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Sustainable Urban Development and Location of Petroleum Stations in Akure Metropolis, Ondo State Nigeria

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ABSTRACT
This study examined the effect of petrol station's location on the sustainable urban development in the study area. Data were obtained from the workers of Ondo State Ministry of Physical Planning and Urban Planning, employees of Department of Petroleum Agency (DPR), Petrol Station Attendants, Petrol Stations' Managers and residence around the petrol station. One hundred and two (102) copies of questionnaire were retrieved for the analysis. Descriptive statistic and appropriate inferential statistic (mean and standard deviation and Pearson Correlation) were employed for the data analysis. The result showed that item with code FT2, FT7 and FT5 indicated that before construction of petrol stations approvals were granted from the relevant authorities with high mean scores of (3.71, 3.65 & 3.64) respectively. The use of Multiple Linear Regression shows that R^2 value of 0.262 indicating that location of petrol station explains 26.2%, while level of conformity to regulations are significant to the model with P-value of 0.601 and 0.969 respectively due to greater than P value of 0.05 ($P \geq 0.05$) at 95% confidence level while safety procedure is significant with P-value at 0.000. The study concludes that there is moderate level of compliance as regards expected distance between petrol station's location and residential houses and public buildings.

Key Words: sustainability, petrol Station, conformity, urban development

I. INTRODUCTION

There has been an increase in the number of petroleum stations established in different parts of Nigeria, due to this increase there's need to ensure rules, planning principles and standards in terms of location, structure or land use for petrol stations. The approval to construct and operate petrol products filling stations is usually obtained from the Department of Petroleum Resources (DPR) (Omeh, 2015). Many petrol stations boycott these bodies in establishing their businesses perhaps to avoid paying the required fees, thus, operating in an unapproved and unconducive environment, most of the time detrimental to human and other economic activities (Omeh, 2015).

Petrol stations are essential part of the modern society, because they have numerous negative effects on the environment and ecosystem at large (Pasi, 2015). Furthermore, every petrol station has potential effect on human health and the surrounding environment either by air, soil, water contamination and other environmental issues of great concern in filling station are waste management, storm water management, and oil spills (Pasi, 2015).

Sustainability has undeniable relevance in the world we live in, as such mankind has constantly been sensitized for the main issues that threaten life and the repercussions that their actions can have on preventing the creation of a sustainable society (United Nation, 2014). According to Elkington (2004), the concept of sustainable development is divided into environmental, social and economic natures which represents the circle of sustainability. Creating a balance between the three sustainability factors will ensures that our environment is preserved, natural resources are protected from likely risk and damage to ensure availability for the future generations that are coming (Revista, 2014).

Mshelia, John and Emmanuel (2015) from their findings showed that the policy and rules for sitting petrol stations have not been adhered by most of the petrol stations located in the study area, and this has been causing serious environmental threat on residence in close range to them. They suggested that government should therefore enact

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law prohibiting both government and individuals from converting plots of land for the development of petrol stations within the community. Further attempt by either of the two sides to convert the use of any land within community should be resisted by the people and the court.

Wang (2016) says adequate human resource management and efforts are one of the important principles of sustainable development. He said that it is the people who will ensure that the principles are adopted and adhered to by the citizens. This makes the role of human resource in the quest for sustainable development very important and critical in achieving sustainable urban development. It implies that the human knowledge and skill in caring for the environment, economy and society need to be developed and adopted (Collste, Pedercini & Cornell 2017).

Finally, Morelli and John (2011), environmental sustainability is a means of providing adequate balance which allows human beings to satisfy their present needs in the environment without harming the ecosystem. The three aspects of sustainability have interrelationship among them and it reflects a reality that a healthy economy depends on a healthy society which are both dependent on a healthy environment (Carlan, 2015). Thus, the need to study the effect of location of petroleum stations as it affects the sustainable urban development in Akure Metropolis in Ondo State, Nigeria.

1.2 Statement of the Research Problem

The rapid growth in population and the quest for development has brought great pressure on the environment. This has resulted in serious environmental degradation in form of soil erosion, pollution oil spills, and so on (Akindele, 2015). Environmental degradation which is the gradual modification of the natural components of the ecosystem by artificial means has an effect which may be beneficial or harmful to humanity and the totality of the environment (Ojo-Fajuru, 2013).

In locating petrol stations, it is important to take some precautionary measures like locating them at a required distance from buildings; places of public assembly such as markets, hospitals and schools and areas of high traffic congestions and residential buildings. As a result of improper location of petrol stations close to residential areas this might have constituted serious hazards to people living closely to such petrol stations. Over time corrosion, cracks, defective piping, and spills during refilling activities of petroleum products may cause water pollution and also other fuels pollution from leaking underground storage tanks leaches into the surrounding soil and groundwater and can contaminate nearby water bodies and ecological systems (Thales, 2015). Finally, there's the need to study the effect of location of petroleum stations on the sustainable urban development in Akure Metropolis in Ondo State, Nigeria.

1.3 Objectives of the Study

The general objective of the study assessed environmental sustainability and location of petroleum stations in Akure Metropolis. While the specific objectives are to:

i. assess the level of conformity of the petrol stations to the physical planning standards in Akure Metropolis; and
ii. examine the effect of petrol station's location on the sustainable urban development in the study area.

II. LITERATURE REVIEW

2.1 Concept of Sustainable Development

Sustainable development stresses the importance of retaining the flexibility to respond to future shocks, even when their probability, the size and location of their effects, cannot be assessed with certainty (Browning & Rigolon, 2019). Acknowledging the pervasiveness of world Commission on Environment and Development definition, Cerin (2006) and Abubakar (2017), they argued that sustainable development is a core concept within global development policy and agenda because it provides a mechanism through which society can interact with the environment while not risking damaging the resource for the future.

Mohieldin (2017), defined sustainable development as an approach to development which uses resources in a way that allows them (the resources) to continue to exist for others. Evers (2018), further relates the concept to the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend. Considered from this angle, sustainable development aims at achieving social progress, environmental equilibrium and economic growth (Zhai & Chang, 2019). Hák, Janoušková and Moldan(2016) maintained that, global concerns have always been expressed for judicious use of the available resources so that it will always be possible to satisfy the needs of the present generation without undermining the ability of future generations to satisfy theirs. It implies that sustainable development is an effort at

guaranteeing a balance among economic growth, environmental integrity and social well-being.

According to Kolk (2016), this is achievable through the integration of economic, environmental, and social concerns in decision-making processes. However, it is common for people to treat sustainability and sustainable development as analogues and synonyms but the two concepts are distinguishable. According to Diesendorf (2000), sustainability is the goal or endpoint of a process called sustainable development.

Jain and Islam (2015) intimate that the Brundtland report engendered the United Nations Conference on Environment and Development (UNCED), known as the Rio Earth Summit, in 1992. The recommendations of the report formed the primary topics of debate at the UNCED. The UNCED had several key outcomes for sustainable development articulated in the conference outcome document, namely Agenda 21. It stated that sustainable development should become a priority item on the agenda of the international community" and proceeded to recommend that national strategies be designed and developed to address economic, social and environmental aspects of sustainable development (Allen, Metternicht, & Wiedmann, 2018).

According to Taylor, Sichinsambwe and Chansa (2016), the three main issues of sustainable development are economic growth, environmental protection and social equality. Based on this, it can be argued that the concept of sustainable development rests, fundamentally, on three conceptual pillars. These pillars are "economic sustainability", "social sustainability", and 'environmental sustainability.

2.1.2 Sustainable Petrol Stations

According to Taylor, et al., (2016) considered different expressions such as filling station, petrol station, gas station or petroleum outlet as any land, building or equipment used for the sale or dispensing of petrol or oil for motor vehicles or incidental thereto and includes the whole of the land, building or equipment.

According to Afolabi, Olajide and Omotayo (2011), defined petrol station as a facility where fuel, gas, kerosene, diesel and lubricants for automobiles are sold. A petrol station is a retail outlet for mostly petrol and other oil and gas products. The petroleum industry in Nigeria is the largest industry which provided approximately 90 percent of foreign exchange earnings and about 80 percent of Federal revenue and subscribe to the rate of growth of Gross domestic product (GDP) (Afolabi, et. al., 2011),

Activities of the oil sector which the Petrol Station is part of, has continue to threaten the environment, however some thoughtful oil companies around the world concerned with achieving a better sustainable and environmental performance are adopting and implementing sustainable actions in petrol stations, which is focused on minimizing consumption of natural resources, minimize use of water and energy as well as minimum waste generation (ABIEPS, 2012).

Environmental sustainability also expresses the principle that future generations should live in a world that the present generation has enjoyed but not destroyed (Clough, Jean & Carol, 2006). Environmental sustainability is a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity (Morelli & John (2011).

Achieving sustainable development hinges on a number of principles, these principles relate among each other's to conserve the ecosystem and biodiversity, production systems, population control, human resource management, conservation of progressive culture and people's participation (Molinoari et al., 2019). There is the need to conserve the ecosystem and biodiversity because without these, living organism will cease to exist.

2.2 Theoretical Review

2.2.1Central Place theory

The underpinning theory for this study is Central Place theory by Walter Christaller in 1933. The theory is a geographical theory that seeks to explain the number, size and location of human settlements in an urban system. The theory posits that settlements simply function as 'central places' in providing services to surrounding areas (Procedure and Conditions for Granting Approvals for the construction and Operation of a Petrol Station, 2010).

2.3 Empirical Studies

Mshelia, Abdullahi and Dawha (2015) studied environmental effects of petrol stations at close proximities to residential buildings in Maiduguri and Jere, Borno State, whereby three household heads around each of the 35 sampled petrol stations were randomly sampled. The finding revealed that the guidelines for siting petrol stations

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have not been adhered to by most of the petrol stations thereby posing serious hazards on residence in close proximity to them. Mshelia et al. (2015) later assert that before the planning permission is granted to construct a petrol filling station, an Environmental Impact Assessment (EIA) must be conducted.

Ahmed, AbdulRahman, Kovo, Ibrahim, Okor, and Agbo (2015) examine the level of awareness of hazards and safety measures among petrol filling stations and assess the prevailing safety Practices in Minna Metropolis of Niger State Nigeria. The result shows that 65% of the Station Attendants are not properly trained on safety. Forty-five (45) of Minna Petrol Filling stations do not conform to Department of Petroleum Resources (DPR) siting rules as setbacks from the road and residential areas were less than 30 meters. Independent Petroleum Marketers shows no concern on people selling Petroleum products in gallon, right in front of their Stations. The study, adopted a qualitative empirical approach and therefore the result cannot be generalized to establish prevalence of the incidence of lack of safety measures in all the filling stations in Minna nor can the result be use to highlight the varying level of significant differences of non-compliance among NNPC, major and independent fuel marketers in the Minna.

Oloko-oba, Badru, Popoola, Alaga, Ogunyemi and Samson (2016) used geospatial techniques to determine the distribution pattern and assess the level of conformity of the filling stations against the physical planning standards by the regulating bodies. The finding shows 225 filling stations in the study area with a clustered pattern of distribution. 71.6% of the filling station met the 15m distance from the edge of the road and 28.4% violation. Also, 97.3% of the filling stations violate the 400m apart with only 2.7% in compliance. 98.7% deviate from the 2km radius of four stations with 1.3% in compliance. However, all the stations ensured that the drainage from their site does not flow into a river and does not lie within pipeline or high-tension cable Right of Way.

Mohammed, Musa and Jeb (2014) studied the location of filling stations based in Metropolitan Kano against the Physical Planning Standards using GIS. The findings in the study revealed that there are 214 filling station located along the 43 roads in the study area, of which 69% are owned by independent marketers, 26% owned by Major Marketers and 5% owned by the NNPC. Most of the station satisfied the minimum requirement of 15m distance from the road (96%). Equally 98% of the filling stations met the minimum distance of 100 meter from the health care facilities. However, many stations had not met the criteria of 400m minimum distance to other. The research however considers few levels of conformity and does not look at spatial distribution and finally concludes that regulatory agencies need to look into the issue and take appropriate measures.

III. METHODOLOGY

The study was restricted to Akure Metropolis, Ondo State. The State is one of the thirty-six states in Nigeria. Ondo State is one of the oil producing states in Nigeria, it has the 2nd largest bitumen deposits in the world. Also, it has one of the largest natural gas deposits in the world. In line with the study, the population consists of; employees of the Ondo State Ministry of Physical and Urban Planning, employees of Department of Petroleum Resources (DPR) in Akure office, employee of Akure Local Government Council, selected 10 retail petrol stations within Akure City, and the residence in the community where the petrol stations are located.

A sample size is the number of elements selected from the population which is representative of that population. A sample size of Two hundred and ten (210) respondents out of the entire population were selected for the research using Krejcie and Morgan calculation table. This number is considered adequate and representative enough to give informed answers to the research questions.

For the purposes of this research, forty (40) Petrol station attendants, forty (40) Petrol Stations Manager/Owners, forty-five (45) Ondo state ministry of physical and urban planning, thirty-seven (37) Department of Petroleum Resources and forty-eight (48) residents of the Akure city where the petrol stations are located were selected. The objective was to have a fair and credible representation of respondents. The above populations were random selection from the field.

Table 1: Selected Population and Sample Size of the Respondents

S/N	Respondents	Population	Sample size
1.	Petrol Station Attendants	40	26
2	Ondo State Ministry of physical and urban planning	45	30
3	Department of Petroleum Resources	37	24

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Volume 3, Issue 10 Oct 2021, pp: 804-812 www.ijaem.net ISSN: 2395-5252

4	Petrol Stations Manager/Owners	40	26
5	Residence Around the Petrol Station	48	31
	Total	**210**	**137**

Source: Field Survey, (2021)

The data was interpreted in relation to the research objectives. The results were compared with other literature to determine if there is any consistence. Data collected from the field was analysed using both inferential and descriptive statistics such as percentages, mean and standard deviation. The Statistical Package for Social Sciences (SPSS) was used to analyse the data. The inferential statistic adopted was Pearson Correlation for the analysis of the data, and to determine whether the formulated hypotheses for the study is accepted or rejected.

IV. RESULTS AND DISCUSSION

4.1 Response Rate of Questionnaire

A total of 137 copies of questionnaire were distributed among respondents (owners or managers of petrol stations) in Akure Metropolis. Table 4.1 shows that out of a total of 137 copies of questionnaire distributed, 102 copies were retrieved from the respondents representing 77.30% of the distributed copies were duly filled and used for the analysis.

Table 4.1: Response Rate of Respondents

Copies of Questionnaire	Respondents	
	Frequency	Percent
Quantity Distributed	137	100.0
Quantity Retrieved (completely and duly filled)	102	77.3

Source: Field Report (2021)

4.2 Levels of Conformity of Petrol Stations to Physical Planning Standards

The descriptive analysis in the Table below shows the level of conformity of petrol stations to physical planning standard in the study area. This was achieved through the use of minimum, maximum and mean values and Relative importance Index (RII) of the items. Figures in the table 4.3 reveal that items with code FT1, FT2, FT4, FT5, FT6, FT7, FT8, FT9, FT10, FT11 has minimum value 1 and maximum value of 5 respectively which indicate that the respondents had diffused response toward the case study while the item with code FT3 has mean value of 2 and a mode value of 5. A wide range of mean value (2.92- 3.71) show that the respondent has diverse view on the subject matter.

From the respondents' point of view, item with code FT2, FT7 and FT5 has a high mean with 3.71, 3.65, 3.64 respectively. This indicate that before the construction of petrol stations in Akure metropolis approvals are granted from the department of petroleum resources (DPR), the basic obnoxious facility principles and standards are duly followed and it is positively influenced by planning principles, standard and regulations. Also, from the survey item with code FT10, and FT4 has a high mean of (3.44 and 3.42) respectively and it indicate that petrol stations are located based on the owners preferential location of choice not minding the closeness to water bodies and the surrounding environment and also some of the petrol station are not aware of the construction and expansion of roads before construction while FT1 has a moderately high mean with (2.92) and it indicate that not all petrol station are located at a minimum distance of 100meters to the water bodies. The study is in agreement with Mshelia, John and Emmanuel (2015) revealed that the guidelines for sitting petrol stations must be adhered to by petrol stations thereby reducing threat on residence in close range to them even though some of these petrol stations were situated much earlier than the residential houses close to them.

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Table 4.2: Level of Conformity of Petrol Stations to Physical Planning Standards

Code	Levels of conformity of petrol stations to physical planning standards	Min	Max	Mean	RII	Remark
FT1	Petrol stations are located at a minimum distance of 100 meters away from water bodies	1	5	2.92	0.58	Moderate
FT2	Petrol stations in Akure metropolis are located based on the DPR	1	5	3.71	0.74	Agree
FT3	Petrol stations located in Akure metropolis are built on guidance from the physical planning authority	2	5	3.54	0.70	Agree
FT4	Petrol stations in Akure metropolis are located based on owners' preferential locational choice	1	5	3.42	0.68	Agree
FT5	Petrol stations in Akure metropolis are located based on obnoxious facility principles and standards	1	5	3.64	0.72	Agree
FT6	Petrol stations in Akure metropolis are located based EIA	1	5	3.46	0.69	Agree
FT7	Petrol stations in Akure metropolis is positively influenced by planning principles, standards, and regulations	1	5	3.65	0.73	Agree
FT8	Petrol stations in Akure metropolis are located according to approved land use act in accordance physical planning standard	1	5	3.47	0.69	Agree
FT 9	Petrol stations in Akure metropolis get letter of consent for urban and regional planning where site is along federal highway	1	5	3.51	0.70	Agree
FT 10	Petrol stations in Akure metropolis are aware of construction or expansion of roads after the petrol station has been constructed	1	5	3.44	0.68	Agree
FT11.	Petrol stations in Akure metropolis follow the masters plan for the state in accordance to the physical planning standard	1	5	3.44	0.68	Agree

Source: Field Survey, 2021

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4.3 Effect of Petrol Station's Location on the Sustainable Urban Development

This objective was achieved through by regressing the constructs of locations of petrol stations (the independent variable on the measurements of sustainable urban development (dependent variable) namely social, economic and environmental dimensions. The use of multiple linear regression affords the determination of relative contribution of independent variables to the model. Table 4.8 presents the model summary which shows a R^2 value of 0.262 indicating that location of petrol station explains 26.2% of variance in sustainable urban development in the study area.

In addition, the coefficient Table which presents the relative contribution of each construct of location of petrol station on sustainable urban development in the study area. Figures from the Table show that two out the three constructs of the independent variable, level of conformity to regulations and proximity to residence and public buildings are insignificant to the model with P-values 0.601 and 0.969 respectively due to greater than P values 0.05 (P≥0.05) at 95% confidence level while safety procedure is significant with P-value at 0.000. The relative contribution of location of petrol stations, explained by the sustainable urban development is determined by the standardized beta value with "safety procedure" having the highest contribution beta value (β = 0.475) relative to the dependent variable. Level of conformity to regulations and proximity to residence and public buildings having beta values (β), 0.085 and 0.006 respectively. The above figures interprets that most petrol stations in Akure metropolis do not conform to rules and regulations guiding the siting of petrol stations as enacted by Department of Petroleum Resources, DPR and Physical Planning Authority. However, the study found out that safety of lives and properties is paramount to the owners of petrol stations in Akure metropolis.

Table 4.3: Effect of Location of Petrol Station on Sustainable Urban Development

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.512[a]	.262	.240	5.07826

a. Predictors: (Constant), Proximity to residence and public buildings, Safety Procedure, Level of Conformity to regulations

b. Dependent Variable: Sustainable Urban Development

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	15.313	2.960		5.173	.000
	Safety Procedure	.406	.080	.475	5.055	.000
	Level of Conformity to regulations	.112	.213	.085	.524	.601
	Proximity to residence and public buildings	.009	.228	.006	.039	.969

a. Dependent Variable: Sustainable Urban Development

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The rejected null hypothesis informs that the siting of petrol stations in the study area has in no way conserved the environment. The study gathered that there is moderate level of compliance as regards expected distance between petrol station's location and residential houses and public buildings. Moreover, the study established that there is high level of adherence of safety precautions put in place by the owners of petrol stations in the study area.

5.2 Recommendations

Based on the findings of this study, the following recommendations shall be made

i. It is advised that restrictions should be placed on the number of approvals for establishment of petrol station within a specific land mass. This is reduced to the effect caused by petrol

stations on man and his environment to the minimum.

ii. Government at all levels must ensure that level of conformity of petrol stations to physical planning standards must be adhere to strictly.

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