

# Sustainable Resources for Tackling Low Cost Housing Challenges in the Benin Metropolis

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**Abstract:- Sustainability is a social goal about the ability of people to co- exist on earth over a long time. It is the assurance that is proven to tackle all challenges with housing with the modern day technologies. Housing the urban population is key to sustainable development since the past two decade; it had been given a serious study by the world generally since there is the need to accommodate the relationship of man and his environment. Sustainable resources are natural resources that can be gotten locally and can be used for or to complement the elements of a building like wall, windows, foundations etc, as well as an embedded sensor to facilitate the comfort of the building. Earth, one of such resources is identified in this paper and through technology, the different uses of it. This article gives detailed research on the availability, usability and other values of sustainable resources to tackle the challenge of low cost housing also on the methodology of utilizing a specific alternative building material that is the Earth. The concept of low cost housing, sustainable housing and alternative building materials were considered in the paper to buttress the sustainability of the material. Appropriate use of earth in construction will produce cost-effective and comfortable buildings because research showed that earth structures have lower embodied energy than buildings made from conventional materials.**

**Keywords:- Sustainability, Earth, Construction Technologies, Low Cost Housing, Low Income Earners, Environment. Smart Home, Smart Cities.**

## I. INTRODUCTION

Housing as a unit of the environment has great influence on other units as its inadequacy results in overcrowding of existing units, squatters and slums. The shortage of housing is a common phenomenon in both rural and urban communities in African countries with the latter being more critical. A sustainable resource is a panacea of overcoming these challenges in shortages being experienced in the provision low cost housing to low and middle income earners. Sustainable resources are natural resources that are renewable and can be replenished at the same rate, or faster than they are being consumed. Sustainable development therefore is an organizing principle that aims to meet human development goals while also enabling natural systems to provide natural resources and ecosystem services to humans. The aim of this study is to assess the provision of low cost housing units with alternative building materials thereby

reducing this problem to the barest minimum. Housing can be classified as a social asset, economic asset and as a political asset.

Benin Metropolis is made up of three Local Government Areas namely; Egor, Oredo, and Ikpoba Okha. It lies within Latitudes  $6^{\circ}20'$  and  $6^{\circ}31'$  North of the Equator and Longitudes  $5^{\circ}32'$  and  $5^{\circ}41'$  East of the Greenwich Meridian. Benin metropolis occupies approximately an area of 112.55sq. Km (Ministry of Land and Survey, Benin City, 2009). It was the seat of the Old Benin Empire, the most powerful Empire in West Africa, whose area of jurisdiction extended beyond the present day Benin metropolis (Omiumu, 1988). The Study Area is bounded on the West by Iguobazua, on the North by Okada and Ehor, while on the East it is bounded by Abudu and on the South by Delta State.

## II. CHARACTERISTICS OF BENIN METROPOLIS

There exist two factors that influence positively or negatively a makeup of an environment. It can be the Physical factors that deal with environmental response to man or the Human factor that deal with humans' engagements within the environment.

The Physical Factors are influenced by:

- **Relief and Drainage:** Being on an undulating low-lying surface, the Benin metropolis is drained to the Ikpoba River and the Ogba River on the east and west respectively. There are series of moats which assist in the poor underground drainage system.
- **Vegetation:** It is a rainforest area that supports the growth of tree crops as palm oil, kolanut, rubber, orange trees and plantain (Eseigbe, 2011). Also, the land is rich in timber resources such as Iroko, Ceda, Obeche, Walnut, White and Black Afara. These trees can easily be used for building and construction purpose, frameworks, carving, furniture.
- **Climate:** The Benin metropolis has its dry season with little or no rainfall between November and April, while the rainy season with heavy rainfall between April and November. By this, temperature, winds, erosion, air pressure varies in the metropolis.
- **Geology:** The Benin metropolis made up of mostly flat plains and isolated hills on few other places with underlain by the sedimentary rocks of the Niger Delta. The soil profile consists of laterite that is reddish brown in colour and good for construction purpose.

The Human Factors are influenced by:

- **Population:** This is the number of persons in a given location at a given period of time. It shows a good evaluation of how people grow in number and expected growth with relationship with time. The 1991 National Population Commission (1991) research, Benin metropolis population at 1,085,676 in 2006. This has shown that there is a rapid urban growth in the Benin metropolis, against the former 780,976, according to Odjugo, et al. (2015); Skole and Thucker (1993); Lambin, Turner, Geist, Agboola, Angelsen, Bruce & Xu (2001) affecting the environment, economic and social interactions of the study area.

- **Socio – economic activities:** Varying occupation, beliefs among others in the Benin metropolis. Development and the location of the case study parts in the Benin metropolis is a defining factor to understand economic activities then, now and a potential overturn with respect to coming years.

Housing is an essential need of man and this great necessity of man has suffered considerable quantitative and qualitative inadequacies. The provision of adequate housing for the urban population is key to sustainable urban development. The strategy of achieving this is Mass housing using indigenous or alternative building materials (Olotuah & Taiwo, 2013).

**Table 1: Population of Benin metropolis in 2006 projected on a 3.0% growth rate to 2020**

Year	Population	Percentage of Growth Rate
2006	1,085,676	3.0%
2007	1,118,246	3.0%
2008	1,151,793	3.0%
2009	1,186,347	3.0%
2010	1,221,938	3.0%
2011	1,258,596	3.0%
2012	1,296,354	3.0%
2013	1,335,245	3.0%
2014	1,375,302	3.0%
2015	1,416,561	3.0%
2016	1,459,058	3.0%
2017	1,502,830	3.0%
2018	1,547,915	3.0%
2019	1,594,352	3.0%
2020	1,642,183	3.0%

Source: Esegbe, J.O. (2011) Unpublished Ph.D Thesis, Ambrose Alli University, Ekpoma.

By this, it is seen that there is an annual 3.0% incensement in growth rate in Edo state.

### III. THE CONCEPT OF LOW COST HOUSING

In the early 1970s, Nigeria mainly found the need for providing adequate housing. This had its bases on the area of shelter, infrastructure, human settlement, citizens' right to adequate housing, affordable housing and understanding other importance of housing advocacy where safety, security of lives, properties and health is assured as given in the Habitat Agenda. United Nations Habitat (2001).

Low cost housing is a practical housing theory that is generally "deemed affordable to low income or medium earners" (Bhatta, 2010). Affordable housing schemes (Low cost housing) should have features as security, safety, affordable and sustainable. With increase in population, the urban Housing Scheme is very important to sustainable development where the government is expected to provide a decent housing system for the poor in the urban. Olotuah & Taiwo (2013) defined sustainable development as the act meeting the needs of the present, without compromising the ability of future generations to meet their own needs.

From research, there are about 15.221 million houses with a population of about 125.4 million in the 1970s. And there are still massive shortage of housing for the low and middle-income earners even with the policies, organization, and regulations put in place in 1960 by the Nigerian Government.

Accordingly to (UNCHS, 1993), The gradual but long lasting effect of the Nation's rapid population growth and rural-urban migration without any action to tackle its associated problems would definitely results to an increase in the gap between housing need and housing supply.

Gichunge (2001) attributed the shortage in the provision of low cost housing to inadequate funding from government, high cost of land in urban areas. Building codes and standards which cover conventional building materials does not cater for appropriate alternative or indigenous building materials. Erguden (2001) identified the major constrains in delivery of low cost housing to include: poor implementation of housing policies, strategies and security of tenure for sustainable development; affordability of land; poor infrastructural development; lack of credit mechanisms for small scale construction and cooperative arrangements.

Inadequate funding for research and pilot schemes, poor utilization of research findings, grossly inadequate utilization of local (alternative) building materials and technology amongst others.

#### IV. THE CONCEPT OF SUSTAINABLE HOUSING

Sustainable Housing is when the planning, design and landscaping produce efficient long-term use of energy, the ecosystem and other resources. The resultant effects are comfort and lower operating costs to the occupants. Shortage of Housing will greatly be affect the urban settlement and makes the urban centres undergo increment in cost of living, overcrowding and abuse of urban resources, services and infrastructure. There can be a balance in the choice of building materials, meeting the requirements of the local environment, improving value of life, passing down heritage and equipping as case study by building innovative structures and/or by renovating existing structures with indigenous materials.

The construction of dwelling houses is critical in environmental management therefore, sustainable housing should be community-based and affordable by low and middle income earners, environmentally friendly with renewable building materials thereby reducing the negative impact that buildings can have on the environment as a result of wrong choice of building materials that are not culturally, socially, economically friendly.

The concept of low-cost housing can be seen through the following ways and this includes:

- Use of Cost-Effective Building Materials: The price of building a house can be greatly decreased by using cost-effective building materials like compressed earth bricks, bamboo, or other locally accessible resources.
- Adopting Innovative Construction Technologies: Innovative construction technologies such as prefabricated or modular construction can help reduce construction time and cost.
- Designing for Efficiency: A cost-effective design is a key element in lowering construction costs. It entails creating homes that are simpler to maintain, utilize less material, and need less labor.
- Cooperation with Government and Non-Governmental Organizations: By gaining access to funds, knowledge, and other resources, collaboration with government and non-governmental organizations can help to lower the cost of housing.
- Microfinance: With this, these programs can give people who cannot afford to build or buy a home access to loans and financing.

Low-cost housing is crucial for a variety of reasons. It assists in meeting the housing needs of low-income families, lowers the likelihood of homelessness, and enhances the general level of living for those residing in subpar housing. Furthermore, affordable housing can promote job creation and local economic development.

#### V. CONCEPT OF ALTERNATIVE BUILDING MATERIALS

Until the introduction of conventional building materials like cement blocks, traditional technique of earth was used in building construction predominantly in the Benin metropolis. Meaning most of the houses before now were mud or sun-dried bricks used as walls. Going beyond a floor through suspended slabs which provided shelter for the occupants was even in existence, as of these buildings dated between 60 to 100 years depending on its level of regular maintenance. The palace wall of His Royal majesty, the Oba of Benin, the first storey building in Benin Kingdom EgedegeN’Okaro – built in 1906 is a very good example in the Benin metropolis. By this, alternative building materials (ABMs) are readily available natural that can best serve the purpose of existing conventional building materials as cements, reinforcement etc. Alternative Building Materials like earth, thatch, jutes and straw, timber, aggregate as sands, gravel, stones / rock, and bamboo when joined together locally with simple tools can be used to build a simple, livable and functional homes.

ABMs are energy efficient, thermal comfortable, aesthetical appealing, renewable and culturally evolving to accommodate people, and at the same time, capable of reduction or elimination of waste, less toxic and affordable.

Iwuagwu (2015) opined indigenous building materials as the affordable method for providing housing the low income earners in the urban settlements. Alternative building materials and technologies is the best solution and best way to promote housing in African architecture. This article will be focused on Earth.



Plate1: EgedegeN’Okaro (1906) - the first storey building in Benin Kingdom.

Source: Author’s Field Work, (2021)

##### A. EARTH

Building has predominantly been done based on materials available during man’s early age. According to Adam & Agib (2001) laterite, was first used by Buchanan in 1807 and it has features as large and extremely variable, proportions of iron, aluminum oxides quartz among other minerals.



By facts, conventional construction technology (CCT) cannot minimize the high demand of people on housing due to cost. Any policies or methodology to address this deficiency will need to consider the particular barriers like poverty, lesser amenities and opportunity linked to the developing societies. The need of crude and alternative construction technology (ACT) is the key and best solution to address these, also it helps to address all other related challenges faced in answering for building sustainability, an housing scheme for majority of the nation's population (USAID, 2009).

The Benin Metropolis as it is known to have a laterite soil profile laterite that is reddish brown in colour that can be easily trenched due to the easy soil and the presence of good rainfall. Earth is good for construction purpose as earlier stated and due to its local availability, the earth was used for construction purpose like the walls of buildings were made of mud paste, fired bricks (terracotta) or sun-dried bricks as such reducing the cost of using conventional building materials like cement, reinforced concrete among others in buildings.

A good example in the Benin metropolis is The palace wall of His Royal majesty, the Oba of Benin, the first storey building in Benin Kingdom (EgedegeN'Okaro) – built in 1906.

## VI. TECHNIQUES TO TACKLING LOW COST HOUSING CHALLENGES IN THE BENIN METROPOLIS

Locally manufactured building materials are used and integrated into building process to checkmate the imbalance between the expensive conventional building materials coupled with depletion of traditional building materials.

Stabilization is the act of improving the properties of soil so as to modify its characteristics. It is the process of adding or/and subtracting to the building material earth so as to attain a better properties suitable for building. Ahianba (2013) opined that the porosity of earth should be reduced to reduce or eliminate the tendency of swelling and shrinking of earth used for building while cohesive attributes (compression) is obtained thus improving resistance to erosion by water. For achieving a better and improved mechanical strength, permeability, and porosity, the following stabilization processes could be used;

- **The Physical Stabilization:** This is changing the (physical) texture of soil by modification of the grain size distribution.
- **The Mechanical Stabilization:** This is the adjusting of comprehensibility, mechanical strength, density, permeability and level of porosity in the earth profile.
- **The Chemical Stabilization:** This is the process of including chemical products at a desirable proportion to the soil, aiding an alternating of the soil's characteristics and binding power causing pozzolanic reaction between the natural resources (clay and lime).

The best way out of this challenge to help low-cost housing is alternative building materials. For instance, the Sandcrete blocks are used as walling (building element) materials for different purposes (for residential, civic, commercial, entertainment, educational and industrial purposes) and by this there is a rising request for sandcrete as building material and as such making the cost of building or acquiring housing difficult for the low and middle income earners.

This makes laterite to be useful and repacked through technology as;

- **The Compressed Earth Bricks (CEB):** This is a traditional building technique that beats sandcrete in area of water resistance and compressive strength. In CEB, the soil, laterite (earth) is slightly moistened, poured into a framed steel press and then pressured (pressed) together either by manual or mechanical process. The blocks are produced in standard or desirable sizes to aid constructing thinner walls, which have a much better.
- **Earth bag:** Earth is a traditional recyclable material mostly used in Africa, also, in South America, Australia, Spain, and Asian countries like India. Earth is one of the oldest and most environmentally beneficial materials still in use today. It is the most widely used and accessible building material in existence (Walker & McGregor, 1996). According to Pollock (1999), earth was used to build the ancient structures, pyramids, and temples. It is possible to prevent or minimize the high energy costs associated with the initial production and construction phase as well as the process of recycling. Earthbag includes the digging out of earth and filled in the sack and this can be arranged layers by layers on top of the foundation slab.
- This method is best used in the military arena for barricading, fencing and/or definition of territories.
- Khalili (1998) came up with the concept of filling clay bags.
- **Compressed Stabilized Laterite (Earth) Bricks (CSLB):** This building material is derived from the naturally by digging the soil to an acceptable depth below the vegetative top soil and using the science of soil profiling to know the proportional amount of chemical additives that can be put in the dug earth to help change the soil properties and improving the soil's engineering properties. These engineering properties include compaction, density, malleability, insulation, and resistance to sound, load bearing capacity that is good for frame structures, load supporting structure and fire safety. When this is done, the laterite can be compressed into frameworks, stored in a neat ventilated space or put in existing crates so as to form desired shapes and sizes. It is different from the Compressed Earth Bricks (CEBs) because of more attention is given to its properties and the introduction of additive.
- **Rammed Earth:** It involves using natural earth materials like earth, chalk, lime and gravel to make walls. The Rammed Earth has a greater structural capacity, subjected to less shrinkage and affordable. The monolithic wall of

rammed earth is done by filling and compacting land between the mould and formwork for filling at a distance of 450 - 600 mm. More recently walls built from earth stabilized with cement can be built with 300mm thickness. The shuttering is struck immediately and then moved along or upwards to form the next section of wall. The coarser soils are sieved prior to compaction to remove larger aggregate (particles). In comparison to mud walls, it which is also suitable for floor construction.

- **Mud wall:** Mud houses have been used for thousands of years in many parts of the world and continue to be built in some regions today, especially in areas with arid or semi-arid climates.

The most common form of earth construction is done by mixing the excavated sub-soil with straw and water until it reaches a sticky but firm consistency. It is a traditional building technique known as cob in England and in Wales, and is most suited to heavy clay soils. It dries to hardness similar to lean concrete, non-toxic and completely recyclable. Doors and windows openings are embedded in the cob (a mixture soil, clay, sand, and straw together to form a mixture that is then used to build walls.) along with their lintels while the layers are building up.

- **Wattle and Daub:** This building material used in walls making. It involve the use of wattle, a woven lattice of wooden straws or strips, daubed with a sticky material made by the combination of moisture soil, sand, clay, and straw. The daub may be mixed by treading either by humans or livestock or by hand. Then applied to the wattle and let to dry and whitewashed most times to increase its resistance to harsh weather like rain.

Alternative building methods involve Eco and Green Developments designed to minimize energy requirements. They use sustainable (social, economic, technological and environmental) materials which have a low environmental impact, protect the natural environment, and promote both physical, mental, health and wellbeing of the occupants. The conventional building methods will throw up buildings that are affordable by the middle and high-income earners of the urban dwellers. In developing countries, the government is averse to lending at rates affordable by the poor and there is generally lack of sufficient orientation with the peoples 'basic needs, hence a disconnect between them (UN-HABITAT. 2006).

**Table 1:** Relationship between use of conventional building materials and low cost housing in the Benin metropolis (Nominal Logistic Regression)  
Significant (Critical t value at 5% = 1.708)

Independent variables	Standardized Coefficient	Standard Error (S.E)	t. value	Exp (β)
Wood (roof)	-1.306	0.563	-2.3197	0.2709
Sandcrete Block (wall)	-1.438	0.39	-3.687	0.2374
Iron door	-0.432	0.238	-1.8151	0.6492
Tiles (floor)	-0.629	0.215	-2.9256	0.5331
Aluminium (window)	-1.927	0.636	-3.0299	0.1456
PVC (ceiling)	-1.271	1.408	-0.9027	0.2806
SandCrete Block (fence)	-0.598	0.14	-4.272	0.5499
Constant	-1.502	0.231	-6.5022	0.2227
<b>Model Statistics</b>				
Model Chi-Square	113.611			
Nagelkerke R <sup>2</sup>	0.599			
Correct Prediction (%)	92.9			

Source: Author’s Field Survey, 2020

From the above table, shows the relationship between conventional building materials and low cost (alternative) housing in the Benin metropolis is given by model chi-square value of 113.611 reveals that the model is valid at the 5% level of significance. While the Nagelkerke R<sup>2</sup> value of 0.599 indicates that 59% of the variation in the cost of buildings is explained by the independent variables. Overall correct prediction variable is high on 92.9 per cent. From the nominal regression analysis conducted, the explanatory variables in the table were significant, the results are hereby discussed.

The relationship between erecting the wall of the building with sandcrete block and low cost housing is

negative (β = -1.438), its odd ratio of 0.2374 implies that respondents likelihood of having a low cost housing when constructing with conventional materials for wall is about 76% less than when this conventional material is not used. In other words, the respondents more times likely to have low cost housing when the walls of the building are not erected with sandcrete block.

The variable wood (roof) has a standard co-efficient value of β = -1.306 and it shows that it is significant and negatively related to low cost housing. Its odds ratio of 0.271 implies that the respondents who roof their buildings with wood are 73% less likely to have low cost housing, than those who do not roof their buildings with conventional

roofing materials. In other words, wood as a roofing material presently contribute significantly to having a non-affordable housing. Hence the need to consider an alternative roofing material in the pursuit for low cost housing.

The odd ratio for the use of iron door is 0.6492 and it's negatively related to low cost housing ( $\beta = -0.432$ ). This indicates that 35% of the respondents who make use of iron for their doors are less likely to have low cost housing than those who do not utilize this material. The reason for this could be attributed to the high cost of these materials.

From the result in Table 4.7, the relationship between tiles (floor) and low cost housing is negative ( $\beta = -0.629$ ) with odd ratio value of 0.533. It implies that 47% of the respondents is less likely to have low cost housing when tiles as a flooring material are utilized.

The variable, aluminium (window) as a conventional building material has a negative relationship with low cost housing with coefficient ( $\beta$ ) value of -1.927, having odd ratio of 0.1456. The result indicates that 85% of the respondents are less likely to have low cost housing when the aluminium window materials are in use.

The odd ratio for the use of PVC as the ceiling material is 0.281 and it is negatively related to low cost housing ( $\beta = -1.271$ ). This indicates that 72% of the respondents are less likely to have low cost housing when the use of PVC as a ceiling material is in place than those who do not make use this material.

From the result in Table 4.7, it was revealed that sandcrete block as material for fence is significant and has a negative relationship with low cost housing ( $\beta = -0.598$ ) with an odd ratio of 0.5499, which implies that 45% of the respondents are less likely to have an affordable fence structure when the sandcrete block material is in use.

In the light of the above discussion, since the computed chi-square  $X^2$  value is greater than the tabulated value, at 0.05 level of significance, we would therefore reject the null hypothesis in favour of the alternate hypothesis and conclude that there is a significant relationship between use of conventional building materials and low cost housing in the Benin metropolis.

It therefore becomes imperative to consider alternate building materials as a panacea to achieve low cost housing. Some of the elements of alternate building materials have been considered as useful components to achieve lower construction cost of housing without compromising quality. To understand the impact of alternate building materials in the provision of affordable housing, the second hypothesis in the study is hereby tested.



Plate2: An example of a compressed stabilized laterite bricks building in Ota, Ogun State Nigeria.

Source: Author's Field Work, (2021)

## VII. INTEGRATION OF AUTOMATION SYSTEM TO HOUSING IN BENIN METROPOLIS

Both "smart homes" and "smart cities" refer to the integration of modern technologies in order to raise the standard of living, promote sustainability, and boost productivity in residential and metropolitan areas in Benin. Despite being separate ideas, they are interconnected and frequently operate in concert to build more intelligent and connected societies.

Modern homes: A smart house is a building with a variety of internet-connected gadgets, sensors, and control systems that let residents automate and remote-manage various elements of their living space. The ease, comfort, energy efficiency, and security of the home are all to be improved by these technologies. Typical characteristics of a smart house include:

- Home automation: With the use of smartphones, voice commands, or pre-programmed schedules, smart homes may automate chores like adjusting lights, managing thermostats, monitoring appliances, and even opening and closing windows.
- Energy Efficiency: Energy-efficient appliances, intelligent lighting, and sophisticated heating and cooling systems are used in smart homes to optimize energy usage, resulting in lower utility costs and a less negative environmental impact.
- Security and surveillance: Smart security systems come with smart cameras, motion detectors, and doorbell cameras that can be viewed remotely. This increases home security by giving owners real-time notifications.
- E-Governance and Citizen Engagement: Digital platforms and e-governance initiatives improve communication between local government officials and citizens, promoting public input and participation in decision-making.
- Public Safety: To improve public safety and disaster management, smart cities use cutting-edge surveillance systems, data analytics, and emergency response systems.



## VIII. RECOMMENDATIONS

Housing is expensive relative to production costs and household income, other goods and other dwellings. This had also been backed by Jaiganesh, Dinesh & Preetha (2016) who revealed that Low Cost Housing involves cost effective techniques, comparing cost and analysis that its process entails.

The introduction of art and technology in use of indigenous building materials can help improve the housing condition provision for the urban poor, accommodating the increase in human and urbanization, causing reduction in cost of building material, and still serving functionality, aesthetics, life span of structure, firmness, and sustainability.

Building homes with laterite materials has a dignified past and a growing acceptance worldwide in contemporary times as an alternative walling material for simple construction of buildings. It is noted for its less fossil fuel-derived energy with a wide range of environmental benefits, including reductions in greenhouse gas emissions. CSLB will be recommended as a walling material in place of sandcrete hollow blocks with consequent reduction on overall building cost.

## IX. CONCLUSION

The first objective is to study the relationship of man and his environment in the Benin metropolis, the low income earners cadre in the Benin metropolis and how sustainable materials are useful in constructions of buildings to help the low income earners. Sustainable resources (materials) are important as it deals with the provision of housing for the middle and low income earners in the Benin metropolis. Earth can be used as a local and alternative building material. Without doubts, the aforementioned is a realistic approach for the future of housing, housing condition as well as educating and serving as templates to other areas or states. By doing this, we can cut down on the production of hazardous trash, safeguard the environment, and utilize less resources while increasing recycling and the rate of building resources reused. The case of rising homelessness among the urban poor is precarious and needs urgent attention. In the time past, traditionally, people evolved different means of housing themselves with locally available natural materials even in the riverine areas. These materials were sustainable, offer protection from danger, inclement weather conditions (rain, wind and storm). They are sufficiently available, easily accessible, energy sufficient, good thermal comfort and renewable in nature.

Both modernism and technology evolved new materials that made the old, traditional local materials to be abandoned instead of being improved upon to suit the current demands. It therefore becomes imperative to research into practical and realistic alternative building materials earth and bamboo (which this study is restricted to) amongst others. The development of indigenous building materials technology is indispensable in meeting the housing needs of the urban poor. The potential of earth building to deliver affordable,

sustainable and durable housing is high. There is a need for the procurement and deployment of domestic technological capacity to produce Indigenous Building Materials (IBM).

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