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The sustainable Impact of Alternative Construction Process on shelter provision: The Case of low-income group in Osogbo Osun state amidst post covid-19 pandemic in Nigeria

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ABSTRACT: *This paper examined the impacts of alternative construction process on building provision in Osogbo Osun state Nigeria, it is to assess various alternative construction process in comparison with the conventional methods whether which of the two has led to increased housing provision for low income groups. The study addresses the economic effectiveness attained, during the alternative construction process this was compared and reviewed in detail. The focus group of professional especially architect and builders were organized to coordinate the study process. This research addresses the sustainability impact of earth as building material at Osogbo in Osun state Nigeria, the impacts were analyzed, presented, interpreted and discussed mainly on the comparison of various conventional materials such as, cement and steel due to high manufacturing cost. The paper reveals the prevailing factors that facilitate sustainability impact of earth as building material, which include Low Energy required in the manufacturing process among others. The paper then concludes on locally produced, sourced and unprocessed material as a means of sustainable impact within the reach of low-income group.*

KEYWORDS*:* Earth, sustainable-impact, unprocessed, reduced energy, recyclability.

INTRODUCTION

In Nigerian cities, the poorer group suffers from high housing costs and poor service availability with the subsequent impact on other features of economic and over-all well-being. To date, intervention have predominantly been to public provide improved housing system for low income group. In reality this as not manifested, the low-income group have been left isolated with no access to affordable standard housing (Simon, *etal*, 1998). Research has shown that the provision of shelter in Nigeria as in civilized world has been accepted as a basic right from the period before the establishment of British Colonial administration. The emphasis has been on direct construction process and the result so far has not been effective because the space of construction is very slow (Onokerhoraye, 1995).

In an earlier study carried out by Geoffery (2005), it became obvious that the past effort government shows that there is a wide gap between the target set and the level of achievement.

Furthermore, considering the limited capital resources for public housing provision, it has been largely guided by substantial financial pre-requisites which tend to marginalize sizeable portion of the population and create high tension for housing need.

In Osogbo, this dysfunction has forced the low-income group to secure housing outside formal housing provision. However, the fact shows that, conventional construction process couldn't minimize the high demand of houses due to affordable cost within short time and quality production. Any strategy to address this challenge will need to take into account the particular constraints linked to developing societies. In fact, the need of alternative construction process is the best solution to address these and other related challenges and build sustainable housing for the majority of the population (USAID, 2009). Therefore, the alternate options should also lead to building massive houses in a high speed at a less costly and quality materials and also preserve natural resources and energy efficient.

Background of the Study

The background of construction is a complex subject encompassing the history of building materials, the history of engineering, the history of building techniques, economic and social history of builders and workmen, the history of construction machinery and temporary works, etc. (Romer & John, 2007). Economic perspective, has revealed the development of construction process that mainly related with and depended on thriving economic survival activities of town dwellers. Clay was being formed in to sundried bricks, in other to meet these construction needs, there began to emerge a group of workers who gained most of their livelihood from the practice of a single construction skill. Skill may have been, mud brick laying, mud construction, carpentry or stone masonry. Such specialization allowed workers to set work standards. Using their skills, these workers learned to shape their environment, or surroundings, in new ways. They began to create a built environment. In time, changing slowly over a period of thousands of years, this built environment would develop in to an environment recognizable to all of us. (James.F., 1991p.14-15).

The literatures has also revealed the initial of alternative construction process in developing countries was created during the Industrial Revolution, developed countries embarked on a campaign of massive transfers of capital and technology to developing countries in order to force a rapid industrialization intended to result in an economic "take-off" in the developing countries that the foreign technology imports were only benefiting a small minority of urban elites. This was also increasing urbanization with the rural poor moving to urban cities in hope of more financial opportunities. The increased strain on urban infrastructures and public services led to "increasing squalor, severe impacts on public health and distortions in the social structure. The local context must be considered as, for example, mud brick is durable in a high rainfall area with a large roof overhang, other forms of natural building process can be considered for instance appropriate construction earth building techniques for the building structure must also be considered. For all that, cost-effectiveness is an important issue in based around appropriate technology in public housing projects (Baron, C. 1984).

Statement of the problem

The 20th century witnessed tremendous growth in economic, social, industrial and technological development which continued to attract massive movement of people. In the developed nation of the world, economic, industrial and technological development led to the creation of wealth and social security which help to enhance urban life. The situation has been different in developing nation however, with high rate of urbanization, which is not matched with the growth in resources. This mis-matched has led to numerous problems facing urban cities today especially in Nigeria, these include inadequate and declining state of infrastructure, urban unemployment, and housing crises among many others. The patterns of urbanization growth in the developing countries have increased most rapidly, Urban settlement have been reported to be growing three times faster than those in the developed countries, with 85 percent of the growth in world's urban population being is in developing countries (Habitat 1986).

Justification of the Study

The importance of the study dealing with the impacts of alternative construction process on housing construction can be expressed in terms of the benefits to be gained by local government, house developers, stockholders, scholars and policy makers in the field of the studying issues of the society.

- **Local Government:** -the significance of the study is far-reaching, In particular contribute to the ensuring environmental sustainability by delivering decent housing with affordable adequate infrastructure and services.

- **House developers**: - the use of alternative construction process will lead to provide adequate and affordable house within the exact work schedule. And also, minimize the overall cost of conventional housing and construction materials like concrete brick, steel, cement, and timber and other inputs as well as cost of labor by substituting alternative construction process materials and construction technologies. That might be solving the problem of the scarce resource and other housing related issue.
- **Target groups:** - low and middle income groups can get affordable and adequate shelter.

- **Scholars and Researchers:** - the finding of this study would help scholars and researchers as an empirical background to conduct further research on the impacts of alternative construction process so as to a significant contribution towards the provision of low cost alternative constructions that improve the speed of construction and reduce the cost of construction as well as to have affordable shelter and also it can help as reference and source of secondary data for further study.

- **Policymakers:** - the outcome of this study might be supposed to inform policymakers about the change brought by alternative construction process in reducing cost, time of construction and its potential to increase the housing supply in the city in particular and country in general. Besides, it would help as a foot-step for policymakers to set strategies for better application as an enhancement of adequate and affordable shelter for the target groups

The accelerated growth of the urban area due to rural migration

The difference in the levels of development and distribution of economic opportunities has resulted in rural-urban drift. People seeking a better living and employment opportunities migrate from rural setting to urban areas thereby increasing population growth (Habitat 1986). The migrant furthermore, are unemployed and poorly housed set of urban residents. Geoffery, (2005) corroborate further that the process of urbanization brought by the low-income migrants, who have occupied the cities and seeking to solve their problem of accommodation informally. They are now become dominant and, in most cases, transforming the city to meet their needs, more often in a conflict and substandard housing.

Unemployment Problem

Consequently, the unprecedented population growth at the urban centers and the government's inability to provide employment opportunities for urban poorer group, this phenomenon has led the unemployed and unemployable to resort to demeaning and less productive jobs. They are categorized as the "urban poorer group" characterized with insufficient education, training or skill to secure employment. They constitute economic drain to the city, and in order to survive, they are reduced far below their potentials to being messenger, shoe maker, house-helps, hawkers, prostitute and the likes.

Urban housing Crises

Sub-standard housing becomes an immediate answer to housing scarcity, and acute shortage in public housing provision as a result of the growing population resulting in low quality, highly congested housing system deployed around the city centers. In essence housing issues become a crisis resulting in the proliferation of substandard national development polices of urban housing scheme.

Nature of the crises

(a) **Qualitative**: This refers to the unavailability of environmentally sound housing schemes that conform with the minimum standard of housing policies, leading to poorly constituted housing system.

(b) **Quantitative**: This expresses the numerical inadequate of minimum standard housing with respect to the manifested housing need.

(c) **Organization**: This connotes the absence of the minimum standard of rudimentary infrastructure. Pattern of Development of informal sector has since independence been the dominant provider of urban land and housing especially to the low-income earners, the so called urban poorer groups. Only about 25 percent of Nigerians enjoy a decent quality of urban life, the vast majority of low- income earner live in overcrowded condition with dilapidated physical dwellings informal housing provided access for the low-income group to decent low cost housing which are in harmony with urban environmental development (Geoffery, 2005).

CASE STUDIES OF OSOGBO CITY

Morphology

According to Onibokun (1990), the morphology of Osogbo is largely as a result of the pressing forces such forces include historical legacies, cultural and socio-economic pattern and the degree of technology patterns. The structure is made up of traditional section (old core) and newly built up areas. Onibokun shows further that growth of old core is based on traditional and rudimentary technology, and the basic component of residential structure is the family compound. The social relationship is based on kingship relationship, so Oba's palace is within the core of this old setting with Oba's market as a typical Yoruba traditional practice. In Osogbo such areas include Oja-Oba, Oke Baale, Isale Osun, Oke-Ayepe and the likes. This old section has been greatly enlarged over time due to massive rural urban drift from Osogbo suburbs. The old tradition buildings characterize such areas which include Asubiaro, Alekuwodo, Igbona, Ayetoro, Oke Fia, Olaiya and Ogooluwa zones.

The new section resulted when the city became a capital city, this brought about the development of government reservation areas and development of modern residential district planning system for new migrants. Furthermore, the settlement of Hausa immigrants is a very common feature in Osogbo as in most Yoruba cities of south western Nigeria. They are popular known as Sabo with distinguishable element that marks them out from other groups, and their immediate host communities.

Social Economic Situation

Osogbo residents are engaged in several kinds of occupation activities in the so-called informal sector. This refers to those selling items on the street, traders and retailers in markets. The informal sector is the most important segment of the economy of Osogbo. This sector is made up of none capital-intensive forms of small-scale trading and services (Onibokun, 1990). This sector acts as employer of newly arriving migrants, especially the unskilled and "Unemployable" people.
With the high rate of on unemployment and poor economic characteristics, it is not surprising that a high proportion of the Osogbo residents are very poor. The poor urban dwellers include workers in both formal and informal sector as well as these unemployed. From the analysis carried out seven five percent of civil servants and other wage earners fall below the poverty index (Goeffery, 2005).

Housing Situation

The prevailing housing situation in the study areas reflects the proliferation of low quality and substandard housing. The tradition housing in the old sector of Osogbo is in chaotic state of dilapidation and at the brink of total collapse. The prevailing urban drift from Osogbo suburbs especially due to arrival of the capital city, youth seeking white collar jobs, establishment of state secretariat with different ministries and parastatals and the creation Teaching Hospital of Ladoke Akintola University of Technology (LAUTECH) among others, has resulted in housing crises.

Further-more, there is rural urban dichotomy, people working in Ede, Awo, Ikirun, and the likes prefer to settle at the capital city because of the availability of social amenities. The afore-mentioned phenomenon has brought about increase in the population situation, because naturally all this attract people to the center of activity within the core of Osogbo alone, from Osogbo and Olorunda local government area, the population from last censor was 288,455 whereas the housing censor only reflect one-quarter of population censor (Courtesy of 2007 population and housing censor).

The prevailing population growth in Osogbo has led to acute housing shortage, for the migrants resulting in major housing needs, the formal response to housing needs either at federal, state or local level has not been effective. The federal housing estate and Osun state housing estate at Oroki and Owode respectively are not enough for government workers and the cost of acquiring such public housing is far beyond the reach of the low-income group.The poor economic situation coupled with relatively low housing provision from the government has led to housing problems. The prevailing situation makes people sleep in mosques, shops, schools, churches and the likes. It has also encouraged congestions and overcrowding in the existing sub-standard housing (Habitat, 1986).Moreover, the city of Osogbo is in a chaotic situation of low quality, sub-standard housing and the inner-city center becomes a place where social crimes are more acute and enormous.

Earthen Materials and building status overview at the study location

The earthen traditional architecture has evolved through generation using local materials. The earthen material has proven its validity through ages, its efficiency in architectural solutions and ability to appropriate design against the influence of climatic and environmental factors (Momcmanova, 2007. Michael, F, 2008). The earth buildings at the study area are made of raw earth traditional buildings, consist of compacted moist soil (especially clayey sand), some are still in their natural state though with multiples cracks. According to focus group report most of those earth building has lasted over hundred years, still counting in functional requirement. It was also reported that the recycle ability of earthen building give sustainability measure to the use of earth as building material, most of dilapidated earthen buildings are being recycle and reuse. Using the same earthen material in reconstruction process without environmental impacts.

Focus group report suggested that traditional earth materials can present specific design opportunities, monolithic forms exhibit inherent plastic qualities with more attractive tactile and visual qualities. Also, mud-wall presents sculptural opportunities that have been exploited locally in domestic construction. Earth construction materials, when appropriately used and properly detailed, it conforms to the requirements of the standards for compliance with building standard (Stevenson et. al., 1998). Furthermore, according to focus group, the use of earth in construction brings environmental benefits, which displaces imported materials. This develops potential for indigenous earth structures which has a positive impact on local and regional economies. This is apparent in rural area where earth tradition building has survived. As this paper suggest, the techniques for earth construction are simple and can relate to existing construction skills.

RESEARCH METHODOLOGY

The study used focus group to engaged rural dwellers in guided interview and discussion at the rural suburbs of Nigeria (Krueger,1994). The participants are experienced local house developers from rural dwellers, the focus groups were led by research fellows, who are aided by a discussion guide developed through prior interview with earth consultants, experts in building local houses with indigenous material especially earth. The focus groups are a form quantitative researches in which purposely-selected participants in the field of study are interviewed in a group setting. Such setting increases the efficiency of interviewing and interaction among the group members, it leads to more insightful response than attained through individual interviews. Such a pattern suggests the probability of a generalized view within the population being studied.

Sustainable impact of alternative construction process overview.
This sustainable impact of alternative construction process consists of Social, economic, technological and environmental sustainability of affordable alternative construction process. Discussed are under below:

- **Social sustainability** - Technological innovations can be said to be sustainable only if they are accepted by the users and are beneficial to their well-being. Proper awareness of the technology is a factor which helps in making the technology acceptable. The materials or technology, those requiring decentralized production can help in enabling the users in self building and result in local level employment and income generation. This will provide direct benefits in upgrading the quality of life of those who couldn't have afforded a 'standard' house; the technique can also be considered as socially sustainable.
- **Economical sustainability**: - technological options which demands minimum infrastructu re, basic resources and unskilled labour requirements improves the affordability of sustainable constructions only if enough accessibility to materials and labour. Given conditions of availability of local labour, the technique can prove to be really low cost and extremely cost-effective for the quality of construction achieved. As the technique is labor-intensive and not material-intensive, the technique is very cost-effective. In this technique, the manufacture and supply of high quality building material and ceramic products used in building are an integral part of the technique. Houses become suppliers of products to the local area, rather than the conventional houses that are consumers of building materials. The surrounding structures and secondary development also see value addition in the products that are brought into the local economy.
- **Technological sustainability** - The sustainability of technological options also depends on strength and durability aspects and is important criterions to be ensured particularly in the case of materials those are locally produced. Along with this, the reliability of technological innovations also adds to technological sustainability.
- Environmental sustainability – Technological innovations can be said to environmentally sustainable only if it either contributes to or maintain the quality of environment rather than degrading it by utilizing non-renewable resources or producing materials which are harmful to the environment.

Conventional Modes of Housing Construction

Conventional building modes is defined as components of the building materials such as cement, cement concrete products, and other metallic building components and methods are prefabricated on site through the process of timber or plywood formwork installation, steel reinforcement and cast in situ. Thus, provisioning of housing is relatively capital intensive because expends money to skilled labors, more raw materials, transportation and result to slow speed of construction. These conventional construction materials and technologies are so expensive and sometimes scarce that they are by and large beyond the affordability of the common people and so cannot be employed. This mode mainly serves for the middle and upper income groups of the urban population. They are often averse to lending to the poor, and generally lack sufficient client orientation and outreach into poorer especially in developing countries. This is mainly achieved through the private market (UN-HABITAT. 2006).

Alternative Construction process with the use of earth as building material

Scarcity of urgent demand of affordable house and shortage of fund and skilled labor these and other challenges are led to research for alternative construction process with the use of indigenous building material such as earth. Accordingly, in the most world countries, recognizing alternative construction process comparing with conventional construction process due to save the scarcity of construction materials and natural resources, solution to shortage of skilled labor and fund, also mainly can be provide affordable, quality houses within short period of time for the low-income group (Deepa. G., 2006). Alternative construction method can be creating job opportunities for unemployed or underemployed skilled and unskilled workers living in poverty. They can also have multiplier effects by creating income earning opportunities for people involved in other housing-related micro- and small enterprises, including home-based enterprises. In addition, cost comparisons of houses using these alternative materials and technologies suggest that they have the potential to enable a 30-50 per cent reduction in building costs (UN-HABITAT. 2006). Furthermore, the benefit is listed below

Comparison of salient physical attribute facilitating housing provision for low-income group with respect to alternative construction process and conventional process.

	Conventional process	**Alternative process**
Easy accessibility to housing provision	Low	High
Low capital requirement	Low	Very high
Self-help construction method	-	high
Low cost of material transportation	-	High
Users initiative for effective design quality	-	High
Close proximity of construction material and cost benefit	Very low	High
Low cost construction process	High cost	Low cost
Special training skill and special construction Equipment	Special skill	Unskilled
Environmental friendly materials	Very low	Very high
Low maintenance cost supporting strategies	High cost	Low cost
Low capital Requirement	Low	High

Focus group report(2019).

FINDING AND DISCUSSION

Sources and Processing of earth as Building Materials

According to focus group report at the Osogbo earth has been exploited as low-cost and low-energy production, unskilled and semi-skilled labour, and established technologies which can readily be applied to the production of low cost and environmentally sustainable building materials. Stulz and Mukerji (1993) and Okereke (2003) identified sources of materials on which indigenous building materials rely as naturally occurring raw material. The environmental benefits of earth as sustainable building material are so great that it has to be considered as an alternative building method to cut down current carbon emissions and energy use in the production and construction process only depends on natural means of dryness. Earth have low carbon footprints, and the materials are locally sourced. According to focus group, responses from local builders there are local construction techniques to take advantage of earth building and can use modern manufacturing methods, such as the ability to make cob blocks. This leads to a natural transfer of skills where most of the workforce in the building and construction industry can be trained. The solution to create low carbon in the production is made easy with the help of modern technology applied to cob and rammed earth building techniques these were made for a significant environmental change.

EMBODIED ENERGY COEFFICIENTS –MJ/KG

Material	**MJ/KG**
Adobe	0.47
Concrete bricks	0.94
Ceramic bricks	2.5
Glazed bricks	7.2
Cement	7.8
Glass	15.9
Steel	35.0

Victoria university of wellington, New Zealand. 2007

Earth (adobe) exhibited low energy use in the production and construction process, also in comparism with other material especially cement, which is a key ingredient in the production of many material the energy used in the production process is very high, also it depends on complex processes that depend on faraway resource that make cement a very expensive building material.

Level of benefits of earth as sustainable building materials

Some of the potential benefits identified by the focus group include:

i. Providing affordable housing
ii. Reducing cost of constructions
iii. Provision of employment opportunity
iv. Meeting increasing demand for housing stock
v. Use of environment friendly resource
vi. Energy conserving alternative

Prevailing factors facilitation sustainability of earth as alternative building material as identified by focus group it includes:

1) Locally produced and sourced materials
2) Low Transport costs and environmental impact
3) Thermal efficiency
4) Financial viability
5) Recyclability of earth as building material
6) No Waste and pollution generation in manufacturing process
7) Low Energy required in the manufacturing process
8) Use of renewable resources
9) No Toxic emissions generated
10) Low Maintenance cost

Sustainable impact solution of Earth as building material sumarized.

a) Local and unprocessed
b) Recyclable material
c) Minimised transport and manufacturing energy and air pollution
d) Local employment

Victoria university of wellington, New Zealand. 2007

Benefits of earth as sustainable impact alternative building material

The study carried out has revealed that the Yoruba traditional earth architecture has adopted use of earth as indigenous building material in its natural form. The house-form process is very simple, articulate and culturally relevant, the benefits Include:

a) Reliance on local material

The Availability of indigenous material such as clay is an advantage for housing provision. It has been confirmed that locally produced building material can replace the expensive imported materials. Also, it has been reported that those locally produced materials also exhibit, functionality, aesthetic, durability and structural stability that enhance sustainable buildings (Un-Habitat 1986, Akinkunmi 2012). Olugbenga and Olaluwoye 2007; Akinkunmi 2010), further buttressed that local alternatives materials provide safe, comfortable, and durable dwellings for rural communities.

b) Provision of affordable building

Cost of building with local materials cost less, than using conventional material, also local building material are affordable and cheap According to (Akinkunmi, 2012; Heathcote,1995). Arumala and Gondal (2007) reported that earth is one of the oldest building materials readily available and very cheap among others. Normally local building materials are not bought, the cost incurred in obtaining them are for only those who will fetch the material e.g. hiring people to cut palm font, dig earth and cut bamboo. This makes it cheap and affordable for obtaining local material for building purpose

c) Reliance on local skill and Technology

Indigenous building technologies are the skills or methods in building constructions that are local in its origin. The advantage of the building technology is that it is within the reach of the masses. The cost is very cheap and affordable. The tools to carry out the construction process are equally available and very cheap.

CONCLUSION

This research study concerns with impacts of alternative construction process on housing supply on housing development project in osogbo Osun state. It aims to assess various alternative construction process in comparison with the conventional process whether which one of the two has led to increased housed provision for low income groups. Introducing the new construction process and cost-effective eco-friendly building materials like earth, etc…increasing the housing stock. Among different approaches the advance and foreword of alternative construction process is the most significant that can reduce the housing cost to a rational rate in Nigeria. Therefore, by applying the aforementioned proposal the ever-increasing cost of conventional building materials and construction process could be regulated and people shall have alternative construction process and access to affordable house.

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