Impact of Rocky Topography on Settlement Pattern and Housing Development in Idanre, Nigeria

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Abstract The pattern of development of urban land-use in relation to topography varies from rural to urban. What distinguishes Idanre community from other Yoruba settlements is the rocky topographical nature that surrounds and abounds within the community. In this paper, the effect of rock outcrops that surround the community and the effects on its development were investigated. The study employed both historical and descriptive analysis to gather relevant data about the origin and locational structure of the town. There were 3,620 existing buildings in the area according to the building demographic survey carried out. The seven quarters in the town were sub-divided into twenty-two sectors from which 10.0% of the total buildings in all the sectors were picked as sample size for questionnaire administration. Our findings in the study show both positive and negative impacts that the rocky topography has on the community. The essential aspect of the discoveries were some viable potentials and topographical features of the town which need to be adequately harnessed and made used off for the benefit of the community and the state at large.

Keywords: Rock outcrops, topographical features, settlement pattern, housing development, and accessibility.

1. Introduction

The extent of development of any settlement is largely dependent on the absence of obstacles. Where there are constraints, people are discouraged and cause the physical development to suffer a drastic set back. The word topography, according to Advanced Learner Dictionary, is expressed as the description of the surface features, which comprise the landscape vegetation, rocks, lake and valleys, buildings, roads, and the general physical outlook of an area. In other word, the pattern of settlement and the development of housing are largely determined by the nature of topography of immediate environment. It constitutes essential factors that determine the growth and development of such settlement. Like any other settlement, Idanre is growing due to increased rate of urbanization, improved technology and industrialization which are responsible among other things for the day to day increase in the requirement of wide expanse of relatively flat land for the rapidly increasing population of the settlement. Idanre town is generally surrounded by hills while some parts of the town is dominated by rock outcrops and characterized by bad roads that negatively affects the accessibility of the town (see Figure 3).

This immensely influences the spatial growth of the town as well as its development. For example, the installation of infrastructure like roads, telephone network, lying of water pipes is very difficult and costly. Digging of well to provide water is also a problem due to the underground rock beneath the sub-surface of the soil, and housing construction is equally affected by this topographical constraint. The expansion of the town is apparently difficult while the internal development is limited by the physical constraints. However, the topography has few positive effects on socio-cultural activities, public utilities, crop production and the general climatic condition of the area. There are some development potentials characterized by the topographical features of the town which can be profitably harnessed. All these constitute the basis of our investigation in this study.

Generally, settlement can be defined as structures on the earth's surface. Emielu (1996) expressed it as a group of buildings with people living in them. In early times, people sought the advantages of living in groups, thereby making it possible to share farm tasks to the benefit of all. Besides, it encourages increased security and pleasures of social contact. Therefore settlement in any given region reflects man relationship with the environment. By studying settlement sites, pattern and structures; one can see the extent to which man has responded to his environment as well as the religious and social customs of his society. According to Lynch 1978, as quoted in Akinsunlola (1999), every city or settlement has a general overall shape or pattern. The one peculiar to the study area (Idanre) is linear pattern of

settlement. This is usually the result of a natural topography which restricts growth or the result of transportation spine in which a string of housing units are arranged along one major thorough fare.

The topography of an area is the pivot on which its growth and development revolves. In the physical development of any settlement, either rural or urban, a relatively flat land is for expansion and internal development is very essential. According to Ologunde (1980), he argued that one of the major factors that created problems in the effective use of land for physical development in Efon-Alaye is the hilly topographical constraint. The relief features of the town affected road links and the structures. In the case of Lagos, it locational advantage on marshy island that is almost surrounded by a lagoon has a unique advantage with an outlet to the sea.

The physical development of the study area has been confronted with many problems emanated from the existence of the rocky outcrops around it. However, this study has set to investigate some of the major restrictions caused by this major physical features and see how the available potentials in the area can be properly harnessed to benefit the people in the area.

2. The Study Area: An Overview

Idanre is one of the major towns in Ondo State of Nigeria, as shown in Figures 1 and 2. It is about 336km from Lagos, and lies between Akure and Ondo towns to the South-Southwest and East-East North of both towns respectively. Idanre falls on latitude $9^0\,8^1$ north of the equator and longitude $5^0\,5^1$ east of the Greenwich meridian. Idanre hills form part of the Yoruba hills that stretch through the northern half of Oyo and Ondo States, which actually form the highest peak in the series.

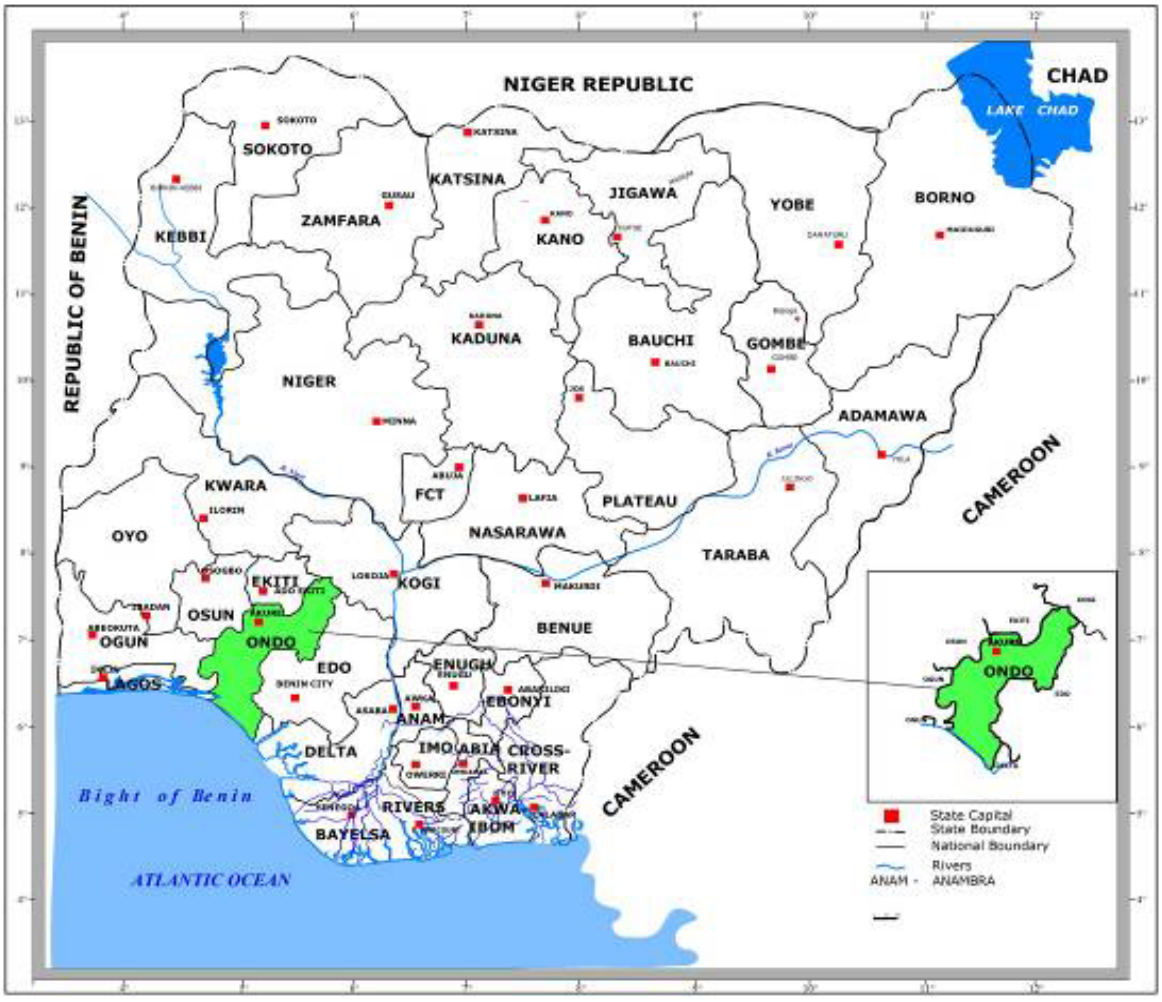

Figure 1a: Ondo State Map in the National Settings
Source: Ondo State Ministry of Lands and Housing, Akure; 2010

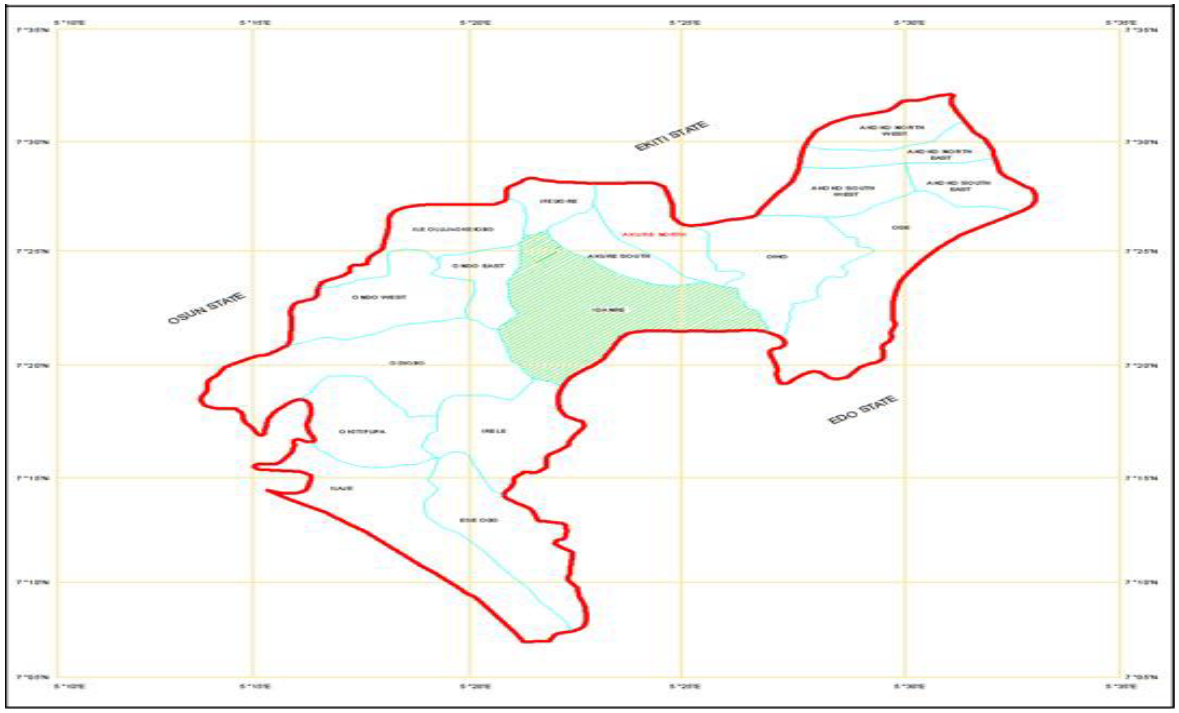

Figure 2: Map of Ondo State showing Idanre Local Govt. Area
Source: Ondo State Ministry of Lands and Housing, Akure; 2010

Idanre hills have, for long time been recognized as having historical value since they offered protection in the past from invaders. In other words, Idanre hills are to the Idanre people just as what Olumo rock is to Abeokuta people and Olosunta rock to the people of Ikere-Ekiti settlers. Associate with the hills is Idanre town, a settlement rich in cultural resources. It is in recognition of its potential in tourism value that prompted the Ondo State Government to build two chalets at Oke-Idanre in 1978 at a cost of about 1.2million Naira (Akinsunlola, 1999). The hills offer various forms of attractions, such as sports for men and women in high altitude terrain, quiet pleasure seeking, and so on. Climbing to Oke-Idanre was extremely difficult in the past but now it has been made relatively easier as series of 600 climbing steps have been provided with 5 resting places. The various streams and rivers that drain the area and its environ include Oto River, Arun River and tributary of Owena River. All took their sources from the surrounding hills. The Oto River is the major river that runs across the length and breadth of Ododе-Idanre while Arun River is prominent at Oke-Idanre. There are villages, hamlets and farmsteads which constitute the surrounding settlements to Idanre town, numbering about 450 settlements. According to NPC (1991) Census, the population of Idanre town stood at 29,156 people, while the projected figure for the year 2000 was 37,481 using annual growth rate of 2.8% increase.

Idanre is one of the most important town that house magnificent rocks and hills in Nigeria. The ancient town (Oke-Idanre) yielded about 80.0% of its landmass to rock outcrops, while about 62.0% of the new town (Ododе Idanre) is occupied by this gigantic phenomenon (Akinsunlola, 1999; Omole and Owoeye, 2010).

Oke-Idanre presents true picture of traditional setting. Evidence of various shrines that once adorned in the town are still visible, some of which are named after some deities with interesting codes of taboos. Some of these features include the ancient palace (Olofin's house), foot print on the rock called Ese-Agbogun. At Ododе, heavy outcrops such as Ularan hills, Orosun hills, Ojimoba hill and others are common rock features with interesting outlooks. Some are egg-shaped, some are cone-shaped, some are like waste left behind by earth-worms at dawn, and some are tall rocks lapping smaller ones of various designs and sizes. Others are just massive rocks sloppy and attractively gratifying, some are susceptible to mountaineering while others appear too rocky for such adventure.

Like other urban areas, various land-uses within the town unit together to form the physical features of Ododе-Idanre. These land-uses can broadly be categorized into residential, industrial, commercial, agricultural, educational, public and semi-public uses. Ododе-Idanre began to grow and expand in the year 1928 as Oke-Idanre began to decline. Notable factors responsible for this development include rugged topography and absence of adequate buildable land necessary for expansion and farmland. Impossibility of bringing amenities up the hills and religious conviction among others also played significant role in the movement of people from Oke-Idanre down to Ododе, which started towards the end of 1920s and concluded in 1933. Figure 3 clearly illustrate these sceneries in the study area.

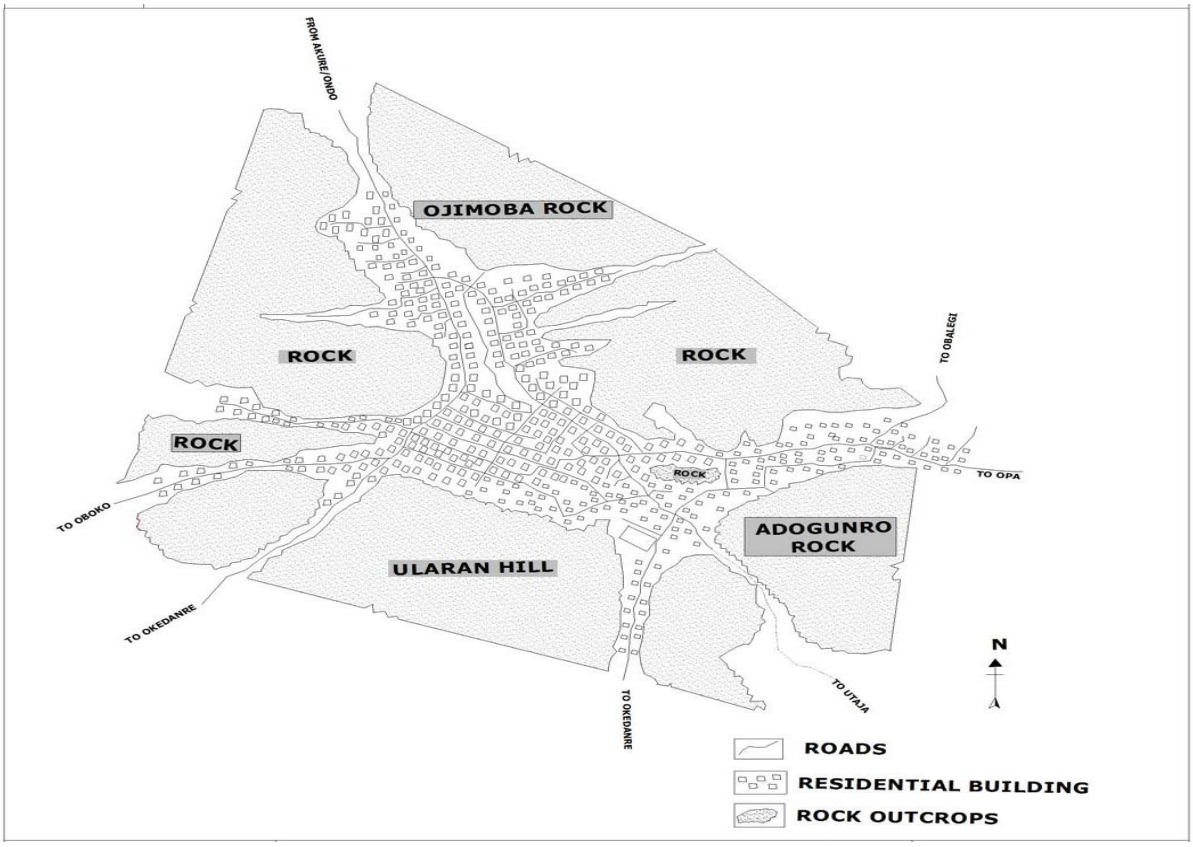

Figure 3: Map of Idanre showing the Rock outcrops at Ododе-Idanre
Sources: Ondo State Ministry of Lands and Housing, Akure; 2010; Denito Planning Associates, Akure; 2010

3. Research Methodology

This study adopts both historical and descriptive research methods in gathering necessary data. The historical research method was used to examine the events of the past relative to the locational structure of the town, while descriptive method was used to systematically describe the facts quality and character of the given and present events. In this regard, questionnaires were designed to collect data randomly on sector basis, which was finally analysis for factual presentation of the research findings.

For the purpose of evenly representation of the research information, each of the identified seven major quarters within Odode were sub-divided into twenty-two sectors using some of the prominent roads within the town for proper and well defined demarcations. Building demographic survey was carried out in each area, and 10.0% total of those houses counted was chosen for both formal and informal interview. Mainly, the household heads or their accredited representatives were interviewed. This is well represented on Table 1. Information collected from primary source include socio-economic and land-use data. Observations were made during reconnaissance survey of prominent areas of interest. Secondary data includes facts and figures extracted from relevant texts, records from the state ministries, current journals and publications. Altogether, 362 questionnaires were administered and used for analysis for this study.

4. Research Findings and Discussion

In attempt to achieve the aim and objectives of this study, the research findings are discussed under different subheadings. About 40.83% of the total landmass is occupied by the natural rock outcrops while only 28.17% is used for residential purposes. Others are shared among the commercial (3.08%) usually along the major roads, light industries (1.92%), access roads (7.17%), agricultural (0.83%), educational (3.83%), and public and semi-public land-uses (15.17%). Altogether, there are 3,620 buildings in the area. Table1 below shows the arrangement in sectors and the sampled choice made in each of the sectors, which are used for the data analysis.

Table 1: Arrangement of Sampled Buildings in sectors

	Quarters	Sectors	Total Buildings	Sampled Choice	Percentage
1.	Irowo	A	200	20	5.52
		B	180	18	4.97
		C	194	19	5.25
2	Okedo	D	200	20	5.52
		E	170	17	4.70
		F	140	14	3.87
3.	Idale	G	160	16	4.42
		H	120	12	3.31
		I	180	18	4.97
		J	200	20	5.52
4.	Jigbokun / Isala	K	150	15	4.14
		L	100	10	2.76
		M	160	16	4.42
		N	220	22	6.08
5.	Odeja	O	180	18	4.97
		P	240	24	6.63
6.	Yaba	Q	100	10	2.76
		R	96	10	2.76
		S	140	14	3.87
7.	Odole	T	128	13	3.61
		U	142	14	3.87
		V	220	22	6.08
		Total	3,620	362	100.0

Source: Field Survey 2010.

4.1 Building Characteristics

The largest proportion of houses in Idanre is used for residential purposes, which accounts for 28.17% of the total land-uses. From the date collected, as shown in table 2, it was revealed that 40.10% of the sampled buildings are made of sandcrete walling materials, 30.10% by stone walling materials and 27.90% by mud materials while 1.9% was made with planks. Investigation about the foundation materials also revealed that 52.76% of the sampled building are made of cement slab, 30.11% are made of sand-crete materials while mud materials take the remaining 17.13%.

Findings from the survey conducted revealed that building type is dominated by storey buildings which account for 59.97% of the sampled buildings, while the rest (40.33%) are bungalows. This might be because of limited space for expansion and difficulty in laying building foundation due to expansive underline rock outcrops.

Table 2: Building characteristics

Variables	Frequency	Percentage
(a) Walling materials		
• Cement Block	145	40.10
• Stone	109	30.10
• Mud	101	27.90
• Planks	07	1.90
Total	362	100.00
(b) Foundation Materials		
• Cement Slab	191	52.76
• Sandcrete	109	30.11
• Mud	62	17.13
Total	362	100.00

Source: Field Survey, 2010.

4.2 Accessibility

Majority of the buildings are accessible by minor roads. This accounts for about 72.10% of the sampled buildings, only

21.82% enjoy good accessibility while the remaining 6.08% are accessible only by footpaths. Most of the inaccessible buildings are due to the presence of series of rock formations around and within the environment that hinders the construction of good roads. Majority of the access roads are in bad state as accounted by 51.10% of the respondents. About 30.94% are in fair condition while only 17.96% are in good condition.

4.3 Major Problems Associated with Idanre Hills

Different major problems are identified in the course of this research as indicated by the respondents. The number one on the list is difficulty that the people faced in climbing the hills which account for 43.92%. Climbing up the hills is said to be very slow as the gradients in some sections are rather steeply and slippery particularly during rainy season while there are a lot of damaged sections of the climbing steps. Other problems identified include absence of social amenities like extension of electricity and pipe-borne water to some parts of the town, particularly the old settlement; poor road linkages with other part of the state and non-availability of guide capable of taking people round all the places of interest in Idanre rocky environment during visits. Beside all these, there are problems relating to accessibility to underground water. Digging of well and even foundation of buildings is extremely difficult if not impossible in some parts of the town. This is because of the large expanse of hard igneous rock outcrops occupying most of the place. Sometimes, several rock blasting has to be made before the mission of accessibility can be achieved.

4.4 Positive Impacts of the Topography on Settlement Pattern of Idanre

(i) Housing: The abundant existence of rocky materials has positive impact on building development in Idanre. However, some building foundations were constructed with stony slabs. Buildings in this category are mostly public office buildings like Town Planning Office, Produce Office, Local Government Maternity Home, Chief Magistrate Court and Better life Nursery and Primary School buildings. Also, some private buildings fall under this categories.
(ii) Socio-cultural: Due to the large expanse of land that the rocky outcrops occupied, available lands for expansions and for other human activities are becoming limited and inadequate. As a result the indigenes are looking beyond their territory for farmlands. There are two main deities they worship Olofin and Orosun. Their cultural belief is that these deities live inside some of the notable rock outcrops around the town. As ancient Idanre was deeply a traditional society, it has many taboos and many spots on rocks within the town which were marked sacred while many utterances are forbidden and many idiosyncrasies are outlawed. In the past, pebbles form the surround rocks were used in calculating dates in ancient Oke-Idanre. A cave inside Ularan (Cater Hill) used to serve as quasi-ware house for the people with wares in the ancient time. Goods kept in this ware house were said to be safe and secure as pilfering or robbery was non-existent as at the time.
(iii) Recreation and Tourism: Idanre hills offer beautiful view of the town down the hills. They are awe-inspiring and picturesque with their steep sided bare inselbergs. The highest peak is Orosun, which is about 944m above sea level (Min. of Trade Akure, 1999; Omole and Owoeye, 2010). In addition to the existing benefits, many advantages can be accrued form Idanre and its surrounding rock out-crops if properly developed and harnessed, particularly as tourist centre.
(iv) Economy: Survey conducted shows that weathering activities is common features found on the rocks. A large amount of the weathered materials from the rocks are usually deposited at the low land of the town where agricultural and other allied land-uses are being carried out. These weathered materials are found very rich in mineral resources like Kaolin, Quarts, and other valuable minerals that help to improve the fertility of the soil. Hence, the high yields in agricultural products, particularly cocoa in Idanre is as a result of this favourable condition in the area (Min. of Agric Akure, 1999).
(v) Water Supply: Adequate regular water supply has been enjoyed in this community, mainly form streams that took their sources from the top of these rocks. The Oto stream and Arun River, for example have really been serving the people adequately. The pipe-borne water supply from Owena is just to supplement this source, which has even ceased to function since.

4.5 Negative Impacts of the Topography on the Settlement of Idanre

(i) Residential (Housing) Development: Residential development forms 28.17% of physical development in Idanre. Some of the buildings are built directly on some of the flat rocks surfaces. Some of these rocks are sloppy in nature and since they serve as natural foundation for those buildings, they tend to dictate the actual gradient of such buildings;

hence, the cost of putting up residential building in the area becomes very high compared with when they are constructed on flat land. Despite the abundant supply of rock outcrops that can only be used for building construction, the cost of blasting these rocks may be too exorbitant thereby exceeding the cost of construction.

(ii) Commercial Land-uses: Two major markets exist in the town, namely Ojadele and Jigbokin market, apart from few other smaller ones. These two markets are specifically located on top of the town relatively flat rocks in different locations within the town. This is in line with the belief of the indigenes in those days that god and goddesses of these rocks will help the markets to flourish. However, the limited space of the locations of these markets has since limit their expansion to only the area where the rocks cover.

(iii) Industrial Land-use: Despite the abundant supply of timbers around the suburbs of Idanre, the major industrial establishments within the town are the few sawmilling industries. Because of the high rate of residential development since the people had descended down to Ododе from Oke-Idanre, about 92.5% parcel of land available within the rocky area of the town. This has since been developed, therefore tends to push various sawmill and allied land-uses meant to be established within the town to relatively flat areas outskirt the town.

(iv) Educational Land-uses: There are five secondary schools and eleven primary schools in Idanre. The original site coverage of most of these schools has been greatly reduced through illegal encroachment by land speculators and illegal building development. Information collected from school principals and head-teachers of the affected schools are shown in Table 3 below.

Table 3: The extent of Encroachment on Educational Land uses

Category	Name of Schools	Level of encroachment/Hect.
(a) Secondary Schools	• Olofin Grammar School • Ilemobola Grammar School • C.A.C Grammar School • Baptist Grammar School • Methodist High School	29.535 (72.95 Acres) 1.012 (2.5 Acres) 0.486 (1.2 Acres) - 0.405 (1.05 Acres)
Total		31.438 (77.65Acres)
(b) Primary Schools	• L.A Primary School • Muslim Primary School • Origbo Primary School • St. George's Primary School • St. Paul's Primary School • Baptist Primary School	1.134 (2.8 Acres) 0.891 (2.2 Acres) 0.607 (1.5 Acres) 0.607 (1.5 Acres) 0.324 (0.8 Acres) 0.202 (0.5 Acres)
Total		3.765 (9.3 Acres)

Source: Field Survey 2010.

(v) Transport (Road) Network: Road network in Idanre are of three categories or hierarchies – Broad Street (Major road), Minor road and Foot –paths. The broad street is the only road tarred, which runs through the length of Idanre, and it is the only route that commercial vehicles pass through since it is the only road that connects the town with the neighbouring towns, through Alade. The local streets, that links the various quarters are majorly connected by the minor roads, while other part of the town that are not accessible with vehicles due to poor conditions are only connected by footpaths. Most parts of the Broad Street (major road) and some of the minor roads within the town are less than the minimum standard width of 9 meters stipulated by the State Ministry of Land and Housing. Majority of these width reductions were caused by the presence of rocks along some areas which these roads pass through. Also construction of proper drains to effectively control erosion along these roads could not be done due to the underline rock nature and non-availability of enough land for development. The available land areas are fragmented among various land uses within the town in which road network is one.

5. Recommendations and Policy Implications

The followings are the policy implications of this paper, which are based on major findings. As a way to cautioning overdevelopment of the existing developed area, there is need for landowners at the outskirt of the town to prepare residential layout for their areas. This will facilitate uniform development and encourage harmonious inter-relationship among the various land-uses within the environment. Thus, an enabling environment is created whereby prospective

developers can purchase land for residential purposes. Since the new area in question has little or no rock outcrop, the cost of building construction would be minimized.

Apart from the two existing major markets sited on the top of two relatively flat rock outcrops, whereby the expansion of the markets is limited by the scope of the rocks; some other areas have been identified wherein mini-market activities usually take place. These areas include the extreme end of Oke-Odunwo street beside Local Authority primary school at Otapete in Idanre, Yaba round-about (Olofin/Gbalegi junction) and Ojota area. These locations, particularly the Yaba round-about and Ojota mini-markets should be well planned, developed and upgrade their status to meet the standard of daily market needs. In these places, there are enough available spaces for expansion and operation beyond their existing periodic activities. The Oke-Odunwo street market should be relocated to vacant land few meters away from the present site, along the old Idanre footpath. This is to avoid the noise generated from the market that may constitute nuisance to the Local Authority primary school learning environment. The implication of this recommendation will help to decongest the existing two traditional daily markets located within the town and, of course, will boost the economic activities of the town.

The location of existing sawmilling industries at the outskirt of the town is highly commendable. This will reduce the negative impacts that such land-use may have on residential environments. The extent of encroachment on school lands can be controlled if the schools concerned can endeavour to fence their land area. The Idanre local government should help to grade those roads within the town that are seriously in deplorable conditions with adequate proper drainage facilities. Development control activities of the Town Planning department at Idanre should be improved upon. Planning approval should not be granted to any development proposal in areas that are not suitable while severe penalty should be attached to defaulters who cannot satisfy planning standard. However, demolition of illegal and deplorable structures should be embarked upon in seriously affected areas. The affected schools whose lands were encroached are advised to fence their school land to prevent further encroachment while the illegal possessors of the lands are to be persecuted. Despite the availability of heavy rock outcrops in Idanre, there are still vacant lands along Gbalegi, Ala, Bajare and Utaja roads which are layout preparation and acquire lands for public uses. This will even serve as control suitable for building development. Thus, relevant agencies should carry out measure on cost of land in the area.

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