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ARTISANAL MATERIALS FOR SUSTAINABLE CONSTRUCTION IN DEVELOPING COUNTRIES

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Sustainable construction is a major challenge to developing countries more so when it comes to the use of artisanal materials in the construction process. This review identifies and examines the challenges facing developing countries in this respect: environmental degradation, poverty, informal settlements, inappropriate regulatory mechanism, inappropriate technology, and neglect in research and development debates. It notes that research and development at local level is necessary for addressing the challenges posed by the use of artisanal materials from sustainable development point of view. Above all, it recommends research into the area of artisanal materials and sustainable construction.

Keywords: building regulation, developing countries, intermediate technology, standardization, technology transfer.

INTRODUCTION

This paper intends to justify the need to undertake research on artisanal material production for purposes of mainstreaming sustainable development in the construction industry of developing countries. The paper defines artisanal materials as well as sustainable construction in a developing country context.

The paper poses questions about the challenges to sustainable construction in developing countries and whether artisanal materials can address these challenges. The aim is to spark debate and stimulate research undertakings in this grey area.

One of the pertinent challenges to sustainable construction in developing countries remains sheer lack of knowledge about it or what it may entail for developing countries. As noted by du Plessis (1999, 2007), the thinking in sustainable construction is dominated by issues to do with developed countries and that are in fact irrelevant to the developing country situation.

The paper is an exploratory work that seeks to persuade that research into the case of artisanal materials is a significant way of addressing the issue of sustainable construction in the developing countries. The paper is merely a review of the situation in order to propose a certain research agenda. For that matter, it does not apply any case study or empirical analysis.

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CONCEPTS AND DEFINITIONS

Artisanal materials

The term artisanal is an adjective of the word 'artisan' and simply refers to any thing associated with artisans. The English dictionary meaning of an artisan is of a person who applies manual skills to do work. See the following definitions for example:

- 'Somebody who is skilled at a craft', Bloomsbury (2005).
- 'Skilled manual worker or craftsman', Oxford (1993).
- 'A worker who has special training in a manual skill', Collin (2006).
- 'A skilled workman; craftsman', Collins (2005).
- 'One who is employed in any of the industrial arts; a mechanic, handicrafts man, artificer', Oxford (1971).

These definitions follow the traditional concept of an artisan as an industrial craftsman; who is skilled, trained and specialized in a particular trade. In the pre-industrial revolution era, artisans consisted of guilded workers who were trained through apprenticeship (Eisenberg 1991). In the construction sector, artisans included painters, plasterers, masons, roofers, joiners, carpenters, et cetera (Gould 1993). To date, such artisans still exist in the construction sector whether in developing or developed countries.

Gore (2004) considers the term craft as any human transformation of raw material into another object. This transformation, he notes, can happen:

- By hand.
- With the assistance of machine tools.
- Through the agency of automated manufacturing equipment.

Artisans are the category of workers who undertake this transformation largely by hand or to some extent with the assistance of machine tools.

Artisanal materials are, therefore those human rather than machine made materials used in the building of structural elements in the construction sector. Examples of artisanal materials may include: manually cut dimension stone, manually broken ballast, manually fetched sand, manually made bricks/blocks etc. Artisanal materials may be considered the antinomy of industrial materials as conceptualized in Turner and Turner (1972), i.e. hand crafted and individually made materials that imply:

- Lack of standardization of the final product (production skills and sites are varied, sporadic and may be irregular).
- Lack of concentration of production and marketing (small scale and sporadic/fragmented).
- Lack of mechanization or automation (labour intensive).

In these characteristics lie the challenges and opportunities for artisanal materials in the urban context where demand for construction products remains high due to urbanisation processes and the rate of use of materials is faster thereby favouring industrial production.

This concept of artisanal materials may but does not necessarily include traditional materials. The latter are construction materials that were used by local communities prior to foreign/colonial intervention. For example, in Kenya, makuti (palm fronds) roofing was used in the coastal areas while grass thatch was predominant in the hinterland. Non-traditional materials on the other hand are materials whose usages were introduced through colonial intervention even if some of them were locally available; these include cement, bricks, dimension stone, sawn timber, sand etc. the materials could have been locally available but the technology for exploiting them had not been introduced. Secondly, they may not have been fully integrated into the local construction tradition.

The dichotomy of industrial/artisanal materials is technology/process based while that of traditional/non-traditional is temporal based i.e. past and present or ancient or modern. On the whole, artisanal materials may be either traditional or non-traditional depending on whether they were used by the society in the past or whether they are recent additions from foreign cultures and practices.

Reasons why artisanal producers tend to thrive in developing countries include:

- Some natural resource materials do not exist in substantial quantities to warrant large-scale exploitation.
- The construction that takes place at localized levels is largely undertaken by individual (other than corporate) developers who rely on materials from non-corporate sources usually identified or attained through personal relations.
- It is easier for artisanal producers to reach developers even in remote areas.
- Construction industry in these countries is mainly a preserve of artisan labour force that is able to form linkage with artisanal sources of materials.
- Artisanal producers do not use heavy equipment and hence can move from place to place in search of material which they can accumulate into adequate quantities.
- Artisanal producers are more distributed and hence their impact on the environment is much less visible hence tolerable.
- Artisanal producers can viably supply even very small developers with low demand that is highly fragmented.

It is for the above reasons that artisanal producers dominate production and supply of materials like: sand, dimension stone, slab stone, bricks, and ballast. Sand for example is universally used as small aggregates in the composition of concrete in Kenya; however, the production and distribution of sand is entirely left to the work of artisans.

Sustainable construction

Sustainable construction is perceived as a concept that has been coined for the purpose of mainstreaming the principles and practice of sustainable development in the construction industry (Hill and Bowen 1997; Miyatake 1996). Construction is related to sustainable development to the extent that it affects the environment, economy and society; the three form the key aspects of sustainable development. In all cases, the effect of construction can either be positive or negative or both. In the sphere of environment, for example, Horvath (2004) sees construction as one of the largest users of energy, material resources and water, and also as a formidable polluter. These are

negative aspects but the positive ones include the fact that construction improves the human living or working environment to habitable conditions.

Since sustainable construction is based on environmental, economic and social factors that differ globally, it may not be easy to define the term. But du Plessis (2002), who had the mandate to do so, have given a definition that is closer to the developing country situation. The authors define sustainable construction as 'a holistic process aiming to restore and maintain harmony between the natural and the built environments and create settlements that affirm human dignity and encourage economic equity' (du Plessis 2002: 8). This definition covers all the three aspects of sustainable development: environment (natural and built), economic and social. The social aspect may not be overtly explicit in the semantics but is well represented in the concepts of dignity and equity. Dignity implies sustainable construction has to ensure socially acceptable living environments while equity implies equitable use and distribution of resources generated or consumed in the process of construction. This definition also clearly captures the aspect of informal settlements, which is the main challenge for sustainable construction in developing countries.

Scholars conceptualize sustainable construction in a cradle to grave imagery. This life cycle approach can be divided into three distinct phases: production phase, use phase and decommissioning phase (Rohracher 2001; Rwelamila *et al.* 2000).

Developing countries

Crump (1991) defines developing countries simply as countries that do not have sophisticated industrial bases to their national economies; their economies are characterized by abundant, cheap, unskilled labour and scarcity of capital for investment. It is these two key factors – abundant labour and scarce capital – that lends these countries' production set-ups to artisanal production; where production is confined to hand or tools operations as already pointed out under artisanal materials production.

Apart from the low industrial base, developing countries are said to have also a low human development index (HDI). Developing countries are classified under low HDI countries meaning they have low scores on longevity, knowledge and standards of living, a condition that implying a lot of work that has to be done in order to bring the index to the threshold standards (UNDP 2000).

The factors of HDI (longevity, knowledge and standard of living) are issues to do with sustainable development. Also, a great part of the work to be done in this case require establishment of infrastructure which therefore involve construction as a major activity in development endeavours. These contribute to the interconnectedness among low human development, sustainable development and hence sustainable construction as discussed further in this paper.

THE CHALLENGES TO DEVELOPING COUNTRIES

Developing countries face the following challenges concerning sustainable construction.

Rapid development

Developing countries, as the name implies, are in the initial process of economic development or industrialization. This situation entails a great demand on construction products hence high volume of construction activities. In developing countries

infrastructure is lacking and has to be hurriedly put in place in order to support various activities for purposes of economic and social progress (Majdalani *et al.* 2006). Infrastructure involves a host of construction products such as buildings (industrial, residential, commercial, social, administrative), and civil engineering structures such as roads, bridges, dams and airports (Bourdeau 1999).

The high volume of construction activities brings certain implications for sustainability; these include the limited environmental resources for undertaking construction projects and the potential damage to the ecological balance. Construction, for example, requires materials that have to be obtained from the natural resource base e.g. cement production involves the mining of limestone. Construction also leads to damage of environmental resources such as loss of flora and fauna in the construction of roads or displacement of people in the construction of dams.

Another aspect of economic development that is common for developing countries involves urban development. Development has brought with it rapid urbanization that puts undue pressure on the supply of construction products. Urban development as part and parcel of economic development therefore builds up the demand for construction products.

Poverty situation

The greatest challenge to developing countries today is the abject poverty that most of their citizens languish in. For that matter, every industry, construction included, is challenged to function toward poverty reduction. Construction is better put in this case because it can provide employment to some of the poorest groups of peoples. It employs unskilled and semi-skilled labour given its labour intensive nature.

Construction materials, apart from the finishes, are largely unprocessed and semi-processed products mean that even the poor can benefit down the supply chain. Construction activity takes place at various scales ranging between small and large. This means that even small-scale operators can participate in the industry, therefore giving opportunity for the poor to make contributions and earn a living.

One other advantage construction has is that it uses materials from within the local area. This enables it to generate a lot of economic opportunities at the grassroots level thereby benefiting local development. Because of these advantages construction is generally seen as a significant industry in the Keynesian economic model that developing countries have adhered to for so long. It is known to have significant multiplier effect in the economy in general. For that matter it can be instrumental in developing sustainable livelihoods for people at local level. This is a novel challenge that has not been explored but that can be of great benefit. Can we integrate construction industry with local livelihood strategies?

Informal settlements

One of the main characteristics of urban development in developing countries is informal settlements. In Kenya, for example, it is estimated that over 60% of the urban dwellers live in squalid conditions in informal settlements (in the form of slums and squatter settlements). Unfortunately, the problems of informal settlements are mainly seen as social problems, i.e. problems of housing, social equity, welfare, or distribution of income and wealth (especially land). The problem is rarely seen as a problem of the construction industry. This proposition reiterates that as much as the problem of informal settlements belongs to the socio-economic realm with its impacts on the physical environment, it is a problem whose immediate causes lie in the

structural inefficiencies of the construction industry. Hence its immediate solution lies with restructuring of the industry by recognizing and promoting sustainable construction practices.

Regulatory mechanism

According to van Bueren and Priemus (2002), institutional factors could form the greatest barrier to the attainment of sustainable construction. One of the greatest challenges of sustainable construction in developing countries is the institution of regulatory mechanism. Majdalani *et al.* (2006: 34) observe that 'inadequate construction standards and lack of sound urban regulations (or enforcement of existing regulations)' aggravate environmental degradation. In developing countries, the mechanisms may not be there, or if they are there, there may not be political will to enforce them, or they may have been inherited from the colonial past without any aspirations from the local society whom sustainable construction are supposed to benefit.

Lessons from the developed world

The other challenge of sustainable construction is whether these countries can learn from the sustainable construction experiences of the developed countries. The latter countries have faced their own challenges in the development process. The question is, can the developing countries learn from the others' mistakes and successes so that they do not fall prey to the same development path. According to du Plessis (2007), the level of underdevelopment in developing countries provides them an opportunity to avoid the problems experienced in the developed countries. The question therefore is: are developing countries in a position to learn from the developed world?

Inappropriate technology

Technology involves a serious challenge for sustainable construction in developing countries. Ofori (1998) noted that the diffusion of modern ways of building and the use of materials without consideration of local, environmental and cultural is a practice inimical to the attainment of sustainable construction. The challenge for developing countries is therefore to identify and develop appropriate technological practices to ensure sustainable construction.

Neglect in international debate

Another challenge sustainable construction is facing in the developing countries is lack of recognition in the international arena where issues to do with sustainable construction are being debated, formulated and prioritized for implementation. Du Plessis (1999) decried the developing countries have been excluded in the sustainable construction debates whereas more than two-thirds of the world population live in these environments. But it behoves these countries to have their own specific agenda to present at the debate. Perhaps they have not been included so far because not have not demonstrated any need to be included in the debate.

THE CASE OF ARTISANAL MATERIALS

The challenges of sustainable have particular implications for the use of artisanal materials in developing countries. Does the use of artisanal materials in the construction industry exacerbate or ameliorate the developing country situation?

Damage to the environment

We have noted that construction does a lot of damage to the environment. According to Horvath (2004) opposition to large-scale construction projects is growing world over. This could be because their environmental damage is enormous and obvious. However, many small-scale works, especially those catering to the residential needs of the population, can easily escape the attention of environmentalists. Unfortunately, this is the segment of the industry where artisanal producers operate.

Artisanal exploitation of natural resources in other sectors like mining and fishing have been shown to cause serious environmental damage; see for example Mensah and Antwi (2002), Campredon and Cuq (2001), Hawkins and Roberts (2004), Rutterberg (2001), in the case of fishing; and MMSD (2003), ILO (1999), Quironga (2002) and Ogola *et al.* (2002), in the case of mining. In the construction sector, artisanal exploitation of natural resources for construction purposes may be damaging to the environment but has not been given adequate consideration. Examples here may include alluvial sand mining, stone quarrying, clay brick making, green timber exploitation etc.

Poverty reduction

Artisanal production of materials is a potential means by which the construction sector can contribute to poverty reduction through sustainable livelihood strategies. As in the case of mining, artisanal production has the potential for employment creation since it can be a means of survival for large numbers of workers and their families (Zamora 2000). But economic impact goes beyond the support of workers and their families to include support for whole local economies by creating demand for goods and services (MMSD 2003).

Informal settlements

Informal settlements are where the poor in urban areas live. They are the same people who also provide labour and skills in the use of artisanal materials where construction is concerned. If artisanal materials are well understood and improved through formalization and value addition, they can provide cheaper resources for self-help and low-cost housing. For example, if techniques of production is improved and accessibility and use are encouraged, materials like green timber from traditional forests, soil blocks etc., can be of acceptable use while stone and sand may be cheaper through elimination of inefficiencies.

Regulatory mechanism

Currently, the regulatory mechanism for construction materials in developing countries does not support the artisanal industry. For most of the countries with a colonial past the use of the materials are outlawed through building standards. This means locking out a good chunk of resources from the local economy and consigning it to the informal or black market economy thereby making it difficult for the artisans to earn their living. The regulations force the artisans to pay protection fees to the local governmental agents. Regulations like bans also make it difficult for individual artisans to operate in the exploitation of materials like sand. Cartel networks of middlemen then come in to control the market and buy at low prices from the artisanal producers. These agents only help to make the operations of artisanal producers inefficient in economic terms. On the other hand if these operations were to be formalized and included in the mainstream economy the efficiency in the use of artisanal materials would be increased.

Lessons from the developed world

The development process in the developed world included the industrialization of the construction process. Although industrialization of the construction process and materials has made it possible to produce building at shorter intervals and en masse to meet the rising demand, the transformation of buildings from a craft to manufacturing industry has also come with some unwanted consequences such as loss of aesthetics or threats to health such as sick building syndrome. In countries like the UK today, an obvious longing for the craftsmen's handiwork is seen in the new buildings constructed within elegant facades of the glorious past. The greatest lesson for developing countries is that industrialization, on which they are so keen, is not always the best options where the building industry is concerned. The developing countries could as well build and maintain their own craftsmanship through artisanal materials.

Inappropriate technology

Artisanal materials are what are available locally for building construction. In most cases they require traditional technology. Suppressing the use of artisanal materials therefore means promoting foreign knowledge and technology that may not be appropriate for local conditions. This results into a drain of local resources to foreigners and also makes it difficult for local people to help themselves with local resources hence making them poorer. This is not a sustainable construction industry. In clay brick making, for example, Parry (1979: 3) noted that 'the very high mechanized and automated plants rely on electric power and the high grades of fossil fuels such as natural gas and propane while traditional plants may use scrub wood or even camel dung as their source of process energy (other than human muscle-power)'.

Neglect in international debate

As far as sustainable construction is concerned, the developing countries could as well contribute the issue of artisanal materials. Production of materials by artisans is a rampant phenomenon in the construction industry with serious sustainability implications in developing countries. This requires further research and debate for purposes of development in the industry.

WAY FORWARD

The paper has looked at the challenges sustainable construction as a principle and a practice pose for the developing world. As a principle, it has certain limitations; for example, little is known about it from the developing country perspective. The reason that has been advanced is that developing countries are ignored in the international fora (du Plessis 1999, 2007). But the international community is not guilty of this neglect; because neglect begins at home where scholars and policy makers have not bothered with certain obvious aspects like the use of artisanal materials. The paper therefore recommends that researchers should probe further into the phenomenon of use of artisanal materials in construction at local levels to inform policymakers and contribute to the knowledge of sustainable construction up to the global level.

Research into artisanal materials from sustainable construction perspectives will be able to resolve the pertinent issues to do with environmental damage, sustainable livelihoods, inadequate housing, inappropriate regulatory mechanisms and appropriate technology that currently beset the construction sector in the developing countries.

The first author, for example, is conducting doctoral studies on the economic use of artisanal building materials in Nairobi.

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