ABSTRACT

We are naturally blessed with nature’s endowment such as crude oil, agricultural products, mineral resources and availability of indigenous local materials abound in our various communities. Earlier in the days, accommodations were never an issue as man could make or create a resting place for him and his family with limited resources. He collects local materials like timber, stone, mud thatch, bush rope, etc with one or two assistant and able to put together a house to accommodate his activities. The paper tries to explain sustainable development as that which harnesses the needs of the present local materials without compromising the ability of the future generations cannot therefore be under estimated. This review is meant to encourage sub-Saharan African, researcher, government and private entities, construction team, clients and contractors committed efforts though research and development into these untapped building materials and highlighting other contributions to environmental designs in order to bail out of housing problems.

Key words: Harness, local/indigenous materials, sustainable development, resources, housing.

INTRODUCTION

Present concerns for sustainable development have led to a revival and harnessing of traditional building practices using natural or recycled resources (Graham, 2001). He also mentioned that there is a perception that buildings constructed from such materials are environmentally benign. This perception is questionable, as often no evaluation is undertaken to assess the associated environmental impacts. According to Paul (2006), the interactions between the human race and its environment are becoming more intensive, thereby exerting increasing heavy pressure on their natural context. Sustainable/green building can be defined as the facilities which are the outcome of sustainable construction for the purpose of promoting occupants health, resource efficiency, minimizing the negative impacts of the built environment on the natural ecosystem (Kibert, 2004). The Microsoft Encarta (2007) defines harness as the gain control of something and put for some purpose. While sustainable development as defined by the World Commission on Environment and Development (1987), is ability of the future generations to meet their own needs from old to new (Chinwe 2007). By supporting this, it was explained that a balance can be formed between how much development we are able to make while still presenting the environment to the extent that it can sustain an acceptable quality of life in the future.

In recent years, environmental degradation has become a matter of concern for humanity. Also, Paul (2006) said that architects should now more than ever before, be more sensitized on issues such as energy consumption, design concepts and the use of environmentally friendly materials that reduce environmental impacts. As Farmer (1996) observed, designers response to these new demands fall into the following categories:

a. High technology response such as the use of modern technology and materials that protect and conserve energy, recycling of waste materials in buildings, the design and production of intelligent building that respond appropriately to environmental factors and forces or;

b. The use of environmentally friendly degradable construction materials such as earth, thatch, turf, stone and the application of traditional and vernacular methods which are in consonance with these materials or the use of organic forms and buildings with organic appearances that stimulate natural space and forms. More of the expectations of on ability of the local/indigenous materials will be discussed in due course.

STATEMENT OF PROBLEM

Most of the building construction works around are costlier than necessary with some environmental hazards. However, there is the need to imbibe some cultural and traditional practices by harnessing use of indigenous and local materials to achieve a sustainable development in the 21st century, of which the country is abundantly blessed with as shown in Table 1 below.
Table 1 shows the availability of Raw Materials in Nigeria

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>States predominately found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granite</td>
<td>Plateau, Ondo, Ado Ekiti, Bauchi, Abia and Ebonyi</td>
</tr>
<tr>
<td>Limestone</td>
<td>Anambra, Cross Rivers, Benue, Imo, and Bendel</td>
</tr>
<tr>
<td>Marble</td>
<td>Kwara, Bendel, Benue, Plateau and Kaduna</td>
</tr>
<tr>
<td>Chalk</td>
<td>Nassarawa, Bauchi and Gombe</td>
</tr>
<tr>
<td>Laterite</td>
<td>All States</td>
</tr>
<tr>
<td>Clay</td>
<td>Cross Rivers, Ondo, Oyo, Sokoto, Gombe, Kano, Niger, Imo and</td>
</tr>
<tr>
<td>Natural fibre</td>
<td>All States</td>
</tr>
<tr>
<td>Bamboo</td>
<td>Eastern Nigeria</td>
</tr>
<tr>
<td>Timber</td>
<td>Eastern and Western Nigeria</td>
</tr>
</tbody>
</table>

Source: Kogbe, 1989; Okereke 2003

AIM
To promote and harness indigenous building materials in the construction industry of the sub-Sahara Africa to meet up with global challenges in the 21st century.

OBJECTIVES
- To rediscover relevant indigenous building materials and their appropriate applications in building construction
- To analyse some criteria on how to obtain and effectively use other materials to suit current situations such as composite materials.
- A thorough synthesis on how to minimize inputs, cost and resources but to maximize output, efficiency and satisfaction with the use of IBM.

METHODOLOGY
The research method employed reviews of few out of the numerous indigenous building materials used in building construction within our immediate environment and how to harness them efficiently and effectively.

THE APPROPRIATE APPLICATIONS OF IBM (Indigenous Building Materials)
Earth: In 2007, Sarah captured the use of earth as a building materials dated back to ancient times. Today, it is still a major building material not only among the rural areas but also in urban centres. Earth/soils is economical, minimal processing, non-polluting, and good thermal comfort. However, the reports of Guillard et al. (1995), Olotuah (2000) and Opoko (2003) had shown that there is ongoing research in the country into how earth can be improved.

Laterite: As pointed out by Arayela (2000), laterite bricks contributed increasingly to housing stock in Nigeria. Despite the fact that it has been used in numerous places throughout the world since pre-historic times it seems that today, this material is in need of some re-evaluation. Such harnessing includes interlocking, additive e.g. pozolana and stabilization. Stabilized laterite bricks houses are meant to provide access to decent and affordable accommodation. Through the use of locally source building materials and technologies as well sensitise policy makers and the public on the viability and feasibility of these materials and train skilled people in the use of this unique technology. Other methods of stability bricks are; Stabilization by reinforcement, cement water proofing, and chemical.

Lime: According to Lucien (1980), apart from wood, stone and brick, lime has been the best know and widely used material since ancient times. Lime which in former times was the only binder used in building, has been gradually supplanted by cement. Lime is usually employed as a wash, which can be used in making up water-repellent washes and mortar to protect roofs and walls, or for the manufacture of particle board or chip board from agricultural waste as a composite materials.

Local Composite materials: From centuries, mankind has used the natural fibre for various types of application including building materials. In most of the countries, users have explored the possibilities of using the natural fibre from different plants, which includes bagasse, cereal straw, corn stalk, cotton stalk, kenaf, rice husk/rice straw etc. Most of the fibre were used mainly for the production of hard board and particle board. Emergence of polymers in the beginning of the 19th century has provided the researcher the new dimensions to use the natural fibre in more diversified fields. At the same time the necessity has also increased the interest in synthetic fibre like glass fibre which due to its superior dimensional and other properties seems to be gaining popularity and slowly replacing the natural fibre in different applications. According to Wikipedia, (2014), composite materials, also called composition materials or shortened to composites are materials made from two or more constituent materials with significantly different physical
or chemical property, that when combined produce a material with characteristics different from individual component. Natural fibre composites in Nigeria have proved that it is a versatile material for application in general construction. The need of the hour is to use these naturally available materials in order to save the environment and energy consumption which is required in the processing of manmade synthetic composites (Adedeji, 2011). Amit and Jha, (2011) revealed that it is possible to produce cement-bonded particle boards using palm kernel fibre with Portland cement binder after hot water treatment. Boards produced could be used as alternative to sandcrete blocks and sawn timber for construction works and furniture. Accelerated dry masonry system using composite materials offer other several advantages such as design flexibility, light-weight, environment friendly and solution to space shortage. Thus, the provided information shows how to reduce cost of housing projects in order to make housing provision affordable and sustainable.

Table 2 shows the availability of natural fibre composite and its possible applications in building materials/construction

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
<th>Application in building material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice Husk</td>
<td>Rice mills</td>
<td>As fuel, for manufacturing building materials and products for production of rice husk binder, fibrous building panels, bricks, acid proof cement</td>
</tr>
<tr>
<td>Banana leaves/stalk</td>
<td>Banana plants</td>
<td>In the manufacture of building boards, fire resistance fibre board</td>
</tr>
<tr>
<td>Coconut husk</td>
<td>Coir fibre industry</td>
<td>In the manufacture of building boards, roofing sheets, insulation boards, building panels, as a lightweight aggregate, coir fibre reinforced composite, cement board, geo-textile, rubberized coir</td>
</tr>
<tr>
<td>Groundnut shell</td>
<td>Groundnut oil mills</td>
<td>In the manufacture of buildings panels, building blocks, for making chip boards, roofing sheets, particle boards</td>
</tr>
<tr>
<td>Jute fibre</td>
<td>Jute Industry</td>
<td>For making chip boards, roofing sheets, door shutters</td>
</tr>
<tr>
<td>Rice/wheat straw</td>
<td>Agricultural farm</td>
<td>Manufacture of roofing units and walls panels/boards</td>
</tr>
<tr>
<td>Saw mill waste</td>
<td>Saw mills/wood</td>
<td>Manufacture of cement bonded wood chips, blocks, particle boards, insulation boards, briquettes</td>
</tr>
<tr>
<td>Sisal fibres</td>
<td>Sisal plantation</td>
<td>For plastering of walls and for making roofing sheets, composite board with rice husk, cement roofing sheet, roofing tiles, manufacturing of paper and pulp</td>
</tr>
<tr>
<td>Cotton stalk</td>
<td>Cotton plantation</td>
<td>Fibre boards, panel, door shutters, roofing sheets, autoclaved cement composite, paper, plastering of walls</td>
</tr>
</tbody>
</table>

Source: Amit and Jha, (2011)

Stone; Adedeji (2000) stated that Nigeria is blessed with many types of stones that are good building materials. Stone is locally sourced with natural interlocking feature and other good properties and characteristics, durable enough for structures and super structures which can be used as walling or flooring materials.

Bamboo/Timber; is a woody perennial evergreen plant with highly attractive natural resources compared to forest hardwoods. Bamboo which occurs mostly in sub-scheme Africa have large potentials in the building poles, light budget tough, used as fences, a bridges and scaffolds more cabinet ward robes, particular, door and windows frames, furniture etc. Bamboo should be treated, and kept fairly dry. Recently, research findings discussed that bamboo can be used to reinforce concrete in place of steel for structural works. Timber is found in large quantities in southern equatorial forest of Nigeria. Local timbers can be improved upon to make ply woods, wood cement boards, fiber board, hard boards, etc.

Brick/clay/mud; Clay and mud have their different meanings but have been used interchangeably. Clay and mud brick products have been widely used for construction right from early civilization periods.

Adedeji (2000) was of the view that archaeological records and exhibits showed some standing ancient buildings indisputably proved that clay are reliable in construction. Apart from this sophisticated factory bricks, bricks can also be made manually and burnt to achieve desired strength. Brick walls and floors and roofs are more suitable to climate; give more thermal comfort when compared with concrete. It also has changes maintenance cost and maintains a traditional character especially when stabilized with other materials. By harnessing the clay bricks, they can be plaster, stabilised, rendered and painted for aesthetics

PROBLEMS ASSOCIATED WITH LOCAL MATERIALS
According to SERGEI (2013), on the other hand, houses built with indigenous building materials (IBM) are easily attracted by rodents and pest. Another one is low strength of the houses below the expectations of the
users. The maintenance of houses built with local materials is higher in order to keeps the building in good use condition. Intensive labour work and additional tray is also pertinent as the men at construction sites are not familiar with some of them. The quality of output of any productive process is a function of the technology adopted and the availability of national or international accepted standards. Though standards are identified to be the basic framework of promoting quality production, there are hardly any available for indigenous building materials (UNCHS, 1985). The lack of patronage of indigenous products implies that the market will not be viable. This is largely due to consumer bias and the general feeling that indigenous materials in some instances are unpopular due to wrong application in construction. Sanusi (1993) identified four problems of using indigenous building materials as follows;

1. That the full range of what constitutes indigenous building intend is not know.
2. The lack of basis for cost comparism between local material and convectional materials.
3. Technical limitation with the use of these materials and,
4. Legal problems where these materials are not considered useable by planning authorities and when used are considered as temporary structures.

However, the areas of potential benefit of incorporating indigenous building materials are;

a) Providing affordable housing for the citizenry though, the general bias is that it will only be suitable for low income cadre of the society.
b) Reducing costs of construction since materials found locally will be used thus eliminating costs associated with manufactured products and transporting.
c) The development and propagation of indigenous technology and the provision of employment. These will invariably contribute to the economic growth of the nation.
d) Produce some of research for both students and professional of construction discipline.

RECOMMENDATIONS

On the basis of all the above, the following recommendations are made:

- According to Humphrey 2007, government should encourage the use of locally available materials for building houses so as to promote their culture and attract tourists for economic growth.
- Real estate developers and government should encourage the use of local materials in order to reduce cost of constructing houses and produce affordable housing.
- People living in relatively hot weather like sub-Sahara Africa to adopt the use of local materials in order to reduce the effect of heat from the hot weather on their health and reduce energy required to fan or air condition their rooms for comfort.
- Researcher should consider reinforcement to increase strength durability of local materials with industrial and agricultural wastes.
- Also, more investigations and findings should come up with better processes and methods to reduce labour intensiveness with their use.

CONCLUSION

The purpose of this study was to review the benefits and associated problems of houses constructed with local material in the sub-Sahara Africa. The study found promotion of cultural heritage, abundance of locally made materials being affordable and cheap. However, low strength, frequent maintenance, intensive labour work, wearing and erosion of materials are the major problems associated with locally available materials in Nigeria Adogbo & Kolo (2005). It is postulated that local material would in future of construction industry in Nigeria offer solutions to our present housing problems.
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