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Conceptual Framework for Sustainable Affordable Housing Construction in South Africa

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Abstract

Housing is a basic human need and is a key factor in the sustainable development of a nation. Worldwide, demand for affordable housing has grown in recent decades and it is expected to continue to grow due to the problem of rural-urban migration which is affecting both developed and developing nations. With the growing demand for affordable housing, the need for a sustainable solution in the construction of housing cannot be over-emphasized. Previous research has shown that the affordability of urban housing in South Africa is usually measured using a housing cost to income ratio, which is an unsustainable way to view affordability. Due to this fact and governments determination to upgrade the “informal settlements” there is a need to critically examine and investigate the scenarios affecting affordable housing construction, towards building homes that are cost-effective to the occupants over the building life-cycle. This research intends to bridge the gap in the literature by providing an effective strategy by which housing can be made affordable and sustainable, through efficient management of construction resources to enhance sustainability in affordable housings constructed for the poor population in South Africa. This strategy could be applied to analyse housing situation of the poor in developing economies.

Keywords: construction strategies, housing affordability, informal settlements, South Africa, sustainability

1. Introduction

Sustainability is currently one of the most argued ideologies of as everyone recognises that it must occur but there is no agreement on what needs to change in response (Sutton, 2004; Armanet *al.*, 2009). This is unsurprising because challenging the goal of sustainability is like objecting to other fundamentally good goals like peace or freedom (Armanet *al.*, 2009). However, the term sustainability is used indifferent contexts in different fields of study and such usage is geared towards the process of keeping something to meet the needs of the present and the future, without compromising the ability of coming generations to meet their needs (WCED: World Commission on Environment and Development, 1987). The concept of sustainable development is centered on efficient allocation of resources, reduced energy consumption and reuse and recycling to ensure effective short and long term use of natural resources (Ding, 2008). Hence, the need for improvement in the performance of buildings (housing) with regard to

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the environment should encourage greater environmental responsibility and place greater value on the welfare of future generations (Ding, 2008).

Du Plessis (2002) opines that developing nations have little time left to decide the future of its settlements and that although large scale development is needed to address issues of adequate housing, rapid urbanisation and lack of infrastructure. Sustainable housing has not been widely developed in affordable housing markets, instead focus has been on displaying architecturally well designed green housing (Arman *et al.*, 2009).

To achieve sustainability in the construction of affordable housing, there is need for an all-inclusive approach to integrate sustainability principles into management of construction resources during the construction stage of a building project. Although, there are hosts of related research in this area, a wide research-gap still exists in integrating sustainability issues in construction of housings. The framework presented in this paper structures the goals of stakeholders in housing construction under the pillars of sustainability concepts to define the problem.

1.1 Significance of housing in sustainable development

Housing activities are significantly linked to the macro-economy, as investments in this sector not only improve and add to the existing stock of housing units, but improve the working and living conditions. Buttressing these, Ferguson and Navarrete, (2003) state that housing generates a significant share of employment (around 9% globally) and often helps to lead national economies out of recession. Furthermore housing has a crucial role in the development of human settlements and like all other developmental activities also has a monetary and subsistence component. Even if it is a self-help or family activity in rural areas, it needs building materials, tools and skilled labour as input factors. Besides creating an individual product, the new or repaired shelter and the combined input factors also contribute to the national product and increase the overall national wealth.

It is worth noting that, improving housing delivery requires a better understanding of the mechanisms governing housing availability. These require better data and policy-oriented analysis, so that housing delivery policy can be formulated in a more holistic way, which include using sustainable affordable construction techniques, selection of building materials and efficient management of construction resources during the construction process.

1.2 Background of the research problem

There has been great demand from stakeholders for the need to minimise the negative threat posed by construction activities on the environment. As a matter of urgency sustainable strategies and actions in the entire building process needs to be adopted. The tendency towards urban sprawl in developing countries is acknowledged, and it is projected that 70% of the world's population will be living in cities by 2050 (World Bank, 2006). This trend is basically driven by the perception of cities as centers of wealth and prosperity that attract people from rural areas in search of a better future (Dumreicher & Kolb, 2008). This upsurge in the global urban population predictably has resulted in a very sharp increase in the demand for housing. Unfortunately, the current housing sector cannot cope with the demand for living space (Jenkins *et al.*, 2007). This gap between demand and supply creates a very complex problem, driving the housing sector towards less efficient and more-expensive solutions and new city inhabitant towards informal self-help construction of buildings (Arman *et al.*, 2009). Self-help

construction has become a prevalent phenomenon in emerging economy countries. It has driven a corresponding sense of urgency to promote socially responsible housing solutions (Wallbaum *et al.*, 2012) that do not unreasonably impact the environment and that can be acquired by low-income family groups in a reasonable period and cost.

Addressing all of these issues highlighted in the background and solving housing problem in South Africa, requires an all-encompassing strategy towards building a house that is not just affordable but equally sustainable to both the building provider and the end-users.

2. Affordable Housing

Affordable housing is that which takes into consideration the well-being of the community for which the housing is provided. The process takes into account accessibility measures for intending occupants, adequacy and quality, availability measures and lastly affordability measures. According to Noble (2007), the process of affordable housing construction starts with the identification of housing as a problem, which is generally derived from a census taken which is prompted by citizen outcry or a visual view of homelessness within a community.

There are a number of ways through which investment potential of housing projects are appraised, but many are still based on traditional and fixed ways of using payback as the yardstick. Traditional accounting systems generally rely on initial capital to finance the project, which means that projects need the total cost as up-front capital. Financing a sustainable housing project could be hinged on the issue of bringing corporate social responsibility (CSR) into the financial accounting system, which is often referred to as the triple bottom line: environmental sustainability, social sustainability and financial sustainability. Summarily, provision of sustainable affordable housing has linkages with several social issues that impact directly on the severity of housing shortfalls.

2.1 Sustainability and sustainable construction

2.1.1 Sustainability

Sustainability is a broad and complex concept, which has grown to be one of the major research focuses of experts in the construction industry. The concept of sustainability has become a major issue of concern due to recognition of an impending and assured global disaster as a result of depleted world's resources (Vallero & Braisier 2008). Sustainability concept has been defined from different perspectives depending on the author's field of research but what is common in all is ensuring a better quality of life for everyone, now and for future generations.

Diesendorf (2000) describes sustainability as the goal of 'sustainable development' or 'ecologically sustainable and socially just development' which enriches the natural environment and human well-being. Gibberd (2005) views sustainability as a complex interaction between 'environment, society and economy'. The author stress further that these characteristics (environment, society and economy) are generally accepted as the important contributor to sustainability. Conversely, the concept is based on the interaction between the "triple legged concepts" that surrounds human existence as shown in figure 1. Sustainability definitions can be summarised with the definition given by ISO (2008) as "state in which components of the ecosystem and their functions are maintained for the present and future generations".

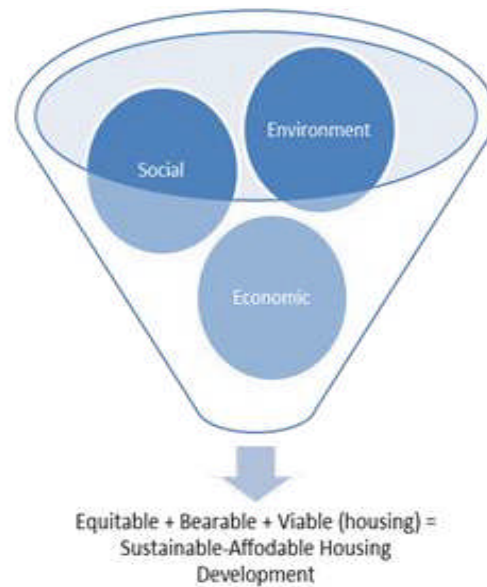


Figure 1: Products of interaction between tripod stand of sustainability

2.1.2 Sustainable construction

Sustainable development is the founding principle towards ensuring a decent quality of life for future generations. The United Nation (UN), in recognition of this fact and the impending and assured global disaster, commissioned the WCED to conduct a study of the world's resources. The WCED in their 1987 report titled "*Our Common Future*" introduced the term Sustainable Development and defined it as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

Sustainable development requires meeting the basic needs of all and extending to all the opportunity to fulfill their aspirations for a better life (WCED, 1987). Conversely, sustainable construction covers a broad interaction between construction stakeholders and the entire construction process. Construction implies all activities from client briefing, site-activities to creation of a building. The International Council for Research and Innovation in Building and Construction (CIB) defined sustainable construction as construction which is set to reach the goal of sustainable development (CIB, 1999). The CIB Agenda 21 explained further that sustainable construction is achievable through:

- Management and organisation of construction processes;
- Material selection and construction methods; and
- Resources consumption.

Ding (2008) in a study conducted in Australia states that lack of sustainability index developed using multiple criteria of ecological, social and economic growth in the society have posed serious challenges to sustainable design solutions and building operations. Further to these, clients' unwillingness to share burden, lack of clear knowledge on the concept of sustainable construction and its benefits, regulatory constraints and inconsistent government policy and lack of fiscal incentives also hinders progress in the adoption of sustainable construction (Adetunji *et al.*, 2003).

Similarly, Shenet *et al.* (2010) suggests that contractors and suppliers should be engaged during the early stages of construction projects due to their knowledge of the environmental issues associated with construction activities, building materials and plants. The green material supply chain presents another challenge to green construction. Green materials are often expensive and the conflict of interest among stakeholders can result in uncertainties and inadequate trust relationships (Love *et al.*, 2002; Shi *et al.*, 2012). Conversely, Pearce and Vanegas (2002) were of the view that green or sustainable materials were not available from standard distribution networks, hence a reliable and flexible supply could not be ensured.

11 Enhancing sustainability in affordable housing: conceptualised framework for housing construction

Achieving sustainable and affordable housing has a strong link to the tripod stand of sustainability. This is due to the fact that house building forms the basic unit of a human settlement which is a crucial component for social development. Previous studies notably (Gibbard, 2005; Nair *et al.*, 2005; Ding, 2008) have shown a clear correlation between economic growth (consumer income), the level of urbanisation, the quality of shelter and basic services provided, and social indicators. The socio-cultural factors determine the individual's primary requirements of housing.

Economic factors define the limit of cost commitment which an individual has to transform his needs into a sound reality. Construction cost has been the most important consideration for implementation of any construction project. In the same vein, cost plays a prominent role in decisions on implementation of sustainable construction (Kunzlik, 2003; Meryman & Silman, 2004). Ofori and Kien (2004) posited extra cost required as the main constraint for implementing sustainable construction. Heravi and Qaemi (2014) believe utilisation of sustainable techniques such as high performance insulation protection, water and energy saving equipment often escalate construction capital cost. However, the cost savings on energy consumption and other service charge overtime are believed to offset part of the increased capital cost (Chang *et al.*, 2011).

The environmental constraints encompass various technological means through which natural resources used for construction can be efficiently utilised and managed to accomplish present demands without compromising the needs of the future generations. Apparently, sustainability of affordable housing falls within this context. It brings together inter-dependent aspects: environment, socio-cultural and economy to achieve sustainable housing.

3.1 Environmental aspects

In the construction industry, the environmental management system (EMS) has little influence on the contractual issues which play important roles on the green performance of projects. Despite implementing EMS, building contractors may not deliver affordable housing based on sustainability concepts because of environment-unfriendly contracts. However, no matter how the operations carried out by contractors are complying with their EMS, the projects may still have a negative environmental impact because the specified materials and practices in the contracts are not conducive to sustainable construction.

Environmental sustainability aspects (Appendix) comprise environmental sustainability criteria for selection and management of building materials, as it affects design of buildings, selection of building materials, choice of construction methods and management of construction materials wastage. The environmental sustainability is influenced by the following:

- **Design consideration:** This includes factors considered at developmental stage of building design to ensure occupants' comfort and enhance sustainability in the building.
- **Building material selection:** This describes the materials and components used in the construction of the building.
- **Construction concepts:** This assesses the willingness of industry practitioners to change the conventional way of specifying existing methods and processes.
- **Management of construction materials wastage:** This relates various construction concepts in relation to efficient use of construction materials.

3.2 Socio-cultural sustainability aspects

A sustainable house is one that provides safe and healthy living to the occupants notwithstanding the cultural and religious beliefs. Hence, the requirements of a shelter differ from one individual to another. A sustainable house should respond to the socio-cultural needs and practice of the occupants and community. It is focused on housing developments that promote social interaction among individuals and ensure equal participation of different groups of people in a community. Socio-cultural sustainability involves different dimensions such as:

- **Cultural beliefs:** This describes the way of living, tradition and household size of the inhabitants of the housing;
- **Stakeholder engagement or beneficiary participation:** This describes involvement of the beneficiary in the planning and developmental process and ensures direct participation of the community in providing labour and other construction inputs;
- **Infrastructure development or available social amenities:** This describes social services available in the community. Available social services affect social relationships and day-to-day living and ultimately the prospects of future generations.

3.3 Economic sustainability aspects

Economic growth is the key to provide the means to meet basic needs and ease poverty. Although, housing problems arise as a symbol of poverty, mere financial assistance alone does not help the poor to meet their housing needs. To ensure economic sustainability of housing, emphasis must be beyond financial assistance and include using construction materials and methods that reduce the total cost of construction, operating cost, and considering various housing-financing options to determine the individuals' affordability. The economic sustainability aspects of housing construction thus include:

- **Cost of construction:** Assess user needs with various construction concepts, to ensure the building is realised at affordable cost to the beneficiary.
- **Cost-in-use or operating cost:** This describes the cost incurred by the user when the building is in normal use. It captures cost gain to the user for energy, water and maintenance.

- Life cycle costing analysis: Assessing total cost performance of building in relation to construction, operation and maintenance.
- Housing financing strategies: These enhance the abilities of beneficiaries to assess finances for housing construction.
- Affordability: The actual cost during construction and various savings to inhabitants during the operational stage of the building.

Integrating the sustainability criteria identified under each of the aspects (see appendix) is intended to assist in formulating strategies for sustainable affordable housing construction. At the decision-making level, sustainable development principles should be integrated into policy strategies and into the planning process as well as construction phase of housing delivery. An uncompromising policy framework is thus inevitable for the efficient working of the policy, which can optimise the limited resources and integrate the various stakeholders. It is important to drive provision of housing based on user's demand, rather than it being an imposition by the authorities.

12 Conclusion

Evidence from literature revealed that understanding the concept of sustainability and its application in construction industry remains one of the fundamental areas that attract research efforts in the construction management field. Succinctly, the frameworks have brought together different aspects of sustainability which when applied during construction of housing has considerable potential to produce building that is energy-efficient, cost-effective to maintain and affordable to all income groups.

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