Mean Concentrations of Pollutants at the District Levels

Variables	Districts	Mean Concentration (ppm)	Nigerian Ambient Air Quality Standards	World Health Organisation (WHO)
CO_2	Ikenegbu District	12.80	6000	5000
	Aladinma District	11.13	6000	5000
	World Bank Area	13.50	6000	5000
	Main Town	13.88	6000	5000
	Amakohia Shell Camp	13.29	6000	5000
	Work Layout Orji	12.37	6000	5000
CO	Ikenegbu District	9.93	10 – 20	35
	Aladinma District	7.2	10 – 20	35
	World Bank Area	4.5	10 – 20	35
	Main Town	11.56	10 – 20	35
	Amakohia Shell Camp	3.41	10 – 20	35
	Work Layout Orji	3.03	10 – 20	35
SO_2	Ikenegbu District	1.399	0.01	0.03
	Aladinma District	0.651	0.01	0.03
	World Bank Area	1.086	0.01	0.03
	Main Town	1.584	0.01	0.03
	Amakohia Shell Camp	1.103	0.01	0.03
	Work Layout Orji	0.829	0.01	0.03
NO_2	Ikenegbu District	0.162	0.06	0.053
	Aladinma District	0.138	0.06	0.053
	World Bank Area	0.2	0.06	0.053
	Main Town	0.32	0.06	0.053
	Amakohia Shell Camp	0.111	0.06	0.053
	Work Layout Orji	0.079	0.06	0.053
SPM	Ikenegbu District	51.06	25	25
	Aladinma District	30.86	25	25
	World Bank Area	14.02	25	25
	Main Town	102.28	25	25
	Amakohia Shell Camp	29.47	25	25
	Work Layout Orji	15.72	25	25

Source: Researchers' Field Work (2020)

From the data collected across the 6 major districts in Owerri urban, 5 air pollutants were measured. These pollutants include Carbon dioxide (CO_2), Carbon monoxide (CO), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Suspended Particulate Matter (SPM). The result revealed that CO_2 in all the 6 district locations were between the range of 11.13ppm-13.88ppm which fall below the maximum natural concentration (600ppm) of carbon dioxide in fresh air and the recommended World Health Organization (WHO) Threshold Limit Value (TLV) of 5000ppm. This is safe for healthy living, for an 8-hour work day. The value of CO_2 concentration of 13.88ppm recorded at the Main town district was highest compared to other districts CO_2

concentration of 12.80ppm, 11.13pm, 13.50ppm, 13.29ppm, and 12.37ppm which were recorded at Ikenegbu, Aladinma, World Bank, Amakohia shell camp and Works layout Orji districts respectively.

Nigerian Ambient Air Quality Standard (NAAQS) stipulates a range of 10-20ppm for an 8-hourly average time of carbon monoxide (CO). The concentration of CO measured in all these six districts were below the NAAQS and these concentrations were as follows: 9.93ppm, 7.2ppm, 4.5ppm, 3.41ppm and 3.03ppm recorded at Ikenegbu, Aladinma, World Bank, Amakohia Shell camp and Works layout Orji district respectively, except for Main town district which has the highest concentration of 11.56ppm and falls within the NAAQS; but below the WHO limit.

Conversely, SO_2 concentration across the entire districts recorded 1.399ppm, 0.651ppm, 1.086ppm, 1.584ppm, 1.103ppm, 0.829ppm in Ikenegbu, Aladinma, World Bank area, Main town, Amakohia/Shell camp and Works layout Orji districts respectively. These SO_2 concentrations were above the NAAQS and WHO limits of 0.01ppm and 0.03ppm respectively. The highest concentration of 1.584 ppm was recorded at the Main town district.

Also, the mean concentration of NO_2 in all the district locations exceeded both the 24-hour limit of the NAAQS and WHO limits which are 0.06ppm and 0.053ppm respectively. Hence, the NO_2 concentration of 0.32ppm, 0.138ppm, 0.2ppm, 0.162ppm, 0.111ppm and 0.079ppm were recorded at Ikenegbu, Aladinma, World Bank area, Main town, Amakohia/Shell camp and Works layout Orji districts respectively. The highest NO_2 value of 0.162ppm was recorded at the Main town district.

The concentration of Suspended Particulate Matter (SPM) across the districts were found to be 51.06ppm, 30.86ppm, 102.28ppm and 29.47ppm at Ikenegbu, Aladinma, Main town, and Amakohia/Shell Camp districts respectively. These were above WHO limit of 25ppm. Whereas the values obtained for SPM at World Bank area and Works layout Orji districts were 14.02ppm and 15.72ppm respectively. These were below the WHO's guidelines and NAAQS of 25ppm limit for a 24-hour average. Therefore, from the above analyses, the results revealed that the Main town district of the urban centre was the most polluted district in the study area. The variations in the levels of concentration agree with the findings of Levy *et al.* (2003) in Boston, Massachusetts and Patel *et al.* (2009) in New York on the measurement of pollutants and particulate matter.

The Spatial Variation in the Level of Concentration of Vehicular Air Pollutants within Owerri Urban Area

Tables 3 also presents the spatial variation in the level of vehicular air pollution within Owerri urban. The results from the average emission evaluation of the pollutants across the 18 locations of the 6 districts in Owerri urban show that The highest value of CO_2 was found to be 13.88ppm at SPE1 (Amakohia, Egbeada Junction) of Amakohia shell camp district. The lowest value recorded across the sampled locations within Owerri urban centre was 11.13ppm SPF2 (Amawire Flyover Junction), Aladinma.

Carbon monoxide (CO) which is a major air vehicular pollutant with the highest mean value of 11.56ppm at SPD3 (Fire Service junction by Mbaise Road) of the Main town district. This location is one of the sites that experience high level of traffic activities as it serves as a last bus stop for taxies, tricycles, and most intra city buses. The mean values of 9.93ppm, 7.20ppm, and 4.5ppm at SPD1, SPD2 of the Main town district and SPD3 of Amakohia Shell camp districts respectively are below the NAAQS which stipulates a range of 10-20ppm for an 8 hourly average working time for CO and also below the WHO limit of 35ppm. Furthermore, the lowest value of CO recorded across the sampled locations was found to be 3.03ppm at Lake Nwaebere Street) of Aladinma district. This sampled location was drastically low in the concentration of CO because of its serene, quiet and less busy nature in terms of vehicular activities as one of the most quiet streets in Aladinma housing estate of Owerri urban centre.

For SO_2, the highest concentration value was, 1.584ppm at SPD1 (Emmanuel College Roundabout by Aba Road). The lowest concentration value of SO_2 was recorded as 0.651ppm, at SPD1 (Lake Nwaebere Street) of Aladinma district. These figures are higher than NAAQ and WHO standards of 0.01 and 0.03ppm respectively.

The highest concentration value of NO_2 across the sampled locations was 0.32ppm at SPD3 (Fire Service Junction by Mbaise Road) of the Main town district. The lowest concentration value of NO_2 was found to be 0.079pm, SPB1 (Lake Nwaebere Street) of Amakohia district. These mean values are above the NAAQ and WHO standards of 0.06 and 0.053ppm.

SPM has its highest concentration value of 102.28ppm SPB2 (Mbano Street by Aladinma Mall) Main town. The lowest value of SPM was recorded as 14.02ppm at SPE3 (Warehouse Junction by Bank Road) of World Bank district. The SPM mean values are higher than the NAAQ and WHO standards of 25 apiece. These results support the conclusions of Westerdahl *et al.* (2005) and Patel *et al.* (2009) who noted marked spatial differentials of levels of pollution between freeway routes and residential areas; and urban and suburban high schools in California respectively.

Conclusion

It is very obvious that the ambient air quality reduction, with respect to vehicular emission in Owerri urban was ascertained to be very high. This means that consideration has to be given to those unique challenges which the city is facing in tackling the problem of its urban vehicular air pollution. This study reveals that Owerri urban area is not safe from the threats of traffic related pollution. Hence, the air quality can be improved through a combination of technical (civil engineering measure), legislative reforms, institutional approaches and economic measures.

Urban Environmental Management Implications of Findings

The poor ambient air quality in the study area resulting from the presence of these pollutants may have contributed to a lot of urban environmental problems in the following ways:

(i) Health Implication: With the present situation in the study area, many people could be at high risk of health challenges associated with these vehicular air pollutants. For instance, SO_2 is known to cause deterioration in patients with pulmonary disease. Eye and nasal irritations are the common problem caused by NO_2. High concentration SPM poses health hazards to humans particularly those susceptible to respiratory illness.

(ii) Structures, Buildings and Monuments: The effect of these traffic related pollutants may have resulted in the damage of buildings and structures visibly seen in Owerri urban. There is the corroding of steel in reinforced concrete which weakens buildings, roads and bridges. The paint of buildings may have deteriorated due to oxidation of these pollutants in the study area. The corrosion rate of roofing sheets have increased as a result of the presence of acidified rain water in the study area.

Recommendations

As a result of the clear negative effects of vehicular emission which could have both environmental and health hazards in Owerri urban, the following recommendations are made:

i. There is need for the government to embark on a regular assessment of the actual level of pollution by these air pollutants through her appropriate agencies. The use of Vehicle Emission Control Technologies which have been useful in reducing emission of pollutants and thereby creating a positive impact on the environment should be enforced.
ii. The study showed significant spatial variations in the level of vehicular air pollutants concentration. This therefore calls for an improvement in traffic flow through proper maintenance of inner city roads to reduce the number of vehicles at major intersection, as this will help reduce the concentration of pollutants in a particular area in the urban centre.

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CONSTRUCTION MANAGER`S SKILLS FOR EFFECTIVE PERFORMANCE AT PROJECT IMPLEMENTATION PHASE IN UYO, NIGERIA

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Abstract
Construction team`s skill is a sine qua non for effective project performance particularly at implementation phase of construction project. This study examined critical skills prerequisite for effective performance of construction manager at implementation phase of construction project in Uyo, Nigeria. Data collection instrument used was structured questionnaire administered on a sample of 153 professionals involved in building construction projects in the study area. The professionals comprised; 47 architects, 13 builders, 64 engineers, and 29 quantity surveyors. Data collected were analysed using descriptive and inferential statistics. The findings of the study revealed a number of skills including interpersonal, monitoring and control, teamwork, contract administration and professional as very crucial for effective performance of construction manager at implementation phase. Further assessment of the data collected confirmed the earlier results through factor analysis which emerged with five major groups of factors. The factors are: professional collaboration management skill, communication skill, people skill, contract administration skill, and interpersonal skill. The critical skills for enhancing construction manager`s performance at implementation phase are technical and non-technical in nature; as such, consistent training within and outside the industry in ensuring global practices is panacea for effective project delivery. The study provides implications for the assessment of critical skills for improving on project performance at implementation phase particularly to the construction managers.

Key words: Construction project, construction manager, critical skill, implementation phase, project performance.

Introduction

Performance in construction is often measured by the extent of keeping the project within allocated budget, time, scope and meeting the required technical standards for quality, operations, functionality, safety and environment protection (Flanagan and Norman, 2003). Project performance encompasses all efforts at ensuring that organizations maximize profitability and minimize the consequences of risk and uncertainty events in terms of achieving the project's objectives (Kululanga and Kuotcha 2010). The initiatives in the modern day construction projects are expected to focus on sustaining the present and future needs of stakeholders. Sustainable development according to Brundtland (1987) is a development that meets the needs of the present without compromising the ability of the future generations to meet their needs. This drive is entrenched in the Agenda 21 for sustainable construction in development countries which puts construction at the centre of how the future is to be shaped, and the sustainability of this future (Du Plessis, 2002). Responding to this, the project management literature reveals that the current trend of measuring project performance has gone beyond the traditional indicators with stakeholders` satisfaction considered as paramount in any project (Bronius et al. 2013). The mismatch and lack of agreement among the professionals on what constitutes the performance measures have contributed to poor performance of construction projects in the recent past. Previous studies showed that project performance in the construction industry has not improved significantly in several countries particularly, in the developing countries (Makulwasawatudom et al. 2003; Mutijwaa and Rwelamila 2007; Tripathi and Jha, 2018; Mengistu and Mahesh, 2020; Adu and Opawole, 2020).

Problems of poor performance are caused by many factors. Ejaz et al. (2013) opined that many projects that failed to deliver are attributed to project management related problems. Management problems in most projects are conceived right from conceptual stage but only to become obvious at implementation phase (Aibinu and Odeyinka 2006). Similar studies attributed problems militating against the achievement of desired

effect on construction project of any country to project execution (implementation) challenges (Gyandu – Asiedu 2009). This may not be unconnected to unexpected changes in design and project scope that arise at execution stage which resulted to a lot of cost and time performance issues (Chan and Kumaraswamy 1996). These unexpected changes overwhelmingly caused by factors within and outside the project domain undoubtedly pose a major challenge to the construction project manager and his team during implementation. Challenges of this nature and drive towards achieving project set objectives make project implementation phase critical in the project life cycle. Construction project manager`s role at this phase is very crucial in achieving success. They are responsible for implementing the processes necessary for the achievement of desired project outcomes within specific time and budget constraints of the project (Donald et al. 2020). In addition, they are accountable to stakeholders for project outcomes and in many cases, they assume the role of a facilitator between groups of stakeholders.

Consequently, the success of a project depends on construction project manager`s personal skill set and specifically their people management skills, in addition to their expertise in the technical elements of their roles (Gareis and Huemann 2000). In other words, highly skilled and experienced construction project manager is required for effective delivery of such project especially in a challenged project environment. In view of this, Hwang and Ng (2013) argued that to manage projects professionally and successfully, a project manager needs to possess the required knowledge and skills. This is very crucial as project organizations are now focusing on ensuring that project managers acquire the core competencies required to be successful in their projects (Khamaksorn 2016). This may be consequential to the poor delivery of construction projects blamed on the lack of required skills of client's project manager, and of the design team and subcontractors (Lee et al. 2015). Nwachukwu (2008) in the same vein observedthat in many projects especially in the public sector there is a lack of professional and technical skills, which has led to poor project quality. Studies further showed that organization failure in recent time is as a result of lack of proper skills among the managers to handle the diverse needs of the external as well as the internal environment within an organization (EL-Annan 2015). Ali (2010) and Othman (2013) also reported that adoption of project management skills in construction is very low in developing countries including Nigeria.

The forgoing emphasized critical nature of project management skills to construction business and more importantly, the consequences of lack of the skills on project delivery. Consequently, this subject has generated a lot of interest in research in the academic world on the required skills for construction project managers in order to achieve the triple constraint of bringing projects to completion according to budget, schedule and technical specifications as well as stakeholders` satisfaction. Previous studies have attempted to identify the needed skills in an effort to achieve project objectives. To this end, Hwang and Ng (2013) studied project management knowledge and skills for overcoming challenges of green construction. The study identified analytical, decision-making, team working, delegation, and problem-solving skills as the most important skills that are required to mitigate the challenges. Devi (2013) investigated the role of project manager in improving projects performance. In the study, the author identified four competency skills for project management in order to meet the objectives of modern projects which include management knowledge, technical knowledge, business knowledge, and human knowledge skill. Mouchi et al. (2011) carried out a study on the skill sets required for managing complex construction projects. The study concluded that specific skill sets for success on complex projects are evolved from knowledge gained from exposure to a wide range of projects. The result of the study further emphasized on experience but the importance of academic training and programmes which are fundamental to acquisition of such skills were not given much priority. Observation from the aforementioned indicates that the studies were generalized on the required skills by construction project manager without particular emphasis on any phase. Based on the need to minimize the challenges at implementation phase with an effort to achieve project objectives; this study examines critical skills for enhancing the performance of construction manager particularly in this phase. This study adds to existing knowledge by providing insights into the required skills for construction managers in the building construction industry.

Project Management Practices in the Construction Industry

Project management has transcended to different fields of endeavour including construction as a result of its importance in achieving organisational goals and objectives. Management of construction is unique and complex in nature. It is unique in the sense that it has its own set of stakeholders with unique environment and

it is both different and separate from the manner in which more routine, process driven work is performed (Kerzner 2003). Its complex nature can be attributed to project execution process which in most instances involves widely dispersed project participants all gathered to achieve a specific task under the influence of rapid technological challenges characterized by uncertainties in a dynamic project environment. Also worth mentioning is the demand for large capital investments which calls for tighter schedules, stringent quality standards and probable escalating cost which add to the complex situation of construction project management. Hence, management of construction projects is inherently risky compared to other industries like manufacturing and agriculture (Adaralegbe et al., 2020). Interestingly, research on project management knowledge and skills to handle some of these complications are limited. Studies relating to effectively manage the project and delivering them based on the set objectives and to the stakeholders` satisfaction are also pointing to more problems. Furtherance to this, construction project manager must be certified in the knowledge of project management which is defined as the discipline of initiating, planning, executing, monitoring and controlling, and closing the work of a team to achieve specific goals and meet specific success criteria (Achara, 2016). Project management Institute (2008) gave a broad definition of project management as "the application of knowledge, skills, tools, and technique to project activities to meet project requirements" and characterises "high quality projects as those that deliver the required product, service, or result, within scope, on time, and within budget." Its objective centres on application of skills and techniques to achieve organizational goals and to optimize the use of resources to produce a well-designed and soundly constructed facility which meets client's requirements (Devi, 2013).

Ealier studies have shown a distinction between project manager and construction manager as well as their roles when engaged in a construction project. The project manager in most projects takes leadership position; lead the project team, and ultimately ensuring the project ends in success. In other words, project managers are responsible for the overall success of delivering the owner's physical development within the constraints of cost, schedule, quality and safety requirements (Achara, 2016). Construction managers on the other hand are involved in personnel management on sites, ensuring delivery of materials on time, making tools available for the work and coordinate the activities within the project management process with the various team members. Construction managers also administer the construction budget, requests for change orders and make decisions as to building practices while ensuring compliance with building codes (Ogunsanmi, 2016). Mamoon et al. (2014) also point out one of the responsibilities of construction managers as; meeting the project target by achieving the completion of the project within time under budget and in accordance with the required performance and quality level. Comparing the duo, they perform complementary roles which revolve around team management, project performance and the overall project management. However, project managers have broader functions which cover the entire scopes of the project including manufacturing, construction, marketing and administrative needs such as budgeting and project funding (Ogunsanmi 2016) while construction manager`s role centres mainly on the implementation phase. As managers they are to manage the project; as a result they are held accountable for the delivery of project management`s outputs and for meeting the project`s constraints. As the roles of the two differ, existing studies appeared not to have satisfactorily delineated the level of commitment and competency skills required by both. This raises the question of critical skills specific to the construction managers which are basic to improving on project performance at implementation phase. This research gap has further led to studies relating to effectively managing the project and delivering them based on the set objectives and to the stakeholders` satisfaction are pointing to more problems and who to blame is apparently unclear.

Project Management at Implementation Phase of Construction Project

Implementation phase can be referred to as processing, production or execution stage at which activities and tasks defined in the planning and conceptual phases are performed to meet the project objectives (Watt, 2014). The phase begins immediately after the award of contract and continues through construction close out. Implementation phase acts as a "reservoir" or "receiver" of all consequences of shortcomings from earlier stages which in any way, construction manager needs to cope with. To this end, implementation stage is a vulnerable and the most risky phase in project life cycle. Although project management is essentially about managing a project from its conception to completion but the bulk of its function is at implementation stage and is very challenging (Kerzner, 2003). Project management at this stage is refers to as a process of

monitoring and controlling the accomplishment of the project goals and intended use (Gido and Clements, 2014). Major concerns of construction manager at this stage are on project matters such as schedule time, budget and the goals of the project. Deviation from plan is inevitable. That is, there may be occasion where project has fallen short. In this situation construction manager must think on the next line of action, evaluate options and be prepared to recommend course of corrections before things get out of hand (Devi, 2013). In achieving this, construction manager needs to be equipped with sound project management competency skills which will also help to overcome other challenges occasioned by implementation stage and deliver based on an agreed plan. Studies have shown that lack of appropriate approach to address some challenges at this phase has led to a lot of undesirable results in project execution in the construction industry of most developing countries (Gyandu – Asiedu, 2009).

Construction Manager`s Skills for Project Management at Implementation Phase

Achieving project performance has been observed to be possible through effective project management skills (EL-Annan, 2015). Morgeson et al. (2010) are of the view that with the development of the best management practices, effective skills is required and will also help in developing the performance of an organization. Construction manager as a matter of necessity must be equipped with required skills in order to achieve project objectives and deliver within available project constraints. Skill has been defined as the ability to act concretely in accordance with pre-defined objectives and is related to empiricism (Moura 2018). This implies knowing how to do something or the ability to make productive use of knowledge. There are various skills within and outside the built environment that construction manager needs to possess for improved performance. Zakaria et al. (2015) found seven characteristics leadership skills that a good project manager should possesses; namely: communication skills, problem solving and decision making skills, team building skills, conflict resolution skills, planning and goal setting skills, sense of responsibility and time management skills. Burger (2015) conducted a study on what employers are looking for in construction managers. The study identifies five essential skills which include; project management, communication, document - management, technical and analytical skills. In the study conducted by Pearson (2002), five basic skills for project managers were identified; namely: personal skills, technical skills, management skills, coping skills and information technology (IT) skills. Similar, study by Capital (2013) identified eight skills essential for successful construction project management which are: knowledge of construction industry, strong leadership, decision-making skills, finances and budget management skills, knowledge of construction equipment, technical skills, computer literacy and skills to use construction specific software.

Related study by Satellizer (2016) identified four important skills for construction manager which includes: time management, negotiation, decision making and problem solving skills. Bedingfield and Thal (2008) on the other hand identified key skills of effective project managers, namely: leadership skill (that is, vision, strategy, delegation, empowerment, mobilising, and motivation), communication skill, decision making skill, administrative skill (such as organisational, planning, and goal setting skills), coping ability, analytical thinking and problem solving, technical competence, and other skills (for instance, integrity, people skills, team building, political sensitivity, enthusiasm and high self-esteem). Similar study by Hwang and Ng (2013) identified 20 knowledge and skill areas for management of green construction projects. Related studies from other authors which include Peterson and Fleet (2004), Kerzner (2009) and Farooqui et al. (2008) also helped to shape the focus of this study.

Skills for project management can be classified as specific skills, general skills, direct and indirect skills, soft and hard skills as explained in the works of Marando (2012); PMI (2012); Hwang and Ng (2013). The skills identified by previous studies for effective project management are summarized in Table 1.

Table 1: Construction Project Management Skills

S/n.	Factor	Source	S/n.	Factor	Source
1	Verbal communication skill	Lent 2012.	27	Diplomatic skill	Cheng *et al*. 2005.
2	Team working skill	Zakaria et al. 2015.	28	Risk management skill	Lei and Skitmore 2004.
3	Stakeholders management skill	Lei and Skitmore, 2004.	29	Monitoring and control skill	Kerzner 2011.
4	Interpersonal skill	Ahn et al. 2010; Mouchi et al.2011.	30	Social skill	Fryer and Fryer 1990.
5	Adaptability skill	Ahn *et al*. 2010.	31	Professional skills	Nwachukwu 2008).
6	Collaborative skill	Ahn *et al*. 2010.	32	Time Management skill	Zakaria et al. 2015; Satellizer, 2016.
7	Contract administration skill	Uher and Davenport 2009.	33	Goal Setting skill	Zakaria et al. 2015
8	Stress management skill	E-dum-Fotwe and McCaffler 2000; Lent 2012.	34	Coping skill	Pearson 2002.
9	Motivation	Rose 2013; Lent 2012.	35	Innovative skill	Morgeson et al. 2020
10	Environmental/cultural skill	Rose 2013; Ahn *et al*. 2010.	36	Conflict management skill	Satellizer 2016; Zakaria et al. 2015; Ahn *et al*. 2010.
11	Delegation skill	E-dum-Fotwe and McCaffler 2000.	37	Networking skill	Lei and Skitmore 2004; Lent 2012.
12	Estimating skill	Ahn *et al*. 2010; E-dum-Fotwe and McCaffler 2000.	38	Presentation skill	Lent 2012; E-dum-Fotwe and McCaffler 2000.
13	Negotiation skill	Satellizer 2016; Lent 2012.	39	Organisation skill	Kerzner 2009.
14	Reporting/feedback skill	Len, 2012; Mouchi et al. 2011; Rose 2013.	40	Coaching skill	Lei and Skitmore 2004.
15	Decision making skill	Satellizer 2016; Farooqui *et al*. 2008; Capital 2013.	41	Business knowledge Skill	Lei and Skitmore 2004.
16	Planning and scheduling skill	Farooqui et al. 2008.	42	Cost management skill,	Lei and Skitmore 2004.
17	Flexibility skill	Peterson and Fleet 2004.	43	Diagnostic skill	Peterson and Fleet 2004.
18	Resource management skill	Kerzner 2009.	44	Political skill	Ahearn *et a*l. 2004.
19	Persuasive skill	Mouchi et al. 2011; Lent	45	Creativity skill	Farooqui et al. 2008.

		2012.			
20	Written communication skill	Ahn *et al* 2010.	46	Result orientation skill	Farooqui et al. 2008.
21	Analytical skill	Peterson and Fleet 2004; Cheng et al. 2005.	47	Entrepreneurship skill	Kerzner 2009.
22	Budget management skill	Peterson and Fleet 2004; Capital 2013.	48	Conceptual skill	Robbins et al. 2009)
23	Coaching skill	Lei and Skitmore 2004.	49	Legal understanding skill	Lei and Skitmore 2004.
24	Behavioural skill	Kerzner 2010; Lent 2012; E-dum-Fotwe and McCaffler 2000.	50	administrative skill	Peterson and Fleet 2004.
25	General management skill	Mouchi et al. 2011.	51	Quality management skill	Odusami 2002.
26	Information technology (IT) skill	Pearson 2002; Ahn *et al*. 2010.	52	Critical path thinking skill	Farooqui et al. 2008.

Methodology

This study adopted survey research approach. The questionnaire was developed and prepared to evaluate the perceptions of professionals in the construction industry in the determination of critical skills required of construction manager in the management of construction project at implementation phase for effective performance. Questionnaire survey was used due to the large population and scattered location of the respondents which made it difficult and expensive to use other methods such as interview (Zarewa, 2019). This survey approach helps not only to save cost but also increase accuracy and better control of data collection errors. The target population for the study consists of registered professionals in the construction industry such as architects, builders, engineers and quantity surveyors practicing in Uyo, Akwa Ibom State. Uyo is the state capital of Akwa Ibom State. The state is the leading oil-producing state in the Niger Delta region. Consequently, it is one of the fastest-growing state capitals in terms of infrastructure and development within the South-South region of Nigeria (Olubajo and Kuma, 2017). The sampling frame of this study was 253 construction professionals, which included 72 architects, 38 builders, 108 engineers, and 46 quantity surveyors, drawn from the directories of registered professional bodies of their respective chapters in the State. This includes the Nigerian Institute of Architects Registration Board of Nigeria ((ARCON), Council of Registered Builders of Nigeria (CORBON), Council for Regulation of Engineering in Nigeria (COREN), and the Quantity Surveyors Registration Board of Nigeria (QSRBN). According to Fellows and Liu (2008), a research instrument (that is, questionnaire) should be initially piloted to verify whether the questions are intelligible, unambiguous, and easy to answer; providing an opportunity to improve the questionnaire and determining the time required in completing the exercise. This process assists in eliminating potential problems of the research instrument and to test the validity and workability of the instrument (Gall & Borg, 2007). This was achieved by administering the draft questionnaire to ten experts in the built environment both in practice and academic. The inputs from the exercise which resulted to 39 variables out of 52 variables of construction manager`s skill derived from literature were adopted in the production of the final questionnaire used in this study. The reliability test conducted in the study reveals that the internal consistency of the scale used (Cronbach's coefficient *a*) is 0.879. The value is acceptable being closer to 1.0 indicates higher internal consistency. This is acceptable since the value being closer to 1.0 indicates higher internal consistency. This research uses the Krejcie and Morgan (1970) table of determining sample size from the population using a 95% confidence interval and a margin of error of 5%; this was derived by applying the formula in equation 1.

$$s = X^2NP\ (1\text{-}P) \div d^2\ (N\text{-}1) + X^2P(1\text{-}P) \qquad (1)$$

where *s* is the sample size from finite population, *X* is based on confidence level 1.96 for 95% confidence interval, which is used for this study, *d* is the precision desired, expressed as a decimal (i.e. 0.05 for 5%), *P* is the estimated variance in population as a decimal (i.e. 0.5), and *N* is the total number of population, 253.

$$s = \frac{1.962 \times 253 \times 0.5\ (1 - 0.5)}{0.052\ (N - 1) + 1.962 \times 0.5(1 - 0.5)}$$

where $s = 156.608$. Therefore, $s = 157$.

A total of eighty six (86) out of the one hundred and fifty three (157) questionnaire distributed which represent 55% were returned. The high percentage of retrieved questionnaires was achieved because the questionnaires were self-administered with effective follow up visits adopted on the respondents. Simple random sampling technique was adopted in this research study to select the respondents**.** Out of the 86 responses received, eleven were invalid which included respondents with less than OND (Ordinary National Diploma) and the incomplete responses, while 75 were properly filled and considered a valid response; this represents a response rate of 49.02%. The valid responses consist of 22 architects, 8 builders, 31 engineers, and 14 quantity surveyors. The returned questionnaires were considered adequate for the study based on the response rate between 40 - 50% in academic studies recommended by Matthews (2007). In addition, the questionnaire response rate in the range of 20% to 30% is adequate for research in construction industry (Idrus and Newman 2002). The structured questionnaires designed for this study were divided into two sections. Section 'A' comprised demographic characteristics of respondents; these included designation of respondents, gender, educational qualifications and year of work experience. Section 'B' was designed in relating to the

study objective which is to examine the critical skills for construction manager at implementation phase. Thirty nine factors resulted from the pilot survey were randomly arranged and presented for assessment to determine which of them are critical to management functions of construction manager at implementation phase. The current research used a five point Likert scale to capture the preferences of respondents in the questionnaire for each with values on the scale as follows: 1 as "low", 2 as "slightly low", 3 as "averagely low", 4 as "high" and 5 as "very high". This conformed to Gliem and Gliem (2003) which posit that information gathered in the social sciences often involves the use of Likert-type scales.

Upon completion of the data collection exercise, all completed questionnaires were assembled, coded, summarized, entered into the computer; and analyzed using the statistical package for social science (SPSS). Data collected were analysed using descriptive and inferential statistics. These include percentage, frequency distribution, mean score, and factor analysis. Mean Score (MS) was used to determine the level of significance of each factor by five expressions defined by the intervals 0.8 with 3.4 as a cut-off for high criticality based on Kazaz et al. (2008). Hence, factors with mean values between 3.4 and 5.0 are considered as critical to construction manager`s skills in improving project performance. Equation (2) presents the mean score formula used for the ranking of the factors:

$$MS = \Sigma(RPi \times Ri)/n \quad (2)$$

where: MS = Mean Score, RPi= Rating point i (range from 1-5), Ri= response to rating point, i) and n = total responses = summation of Ri from1-5

Factor analysis was carried out in this study to reduce the dimension of the skill factors for construction manager at implementation phase into more manageable and significant sizes. Factor analysis is used to recognise a small number of factor categorisations that could be employed to show relationships among sets of numerous inter-related variables (Pallant 2007). Thus, factor analysis was applied to the survey data to explore the grouping that might exist among the skill factors required for construction project manager. To establish the adequacy of the factor loading arising from factor analysis the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were used. Kaiser-Meyer-Olkin (KMO) and Bartlett`s Test are commonly used to measure the sampling adequacy in factor analysis. The KMO index ranges from 0 to 1, with 0.6 suggested as the minimum value for a good factor analysis (Tabachnick and Fidell 2007). Nonetheless, the threshold value of KMO is advocated to be greater than 0.5 if the sample size is adequate while Bartlett`s Test of Sphericity should be significant ($p < 0.05$) for the factor analysis to be considered appropriate.

Data Presentation and Analysis

Demographic characteristics of respondents

The characteristics of respondents that supplied the data used for the study were analysed to ascertain dependability of the data. The characteristics are: age, profession, year of experience, academic qualification, and professional affiliation as presented in Table 2.

As shown on Table 2, the age distribution of the respondents was sought which outlines that 8.6% (6) of the respondents had ages between 21-30 years, 46.2% (35) were between 31-40 years, 23.7% (18) were between 41-50 years, 17.4% (13) were between 51-60 years, while 4.1% (3) were above 60 years. This shows that the respondents are mature and active working class adults; as a result, outcome of the study would be satisfactory. The result of the respondents` profession shows that 29.3% (22) of the respondents are Architects, 10.7% (8) are Builders, 41.3% (31) are Engineers, and 18.7% (14) are Quantity Surveyors. This implies that the built environment professionals that participated in this study are well spread with required knowledge on the subject matter of this study. Table 2 also shows the year of professional experience of the respondents in which 21.7% (16) of the respondents have between 1–10 years of requisite working experience, 31.4% (23) are between 11–20 years, 18.3% (14) are between 21–30, 12.9% (10) are between 31–40 years, and 15.7% (12) of the respondents had experience of 41 years and above. This indicates that, the information supplied by the respondents is considered adequate and can be relied upon.

The result reveals that the respondents have various levels of educational degrees. From Table 2, none of the respondents were at the level of Ordinary National Diploma (OND), 15% (11) of the respondents have

attained the Higher National Diploma (HND) level, 47% (35) have the Bachelor of Science/ Bachelor of Technology (B.Sc./B.Tech.) degree, 29% (22) have the Master of Science (M.Sc.) degree, while 9% (7) of them have attained the Doctor of Philosophy (Ph.D) educational status. This implies that the respondents are knowledgeable and would be able to respond to the questions with understanding. The result on professional affiliation shows that all the respondents are affiliated to relevant professional bodies in their respective professions which are: NIA - 29.3% (22), NIOB - 10.7% (8), NSE - 41.3% (31), and NIQS - 18.7% (14). This implies that the right hands were selected in the study and would give relevant information that can be relied upon in this study.

Table 2: Demographic characteristics of respondents

Category	Classification	Frequency	Percentage
Age	21-30	6	8.6
	31-40	35	46.2
	41-50	18	23.7
	51-60	13	17.4
	Above 60 years	3	4.1
Profession	Architecture	22	29.3
	Building	8	10.7
	Engineering	31	41.3
	Quantity surveying	14	18.7
Year of experience	1–10 years	16	21.7
	11–20 years	23	31.4
	21–30 years	14	18.3
	31–40 years	10	12.9
	41 years and above	12	15.7
Academic qualification	OND	0	0
	HND	11	15
	BSc/BTech	35	47
	M.Sc	22	29
	Ph.D	7	9
Professional affiliation	NIA	22	29.3
	NIOB	8	10.7
	NSE	31	41.3
	NIQS	14	18.7

Ranking of construction manager`s skills for project management at implementation phase

Table 2 reveals the results of analysis of thirty nine (39) critical skill factors of construction manager for effective project management performance at implementation phase previously derived from literature and analysed by the formula in equation (2). The results of Mean Score (MS), Standard Deviation (SD) and rank of each item are presented in Table 3.

Table 3: Construction Manager`s Skills for Project Management

Factors	Mean Score	Std. Deviation	Rank	Remarks	Factors	Mean Score	Std. Deviation	Rank	Remarks
Interpersonal	4.71	0.6185	1st	VHC	Motivation	3.97	0.9734	21st	HC
Monitoring and control	4.64	0.5868	2nd	VHC	Written communication	3.96	1.1398	22nd	HC
Team working	4.59	0.7162	3th	VHC	Analytical	3.94	1.1836	23rd	HC
Contract administration	4.56	0.6265	4th	VHC	Presentation	3.92	1.0226	24th	HC
Professional	4.49	0.7143	5th	VHC	Estimating	3.87	1.2546	25th	HC
Coaching skill	4.46	0.7893	6th	VHC	Reporting/feedback	3.82	1.2890	26th	HC
Collaborative	4.45	0.7198	7th	VHC	Flexibility	3.79	1.1556	27th	HC
Resource management	4.40	0.8227	8th	VHC	Delegation	3.76	1.0372	28th	HC
Verbal communication	4.38	0.8387	9th	VHC	Stress management	3.73	1.1518	29th	HC
Planning and scheduling	4.37	0.7853	10th	VHC	Goal Setting	3.7	1.5281	30th	HC
Social	4.32	0.9618	11th	VHC	Decision making	3.68	1.1109	31st	HC
Networking	4.3	0.8476	12th	VHC	Negotiation	3.66	1.0666	32nd	HC
Information technology (IT)	4.26	1.0220	13th	VHC	Listening	3.61	1.2173	33rd	HC
Behavioural	4.25	0.9457	14th	VHC	Environmental/cultural	3.59	1.2489	34th	HC
General management	4.23	0.8473	15th	VHC	Diplomatic	3.56	1.1953	35th	HC
Stakeholders management	4.14	1.0160	16th	HC	Innovative	3.52	1.1968	36th	HC
Time Management	4.05	1.2162	17th	HC	Persuasive	3.47	1.3777	37th	HC
Conflict management	4.03	1.0100	18th	HC	Coping	3.46	1.2429	38th	HC
Risk management	4.01	1.1289	19th	HC	Adaptability	3.41	1.3715	39th	HC
Budget management	3.99	1.1174	20th	HC					

The result of the analysis shows the level of criticality of the factors ranging from high criticality to very high criticality with the MS $3.41 \leq MS \leq 4.71$. Out of the factors considered for the analysis fifteen (15) have very high criticality (VHC) while others in total of twenty four are in the second category - high criticality (HC). The result reveals interpersonal skill as the most critical skill required for effective performance of construction manager at implementation phase. The least factor identified as construction manager skill is adaptability skill. Though this factor is given the least accord among the factors, it importance lies in the fact that construction managers are dealing with people probably he or she has not worked with before and need to study, understand who and what they are in the interest of the task or activity assigned to them. The ranking and SD of the five most important among the fifteen (15) skills which incidentally have very high criticality are: interpersonal skill (MS = 4.71, SD = 0.62), monitoring and control skill (MS = 4.64, SD = 0.59), teamwork skill (MS = 4.59, SD = 0.72), contract administration skill (MS = 4.56, SD = 0.63) and professional skill (MS = 4.49, SD = 0.71). Coaching skill was ranked sixth with MS and SD of 4.46 and 0.79 respectively. This was followed by the collaborative skill (MS = 4.45, SD = 0.71), resource management skill (MS = 4.40, SD = 0.82), verbal communication (MS = 4.38, SD = 0.84), and planning and scheduling (MS = 4.37, SD = 0.79) as seventh, eighth, ninth and tenth factors respectively. The five least of the factors as revealed from Table II included diplomatic skill (MS = 3.56, SD = 1.20), innovative skill (MS = 3.52, SD = 1.20), persuasive skill (MS = 3.47, SD = 1.38), coping skill (MS = 3.46, SD = 1.24), and adaptability skill (MS = 3.41, SD = 1.37). Implication of the least ranked factors in this study is that the importance of the skills lies in the complementary role they perform with other factors. Incidentally, the skills could be highly critical in some situations but depending on project size, complexity, scope, types of stakeholders involved, political and environment factors. The construction manager should therefore give necessary attention on these categories of skills as demanded by project situation.

Principal Component Analysis

Factor analysis using Principal Component Analysis was conducted on the responses of respondents on the critical skills required of construction manager in managing project at implementation phase. Factor analysis reduced the variables into a fewer number of non-correlated factors that represent the original variables (Fellows and Liu 2008). Test of Cronbach`s alpha on the adequacy of the sample size for establishing the reliability of factor analysis was found to be 0.83 showing an acceptable internal consistency as well as a high level of reliability of the survey instrument. Table 4 showed that the result of KMO is 0.967 which is consist with the boundary of 0 – 1, where 0.967 is close to 1 than 0. This is an indication that the patterns of correlations are relatively compact and reliable (Yong and Pearce 2013). The Chi-squared value in the Bartlett's sphericity test is significant (10356.706) with the significance level p = (0.000) suggesting that the population was not an identity matrix (Wai et al. 2013).

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.967
Bartlett's Test of Sphericity	Approx. Chi-Square	10356.706
	Df	741
	Sig.	.000

On establishing the KMO sampling adequacy and Bartlett's test of Sphericity, data were further analysed to obtain the rotated component matrix and total variance explained for factor groupings. Table 5 shows the factor extraction of principal components analysis technique and summary of the main components of critical skills required by construction manager at implementation phase. Five main components which recorded eigenvalues greater than 1 were extracted using the factor loading of 0.50 as the cut-off point as presented in Table 5. These five set which is greater than the threshold of 50% total variance explained as suggested by Pallant (2007). Thus the five main underlying construction manager`s skill variables identified were

professional collaboration management skill, communication skill, people skill, contract administration skill, and interpersonal skill; components extracted cumulatively explained 66.814% of the variation in the data.

Table 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.766	48.118	48.118	18.77	48.118	48.118	12.78	32.78	32.78
2	3.39	8.692	56.81	3.39	8.692	56.81	5.84	14.973	47.753
3	1.621	4.156	60.966	1.621	4.156	60.966	4.98	12.768	60.522
4	1.226	3.143	64.109	1.226	3.143	64.109	1.394	3.573	64.095
5	1.055	2.705	66.814	1.055	2.705	66.814	1.06	2.719	66.814

Extraction Method: Principal Component Analysis.

Table 6 also shows the component factors of critical skills for construction managers and the loading items. Communalities of the variables loaded under each component factor ranged from 0.243 to 0.882, which gives information about how much of the variance in each item is explained. The total variance explained by each component extracted is as follows: the first principal component professional collaboration management skills accounted for 48.12% of the total variance, the second component, communication skills explained 8.69% whilst the third component, people skills explained 4.16%. The fourth component, contract administration skills accounted for 3.14% and component 5, interpersonal skills accounted for 2.72%.

Table 6: Rotated Component Matrix[a]

Construction manager`s skills	**Component**				
	1	2	3	4	5
Professional collaboration management skills					
Delegation	0.433				
Change management	0.708				
Information technology (IT)	0.582				
Budget management skills	0.563				
Networking	0.796				
Behavioural skills	0.774				
General management skills	0.786				
Professional skills	0.874				
Diplomatic skills	0.700				
Risk management skills	0.665				
Monitoring and control skills	0.884				
Resource management	0.763				
Time Management	0.746				
Goal Setting	0.725				
Environmental/cultural skill	0.73				

Innovative skills	0.777				
Conflict management skills	0.791				
Collaborative skills	0.835				
Communication skills					
Estimating skills		0.528			
Analytical skills		0.74			
Coping skills		0.657			
Persuasive skills		0.536			
Verbal communication		0.538			
Presentation skill		0.798			
People Skills					
Listening			0.753		
Health and safety			0.677		
Adaptability			0.645		
Stress management			0.734		
Motivation			0.509		
Negotiation			0.563		
Reporting/feedback			0.514		
Contract administration skills					
Decision making				0.561	
Team working				0.566	
Planning and scheduling				0.476	
Contract administration				0.683	
Site management				0.619	
Written communication				0.63	
Interpersonal Skills					
Interpersonal skill					0.937
Social					0.862

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Professional collaboration management skills named as the first component accounted for 48.12% of the variance with eighteen (18) loading items having high loading scores that range from 0.884 to 0.433. These factors and the loading of each variable impact on the component are: delegation (0.433), coaching (0.708), information technology (IT) (0.582), budget management (0.563), networking (0.796), behavioural (0.774), general management (0.786), professional (0.874), diplomatic (0.700), risk management (0.665), monitoring and control (0.884), resource management (0.763), time management (0.746). Other skills are: goal setting (0.725), environmental/cultural (0.73), innovative (0.777), conflict management (0.791), and collaborative skill (0.835). The second component named as communication skills accounted for 8.69 per cent of total variance not explained by the first components. Six variables loaded onto the component including; estimating (0.528), analytical (0.74), coping (0.657), persuasive (0.536), decision making (0.561), and presentation skill (0.798). Component 3 was labelled people skills comprised five (5) variables, which accounted for 4.16% of the total variance. Some of the items loaded with their loading scores include; stakeholders management

(0.677), adaptability (0.645), stress management (0.734), and listening (0.753). Others are motivation (0.509), negotiation (0.563), and reporting/feedback skill (0.514). Component 4 was labelled contract administration skills which accounted for 3.14 per cent total variance not explained by the former components. These items include verbal communication, team working, planning and scheduling, contract administration, site management, and written communication with respective eigenvalues of 0.538, 0.566, 0.476, 0.683, 0.619 and 0.630. The fifth Component was named interpersonal skills which accounted for 2.72%.of the observed variance with two variables loaded onto it: interpersonal (0.937) and social skill (0.862).

Discussion of Results

The results of the study show that all the skills considered in this study are critical. This implies that, with the adoption of these skills, construction manager`s performance will not only improve but will also improve overall performance of the project. This was informed by the results of the study which classified fifteen (15) of the factors as very high criticality (VHC), with twenty four (24) others as high criticality (HC). The most highly ranked among the factor was interpersonal skill which implies that, the factor alone though needs to be complemented by other factors can produce required management functions expected of construction manager in terms of project cost, time, quality and stakeholder`s satisfaction. Interpersonal skill sometimes known as "soft skills," is an essential requirement for construction manager in dealing with different types of people, trades and attitudes characterized by a project. Earlier focus on just only hard skill (technical – that is, abilities to apply knowledge in the relevant field) has proved ineffective especially in a project management environment characterized by large stakeholders with other associated external and internal challenges. This is in addition to the fact that modern-day client`s are becoming sophisticated in their demands and projects are also becoming more complex. Supporting this assertion, This result is agrees with Eigelaar (2012) who argues that success in the role of construction manager cannot be attained with a technical skill set only while Belzer (2014) observes that interpersonal (soft) skill is `the missing link' in managing a successful project. PM4DEV (2018) opines that construction project manager should concentrate on managing the project and letting the project team members perform the technical work and limit her technical involvement to evaluating the work of the team.

Construction manager`s competency in managing projects through monitoring and control skill underscores management efforts in achieving project plans as plan alone cannot bring about the required end by themselves (Idoro, 2012). Monitoring and control skill provides the required checks and balances for ensuring that the plans and overall project objectives are achieved. Monitoring and control as a project management functions involve collecting, recording and reporting information, coordinating and regulating actions on any or all parts of the project in relation to the agreed implementation schedule or plan (Ritz 1994; Enshassi 1996). While applying this skill, construction manager should focus on the project objectives – completion of project within a scheduled time and cost and to a specified quality standard. The construction industry is seen from the project management context as teamwork-based and mostly defined in terms of teamwork. Recent studies show that the major causes of poor performance can be addressed through effective teamwork (Assaf et al. 2014). In related study, Yang et al. (2011) confirm the important role that teamwork plays in project team performance and buttress that teamwork significantly affect project performance and the overall project success. The team members among other things should embrace high degree of cooperation, trust, openness, timely and effective communication and ethical behaviour for the team to be effective (Gido and Clements 2011). Furthermore, construction manager should watch out on problems capable of jeopardizing teamwork such as poor leadership, poor rapport among team members, lack of effective communication, lack of motivation of team members, and professional rivalry (Adu and Opawole 2020). Construction manager should value the five major groups of entities that may influence performance of teamwork, namely: people, tools and techniques, organisational process, work, and leadership (Thamhain 2004). These factors are capable of impacting on project outcomes as such; construction manager should give them adequate consideration while defining project scope and level of performance required by the stakeholders. Their influences in a particular circumstance among other things also depend on project complexity, managerial and organisational supports, and social, economic, and business environments (Thamhain 2004).

Arising from the results of factor analysis, five components of critical skills for construction managers were identified. The first component was professional collaboration management skills loaded with eighteen items. This included delegation, flexibility, information technology (IT), budget management, networking, behavioural, general management, professional, diplomatic, risk management, monitoring and control, resource management, time management. Others are: goal setting, environmental/cultural, innovative, conflict management and collaborative. The most highly ranked among the factors are monitoring and control skills, collaborative skills, networking and conflict management skills; consequently, it is labelled Professional collaboration management skill. The skill is appreciably needed for effective project monitoring and control which requires collaborative efforts among the various professionals in an attempt to achieve project set goals. Monitoring and control are two major intertwined activities at implementation stage often entail resolving issues to keep the project on track. Usually conflicts and disputes may arise in a project especially during implementation phase; construction manager should be able to manage the situations. Stem from project management context, conflict and dispute are not necessarily a problem, rather it is a team's awareness of discrepancies, incompatible wishes, or irreconcilable desires and what they do because of them (Jehn and Mannix 2001). However, if not properly managed can cause a number of negative outcomes, such as decreased individual satisfaction, reduced creativity and risk taking, and decreased team performance (De Dreu and Weingart 2003; Jehn and Bendersky 2003). PM4DEV (2018) identified some techniques that can be used in addressing some of these problems, namely: breaking problems down into manageable parts, identifying root causes of problems; analyzing - strengths, weaknesses, opportunities and threats (SWOT).

The second component was communication skills loaded with the following items: estimating, analytical, coping, persuasive, decision making, and presentation skill. The result demonstrates the need for construction manager to be highly equipped with communication skill as an essential requirement at all stages of construction especially during implementation phase to ensure a successful project completion. Communication skill enables construction project managers to ensure timely and appropriate generation, gathering, distribution, storing, retrieval and disposition of project information (Muszynska 2015). The finding of Odusami (2002) is consistent with the result of this study which identified communication as second most crucial skill out of 13 aptitudes for successful project leadership in construction. The result of this study also conformed to Aiyewalehinmi's (2013) empirical findings on communication in the construction industry using a factor analysis. The study revealed positive correlation between construction productivity and the amount and quality of communication that flowed between individuals involved in the design and implementation of a construction project. This also supports findings by Yang et al. (2011) whose study demonstrated the significant impact of group communication and found communication as a critical function of teamwork in ensuring project success. In the contrary, similar studies revealed high project de-motivated workforce, inefficiency, delay, cost changes, design errors, slowdown in the entire job and failure in production, risks, project failure as a result of poor or ineffective communication (Tipli et al. 2014; Cheung et al. 2013). Communication problem in Nigerian construction industry is still a major challenge like any other developing countries where over 50% of projects were unsuccessful due to inappropriate communication method (Kasimu and Usman 2013). Effectiveness of communication skill lies in the fact that construction managers must have to listen effectively, have strong verbal, graphical, and written communication skills, deliver good and bad news effectively, have strong presentation skills, be able to liaise among stakeholders, and have strong networking skills.

The third component of construction manager`s skills for effective project performance at implementation phase was labelled people skill. Seven **i**tems were loaded under this component which includes: stakeholder's management, adaptability, stress management, and listening. Others are motivation, negotiation, and reporting/feedback. People (human) skill is the ability to work with and through other people (Robbins et al. 2009). In other words, people skill is the ability to work cooperatively with others, to communicate effectively, to motivate and train others, to resolve conflicts, and to be a team player. Supporting the findings of this study Fisher (2006) found that People skill is a differentiating factor between effective project managers and other project managers (Fisher 2006). This operates on the premise that construction manager understand the various stakeholders involved and how their individual interest are protected within the project

resource constraints. The fourth component was contract administration skill and items loaded under this skill include: verbal communication, team working, planning and scheduling, contract administration, flexibility, and written communication. According to Uher and Davenport (2009), contract administration skill involves ability to establish cordial relationships between the parties, defining responsibilities and determining the most appropriate administrative procedures. It is inherently communication-based and can be referred to as a major determinant in ensuring a successful construction project implementation from planning to construction stage.

Client`s organisation should ensure timely flow of information and decision made regarding any aspect of the project to enable completion of the project as required by the contract documents including review and observation of the construction project (Surahyo, 2018). This is achievable where there is effective interpersonal communication between all the parties involved especially the project manager, construction manager and other team members. This should be proactively done in order to stimulate the team in enhancing its creativity, innovation, problem solving, decision making, support and work performance (Burke and Barron 2014). The "big" task of contract manager as a member of project team is to coordinate and motivate the various construction parties involved. As a project "administrator" he or she must know where to go, have an effective strategy of how to get there, and communicate that strategy clearly to all involved (Cunningham, 2016). Quantity surveyors (QS) has valuable role to play in this regard. Therefore, QS should be appointed to complement the role of the contract administrator to offer such services as cost advice relating to on-going design decisions, contractual payment issues, evaluate change orders and loss and expense claims, assessing entitlements for extensions of time, providing the necessary financial services relating to the issue of certificates, and dealing with the financial implications of the administrator's instructions (Cunningham 2016). The fifth component of construction manager`s skill was interpersonal skill loaded with two items - interpersonal and social. Interpersonal skill was earlier ranked highest by the respondents and is highly loaded from the result of the factor analysis. This shows the importance accorded to the factor by the professionals involved in the survey as previously discussed. Interpersonal skill is an intangible and behavioural competency that includes proficiencies such as communication, emotional intelligence, conflict resolution, negotiation, influence, team building, and group facilitation (PMI 2013). Interpersonal skills among other things include the ability to deal with people of different backgrounds, discuss issues openly with team members, being supportive and showing respect and commitment to the team and to its individuals (Brenton and Levin 2012). This also requires understanding people, their attitudes, and human dynamics (PM4DEV 2018)

Conclusion and Recommendations

The study assessed skills critical for effective performance of construction manager at implementation phase of construction project. Out of 52 skill factors derived from literature, 39 were adopted and used for the analysis based on the result from the pilot survey conducted. From the outcome of the survey, all the skill factors identified were significant for effective performance of construction manager at implementation phase of construction project. The study concludes that both technical and non-technical skills which were identified and further categorized into five groups in this study such as professional collaboration management skill, communication skill, people skill, contract administration skill, and interpersonal skill are crucial for effective performance of construction manager. This study recommends adoption of the set of skills identified in this study for construction managers for improved performance and to achieve project success. This study also recommends a consistent training for construction managers in order to get them acquainted with project management standard skills for effective performance especially at the current global economic challenges. To complement the efforts of construction manager, the study further recommends an appointment of QS as a "contract administrator" to offer among other things cost and financial related services and other issues that bother on variation order for prompt management decisions. The current study used questionnaire survey that involved a small sample in just one city. This in essence limits the scope of generalization. Furthermore, the findings of this study focused on critical skills for effective performance of construction manager at implementation phase of construction project in the construction industry but may not generalise to other phases in project lifecycle and project implementation in other industries. Ultimately, the study provided

implications for the assessment of critical skills specific to the construction managers which are basic to improving on project performance at implementation phase.

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VALUE AND RISK MANAGEMENT IN CONSTRUCTION PROJECTS – SMART STRATEGY REVISITED

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Abstract
Value management determines uncertainty relating to project objectives while risk management resolves uncertainty relating to outcomes. These outcomes cannot be assessed without clear understanding of the project objectives. The use of simplistic cost model was adopted in resolving design problems but it was proven abortive when the demand for decision making at the briefing and concept stage was initiated. This led to the demand for an alternative strategy that lays emphasis on learning process. The use of SMART strategy was developed to create an expectation of participative decision making at the early design phase with the principles of group decision support (GDS). The paper explores the potential benefits of adopting smart strategy in managing value and risk in construction projects. Data were collected through questionnaire survey from construction personnel within the study area. The results reveal that profitability, contractual dispute resolution, client's confidence, and users' acceptability are highly commendable in SMART strategy. Quality of end product and absolute reliance on facilitator's skills can be improved on, while time, uncertainty, exceeds budget, exceeds contract period, and staff strength are difficult to achieve. The study concludes that adoption of SMART strategy in managing value and risk in construction projects is recommendable.

Introduction

Value and risk management are important aspect in implementation of a construction project. In real-life practice, these aspects have not been properly utilized in the Nigerian construction industry. The construction cost reduction has remained a major focus in project design. It is important to note that the real value of money cannot be achieved by reducing contract sum alone but also providing solutions to associated design problems. Value and risk management are inter-related in the sense that uncertainty relating to outcomes cannot be assessed without resolving uncertainty relating to project objectives (Masengesho et al., 2021). In the 1980s, the use of cost models in assessing uncertainty relating to project objectives has proven effective but in 1990s, the pattern changed when the decision making are expected to commence during the briefing and concept stage. This led to demand for an alternative solution which lays emphasis to learning process. The use of smart strategy was developed to create an expectation of participative decision making at the early design phase with the principles of group decision support (GDS). The application of this approach into value and risk management has not been studied extensively, although the use of GDS has been accepted and sponsored by various institutions including Chartered Institute of Building, UK. The study explores the potential benefits of adopting smart strategy in managing value and risk in construction projects.

Value management

The concept of function is important in establishing an understanding of value management. Value is defined as finding the most effective way of accomplishing a function that will meet the users' needs, desire, and expectations (Australian Standard, 2007). Likewise, value management is concerned with adopting structured and analytical process to enhance best value for money through the study of function (Ann and Ivan, 2009). An essential function of building design comprises the targeted project objectives, which includes quality, time, and cost constraints. Value management is concerned with resolving uncertainty related to project objectives. The earlier definition of value management describes it as a way of resolving ambiguity and establishing shared commitment to a common set of design objectives (Green, 1999). Functionality plays a vital role in maximizing value; it is achieved by considering the interplay between functional performance and cost of resources (Bowen et al., 2009). This allows for all tasks involved to be critically appraised in order to determine the optimal methods to adopt so as to produce deliverables and also create benefits. This can literally be explained as implementing a project using a strategy that can deliver value to the users' and also business profits (benefits) to the client.

Value management can be generalized into two approaches namely: (a) the use of value engineering, and (b) strategic interface between project stakeholders (Dallas, 2006).The first approach is tagged value engineering is based on proofs that can be defined rather than ideas. Roseke (2020) defines value engineering as a systematic approach used to analyze a system/project in order to add value by managing the essential functions while lowering cost. Value engineering involves identifying what the required functions are, and adopting brainstorming techniques that can provide alternative solutions. This approach believes that problems can only be tackled technically irrespective of human perception. The methodology of value engineering is usually well established to create means of achieving cost reduction and is often referred to as the "job plan". The job plan is strictly adhered to in value engineering using team approach. The second approach of value management adopts the philosophy of social science which emphasizes that sharing of different perceptions contribute to existence of problems. Social interaction between the client organization and construction projects plays an important role in achieving the design objectives. This concept lays in communication skills and consensus building between project stakeholders. Value engineering is applicable to hard technical issues that relates to financial issues and hazardous operations while the use of strategic interface between project stakeholders is applicable to soft strategic problems which relates to how the stakeholders think, behave, and interact. Most clients are attracted to service which offers "shared social reality" because they believe that it reduces time shared to convene meetings for stakeholders and also easier to adopt in practice (Ann and Ivan, 2009).

Risk management

Risk is defined as the uncertainty of future occurrence (Egolum, 2006). Risk management is regarded as coordinated activities required to identify and control the risks relating to the preferred project option (Standards Australia, 2009). In the construction industry, risk management is mostly used to measure the impact of potential risks on global parameters such as time and costs (Schatterman et al., 2006). Kerzner (2002) defines risk as a measure of the probability and consequence of not achieving project goals such as time, cost, and quality. The aspect of risk management involves the systematic way of examining the associated risk and determining how each can be treated (Pedju and Mawu, 2013). The question of "how" will provide steps involved in managing risk; this can be referred to as management tool. Uher (2003) described management tool as a method that can be used to identify the sources of risk and uncertainty, determining their impact and, developing appropriate management process. The process of risk management can be categorized as risk classification, risk identification, risk analysis, and risk response. Risk management is a critical aspect of project implementation, which is usually initiated at the concept and design phase. This will allow the key stakeholders to be aware of associated risks prior to decision making. There is no risk free project; therefore it is the duty of stakeholders to weigh the associated risks in accordance with benefits (value).

Integrating value and risk management

Assessing and managing risk will provide a framework for controlling the uncertainty of value management. Value means ensuring that the right choices are made about obtaining the optimum balance of benefit in relation to cost and risk. Risk and value management are interrelated tasks that should be carried out side by side. Value management is carried out first, to determine what constitutes value for a project, and second, identifying its associated risks. This will enable the decision makers to arrive at optimum balance of value and risk, and also allow the clients to know whether value of the business is worthwhile. Many researchers have advocated for the integration of value and risk management in a single process to avoid duplication of work and better value for money leading to better project outcomes rather than an independent practice (Haghnegahdar and Asgharizadeh, 2008, Dikun and Rahman, 2010, Abd-Karim et al., 2011). The possible interface between value and risk management was developed by Pedju and Mawu (2013) with focus on achieving project objectives (see figure 1).

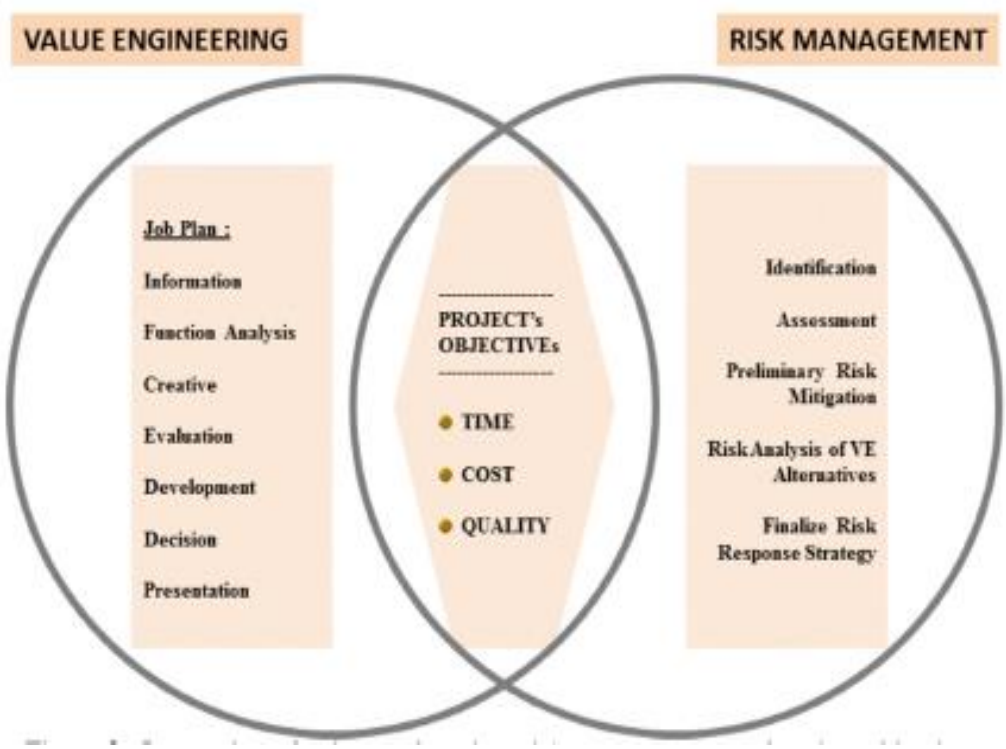

Figure 1: The integration of value and risk management (Pedju and Mawu, 2013)

Smart strategy

It is important to note that in striking a balance between value and risk, construction risks are inevitable. Therefore, the smart strategy involves shared views and perceptions rather than optimizing views and these are accompanied by uncertainty. In 1980s', the pursuit of value for money was based on the use of simplistic cost models in making decisions. The major concerns of project designers were to maximize floor area and minimum construction cost. The use of these models in resolving static problems proved legally effective over the years but the application of these models to soft problems which are not well-defined has proved abortive. In 1990s', decision making by stakeholders are expected to commenced during the briefing and concept stage. The use of cost models was not effective at this stage which created the demand for an alternative. This demand led to the development of a model that lays emphasis on learning process. In 1994, Green developed a concept known as SMART value management in accordance with the principle of Group Decision Support (GDS) (Green, 1994). The concept of SMART strategy focused on its usage at the early design phase to develop a common understanding of the design problem and identify explicitly agreed statement of design objectives by the project stakeholders (Green, 1994). The application of GDS systems in SMART approach is to assist project stakeholders working together to spend considerable time in meetings to reach consensus (Gray, 2008). The GDS systems were sponsored by Chartered Institute of Building, United Kingdom and are currently adopted by various stakeholders in the UK to support both group and individual work. The introduction of SMART strategy is focused on the methodology of fundamental assumptions relating to the nature of design problems. The acceptability of these assumptions is based on individualistic view by various project stakeholders in resolving design problems. The presence of similarity in their views will guarantee the acceptability of these assumptions. The use of SMART strategy creates an expectation of participative decision making which allows for participants to be willing to share power and ideas among themselves. This strategy stimulates decision makers to generate, organize, and prioritize ideas to create value for money.

Conceptual framework

As earlier established, the integration of value and risk management in a single phase will provide better project outcomes. Based on the literature review, the study developed a conceptual framework that captures value and

risk management, project objectives, and SMART approach in a single phase. Figure 2 reveals the possible interface amongst value/risk management, project objectives, and SMART approach. The process flow allows for the setting of project objectives, and then the involvement of SMART approach team before the assessment of identified risks against benefits (value). After the analysis, the strategies and alternatives are developed with the application of value and risk management tools. The project team will meet to select the best alternatives for the construction process, the implementation of selected alternatives are monitored, and feedbacks are ploughed back to measure against the set objectives/targets.

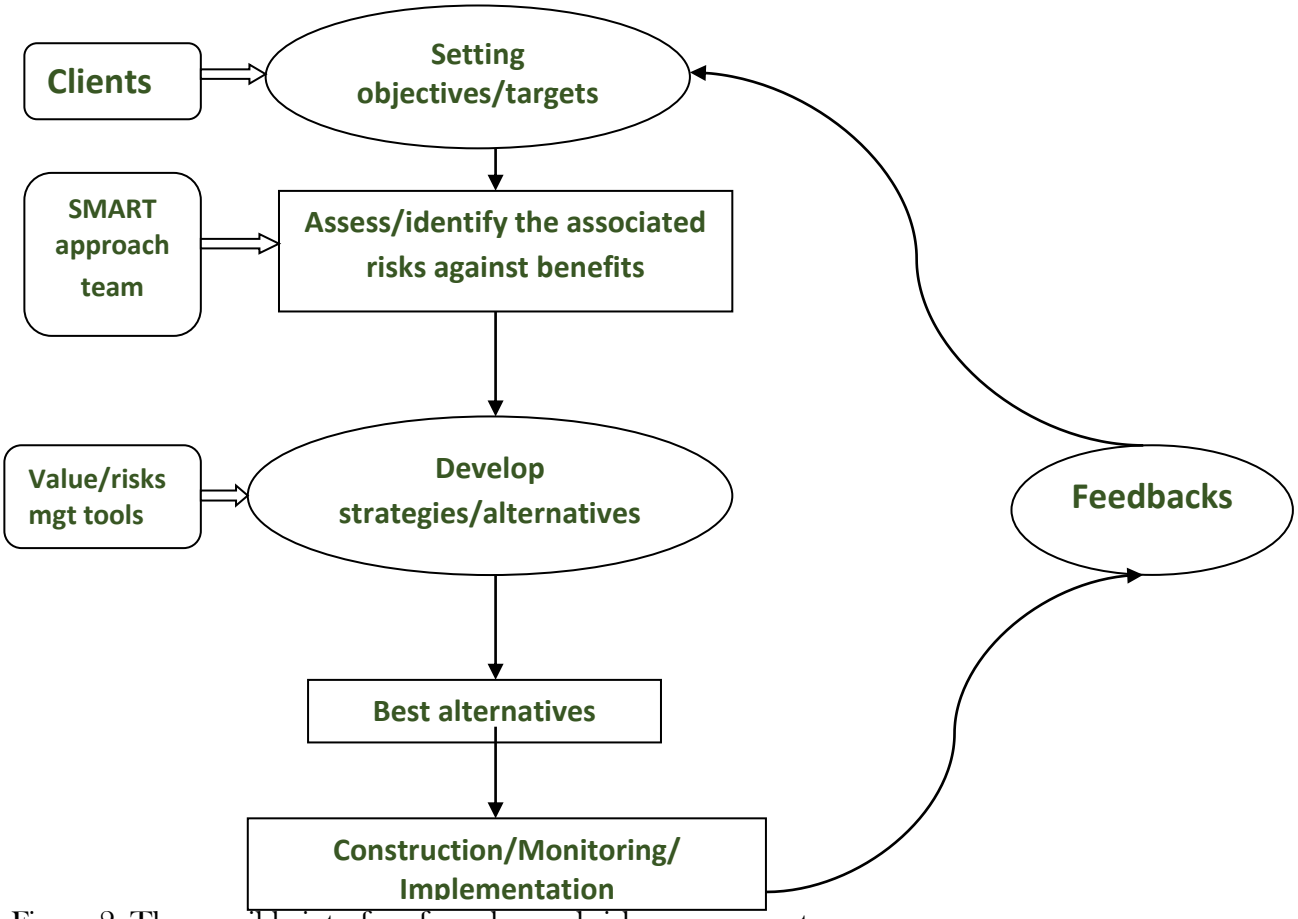

Figure 2: The possible interface for value and risk management

Research methodology

The major focus of the study is to explore the potential benefits of adopting smart strategy in managing value and risk in construction projects. Therefore, the measures of SMART approach as identified by Green (1994) were identified for the study. The use of SMART approach is Nigeria is not rampant; this limited the number of respondents adopted for the study. The study adopts purposive sampling technique where the respondents were first contacted to know if they have participated in SMART approach before they are issued questionnaires to answer. The study covers the sample frame of South-South region of Nigeria and the target population comprises construction personnel who have participated at the management level in executing either commercial or public infrastructure projects, or both. A total number of 87 persons were contacted and only 27 persons administered to have participated in group decision making meetings for project execution. Fortunately, all respondents gave valid responses. The survey was carried out within two months.

The questionnaire was designed into two parts. Part one presents the background information of respondents and part two assesses the potential benefits of SMART strategy based on project success factors such as

profitability, time, uncertainty, quality, contractual dispute, client's confidence, users' acceptability, exceeds budgets, exceeds contract period, staff strength, and absolute reliance on facilitator's skills (Abbas et al., 2016; Nader et al., 2011; Serrador and Turner, 2014) In part two, the respondents were asked to assess these factors using impact ranking scale, opportunity weighting scale, and critical acceptance level (see Table 1).

Impact ranking scale	
Highly positive	5
Positive	4
Neutral	3
Negative	2
Highly negative	1

Opportunity weighting scale	
Impossible	1
Slightly impossible	2
Neutral	3
Slightly possible	4
Possible	5

Critical acceptance level

Percentage	Level	Actions
70% and above	Acceptable	Accept
50% to 69%	Weakly acceptable	Develop
Below 50%	Not acceptable	Reject

Data analysis/Findings/Discussion

The demographic data of respondents is shown in Table 1. The respondents were asked to rank the five identified parameters using the impact ranking scale and opportunity weighting scale. The summary of assessment is shown on Table 2; the result reveals that profitability, contractual dispute resolution, client's confidence, and users' acceptability are highly commendable in SMART strategy. Quality of end product and absolute reliance on facilitator's skills can be improved on, while time, uncertainty, exceeds budget, exceeds contract period, and staff strength are difficult to achieve.

Table1: Demographic information of respondents

Classification	Groupings	Frequency
Level of position	*Top Management*	18
	Middle Management	9
	Total	**27**
Working Experience	Below 5 years	0
	5-10 years	4
	Above 10 years	23
	Total	**27**
Highest Education Qualification	HND	3
	B.Sc.	18

	M.Sc.	6
	PhD	0
	Total	**27**
Type of organization	Consulting firms	5
	Contracting firms	22
	Total	**27**

Table 2: Summary of assessment on value and risk management using SMART strategy

S/N	Parameters	Impact ranking scale(I)	Opportunity weighting scale (O)	Percentage scale (I*O*4)	Remarks of action
1	*Profitability*	5	4	80	Accept
2	*Time*	2	3	24	Reject
3	Uncertainty	1	4	16	Reject
4	Quality	5	3	60	Develop
5	Contractual dispute	5	4	80	Accept
6	Client's confidence	5	5	100	Accept
7	Users' acceptability	5	4	80	Accept
8	Exceeds budget	1	1	04	Reject
9	Exceeds contract period	3	3	36	Reject
10	Staff strength	1	1	04	Reject
11	Absolute reliance on facilitator's skills	5	3	60	Develop

The study reveals that decision making at briefing and concept stage of a project has intense positive impact on the value of money. The use of SMART methodology requires the project stakeholders to study the problems and make assumptions. Due to human nature, significant reduction in time spent in decision making cannot be guaranteed. The display of up-to-date management skills in resolving design problems for clients or users will win their confidence. SMART methodology displays the skills of facilitator encouraging him to initiate new ideas in resolving design problems. This is in the study conducted by Mootanah (1998), it emphasizes that SMART approach encourages shared views and perception amongst project stakeholders. In resolving decision problems through smart strategy, most of the decisions are constrained by top management and directed to other project participants for adoption. This practice is regarded as being manipulative because other participants are neglected in decision making. This is usually accompanied by uncertainty, the assessment of risk and risk perceptions can provide a valuable platform for controlling uncertainty. Toth and Sebestyen (2014) state that

there exists contradiction in integrating value and risk management, where the details of the owners' value-making approach are often lost at the operative management. It is not surprising that the owners' expectation may be identified at the last stage of construction. The adoption of GDS through SMART approach will provide opportunity for owners' expectation to be considered therefore leading to higher added value and also improved quality of the end product. Based on the critical acceptable level, the use of SMART approach is effective in achieving profitability, contractual dispute resolution, client's confidence, and users' acceptability in project delivery.

Conclusion

The study reveals that the value of money cannot be achieved by reduction in construction cost alone but also providing solutions to the associated problems. Value and risk management can be integrated by adopting the "uncertainty". Value management determines uncertainty relating to project objectives while risk management resolves uncertainty relating to outcomes. It is established that outcomes cannot be assessed without clear understanding of project objectives. This makes the practice of value management dependence on assessment of risk. The use of simplistic models in resolving issues in managing value and risk has proved legally effective over the years but the application of these models to undefined problems has proven abortive. This has created the demand for an alternative strategy that lays emphasis on learning process. The use of SMART strategy has proved effective; it focuses on stakeholders making fundamental assumptions relating to the nature of problems. The adoption of these fundamental assumptions depends on its acceptability by stakeholders. The research findings reveal the benefits and limitations of SMART strategy usage. It is evidenced that the use of SMART strategy creates a reflective approach to decision making. The integration of value and risk management is a vital aspect of project design and therefore, they require continuous development in order to remain relevant and effective to clients.

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HOUSEHOLD HEADS' AGE STRUCTURE AND CROWDING IN PUBLIC HOUSING MULTIFAMILY APARTMENTS IN LAGOS, NIGERIA

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Abstract
Age-specific demographic factor in household headship is now recognized as a major influence in interpreting the space needs, preferences and attitudes of occupants of residential apartments. Specifically, understanding the dynamics associated with the diversity of household structure by age of household head is speculated to affect the likelihood of such households being crowded, and to varying intensities. The study aims to measure the effect of age of household heads on the probability of crowding across Lagos State Property Development Corporation (LSDPC)'s multifamily apartments in Lagos, Nigeria. A case study methodology was adopted to deal with specific issues of age of household head and crowding in low income and medium income multifamily apartments in four purposively selected estates. The study relied on a sample frame of 7764 apartments from which a sample of 7.5% (582) was chosen for distribution of pretested questionnaire. The apartments visited were picked after applying stratification and systematic random techniques. The crowding level was measured using the Canadian National Occupancy Standard (CNOS). The results indicate that the productive age bracket 31-65 years account for 76.2% of the respondents. The data were analyzed using descriptive statistics, involving tables, and graphical illustrations. The results showed that there was a preponderance of 3-5 occupants per apartment. Overall, the statistical evidence reveals that age of household head had no significant effect on apartment crowding. These findings are useful for policy and planning purposes in regard to family life-cycle and household size considerations in public housing delivery. For LSDPC, the findings are important in assisting the agency's quest to improve the designs of its multifamily apartments.

KEYWORDS: age structure, crowding, habitable rooms, household composition, multifamily apartments, public housing

Introduction

As demographic entities, households or human groupings in general are usually not perceived based on uniform characteristics. On this basis, the range of household structure and characteristics has continued to be widened. The composition of households by age of household head and ages of other occupants could reveal certain signs of housing stress that influence the utilization of an apartment's spaces. Household structure by age of household head connotes a major demographic diversity in the way people of different age categorization occupy dwellings in terms of space needs, preferences and attitudes.

One of the remarkable expressions of such stressful situations or experiences corresponds to household crowding intensity. Household crowding is often times associated with internal density or in-dwelling density of persons in a specific area or space within a residential setting (Hosseini et al, 2021; Iweka 2012).

A number of previous authors have pointed out that there is no universally accepted format for defining crowding, especially the threshold at which it could be regarded as intensive (overcrowding) (Díaz and Fernández, 2016). These attributes vary, depending on the cultural, historical and developmental actualities of the people in focus. However, most studies of dwelling occupancy and habitability have approached the interpretation of household crowding from two main perspectives: (i) number of individuals in the household (ii) the dwelling itself.

The age-specific headship of residential apartments yields a demographic measure of insights into patterns of dwelling occupancy or average household size specific to the age of the householder. From this premise, the age-structure of households becomes one of the most significant demographic factors for predicting or explaining apartment crowding. In fact, a study by (California Research Bureau (2002) contends that households headed by younger adults (30-44 years) are 120.0 percent more likely to be more crowded than those headed by seniors. In recent times, this demographic factor of household head has attracted more explanatory attention in the phenomenon of crowding than previously imagined globally.

In general terms, researchers consistently maintain that there is no specific standard for measuring crowding. In fact, the claim is that household crowding can be attributed to demographic factors, physical factors of the dwelling and social factors (Díaz and Fernández, 2016). Most objective and quantitative indicators tend to rely on three most commonly used indices. These are (a) The Canadian National Occupancy Standard (CNOS); (b) The Equivalized Crowding Index (ECI); and (c) The American Crowding Index (ACI) (Hosseini et al 2021; Iweka 2012). In all of these, overcrowding is interpreted as a situation where too many people occupy a space in the micro-environment of the home, resulting in lack of privacy or inability of persons to control the presence of others.

In Lagos Nigeria, the multifamily apartments belonging to the Lagos State Development and Property Corporation (LSDPC) were designed with a fixed number of bed spaces and occupants in mind. However, in practice it can scarcely be expected that the number of occupants the apartment was designed to accommodate will actually use that dwelling unit. More specifically, the impact of the changing demographic structure of age of household heads affects the probability of such households being crowded, and to varying intensities.
Thus, there is a need to establish the relationship between household size and age of household heads across LSDPC's multifamily apartments in different locations within Lagos. The grouping of age cohorts will help the agency to understand and interpret how the age structure of the multifamily apartment occupants affects household crowding. Therefore, this study aims to measure the effect of age of household heads on the likelihood of crowding across LSDPC's multifamily apartments in Lagos.

Literature review

Nature of Multifamily Housing and associated demographic issues: Different organisations or agencies define multifamily housing differently, and this tends to create some confusion. Zietz (2003) asserts that the popularity of multifamily housing as a housing choice is growing fast. He rationalized that this is due to changing household demographics. According to him, 25% of all households in the United States of America (US) live in multifamily housing. The operational definition by the US Congress for multifamily housing is any housing project that contains four or more units of apartments (Zietz, 2003).
This definition by the US Congress varies slightly with the one adopted by the US Department of Housing and Urban Development (HUD), and the one used by the Bureau of Census. A document released by HUD defined a multifamily housing as a property that has five or more dwelling units (Colton & Collignon, 2001; Zietz, 2003). Closely related to the HUD's definition is that of the Bureau of US Census which regards multifamily housing as five or more units contained within a single building (Van Vliet, 1998; Akkerman, 2005). The focus of this present study is on multifamily dwellings configured in the form of three to four floor walk-up buildings for the purpose of achieving medium or high density low rise urban housing (Larco, 2009).

Occupants of multifamily dwellings generally comprise people of all ages, life stages and income levels. According to Larco (2009) multifamily housing is actually a choice by individuals based on their lifestyles and stage in the life-cycle. He also recognizes that this multifamily housing is attractive to specific demographics like young singles, couples without children, the elderly, and the divorced because it is affordable and does not require much maintenance.
Similarly, Colton and Collignon (2001) observed that a growing number of professional and empty nester households now inhabit this housing type in different locations. Other researchers like Nadji (1997) and Zeitz (2003) also agreed that an ageing population tends to crave for multifamily dwelling units in a number of countries particularly in the US. According to these authors, the inclination of many American households towards multifamily housing units is ascribed to their busy lifestyles and the desire for freedom from the responsibility of maintenance costs and repair time, the mobility of the work force and the convenient location of most of the apartments.

In Australia, recent studies by Urban Design Advisory Committee (2000) have sown evidence of increased demand for multifamily housing units. The study estimated that multifamily dwellings constitute over 50% of the total number of dwelling approvals in Sydney for each of the last five years of the past Century. According to the study, this increase is justified by the changing social structure of the society. This is evident in the

preponderance of an ageing population, smaller household sizes, late marriages, women active in workforce, etc.

Home spaces, habitable rooms and crowding: Home space in the context of this study represents all interior spaces within each housing unit in LSDPC's multifamily apartments. In this research, the interior spaces of LSDPC apartments are the primary focus. Each single interior space is typically referred to as a habitable room. These spaces usually include living room, family room, kitchen and dining room. These are the spaces where the family spends most of its time. Living activities usually consist of household gathering, entertainment, cooking and eating. Also activities such as sleeping and relaxing utilize habitable spaces. The spaces may equally be utilized for activities like reading, writing, and using computer.

Support spaces made up of service space and circulation space such as closets, pantry, laundry room, garage and utility room and storage spaces, are not habitable rooms. Also, circulation spaces such as corridors, foyers, and stairs are for movement facilitation and are not habitable rooms.
Obateru (2005) describes habitable rooms as spaces that normally serve the functions for sitting, sleeping, eating, studying or recreation. However, he included kitchens as part of habitable rooms but excluded bathrooms and closets. The present study accepts Obateru's position on kitchens. Thus kitchens were regarded as habitable rooms. This position was justified by Asquith (2006), who argued that apart from cooking and eating, a kitchen may also be used for many other purposes like working, homework, playing, entertaining, hobbies and talking. The bathrooms and closets were not regarded as habitable rooms in this study.

In terms of crowding, the occupancy rate and number of people in each habitable room provides a basis for assessing the situation (Gray, 2001: Hosseini, et al. 2021). Some earlier studies had categorized crowding as critical if the number of persons in a bedroom is equal to three or more; or semi-critical if the number of persons in a bedroom is more than two (Díaz and Fernández, 2016).
The quantity of habitable rooms in an apartment and the way in which the household occupants use them in a range of apartment types reveals the crowding experiences in those apartments. Therefore, the changing demographic structure of multifamily apartments' occupants tends to show household types that have more rooms than they need. Such demographic changes indicate crowding and social trends associated with age cohorts of household heads.

In the case of the present study, the relationship between household crowding and age of household head in LSDPC's multifamily apartments is tested. The purpose is to establish the magnitude and distribution of apartment crowding based on ages of the household heads in LSDPC's multifamily housing units.
What happens to size of the household as the household head gets older? This could provide socio-demographic indications about age group and crowding that can affect policies on living facilities (Díaz and Fernández, 2016). For example, assert that if the head of household belongs to the age bracket at which there is a high probability of being crowded, policies will focus on provisions which could improve the situation, like grants that can improve wealth and welfare in the household. This could also guide policy on average number of children present in specific age group of household with targeted outcomes (Akkerman, 2005)

Methodology
This study is essentially an inquiry that focused on investigating a real-life contemporary phenomenon. Therefore, a case study methodology was considered as a preferred option for this research. According to Yin (1994), every case in a case study research should address a specific purpose within the general context of the inquiry. Age of household head and crowding are specific issues within housing demographic studies. A case study design allows the researcher to understand the impacts of independent variables on dependent variables, while making it difficult for such a researcher to influence or alter participants' attitudes.

The main objective of the present study was to establish the effect of age of household head on the likelihood of crowding in multifamily apartments belonging to LSDPC across Lagos State, Nigeria. Specifically, a multiple case study of four purposively selected housing estates in the low income and medium income category was adopted. These are: (1) Low income estate located at Abesan, containing 4,272 multifamily apartments in the categories of 2-bedroom (1,672) and 3-bedroom (2,600) units (2) Low income estate

located at Iba, containing 2,388 multifamily apartments in the categories of 3-bedroom units (3) Low income estate located at Dolphin II, containing 576 multifamily apartments in the categories of 2-bedroom (136) and 3-bedroom (440) units (4) Medium income estate located at Ebute-Metta, containing 528 multifamily apartments in the categories of 4-bedroom units.

The study relied on a sample frame of 7,764 multifamily apartments in the staple of 2-bedroom, 3-bedroom and 4-bedroom units, from which a sample of 7.5% (582 units) was chosen for questionnaire distribution. In determining this sample size, this study relied on published tables which provide guidelines for a given set of precision, confidence levels and variability. This sample size of 582 (7.5%) was considered adequate because it far exceeds the figure of 366 (4.71%) recommended many years ago as appropriate for a study population of 7,764, based on assumed standard error of 0.5 (Krejcie & Morgan, 1970). The procedure further follows the recommendation of Denscombe (1998) that researchers should build an allowance in the sample size for non-responses. Hence, the sample size was deliberately increased to compensate for non-response.

Data for this study was collected using a survey technique. A principal field survey approach employed was the administration of structured questionnaire. The apartments eventually visited for questionnaire administration were picked after applying stratification and systematic random techniques to different design categories in each estate based on number of bedrooms.

The study relied on the Canadian National Occupancy Standards (CNOS) in establishing the size of a household in terms of number of occupants. Significant factors that were considered included gender (sex), marital status and age of every occupant. The maximum number of persons expected to occupy a habitable room, based on CNOS is pegged at one. However, what constitutes a person is not absolute, but determined based on internationally acknowledged norms regarding accepted sleeping arrangements. This provided the unit of analysis for establishing an apartments crowding level, based on number of adult-equivalent individuals in the household. According to Australian Bureau of statistics (2016), the CNOS measure applicable to this study specifies that:
Not more than two persons should be assigned to a room
Children one year old and below are disregarded

Children above one year of age but below five years can share a room, irrespective of their gender

i. Children less than eighteen years can share a room provided that they are of the same gender
ii. All persons eighteen years and above who are not in a marital relationship should have a separate room each
iii. All parents or couples in a marital relationship are to share a room.

In analyzing the data, children who are one year old and below are disregarded. All other children below eighteen years are assigned as "half" of a person. Individuals in a marital relationship are assigned as "half" of a person each. Other individuals eighteen years and above are assigned as "one" person (Iweka, 2012).

In computing the spaces of the apartments, rooms below 6.5 square metres are not considered as habitable rooms or bed rooms. Habitable rooms that are 19.0 square metres and above are counted as two. Size of the apartment is the area of the whole dwelling unit, taking from extreme internal dimensions.

Results and discussion

Survey respondents were requested to "please indicate your age as of your last birth day". The following six age groups were provided as response options: (a) less than 18 years, (b) 18-30 years, (c) 31-40 years, (d) 41-50 years, (e) 51-65 years, and (f) above 65 years. Table 1.0 shows that the largest number of respondents 28.4% (50) was in the category 31–40 years. The result on age distribution of respondents indicates that persons in the productive age bracket 31–65 years account for 76.2% (134).

Table 1.0: Crowding outcome for respondents according to age distribution

Age group of household head	Number of Respondents	Percentage (%)
Less than 18 years	3	1.7
18-30 years	29	16.4
31-40 years	50	28.4
41-50 years	48	27.3
51-65 years	36	20.5
Above 65 years	10	5.7
Total	**176**	**100.0**

On the other hand, respondents who could be regarded as youthful and those regarded as senior citizens jointly constitute only 23.8% (42). This difference could be useful for policy and planning purposes particularly in regard to family life-cycle and household size considerations in public housing delivery.

Table 2.0 shows the results of crowding outcome for respondents in the five age range categories investigated in this study. As could be observed three criteria were employed in the measurement of crowding for each of the six apartment types selected for in-depth investigation. These are: number of habitable rooms, number of bedrooms and total area of each apartment.

Table 2.0: Crowding outcome for five age range categories in all six apartment types

		Type 1, 2-bedroom, Abesan	Type 2, 2-bedroom, Dolphin	Type 3, 3-bedroom, Abesan	Type 4, 3-bedroom, Iba	Type 5, 3-bedroom, Dolphin	Type 6, 4-bedroom, Ebute Metta
Design occupancy by habitable rooms		7.0	7.0	8.75	8.75	10.5	9.0
Design occupancy by bedrooms		3.5	3.5	5.25	5.25	5.25	6.0
Design occupancy by apartment size		7.43	8.99	11.37	9.66	13.08	15.36
Crowding during habitation	18-30 years	1.0	4.67	2.0	4.25	3.69	4.4
	31-40 years	5.83	1.6	2.73	2.86	6.0	3.41
	41-50 years	2.38	5.2	3.14	6.38	3.83	2.0
	51-65 years	-	4.0	3.53	-	4.25	4.19
	Above 65 years	-	3.5	2.17	-	2.0	-

The table reveals that for household heads aged 18-30 years, all apartments regardless of type, were under-occupied based on number of habitable rooms and total area of each apartment. Results of crowding based on number of bedrooms indicate that over-occupancy occurred in Type 2 (Two-bedroom) apartment for households headed by persons in the age range 18-30 years. A surplus of 1.17 adult-equivalent occupants were accommodated in the apartment.

All the other five apartment types in this study were under-occupied based on number of bedroom measurement indicator. The apartment types that were under-occupied are: (a) Type 1 (two-bedroom) at Abesan (b) Type 3 (three-bedroom) at Abesan (c) Type 4 (three-bedroom) at Iba (d) Type 5 (three-bedroom) at Dolphin II (e) Type 6 (four-bedroom) at Ebute-Metta. Among all these, Type 3 apartment recorded the highest difference between design occupancy and actual occupancy in terms of under-occupancy.

In households where the heads are 31 – 40 years, the table reveals that all the apartments covered in the study were under-occupied based on number of habitable rooms and total area of apartment. When the number of bedrooms was applied as the measuring indicator, Type 1 (2-bedroom) and Type 5 (3-bedroom) recorded over-occupancy. However, all the other four apartment types indicated under-occupancy, based on this measurement indicator. The four types that recorded under-occupancy based on number of bedrooms are: (1) Type 2 (two-bedroom) at Dolphin (2) Type 3 (three-bedroom) at Abesan (3) Type 4 (three-bedroom) at Iba (4) Type 6 (four-bedroom) at Ebute-Metta.

The results therefore suggest that Type 1 (two-bedroom) at Abesan was unsuitable for household heads in the age range 31-40. On the other hand, Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta seemed to be the most appropriate types, based on the results of the present study.

Persons who belong to the age category 41-50 years were spread among the six apartment types investigated in this research. All apartments regardless of type were under-occupied. The two criteria that gave this result are: number of habitable rooms and total area of each apartment. A slightly different result was obtained when an indicator of number of bedrooms was applied in the measurement of crowding. The table shows that Type 2 (2-bedroom) at Dolphin II and Type 4 (three-bedroom) at Iba recorded over-occupancy. This indicator of number of bedrooms, however, gave under-occupancy in the other four types of apartments headed by persons within the age bracket 41-50 years. The four apartment types in this category include: (1) Type 1 (two-bedroom) at Abesan (2) Type 3 (three-bedroom) at Abesan (3) Type 5 (three-bedroom) at Dolphin II (4) Type 6 (four-bedroom) at Ebute-Metta.

Again, it could be observed from the table, that all the apartments in Abesan estate and Ebute-Metta estate were under-occupied when the indicator of number of bedrooms was used for crowding assessment.

Respondents whose ages are from 51 years to 65 years were less likely to be found in Type 1 (two-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. Two indicators revealed under-occupancy in all apartment types where household head was aged 51-65 years. These two indicators are number of habitable rooms and total area of each apartment. The application of an indicator of number of bedrooms shows that Type 2 (two-bedroom) at Dolphin II estate was over-occupied. There were more adult-equivalent persons (0.5) than the estimated dwelling occupancy by design. On the other hand, this indicator of number of habitable rooms reveals that three apartment types were under-occupied. These under-occupied apartments could be found in Type 3 (three-bedroom) at Abesan, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Household heads whose ages are above sixty-five years were not found among residents of three apartment types in the study area. These are: Type 1 (two-bedroom) at Abesan, Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta. Instead, respondents in this age category were seen in Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 5 (three-bedroom) at Dolphin II.

The data shows that among the three apartment types where respondents in this age reside, only Type 5 (three-bedroom) at Dolphin estate was completely under-occupied irrespective of the measuring indicator applied.

With regards to Type 2 (two-bedroom) at Dolphin II, the households were under-occupied using two indicators of number of habitable rooms, and total area of apartment. A significant result was recorded when the number of bedrooms was used to assess crowding in apartment Type 2 (2-bedroom) at Dolphin for respondents above 65 years. This was one of the few instances where the apartment was occupied as designed. The actual crowding was equal to the design occupancy rating.

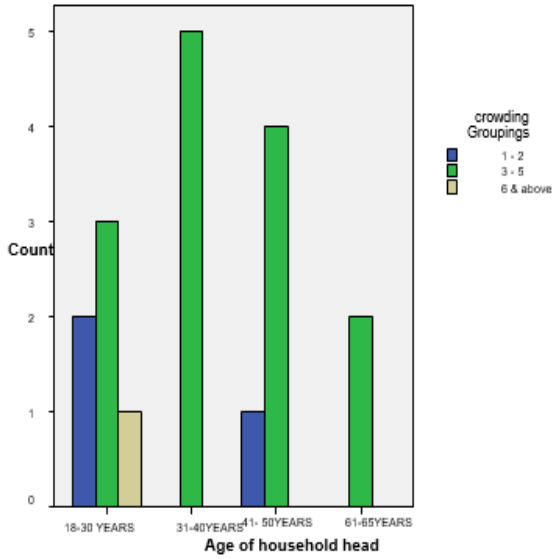

Figure 1: Crowding during habitation for Apartment Type 1

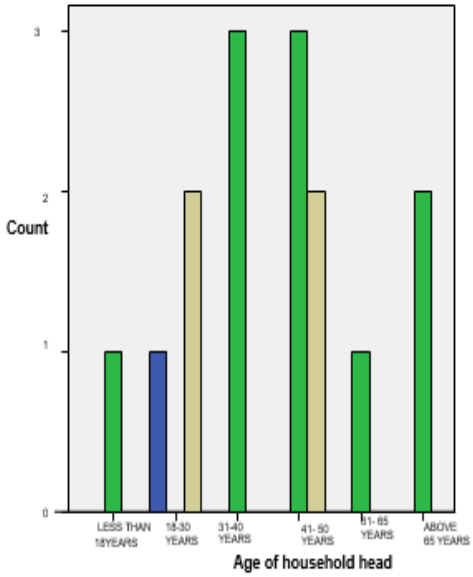

Figure 2: Crowding during habitation for Apartment Type 2

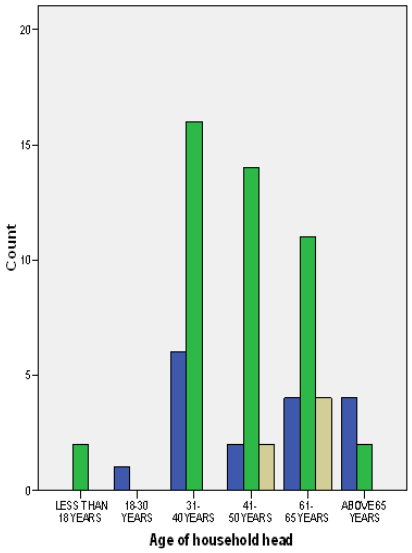

Figure 3: Crowding during habitation for Apartment

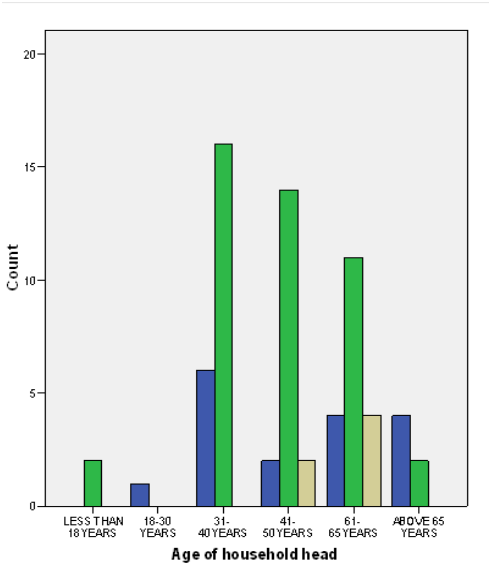

Figure 4: Crowding during habitation for Apartment

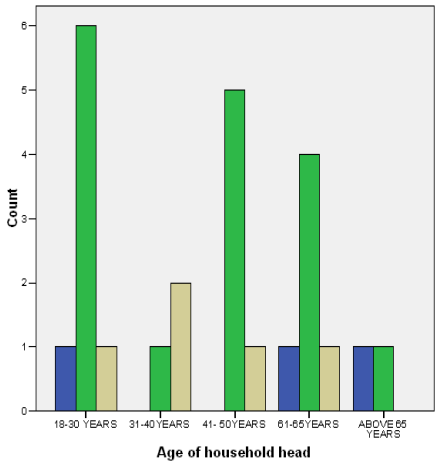

Figure 5: Crowding during habitation for Apartment

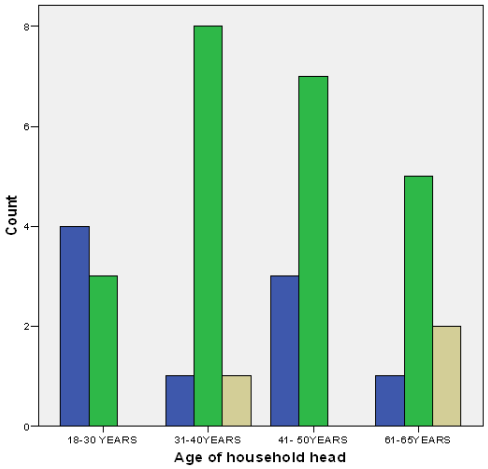

Figure 6: Crowding during habitation for Apartment

Figure 1 to Figure 6 show the actual crowding outcome during habitation for different age categories in various apartment types, presented in three groupings of 1-2 occupants, 3-5 occupants, and 6 & above occupants. The figures show a preponderance of household sizes of 3-5 occupants.

Statistical validation of effect of age of household head on crowding: Table 3.0 shows the result of a chi-square test to determine the effect of age of respondents on crowding among the six apartment categories investigated. At 95% confidence level, the data reveals that age of household head had no significant effect on apartment crowding. These findings are important for LSDPC in its determination to improve the designs of its multifamily apartments.

Table 3.0 Effect of age of household head on crowding

Apartment type	Chi-square Value	P-Value	Remark
Type one (two-bedroom), Abesan	5.243	0.513	Age of household head has no significant effect on crowding in all apartment types
Type two (two-bedroom), Dolphin II	11.200	0.342	
Type three (three-bedroom), Abesan;	17.223	0.070	
Type four (three-bedroom), Iba	5.982	0.200	
Type five (three-bedroom), Dolphin	8.448	0.391	
Type six (four-bedroom), Ebute-Metta	9.171	0.164	

As expected, a household headed by a senior citizen had a significant negative effect on crowding. Among the three apartment types where they reside, their households were either most under-occupied, or the second most under-occupied. This may be due to the exit of children from the houses.

Conclusion and policy implications

The variability in the age structure of heads of households in LSDPC's multifamily apartments served primarily as a proxy for recognizing age cohorts of households as distinct demographic groups. Understanding crowding among these groups is important because it might be a sign of housing stress, excess of simulation and impingement on privacy. The empirical analysis from field data indicates that age of household heads has no statistical significant impact on the likelihood of being in crowded or overcrowded situation.

Additionally, the findings could have public policy implications. In that sense, a set of variables connected with head of households could address social problems and lead to improved living conditions of the entire household.

Currently, the vast majority of households in the multifamily apartments have surplus spaces. They have more rooms than they need. LSDPC's policies should therefore focus on improving the diversity of apartment sizes

and types in such a way that available units can be utilized more efficiently by households belonging to different age cohorts.

Findings from this study could enable policy makers to develop a demographic perspective on the aspects of housing consumption, with respect to household structure and composition of occupants in different age cohorts as a predictive factor for apartment crowding levels.

Finally, the policies pertaining to life-cycle and household sizes in public housing multifamily apartments can be derived from the knowledge of age distribution of respondents in this study.

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ASSESSING ORGANIZATIONAL COMPETENCY MEASURES IN CONSTRUCTION PROJECT DELIVERY

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Abstract
There is a general concern that project success is centred on the competency of professionals or project team involved in the project. It is therefore, important to understand how to evaluate competencies within their domain. The study assesses the influence of organizational competency measures on project performance in the Nigerian construction industry. The survey was carried out using explanatory sequential approach. The research findings reveal that "easy access to knowledge" and "historic events" as the top highest loading measures. The study concludes that organizations should create enabling environment for knowledge generation and utilization, and also previous track records should be properly documented. It further recommends that project stakeholders should focus on how to improve their efforts based on the identified measures.

Introduction

Over the years, performance measurement system was based on the iron triangle of project management which includes cost, time, and quality related criteria (Bryde and Brown, 2004). With the shift from industrial age to information age, other performance measures have been developed. The demand for measurement system in the industry emerged from the need of the organizations to quantify the efficiency and effectiveness of their actions (Pereira and Carvalho, 2009). The increased complexity of construction industry and the markets in which they compete deem it no longer appropriate to use the financial measures as sole criteria to measure an organizational performance (Kennerly and Neely, 2002). Many other criteria have been adopted including competency. Assessing competency is essential at both organizational and individual levels in any business domain (Macky and Johnson, 2010). Studies have shown that one of reasons for unsuccessful project completion is centred on the incompetency of professionals or project team (Fajar et al, 2020; West and Plumeri, 2008).

In assessing competency amongst project players, it is therefore important to note that each organization or stakeholder needs to understand how to evaluate competencies within their domain so as to allow them capture and anticipate continuous changes. Likewise, in assessing an organizational competency, it is equally important to understand that the organization exists in a striving environment therefore the necessary skills, knowledge, and attributes required to compete should be considered (Stevenson, 2000). There exist few empirical studies on the assessing of organizational competency within the Nigerian construction industry focusing on competency requirements for the implementation of BIM (Rishi et al., 2020), competency of construction managers (Adelerri et al., 2021), project management competencies (Tunji-Olayemi et al., 2016). Based on the literature scan, there is no empirical study on assessing organizational measures amongst all stakeholders including contractors, consultants, and clients. The study explores the research gap by assessing the influence of organizational competency measures on project performance amongst all stakeholders in the Nigerian construction industry.

Literature review

Competencies are defined as 'the knowledge, skills, traits, attitudes, self-concepts, values, or motives directly related to job performance or important life outcomes shown to differentiate between superior and average performers' (Shippmann *et al.,* 2000). This requires the need for a measurable human capability to drive meaningful achievements in projects. Measuring competency is essential to ensure that organizations understand where to devote greater attention in order to maximize their resources. There are four elements of organizational competency as identified in the literature scan, which are knowledge, skills, abilities, and personal characteristics.

(a) Knowledge sharing

The ability to create new knowledge, to circulate knowledge within an organization and to utilize the knowledge into new products quickly, is the bedrock of success in any organization. Rapid development of science and technology has created dynamic market competitions where the growing importance of capturing, sharing and innovating experiences and knowledge provide competitive advantages for organizations (Liu and Liu, 2009). Knowledge can be classified as: a) tacit knowledge and b) explicit knowledge. Explicit knowledge is codified, physically stored in either paper or electronic format, and shared in forms of data or scientific formulas while tacit knowledge is highly personal and it is stored in people's heads and acquired through experience (Liu and Liu, 2009). Knowledge sharing is crucial to enhance project success. Grillitsch *et al.* (2007) identified factors to be considered for a successful knowledge transfer as significance of the knowledge, employee acceptance and involvement, and the transfer medium. Ismail *et al*. (2009) propose a framework for knowledge sharing in project management as shown in Figure 1.

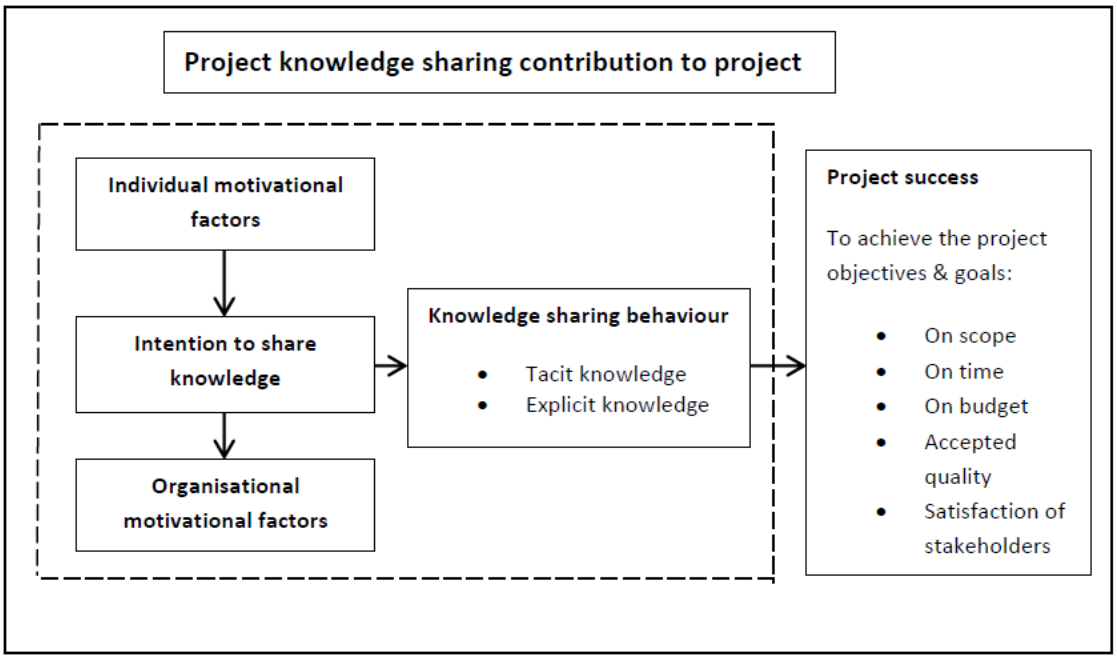

Figure 1: Framework for knowledge sharing contribution to project (Ismail et al., 2009)

(b) Skills and technology transfer

Skills gap is the disparity between an organization's current capabilities and the skills required to achieve project objectives (ASTD, 2012). Different skills are required at different organizational levels whether individually or in a group. Peterson and Van Fleet (2004) define skill as the ability to either perform some specific behavioural task or to perform some specific cognitive process that is functionally related to some particular task. Likewise, technology transfer is regarded as the process of conveying technology from one entity to another. This process is regarded as successful if the receiver can effectively utilize and assimilate the transferred technology (Ramanathan, 1994). The transfer of skill and technology is beneficial for economic advancement, knowledge advancement and project performance (Waroonkun, 2007). The factors influencing skills and technology transfer are reviewed and presented in Table 1.

Table 1: Review of factors influencing skills and technology transfer

Factors	Author(s)
1. Technology transfer method	Lin and Berg, 2001; Waroonkun, 2007
2. Work ethic	Waroonkun, 2007; Soltanzadeh and Khoshairat, 2012
3. Willingness to transfer technology	Waroonkun, 2007
4. Intent to learn technology	Waroonkun, 2007
5. Cultural traits of transferor/transferee	Waroonkun, 2007; Lin and Berg, 2001; Soltanzadeh and Khoshairat, 2012
6. Transfer environment	Waroonkun, 2007; Soltanzadeh and Khoshairat, 2012
7. Level of involvement of transferor/transferee	Soltanzadeh and Khoshairat, 2012

(c) Abilities

Ability denotes 'employee perceptions regarding management's competence and skills' (Johns and Saks, 2007). The ability of an employee to perform in an organization is influenced by the organization's ability to meet its mission and also propel employees to improve performance within an organization. There are several factors that can affect the employee's ability to meet project expectations (see table 2) and they are categorized into two groups, namely: a) individual factors and b) organizational/job factors (Service Canada, 2011).

Table 2: Factors that affect employee's ability (Service Canada, 2011)

Factors	Sub-factors
Individual	
	1. Personal circumstances 2. Physical/emotional problems 3. Inappropriate personal behaviours 4. Incompetence 5. Job mismatch
Organization/job	
	6. Poor leadership 7. Lack of clarity 8. Cumbersome work processes 9. Unrealistic policies and procedures 10. Work environment 11. Inadequate tools and support 12. Poor reward system 13. Feedback

(d) Personal characteristics

The personal characteristics of employees have a dominant role to play in any organization's success. Most firms try to realize competitive advantage over others by improving their employees' satisfaction with the intention of influencing their personal characteristics (Gursoy and Swanger, 2007). Previous studies reveal that personal characteristics, for example, personality traits, values and beliefs affect thoughts and actions in a consistent way across different situations (Weiss and Adler, 1984; Staw *et al.*, 1986). Likewise, interactional psychologists describe individual behaviours as a composition of both personal and situational attitudes (Muzumdar, 2011). Personal values, beliefs, and attitudes are elements of personal characteristics which can influence employees' efforts in any organization. Factors influencing personal characteristics are social network (family and friends), work ethics, lifestyle, religion, culture, technology, media/music, historical events, and educational institutions (Andersson *et al.*, 2005; State of New South Wales (DET), 2009).

The identified key practices and parameters that influence organizational competency in project performance are highlighted in Table 3.

Table 3: Practices influencing organizational competency in project performance

Practices/parameters
Knowledge sharing
1. Commitment of decision makers
2. Competence of team members
3. Interaction within team members
4. Integrative concept of sharing
5. Easy access to knowledge
Skill and technology transfer
6. Technology transfer method
7. Work ethic
8. Willingness to transfer technology
9. Intent to learn technology
10. Cultural traits of transferor/transferee
11. Transfer environment
12. Level of involvement of transferor/transferee
Abilities
13. Feedback process
14. Job mismatch
15. Lack of clarity
16. Unrealistic policies and procedures
17. Poor reward system
Personal characteristics
18. Lifestyle
19. Historic events
20. Educational background

Research Methodology

Data collection

The study population comprises of project personnel who have participated in both building and civil engineering works in Federal Capital territory of Nigeria known as Abuja. Abuja is made of seven districts and has the highest record of construction activities with most of the multinational companies having their headquarters situated in the Capital. For data collection, the study adopts an explanatory sequential approach of mixed methods research design for the collection of quantitative data first and then, qualitative data. This involves the combination of questionnaire for field survey and interview for case studies. Saunders et al. (2009) further stipulated that in choosing a sample size, there are four factors to be considered: (1) the level of certainty that the characteristics of data collected will represent the characteristics of the total population, (2) the margin of error that can be tolerated, (3) the type of analysis to be used, and (4) the size of population. Based on this recommendation and Yamane's formula (1967), a total number of 338 construction professionals were selected for the study. The sample population includes public sector clients, registered contractors with Federal Ministry of Works and Housing, and registered consultants. The study adopts a stratified probability sampling method based on principles of randomness and probability theory to select respondents of sample size from the study population. The field survey was carried out within three months; a total number of 101 valid responses were computed for data analysis with response rate of 30 percent (Yamane, 1967). For qualitative survey, four case organizations were selected based on their designation and experience using a purposive sampling technique. According to Saunders et al. (2009), purposive sampling technique enables a researcher to use judgement in selecting case organizations that can best answer research questions and meet research objectives.

Measures/Variables

The questionnaire is classified into two parts. Part one focuses on the demographic data of respondents, this is shown in Table 3. The ordinal scale measure of Likert as designed by Bowling (1997) was used to measure the opinions of respondents. Part two examines the influence of organizational competency on project performance using a 5 Likert scale of No effect (1), Minor effect (2), Neutral (3), Moderate effect (4), and Major effect (5). The variables/parameters shown on Table 3, were adopted for the study.

Data analysis/Findings

Table 4 reveals the cross-tabulation result of respondents' profession against their demographic information. From the analysis, the three major contracting parties are well-represented while majority of respondents working with clients and consultants are either in managerial or middle management positions. The analysis of work experience reveals that almost all respondents have more than one year experience with 20 percent having above 19 years work experience and 32 percent have between 10 to 19 years work experience. The analysis also shows that 34 percent of respondents have participated in over 15 construction projects while 15 percent have participated in 6 to 10 projects. A total of 31 percent of respondents have either M.Sc. or M.Tech. or MBA in the related field of study while 46 percent have either B.Sc. or its equivalent. The studied construct can be classified as a managerial problem, therefore their opinions can enable the study to draw reasonable conclusions based on the research aim.

Table 4: Cross-tabulation result of respondents' profession against their demographic information

		Clients	Consultants	Contractors	F	%
Level of position	Managerial	11	18	8	37	37
	Middle management	5	25	9	39	38
	Operational (skilled/unskilled)	0	0	25	25	25
	Total	16	43	42	101	100
Work experience	Less than 1year	0	0	8	8	8
	1 to 9years	4	21	15	40	40
	10 to 19years	7	16	10	33	32
	Above 19years	5	6	9	20	20
	Total	16	43	42	101	100
Number of participated projects	1 to 5	0	5	26	31	30
	6 to 10	3	15	3	21	21
	11 to 15	5	6	4	15	15
	Above 15	8	17	9	34	34
	Total	16	43	42	101	100
Highest formal education	Waec	0	0	6	6	6
	N.Diploma/HND	1	0	12	13	13
	B.Sc./B.Tech/B.Com	8	18	21	47	46
	M.Sc./M.Tech/MBA	7	21	3	31	31
	PhD/D.Tech.	0	4	0	4	4
	Total	16	43	42	101	100

F = frequency; % = percentage

The survey for this study was conducted using quantitative and qualitative techniques. The quantitative section evaluates the construct using Principal component analysis (PCA) to reduce 20 variables identified from the literature review and also identify similarities in data grouping. The result of eigenvalues of the correlation matrix for organizational competency measures is shown on Table 5. Based on the criteria for selection, two components are retained for rotation and interpretation. Table 6 shows the result of the variables with more than 0.40 loadings, the decision on which component to retain for interpretation is based on the fact that a component must have at least three variables with significant loadings to be retained. Based on this criterion, components 1 and 2 are retained for interpretation.

Table 5: Eigenvalues of the correlation matrix for organizational competency measures

Components	Eigenvalue	Difference	Proportion	Cumulative
1	10.690	8.438	0.534	0.534
2	2.251	1.258	0.112	0.647
3	0.993	0.082	0.049	0.696
4	0.911	0.162	0.045	0.742
5	0.748	0.097	0.037	0.779
6	0.651	0.018	0.032	0.812
7	0.632	0.065	0.031	0.844
8	0.566	0.123	0.028	0.872
9	0.442	0.039	0.022	0.894
10	0.403	0.060	0.020	0.914
11	0.342	0.065	0.017	0.931
12	0.276	0.054	0.013	0.945
13	0.222	0.004	0.011	0.956
14	0.218	0.018	0.010	0.967
15	0.199	0048	0.010	0.977
16	0.151	0.052	0.007	0.985
17	0.098	0.010	0.004	0.990
18	0.087	0.023	0.004	0.994
19	0.064	0.017	0.003	0.997
20	0.046		0.002	1.000

Initial factor method: Principal component analysis (SAS)

Table 6: Rotated factor pattern from PCA of organizational competency measures

Measures	Factor 1	Factor 2
V16_1e	0.839	
V16_2b	0.833	
V16_2f	0.828	
V16_3c	0.824	
V16_2g	0.823	
V16_1b	0.818	
V16_2a	0.802	
V16_1d	0.801	
V16_2c	0.794	
V16_2e	0.791	
V16_3b	0.789	
V16_3d	0.758	
V16_1c	0.743	
V16_3a	0.713	
V16_3e	0.665	
V16_1a	0.638	
V16_4b		0.926
V16_4a		0.911
V16_4c		0.758

Rotation method: Varimax

Work-related factors

Component 1 has 17 organizational competency measures retained; these variables are grouped as work-related factors. Table 5 reveals the final communality estimates for the 17 measures ranging from 0.716 to 0.408 where all measures have a threshold of above 0.5 except two measures that have thresholds below 0.5; therefore these two measures, namely: poor reward system and commitment of decision makers are eliminated from component 1. The measure with the highest loading from the rotated factor matrix is "easy access to knowledge". The overall Cronbach's alpha for component 1 is 0.96 (N of items = 17) which also indicates a high level of internal consistency for the scale with this specific sample.

Table 5: Final communality estimates for work-related factors

Measures	h^2
Easy access to knowledge	0.714
Work ethic	0.699
Transfer environment	0.694
Intent to learn new technology	0.683
Clarity in technological process	0.716
Level of involvement of transferor/transferee	0.686
Competence of team members	0.686
Technology transfer method	0.645
Integrative concept for sharing	0.650
Willingness to transfer technology	0.631
Cultural traits of transferor/transferee	0.667
Job mismatch	0.648
Unrealistic policies and procedures	0.587
Interaction within team members	0.555
Feedback process	0.529
Poor reward system	0.457
Commitment of decision makers	**0.408**

h^2 = final communality estimates

Personal characteristics

Three organizational competency measures were retained in component 2; the similarities between the variables can be grouped as personal characteristics. Table 6 reveals the final communality estimates for these measures ranging from 0.864 to 0.583 which is above 0.5 threshold indicating that the criterion is met. "Historic events" has the highest loading of all variables in component 2 from the rotated factor matrix. The overall Cronbach's alpha for component 2 is 0.84 (N of items = 3) which also indicates a high level of internal consistency for the scale with this specific sample.

Table 6: Final communality estimates for personal characteristics

Measures	**h^2**
Historic events	0.864
Lifestyle	0.838
Educational background	0.583

h^2 = final communality estimates

Measurement model for organizational competencies in project delivery

For the purpose of measuring organizational competencies, the highest loading for each retained component is adopted. There are two retained components and they are represented as component 1 (CMP1) and component 2 (CMP2). This is presented in Figure 2 showing the highest variable for each component. The result of this analysis is adopted for the qualitative survey.

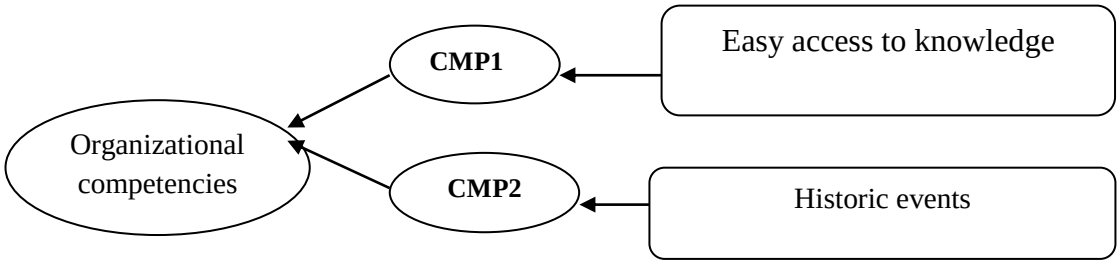

Figure 2: Measurement model for organizational competencies

Qualitative survey: an explanatory analysis results

The explanatory sequential approach allows for variables to be identified through quantitative approach and adopted for a qualitative survey process. The case organizations were construction companies at the grade 3 under the New Procurement Act, 2007 in the study area. A total number of 4 case organizations were selected for qualitative survey based on their familiarities with the research contexts and also willingness to participate in the survey. The interviewees were selected from directors and managerial positions of each case organization. They are considered to be best placed on matters of knowledge about operations and policies of the organizations, and therefore are able to provide useful and reliable information about the contract.

Interview guide was developed using a semi-structured questions as follows:

Question: Please rate how these factors influence the assessment of organizational or workforce competencies in project delivery using 1 = not important; 2 = slightly important; 3 = moderate; 4 = important; 5 = very important and comment where necessary (see table 7).

Table 7: Result for interviewees' rating for organizational competencies in Nigeria

Competency measures	Average Score	Ranking
Easy access to knowledge	5.00	1
Historic events (company's past activities)	**4.00**	**2**

The interview transcripts were analyzed using thematic synthesis through three stage which overlap one another. These stages are coding text, developing descriptive themes, and generating analytical themes. The analytical themes were further translated into the followings:

- Easy access to knowledge… "*Public sector employers are concerned with how to improve construction activities. Easy access to knowledge will assist to transfer knowledge from experts to indigenous contractors thereby improving the industry. In some cases, knowledge may be available but employees are not willing to absorb it. There is a need to rightly motivate them for easy absorption of knowledge that may not be financial. In the construction industry, creating easy access to knowledge has been seen as a major avenue of transferring skills from the expatriates to the indigenes and also from theoretical aspects to practice. Easy access to knowledge is very important because it aids effective communication and information among project team members. This enables members to understand the work process and also eliminate mistakes or failures".*

- Historic events (company's past activities)… "*Assessing an organization based on past activities is very important because it will enable the employer to evaluate the competencies of such organization in executing the new project… The past activities of any organization are equally important to assess its competencies… Favouritism has played a major role in assessing organizational competencies in Nigeria where a company may have a similar capability but do not have a "god father" and that disqualifies the company from being awarded such contract. Although "due process" is in place most times it is not adhered to. In most PPP projects, communities influence the assessment of organizational competencies in project procurement".*

Discussion

The use of PCA to assess the 20 variables of organizational competency measures in project delivery, grouped the data set into two components namely: (1) work-related factors (easy access to knowledge) and (2) personal characteristics (historic events). Under work-related factors, "easy access to knowledge" was identified as the variable with the highest loading. Most respondents agreed that having access to knowledge in an organisation is important in assessing the technical skills of the organisation. The literature review discussed different ways of accessing knowledge within an organisation. The unique, complex, and labour intensive nature of construction sector show the need for adequate knowledge generation and utilisation. The industry relies on skills, experience and capabilities of construction employees when delivering the products and services (Pathirage et al., 2007). It is therefore important to have knowledge workers, who are even ready to learn, acquire, and absorb estimating and tender skills, and other construction related hands-on experience. This is in line the study conducted by Pathirage et al. (2008), which stipulates that employees do fall back on experiences, friendship, and collaboration when faced with complex projects or challenging situations.

Likewise, "historic events" was identified as the variable with high loading under personal characteristics. Historic events incorporate past activities within an organisation which is not only limited to past projects but also to affiliations, for example, political influence. This is considered an essential activity required during the selection process of a contractor; it involves the assessment of the technical abilities of the contractor for a particular project. The use of previous work done is usually part of pre-qualification criteria in the construction sector globally, including Nigeria. The study conducted by Tarawneh (2004) in Jordan concludes that the use of contractors' previous track record and past experience in similar projects has high priority

among public clients. The case study investigations revealed that the use of these two most important measures in Nigeria would also force contractors to devise means of incentivizing easy access to knowledge so as promote communication and information exchange among team members. This provides better understanding of the work processes thereby eliminating mistakes and failures.

Conclusion

The paper focuses on the influence of organizational competency measures on project performance in the Nigerian construction industry. The study evaluates the parameters identified from the literature review using explanatory sequential approach to analyze the collected data. The quantitative section evaluates 20 identified variables using PCA to reduce and also identify similarities in data groupings. Based on the PCA result, two components were retained and the result was adopted for qualitative survey. The research findings reveal that "easy access to knowledge" has the highest loading followed by "historic events" as the second highest measure. Most respondents believed that having easy access to knowledge in any organization is important for assessing its technical skills. Therefore, organizations should create environment where knowledge generation and utilization can easily be assessed.

Likewise, the use of previous track record and past experience of organizations are essential activities required during the selection process of a contractor. The research findings provide an empirical study on the influence of organizational competency measures on project performance, thereby identifying the key parameters. The study recommends project stakeholders should focus on how to improve their efforts based on these parameters. Similar studies should be considered in other countries to identify the most relevant organizational competency measures within the construction industry.

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ASSESSMENT OF THE DISTRIBUTION PATTERN AND THE SPATIAL ORGANISATION OF CHURCHES IN UYO URBAN, AKWA IBOM STATE.

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Abstract

A church is a building used for nonprofit purposes by recognised and legally established sects solely for worship. The how and where churches are located can have significant spatial impacts and therefore implications on urban planning. This work sought to assess the distribution pattern and spatial organization of churches in Uyo urban. The concept of nearest neighbourhood is applied in the study. Using a non-experimental and descriptive approach, 19 churches were randomly selected out of the 194 churches in the study area. The findings revealed that within 1 kilometre of the study area, the churches were clustered around transportation routes in the study area. It was concluded that the location of churches should be equidistant to worshippers and not clustered as it is in the study area.

Introduction

Churches are buildings used for nonprofit purposes by recognised and legally established sects solely for worship (Davidson and Dolnick, 2004). A Church is a term generally applied to an institution of the Christian religion (Kelly, 2009). In developing countries particularly in Africa, Cobbinah*et. al.* (2013) noted that with the widespread of poverty conditions, churches are perceived by many urban residents as citadels against fear, hopelessness and haven for quick material breakthrough (Gifford, 2004). It is this belief that has motivated many faith groups who take advantage of the increasing demand for churches by urban residents, and this leads to an astronomical rise in the development of churches in Africa and other developing Countries (Bouma*et. al*., 2000, Meyer, 2002 and Cobbinah*et. al*., 2015).

Thomas and Pojani (2019) noted that an ill-conceived location of a church development could precipitate land-use conflicts, give rise to transit and parking issues, cause noise and/or amenity problems in neighbourhoods, and contribute to urban sprawl. Therefore, physical planning is needed to ensure a maximum degree of comfort, convenience and functionality when siting churches. This serves as an effective measure to control the development of churches in the public space to avoid their haphazard, unorganised or uncontrolled locations.

It was Thomas and Pojani (2019) who stated that how and where churches are located can have significant spatial impacts and therefore implications on urban planning. Hamilton (2002) was of the opinion that religious buildings sometimes are not ideal neighbours, especially in residential districts. At times, where provisions are made for the location of churches in land use planning schemes, such provisions are usually not followed by faith groups (Cobbinah*et. al.,* 2015) and this is noticeable in developing countries like Nigeria where churches are located in unauthorised locations within urban environment such as nature reserve (Ahmed *et. al*., 2012).

However, Thomas and Pojani (2019) wrote that how and where churches are located can have significant spatial impacts and urban planning implications. Therefore, it is crucial for stakeholders in the built environment to take urgent steps in enforcing development control regulations where they exist or probably seek legal frameworks to guide the unplanned sporadic proliferation of churches at different locations just like Adesanya (2011) opined.

The Study Area

The study area is Uyo urban, headquarters ofAkwaIbom State and Uyo Local Government Area (LGA). This work focuses on the distribution pattern and spatial organization of churches in Uyo urban. Uyo urban area covers a total of ten kilometres radius from the city centre (Ibom Plaza). The study however covers

one kilometre radius from the city centre. The reason for choosing one kilometre radius is because the plaza serves as the Central Business District (CBD) of Uyo urban where a large variety of economic and social activities take place. It is also the node or focal point where the arterial roads (Abak Road, Aka Road, Oron Road, Wellington Bassey Way and IkotEkpene Road) within the urban areameet. Figure 1 shows the map of the study area on the map of Uyo urban.

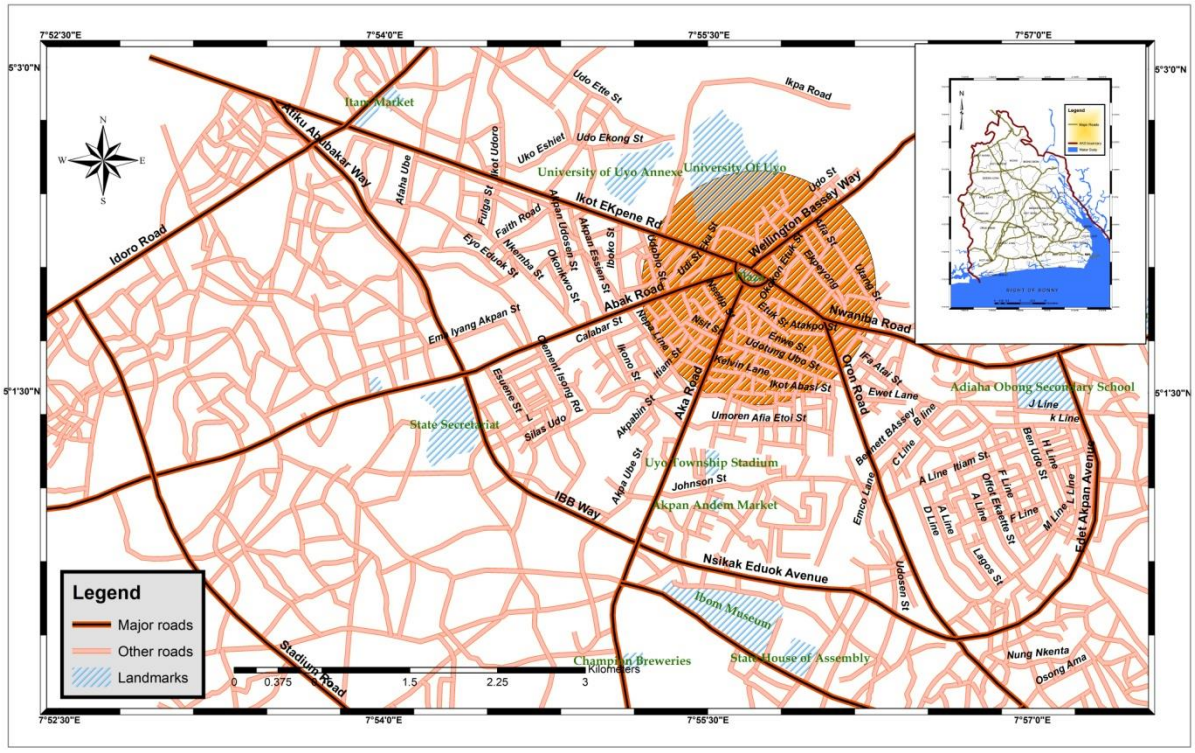

Figure 1: The study area on the map of Uyo urban
Source: ArcGis Software (2020)

Review of Related Literature

According to Berkley Forum (2019) religious land use has remained a largely ignored part in contemporary urban planning theory, such as the New Urbanism movement. Through planning, control is exerted over where religious facilities such as churches, mosques, and synagogues are located (Gale, 2019). Religious communities face a number of challenges when it comes to urban planning. American faith groups of various backgrounds have experienced difficulties in the zoning approval process, even with the Religious Land Use and Institutionalized Persons Act, a federal law meant to prevent zoning discrimination against religious groups (Berkley Forum, 2019).

According to Ives and Elisara (2019) churches have spiritual significance and they form part of centerpieces for community cohesion around which many urban residents' lives revolve. In today's modern world, religion is actually experiencing resurgence. Berkley Forum (2019) stated that as the share of the worldwide population living in cities and the proportion affiliating with a religious tradition are both projected to increase by 2050, religion will certainly continue to shape urban life and the built *environment*. The world today is as furiously religious as it ever was.

A study of part of Minna, Niger State, Nigeria which analysed the spatial distribution of worship centres with the aim of solving the problem of noise generated by loud speakers during worships to the nearest

neighbourhood revealed that within a distance of 500 metres of the city centre the distribution was dense and the noise level high. In addition to this, there were no restriction rules governing the sitting of worship centres (Adesina et al., 2017).

In a similar study of the spatial analysis of 36 faith based locations (worship centres) in Ota, Ogun State, Nigeria Akinpelu *et al.* (2021) it was reported that the worship centres consisting of 24 churches, 8 mosques and 4 shrines/temples were unevenly distributed and clustered. They added that the distributional pattern caused traffic congestion on worship days. It was also found out in the study that the most important factors influencing the distributional pattern of worship centres were cost of land and ease of getting transport (accessibity). A concentric zone analysis approach of the study concluded that worship centres were concentrated within the city centre and decreases inversely with distance from the centre.

Ives *et. al.* (2019) stated that urban planning challenges continue to increase, and become more pressing than ever before; therefore, there is an urgent need for transformative changes that will bring about sustainability. Gale (2019) noted that until recently, there had been little public or academic discussion regarding the intersections between urban planning and religious belonging, despite the effects of planning controls on the development of religious buildings and the controversy that has frequently ensued. Since churches are usually located on land, it is the responsibility of planners and urban designers to provide optimum location for them. When attempting to mitigate the effects of "noise" and "disturbance" on neighboring property owners, planning frequently intercepts the efforts of religious groups to establish places of worship close to residential communities. The result has often been that new religious sites, notably those of large and ornate design, become located in incongruous settings such as industrial estates and retail complexes, at some distance from their congregations (Gale, 2019).

The Concept of Nearest Neighbourhood Analysis

The conceptual underpinning for this study is the Nearest Neighbourhood Analysis. The concept can be applied to phenomena, which are assumed to be distributed in an isotropic or uniform surface or phenomena that are strongly clustered. The Nearest Neighbour Analysis (NNA) is based on straight line measurement of the distance separating a phenomenon and the nearest neighbourhood space (Umar *et. al.*, 2015). The concept was originally developed by plant ecologists Clark and Evans in 1954 who were interested in the distribution of various developed plants species over the earth surface (Israel *et. al.*, 2009). The concept indicates the degree to which any observed distribution deviates from what may be expected if the distributions of points are random. Phenomena are said to be randomly distributed if they satisfy the following conditions:

i. Any part in the area has the same chance of occurring in any sub-area like any other point.

ii. Any sub-area of specified size has the same chance of receiving a point as any sub-area of that size.

iii. The placement on the location of each point is not influenced by any other point.

Therefore, Nearest Neighbourhood Analysis by definition produces a figure (expressed as Rn), which measures the extent to which a particular pattern is clustered (nucleated), random or regular (uniform).

The formula for the Nearest Neighbourhood Analysis is expressed as;

$Rn = 2đ\sqrt{n/a}$ - - - - - - - Equation 1

Where:

Rn = description of distribution

Đ= the mean distance between the nearest neighbours (km)

A = area under study (Km^2)

N = total number of points.

Furthermore, Rn (the nearest neighbourhood index) measures the extent to which the pattern is clustered, random or regular.

When Clustered: Rn = 0. All the dots are close to the same point.

Random: Rn = 1.0 There is no pattern.

Regular: Rn = 2.15: There is a perfectly uniform pattern where each dot is equidistant from its neighbours. Nearest Neighbourhood Analysis (NNA) has been applied in a spatial dimension by scholars.

Research Method

This is a non-experimental study and descriptive in approach. Empirical research and exploratory survey methods were employed to conduct the study. The nature of this research, therefore, made the adoption of the end practical and survey methods suitable. The data were primarily sourced from the location of the churches. The secondary data were sourced from libraries, newspapers, reports, journal publications, internet, institutions, and archives. These sets of data include maps obtained from the Directorate of Town Planning, data derived from the National Population Commission (NPC) of 2006 Uyo urban population, which is projected to 2020. Google earth imageries also were used to show the location of churches within the study area and analysis for the spatial distribution of churches within the study area was made.

The primary data were obtained through questionnaire and field observations. Basic data on the location of churches and their physical planning implications in Uyo urban planning were collected. Structured questionnaire was prepared for the respondents and was administered using simple random sampling technique. With the design of the study being exploratory, the most structured part of the primary data were those collected via measurement with GIS aided tool. These data were based on the information and insight obtained from the interview of worshipers and people living around the churches.

Random sampling technique was employed to select respondents for interview/data gathering from individual members of the targeted population to avoid bias. The 190 churches in a part of Uyo urban (within one-kilometre radius from the city centre, Ibom Plaza) were sampled and the questionnaire was administered to the worshippers, residents and respondents in the study area. This type of sample gave every item a 50-50 chance of being selected or left out (Udofia, 2013).

Presentation of Data, Analyses and Discussion

It was observed that there were 190 churches in the study area and 10% or 19 were sampled. This percentage which is statistically acceptable Udofia (2011) was chosen for manageability. Table 1 shows a list of sampled churches, location and GPS coordinates, Figure 2 is a Google Earth image which shows the location of sampled churches, Figure3 shows the location of churches and Figure 4 shows the nearest neighbourhood analysis result.

Table 1: The Sampled Church Location within the Study Area

S/N	Names of Churches	GPS Coordinates
1	Qua Iboe Church (2 Abak Road)	5°2' 2.861" N 7° 55' 36.385" E
2	Greater Life Gospel Centre (Aka Road By Plaza)	5° 2' 0.779" N 7° 55’ 40.002" E
3	The Reformation Chapel (20 Atim Atakpo Street)	5° 1' 46.536" N 7° 55’ 56.076” E
4	The Apostolic Church (31 Eka Street)	5° 2' 10.152" N 7° 55' 35.897" E
5	Shalom Zion Bible Church (45 Ekpeyong Street)	5° 1' 55.056" N 7° 56 6.079" E
6	The Lutheran Church of Nigeria (37 Enwe Street)	5° 1' 42.343" N 7° 55’ 50.286" E
7	The Apostolic Pillar Church Nigeria (1 Ibanga Street)	5° 1' 45.156" N 7° 56’ 5.136" E
8	New Holy Ghost City Int’l (15 Ikpa Road)	5° 2' 17.755" N 7° 55' 23.879" E
9	City Strong Tower Church (39 Itiam Street)	5° 1' 38.784" N 7° 55’ 22.032” E
10	Chapel of Answers Int’l (5 Kelvin Lane)	5° 1' 37.452" N 7° 55’ 26.988” E
11	Redeemed Christian Church of God (Jehovah Shalom Parish) (10 Okon Essien Street)	5°1' 42.841" N 7° 55’ 16.644” E
12	Redeemed Christian Church Of God (Citadel Of	5°1' 57.006" N 7° 55’ 52.056" E

	Champions) (41 Oron Road)	
13	City of Truth Chapel Int'l (12 Paul Bassey Street)	5° 2' 0.031" N 7° 55' 55.213" E
14	Restoration Bible Church (11 Udo Eduok Street)	5°1' 48.631" N 7° 55' 31.439" E
15	Redeemed Christian Church Of God (Total Salvation Parish) (8 Udo Obot Street)	5° 1' 42.16" N7° 56' 8.26" E
16	Methodist Church Nigeria (67 Udo Umana Street)	5° 1' 35.718" N 7° 55' 48.114" E
17	The Salvation Army Church (Udo Utung Obo Street)	5° 1' 38.527" N 7° 55' 50.286" E
18	Lamb's Deliverance Mission Int'l (Umoren Lane)	5° 1' 31.691" N 7° 55' 37.027" E
19	Presbyterian Church of Nigeria (Wellington Bassey Way)	5° 2' 19.859" N 7° 56' 2.898" E

Source: Researcher's Field Survey (2020).

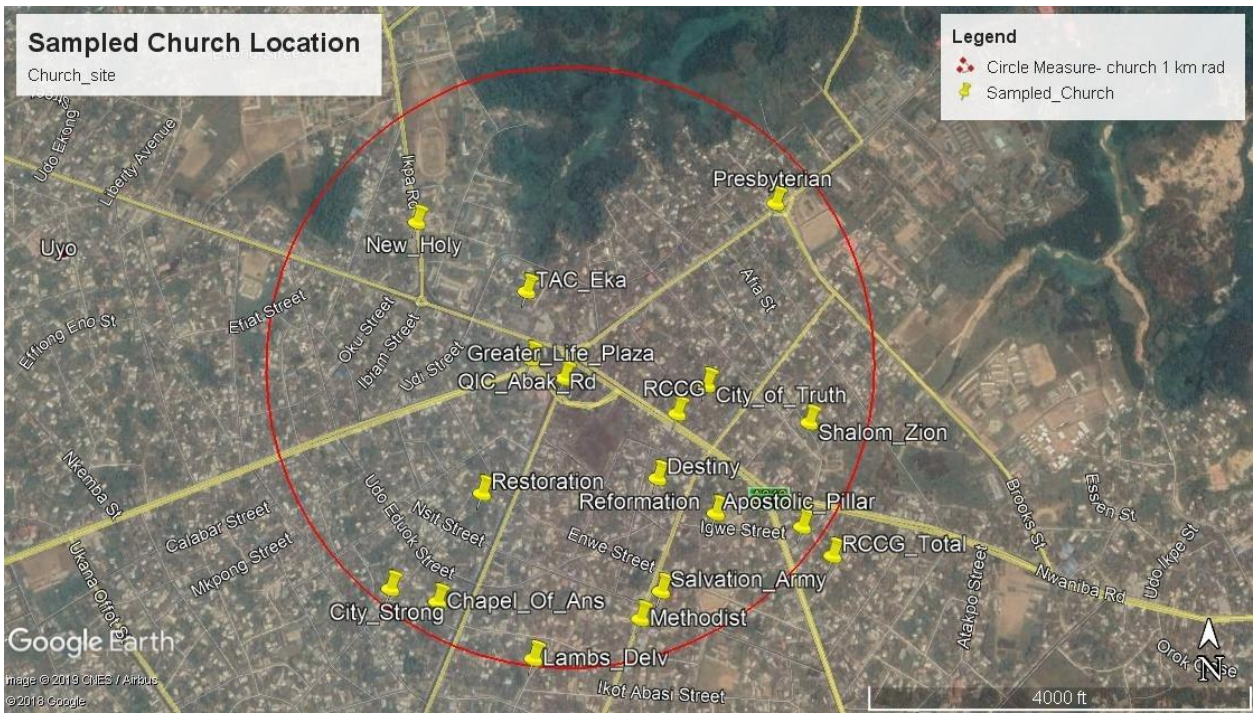

Figure 2: Google Earth Image showing the Location of Sampled Churches
Source: Google Earth (2020).

Distribution Pattern and the Spatial Organisation of Churches in Uyo Urban.
Using the Nearest Neighbourhood Analysis (NNA) concept it was revealed that within 1 kilometre of the study area, the churches are situated in a clustered manner around transportation routes see Figure 3.

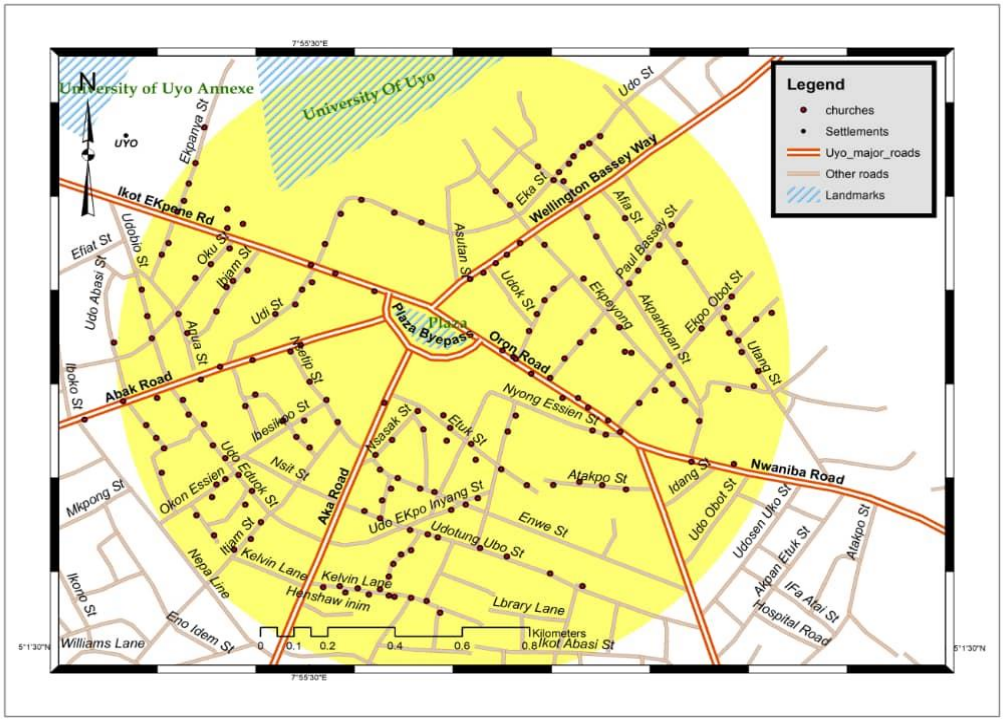

Figure 3: Location of Churches in a Clustered Pattern on the Map of Uyo Urban
Source**:** Prepared using ArcGIS (2020)

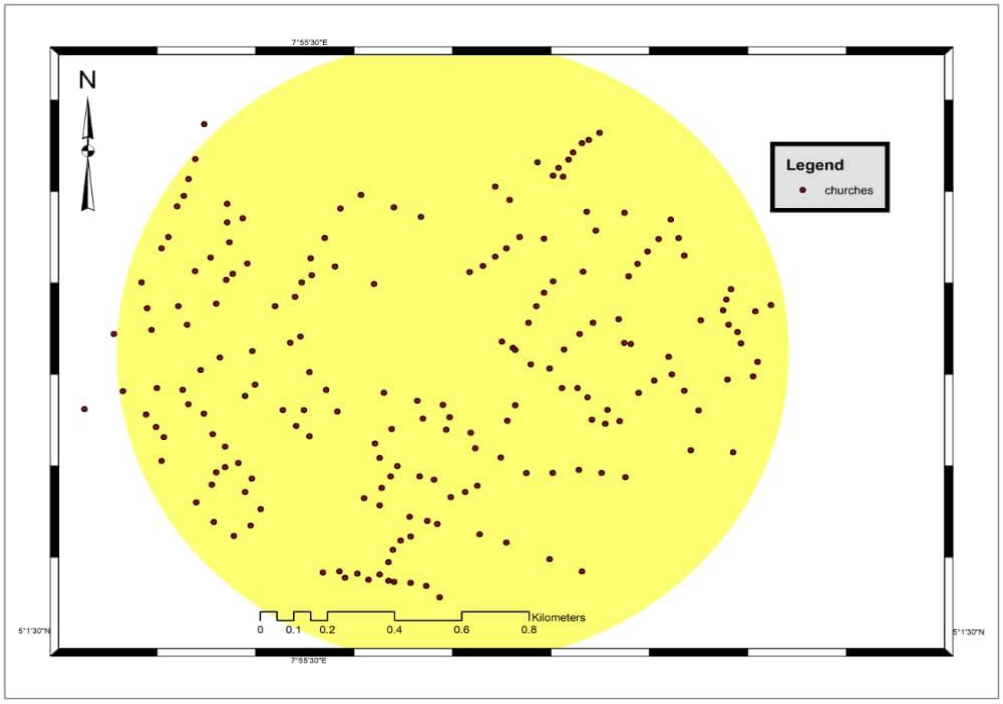

Figure 4: Map showing the distribution of the churches within the study area.
Source**:** Prepared using ArcGIS (2020)

Result Sheet for Nearest Neighbour Analysis
Nearest Neighbour Ratio: 0.889028
z-score: -2.949340
p-value: 0.003185

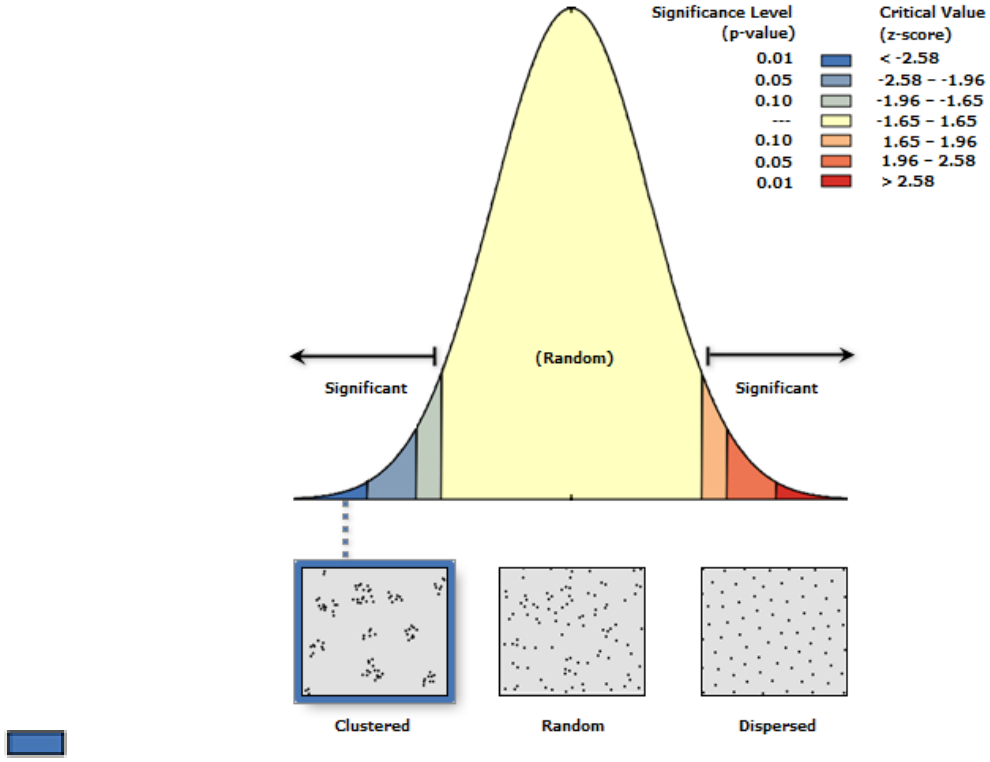

Figure 5: A graph showing the nearest neighbourhood analysis result of the study area
Source: Arc Gis Software

Given the z-score of -2.94933968616, there is less than 1% likelihood that this clustered pattern could be the result of random chance.

Table 1: Result of the Nearest Neighbourhood Analysis

Observed Mean Distance:	55.2892 metres
Expected Mean Distance:	62.1907 metres
Nearest Neighbour Ratio:	0.889028
z-score:	-2.949340
p-value:	0.003185
Average Nearest Neighbour Summary	
Input Feature Class:	Churches
Distance Method:	Euclidean
Study Area:	2985849.781213
Selection Set:	False

Dataset Information

The result of the analysis shows that the distribution of churches in the 1km radius of the urban centre is clustered in pattern. This shows that the churches sampled are clustered around the transportation routes in residential areas. Figure 5 above shows the graphical nearest neighbourhood analysis of the churches located within the study area. Clustering of churches within residential areas is not without effect on their immediate physical environment. This result agrees with the findings of Adesina *et al.* (2017) that the dense concentration of worship centres in the core of the city has significant environmental effect (noise).

Given the z-score of -2.94933968616, there is less than 1% likelihood that this clustered pattern could be the result of random chance. From the graph, it can be deduced that though the churches are not randomly distributed however, it is significant. The mean distance between churches according to the Nearest Neighbour analysis by the GIS is 55.29metres. This further validates the clustered pattern result earlier obtained. The above results are in consonance with the findings of Akinpelu *et al.* (2021) who reported that worship centres in Ota, Ogun State, Nigeria were unevenly distributed, clustered at the city centre and causing traffic congestion.

Conclusion

The findings of the study have revealed that churches are located along traffic nodes.When churches cluster especially along nodes, the planning implication is negative. Members park their vehicles along these nodes which obstructs the free flow of traffic especially during worship periods causing untoward inconveniences to other road users especially motorists. This pattern is replicated at most of the nodal points in the study area which is a huge concern to urban managers.

Recommendations

The following recommendations were made based on the findings of the research:

i. Churches in the study area should be equidistant to worshippers.
ii. Churches should be located away from the arterial roads to avoid traffic congestion in the study area.
iii. Churches should be located where there are ample spaces for parking by worshipers.

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INFLUENCE OF ORGANIZATIONAL CULTURE ON WORKS DEPARTMENT EMPLOYEE COMMITMENT IN PUBLIC INSTITUTIONS IN ZARIA, KADUNA

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Abstract
Culture and organizational commitment. The objective of this paper is to investigate the influence of four organizational culture traits namely: Involvement, Consistency, Adaptability, and Mission on Works department employee commitment in Public Institution. Base on Denison on organization culture traits and Mowday on works department employee commitment, a structured questionnaire was developed with total respondents of 38 employees. The data collected were analyzed using correlation and regression analysis. The result shows that the four traits measuring organizational culture were all positively related to works department employee commitment within the range of r= 0.175 to r=0.608. Moreover, involvement is the most contributing organizational culture trait in the prediction of works department employee commitment with the beta coefficient 0.322. The other three organizational culture traits in their descending order of standardized coefficients are adaptability, mission, and consistency. Furthermore, statistically significant of three organizational culture traits: involvement, adaptability, mission indicate that there is a significant relationship with employee's commitment. However, consistency doesn't have a significant influence on works department employee commitment as it is explained by significance level p>0.05. The organization should continue to cultivate the skills of employees and allow employees to increase capacity for self-determination. However, the organization would focus on selected organizational culture and also it would be possible to have improvements in workplaces to help employees become more committed to their jobs.
Keywords: *Organizational Culture, involvement, consistency, adaptability, mission and works department employee commitment.*

Introduction

The concept of culture has been defined in a number of ways. According to Dolan and Lingham (2012), culture is a set of values and commonly held beliefs that determine which behaviors are acceptable and expected for a given group. And thus countries, religious and ethnic groups, and organizations all have cultures. Similarly, Schein, (2004) defined culture as abstraction, yet the forces that are created in social and organizational situations that derive from culture are powerful. Further, Dolan & Lingham (2012) support the Schein definition by explaining culture as one of those terms that are difficult to express distinctly, but everyone knows it when they sense it.

Various studies and literature defined organizational culture traits in a different dimensions. Robbins and Judge (2013) listed the seven primary characteristics of organizational culture. These are; innovation and risk-taking, attention to detail, outcome orientation, a people orientation, team orientation, aggressiveness, and stability. Moreover, Dolan and Lingham (2012) explain Charles Handy's organizational culture concepts that classify organizational cultures as power, role, task and person culture. The first trait: power culture concentrates on power among a few with few rules and little bureaucracy. Role culture, second organizational trait, is demonstrated when employees have clearly delegated authorities within a highly defined or bureaucracies structure. The third trait is task culture in which teams are formed to solve particular problems and there will be multiple reporting lines of a matrix. The last culture: A person culture exists where all individuals believe themselves superior to the organization.

Similarly, Coffey, Trew, and Trigunarsyah (2012) explained the four organizational cultures (Involvement, consistency, adaptability, and mission) depicted on Denison's organizational culture model. The researcher further explains these traits as follows: involvement, the first organizational trait, ensures the participation of employees in decision making. And consistency trail emphasizes on the maintenance of the status quo by

being well-coordinated and well-integrated. The third trait, adaptability, depicts the ability of the organization in translating the demands of the business environment into action. The last trait is a mission whereby organizations devise meaningful long-term strategic direction and vision of the company.

Hakim (2015) defined organizational commitment as the desire and the willingness of employees to remain in the organization and devote themselves to the success of the organization. Similarly, Jaros (2007) has explained the organizational commitment model of Allen and Meyer. This model encompasses three types of commitments: normative commitment is the first organizational commitment type which can be defined as a perceived obligation towards the organization. Affective and continuance are the second and third organizational commitments types that can be explained as emotional ties the employee develops with the organization and perceived costs (economic cost or social cost) of leaving the organization respectively.

Moreover, Nongo and Ikyanyon (2012) summarized the three defining characteristics of organizational commitment which were devised by Mowday. The first character is a strong belief in and acceptance of the organization's goals and values. Willingness to exert considerable effort on behalf of the organization is the second trait of organizational commitment and the last character is a strong desire to maintain membership in the organization.

Kondalrk (2007), Robbins and Judge (2013) have explained that the agreement of employees on organizational culture builds organizational commitment. Besides, these authors noted that the more members accept the core values, the greater their commitment and the greater their influence on their behavior. Similarly, various researchers found out positive and significant relationship between overall organizational culture and organizational commitment. (Asghar, Mojtaba&Sadeghi (2015); Hakim (2015); Ghader&Afkhami (2014); Habib, Aslam, Hussain, Yasmeen & Ibrahim (2014); Messner (2013); Azadi, Bagheri. Eslami & Aroufzad (2013), Sabir, Razzaq & Yameen (2012)

Keep in view of understanding the concept of culture and organizational commitment, and the positive relationship between organizational culture and organizational commitment asserted by different researchers, this paper will be conducted with the objective of identifying which organizational culture traits can significantly correlate with organizational commitment in public institution.

Hence, examining influence on each organizational culture trait enables organizations to identify a cultural trait that has a greater influence on works department employee commitment. Coming to the specific case organization, public institution has an organizational culture which distinguishes it from other organizations. This organization's culture encompasses shared values, norms, and attitudes which guide the way employees behave Organizational culture and organizational commitment are the most extensively researched about concepts in management studies, yet the two concepts still remain elusive as ever (Shoaib et,al, 2013). Not only that, as showed on the literature , the influence of different organizational culture traits on organizational commitment investigated and conclude by the different researchers is inconsistent.

Influence of Organizational Culture on Organizational Commitment

The findings of different scholars who tried to investigate the influence organizational culture (Involvement, consistency, adaptability, and mission) on employee commitment.

Involvement and Employee Commitment

A study conducted by Nongo and Ikyanyon (2012) found a significant and positive relationship between involvement and commitment. This means that employees are committed to their organizations when they are involved in decision making. The key success factors for organizations today are employee empowerment, teamwork, and employee development. These enable managers and employees more committed to work and feel that they own a piece of the organization. People at all levels feel that they have at least some inputs into decisions that affect their work and that work is directly connected to the goals of their organization.

Furthermore, Asghar, Mojtaba and Sadeghi (2015) Involvement is one of the most important dimensions of organizational culture and it has a great role in the fulfillment of the organizational commitment of teachers. This shows that people participating in work helps their intention to stay in workspace. The employees" Involvement means using them in decision making and this leads to the stability of their commitment.

Consistency and Employee Commitment

Nongo and Ikyanyon (2016) found out that there was no significant relationship between consistency and commitment. As much as organizations try to maintain a strong culture by being highly consistent, well-coordinated, and well-integrated, this does not impact significantly on the level of employee commitment. In other words, employees prefer to be given the freedom to do the job rather than being compelled to do it in a rigid manner. Hence, the researcher concludes that the key success factor for organizations today is flexibility rather than consistency.

To the contrary, research finding by Asghar et.al, (2015) and Ghaderand Afkhami (2014) revealed that there is a positive relationship between consistency and organizational commitment in which coordination and integration, agreement and fundamental values as a component of consistency increase employee commitment to providing efficient and influence work. Similarly, Hakim (2015) asserted that an indicator of the most powerful in shaping the organizational culture variable is stability (consistency). It means that cultural values that received the most attention in the activities of the organization, which emphasizes the maintenance of the status quo as a contrast to the growth will have a positive influence on organizational commitment.

Adaptability and Employee Commitment

Adaptability predicts works department employee commitment more than any other corporate cultural variables. Employees are more committed to organizations that adapt to changing circumstances. Companies should encourage innovation and teamwork among employees. This will enable employees to adapt in an environment of change, thereby improving their level of commitment. (Nongo & Ikyanyon,2012) Similarly, employees exhibited the highest organizational commitment when they perceived higher learning culture (adaptability traits) which includes the culture of creating, acquiring, and transferring knowledge and also quickly react to current trends, and anticipate future changes. (Ghader&Afkhami (2014), Azadi, Bagheri, Eslami, and Aroufzad (2013)

Mission and Employee Commitment

According to Denison and Neale (2011) mission provides purpose and meaning by defining a social role and external goals for the organization. And also mission provides clear direction and goals that serve to define an appropriate course of action for the origination and its members which result in the increase in the level of works department employee commitment to the organization.

On the contrary, Nongo and Ikyanyon (2012) found no significant relationship between mission and commitment. This means that employees identification with the purpose, mission, and goals of the organization does not bring a commitment to the organization. But establishments should define the mission of their organization clearly and communicate the same to employees at all times.

Conceptual Framework

Denison (2015), has developed a model which highlights four key organizational culture traits and the unique future of these model is that it is behaviorally based .Moreover, the model depicts the correlation between cultural traits and organizational influence measures which includes employee satisfaction, return on investment, product development, etc. Accordingly, he found that nearly all of the underlying organizational traits showed a significant and positive correlation with organizational influence. The modified framework is shown below.

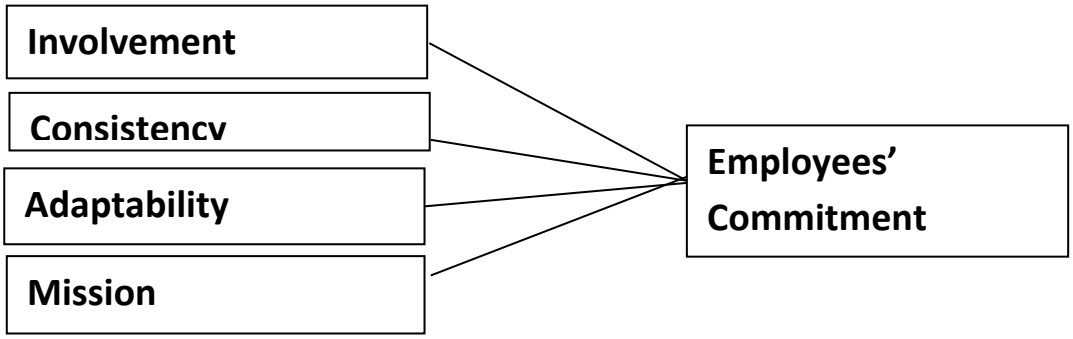

Fig. 2.1 Conceptual Framework

Based on the literature review and the hypothesized connections presented in the conceptual framework the following hypotheses were drawn for this paper.

H0: There is no significant relationship between employees' involvement in decision making and employees' commitment.
H1: There is significant relationship between employees' involvement in decision making and employees' commitment.
H0: There is no significant relationship between consistency and employees' commitment.
H_1: There is significant relationship between consistency and employees 'commitment.
H_0: There is no significant relationship between organization adaptability and employees commitment
H_1: There is significant relationship between organization adaptability and employees commitment
H_0: There is no significant relationship between employees'' identification with organizational mission and employees' commitment
H_1: There is significant relationship between employees' identification with organizational mission and employees' commitment

Research Method
In order to achieve the study objectives, the researcher used correlational research design in determining the relationship between the different types of organizational culture and works department employee commitment.

Different kinds of literature and empirical studies were reviewed to gain insights and background information about the influence of different types of organizational culture on works department employee commitment. The information from this step help in designing the questionnaire and to better understand the problem of the study.

Accordingly, case study research technique with quantitative research design, whereby close-ended questions with pre-determined scale for response collected from the works department of public institutions employees. This cross-sectional data / single point in time responses analyzed and interpreted mainly using SPSS version V24.

As the issue under investigation is a project management matter, the participants should have exposure to such an issue in the case organization. Accordingly, the researcher used his preliminary observation to identify the right respondents who had pertinent knowledge, experience, and ability to provide a response to the research questions.

The data for this paper obtained from two sources, primary and secondary. The primary data collected from the research participants through a structured self-administered questionnaire. Secondary data was extracted from books, journals, articles, public institution websites, internal brochures, and publications.

The primary instrument for data collection in this paper is a structured questionnaire that measured the organizational cultures of the case works department and the commitment of its employees respectively. Thus,

organizational culture was measured using some items that is adapted from the Denison organizational culture survey (Denison, 2015). The instrument has four subscales, measuring the four main cultural traits namely: involvement, consistency, adaptability, and mission. So, using a 5 - point Likert scale, on which label given for respondents to express their level of agreement for each item among the scales and then the average score on each trait used during data analysis and interpretation. In addition, organizational commitment measured by using Mowday's (1979) organizational commitment questionnaire (OCQ). The instrument contained 8 items that measured the employees' level of identification with their organizations on a 5-point Likert type scale ranging from 1-strongly disagree to 5-strongly agree.

The data analysis was made by using multiple regression which was used to examine the significant contribution of each independent variable to the dependent variable; organizational commitment. The major findings interpreted based on the result. Pearson correlation coefficients reveal the magnitude and direction of relationships (either positive or negative) and the intensity of the relationship (-1.0 to +1.0). Correlations are perhaps the most basic and most useful measure of association between two or more variables (Marczyk, Dematteo & Festinger, 2005).

As per Marczyk, Dematteo and Festinger, (2005) correlations of .01 to .30 are considered small, correlations of .30 to .70 are considered moderate, correlations of .70 to .90 are considered large, and correlations of .90 to 1.00 are considered very large.

It is expected that at the end of this research, the paper would provide the work culture in the works department of public institutions systems that relates to staff commitment. The study should serve as a model for similar studies in a tertiary institutions in Nigeria. The study will make the works department of public institution concentrate on the culture that improves staff commitment for greater efficiency.

Results and Discussion

This section presents the data analysis and discussion of the research findings obtained from the data collected from the survey questionnaire. Responses for the measures on the questionnaire are summarized and presented using tables. The different statistic analyses were employed in order to analyze data obtained from the survey. standard multiple regression was used to test hypotheses and achieve the study objective that focuses on identifying and organizational culture trait with a higher contribution to the dependent variable. Furthermore, the Pearson correlation coefficient is also used to test the goodness and relationship of the measure. The 50 questionnaires distributed, 38 filled questionnaires were collected. Therefore, the paper has excluded these responses and lowering the number of the filled questionnaires to 38 which gives a response rate of 89%.

Table 1.0 summarizes the demographic characteristics of the sample, which includes age of the respondent, gender, education level, work experience and marital status. The purpose of the demographic analysis in this research is to describe the characteristics of the sample such as the proportion of males and females in the sample, education level and marital status so that the analysis could be more meaningful for readers.

Table 1.0: Demographic Profile of Respondents

Gender		Frequency	Percent
1	Male	24	63.2
	Female	14	36.8
Education Level		Frequency	Percent
2	Masters and above	12	31.6
	B.sc/ HND	19	50.1
	Diploma	4	10.5
	SSCE	3	7.80
Work experience in the Institution		Frequency	Percent

3	1-10 Years 11-20 Years 20 Years and above	17 11 10	44.7 28.9 26.3
Marital Status		Frequency	Percent
5	Single Married Divorce	7 27 4	18.4 71.1 10.5

Source; Survey data (2021)

Table 1.0 visualizes the demographic profile of 38 respondents. In terms of gender, respondents were roughly proportionate between male and female, even though the numbers of male respondents are a bit higher (female 36.8%, male 63.2%). In terms of education, the distribution is not very equally distributed. 10.5% of respondents have Diploma, while 31.6% of the respondents are masters or above holders while 7.8% have SSCE. Moreover, the largest group; 71.1% of the population comprises first degree holders. In the same token, demographic profile of respondents shows more than half of respondents or 71.1% are married which followed singles employee is 18.4%.

When looking at the tenure of respondents in public Institution, 44.7% of the respondents have 1-10 years of experience in the company and these takes the majority. 28.9 % and 26.3 % of the respondents have 11-20 years and 21 years and above experience respectively. Furthermore, majority of the respondents (71.8%) are in non-management group and the remaining (28.2%) respondents are management position holders these includes team leaders, managers and directors.
This paper assessed the relationship that the selected organizational cultures have with employees' commitment. For this purpose, correlation and regression analysis have been used and the results are presented in Table 2.0 and Table 3.0.

Table 2.0: Correlation Analysis

Pearson Correlation	**Adaptabilit**	**Mission**	**Involvement**	**Consistency**	**Commitment**	
Adaptability	1	.608	.666"	.685"	.411"	
Mission		1	.646"	.652	.231	
Involvement			1	.730"	.225	
Consistency				1	.175	
Commitment					1	

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

Table 2.0 Pearson correlation coefficients show that the four factors measuring organizational culture were all positively related to employee commitment within the range of 0.175 to 0.608, all were significant at $p<0.01$ level. All the independent variables i.e. adaptability, mission, involvement, and consistency showed a moderate level of a positive relationship with the dependent variable (employees commitment)

In order to see the contribution each organizational culture traits on works department employee commitment, standard multiple regression analysis was employed. The regression model presents how much of the variance in works department employee commitment is explained by the selected organizational traits: involvement, consistency, adaptability, and mission. As shown in the Table 4.4, a 26% variation in works department employee commitment is explained by organizational culture (whereby R square is 0.259 and adjusted R square is 0.170)

Table 3.0: Multiple Regression result of selected organizational cultures traits and works department employee commitment

Model Summary

Model	R	R Square	Adjusted R Square	Std. error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.509[a]	.259	.170	2.95401	.259	2.890	4	33	.000

Predictors: (Constant), Consistency, Involvement, Adaptability, Mission

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	100.878	4	25.220	2.890	.000[b]
	Residual	287.964	33	8.726		
	Total	388.842	37			

a. Dependent Variable: Commitment

b. Predictors: (Constant), Consistency, involvement, adaptability, Mission

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.059	3.198	0.00	6.585	.000
	Adaptability	.152	.132	.276	.151	.026
	Mission	.133	.168	.149	.969	.034
	Involvement	.196	.135	.322	.452	.016
	Consistency	.523	.108	.041	1.483	.543

Source; Survey data (2021)

Furthermore, Table 3.0 shows the overall significance/acceptability of the model from a statistical perspective. As the significance value of F statistics shows a value .000, which is less than $p<0.05$, implies the model is significant. This indicates that the variation explained by the model is not due to chance and in in consistence with the previous studies by Ingersoll, et al., (2000), Pham (2013), Kawiana, et al. (2018) and Soomro & Shah (2019).

As it is stated earlier in the introduction, this paper aims to identify the most contributing independent variables in the prediction of the dependent variable. Thus, the strength of each predictor (independent) variable influence on the criterion (dependent) variable can be investigated via a standardized Beta coefficient. Hence, the regression coefficient explains the average amount of change independent variable caused by a unit of change in the independent variable.

Therefore, Involvement is the most contributing organizational culture traits in the prediction of works department employee commitment with beta value of 0.386. The other three organizational culture traits, in their descending order of standardized coefficients, are adaptability (B=.276), mission (B=. 149) and consistency (B=.041) that the variables are making signs to the prediction of works department employee commitment. In addition, Table 4.2 depicts that significant levels of adaptability, mission, involvement,

like .026, .034 and 0.016 respectively, which are less than 0.05. This indicates that there is a statistically significant relationship between them and the dependent variable (works department employee commitment) and hence, alternative hypotheses related to adaptability, mission, and involvement were accepted. On the contrary, alternative hypotheses which are related to consistency were rejected as the significance level is .543 (p>0.05.

Table 4.0: Summary of the overall outcome of the research hypothesis

Hypothesis	**Result**
Ho: There is no significant relationship between employees' involvement in decision making and employees' commitment	B = .322
HI: There is a significant relationship between employees' involvement in decision making and employees' commitment	Ho: Rejected
Ho: There is no significant relationship between organization adaptability and employees' commitment	B = .276
HI: There is a significant relationship between organization adaptability and employees' commitment	Ho: Rejected
Ho: There is no significant relationship between consistency and employees' commitment	B = .041
HI: There is a significant relationship between consistency and employees'	H1: Rejected
Ho: There is no significant relationship between employees' identification with organizational mission and employees' commitment	B = .149
HI: There is a significant relationship between employees' identification with organizational mission and employees' commitment	Ho: Rejected HI: Accepted

Table 4.0 summarized the overall outcome of the research hypothesis. In general, among the four predictors, multiple linear regressions (Beta coefficients) analysis revealed that involvement is the first most significant variable for works department employee commitment followed by adaptability. And, the mission of employees takes the third place and availability of consistency is regarded as the fourth important predictor of works department employee commitment. On the other hand, unlike the other three organizational culture traits, consistency doesn't have a significant influence on works department employee commitment as it is explained by significance level p>0.05. This indicates that, as much as the public institution tries to maintain a strong culture by being highly consistent, well-coordinated and well-integrated, this doesn't significantly contribute to the level of works department employee commitment.

Conclusion

This paper was initiated to investigate the influence of the selected organizational culture traits on works department employee commitment in public institutions. The paper found that Involvement is the most contributing organizational culture traits in the prediction of works department employee commitment. The other three organizational culture traits; adaptability mission, and consistency are ranked depending on their contribution from most to the least.

Therefore, it can be concluded that the more the organization involve in changing circumstances the more works department employees are committed to the organization. Furthermore, the works department of public institution capacity to restructure a set of behaviors, ability to perceive and respond to the employee enhances their commitment.

Involvement, one of the other organizational culture traits, is found to be more practiced in the works department of

the public institutions. This is asserted by the highest mean score of involvement, which indicates employee agrees with the measure of involvement. The results of regression analysis indicated that mission is the third-highest predictor of works department employee commitment in which employees' identification with the purpose, mission, and goals of the organization elicit a commitment to the organization. Therefore, it can be concluded that being able to internalize and identify with the works department of the public institution mission contributes to both the short and long term commitment of employees to the institution.

The paper shows that involvement has a moderate level of correlation with works department employee commitment, which means that works department employees are committed to their organizations when they are involved in decision making and also a sense of ownership result a greater commitment to the institution.

However, the result from multiple regression analyses indicates consistency doesn't have a significant influence on works department employee commitment. Hence, as much as organizations try to maintain a strong culture by being highly consistent, well-coordinated, and well-integrated, this does not have a significant contribution to the level of works department employee commitment. This lead to the conclusion that works department employees prefer to be given the freedom to do the job rather than being compelled to do it in a rigid manner while institutions need to maintain a strong organizational culture, they need to be flexible. In general, as per the findings of the paper, it can be concluded that organizational culture is important in improving the level of works department employee commitment which is asserted by the positive contribution of involvement adaptability and mission practice to works department employee commitment. However, consistency; defining values and systems which creates an internal system of governance with a clear set of do's and don'ts, with $p > 0.05$ has no significant contribution to works department employee commitment. Ultimately, not all corporate cultural measures have a significant influence on works department employee commitment.

Recommendations

Although organizational culture is important in improving the level of works department employee commitment as involvement has positive and significant predictor of works department employee commitment, the organization should continue its investment to develop the skills of employees and empower employees so as to increase capacity for autonomy.

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ASSESSMENT OF TOPOGRAPHIC CHARACTERISTIZATION AND SOIL EROSION IN A PART OF IKPA RIVER BASIN

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Abstract
Soil erosion is one adverse cause of land degradation, loss of valuable ecosystems, loss of agricultural lands, degradation of water quality and deformation of the landscape. A major factor responsible for soil erosion and subsequent soil loss in any region is topographic factor which includes several parameters such as slope length, slope steepness, aspect, shape, flow direction and flow accumulation. Understanding the character of these terrain variables will help in understanding the rate and magnitude of soil erosion in the region. Dataset used in the study was Advanced Space-borne Thermal Emission and Reflection Radiometer (ASTER) Digital Elevation Model (DEM) of 30m resolution. Geographic Information System and remote sensing tools were employed in deriving the topographic factors of the area including slope, flow direction, flow accumulation, slope length and slope steepness factor. The slope length and slope steepness factor were obtained using the map algebra in ArcGIS environment where the following parameters were considered; flow direction, flow accumulation, slope and resolution of DEM. The entire area was classified into five different slope classes. The slope classes ranged from 0 – 67.19%. Flow accumulation ranged from 0 – 631369. Flow direction ranged from 1 – 128. Slope length and slope steepness (LS) factor ranged from 0 (low) to 32.9625 (high). Areas with a high degree of steepness were observed to experience soil loss even with slight and moderate amount of rainfall and soil disturbance. Remote sensing and GIS provided an effective approach in analyzing the spatial dimensions of soil erosion and understanding the topographic character of the river basin as well as their effect on soil erosion.

Introduction

Soil erosion is one of the major environmental challenges facing the world today and it is one adverse cause of land degradation, loss of valuable ecosystems, loss of agricultural lands, degradation of water quality and deformation of the landscape. Soil erosion is a complex phenomenon with spatial heterogeneity (Saavedra 2005), and occurs as a result of some natural, environmental or human-induced factors or a combination of these factors. The impact of some factors may be slow and gradual while some factors have severe and accelerated effects. Topographic factor usually has severe impacts on soil erosion and when accompanied by other factors usually accelerate the impact of erosion and subsequent soil loss. Topographic factors contribute mainly to the development of gullies in many regions. Ganasri and Ramesh (2015) stressed that the impact of slope and aspect play a major role in runoff mechanism as this reduces infiltration rate. In Akwa Ibom state, soil erosion is taking an alarming dimension. The increasing population in the state is putting more pressure on the land and accelerating erosion processes and land degradation. In most cases, land degradation tends to increase as a result of inappropriate land use and management practices (Badulescu et. al. 2017). According to Igwe (2012), although man has helped to reshape and preserve the earth surface, yet man has also helped in causing instability of equilibrium in the natural ecology hence the rapid spread of natural problems such as erosion. Identifying critical areas and assessing the impact of erosion and soil loss is an effective means of developing strategies to implement the best management practices.

One of the major factors responsible for soil erosion and subsequent soil loss in any region is topographic factors which includes several parameters such as slope length, slope steepness, aspect, shape, flow direction and flow accumulation. In modelling soil erosion effectively, the different dimensions, nature and complexity of the terrain along with other factors need to be carefully considered as this will help in understanding the overall cause and effect soil erosion and soil loss in a region.

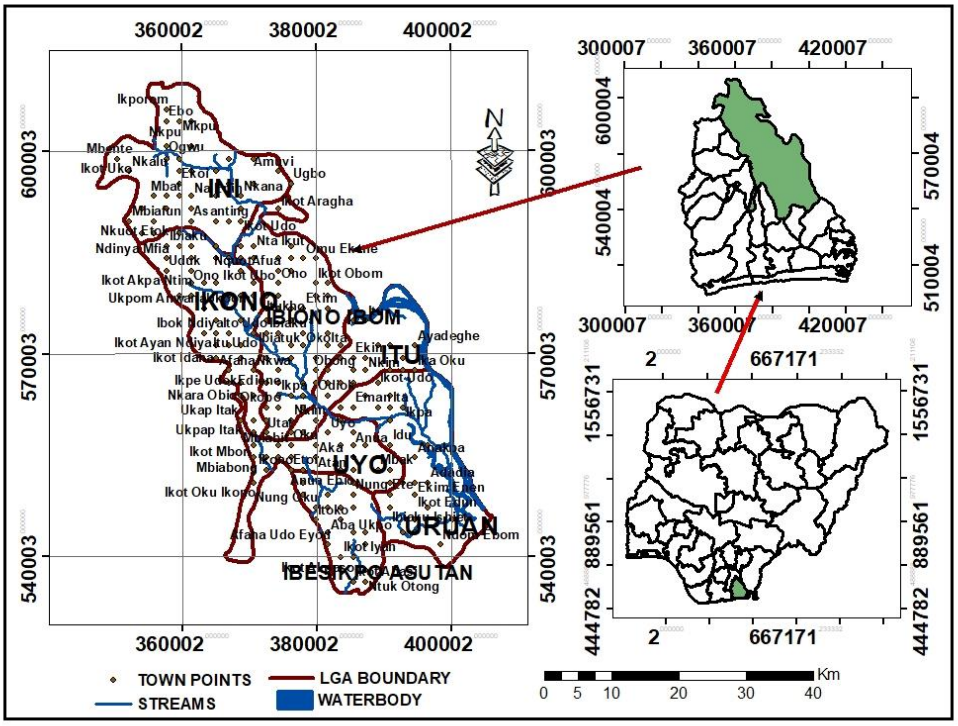
Geographic Information System and remote sensing are valuable information in improving understanding of events of environmental hazards such as floods, erosion and other ecological parameters. The availability of analytical tools through the GIS platform and space-based data sets with varying spatial and temporal

resolutions play a very useful role in mapping and analysing terrain parameters in order to understand its role in the spatial patterns of soil erosion. The application of the science of remote sensing in the study of environmental phenomena has been an effective approach in mapping various events of land degradation in a cost effective manner (Tagore et al., 2012). The integration of experimental data with remote sensing provides an excellent platform in interpreting field reality as well as estimating processes relating to erosion and hyrology. Remote sensing and GIS are effective and complementary technologies in modelling and analysing dimensions in environmental phenomena.

Study Area

The study is carried out in a section of Ikpa River Basin in Akwa Ibom State which is a major tributary of the Cross River Basin and a major coastal zone in Nigeria with mangrove forest and sandy beach. The study area covers about seven local government areas of the state with a total area of about 18304.47Sq.km. It is bounded by latitudes 4^{0}20N and 5^{0}12N and 7^{0}31E and 8^{0}11E. There are some natural scenes like valleys, marshes, ravines and swamps in some areas due to the influence of Atlantic Ocean, Qua Ibo, Imo and the Cross Rivers. According to Udosen 2008, the loose, friable and unconsolidated ferrallitic soils of the coastal plains sand are deficient in weatherable mineral reserves. The study area has weak unconsolidated sandy formations which are more susceptible to agents of erosion than compacted sediments that have accumulated over the years. High erosion risk is obtainable in areas of weak geological under-cover and worsened where there are steep slopes. The area has a soil type that triggers soil erosion with the rugged topography in some regions. The rolling sandy plains which consist mainly of gently undulating plains and cover about 75 percent of the state. Ofomata (1985) established that there is a positive relationship between relief and soil erosion in the south-eastern part of Nigeria.

MAP OF THE STUDY AREA



Methodology and Parameter Estimation

Data Description

The dataset used in the study was remote sensing data (Digital Elevation Model) from Advanced Space-borne Thermal Emission and Reflection Radiometer (ASTER) The digital elevation model was of 30m resolution.

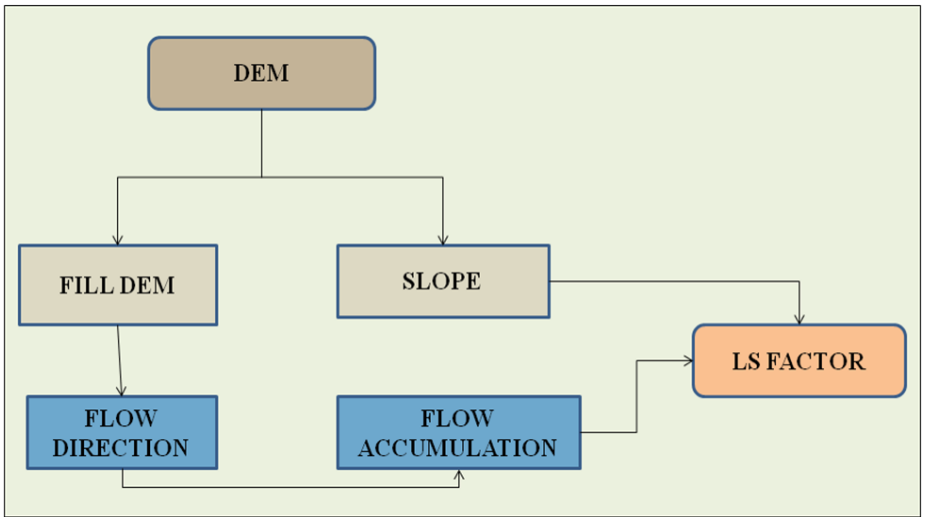


Figure 1. Flow Chart

Topographic parameters that were considered in this study included slope length, slope steepness, flow direction and flow accumulation. Understanding the character of these terrain variables will help in understanding the rate and magnitude of soil erosion in the region.

Image Processing

The Elevation Model (ASTER DEM) was processed to derive terrain parameters of slope length, slope steepness, flow direction and flow accumulation. The DEM data was visually inspected and pixel values checked. It was observed that the DEM image statistics was a little distorted. In order to correct for this distortion, the statistics was recalculated using the Arc tool calculate statistics of the data management tool in ArcGIS 10.5. The DEM data had some inherent errors which are called Sinks. Sinks are errors that are often caused by resolution of the data, sampling effects and the rounding of elevations to the nearest integer value. Sinks were filled in order to achieve accurate delineation of basins and streams. The Fill sink was implemented using the ArcHydo extension tool in ArcGIS 10.5. The Fill tool adopts the equivalents of some tools, such as Focal Flow, Flow Direction, Sink, Watershed, and Zonal Fill, to identify and fill sinks. The tool carries out some iteration until all sinks within the specified z limit are filled. The DEM data were resampled using the nearest neighbour algorithm to keep the original pixel values. The slope length and slope steepness factor were obtained using the map algebra in ArcGIS environment where the following parameters were considered; flow direction, flow accumulation, slope and resolution of DEM. A slope degree map was then generated for the area of study from the filled DEM. The slope operation was implemented using the slope function of the spatial analyst tool of the ArcGIS 10.5. The slope map created for the entire area gives an impression of the steepness of the terrain. The slope tool in ArcGIS calculates the maximum rate of change in value from that cell to its neighbours. The maximum change in height over the distance between the cell and its eight neighbours identifies the steepest downhill taken from the cell. The slope is calculated in degrees. Another input factor for the calculating the slope length and slope steepness factor (LS) is the flow accumulation. When calculating flow accumulation, flow direction is used as the input raster and this was implemented using the flow accumulation tool in ArcHydro.

The Flow Accumulation tool calculates accumulated flow as the accumulated weight of all cells flowing into each downslope cell in the output raster. If no weight raster is provided, a weight of 1 is applied to each cell, and the value of cells in the output raster is the number of cells that flow into each cell. In figures 2 and 3, direction of travel and number of cells are shown. Figure 2 shows the direction of travel from each cell and figure 3 shows the number of cells that flow into each cell. Cells with a high flow accumulation are areas of concentrated flow and may be used to identify stream channels.

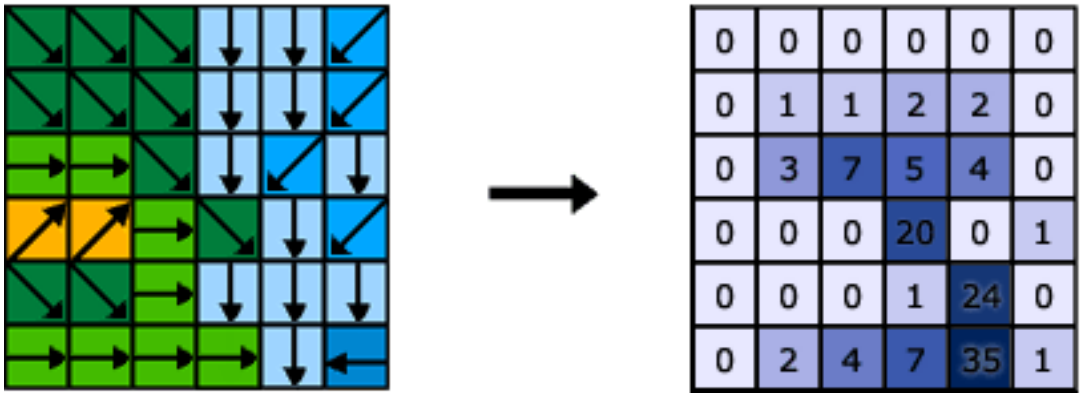


Figure 2: Illustration of Flow Direction ***Fig. 3: Flow Accumulation***

In deriving the LS factor, the following steps were applied

(i) A slope layer was first derived from the existing DEM using the Spatial Analyst Extension in ArcGIS (Spatial Analyst - Surface- Slope) in degrees

(ii) The flow accumulation layer was derived from the DEM. To derive the flow accumulation layer, three steps were taken in the following logical order:

(iii) A new DEM was derived from the existing DEM by filling all sinks and depressions in the existing DEM using the Fill option in the Hydrology Tools section of the Spatial Analyst

(iv) The new DEM was then used to derive a flow direction raster (hydrology tools - Flow direction)

(v) The flow direction raster was then utilized in deriving the flow accumulation raster (hydrology tools/ flow accumulation)

Finally, in order to develop the LS layer, the derived inputs of slope and flow accumulation layer were factored into the equation below for the derivation of this layer, using the raster calculator in ArcGIS Spatial Analyst.

The equation was written as;

Power("flow accumulation"[cell resolution]/22.1,0.4)*Power(Sin("slope of degree"*0.01745))/0.0896, 1.4)*1.4 ……4.4*

By multiplying L and S factor maps, the LS factor map in raster format is obtained.

Computing Slope Length and Slope Steepness Factor (LS)

The slope length and slope steepness (LS) factor accounts for the effect of topography on soil erosion. In general, as slope length (L) increases, total soil erosion and soil erosion per unit area increase due to the continuous accumulation of runoff in the downslope direction. As the slope steepness (S) increases, the velocity and erosivity of runoff increases (Kim, 2006).

The general equation used for calculating LS is an empirical equation developed by the United States Department of Agriculture (USDA) Agriculture Handbook (Wischmeier and Smith, 1978). LS factor was computed using the equation proposed by Wischmeier and Smith (1978) with the DEM as an input data.

$$L = (m+1)\left(\frac{\lambda_A}{22.1}\right)^m$$

Where L is the slope length factor at some point on the landscape,

λ_A is the area of upland flow, m is an adjustable value which depends on the soil's vulnerability to erosion and 22.1 is the unit plot length.

Generally, m = a constant dependent on the value of the slope gradient;

0.5 if the percent slope greater than or equal to 5%,

0.4 for slopes between 3.5% and 4.5%,

0.3 for slopes between 1% and 3% and

0.2 for uniform gradients with slopes less than 1% (Wischmeier and Smith, 1978).

As the slope steepness increases, the soil erosion also increases as a result of increase in the velocity and erosivity of runoff.

The S factor (slope steepness) is the ratio of soil loss relative to a 9% slope which is the standard slope that experiments plots use. The slope steepness factor is calculated as function of slope shown below;

$S = 10.8 \sin \theta + 0.03$, slope gradient $\leq 9\%$

$S = 16.8 \sin \theta - 0.50$, slope gradient $\geq 9\%$

Where S is the slope factor and θ is the slope angle. Depending on the measured slope gradient, a different equation for S must be used. $S = (\sin (0.01745 * \theta \text{ deg}))/0.09)^n$

Where θ is the slope in degrees,

0.09 is the slope gradient,

The value of m is derived based on the slope steepness as stated in the table

In this study m = 0.4 and 1.3.

Table m values for LS factor

m value	Slope (%)
0.5	>5
0.4	3-5%
0.3	1-3%
0.2	<1

Source: (Ministry of Natural Resources and Environment Malaysia, 2010)

Result and Discussion

Topographic factors represent the effect of slope length and slope steepness on erosion under given condition to that site with the standard slope steepness of 9% and slope length of 22.6m (Wischmeier and Smith 1978). Slope steepness produces greater impact on soil loss than slope length.

Slope Classes
The entire area was classified into five different slope classes. The slope classes ranged from 0 – 67.19%. The slope analysis revealed that a greater proportion of the area had slope values in the range of 0 – 14.23% while a smaller proportion fell within the range of 14.24 – 67.19%.
Flow Accumulation: Flow accumulation ranged from 0 – 631369
Flow Direction: Flow direction covered eight sections which ranged from 1 – 128.

Slope Length and Slope Steepness Factor (LS)
LS factor ranged from 0 (low) to 32.9625 (high). Majority of the study area had low LS factor values whereas very few locations had high LS factor values. The high values may be due to highly dissected terrain with abrupt slope changes in a few locations of the study area. The higher LS factor values were scattered and observed in hilly or mountainous areas and gully areas with steep topography and these areas are more prone to erosion and soil loss. Areas with a high degree of steepness were observed to experience soil loss even with slight and moderate amount of rainfall and soil disturbance. High values of slope steepness were observed in Ini, Ibiono Ibom and Itu. Higher slopes also account for shallow soil depth which places a limitation on vegetative cover growth and development and vegetative cover plays an important role in protecting the soil surface from erosive forces by allowing more infiltration and limiting the rate and amount of runoff.

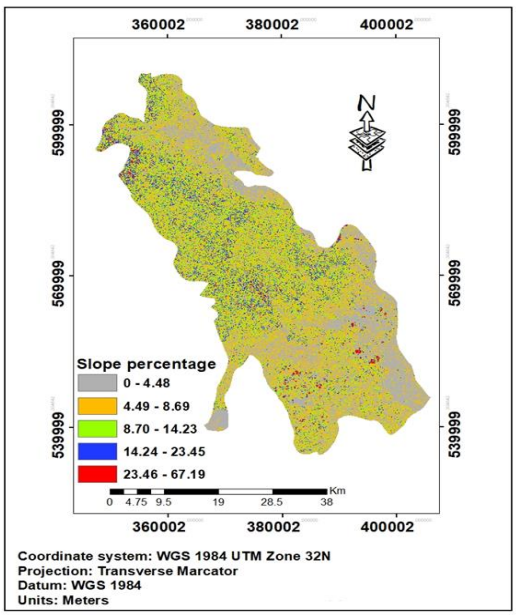


Figure 4: Slope Percentage
The percentage of slope for different classes ranged from 0% to 4.48% for class 1. The range of slope values was seen in a few locations in the North-East, South-East and South-West part of the study area. Erosion in these areas was quite minimal but sometimes accelerated by heavy rainfall and land use practices. Class two had slope percentages ranging from 4.49% to 8.69%. For class three, the percentages ranged from 8.70% to 14.23%. These areas also showed moderate soil erosion with some sites of rill and inter-rill erosion. Gully erosion was observed in some locations. Class four and class five had slope percentages ranging from 14.24% to 23.45% and 23.46% to 67.19% respectively. These areas were seen to experience higher rate of erosion and severe soil loss in some regions. The magnitude of runoff and sedimentation in these areas were quite high with several rill, inter-rill and gully erosion occurrence. The highest slope percentage derived from the elevation model was 67.19%. It was observed that the longer the slope length, the greater the amount of cumulative runoff. Susceptibility of soil erosion with slope categories shows that the steeper the slope of the land, the higher the velocities of runoff which contribute to the rate and severity of erosion in the areas with high and extreme erosion resulting from slope factors.

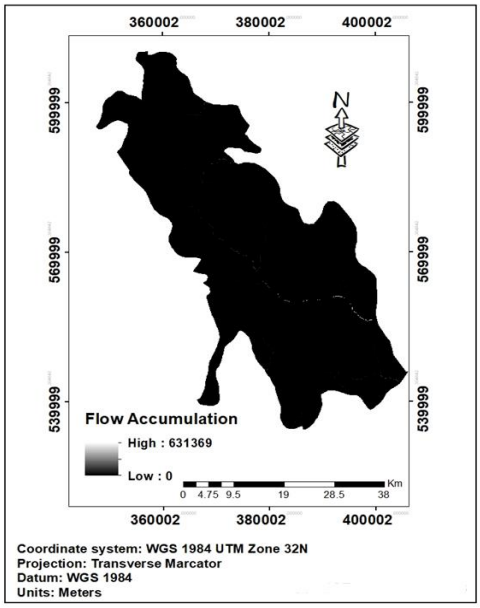


Figure 5: Flow Accumulation
Flow accumulation ranged from 0 to 631369

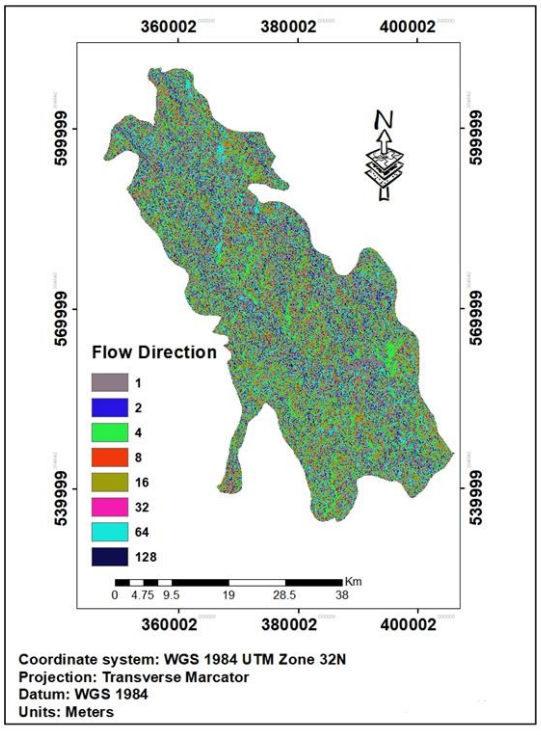


Figure 6: Flow Direction

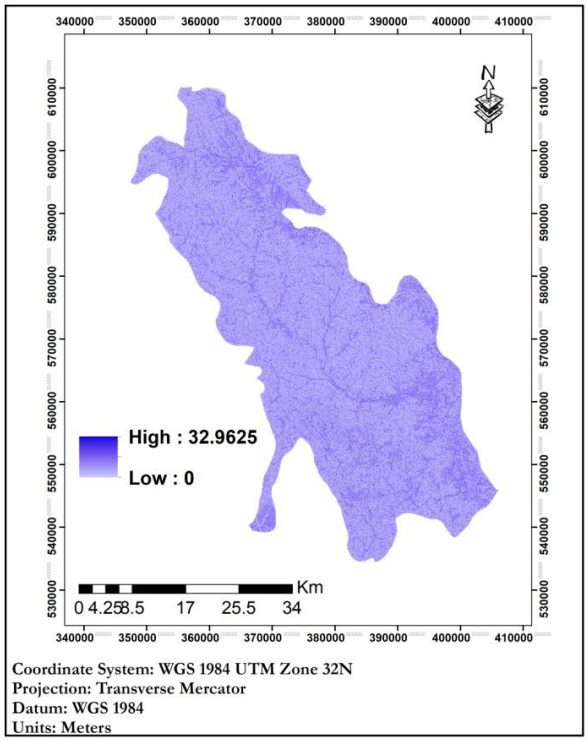


Figure 7: Slope Length and Slope Steepness (LS) factor

The derived slope length and slope steepness factor ranged from 0 to 32.9625

Summary and Findings

Although there are several studies on soil erosion in the area, there are no research works on the quantitative estimates of soil loss in the region. The available studies were basically on the environmental, anthropogenic as well as the geomorphological properties affecting soil erosion, sedimentation and soil loss. The work of

Udosen (2008) revealed that topography and soil properties greatly influenced soil erosion in the region. The result of this study indicates that topography greatly influenced soil loss in the north, north east and southern part of the study area. Areas with steep slopes and rugged topography were prone to heavy soil loss. This is also confirmed by the research of (Udosen 2008 and Ettang et. al. 2021) which had it that the topography of the region with the loose friable soil structure had made the area more susceptible to soil erosion even at the lowest rainfall. Topographic factors – (slope length and slope steepness) LS factors as derived from this study ranged from 0 (low) to 32.9625 (high). The research of Ettang et. al. (2021) (unpublished) in the same study area using Shuttle Radar Topography Mission (SRTM) datasets revealed that slope length and slope steepness factor fell within the range of 0 to. 31.1512. A greater percentage of the study area had low LS factor values whereas very few locations had high LS factor values. Highly dissected terrain with abrupt slope changes showed high LS values and these were seen in the northern and south-eastern part of the study area. There were cases of sedimentation in these areas in which valuable soil materials and soil nutrients were transported from uphill down the slope. The higher LS factor values were scattered and observed in hilly or mountainous areas and gully areas with steep topography and these areas were more prone to erosion and soil loss as the effect of soil loss and nutrient loss did not support root development hence poor vegetative growth. Areas with high slope steepness values were observed to have soil loss even with slight and moderate amount of rainfall and soil disturbance. Higher slopes usually result in shallow soil depth which in a way affect ground cover growth and development and good vegetative cover plays an important role in protecting the soil surface from erosive forces by limiting the rate of runoff

Conclusion

Land degradation through soil erosion in Ikpa River Basin is posing serious threat and limitation to meaningful development. This is a major cause for concern and calls for immediate intervention. A combination of remote sensing and GIS provides an effective approach in analysing the spatial dimensions of soil erosion and understanding the topographic character of the river basin as well as their effect on soil erosion. The various parameters of the terrain were assessed and the result revealed that although there were other factors responsible for erosion, topographic factors contributed immensely to erosion and subsequent soil loss in the area. Findings from this work will play a vital role in decision making and will further serve as a ready tool for sustainable erosion control practices and environmental management. The result will help planners in taking measures toward the management of soil erosion hazards. It will be a guide in prioritization of different regions in the river basin for effective and strategic control measures.

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WATER SUPPLY CHALLENGES AND IMPLICATIONS IN PERI-URBAN AREAS OF UYO METROPOLIS

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Abstract
This study focused on investigating the provisioning of water supply and challenges in peri-urban areas. The continuous increase in population has affected municipal agencies and water corporations in extending water connections to the growing areas. In this study, a sample size of 330 households was selected for the study using a cluster sampling technique. The methods for data collection were focus group discussions, interviews, and questionnaire administration. In addition, government gazetted materials; published journal and thesis were part of the secondary sources of data gathering. Descriptive analysis of data using percentages, frequencies from Statistical Package for Social Sciences (SPSSv16) and Microsoft Excel (2016) for data visualization was used for presentation. The study revealed that there was no policy instrument for the extension of water supply infrastructure in these zones; however, pipes were laid along major roads to connect water supply within the city. Major challenges to water provisioning in the study area were: lack of funding, ageing infrastructure, service unreliability, absence of electricity to pump the water. The findings further revealed that household water consumption was at 34.8% which was more than 150 litters/day. The implication is that majority of households depend on alternative water sources which may not be good for consumption resulting in serious public health concerns. The study concludes that municipal authorities have to look for ways of designing and financing water infrastructure as well suggest some legal instruments that will enhance their effectiveness in water supply provisioning in these areas.
Keywords: Access, Connections, Consumption, Household, Infrastructure

Background to the study

Water supply provision is one of the fundamental responsibilities of governments. The importance of water supply cannot be overemphasised and it is now challenged with the growing urban populations in cities. In today's world, due to the increasing rate of the urban population, many municipalities are incapacitated in the provision and delivery of critical urban services including water and sanitation. Urban water scarcity stems mostly from growth in domestic and industrial uses; another important contributing factor is pollution(Hassan Rashid et al., 2018).

United Nations Habitat (2015) argues that an increase in urban population will be higher in developing countries by 2030 with about 50 percent of the population currently living in cities. However, most cities in developing nations are not prepared for this expansion in addressing the infrastructural needs of their citizens. With growing inadequacies and major developmental challenges, households in these areas are usually involved in some coping Strategies as well provide alternatives to meeting basic urban services (Smith, M.D. Sohail M., and Saywell, 1998).

The evidence is greater in peri-urban areas surrounding the cities which results in making urban planning difficult to attain environmentally, physically, and politically. In addition, these areas face a variety of challenges related to poverty, environmental degradation, shifting cultures, and unclear social boundaries (Jennifer McConville and Hans Bertil Wittgren, 2014).

Peri-urban areas of cities are areas of rapid population growth, and zones of transition which are placed geographically at the fringes or edges of the cities; lack adequate access to infrastructure service provision by formal institutions; and could be situated within the largest metropolitan region and yet not have any basic service other than electricity (Webster and Muller, 2002; Ravetz et al., 2013; Shaw, 2005). However, there is no universally acceptable definition of peri-urban areas in the academic literature. The characteristics differ from different cultural backgrounds, thus making the concept of peri-urban an issue that is contested and

could be defined based on function or geography (Webster and Muller, 2002). Hence, the working definition of this research takes the position of finding peri-urban areas that exist within the largest metropolitan areas.

Problem Statement

In Nigeria, it is estimated that 48% of the citizens have access to potable water supply in urban and peri-urban areas whereas only 39 % of the rural population have access to potable water (Federal Republic of Nigeria, 2004). Peri-urban areas are inadequately serviced with water supply and sanitation. Thus, households in these areas often devise means to address their water access challenges. Households in developing nations suffer from the inadequacy of urban services as the city sprawls outwardly. Furthermore, access to cheap land and interactions from the city provides relationships existing between the transition zones (Olajuyigbe, 2016). Institutional constraints in the way of coordination, funding, transparent pricing, and supply of maintenance of facilities are responsible for the inadequacy in the provisioning of urban services (Angueletou-marteau & Anastasia, 2009). In addition, problems relating to access and duration of services, pricing of water, and other environmental services contribute to household quest in developing coping strategies. The implications of such strategies could lead to inconveniences in cost, health, and other forms of negative consequences for peri-urban inhabitants. Thus, for water supply services, coping with the unreliable services involve some behavioral practices adopted to ease their access to the service (Allen et al., 2006). Hence, this study seeks to empirically assess various ways households respond to inadequate water supply provided by the municipal agencies in peri-urban areas of a city.

The Study Area

The study area is located in Akwa Ibom State, Nigeria. It is in the south-south region of the country. The capital of the State is in Uyo in which the urban metropolis covers about areas of Itu, Ibesikpo, Uruan, and Ikono Local Government Areas. The selected areas have grown along the major roads that connect the city to its outer parts. These roads are Aka Etinan road which leads to Mbierebe Obio, Aka Road leading to Nung Oku in Ibesikpo LGA, Abak road leads to Ikot Oku Ikono in Nsit Ibom LGA, Ikot Ekpene Road covers Itam in Itu LGA and Nwaniba road leads to Idu Uruan (See Figures 1.1 and 1.2).

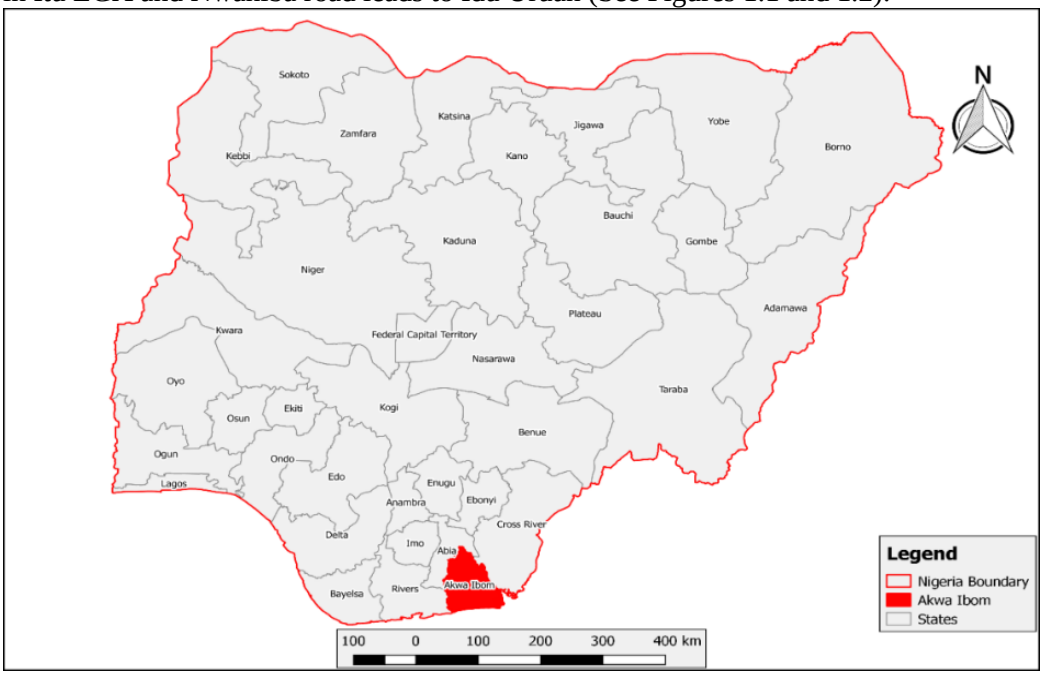

Figure 1.1: Akwa Ibom in the context of Nigeria
Source: Uyo Capital City Urban Development Agency (UCCDA), 2018

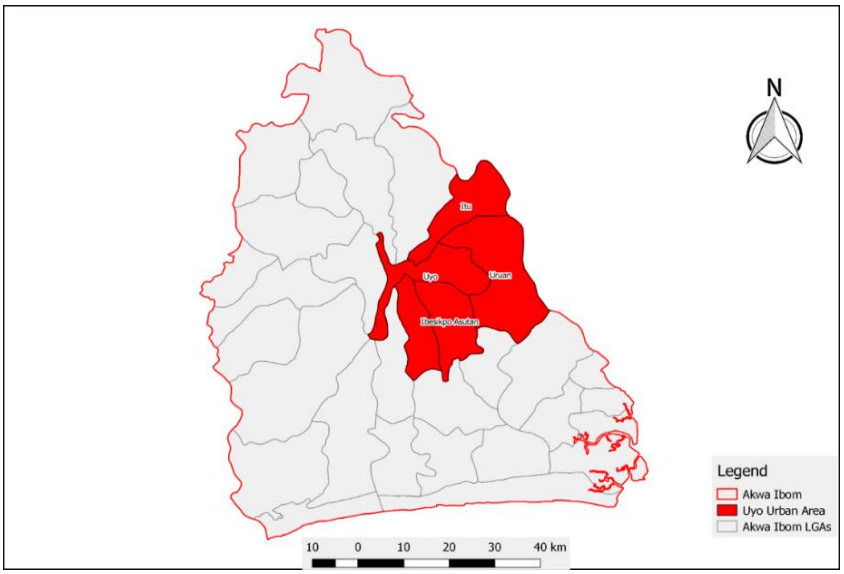

Figure 1.2: The LGAs of Uyo Metropolis and other LGAs in Akwa Ibom State
Source: Uyo Capital City Urban Development Agency (UCCDA), 2018

Uyo metropolitan area is located between latitudes 4º59' and 5º04' N and Longitude 7º53' and 8º00'E. Uyo is bounded by Ikono, Ibiono – Ibom and Itu Local Government Areas, and northern Uruan in Uruan Local Government Area in the north; it is bounded by Uruan Local Government Area in the East, Ibesikpo Asutan, and Nsit Ibom Areas in the South. It is one of the fastest-growing cities in Nigeria (Patrick et al., 2017). The current projected population from National Population Census data (2006) as of the year 2018 is about 1,238,292 persons. Also, Figure 1.3 shows the map of the Uyo Local Government in the context of the urban areas, and the selected peri-urban areas for the study are shown in figure 1.4 with its existing land uses in which these areas are within 10-15 kilometer radius from the city center.

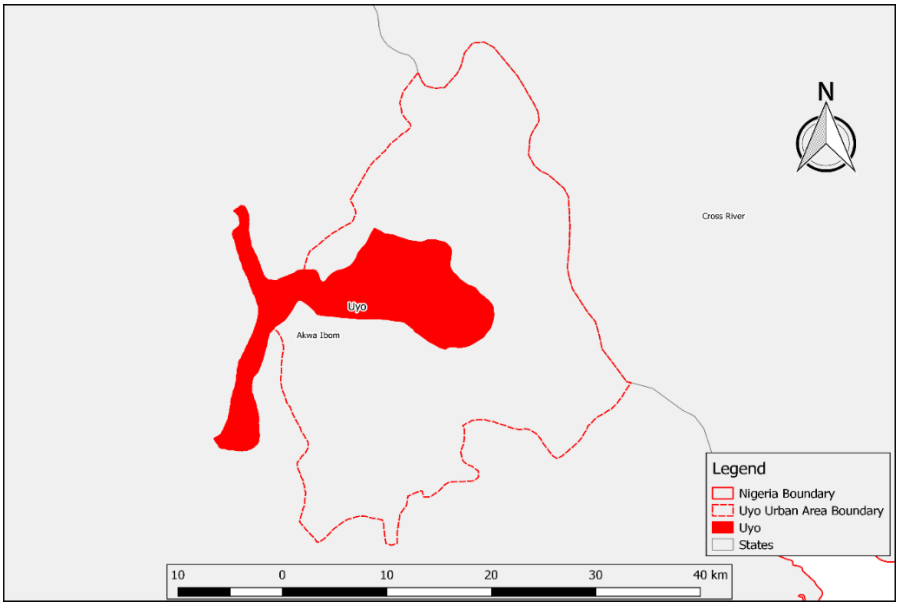

Figure 1.3: Uyo Local Government Area of Akwa Ibom State
Source: Uyo Capital City Urban Development Agency (UCCDA), 2018

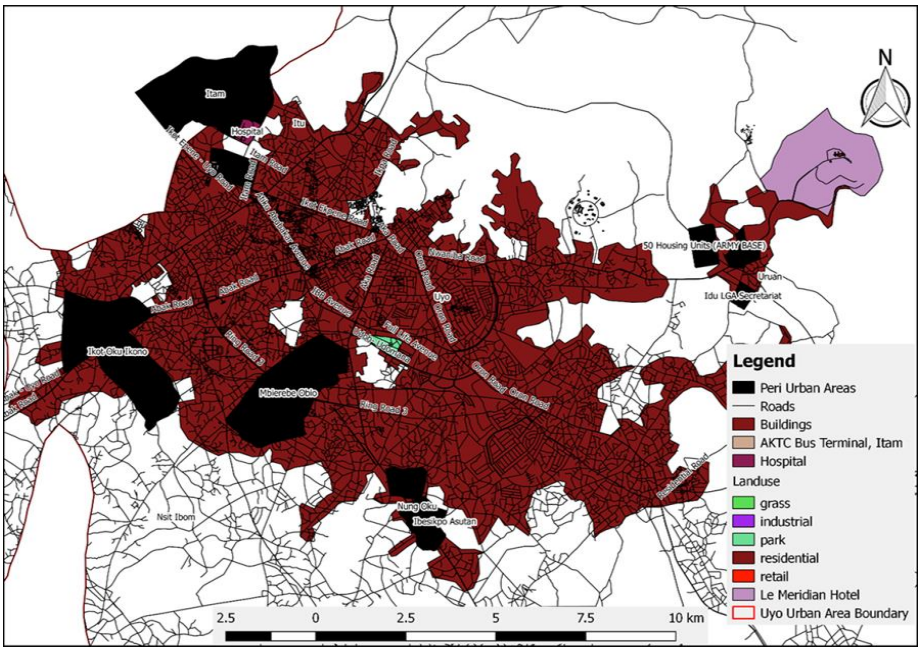

Figure 1.4: Selected peri-urban areas of Uyo metropolis identified with black coloration
Source: Uyo Capital City Urban Development Agency (UCCDA), 2018

Materials and Methods

The research method used for this study is mixed methods which have been effectively applied and used in previous research by (ZHENG et al., 2018). This research was first approached using qualitative methods of data collection ranging from focused group discussions, in-depth interviews, and observations. The variables gotten from the qualitative inquiry were later subjected into quantitative forms as variables which helped in the preparation of the study questionnaires. Both secondary data from books, journals, and published articles; thesis and projects, government gazette were used to complement the primary data field collection.

The instruments used for data collection include; a well-detailed questionnaire with closed and open questions, gathering data from households particularly on the socio-economic characteristics, use of water supply, challenges encountered in accessing water, and the implications in terms of cost among others. Cluster sampling was identified as the most effective sampling technique for the study due to the spatial configurations of the neighbourhoods in the study.

The sum of the population for the study was sixty thousand and forty-seven (60,047) households (Primary Health Care Unit, 2018). Using a systematic random sampling technique, household heads or representatives in the peri-urban areas were given the questionnaire to respond to them. The Krecjie and Morgan table of sample size distribution was adopted (Krejcie & Morgan, 1970) which argues that for a population of 50,000 to 75,000 a sample size of 381 is sufficient to represent for the study (See Table 3.1).

Table 3.1 Catchment Population of Selected Clusters

S/N	LGA	Peri-urban areas	Population	Questionnaire Distributed	Questionnaire Retrieved
1	Uruan	Idu Uruan	15,336	97	87
2	Itu	Itam	15,847	101	76
3	Ibesikpo	Nung Oku	11,994	76	61
4	Uyo	Mbierebe Obio	9,900	63	63
5	Nsit Ibom	Ikot Ntuen Nsit	6,970	44	43
Total			**60,047**	**381**	**330**

Source: Field Survey, 2018

A total of 381 questionnaire were distributed over the course of 8 weeks using Mondays-Fridays from 9 am to 6 pm daily. However, only 330 questionnaires were used for analysis from each cluster with household heads as participants. This was more than sufficient to be used for making any appraisal. Uncompleted and incorrectly filled questionnaires were excluded from the final analysis. The data collection period did not cover weekends because of the established inconsistencies that occurred during the pilot survey before the commencement of the research. Ethical considerations were considered during the questionnaire administration. Lastly, the tools for analysis were SPSS V16 and Microsoft Excel, 2016 for descriptive and inferential analysis while focused group discussions and interviews were analyzed using discussion analysis and text.

Results

Status of Water Supply Provision in the Peri-urban Area

Water supply provision by the government in Uyo Metropolis is the responsibility of Akwa Ibom State Water Corporation (AKWC). Access to the water supply is through the mains on the major main roads in the metropolis. Currently, there are no policy frameworks on the distribution and governance of water supply in the State. About 25,000 households are connected to the supply and only about 10,000 connections experience water supply services between 3-4 hours daily within the metropolis. The state waterworks supply about 11,500 -15,000 litres per day.

Public water supply provisioning implies water sources provided by Akwa Ibom State Government through the state waterworks. They include public standpipes and pipe connections. It is also referred to as a water board found in Idu Uruan and Ifa Ikot Okpon whereas other areas are not functional despite the availability of water kiosks in some of the areas (*as shown in Plate I*).

Plate I indicate the dysfunctional water kiosk provided by the state government in peri-urban areas of Uyo. There is a generator close to it which is used to power street lights in the areas. The water kiosk is made of fine synthetic materials that can withstand adverse weather conditions. However, for a period of about two (2) years, there is no water rushing in the taps.

***Plate I**: Government Public Water Kiosk (Standpipes) in the Study Area*

Source: Field survey, 2018

Government provision through Akwa Ibom State Water Corporation was only available for about 4-6 hours daily in the area in Idu Uruan. The reason for the availability of this source of water is because Le

Meridian five-star hotel uses the water for their hotel services. Efforts have been made by the State government to connect homes in the areas to the water mains. Due to the high cost of connection, some households buy water from households that are connected to the State Water Corporation (AKWC). Those that are connected usually pay huge sums to be connected and a monthly water rate of N2, 100.00.

Furthermore, accessing the services comes with the huge cost of registrations and connections depending on the proximity to the main roads where the water mains are networked for the State Water Corporation (AKWC). Private individuals and churches have drilled boreholes to supplement the inadequate and unreliability of service by the public supply. Focused group discussions during the study revealed that households in Idu Uruan prefer the public water supply because it is usually treated before supply.

The area manager at Idu Uruan revealed that after two months' interval, washing of the reservoirs and treatment of the water is usually done to get rid of the possible contaminations that may infect the water. This water service is free for those that could fetch from the standpipes but sell to individuals who connect to the service. Respondents complained that the water supplied by the government is not sufficient for them as a community. One of the interviewees narrated that:

'Just the little that gets to 5- star hotel is what everyone connected tries to tap during the process of supply. So this makes the common people suffer due to low capacity.

One of the participants in the focused group discussion said that he regretted attempting to connect to the public supply system after spending about Six Hundred and Fifty Thousand Naira (650,000.00) but up to date has no water that is over a basin full. The cost was in the registrations, buying of the materials used for extending the water connections such as the pipes, gums and paying for the service.

Generally, respondents prefer to buy water from their neighbours since they cannot afford that provision from the government due to the cost of registrations. Households that were connected previously usually pay a monthly rate of N500.00 only. However, since the increment in the price for water, many households have resorted to buying the water from individuals who store this water for sale or try to connect illegally. The unit cost of water in 25 litter Jerry can is N10 only.

The office blocks and the treatment plant for water supply are not well maintained *(as shown in plates 11 and 111 below)* shows the condition of the facilities where water supply is distributed to the peri-urban areas. These facilities are old and they are not well maintained.

Plate II: Akwa Ibom State Water Corporation

Plate III: Water Treatment Plant in Akwa Ibom State

Source: Field Survey, 2018

Access to Water Supply in the Study Area

Responses of respondents on the presence of water supply in their homes revealed that about 51.8% of respondents had a water source in their compound while 48.2% had water in different places. This means that households in the areas purchase water from their neighbours or travel distances to access water for their domestic uses and drinking.

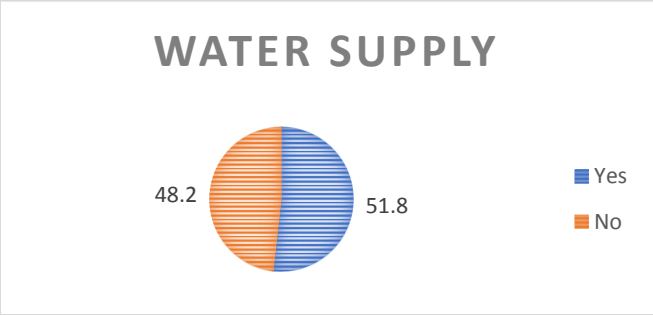

Figure 4.1: Water supply access

Source: Field Survey, 2018

Distribution of Water Sources of Respondents in the Study Area

The study revealed that 70% of respondents use boreholes, 16.1% use pipe connections, 9.7% use public standpipes and less than 5% use water from streams, rivers, wells, and rain harvesting water were other water sources for their daily needs. Idu Uruan was the highest beneficiary of Government water supply and the lowest in private borehole ownership. The presence of Le Meridian hotel in Idu Uruan is a big influence in the provision of government water supply in the area. There was poor coverage of pipe extensions to the inner parts of the peri-urban areas. Some households access water freely from neighbours, others purchase from neighbours and sometimes may use wheelbarrows to commute to access water.

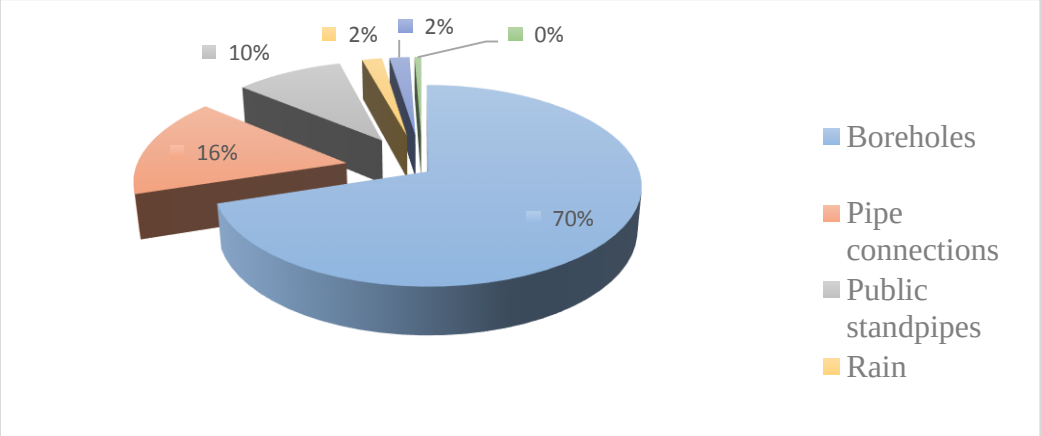

Figure 4.2: Water sources in the study areas

Source: Field survey, 2018

Agents in Water Infrastructure provision

The provision of water infrastructure in the study areas revealed that the majority of its infrastructure was provided by individuals. The findings revealed that about 74.8% of respondents had provided private boreholes for their consumption. Government provision was about 12.4%, community, 7.0%, Non-Governmental Organisations 3.3% and nature-based provisions were 2.4%. Nature-based includes; streams, rivers, wells, and rain harvesting which constitute unprotected sources of water supply.

Table 4. 1: Agents of Water Provision in the Study Area

Agents in Water Provision	Frequency	%
Community organisation	23	7.0
Government Intervention	41	12.4
Non-Governmental Organisation	11	3.3
Individuals	247	74.9
Nature	8	2.4
Total	**330**	**100.0**

Source: Field Survey, 2018

Distance to Source of Water Supply (Metres, m)

The study reveals that the distance to access the source of water in these areas is within workable distances of about 0-50metres. The results reveal that in the peri-urban areas of Uyo Metropolis, more than 70% of the respondents had access to water supply sources within 50 meters' distance and about 15% had access to water supply within 100 meters.

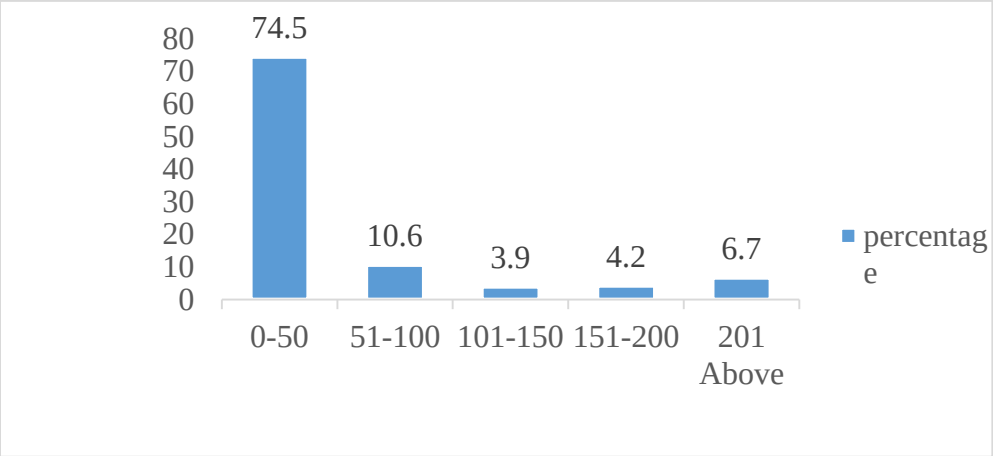

Figure 4.3: Distance to Water Supply Sources (Meters)

Source: Field survey, 2018

Household water consumption rates

The average water consumption by households in the peri-urban areas from the study shows that about 34.8% of the households consume more than 151 litres of water daily. The results further showed that 50-100 litres and 101 – 150 litres of water were consumed by the household with about 23.9 % each. Only a few households consumed water that was less than 10% for both 26-49 litres and less than 25 litres. The study revealed that peri-urban areas with higher consumption patterns were Idu Uruan and Ikot Oku Ikono.

Table 4.2: Household water consumption

Water Consumptions(litres)	Frequency	%
Less than 25 L	29	8.8
26L-49 Litres	28	8.5
50L-100 Litres	79	23.9
101L-150 Litres	79	23.9
151 Litres above	115	34.8
Total	**330**	**100.0**

Source: Field Survey, 2018

Time Taken to Access Water Supply Services

From the study, about 64.8% of respondents used about 15-30 minutes to access water. This means that the water supply was readily accessed and available in the study area. However, about 17% of households accessed water for more than 30 minutes. This implies that households do not have to wait too long to access water in the areas. The majority of the time, fetching water is done in the morning between 6 am -7:30 am and 5 pm -8pm by young males and females to prevent lateness or queues. The children do this in preparation for work and school to prevent going late to school on the following day.

Table 4.3: Time taken to Access Water Supply in Peri-urban Areas

Time (Minutes)	Frequency	%
0-15	57	17.3
15-30	214	64.8
31-45	28	8.5
46-60	23	7.0
61 above	8	2.4
Total	330	100.0

Source: Field Survey, 2018

Water Supply Challenges in Peri-urban areas

The challenge faced by peri-urban households in accessing water from public or government sources is mainly due to the unreliability of water supplied to them. Households are oftentimes depending on spending extra income to access water. However, from the institutional perspective, issues relating to funding, electricity to pump water for distribution bereft households from having adequate water to use in their homes. Thus, the table below shows a summary of some of the challenges encountered by respondents in the provisioning of water supply to the areas.

Table 4.4: Challenges of water supply in Peri-urban area.

S/N	Water Supply	Implications
1	The service is not available in all areas. Only the main roads of the peri-urban areas are piped with the service	Illegal connections and extra cost of extending services to residential locations.
2	Lack of Funding by the municipal agencies	This has led to low capacity in service delivery.
3	Aging and conditions of existing infrastructure	Most of the infrastructure is too old and sometimes had malfunctioned without proper and adequate maintenance.
4	Illegal connection	Illegal connection or water theft is rampant. This makes the pressure of the water supply to be very limited and low in supply.
5	The absence of electricity supply	Water supply requires the use of electrical energy to pump it. However, the utility company complains of lack of electricity to carry out their duties. Using a generator is always an expensive case.
6	Fraudulent Actions by Staff and Poor Community Leadership	Many respondents complained of the fraudulent act by Staff of the agencies.

Source: Field Survey, 2018

Discussions

Water supply provisions in the study areas are mainly provided by private participants who constitute over 70% of the provision. At proximity, respondents in all the study population had access to water supply either from the Government supply system, as is the case in Idu Uruan, or private boreholes drilled in the area. The study result revealed that about 12% of the water consumed in all the areas was provided by the government through public connections and 16.1% through public standpipes. The only community that benefited more from this service was Idu Uruan community since most of the cost in the provision of the service is borne by the 5-star hotel situated in the area. This implies that without the hotel, there will be no water provision in the areas.

Ohwo and Abotutu (2015) indicated that peri-urban areas are characterized by the proliferation of boreholes in short distances that enables residents to access the service. This present study is in line with their findings and the possible reason could be because the study areas have the same geological formations from the Niger Delta region of Nigeria. As a result, water cost is cheap and affordable but stance a chance of poor quality and bad distributions. This further explains the decision of residents of Idu Uruan in consuming more of the treated government water supply.

The study also differs from others such as Abdullahi (2017) and Ronald (2018) who argued that water access was a problem in Maiduguri and Kisenyi, it was expensive despite the availability of water. This result shows that water consumption is high in the study area because it is available and affordable. In terms of reliability of the service by the public water supply, the findings of the present study are consistent with those of Chaminuka and Nyatsanza (2013) in Harare who argued that clean water taps were not flowing very regularly leading to residents developing other forms of water provisions and storage.

In addition, it differs from studies of Ahile et al., (2015) in Makurdi whose argument was on the existing public water supply failure causing acute water shortage in the town. Even though there are only about 4-6 hours of daily public water supply in Idu Uruan, residents usually have water from their neighbors who sell to them the stored government water supply from their reservoir tanks. These results imply that government loses out serving the people with good water supply because of the limited supply capacity. Residents are reluctant to pay for the service because of the recent increase in price from N500.00 to N2100 monthly rate.

This has caused the utility company to lose revenue generations and there is a high level of water theft through illegal connections from the water mains. Nevertheless, residents could purchase the water from the ones who can pay the huge cost of registration and resale the water to them from the reservoir tanks. The study also revealed that about 51.8% of respondents had a water source whereas 48.2% of the respondents either purchase water or received it as a gift from their neighbors. There are no incidences of water scarcity or queuing for the service since most water points are readily accessible within 50-100 meters.

Previous studies have shown that there is a relationship between per capita household water consumption and household size. Previous findings indicated a weak negative association between household size and water consumption in neighborhoods. The findings of the present study ($r=-0.3, 0.05$) are in line with previous findings of Amin et al., (2011); Fan et al., (2013); Sadr et al., (2016) whose results indicated an increase in household size leads to a decrease in per capita household water consumption in the neighbourhood. The rationale for this result is that more household size tends to manage their use of water in peri-urban areas due to related factors of access to supply and their availability of services. This result implies impending water scarcity may result in increasing household size in the peri-urban area. This has serious sustainability implications given the global rise in the demand for water as confirmed by the World Health Organization (2021) bulletin stating that by 2025 half of the world's population will live in water-stressed areas.

Conclusion.

This study focused on accessing water supply provision and challenges to peri-urban areas of a city- Uyo metropolitan area. The study found out that the majority of the respondents depend on private borehole water

provision and stated that municipal agencies are without the capacity to fund the water supply services to these emerging areas. The agencies are challenged by water theft occurrences, aging infrastructure, and a lack of electricity to supply water to a few connected households. It is recommended that adequate and urgent need to network these areas with pipe water infrastructure will help reduce the continuous digging of boreholes which could lead to the destruction of the earth crust and as well prevent cases of public health concerns.

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PERCEPTION OF CONSTRUCTION PROFESSIONAL ON PAYMENT PERFORMANCE ATTRIBUTES

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Abstract.
Purpose – The purpose of this paper is to establish professional consensus on payment performance attributes in public organization for Nigerian Construction Industry.
Design/methodology/approach – The research adopted Delphi technique in data collection. A list of 25 different types of attributes was administered to the Experts for consensus evaluation in three numbers of rounds. Wilcoxon non-parametric rank test was used to test the consensus.
Findings – The decision rule for the study is 70% score. A score of 70% and above was retained and below was dropped. The findings indicate that only earthquake was dropped among the twenty-five attributes. The remaining of twenty-four were identified by experts as payment performances attribute for Nigerian construction industry.
Practical implications – This research has provided a literature on clients' payment performances attributes that affect the payments process positively or negatively depending on the organization's payment performance outcomes.
Originality/value – This paper is among the recent study that used Delphi approached in establishing the construction professional consensus opinions on payment performance attributes
***Keywords*:** Legal contractual matters, Construction industry related matters, clients related matters, contractors related matters, External related matters.

Introduction

The payment attributes are the drivers in the payment performances outcomes and it describes the payment process in construction contract that leads to positive or negative payment performance of the construction clients. It is contractually related matters, construction industry related matters, paymasters related matters, contractors related matters, external related matters. Payment performance is the process and procedure of making payment to the contractors which is guided in the standard form of contract and the process is carried out within a professional code of conducts. Federal Ministry Works lump sum contract recent edition is widely used in public and private organization in Nigeria (Emenike, 2010 and Sarki et al., 2018)

Payment can be well-defined as monetary consideration given by the clients to the contractors for the value of work done, materials or goods comprised in the subcontract. The payment process and procedure are generally affected by several factors which include the nature of the construction industry related matters, paymasters related matters, contractors related matters, legal and contractual related matters and external related matters. The payment process in the construction industry is a fragment, due to the number of procurement process employed in the industry, all the method is to use in order to meet the clients's requirement or obligation (Seeley, 1997; Sawacha et al., 1999; Kadefors et al, 2021). In the recent study, Manucharyan, (2021) among others, classified construction procurement methods into two broad categories as traditional procurement method and non-conventional procurement method. However, all the two methods are used in Nigeria. The widely used method in Nigeria is traditional method of procurement (Babatunde, 2010).Despite the various study on procurements and contractor's payment process there is little evidence or no existing literature on the client's payment performance attributes as such this paper is considered to be exploratory and aimed at providing the construction professional consensus opinions on payment performance attributes for construction industry.

Nigerian Construction Industry

Nigerian Construction Industry is dynamic and complex in nature in terms of the industrial development over the years. (Alinaitwe, Mwakali, & Hansson, 2009) According to Sodersten et al. (2018), the construction industry in Nigeria produced about 69% of the country's fixed capital formation. This means that the industry represents nearly 70% of the capital base of the country (Akpadiaha, 2012) Today Nigerian construction

industry comprises of clients, contractors, sub-contractors design management, specialist consultants, and suppliers. The paymaster is the financier of the projects and the employer of contractors and consultants and he is vital in achieving projects success generally (Omole,1986 and Oke et al. (2022). There are public and private paymasters in Nigerian construction industry. The public paymasters comprise of the federal government, state government and local government and the private paymasters are an individual and co-operate client that embark on construction projects. The paymasters /employer's side of the bargain-basement is usually the payment of money. The main obligation upon the employer is to make payment according to contract terms and condition, the amount paid to the contractors saved as the consideration for the contract (Hughes, & Murdoch, 2000)

Construction Payment Performances Attributes

The payment to supply chain is intended for the industry to improve performance. This can be achieved if the appropriate payment instrument is recognized by the relevant project members in a transparent and negotiated way (Motawa & Kaka, 2009).Payment by progress is the habituated technique of payment within the construction industry. The standard forms for construction contracts provide expressed payment clause stated progress payment to contractors and subcontractors. As a general rule in traditional procurement method, payments are specified to be monthly. The construction contract mostly financed through progressive payment. there are two types Payments in construction projects under traditional payment system, the Interim and Final Payment. The interim certificate, states the amount due to the contractor from the employer and Final Payment The final certificate is a statement as to the sum of money finally due between the employer and contractor (Abdulrashid, 2010)

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Payment performance is the process and procedure of making payment to the constrictors which is guided in the standard form of contract and the process is carried out within a professional code of conducts. Federal Ministry Works lump sum contract recent edition is widely used in public and private organization in Nigeria (Emenike et al., 2010). Clause 30 of the said form of contract deals with all certificates and regulates the entire subject of a payment under the contract. Clause 30 of the standard form of contract deal with the issues relating to the payment in contract Clause 30.0 certificates and payment, Clause 30.1 issue of interim certificate, Clause 30.2 amount due in interim certificate, Clause 30.3 certified value retained, Clause 30.4 rules regarding retention fund, Clause 30.5 completion of measurement and valuation and certificates and Clause 30.6 provisions for final certificate. However the payment issues are ranging from the legal and contractual matters, paymasters related matters, contractors related matters, construction industry issues and external related issues Payment performance issues had been in the industry for quite a while since the 1960s when the Barnwell disclosure 1964 saw the enormity of on time payment and the impotent of payment performance that improves the correct stream of cash to the contractors Latham's report 1994 and Egan report 1998 (Latham, 1994 ; Egan, 1998) highlighted, related issues. In stable conditions, the construction business, require limitedly working financing to work. The contract generally financed through progressive payment, which consistently stated in the condition of contract and is done monthly. There are two categories payments being used, the Interim and Final Payment (Abdulrashid, 2010). Furthermore, the payment performance summited to round 1 were categories into five subheadings Legal and contractual, paymaster relate matters, Paymaster related matters, Contractors related matters, and construction industry related matters and external related matters as shown in Table 1.0

Table 1.0 Payment performances collected by round 1

Broad Category		Payment performance
Legal and Contractual Related Matters	1	Regular payment
	2	Payment according to contract terms
	3	Setting-off sum certified.
	4	Rights to payment
	5	Certified value retained
Client's Related Matters	1	Certification of work executed
	2	Supervision
	3	Movement of file for payment approval
	4	Selective payment
	5	Paymaster satisfaction
Contractor's Related Matters	1	Contractor's claims
	2	Materials used
	3	Workmanship used
	4	Time delivery
	5	Contractors satisfaction
Construction Industry Related Matters	1	Credit payment
	2	Project duration
	3	Amount of interim payment
	4	Cost overrun
	5	Time overrun
External l Related Matters	1	War or civil disturbance
	2	Flooding
	3	Earthquake
	4	Change of Government/Policies
	5	Economic Meltdown

Research Method

One of the purposes of exploratory research is the discovery or identification of variables (Marshall & Rossman, 1994). Since the construction professionals are central to the paper, it is appropriate to get their views and perception to achieve the aim of this research. Suitable research approach, design, and methods also require in achieving the aim of the paper successfully. This paper utilized a Delphi methodology in contrast to traditional quantitative studies. The Delphi method is particularly useful when objective data are unattainable; there is a lack of empirical evidence (Hallowell & Gambatese, 2010). According to Pasukeviciute and Roe (2001), one of the defining features of the Delphi methodology and an essential element for its success, is purposeful sampling to inform the research instead of the random sampling desired for traditional quantitative research methods. Purposeful sampling implies the researcher determines ahead a set of criteria or attributes. Creswell and Zhang (2009) states the reason for purposeful sampling is to "ensure a selection of participants that will assist the researcher to understand the problem and answer the research question". Delbecq et al. (1975) called this sample a panel of experts.

Hasson et al, (2001) and Powell (2003) defined experts as individuals accomplished in their field and respected as such by their peers. Pasukeviciute and Roe (2001) noted that crucial for success is that the panel of participants "must have a deep interest in the problem and experience to share" and they should be

"representative of their profession or organizations". Delbecq et al. (1975) noted that besides expertise, panel members must be highly motivated to work on the problem and be willing to remain engaged for the duration of the study.

For this research the study has pursued participants that meet the definition of an expert from five different career disciplines a) Quantity surveyors b) Architects c) Engineers d) Builders and e) Accountants.

All five of these types of people routinely observe, participate in the payment activities that relate to the client's organization. However, because their job functions are different, they view the payment performance attributes through different perspectives, which some researchers have found advantageous. For example, Delbecq et al., (1975), Powell (2003) and Rowe and Wright (2011) reported that those Delphi panel participants with widely varying personalities and substantially different perspectives produce higher quality and more acceptable solutions. Powell (2003) reported that the participant panel size is an attribute that is equally as important as the panel's level of expertise. Considerable discussion by researchers is found in the literature regarding the most appropriate size for a Delphi panel. In a comparison of healthcare studies conducted over a 10-year period using Delphi methodologies, Reid (1988) found panel sizes to be as few as 10 to as many as 1,685. The study also noted that proof from many studies demonstrated that the more the panel, the higher the drop-out rate, with panel of 20 tending to keep their individual's members. For this research, the study set a goal of at least 24 participants to be remaining at the end of the research study, which compares favorably to the recommendations of Reid (1988), and Bonnemaison et al. (2007)

Numbers Sample

As mentioned above, the total number of participating organizations are 24 which include one respondent from each of the participating organizations. The respondents are systematically selected based on their profession as indicated in Table 5.2, academic qualification, and experiences.

Academic Qualification

Table: 2.0 Academic Qualification of the Delphi participants

Participant Qualification	Frequency	Percentage
B.Sc.	6	25
M.Sc.	15	62.5
PhD	3	12.5
Total	24	100

The Table 2.0 above shows that 25% of the participants were B.Sc. holder, 62.5% % M.Sc. holders, 12.5% Ph.D. holders, while, 62.5% have master's degrees. It is considered to be a good distribution of participants in term of academic qualification.

The profession of Delphi Participants

The profession of the participant of the Delphi exercise highlighted the composition of the participants involved. Table 5.2 shows the professions of the participants of this research, who by their profession are involved in payment practice and procedures ranging from evaluation, approval and certification, and assurances of payment to the contractors at one time or another. There is a total of twenty-four (24) respondents from different organizations. The respondent that were categorized according to professions shows that 29.2% Engineers, 20.8 % quantity surveyors, 20.8% Accountants 16.7 %)Architect, and 12.5% Builders.

Table: 3.0 Delphi Participants by Profession

Participants Category	Frequency	Percent
Quantity Surveying	5	20.8
Architecture	4	16.7
Engineering	7	29.2
Building	3	12.5
Accounting	5	20.8
Total	24	100

Work Experience

All of the participants have at least 10 years working experience while 37 % of the participants have more than 20 years of working experience. Table 5.3 shows the distribution of the research participants years of working experience as follows 10-15 years 9 (37.5%), 16-20 years 6 (25.0%), 3-21 years 7 (29.2%) and more than 25 years 2 (8.3%).

Table: 4.0 Delphi Panel Participants years of experience

Experience of participants(years)	Frequency	Percent
10-15	9	37.5
16-20	6	25.0
21-25	7	29.2
> 25	2	8.3
Total	24	100

Participants Ranks/ Positions

The participants rank and position can give a highlight on the vastness of the participants. it is suggested that the participant is extremely experienced in the construction practice which includes payment performance, practice, and procedure as well as associated work culture.

Table: 5.0 Participants Ranks and Position

Participants Ranks/Position	Frequency	Percent
Project Manager	9	37.5
Contracts Manager	6	25.0
Construction Manager	3	12.5
Chief Accountant	3	12.5
Directors	3	12.5
Total	24	100

Table 5.0 shows the rank/position of Delphi participants. The percentage of respondents according to rank/position were site project managers (37.5%) Contract managers, (25.0%) Construction managers, (12.5%) Chief Accountants, (12.5%) Builders (12.5%) and Directors (12.5%).

Delphi questions consist of 25 different types of payment performances attributes for the expert to gives their opinion using a 9-point liker scale in three number of rounds

The purpose of round 1 inquiry is to explore or deduce more information on the list of payment performances as shown in Table 1.0 submitted to the experts for assessment. The questionnaire was open ended question to facelifted, the exploratory research component of this study

A mixed-method version of the Delphi methodology uses both qualitative and quantitative methods and the transition begins with this Round 2 inquiry. The objectives of the Round 2 inquiry are to (a) provide the participants with sufficient feedback from the first round to allow them to comprehend the positions of the other participants; (b) obtain each participant's quantifiable agreement, or disagreement, with payment performances attributed that should remain on the list; and (c) obtain quantifiable decisions from each participant about how agreed with each of the payment performances attribute. The Delphi Round 3 analysis, however, provided the opportunity to quantitatively test for consensus, the desired outcome of the Delphi methodology. Wilcoxon non-parametric rank test used to test *the* consensus, and the consensus is occurring when the stability of the dispersion around the median, is determined. Table 6.0 showing the hypothesis test result.

The hypotheses for the test are:

H0: The median of different between round one and round two equal zero.

Ha: The median of different between round one and round two, not equal zero.

Table: 6.0 Hypothesis Test Summary

S/N	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between Round 2 and Round 3 equals 0.	Related Samples Wilcoxon Signed Rank Test	0.638	Retain the null hypothesis

Asymptotic significances are displayed. The significance level is 0.5

Table 7.0 shows the result on the payment performance attributes for public clients as agreed by the participant of the Delphi round. Upon applying the decision rule to these data, only one out of the 25 payment performance attributes were dropped from continued evaluation for not meeting the minimum of 70% being set as the decision rule.

Table 7.0: Showing Payment Performance Attributes Result Evaluated by Delphi inquiry

S/N	Payment performance (General)	N	Mean	Median	SD	IQR	6 - 9%	Action
A	**Legal and Contractual Matters**							
	Regular Payment	24	6.58	7.00	2.26	2	83.30	Retain
	Payment according to contract	24	7.42	8.00	1.56	1	91.07	Retain
	Setting off sum certified	24	6.54	7.00	1.87	3	75.00	Retain
	Contractors Right to Payment	24	6.88	7.00	1.96	2	87.50	Retain
	Certified Value Retained	24	6.83	7.50	2.12	2	87.50	Retain
B	**Paymaster Related Matters**							
	Certification of work	24	8.13	8	0.99	2	100.00	Retain
	Supervision	24	7.83	8	1.09	2	95.80	Retain
	Processing files for Payment	24	7.13	7	1.83	1	87.50	Retain
	Selective Payment	24	6.08	6	1.89	3	71.00	Retain
	Paymaster Certification	24	7.38	8	1.35	1	91.70	Retain
C	**Contractors Related Matters**							
	Contractors Claims	24	6.83	7	1.52	2	83.30	Retain
	Compliance to Design	24	7.42	8	1.64	1	95.80	Retain
	Compliance to Specification	24	7.33	8	1.63	1	95.80	Retain
	Time of Delivery	24	7	7	1.38	2	87.50	Retain
	Contractors Satisfaction	24	7	7	1.82	3	83.30	Retain
D	**Construction Industry Related Matters**							
	Credit Payment	24	7.17	8	1.55	2	83.30	Retain
	Project Duration	24	7.17	7	1.40	2	91.70	Retain
	Amount of Payment	24	7.08	7	1.67	2	91.70	Retain
	Cost Overrun	24	7.25	8	1.62	2	91.70	Retain
	Time Overrun	24	7.13	8	1.70	2	91.70	Retain
E	**External Related Matters**							
	War or Civil Disturbance	24	6.88	7	1.75	2	83.30	Retain
	Flooding	24	6.67	7	1.47	2	87.50	Retain
	Earthquake	24	3.38	2.5	2.20	4	20.80	Drop
	Change of Government Policies	24	7.46	8	1.67	2	91.70	Retain
	Economic Meltdown	24	7.29	8	1.65	2	79.20	Retain

Results and Discussions

This study utilized a Delphi methodology in contrast to traditional quantitative studies. The Delphi questions consist of 25 different types of payment performance attributes for the expert to gives their opinion using a 9-point liker scale in three number of rounds. The column labeled "6 to 9 %" representing 6 (Slightly agree), 7 (Moderately agree), 8 (Very much agree) and 9 (Extremely agree very often). The decision rule of ≥70% score of agreement and above by experts is retained and below was dropped and the result shows that only one item was dropped and upon applying the decision rules the following attributes were retained Regular Payment(83.30%), Payment according to contract (91.07%), Setting off Sum Certified (75.00%), Contractors Right to Payment (87.50%), Certified Value Retained (87.50%), Certification of work (100.00%), Supervision (95.80%), Processing files for Payment (87.50%), Selective Payment (71.00%), Paymaster Certification (91.70%), Contractors Claims(83.30%), Compliance to Design (95.80%), Compliance to Specification (95.80%), Time of Delivery(87.50%) ,Contractors Satisfaction (83.30%), Credit Payment (83.30%), Project Duration(91.70%), Amount of Payment (91.70%), Cost Overrun (91.70%), Time Overrun (91.70%) , War or Civil Disturbance (83.30%), Flooding (871.50%), Change of government policies (91.70%) and Economic Meltdown (79.20%). The Earthquake has scores of (20.80%) and is dropped.

Conclusions and Recommendations

This paper has determined expert consensus on construction industry payment performance attributes and the result shows that only Earthquake was dropped. And the Regular Payment, Payment according to contract, Setting off Sum Certified, Contractors Right to Payment, Certified Value Retained, Certification of work, Supervision, Processing files for Payment, Selective Payment, Paymaster Certification, Contractors Claims, Compliance to Design, Compliance to Specification, Time of Delivery ,Contractors Satisfaction, Credit Payment, Project Duration, Amount of Payment, Cost Overrun, Time Overrun , War or Civil Disturbance, Flooding, Change of government policies, and Economic Meltdown were retained which unanimously. agreed by expert as the payment performance attributes in construction industry. The result of this study can used to describe the employer's payment performance in the construction industry. The finding of the study can also be replicated in another country with a large sample to revalidate the study.

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VULNERABILITY OF RIVERINE COMMUNITIES TO FLOODING IN MAKURDI TOWN, NIGERIA

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Abstract
Riverine environments are of significant economic, ecological and social importance to the global population. They are however, under increasing pressure from rapid anthropogenic developmental activities and the effect of climate change. This paper characterizes vulnerable riverine communities, their level of vulnerability, and suggests adaptive measures for the vulnerable communities. Coastal vulnerability index (CVI) adapted from Palmer (2011) was used to measure prescribed physical parameters of bank width, coastal slope, distance of vegetation behind back of the river bank, distance of communities from the river, percentage rock outcrop, avalanche risk and presence of braided channels. Vulnerability levels of the communities were classified based on the CVI index (Very low, Low, Moderate, High and Very high). The result shows that Wurukum and Wadata with indices of 26 and 25 respectively have very high vulnerability to flooding; Fiidi has an index of 22 indicating high vulnerability while both High level and North Bank have values of 14 each meaning low vulnerability. The study recommends dredging of river Benue, building of embankments and avoiding building in marshy areas that are flood prone in Makurdi town.
Keywords: *Vulnerability, Riverine, Flooding, Communities and parameters*

Introduction

Since early civilization riverine and coastal areas generally have been attractive settling grounds to human population as they provide abundant marine resource, fertile agricultural land and possibilities for trade and transport (Scheartz, 2005). The characteristics of riverine and coastal environments, however pose some great challenges to human habitation. Riverine and coastlines are highly dynamic natural systems that interact with terrestrial, marine and atmospheric processes and undergo continuous change in seasons to these processes (National Oceanic and Atmospheric Administration 2016). Over the years, human societies had often failed to recognize the hazards related to these dynamics and this has led to major disaster and societal disruption to various degrees.

Riverine and coastlines - the boundaries between water bodies and the land we lived on, are getting more exposed to the dangers and disasters associated with them. Implying communities settling along this boundary face a worsening situation as the effects of climate change including floods arising from worsening frequency of storm surges and heavy rainfall of long duration or high intensity become more severe (Nicholls, 2004). Risk associated with flood makes it a requirement to capture information on rainfall pattern and drainage systems (Bello and Ogedegbe, 2015). In particular, information on drainage systems and the hydrologic morphometry of any nation is a veritable resource among the core dataset usually captured when producing a topographic map of a country (Bello, Adzandeh and Rilwani 2014). Vulnerability is the degree to which a system is susceptible to or unable to cope with adverse effects of climate risk, including climate variation to which a system is exposed, its sensitivity and its adaptive capacity (IPCC, 2001). It is a function of the character, magnitude and rate of climate change and the degree to which a system is exposed, along with its sensitivity and adaptive capacity. It increases as the magnitude of climate change or sensitivity increases, and decreases as adaptive capacity increases (OECD, 2009).

In Nigeria, series of flood hazards from various parts of the country at different periods have occurred. For instance in 2001coastal communities in Abia, Adamawa and Akwa Ibom states witnessed heavy down pour and rainstorm which affected about 5000 people. In the same year about 12,300 persons were displaced by torrential rain which destroyed farmlands, damaged properties and submerged building in Zamfara state. In 2012, a widespread devastating river flooding hit the country cutting across major cities in about 14 states that border the Niger-Benue River with the coastal communities affected most. The worst affected where Adamawa, Taraba, Benue, Kogi and Anambra state (Nkeki et al, 2013).

Okereke (2007) highlighted the basic effects of flooding to include loss of human lives, submerging of farmland, residence and streets, inflow of sewage, municipal, pollution, damage of property, health hazard, clean-up cost, disruption of services, traffic obstruction, aesthetic discoloration, economic loss and infrastructural damage. Makurdi town is situated within the valley plains of River Benue. The proximity of the town to the channel of the Benue River in combination with the low elevation of the flood plain within which the town is situated makes it vulnerable to flooding.

Materials and Methods

Study Area

Makurdi town is located at $7^0\,43^1\,5^{11}$ N and $7^0\,45^1\,47^{11}$N and $8^0\,32^1\,10^{11}$ E and $8^0\,33^1\,40^{11}$ E. The town is situated astride river Benue in the North central part of Benue state, divided by the river Benue. The city of Makurdi defined politically, has a radius of about 10km with an area of about 314.2km2. The city stretches from the airport along Gboko road in the West; in the South the town is bounded by Apir while in the North it is bounded by Agan toll gate. Makurdi falls within the tropical wet and dry (Aw) climate. The climate is dominated by South West and North East monsoons that determine the wet and dry seasons respectively. Three temperatures seasons are experienced in the study area (Tyubee, 2004). High temperatures are experienced especially in the months of March and April, daily temperature average is about 36^0C. January is regarded as the coldest month with mean temperature of about 30^0C. Average daily temperatures are as high as 32^0C and rarely fall below 20^0C.

The vegetation of Makurdi is typical of Guinea Savannah, made up of trees and grasses of various types. Agriculture, especially subsistence farming is widely practised together with market gardening at the valley of river Benue. Most Makurdi dwellers are civil servants and traders, fishing and brick laying are other economic activities carried out at the Benue river. The choice of this study area is because the town is located along the banks of river Benue and the Coastal Vulnerability Index is best at analysing flooding vulnerability along a stretch of coastal area. The town is shown in the Figure 1.

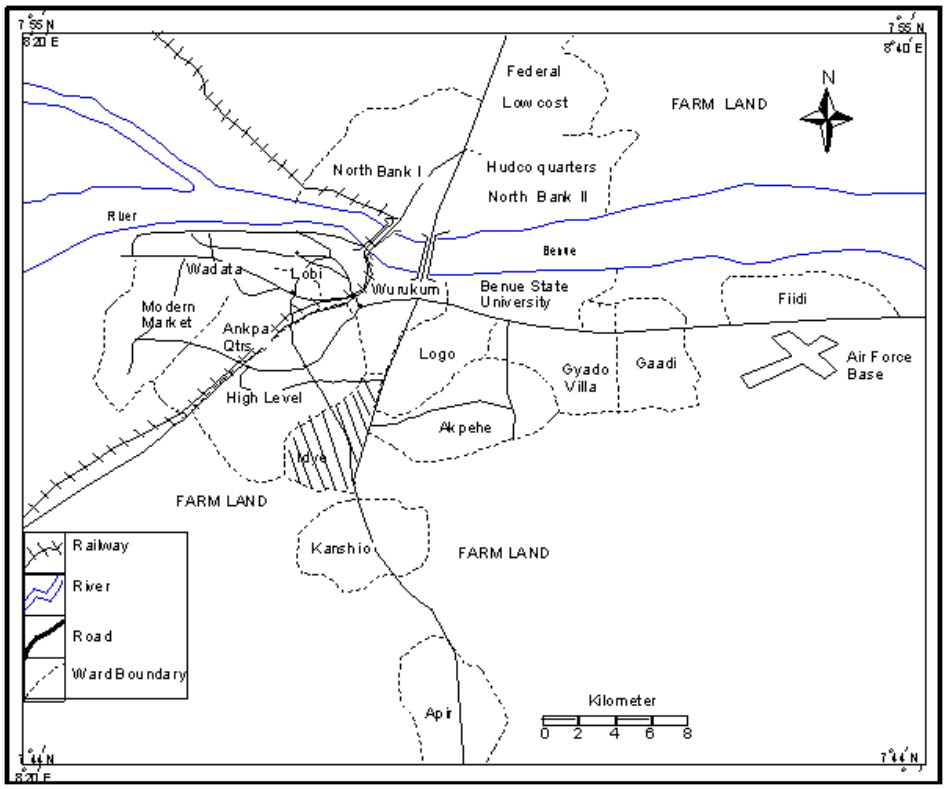

Figure 1: Map of Makurdi town, Benue State, Nigeria.

Data Collection

The data for this study were generated from;

i. Topographic map of the riverine communities.
ii. Co-ordinates of the communities under study.
iii. Elevation (m) and proximity (km) of the river line communities to adjourning river Benue.
iv. Bank width (m), Coastal slope (degrees), Percentage rock outcrop, Avalanche risk and Presence of braided channels.
v. Vegetal cover, occupation and water sources of inhabitants.

Topographic map of the study area was collected from the Ministry of Lands and Survey, Makurdi and was used to determine the parameters. Ground truth verification by observation and measurement was also done to confirm the map information.

The Coastal Vulnerability Index was used to calculate the vulnerability of the riverine communities under study to flooding. The Coastal Vulnerability Index has been used and modified by many researchers to the needs of their research. For the purpose of this research, the method used by Palmer (2011) was adopted. The choice of this method is that it ensures a quick and efficient measure of assessing vulnerability over a long stretch of coastline. This method uses absolute figures (indices) which are used to rank the attributes of the variables under study. The attributes which were used to evaluate the coastal vulnerability are:

a = Bank width
b = Coastal slope
c = Distance of vegetation behind back of the river bank
d = Distance of communities from the river
e = Percentage rock outcrop
f = Avalanche risk
g = Presence of braided channels
The formula used is as stated below:

Relative CVI = a + b + c + d + e + f + g

Where a, b, c, d, e, f, g are the ranked index given to the assessed variables. Therefore the highest rank index is four (4) and the maximum value for CVI is twenty eight (28) i.e.

a = River Bank width - 4
b = River Bank slope – 4
c = Distance of vegetation behind back of the River Bank - 4
d = Distance of community to river - 4

e = Percentage rock outcrop - 4
f = Avalanche frequency - 4
g = Presence of braided channels – 4
Total = 4 + 4 + 4 + 4 + 4 + 4 + 4 = 28

The values in Table 1 were used to rank the index:

Table 1: CVI Parameter ranking

Physical parameters	Extremely Low (1)	Low (2)	Moderate (3)	High (4)
River Bank (width)	> 150m	100-150m	50-100m	< 50m
River Bank (slope)	> 12^{O}	12^{O}-8^{O}	8^{O}-4^{O}	< 4^{O}
Distance of community to river	>4km	2 - 4 km	1- 2 km	<1km
Distance of vegetal behind the back of Bank (RB)	> 600m	200-600m	100-200m	< 100m
Percentage Rocky Outcrop	> 50%	20-50%	10-20%	< 10%
Avalanche frequency	0	1-10	11-50	>50
Presence of braided channels	0	1- 2	3- 4	> 4

Source: Adopted from Palmer (2011)

With ranking applied, these values were then inputted into a simple equation (CVI = a + b + c + d + e + f + g) to calculate each riverine community's CVI score; a score that indicated each riverine community's vulnerability comparative to other communities along the riverine. The minimum score possible is 6 and the maximum is 28.

Palmer (2011) organised the CVI scores into five (5) categories of very low, low, moderate, high, and very high vulnerabilities. Riverine communities scoring within the mid-range (between 25% and 75% percentiles) were ranked as moderate Vulnerability while communities scoring below or above the moderate class are categorize as lower or higher vulnerability respectively. This ranking system is presented below:

Very low	=	6 – 12
Low	=	13 – 15
Moderate	=	16 – 18
High	=	19 – 22
Very high	=	23 – 28

Result and Discussion

Major Vulnerable Factors of Flooding Hazard

A field study guided by requirements of the Coastal Vulnerability Index considered seven (7) major factors posing as threats to flooding in Makurdi town as given by Palmer (2011). These factors are:

River Bank Width

Various structures are referred to as banks in different fields of geography but in general a river bank refers to the land alongside a body of water (Luna, Gordon and Miller 1995). The river bank width mentioned here is the extent from the river bank to the mainland i.e. the wideness of the Benue bank at the various locations in the study area. The wider the river bank, the shallower and the more the chances of water spilling into the neighboring areas leading to create flood.

River Bank Slope

The river bank slope is the gradient of elevation between the river bank and the mainland. This is referred to the steepness and length of line connecting the river at the bank and the mainland. Due to the verifying nature of the underground rocks and vegetation at the river Benue bank, there is varying degrees of erosion and hence, the slope of the river bank is not uniform throughout the study area. The steeper the river bank gradient, the less vulnerable the area is to flooding. On the other hand, a gentle or flat bank allows more easily water to spill in the surrounding areas increasing the level of vulnerability to flooding.

Distance of vegetation behind the Bank
This refers to the distance between the river bank and where vegetation grows along the river Benue bank. Vegetation has role of acting like a giant sponge that holds water and release to the environment gradually. Where vegetation is closer to the bank, it helps to prevent water from directly moving into the neighborhoods.

Distance of community to river
The further a neighborhood is away from river Benue the lesser the chances of flood water moving into it and the closer the more the risk. Distances of neighborhoods in Makurdi were measured and included as a variable in determining the neighborhoods' risk level to flooding.

Percentage Rock Outcrop
This is the amount and frequency of rock formation that appears above the surface of the surrounding land. This affects the vulnerability along the bank of river Benue in that its presence reduces the rate of erosion process while its absence makes it easier as the normal soil offers less resistance.

Avalanche Frequency
This is a geological phenomenon that includes a wide range of ground movements, such as rock fall, deep failure of slopes and shallow debris flow. This has left the river bank of River Benue prone to flooding, for instance, in places where it occurs in high frequency it loosens and levels the river bank making it easier for water to rise above the river bank into the neighboring communities.

Presence of Braided Channels
A braided channel is a channel or water path that consists a network of smaller channels separated by small and often temporary islands. A high presence of these channels means it is easier for the River Benue to spread its water inland during flooding. The higher the concentration of these channels the more vulnerable a place is to flooding.

Classification of Flood Vulnerability Levels among Neighborhoods in Makurdi Town

Using the Coastal Vulnerability Index requirements, the variables for each of the Neighborhood were considered. With rankings applied as in table 2, these values were then inputted into the equation to calculate each communities score.

Relative CVI = a + b + c + d + e + f + g

Fiidi
Relative CVI = a + b + c + d + e + f + g
= 4 + 4 + 1 + 4 + 3 + 4 + 2 = 22

Wurukum
Relative CVI = a + b + c + d + e + f + g
= 4 + 4 + 4 + 4 + 4 + 4 + 2 = 26

High Level
Relative CVI = a + b + c + d + e + f + g
= 4 + 2 + 2 + 1 + 2 + 2 + 1 = 14

North Bank
Relative CVI = a + b + c + d + e + f + g
= 4 + 1 + 4 + 1 + 1 + 2 + 1 = 14

Wadata
Relative CVI = a + b + c + d + e + f + g
= 4 + 4 + 4 + 4 + 4 + 4 + 1 = 25

The vulnerability index as presented by Palmer (2011) indicated the levels as:

Very low	=	6 – 12
Low	=	13 – 15

Moderate	=	16 – 18
High	=	19 – 22
Very high	=	23 – 28

According to the results, Fiidi with a CVI score of 22 has a high vulnerability level to flooding, Wurukum with a CVI score of 26 has a very high vulnerability level to flooding, High level with a CVI score of 14 as interpreted by the CVI ranking has a low vulnerability to flooding, North Bank which has a CVI score of 14 also can be considered as a low level of vulnerability, and Wadata with a CVI score of 25 can be identified as a very high vulnerability to flooding. The result agrees with the work of Nasir, Jahari and Ahmad (2016) who concluded that the indicator based approach gives more precise vision of overall flood vulnerability in each area. Also, the result conforms to that of Ologunorisa (2004) who assessed flood vulnerability zones in the Niger Delta, Nigeria by using hydrological technique based on some measurable physical characteristics of flooding and vulnerability factors.

Satellite imageries of Makurdi area showing the riverine communities obtained from the National centre for remote sensing, Jos presented in Figures 2, 3 and 4 respectively agrees with the result of the vulnerability index. Figure 2 shows a digital terrain model of the low land area indicating high relief areas in light colour and low relief areas most vulnerable to flooding in dark colours, Figure 3 shows land use and land cover of the area indicating water bodies, vegetation, silt soils, moist soils, built up areas and bare land while Figure 4 shows the rate of vulnerability of Neighborhoods in the low land area of Makurdi. This agrees with spatial assessment of flood vulnerability in Anambra East LGA, Nigeria using GIS and Remote Sensing by Okwu-Delunzu, Ogbonna and Lamidi (2017) where the procedure consists of mapping of flood prone areas and modeling of digital terrain elevation. The result is also in tune with Ifatimehim, Enenche and Ismail (2020) in their work on flood vulnerability assessment of Settlements in the Niger-Benue trough, central Nigeria where mapped and remotely sensed retrieved data (spot 5 and the Shuttle Radar Topography Mission (SRTM) were analysed with ArcGIS 10.5. The result showed that more than 50% of the area was under the high and moderately high risk zones.

Table 2: Index values used to rank the data

S\N	Communities	Location	River Bank Width (a)	River Bank Slope (b)	Distance from River (c)	Distance of Vegetation (d)	Percentage Rock Outcrop (e)	Avalanche Frequency (f)	Presence of Braided Channel (g)
1.	Fiidi	Lat 7^0 48^1 Long 8^0 39^1	40m	2º	3km	30m	12%	72	2
2.	Wurukum	Lat 7^0 46^1 Long 8^0 33^1	30m	2º	650m	20m	2%	60	1
3.	High Level	Lat 7^0 47^1 Long 8^0 33^1	32m	12º	4km	4km	45%	8	0
4.	North Bank	Lat 7^0 51^1 Long 8^0 36^1	32m	14º	400m	650m	70%	7	0
5.	Wadata	Lat 7^0 50^1 Long 8^0 34^1	30m	2º	500m	18m	5%	70	0

Source: Field Survey 2021

Table 3: Ranking of the field data in accordance with the CVI

S/N	Communities	a	b	c	d	e	f	g
1.	Fiidi	High(4)	High (4)	Extremely low (1)	High (4)	Moderate (3)	High (4)	Low(2)
2.	Wurukum	High(4)	High(4)	High(4)	High(4)	High(4)	High(4)	Low (2)
3.	High Level	High(4)	Low(2)	Low (2)	Extremely Low (1)	Low(2)	Low(2)	Extremely Low (1)
4.	North Bank	High(4)	Extremely Low(1)	High (4)	Extremely low (1)	Extremely Low(1)	Low (2)	Extremely Low (1)
5.	Wadata	High (4)	High(4)	High(4)	High(4)	High(4)	High(4)	Extremely Low (1)

Source: Field Survey 2021

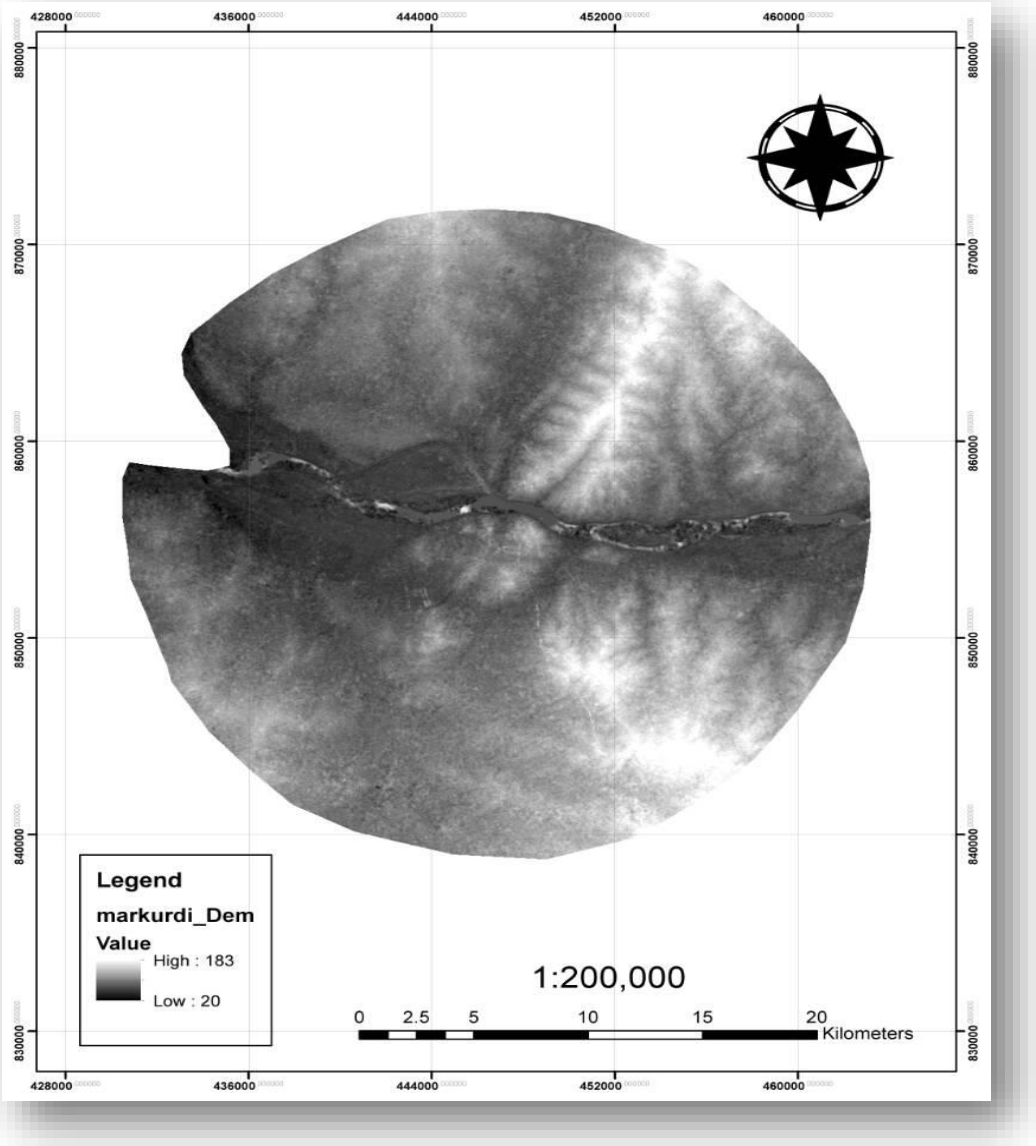

Figure 2: Digital Terrain Imagery of Makurdi LGA area showing Relief

Source: National Centre for Remote sensing, Jos 2021

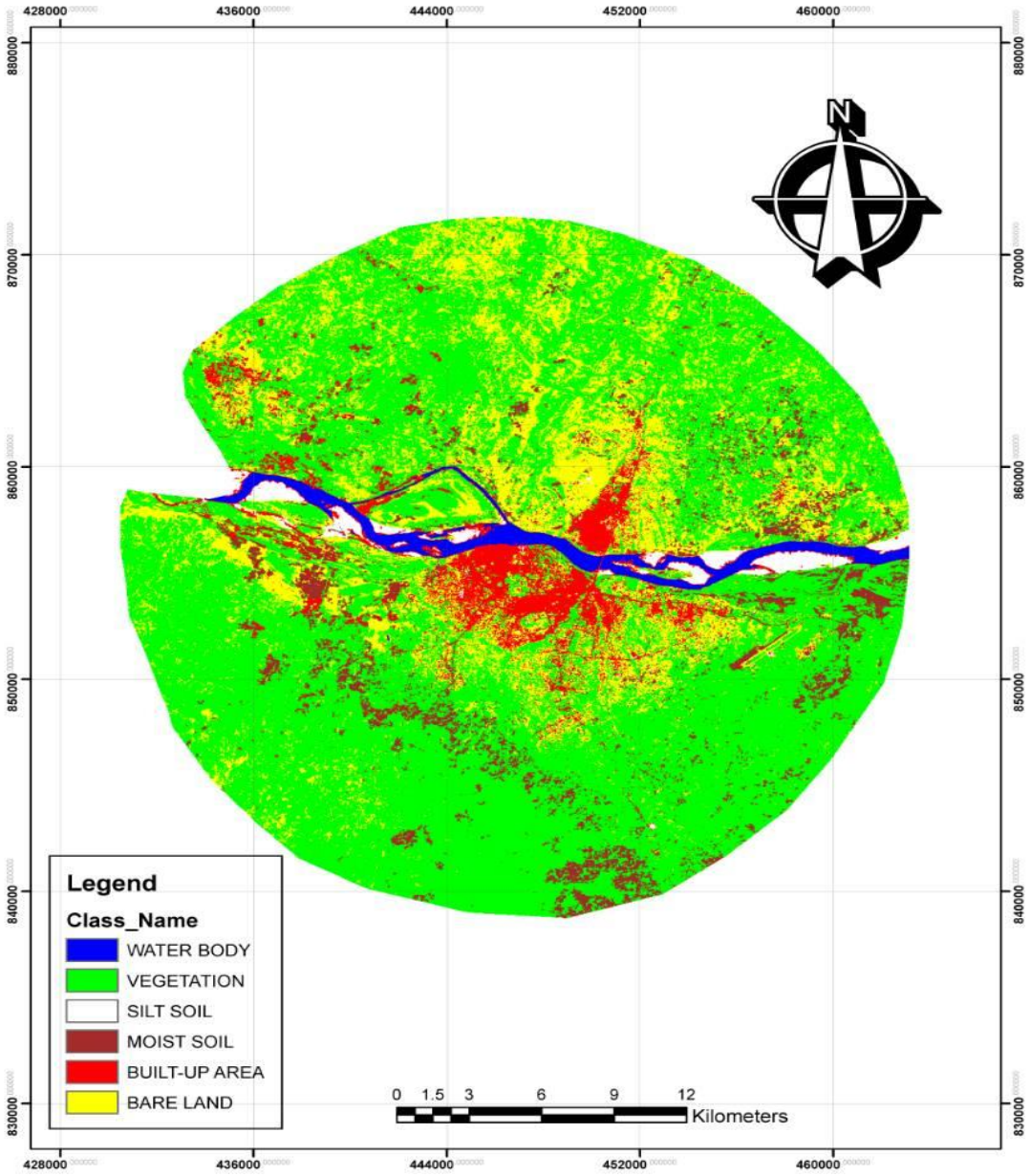

Figure 3: Land use and Land cover of Makurdi LGA

Source: National Centre for Remote sensing, Jos 2021

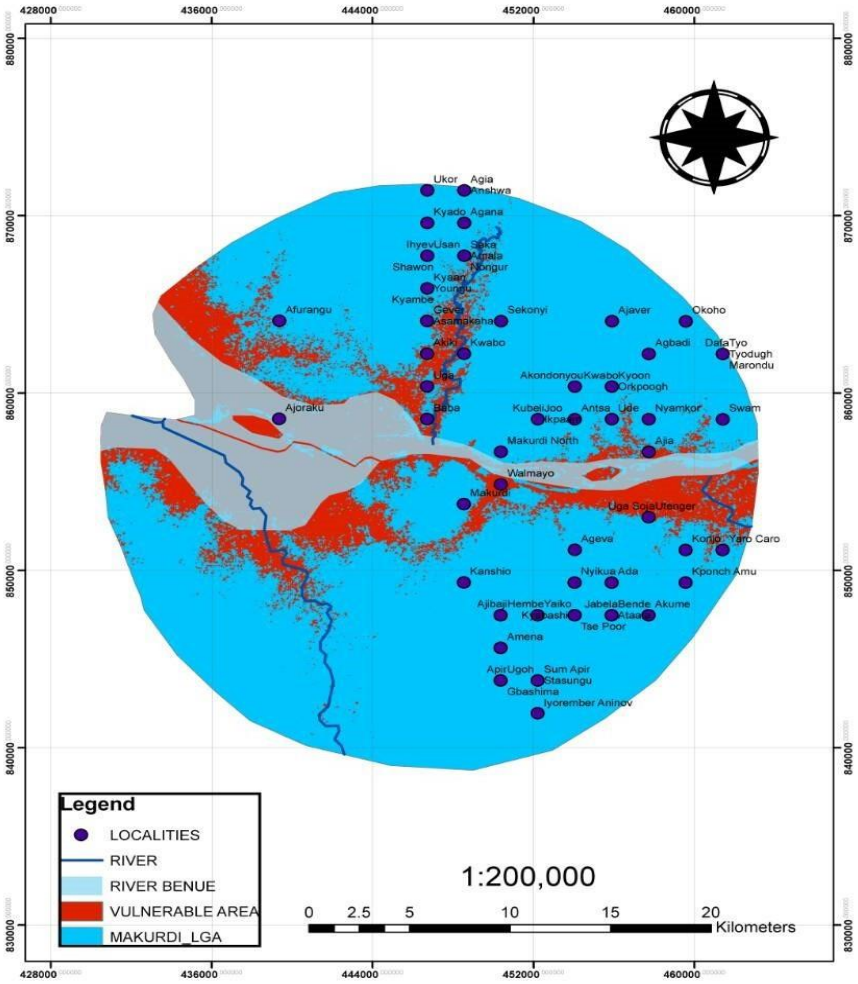

Figure 4: Vulnerability to flooding of Neighborhoods in Makurdi LGA
Source: National Centre for Remote sensing, Jos 2021

Conclusion and Recommendations

There is no doubt that every community bordering a water body is vulnerable to one form of flooding or another but the nature of such impact is distinct to every region. This is the case in the research which reveals that the communities along River Benue in Makurdi town are vulnerable to flooding at varying levels. The study recommends dredging of River Benue, building of embankments and avoiding building in marshy areas that are flood prone in Makurdi town.

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CLIMATE CHANGE, COVID-19 PANDEMIC AND FOOD SECURITY IN THE ENVIRONMENT

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Abstract
The use of fossil fuel has increased the concentration of greenhouse gases in the atmosphere resulting in the increase of the surface temperature of the Earth. This increase in the global temperature altered the configuration of other climatic parameters such as precipitation, humidity, wind and solar radiation, resulting in the overall effect of climate change. The events in the world today that have been very deleterious to man and his environment are all attributed to serious dramatic changes in climatic patterns. In the midst of this environmental upheaval Covid-19 Pandemic broke out in Wuhan China in 2019, the effect of which ravaged and overwhelmed the global community. All the Covid-19 Protocols and strategies aimed at containing the spread and transmission of the virus and the combined effects of the various environmental impacts of the climate change are phenomena that can affect the state of food security in the environment. It is on this note that this paper tries to investigate and establish some nexus between the complexities of climate change, Covid-19 and the effect they have on Food Security.

***Keywords*:** Climate change. Covid-19. Environment. Food security. Greenhouse gases.

Introduction

The warming of the Climate System is unequivocal and scientists are more than 90% certain that it is primarily caused by the increase in the concentration of greenhouse gases in the atmosphere that are being produced by human activities like deforestation, burning of fossil fuel, such as coal, natural gas and oil (IPCC 2007).

Greenhouse gases especially Carbon dioxide, Mathane, Chlorofluorocarbons (CFC's) and nitrous oxide have the property of allow the passage of short wavelength solar radiation from the sun through the Earth's surface but absorbing the re-radiated radiation (at lower temperature and longer wavelength) from the Earth. The natural occurrence of these gases in the atmosphere with the exception of chlorofluorocarbons, CFC's has helped to make the Earth habitable by maintaining an average temperature of 33 degrees Centigrade which is comfortable enough to sustain life on Earth as we know it. However, since the beginning of Industrial Revolution, human activities have added more and more of these gases into the atmosphere, for example, level of Carbon dioxide a powerful greenhouse gas have risen by 35% since 1750 (Manstrandrea and Schneider, 2009) largely from the burning of fossil fuel. With more of these gases in the mix, the atmosphere acts as a thickening blanket and traps more heat, thereby increasing the surface temperature of the Earth in what is known as global warming, which is the cause of climate change.
Climate change has altered the frequency, magnitude and the geographic distribution of climate related hazards including flooding, drought, heat waves, which in turn have created patterns of extreme weather conditions and increase in the intensity of climatic variables such as temperature, solar radiation, wind, precipitation and humidity (IPCC, 2007).

As the global community is battling with the impact of the climate change, Corona Virus Disease 2019, called Covid-19 for short broke out in Wuhan China in the year 2019. Covid-19 is a highly contagious respiratory virus disease that is transmitted by air borne droplets generated mainly through speech, coughing and sneezing (IISBE 2020). In 30th January 2020, the World Health Organization, WHO, declared Covid-19 as a global health emergency, and on 11thMarch of the same year, it was declared a Pandemic. In order to reduce it's spread and transmission, some strategies were put in place known as Covid-19 Protocol. These are personal regulatory actions observed in dealing with fellow human beings and objects of contact within the built environment.

This is apparently to reduce the spread and transmission of Covid-19 Pandemic.
These actions include, hand washing, sanitizing, social distancing, quarantining and the use of face mask. A social distance of 2.0meters is allowed between individuals.
With the global impact of climate change that affects the weather, agriculture and the natural systems, coupled with the presence of Covid-19 Pandemic which has overwhelmed the global community with its restrictions on movement, the issue of food security becomes a matter of global concern.
It is on this note, that this paper tries to investigate the impact the complex combination of Climate Change and Covid-19 Pandemic has on Food Security, during the Covid-19 era.

Climate Change During Covid-19 Pandemic

Climate change is being driven by both natural and anthropogenic factors (Stern and Kaufman, 2014). The natural forces are as a result of solar irradiance and stratospheric volcanic aerosols that throw up pollutants into the atmosphere thereby creating imbalance in the global atmospheric configurations. The anthropogenic factors are mainly the burning of fossil fuel such as oil, coal and gas which generate high emissions of greenhouse gases in the atmosphere. With the lockdown occasioned by the outbreak of Covid-19 Pandemic there was a significant reduction in the emission of Nitrogen dioxide, No2, and Carbon dioxide, CO_2.

This is due to the imposition of the Covid-19 Protocol which resulted in slower usage of transportation, decreased electricity demand, and halted industrial activities. Kumar and Ayedee (2021), in their findings reported that substantial reduction in the demand for fossil oil and electricity can positively affect the environment and climate change in the following dimensions:
18.1% decline in CO_2
19.3% decline in NO_2.
Bertran et al (2021), corroborating the above findings, reported that Covid-19 has a deep impact on energy systems worldwide. There is a significant reduction in CO_2 emission from the power sector resulting from sharp decline in electricity demand as a result of the Covid-19 economic shutdown. The global community is overwhelmed by the combined effect of climate change and Covid-19 Pandemic, therefore it is imperative that preemptive actions be taken to reduce their severity.

Impact of Climate Change on Covid-19

Some studies point to the fact that transmission of the Covid-19 virus from one person to another is affected by temperature. In Pakistan, a tropical country found fewer Covid-19 -Positive case than cold and dry regions (Bukhari et al 2020). This confirms the fact that high temperature kills most of the virus and slows down the rate of transmission.

According to Andronova and Schlesinger (2000), available evidence shows that the changing climate is influencing the transformation of native habitat from shrub lands to Savannah as in Southern Yunnan. This could likely be the source of Covid-19. Altamini and Ahmed (2020), posit that climate change might have severely contributed to facilitating to this transmission through such extreme climatic conditions like increase in rainfall, and violent flash flood that result in home loss. People are forced to assemble closer together facilitating the opportunity for viral infections. This is evident by the concentration of covid-19 in population dense areas.

Commenting on the part played by increase in temperature and relative humidity, Altamini and Ahmed (2020) posited that such climate conditions can favour the long-term survival of infectious particles in the environment. Temperature and humidity have been shown to affect the duration of particulate matter suspended in the air and their influence in virus transmission.

It is known that, according to Anchordoqui et al (2020), increase in humidity elevates the rate of toxic chemical agents in the air and provide a suitable environment for more viral organisms to propagate and cause respiratory disease. The aerosols and particulate matter are known to affect the global climate by altering the radiative properties of the atmosphere and could possibly act as effective covid-19 carriers (Bornstein, 2020).

With these it can be seen that the phenomenon of climate change could facilitate the transmission of covid-19 pandemic virus.

Impact of Covid-19 on Climate Change

i) The air we breathe has become clearer as there is less emissions of pollutants in the air because of lockdowns. Ching and Kajino, (2020).
ii) There is a reduction of the two most dangerous, greenhouse gases that are contributing to global working, CO_2, carbondioxide, and NO_2 Nitrogen dixode.
iii) Brassey et al (2020), asserts that while the spread of the virus may be slowed down because of warm water weather, if is not sufficient to depend on climate change alone.
iv) The reduction in air travel has reduced the emission of greenhouse gases (Kingham, 2020).
v) Air pollution contribute to 26% of the death due to respiratory infection, 25% death due to chronic obstructive Pulmonary Disease, COPD, and 17% of Ischemic Heart Disease and stroke (WHO, 2016)
vi) There is an improvement in clean and green investment in that as people get self isolated in diers, activities get more attention. Such activities as indoor gardening. This has increased tremendously, giving positive gain to the climate change adaptation strategy of forestation and green architecture (Minawi, 2020).

The Concept of Food Security

Besides, housing and clothing, another essential need of man is food. Food is the most important needs of man. Without food, man's life on Earch is not assured. Anything that tree ten's food supply thureature the existence of man in his environment. Hence one can say that food security is at the baseline of human need and survival (CCSP, 2008).

According to World Food Summit (1996), food security exists when all people at all times have physical and economic access to sufficient, safe and nutrition's food that meets their dietry needs and food preference for an active and healthy life". This implies that, food security is about having consistent, reliable, access to safe nutrition food.

There are four (4) components of food security namely, availability, Access, utilizations and stability.

Availability

This components of food security seeks to ask "does food exist near me?" is there food? It's concern with the availability of sufficient quantities of food of appropriate quality either through domestic production are importation. Food availability address the supply side of food security and its determined by the level of food production, stock capacity and trade.

Access

This component of food security seeks to ask "can I get food easily?" can food be easily accessed at a household level?.

An adequate supply of food at a national level does not guarantee household level food security. There could be restriction of assess due to social crises. During the Biafran Nigerian war, there were situations were food was available, but out accessible due to the prevailing social conflicts Governmental restrictions etc.

Utilization

This seeks to ask "will this food contribute to my health and wellbeing?". Eating only cassava might not contribute to health and wellbeing. There would be poor utilization for overall health and well-being.

Other components items of food should be brought into play to provide sufficient utilization for effective good health and wellbeing. If some components of food are lacking to the point of not providing enough nutrition, then there is a case of food insecurity.

Stability

This component of food security seeks to ask "will food be available tomorrow, next week and next month?"
If a household eats food now, and is not sure of the next food, there is certainly food insecurity.
If your food intake is adequate today, you are still considered food insecure if you have inadequate access to food on a periodic basis.
Climate change, political instability, disaster, social uncertainty can impact heavily on food insecurity.

Climate Change and Food Security

Food security is tied to climate change. With the event of climate change, our soil freshwater oceans forest and global biodiversity are experiencing rapid destruction. Climate change is putting more pressure on the ecosystems and the very natural resources we depend on, increasing the risk of natural disasters like droughts, floods and even heat waves. Climate related hazards, including extreme weather events, droughts, flood and storms have doubled their intensity since 1990's causing serious harm to our agricultural productivity.
Impacts on crops
Changes in temperature and the intensity and frequency of extreme weather patterns coupled with the amount of carbondioxide would have significant impact on crop yield.
Impact on livestock
Heat waves, which are expected to increase as a result of climate change could threaten livestock globally. It has been reported that some more than 50,000 animals have been lost, as a result of heat stress from climate change (CCSP, 2008).

i) Impact on Fisheries

Because many marines life, have a certain range of temperature under which they can survive, increase in temperature could only result in the extinction of some species (Field, et al 2007).

ii) Food web distraction

The prospect of species extinction due to climate change could trigger at a serious imbalance in the food web that could affect other range of wild organisms (ACIA, 2004).

Covid-19 Pandemic and Food Security

To contain the spread of covid-19 pandemic, strategies were rolled out, known as covid-19 protocol; viz quarantine, social distancing, sanitizing and lockdown. These are the phenomenon that affected the issues of food security during the pandemic.

i) The lockdown that was enforced as part of the covid-19 protocols affects the availability of labour on the farm, thereby hampering agricultural operations and post-harvest activities.

ii) Poor storage capacity resulted in lack of fresh products. Since power supply was highly unavailable. In the absence of storage capacity perishable commodities suffer deterioration and decomposition; especially such food items as tomatoes, fish, vegetables, egg, dairy products.

iii) In an attempts to observed social distancing food distribution suffered serious setbacks.

iv) Food processing was badly affected as a result of industrial shutdown.

v) Quarantining of people resulted in indoor activities, such as gardening and the closing down of restaurants and public eateries.

This development, also resulted in emergency food scarcity and hoarding. People having being quarantined, begin to make panic purchasing that increased the demand of food supply. This results in increase in price and hoarding.

vi) International food supply through transportation was heavily affected due to close down of territorial boards for international food delivery. The combination of these phenomenon impacted heavily on the food security during the Covid-19 pandemic.

Conclusion

The issue of Food security is at the baseline of human survival.
Without food man cannot survive on earth. That's why food is considered the most important of all the needs of man. It's only when man is properly fed that he begins to think of thriving in his environment. That's when he begins to make plans for success. Feeding offers man the emotional preparedness for a successful living.

Climate change and Covid-19 are two global phenomena that have the capacity to tremendously affect Food security. Not only that, they can leave heavy impact on each other, creating a complex web of interactions within the ecosystem.

To sustain our survivability on earth, we must understand this complexities and respond to then appropriately and accordingly. We employ Adaptation and Mitigation to respond to climate change.

Since, climate change is anthropogenic, that is to say man made, it would never come to an end. The emphasis must be to adapt to the environment.

Adaptation offers us strategies that would help us cope with the effect of climate change and to reduce the vulnerabilities.

Another response to climate change is Mitigation. This is an attempt to remove those circumference that are contributory to climate change in order to stop it entirely or reduce its severity. In this case, since it has been established that the emissions of greenhouse gases through the burning of fossil fuel is responsible for the climate change, mitigation process would aim at reducing emissions by eradicating the use of fossil fuel.

On the emergence of Covid-19 in the midst of the ravaging climate change, sustained efforts should be made on the observations of Covid-19 Protocols of Lockdown, Social distancing, Quarantining, and the Use of Face marks as means of checkmating the spread and transmission of the virus.

When all these mechanisms are sustainably put in place, we can then effectively battle the threat to Food security which is at the base line of the survival of humanity here on earth.

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MANAGING URBAN FLOODING THROUGH PHYSICAL PLANNING INTERVENTIONS IN MAKURDI TOWN, NIGERIA

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Abstract
Incidences of urban flooding are increasingly becoming frequent, devastating and costly to manage in the face of rapid urbanisation in Nigerian cities like Makurdi. The current and projected levels of urban flooding and its accompanying impacts are and will be exacerbated by climate change. The combined effects of urbanisation and climate change give urgency to the need to focus on urban flood management. Thus, this paper analysed the current state of the Idye drainage basin in Makurdi town and examined specific physical planning interventions that can be applied to sustainably manage urban flooding in Makurdi town. Data were collected through observation and interviews with residents and staff of Benue State Urban Development Board. Google images of the Idye drainage basin for the years 2005 and 2020 were analysed and compared to see the extent of land use change. The study found that though the Makurdi master plan (which is currently obsolete) designated the Idye drainage basin as a green area, buildings have emerged in the area; contributing to the intensity of flooding in Makurdi town. However, many of the buildings have been constructed without planning permission from the Benue State Urban Development Board. In spite of the conversion of the area into a built-up area, inadequate provisions have been made for drainage channels to discharge the excess surface run-off. Physical planning interventions that could be applied are the creation of detention/retention basins which are large tracts of open space that hold the excess run-off, introduction of alternative less intensive land uses such as recreational uses or well landscaped open spaces that add aesthetic value to Makurdi town. The study recommends the preparation of flood risk maps for urban areas to assist in making evidence-based decisions in sustainable flood management.
Key words: Urban flooding, Development control, Drainage basin, Makurdi

Introduction

Research suggests that the global trend of urbanisation and climate change will influence the scale and impact of flood events now and in the coming years (Jha, Lamond, Bloch et al., 2011). This implies that flood events may increase in the future as a result of climate change, steady increase of human population, as well as increasing growth of the built-up environment (United Nations International Strategy for Disaster Reduction, 2004). A significant percentage of the extant literature on the causes of urban flooding in developing countries reviewed by Asiedu (2020) identified heavy rainfall, urbanisation, inadequate drains or poor maintenance of drains, poor waste management, unplanned urban growth, failure of infrastructure, storm surge, development on flood plains and climate change as the causes of urban flooding (Asiedu, 2020). The correlation between urbanisation and flooding has also been confirmed by Zhang, Villarini and Smith (2018) in their study in Houston, USA where they reported that the probability of extreme flood events caused by hurricane Harvey increased by about 21 times in 2017 because of urbanisation. Similarly, Singh and Upmanyu (2019) reported that the Chennai international airport in India which is built on the riverine flood plains led to massive flooding in 2015. With the growing evidence of the singular and combined influence of urbanisation and climate change on flooding, the focus will be on low- and middle-income developing countries in Asia and Africa like Nigeria; where the prognosis suggests that poor physical planning and extreme weather events will leave urban populations vulnerable to floods.

Already, analysts suggest that Africa is fast transitioning into an urban continent. It is estimated that more than half of the population in Africa will live in urban areas by the year 2050 (Bello-Schunemann and Aucoin, 2016; Teye, 2018). Data presented by the World Bank suggests that the urban growth rate for Nigeria in 2019 was 4.2%. With the high urbanisation rates, urban centres are witnessing intensive physical development in terms of building construction to accommodate the increasing urban population (Falade, 2003). The intensive

physical development occasioned by urbanisation has increased impervious surfaces and by extension surface run-off on one hand; and led to the encroachment on marginal urban lands, including floodplains on the other. The consequence of this is the rising incidences of flooding witnessed in many states of Nigeria. In fact, the 2021 annual flood outlook released by the Nigerian Meteorological Agency presents gloomy predictions for some States and cities in the country. The forecasts show that river flooding is expected in fourteen states of Nigeria, including Benue State; while on the account of poor drainage facilities which is a product of poor urban planning, flash and urban flooding are expected in cities like Lagos, Port-Harcourt, Yola, Kaduna, Maiduguri, Ibadan, Sokoto and Makurdi.

Makurdi town has witnessed significant growth since it became the capital of Benue State in 1976. The city grew from a population of 151,515 in 1991 to 300,377 in 2006 (National Population Commission, 2006). In recent times, Makurdi has grown exponentially as a result of the influx of displaced persons from rural communities affected by conflicts in Benue and other neighbouring States. This has triggered rapid development and expansion of the built-up spaces, increasing building density in the older neighbourhoods and further encroachment on marginal lands in virtually all directions of the town. Additionally, flood occurrence has become an annual seasonal event impacting lives, properties and the environment as a whole. Concern over the incidents of flooding, especially in urban areas, has attracted several studies focusing on different aspects like Akintola (1978); Akintola (1982); Omiunu (1981); Odemerho (1983); Rashid (1982); Ayoade and Akintola (1980); Babatolu (1997); Oriola (2000); Ologunorisa (2004); Ali (2005) and Ologunorisa and Tor(2006). Thus, in view of the links between urban growth and poor physical planning to flood risks, it is imperative to examine the ways in which urban planning measures can be applied to mitigate flood occurrence in vulnerable cities like Makurdi. This paper therefore, aims to analyse the current state of the Idye drainage basin in Makurdi town and examine specific physical planning interventions that can be applied to sustainably manage urban flooding in Makurdi town. The Idye drainage basin was initially designated as an open space in the now obsolete master plan of Makurdi town. Figure 1 shows the location of the Idye drainage and adjoining neighbourhoods in Makurdi town.

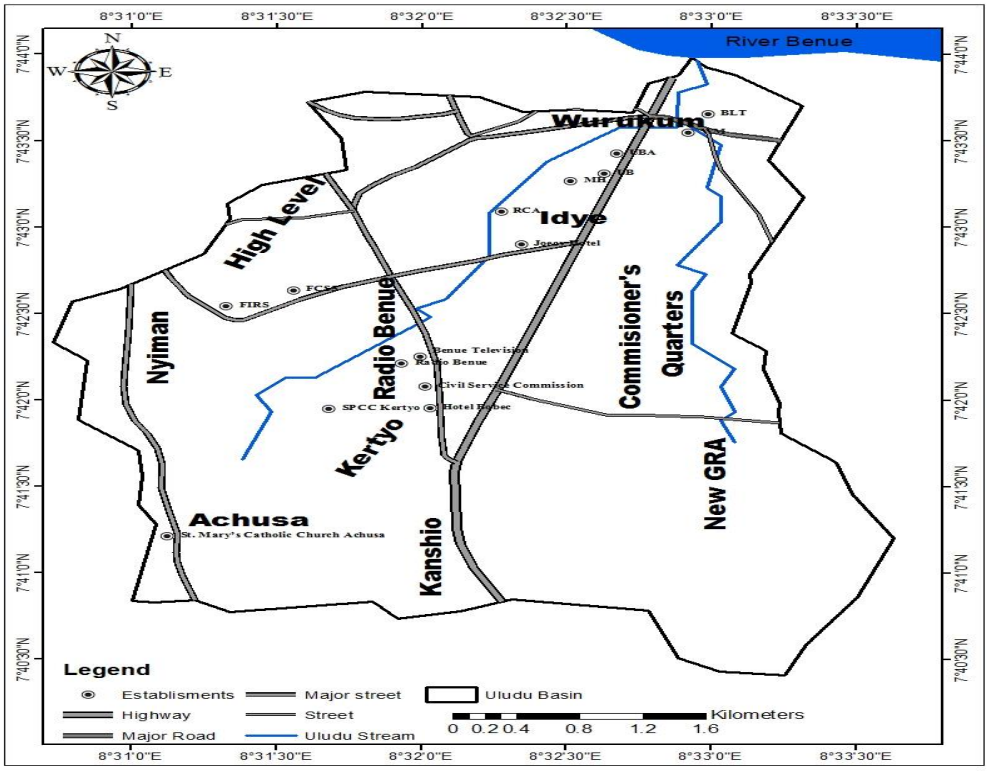

Figure 1: Idye Drainage Basin and Adjoining Residential Areas in Makurdi Town

Methodology

The study collected data on the conditions of the Idye drainage basin through observations, interviews and the application of Geographic Information System (GIS) to analyse the changes in land use and land cover in the area for the years 2005 and 2020. The observations involved examining the drainage channels in the area, waste disposal and the level of physical development. The interviews with officials of the Planning Agency focused on lapses in development control and potential ways in which physical planning measures can be applied in curbing flooding and managing floodplains in a sustainable way. The land-use/land cover change were analysed, computed and presented in maps and a table. The interviews were analysed descriptively. Photographs were also presented to show the current condition of the Idye drainage basin.

Findings and Discussions

The Idye drainage basin is a wetland ecosystem characterized by poorly drained mineral soils and by plant life dominated by grasses. Since the area consists of sediments deposited by the stream water, the lands are poorly drained and the area is often waterlogged. Sediments deposited by the stream provide fertile grounds for fibrous-rooted grasses which bind the mud together and further hinder water flow. Though there is an uncompleted drainage channel which was constructed as part of the ecological funds released to Benue State and managed by the Ministry of Water Resources and Environment, flooding in the area and its environs has continued unabated. The condition of the constructed concrete drainage channel and the natural channel is further worsened by solid wastes which contribute to the clogging of the channels as shown in Plate 1.

Plate 1: Wastes disposed in the Natural drainage channel

The Idye drainage channel evacuates excessive surface water that cannot infiltrate into the ground during intense rainfall and discharges same into the River Benue. However, with the absence of drains in some parts of the Idye basin and the poor maintenance of the concrete and natural drainage channels, the excess surface flow usually inundates the area leading to flooding. In addition, the effectiveness of the existing concrete drainage channel to evacuate water is affected by the design of the channel- its alignment, size and gradient. The constructed concrete drain in the Idye drainage basin is 8metres wide, the depth is 2 metres while the length is 3,619metres.The size of the drainage has proven to be inadequate in evacuating

large volumes of water especially during the raining season. This leads to flooding in the area (Plate 2a, 2b) and other adjoining neighbourhoods.

Plates 2a, 2b: Flooded Houses and Access Route in the Idye Drainage Basin

Physical Development in the Idye Drainage Basin

Uncontrolled development is currently occurring in the Idye basin as a result of the increase in population and accompanying demand for housing in Makurdi town. Though the master plan of Makurdi town which is now obsolete designated the area as a green area, it was observed that buildings have been constructed and occupied and are still under construction in the area. A total of 74 buildings were sited in very close proximity (7 metres) to the constructed concrete drainage channel in the area while other completed and uncompleted buildings were also seen in other parts of the drainage basin. Interviews with the residents revealed that their decision to build in the area was due to unavailability of land and poverty. Staff of the Urban Development Board also revealed that majority of the residents purchased the land from older settlers and built without obtaining planning permission from the Board. However, there are obvious lapses in development control since the buildings have not been demolished or the residents relocated or evicted. The absence or weak enforcement of development control measures have emboldened developers as more buildings are springing up in the area. The progressive land use change and growth of built environment on unsuitable urban places or areas liable to flood plays a significant role in the increasing flood frequency in Makurdi.

An analysis of the land use/land cover change for the Idye drainage basin area using Geographic Information System (GIS) shows that while the built-up area covered 866 (39%) out of the total 2,250 hectares in the year 2005, it increased to 969 (43%) hectares in the year 2020 (Figure 2). On the other hand, vegetation cover decreased from 1,055 hectares (47%) in 2005 to 739 hectares (33%) in the year 2020 (Table 1). The results suggest that the area is gradually been taken over by physical development; a situation that could contribute to worsening incidences of flooding in the area and its environs.

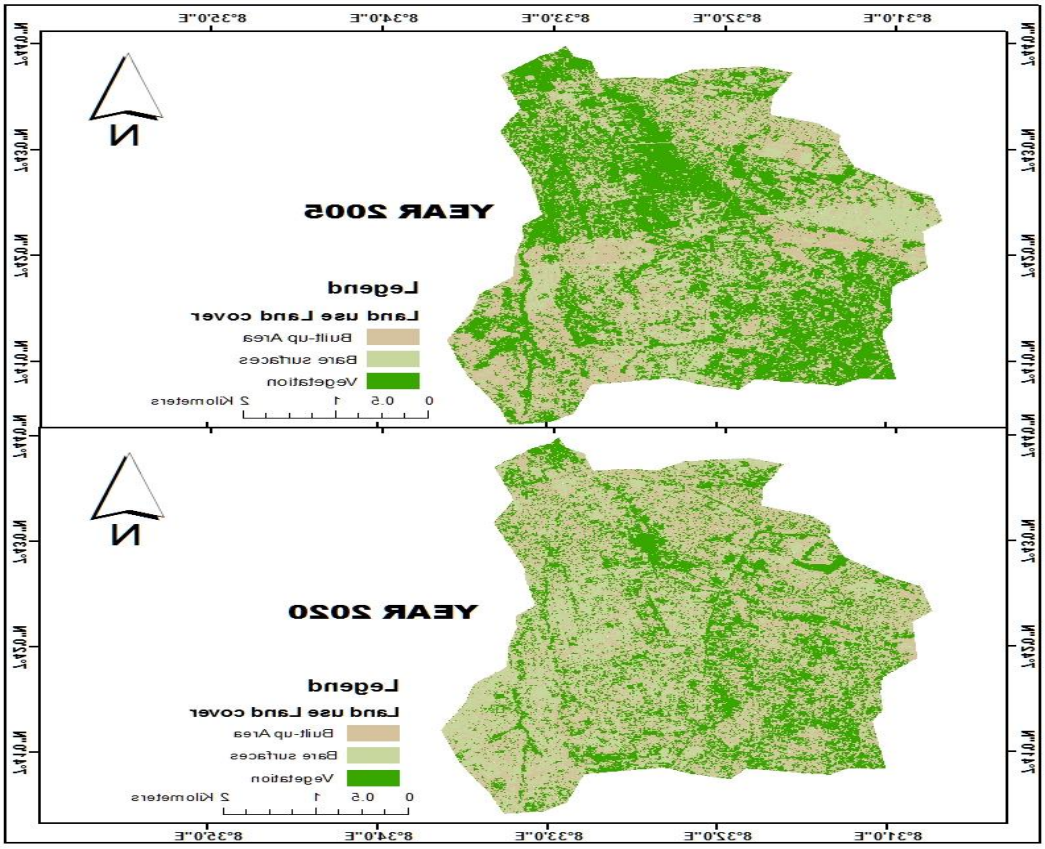

Figure2: Idye Drainage Basin showing Land Use/Land Cover changes in 2005 & 2020
Source: Benue State University, Makurdi GIS Laboratory

Table1: Analysis of Land Use/Land Cover in Idye Drainage Basin (2005&2020)

	Year			
LULC Type	**Area in Hectares**			
	2005	**%**	**2020**	%
Vegetation	1055.88	46.92	739.75	32.87
Built-up Area	866.88	38.52	969.42	43.08
Bare surfaces	327.59	14.56	541.24	24.05
Total	**2250**		**2250**	

Source: Benue State University, Makurdi GIS Laboratory Analysis

Managing Urban Flooding through Urban Planning Interventions

Flood occurrences could be managed effectively through physical planning interventions like the provision of flood mitigation infrastructure. The creation of detention/retention basins which are large tracts of open space that hold the excess run-off are an often overlooked form of flood mitigation infrastructure. In addition, alternative less intensive land uses such as recreational uses or well landscaped open spaces that add aesthetic value to Makurdi town could be introduced. Recreational land uses are suitable for floodplains because they are not greatly affected by flooding and they do not trigger flood events; especially because such land use may not require intensive physical development and constructions. In addition, zoning by-laws and building permits can be used to control development and direct urban growth in ways in which floodplains

remain protected fragile ecosystem. Planning agencies in Makurdi like the Urban Development Board do not have either flood risk maps or flood risk reduction strategies; in spite of the noticeable impacts of urbanisation on incidences of flooding. A comprehensive approach that involves the development of flood risk maps and flood mitigation measures will enable land use planners to prevent or manage incidences of flooding more effectively and sustainably.

Conclusion

The study has shown that weak development control and the neglect of urban planning have significantly contributed to the incidences of flooding in the Idye drainage basin and its environs in Makurdi town. The study reveals some of the unintended but often inevitable consequences of unplanned urbanisation. The paper further highlights the importance of flood risk plans that provide information of areas at risk by defining flood risk zones to give input to spatial planning and support the processes of prioritizing, justifying and targeting investments in order to manage and reduce the risk to people, property and the environment.

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