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Environmental Implications of Construction Activities in a Fast-Growing City: A Case Study of Ota, Nigeria

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Abstract:
Globally, cities are regarded as engines of growth and sustainable development. However, the socio-environmental implications of rapid urbanization and industrialization such as unprecedented construction activities, urban degradation and poverty exacerbation have constrained cities from fulfilling their socio-economic function of providing a functional, livable, and sustainable environment. Ota, the case study city, has witnessed failures in the execution of policy frameworks and programmes aimed at conserving the environment through proper regulation and management of construction activities. It is based on this backdrop that this study examines the environmental implication of construction activities in Ota city, Nigeria. This study adopted a cross-sectional research design and a systematic random sampling technique was used to administer 400 copies of the questionnaire to residents of Ota. The study revealed that industrial agglomeration remained the major factor influencing rapid construction activities in Ota. Findings also revealed that factors such as social damage and urban structure damage (3.483), urban degradation and urban stress (3.188), increase in transport and logistics externalities (3.128), floods and erosion disaster (3.095), and loss of wildlife and green area (3.090) constitute the major negative impacts of construction activities on Ota city. The study concluded that an efficient and sustainable approach to the use and management of environmental resources and construction activities are needed for the development of a sustainable city**.** It recommended the implementation of sustainable measures capable of ameliorating the environmental implications of construction activities in Ota city, Nigeria and other cities with similar issues.

Keywords: Construction, Environment, Environmental implications, Nigeria, Ota city

1 Introduction

The environment has been an age-long phenomenon and its contributions to the survival, growth and prosperity of man cannot be underestimated. Man has been making use of his environment in various ways and through several processes before the period of early civilization to date (World Economic Forum, 2014). Specifically, man's quest to satisfy his socio-economic and industrial needs and aspirations have not only led to exploitation and

exploration of resources domicile within his environment but also led to disturbance of environment with accompanying consequences (Adejare *et al.*, 2016; Akanmu *et al.*, 2016). The unwanted consequences of the impact of human actions on his immediate and remote environment are being felt through farming and agricultural practices, urbanisation and industrialization, exploration of mineral resources, and more importantly, construction activities (Hardingham-Gill, 2018). The construction activities and industry although facilitates improved socio-economic development and prosperity of any nation (Oke *et al.*, 2016; Kheni *et al.*, 2008). However, recently due to weak management have sporadically increased the various environmental issues and implications on man's welfare and public health of urban areas including cities (Anands, 2013; Kheni *et al.*, 2008; Watuka & Aligular, 2002). Worthwhile, the construction activities through continuous exploitation of renewable and non-renewable resources, project development and demolition have always generated huge and diverse quantities of waste which is a major urban environmental challenge (Oke *et al.*, 2016; Kheni *et al.*, 2008; Watuka & Aligular, 2002). Nevertheless, the alarming rate of environmental issues and implications occasioned by the unguided construction activities have now become a factor militating against the development and sustainability of cities.

In other words, cities are the engine of growth and catalyst for livable and sustainable development (Odufuwa *et al.*, 2018). The failure of most cities including Ota to meet and fulfil its socio-economic functions of human development and livability undoubtedly constrained by the unguided rate of urbanization and industrialization (Hardingham-Gill, 2018; Anands, 2013). These constraints have resulted in environmental issues and implications such as degradation, distress and poverty exacerbation (Ogunsesan *et al.*, 2016; Ogboi *et al.*, 2015). Nigerian cities including Ota have been witnessing a monumental increase in urbanisation due to an unprecedented increase in birth rate that sporadically increases the city population, increasing industrial growth in the last decades, increasing rate of poverty and a large number of immigrants' influx from other parts of the country has resulted in high pressure on this city and its adjourning urban areas. It is not an overstatement that the greater number of migrants attracted in the last decades and the increasing industrial growth have pressurized the available employment opportunities and triggered housing demands in the city of Ota, Nigeria. Meanwhile, the quest to address the increasing housing demands and social exclusion in the city of Ota has increased construction activities both legally and illegally built.

The persistent increase in the illegal construction activities and high rate of poverty in the city of Ota have made efforts put in place by the built environment stakeholders in Ogun State most especially the government to fail in controlling the sporadic development in the city of Ota. Various institutional policy frameworks and programmes meant to regulate the construction activities and conserve the environmental resources have equally failed and thus serve as a major tool for promoting environmental hazards and misfortunes in the city of Ota. Indeed, environmental issues and implications are a major concern to the city and thus questioned the functionality, livability and sustainability of Nigerian cities and urban centres in the global ranking of cities. However, the issue of quality of life brings into focus and attention, the concept of the environment (Odufuwa *et al.*, 2018; Ogunsesan, 2002), while the needs to reconcile socio-economic and industrial growth as well as development necessitate conservation and retaining the rare quality of the environment (Egunjobi, 1990). Hence, the quest to address these environmental issues and implications particularly in fast-growing cities including Ota becomes an interest to stakeholders, most especially the built environment professionals.

It is based on this backdrop that the study assessed the environmental implications of construction activities in Ota, a fast-growing Nigerian city. In achieving this aim, the study examines socio-economic characteristics of residents of Ota; evaluates the factors influencing the rapid construction activities in the city of Ota; appraises the contemporary environmental implications of the construction activities in Ota city, and examine the measures towards ameliorating the environmental implications of the construction activities for sustainable development of the city of Ota, Nigeria. In other words, this study evolves strategies not only for enhancing environmental quality in the city in particular and other cities with similar issues, but also proffer possible policy implications and measures to improve the city environment.

2 Material and Methods

2.1 Study Area

Politically, Ota city situates in Ado-Odo/Ota local government area (LGA) of Ogun State in southwestern Nigeria. Ado-Odo/Ota LGA was created on May 29, 1989, when it was carved out of the defunct Ifo/Ota LGA and Ado-Odo/Igbesa administrative areas of Egba South local government. It shares a boundary with Alimosho LGA in Lagos State to the south, Ipokia LGA to the west, Yewa South LGA to the northwest and Ifo LGA to the north and northeast respectively. Geographically, Ota city, covering an area of 878 square kilometres, lies between latitudes 6º 41'N and 6º 68'N and longitudes 3º 41'E and 3º 68'E (Olukanni et al., 2014). The city is one of the fastest-growing areas in Ogun State and has been categorised among the Development Pressure Areas not only in the State but the country as well (Ogun State Government, 2008). With the industrial concentration in Ota, the city is ranked third most industrialised in the country behind Ikeja and Apapa (both in Lagos) and has encouraged the continuous migration of people into the area for employment opportunities and greener pasture (Salako, 2009; Ogunseye & Kadiri, 2017).

2.2 Study Methodology

A cross-sectional design that explored descriptive, explanatory and exploratory methods was adopted towards understanding and addressing the research objectives. The descriptive method was used in the presentation and analysis of both the qualitative and quantitative information relative to this research study, while exploratory and explanatory methods were used to explore and give vivid explanations to the issues raised in the study. The cross-sectional design was found suitable for identifying the specific phenomena within a particular time and thus, the best approach for this research. Both primary and secondary data sources of data were explored and used for data collection in this study. The primary data were obtained through personal fieldwork involving the self-administration of a questionnaire administered on residents and complemented with field observation by researchers. The questionnaire addresses questions on the socio-economic characteristics of the respondents, the factors influencing the rapid construction activities in the city of Ota, the contemporary environmental implications of the construction activities in Ota city, and measures towards ameliorating the environmental implications of the construction activities for sustainable development of the study area. While, secondary data were sourced from both published and unpublished materials including magazines, gazettes, and journals.

In other words, the populations for the study comprised the total number the people living within Ota city based on the 2006 National Population Census. It comprises the

residents' population since virtually all residents engage in physical development and construction activities in one form or the other in the study area. The respondents that are the residents were sampled using Taro Yamane Sample Formula [n= N/1+N(e)2] based on the 2006 population figure of Ota as projected in 2020 to be 247,601. In other words, a total of 400 residents were considered for this study. A systematic random sampling technique was adopted for this study. It was used in administering a questionnaire on a resident as a representative found in an apartment at every fifth (5th) buildings within the study area. Data obtained were analysed using descriptive and inferential statistics (Summation of Weighted Value – SWV). The descriptive statistics engaged the use Likert scale to analyse the different opinions of the residents based on the research questions. Statistical Package for Social Sciences (SPSS) IBM version 21 was used for data analysis.

3 Findings and Discussion

3.1 Socio-economic characteristics of respondents

The results of the analysis of data on the socio-economic characteristics that include gender, age, income, occupation, household size and educational characteristics among other respondents are presented in Table 1. It is observed from Table 1 that close to two-thirds (68.5%) are male, while the remaining one-third (31.5%) are female denoting the eagerness and sense of feelings attached to residential development/construction by male than female. Also, the age distributions of the respondents significantly varied and established respondents to be adults in which only 3.2% is less than 20 years, while more than one-tenth (19.5%) is between 21 and 40 years, while slightly more than one-third (31.2%) is between 41 and 60 years and the remaining 46.0% is more than 60 years. Likewise, the educational characteristics of the sampled in the study area show that a substantial portion of respondents is literate as only 2.0% has no formal education, while more than one-quarter (29.5%) has primary school level education and close to half (43.5%) has secondary level education and the remaining one-quarter (25.0%) obtained tertiary level education. Regarding marital status, only less than one-quarter (18.8%) is unmarried, while the remaining 81.2% is married denoting the fact that the study population is dominated by different marital status.

There is a mixture of ethnic affiliations among the respondents in the study area in which close to half (47.0%) belongs to Yoruba ethnic, while slightly less than one-quarter (19.8%) belong to Hausa/Fulani ethnic affiliation. Also, the Igbo ethnic nationality accounts for slightly less than one-quarter (20.5%), while the remaining 12.8% are non-Nigerians denoting foreigners from other countries who take solace in Ota and its proximity to Lagos for their socio-economic engagements. The period of living in the study area by respondents ranges from less than 5 years to more than 5 years. Accordingly, slightly more than one-tenth (14.2%) has less than 5 years of residency, while the remaining 85.8% have been residing in the study area for more than 5 years. This indicates that most of the residents have been residing in the study area for a long period and as such, familiar with spatial development and construction activities in the area. Concerning the employment status, it was observed from the results of the analysis that less than one-tenth (8.8%) are students, while close to half (43.8%) are in private employment and almost one-quarter (23.0%) are civil/public servant. Also, 11.8% were self-employed while 12.8% are unemployed. It can be inferred from this result that a substantial number of residents is gainfully employed with notable means of livelihood and socio-economic engagement.

In addition, the average monthly income ranges from below ₦30,000 to above ₦150, 000. Precisely, only 4.5% of the respondents earn less than ₦30,000 among the respondents, while more than one-tenth (17.2%) earn between ₦30,000 and ₦70,000 monthly, and more than one-third (41.2%) earn between ₦70,001 and ₦ 110,000. Also, those who earn between ₦110,001 and ₦150,000 accounts for less than a quarter (17.8%), while the remaining 19.2% earn above ₦150,000 monthly. This shows that most of the respondents are gainfully engaged with a reasonable income, which is more than the national minimum wage of ₦30,000; hence, the quest to satisfy necessities of life in which residential and property construction and development is a priority. On the household size, the analysis showed that slightly more than one-tenth (14.8%) have between 1 and 3 persons in the household, while more than half (65.2%) have between 3 and 7 persons. Likewise, 18.2% have a household size that consists of between 7 and 11 persons, while the remaining 1.8% have a household size that exceeds 11 persons. Lastly, analysis of the ownership of housing units of dwelling reveals that slightly less than two-thirds (64.5%) is living in owner-occupied homes, while the remaining that is slightly more than one-third (35.5%) are residing in a rented apartment.

Table 1. Socio-Economic Characteristics of Respondents

Gender	**Frequency**	**Percent**	**Income**	**Frequency**	**Percent**
Male	274	68.5	Below 30,0000	18	4.5
Female	126	31.5	30,000 -70,000	69	17.2
Total	400	100.0	70,001 – 110,000	165	41.2
Age	**Frequency**	**Percent**	110,001 – 150,000	71	17.8
Less than 20 years	13	3.2	Above 150,000	77	19.2
21 – 40 years	78	19.5	Total	400	100.0
41- 60 years	125	31.2	**Education**	**Frequency**	**Percent**
Above 60	184	46.0	No formal education	8	2.0
Total	400	100.0	Primary	118	29.5
Employment status	**Frequency**	**Percent**	Secondary	174	43.5
Civil/ public servant	92	23.0	Tertiary	100	25.0
Self-employed	47	11.8	Total	400	100.0
Private employee	175	43.8	**Marital status**	**Frequency**	**Percent**
Student	35	8.8	Single	75	18.8
Unemployed	51	12.8	Married	325	82.2
Total	400	100	Total	400	100.0
Ethnicity	**Frequency**	**Percent**	**Household size**	**Frequency**	**Percent**
Yoruba	188	47.0	Less than 3	59	14.8
Hausa	79	19.8	3-7	261	65.2
Igbo	82	20.5	7-11	73	18.2
Foreigner	51	12.8	Above 11	7	1.8
Total	400	100.0	Total	400	100.0
Period of Stay in housing unit	**Frequency**	**Percent**	**Ownership of housing unit**	**Frequency**	**Percent**
Less than 5 years	57	14.2	Owner occupied	258	64.5
Above 5 years	343	85.8	Rented occupied	12	35.5
Total	400	100.0	Total	400	100.0

(Source: Authors' Survey, 2021)

3.2 Perceived factors influencing rapid construction activities

The analysis of factors influencing rapid construction activities was done on 4-point Likert's scale with a gradation value consisting of Strongly Disagree, SD=1; Disagree, D=2, Agree, A=3 and Strongly Agree, SA=4. The index for each variable was arrived at by dividing the Summation of Weight Value (SWV) by the total number of responses. In line

with Akanmu *et al.* (2016), the SWV for each of the variables was obtained through the addition of the product of the number of responses to each aspect and the respective weight value attached to each rating. This is expressed mathematically as thus:

$$\mathbf{SWV} = \sum_{i=1}^{4} X_i Y_i \ldots\ldots\ldots \text{equation 1}$$

Where:
SWV = Summation of Weight Value,
X_i = number of respondents to rating i
Yi = the weight assigned a value (i = 1, 2, 3, 4). Therefore, the higher the Relative Importance Index – RII and the Mean Index Value -MIV, the higher the level of effectiveness for the variable under consideration which is expressed quantitatively as;

$$\mathbf{RII} = \frac{\mathbf{SWV}}{\sum_{i=1}^{4} X_i} \ldots\ldots\ldots\ldots\ldots\ldots \text{equation 2}$$

Table 2 shows the result of the whole analysis in which the Mean Index Value MIV is estimated to be 2.446. Undoubtedly, industrial agglomeration (3.308) remained the most factor influencing rapid construction activities in the study area and is closely followed by increasing rate of housing demands (3.178), the foreign exchange rate on importation (3.105), rapid urbanization (3.030), unguided population (2.838) and poor enforcement of development legislation (2.505). However, the absence of a functional spatial development plan, access to capital, instability in governance and politics, weak policy framework, weak public enlightenment and unexpected geological condition/ disaster are among the least factors influencing rapid construction activities in Ota city, Nigeria. Importantly, the nature of industrial agglomeration has always been the major propelling factors for other construction activities which accommodate other ancillary facilities, services and utilities aside from the magnetic power of the industrial cluster of Ota in attracting people, investments and activities which thereby induced construction activities.

Table 2. Measured of the perceived factors influencing rapid construction activities

Factors	**SD**	**D**	**A**	**SA**	**TWV**	**RII**	**MIV**	**RK**
Rapid urbanization	36	66	642	468	1212	0.758	3.030	4
Poverty / poor income status	191	46	300	344	881	0.551	2.203	9
Unguided population	47	66	774	248	1135	0.709	2.838	5
Increasing rate of housing demand	44	36	483	708	1271	0.794	3.178	2
Weak policy framework	175	162	156	368	861	0.538	2.153	11
Poor enforcement of development legislation	129	46	495	332	1002	0.626	2.505	6
Unexpected geological condition/ disaster	363	68	9	0	440	0.275	1.100	13
Absence of functional spatial development plan	120	248	282	248	898	0.561	2.245	8
Industrial agglomeration	38	78	255	952	1323	0.827	3.308	1
Access to capital	83	362	168	320	933	0.583	2.333	7
Weak public enlightenment	185	364	99	0	648	0.405	1.620	12
Instability in governance and politics	179	150	126	416	871	0.544	2.178	10
Foreign exchange rate on importation	84	42	192	924	1242	0.776	3.105	3
							MIV = 2.446	

(Source: Authors' Survey, 2021)

3.3 Environmental implications of the construction activities

The environmental implications of the construction activities in Ota were measured and assessed in Table 3. Table 3 shows the result of the whole analysis in which the MIV is estimated to be 2.631. In this regard, the negative impact of construction activities on society such as social damage and urban structure damage with fear of the unknown etc. is the most prominent environmental implications with the highest index value of 3.483. This is closely

followed by urban degradation and urban stress (3.188), increase in transport and logistics externalities (3.128), floods and erosion disaster (3.095), loss of wildlife and green area (3.090). In addition, unguided development control (2.983), spatial encroachment (2.918), rapid urbanization and industrialization (2.898), illegal dumping of construction waste (2.845), violation of environmental norms (2.825), severe damage to the ecosystem (2.823), depletion of agricultural land (2.745) and development of sprawl and slums **(**2.683) are among the possible adverse environmental implications of construction activities. However, the remaining factors that include violation of policy framework, unprecedented population, air and noise pollution and increase construction waste are of less significance.

Table 3. Environmental implications of the construction activities in Ota

Implications	**SD**	**D**	**A**	**SA**	**TWV**	**RII**	**MIV**	**RK**
Violation of policy framework	143	36	378	452	1009	0.631	2.523	14
Water pollution	335	108	33	0	476	0.298	1.190	20
Floods and erosion disaster	71	50	297	820	1238	0.774	3.095	4
Air and noise pollution	228	238	159		625	0.391	1.563	19
Urban degradation and urban stress	49	66	336	824	1275	0.797	3.188	2
Spatial encroachment	17	152	690	308	1167	0.729	2.918	7
Poor sanitation and land use disorganization	185	254	87	236	762	0.476	1.905	17
Increasing level of poverty	187	144	405	24	760	0.475	1.900	18
Development of sprawl and slums	50	158	657	208	1073	0.671	2.683	13
Unprecedented population	109	82	612	184	987	0.617	2.468	15
Unguided development control	55	38	612	488	1193	0.746	2.983	6
Violation of environmental norms	25	288	321	496	1130	0.706	2.825	10.5
Increase construction waste	158	78	291	424	951	0.594	2.378	16
Rapid urbanization and industrialization	77	0	630	452	1159	0.724	2.898	8
Loss of wildlife and greenery	51	54	471	660	1236	0.773	3.090	5
Negative impact to the society such a social damage, urban structure damage with fear of the unknown etc.	13	0	504	876	1393	0.871	3.483	1
Depletion of agricultural land	69	14	843	172	1098	0.686	2.745	12
Illegal dumping of waste	105	0	441	592	1138	0.711	2.845	9
Severe damage to ecosystem	101	10	474	544	1129	0.706	2.823	10.5
Increase in transport and logistics externalities	56	2	537	656	1251	0.782	3.128	3
							MIV= 2.631	

(Source: Authors' Survey, 2021)

3.4 Measure towards ameliorating the environmental implication of construction activities for sustainable city development

Twelve (12) measures identified for ameliorating the environmental implication of construction activities for sustainable city development were assessed and findings are presented in Table 4. The analysis which quantitatively expressed as the MIV of approximately 2.553 as presented in Table 4. Importantly, comparing the mean index value of the analysis with individual relative index value revealed that preparation and implementation of the spatial development plan (3.415); attitudinal change and compliance with construction guidelines and development (3.360), and strengthening legal and socio-economic framework (3.105) as major measures towards ameliorating environmental implications of construction activities in the study area. In like manner, strengthening of public awareness of environmental and socio-economic impacts of illegal constructions (2.923) and strengthening of technical documentation, revision and control mechanism of projects (2.868) are other viable measures for improving adverse environmental implications of construction activities in the Nigerian built environment.

Other measures such as the introduction of a mechanism of improvement of illegal constructions to achieve a standard level of reconstruction, adaptation or removal; strengthening the legal relationship between urban planning and construction industry, reducing the cost of planning, design, registration and approval of title documents; strengthening of existing legal instruments and sustainable resources management approach for environmental protection; introduction and thorough implementation of economic-wide environmental policies such as the imposition of fines and levies; introduction of safety and security technological processes and monitoring team and involvement of public strategic participatory and assistance in control measures are less paramount among the assessed measures.

Table 4. Measures towards ameliorating the environmental implication of construction activities for sustainable city development

Measures	**SD**	**D**	**A**	**SA**	**TWV**	**RII**	**MIV**	**RK**
Strengthening legal and socio-economic framework	59	6	525	652	1242	0.776	3.105	3
Strengthening of technical documentation, revision and control mechanism of projects	93	4	510	540	1147	0.717	2.868	5
Strengthening of public awareness of environmental and socio-economic impacts of illegal constructions	87	126	132	824	1169	0.731	2.923	4
Introduction of mechanism of improvement of illegal constructions to achieve a standard level of reconstruction, adaptation or removal	165	50	465	220	900	0.563	2.250	6
Introduction of safety and security technological processes and monitoring team	217	46	195	380	838	0.524	2.095	11
Introduction and thorough implementation of economic-wide environmental policies such as the imposition of fines and levies	208	44	252	344	848	0.530	2.120	10
Strengthening legal relationship between urban planning and construction industry	199	58	246	360	863	0.539	2.158	7
Involvement of public strategic participatory and assistance in control measures	220	46	201	360	827	0.517	2.068	12
Reduce cost of planning, design, registration and approval of title documents	202	46	264	348	860	0.538	2.150	8
Strengthening of existing legal instruments and sustainable resources management approach for environmental protection	208	46	234	364	852	0.533	2.130	9
Preparation and implementation of spatial development plan	41	28	249	1048	1366	0.854	3.415	1
Attitudinal change and compliance with construction guidelines and development	64	0	192	1088	1344	0.840	3.360	2
							MIV= 2.553	

(Source: Authors' Survey, 2021)

3.5 Contribution to Knowledge

The study has added to the existing literature on environmental planning and resources management as it has extensively discussed the environmental implications of construction activities using a case study of a fast-developing economy.

4 Conclusion and Recommendations

This study has significantly examined the environmental implications of construction activities in the fast-growing city of Ota, Nigeria. Quality academic justice has been done on the study objectives that include the socio-economic characteristics of residents in the city, the perceived factors influencing rapid construction activities in the

study area, environmental implications of the construction activities in the study area, and measures towards ameliorating the environmental challenges and implications in the Ota city and other cities with similar issues. Worthwhile, as the emergence of man on earth has been characterized by utmost dependence on the natural environment, humans have to rely mostly on its nature for growth and survival. Hence, the exploration and exploitation of resources domiciled in the natural environment have been the pre-occupation of man, but with accompanying environmental disadvantages and consequences. In conclusion, the above environmental implications or consequences caused by divergent human actions particularly the construction activities in the study area are numerous ones and they combined to adversely impact the functionality and livability of Ota city. No doubt the environmental implications from the construction activities don't just occur, they were caused by factors such as rapid urbanization or unprecedented population growth, increasing rate of housing demands, high poverty/poor income status, and unguided population growth. Other factors noted in this study are the absence of a functional spatial development plan, weak policy framework, poor enforcement of development legislation, industrial agglomeration, poor access to investment capital, weak public enlightenment and instability in governance and politics to mention a few.

To ameliorate these identified environmental challenges and implications, sustainable measures which include adequate preparation and implementation of the spatial development plan, total compliance with construction guidelines and development by stakeholders including the residents, strengthening the legal relationship between urban planning and construction industry, strengthening the legal and socio-economic framework, and strengthening of the technical documentation were recommended. Others include, revision and control mechanisms of project developments, strengthening of public awareness of environmental and socio-economic impacts of illegal constructions and introduction of the mechanism of improvement of illegal constructions to achieve a standard level of reconstruction, adaptation or removal were observed best possible measures capable of ameliorating the environmental challenges and implications in Ota city, Nigeria and other cities with similar issues.

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