

Improving Housing Durability in Deprived Settlements of Lagos Megacity through Ingenious Use of Sustainable Indigenous Materials

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Abstract

The challenge of housing delivery in many developing nations is exacerbated by the predominance of deprived settlements, according to recent publications of the United Nations Settlement Programme (UN-Habitat). In Nigeria, 30% of its urban population is currently living in Lagos megacity. The Lagos megacity region plays host to more than 200 officially recognized slum settlements. Going by the United Nations' adopted definition, these settlements harbour households that suffer from lack of access to one or more housing deprivation measures such as durable housing, improved water, improved sanitation, sufficient living space and security of tenure. Nine major slum communities in this fast-growing megacity are presently benefiting from a massive World Bank assisted seven-year upgrading exercise that commenced in 2006. However, there is perplexity because emphasis is ostensibly on infrastructure, particularly roads. There is apparent neglect of the housing durability element. This paper argues that the approach adopted in this exercise is not exhaustive, and could in fact, portend danger for the future. The study discusses how the durability component of housing deprivation can be addressed through actions and policies that encourage ingenious use of indigenous building materials.

Key Words: *Housing deprivation, housing durability, slum upgrading, indigenous materials.*

1.0 INTRODUCTION

Although recent advances in upgrading of slum communities in Lagos is generally perceived to improve the housing deprivation index, there are arguments that integrating housing durability element into the upgrading exercise can substantially increase this rating.

In Nigeria and other parts of the developing world, the UN-Habitat has identified slums and informal settlements as an issue that could precipitate major housing crises [1]. We are currently living in a time in which an occupant's perception of the effectiveness of his or her housing is tied to the materials used and their configurations. Majority of people, particularly in urban slums and rural areas build their own shelter with materials that are classified as non-durable.

The United Nations human settlement programme [2], describes a house as durable if it is built on a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions.

The awareness brought about by the Millennium Development Goals introduced a new perspective to the definition of slums. Households have now become recognized as units of measurement for identification and analysis of slums. A slum household is a household lacking any of the following housing deprivation elements:

- Access to improved water.
- Access to improved sanitation.
- Security of tenure.
- Durability of housing.
- Sufficient living area [3],[4],[5]

The durability of housing stock in the deprived neighborhoods, popularly called slums recognized as quality assessment index.

This paper does not delve into the geography of locations and associated hazards that constitute part of the definition of housing durability. Instead, attention is focused on the dominance of structural elements that are impermanent and inadequate, and therefore, incapable of providing the expected protection to the inhabitants.

The structural context of a house is elementarily understood to be contingent upon three knowledge areas that are not mutually exclusive: material science, fundamental mechanics and new technologies. This study emphasizes the need to improve the existing level of knowledge and versatility of locally available materials in Nigeria.

The historic city of Lagos has been associated with slums ever since the outbreak of bubonic plague in the 1920s. Today, it is established that there are about two hundred distinct slums in the town [4]. Successive governments have addressed the issue of slums by embarking on intervention initiatives like resettlements, slum clearance and so on. The

new global definition of slum households has, however, heightened the anxieties, distrust and dissatisfaction in slum neighborhoods. The challenge posed to housing management in the urban town has consequently become more intense.

A number of slum upgrading activities are currently going on in Lagos. Analysts are, however, expressing doubts about how the outcome of such exercise will improve the rating of households if the housing durability element is not adequately addressed. The argument on durability centers on using building materials to achieve necessary adjustments that will ultimately improve the structural integrity of the housing stock in deprived neighborhoods. The exclusion of this durability component in the on-going slum upgrading initiative is likely to quantitatively increase the risk to life and property. The upgrading projects may therefore end up as white-elephant schemes, if adequate measures are not taken to review the policy.

This paper addresses this gap by aiming to expand the knowledge base that is necessary to promote the application of locally available materials in Nigeria. To a large extent, materials that exhibit improved durability characteristics are identified. The study will be useful to the National government and the Lagos State government in Nigeria. These different levels of government will become sensitized about the new quantitative determinants and measures of housing deprivations. The appropriateness of the current approach to slum-upgrading could therefore be subjected to evaluation. The paper commences with a discussion of how the phenomena of housing deprivation and urbanization contribute to the growth of slums in Lagos. This is followed by an appraisal of slum upgrading activities in Lagos and case studies from other parts of the world. The Strategies for assessing and upgrading the durability of existing housing stock in the city's slum neighborhoods are also examined. Finally, the paper looks at how the historical and local materials available in the Lagos megacity region can be utilized in making the existing housing stock in slum neighborhoods more durable. The implications of all these for sustainable housing provision and slum upgrading are highlighted in the concluding remarks section.

2.0 HOUSING DEPRIVATION AND THE GROWTH OF SLUMS IN THE FACE OF RAPID URBANIZATION OF LAGOS

Recent population projections claim that some 17million inhabitants currently live in Lagos. According to experts, 60-70% of this figure is distributed among the 200 officially recognized slums in the mega city. [6]

Housing provision in these places is characterized by a proliferation of substandard structures that are built of diverse materials. Housing problem in Lagos has been acute by any known standard. An influx of population from rural areas added to the severity of the housing shortage in the city. Urbanization and the shortage of housing among poor residents of the city are therefore seen as factors that aggravated the growth of slum settlements in Lagos.

According to UN-Habitat [7], these settlements in most cases lack decent shelter and basic infrastructure. The consequence is that the inhabitants are subjected to unwholesome living conditions. This experience is worrisome because it has become a world-wide phenomenon. A substantial proportion of the urban population in developing nations is said to be living in inadequate housing conditions. For example, slums such as

kibera in Nairobi, Kenya, are characterized by extremely dense living settlements. There is an average of 250 dwelling units per hectare. These slums are proliferated with structures that are unplanned and built with materials that are of low standard [8]. The way materials are organized, shaped and connected or configured is fundamental to attaining structural quality and durability of dwellings. Most functions of materials are tied to the physical safety and integrity of the building while some other functions are equally tied to operational and aesthetic aspects. According to Falade and Iweka [9], the application of building materials may be seen from three perspectives. These are: materials for basic structure, protective/decorative finishes, and fixtures/fittings. The thrust of this paper is the search for locally available materials that are durable and safe enough for use in upgrading of the basic structure of buildings in deprived neighborhoods.

Materials have always been the cornerstone of structural quality and durability of dwellings. Materials as part of the building envelop play a significant role in ensuring that a building structure is capable of resisting physical attacks.

Fadahunsi [10] observed that most of the inhabitants of slums in Nigeria use materials that were in vogue in the rural areas from where they migrated. This explains the widespread use of mud walls in place of cement/sand blocks; rammed earth floors in place of concrete; unprocessed roof timber and covering instead of steel, processed timber and corrugated iron sheets or aluminum roof materials. The inability of both the central and state government to address this issue of material is problematic in that it fuels the continuous growth of existing slums and formation of new ones.

Different forms of disasters have occurred more rapidly in urban areas where non-durable housing abounds: houses have collapsed; preventable fires have broken-out incessantly; and fatalities have been recorded. Disasters are ultimate latent failures of socio-technical systems which occur after a period of incubation. Peasants in deprived neighborhoods who erect and occupy buildings without the requisite knowledge of structures provide a platform for incubating a collapsed building.

The utility of a building can be enhanced if the component of fire safety is considered. Fire prevention and protection is an issue that can be tackled through the removal of many hazards and reduction of many risks. Providing a structure that is protected from fire hazard is intrinsic to the materials used in housing. Fire safety could be dramatically improved by developing fire-resistant and non-toxic materials for residential buildings [11]. The severity of the risk of exposure to fire in slum neighborhoods can be explained in comparative terms. If in the United States of America with high technology and large amount of durable housing, fire hazards associated with housing accounts for about 3000 deaths and six billion dollar property loss each year, then the situation in Nigeria is certainly pitiable [11].

3.0 APPRAISAL OF SLUM UPGRADING ACTIVITIES IN LAGOS

The government of Lagos State has been carrying out renewal and slum upgrading projects in order to respond to the present needs for some time now. Nine major slum communities in this fast-growing megacity are presently benefiting from a massive World Bank assisted seven-year upgrading exercise that commenced in 2006. One common feature of the slum areas of Lagos is the lack of modern facilities and services. The buildings in the neighborhoods are typically too old and often structurally unsafe for

habitation. The most frequent complaint from residents of such deprived neighborhoods deals with the aspect of physical environment, and basic facilities. Theoretically, there are three broad approaches to slum upgrading:

- Greenfield approach (in-situ upgrading).
- Brownfield approach (total clearance).
- Hybrid approach (partial clearance).

The in-situ upgrading approach requires that as far as possible, the housing units are left where they are, while access routes are formalized and services are brought in.

The insufficiency of electricity and water is a national problem in Nigeria. State and Local governments have shown incapacity in revamping these sectors. The Federal government on whose shoulders lay the enormous responsibility has performed poorly. Local estimates say that more than 60% of Nigerians lack access to clean water, while the figure for electricity is even worse. This probably explains why slum upgrading in Lagos does not focus on the provision of these two facilities. Instead, the preferred alternative is the improvement of external neighborhood environments and facilities that fall short of residents' desired living standards.

Massive attention is being given to the overhaul of roads and lanes in the slums of Lagos. Prominence has been given to the drains and water channels. More areas have now been reserved for greenery and vegetation, while playgrounds have been created, all in a deliberate effort to ensure that pleasant spaces adorn the entire city. The city also witnessed a dramatic clean-up of illegal structures particularly along the roadways and water channels in the deprived neighborhoods. Though this exercise was received with mixed feelings, the impact has led to the restoration of harmonious open spaces and improved transport management.

The approach adopted in Lagos has been largely criticized for focusing only on conventional methods.

4.0 SELECTED CASE STUDIES OF CURRENT BEST PRACTICES IN URBAN SLUM UPGRADING AROUND THE WORLD

Huchzermeyer [8] argues that informal settlement upgrading requires paradigm shift, unconventional solutions and innovation. A number of upgrading projects in different countries have strived to meet these criteria.

4.1 Orangi pilot project (OPP) in Karachi, Pakistan

The Orangi Pilot Project (OPP) in Karachi, Pakistan is arguably the world's most reputed nongovernmental initiative that addressed the sanitation problems in urban slums. Karachi, with a population of 13.0 million (megacity), has functioned as the initial capital city of Pakistan from 1947 when the country was created up to 1960. It is the country's only port city and is reputed to be the hub of industrial and commercial activities. Hence it became an attraction for employment seekers, who migrated from all

over Pakistan. Most of these migrants constitute the 40% of the city's population that are housed in about 650 officially recognized slums (also called katchi abadis in Pakistan) [12],[13],[14].

Orangi is one of Karachi's towns and consists of an agglomeration of slums with a total population of 1.2 million, making it to stand out as the largest slum settlement in Asia. A slum improvement and regularization programme operated by the government since 1973, and funded by the World Bank and the Asian Development Bank (ADB) did not record substantial success.

The OPP came into existence in 1980 with the purpose of overcoming the constraints faced by the government. The OPP is basically about collaboration among local people who took initiative on their own to build basic infrastructure for their community. The objectives of the project were described by Hasan [12], as follows:

- To understand the problems of Orangi and their causes
- To develop solutions that people could manage, finance and build through action research
- To provide people with technical guidance and managerial support to implement the solutions, and in the process,
- To overcome the constraints that governments face in the upgrading of slums.

A major initial step was to embark on social preparation of the community by identifying and dialoguing with local community organizations. Emphasis was on smaller and functional social organizations rather than large-scale ones. Attention was also taken to identifying and appointing local leaders from within the organizations as key development workers. In addition, the projects were packaged to generally rely on available resources and systems. The method adopted was to organize the residents in groups of 20-40 families, who lived along the same lane.

The OPP's philosophy was that if poor people are assisted with skills, knowledge and advice, they can invest their resources and overcome problems. The focus was on sanitation and sewerage problems. Prior to the emergence of OPP, inhabitants of Orangi settlements were already trying to build sewers, but they did not possess the requisite skill for the construction of underground sewer lines. Again, high level community organizations for collective action were non-existent, and the cost of sewerage was prohibitive for unit households. These barriers made the initial efforts and investments to be unsustainable.

The OPP adopted a strategy of developing designs that were simple, affordable and technically implementable locally. Parts were standardized, easy to construct and maintain. Through this approach, the costs were drastically reduced to less than 25%, thus ensuring that the improvements do not lead to increased costs and displacements, which constitute a key challenge in slum upgrading schemes.

The OPP brought about a radical change in Orangi Settlement. It demonstrates that communities can build extremely low cost underground sewers through total reliance on local materials and skills of the urban poor population, provided that they are organized and supported with technical and managerial guidance. A prominent lesson from the OPP is that the urban poor can finance, build, administer, maintain and sustain primary infrastructure.

4.2 Yantai's upgrading projects in China

The UN-Habitat [1], for example, reports that a major urban upgrading project was executed in Yantai, China. Four main types of housing and urban upgrading approaches were identified:

- Urban upgrading, that focuses on improving the physical environments in neighborhoods.
- Upgrading of urban infrastructural facilities and services.
- Neighborhood wide development
- Multi sector urban upgrading.

A major area of innovation in Yantai's upgrading projects is that the external walls of more than 430 residential buildings were renovated. In addition, residential buildings estimated at about 280 were re-roofed. The idea was to increase the protection against the harsh cold weather and reduced energy consumption.

The situation in Yantai is certainly more elaborate than what is currently happening in Lagos, Nigeria. The attempt in Lagos focuses on only one area as against the four that were identified in Yantai. More importantly is that attention is not paid to the external walls and roof of residential buildings. This is a major element in the evaluation of housing deprivation and definition of slum household. The implication is that while the structural quality/durability index is sufficiently addressed in Yantai, it is largely ignored in Lagos. Therefore, despite the huge efforts and resources, the upgrading projects in Lagos may not reduce the quantitative estimate of the total number of slum households in the city. The situation can only be reasonably altered if a method is adopted that incorporates the housing durability component as was done in Yantai.

Lessons from these two case studies, and others like them, can be incorporated into improving the housing durability component of existing residential buildings in dense slum settlements. The case studies provide a range of ideas and measures that have positively influenced the development of low income settlements in the past. They further confirm that if local communities are given the requisite technical and managerial support, they have the ability to plan, construct and sustain their own infrastructure.

The city of Lagos bears semblance to Karachi in many ways. It is a major port city and a former capital city of Nigeria. It has a population in excess of 17.0 million out of which 60 – 70% live in slums. Although the OPP focuses on sewerage and sanitation aspect of housing deprivation, the methodology is relevant to the present study which focuses on the durability and permanency of housing structures in the slums of Lagos

megacity.

The durability problems identified are as follows:

- Dilapidated structures, resulting from use of substandard materials for main building components of foundation, walls and roof.
- Non-compliance with building regulations.
- Manifestation of faulty construction, due to technical ignorance.

The methodology used in the OPP can be modified and applied to improve the housing units in slum areas that are currently being upgraded in Lagos. For example, community organizations should be established to champion the assessment of unit buildings and assist the owners with managerial functions, while the building owners fund the exercise. These community organizations should establish links with authorized research agencies, for provision of technical support on standardized and tested materials that are locally available. Furthermore, such community organizations should nominate permanent residents, who are well known and trusted, for trainings in skills necessary for the fixing of materials, which will ultimately be available to carry out the works, and be supervised by a professional serving as an agent of the community organization.

5.0 STRATEGIES FOR ASSESSING AND UPGRADING THE DURABILITY OF EXISTING HOUSING STOCK IN SLUM NEIGHBORHOODS

The housing stock in the slums of Lagos is characterized by relatively simple structures. The materials used in erecting them appear to have evolved more from practice and experience than purposeful attempt to improve the structural integrity of houses. Some of the natural materials adapted from the villages may be classified as durable, yet lack of knowledge of the important durability issues of building systems by the users could make the housing stock fall into the category of non-durable housing. Dwellers in this type of housing stock may therefore not enjoy adequate protection against weather and climate due to the overall state of their dwellings [2].

The slums in Lagos are bereft with buildings that are substantially in a state of disrepair, due to age, low standards and structural inadequacies. According to UN-Habitat [7] these levels of disrepair constitute a grave danger for people, because structurally unsafe buildings could collapse at any time.

The ages of buildings that make up the housing stock become a critical variable in establishing their durability status from the perspective of service life consideration. The service life of housing varies, based on materials that are used for walls, floor and roof systems. The variability in the local contents and composition of most materials has also been identified as a reason why service life of buildings changes from country to country, and even across locations in the same country [15]. Hideki [16], for example, pegs the average service life in Japan at slightly more than thirty years. This estimate is far shorter than what obtains in Europe and America. In all of these countries, the use of standards has been a great factor in quality control of materials used in housing development. Established statutory authorities are usually relied upon to provide such standards and codes which building materials must satisfy in order to meet housing durability

requirements. The United Nations Settlement Programme [2] recommends that durable housing structures are those in which the floor, walls and roof are erected from strong building materials.

In order to be able to extend the service life of several derelict houses that adorn the slum neighborhoods in Lagos, two relevant steps should be understood and followed:

- The floors, roof and wall elements that constitute the skeleton for upgrading intervention must be identified.
- The dominant materials used in the skeleton, which can be modified or reconstructed in response to the sustainable upgrading philosophy must be clearly identified and isolated.

These two steps that clearly distinguish the skeleton imply that any non-durable building can be renovated without much waste. As seen from the example of the case studies, a community participation approach can be adopted.

6.0 THE PLACE OF HISTORICAL AND LOCAL MATERIALS IN ACHIEVING DURABLE HOUSING IN LAGOS MEGACITY

As noted above, community organizations are to act on behalf of their members in maintaining a liaison with authorized agencies which are to assume responsibility for technical information on locally available materials. In Nigeria, people exhibit ignorance of existing alternative building materials around them. Building constructors and users are also demanding for more reliable and more durable building materials. One typical constraint which hinders wide adoption of local building materials is the lack of standard application for such materials. Madedor [17] claims that as recent as October 1991, there were no statutory standards for building materials in existence such as sand crete blocks, soil blocks, fired clay bricks, pozzolana cement, fiber cement roofing sheets and aluminum roofing sheets.

This scenario has, however, improved marginally with the emergence of the Nigerian National Building Code in 2006 [18]. Section Ten of the Code is devoted to materials and specification requirements. The Building Code has nevertheless, been criticized as an imitation or adaptation of European Code. This situation is not peculiar to Nigeria. Cramer [15] for instance, has argued that prior to 1830; housing in the United States of America (USA) was an adaptation of European process. Notwithstanding this, the USA still went ahead to utilize the abundance of timber by developing housing that is dominated by wood materials.

A number of innovations are now taking place in Nigeria, which generally seek to harness abundant local materials that can improve the durability of buildings accommodating slum households. The challenge is in determining which locally available materials can be considered durable in an urban setting like Lagos. Another issue is on materials that will ultimately become relevant as a means of upgrading the skeleton of non-durable homes, to make them durable. The community organizations will form the nexus for actions that will tackle these barriers.

The skeleton in this sense means the identified structural framework that is supposed to be durable but remains non-durable, making the building to suffer deprivation. In other words, a critical issue is to identify the basic structure (or skeleton) and separate it from infill. The infill refers to floor plans, interior partitions and finishing which the occupants can modify or reconstruct without jeopardizing the structural sanctity of the building. The characteristics of the infill and whatever role it plays are seen as not affecting the structural durability of the house.

Hence, in the context of this paper, attention is focused on issues related to wall system and roof system in existing housing stock that require renewals for long-term durability. In order to discover materials that will be appropriate to solve the problem of basic structure in slum households, it is important to take a cue from the way building materials are classified. Building materials are generally grouped into three categories. They can be seen as:

- Basic structure (walls and roof)
- Protective and decorative finishes
- Fixtures and fittings

Emphasis of this study is on materials for basic structure, as a way to change the rating of dwellings from non-durable to durable. The current slum upgrading initiative of Government is facing criticism for omitting this aspect, which according to Aribisala [19] costs less than one-fifth of the overall cost of a dwelling, the remaining four-fifths being spent on finishing, fixtures and fittings.

Apart from abundance and cheapness, there are many other important parameters to be considered in a material before it can be regarded as a viable alternative to conventional building materials. The most important of these are strength, durability, water absorption, shape, size and thermal conductivity. Some materials for basic structure that have been tested are discussed below:

6.1 Foundation and Walling Material

Stone crete blocks and burnt clay bricks are alternatives to sand Crete blocks that can be used both for foundations and walling. However, due to high water table in Lagos, clay burnt bricks cannot be used as foundation materials.

A proposal by Okusanya [20] for the introduction of interlocking sand blocks for walls was intended to reduce the use of cement in housing construction. Also, Salau and Sharu [21] studied how bamboo strips influence the strength of laterized concrete columns supporting the structure of a house. The results showed that the bamboo reinforcement did not contribute to the load carrying capacity of the laterized concrete columns due to its low modulus of elasticity and shear capacity. Bamboo strips are thus not appropriate as reinforcement in laterized concrete columns.

Mud can be used as a walling material and is said to account for more than 95% of building in the rural areas [22], [23]. Mud is cheap and available everywhere, but cannot be recommended because of low compressive strength and durability. Also, un-stabilized, sun-dried (Adobe) bricks possess the same characteristics. Hence, walls, particularly external walls built of this material need constant maintenance and protection against the

rain. This is not a good option in Lagos where it rains for ten months every year.

6.2 Roofing materials

Roofing tiles produced from an admixture of cement and coconut fibre have emerged as alternative to iron roofing sheets and have equally been found to be economical and affordable by all. Coconut fibre is abundant in the coastal areas like Lagos, Badagry, Calabar and Bonny. The Nigerian Building and Road Research Institute (NBRI) has produced and used these tiles in some model houses at Yankatsari village in Kano State, Northern Nigeria, and Drivers' office at its headquarters in Lagos. The products are strong, tough and durable. Clay roofing tiles are equally durable, with pleasing appearance and good properties, almost maintenance-free. The use of roofing clay tiles as an alternative to other conventional roofing materials such as galvanized corrugated iron sheets, aluminum sheets, and asbestos sheets in the tropics has many advantages. They are known to be more durable and provide better thermal and acoustic properties. They are particularly suitable in coastal areas like Lagos where the conventional materials are easily corroded away. However they are comparatively heavier than other roofing materials and therefore need stronger rafters and purlins.

7.0 CONCLUSION

This paper examined the argument that the official designation of slums cannot be substantially altered if the durability component of housing deprivation is not addressed in the on-going upgrading activities in Lagos megacity. The focus is that locally available building materials can be organized, shaped and connected to improve the durability of slum dwellings in Nigeria. Disasters associated with slums in Lagos, such as incessant fire outbreak and building collapse occur because peasants living in non-durable building envelopes do not understand that achieving housing durability is intrinsic to the materials used. Policy thrust in this direction requires a paradigm shift and innovation. Relying on the experiences in Yantai, and Karachi, the slum upgrading exercise in Lagos can integrate the basic structure of buildings such as walls and roof. To achieve this, the locally available materials should be used to modify or reconstruct the building elements.

The government should establish policies that motivate residents to belong to community organizations in their neighborhood. The policy should also facilitate a liaison of community organizations with research agencies and other identified stakeholders. Through this approach, alternative building materials in existence will be identified and standardized for use. The involvement of community organizations will provide opportunities for skill acquisition and sustainability. Above all, poor residents shall be favourably disposed to contribute towards the funding, and not relying on government as is presently the case. This method was successfully used in Karachi. The long term benefit will extend to other sectors, such as health, education and economic empowerment in Nigeria.

8.0 REFERENCES

- [1] UN-Habitat, "Housing and Urban Upgrading in Yantai, China", United Nations, Nairobi, 2008.
- [2] UN-Habitat, "United Nations Human Settlement Programme: The Challenge of Slums" United Nations, Nairobi, 2003.

- [3] UN-Habitat, “Guide to Monitoring Target 11: Improving the Lives of 100 Million Slum Dwellers United Nations Settlement Programme, Nairobi, 2003.
- [4] UN-Habitat, “State of the World’s Cities Report 2008/2009: Harmonious Cities”, 2009.
- [5] S. Chandrasekhar and A. Mukhopadhyay, “Multidimensions of Urban Poverty: Evidence from India”, Indira Gandhi Institute of Development Research, Mumbai, 2007.
- [6] Federal Republic of Nigeria, “Presidential committee on Redevelopment of Lagos Megacity”, Abuja, 2006.
- [7] UN-Habitat, “Housing for All: The Challenges of Affordability, Accessibility and Sustainability”, Nairobi, 2008.
- [8] Huchzermeyer, M. 2004. “Prospects for a Policy on Informal Settlements in South Africa: An International Reflection”. Paper presented at the Institute of Housing Conference: “Housing in the Next Decade: Quo Vadis Housing” Cape Town. October 3 – 6.
- [9] F.A. Falade and A.C.O. Iweka “The National Building Code as it Relates to Material Specifications and Quality Control”, Paper presented at the Biennial General Conference, Nigeria Institute of Architects at Shehu Musa Yar, Adua Centre, Abuja. 2007.
- [10] S. O. Fadahunsi, “Improved Housing for Rural Population: Ways and Means of Achieving it”. Paper presented at the national seminar on rural housing development at Agura Hotel, Abuja, October 14 – 15, 1987.
- [12] A. Hasan “Orangi Pilot Project: The Work Beyond Orangi and the Mapping of Informal Settlements and Infrastructure” Environment and Urbanization Vol. 18, No. 2, 2006, pp. 451–480.
- [13] M. H. Ali, “Orangi Pilot Project. Paper presented at the Kitakyushu Seminar on Public Participation, Japan, January 20 – 21, 2004.
- [14] Centre on Housing Rights and Evictions, “Slum-Upgrading General Introduction and Compilation of Case Studies” Geneva, Switzerland, 2005.
- [15] S. M.Cramer, “Structural Design and Materials: Research Needed to Reinvent Housing in the United States”, Proceedings of the NSF Housing Research Agenda Workshop, Feb 12-14, in Orlando Florida. Eds. Syal, M., Hastak, M., and Mullens, M. Vol. 2, pp Focus Group -2, 2004.
- [16] K. Hideki, “Realization of Durable Housing Apartment Buildings by the Open Building Approach”. www.nilim.go.jp/english/report/annual/annual2002/027.pdf. Assessed August 8, 2009.
- [17] A. O. Madedor “Formulation of Standards for Locally Developed Building Materials”, Paper presented at the Cida International Conference on Affordable Housing for All in Developing Countries at Nike Lake Resort Hotel, Enugu. October 28 – November 1, 1991.
- [18] Federal Republic of Nigeria, “Nigerian National Building Code”, 2006.
- [19] O. A. Aribisala, “Sourcing of Local Raw Materials and Investment Opportunity in the Building/Construction Industrial Sector” Published Proceedings of the National Workshop held at Central Hotel, Kano, October 16 – 20, 1989, pp 23 – 37.
- [20] O.O. Okusanya (1991). Towards An Intermediate Building Technology: Materials And Construction Methods. Construction Journal of the Federation of Building and Civil Engineering Contractors in Nigeria, Vol.8, No. 1, January – March, pp 3 – 12 .
- [21] M.A. Salau and A.S. Sharu (2004). Behaviour of Laterized Concrete Columns Reinforced with Bamboo Strips. West Indian Journal of Engineering, Vol 27, No. 1, pp 38 – 49.
- [22] A. A. Hussein, (1985). The Reliability of Clay Products in Housing Development. Paper presented at a seminar on Clay Bricks and Blocks, Zaria, National Building and

Road Research Institute.

[23] E.O. Olabiran, E.O. Asaolu, & C.R. Etuka, Innovative Local Materials for Use in Housing. Published Proceedings Of The National Workshop Held At Central Hotel Kano, October 16 – 20, Pp 149 – 164 .