Project life cycle sustainability indicators

INTRODUCTION

A typical meaning of sustainability is hard to build, which represents a test when endeavouring to achieve agreement on the most ideal route in which it might be accomplished, (Mog, 2004). Various stakeholders have begun to adopt the technique of sustainable building, (Zhang, 2014). Developing consideration and interest over the social and environmental impact of business and how the social and environmental (surroundings, habitat, climate) issues affect business has led some companies to strongly report and take care of their sustainability footprint, (Adams and Frost 2008).

The building sector has dependably been viewed as an extremely noteworthy front line for advancing sustainable development by more feasible practices in the procurement, planning, design, construction and office administration stages, (Zhang, 2014). Different advances are accessible for implementation in creating sustainable projects over distinctive phases of the projects, including planning, designing and maintenance, (Zhang, 2014), perception of sustainable implementation of projects is essential because of the effect it has on surroundings and environs and also concerns various parties (Bueno et al., 2013; Jeon and Amekudzi, 2005; Litman, 2007). Several indicators have been developed to be able to identify project sustainability at various levels of the project life cycle.

SUSTAINABILITY

The triple bottom line has been made reference to in several research works, this is often referred to as the 3P’s (people, planet and profit) or sometimes

as 3BL, the triple bottom line is referred to as the foundation of sustainability and it emerged in the mid 90’s. Sustainability has been defined in so many ways by so many authors in their research work, but there is still a similarity in the definition, sustainability is about preserving natural resources, the environment for future generations while utilising it, the concurrent development of social, technological, environment and ecology are general requirements for sustainability, (Pons and Aquado, 2012; Terio and Kahkonan, 2011; Abeysundara and Babel, 2010). Kleindoorfer et al., 2005 defines sustainability as the. Since the ideology of sustainable development was introduced in 1987 by Bruntland, a lot of gradual events have taken place to boost the attention on environment and sustainability program, (Zainul Abidin, 2008). Abidin, (2010) mentioned awareness and knowledge as factors that boost sustainable movement, interest, demand and implementation comes after (Du Plessis, 2007). Civil engineering projects has a large percentage of contribution to the environmental sustainability, in construction organisations, sustainable development has been an important issue, (Holton et al., 2010), in an annual report in UK, 42 construction companies were reviewed to have little information on sustainability, (Myers, 2005). Considerable changes related to materials, management, skills, technique and innovations needed in the construction organisation are as a result of sustainable issues, (Glass et al., 2008).

The issue of sustainability and how it affects the projects progress has been a rising issue among management teams, in order to address the need towards sustainable development, sustainable evaluation frameworks have been executed by the development industry (Clevenger et al., 2013), several

frameworks for assessing infrastructural sustainability of projects has been developed, (Lim, 2009; Clevenger et al., 2013), these sustainable assessment are created either by non-governmental, government or by joint work with academic bodies, some of these assessment schemes are available in state system and also some are available at national level, (Hezri, 2004). Companies that comply with the sustainability regulation are likely to experience loss of income, (Tan, Shen and Yao, 2011), sustainable buildings are expected to have less impact on the environment, although the efficacy of the delivering process would be affected by complications in delivering sustainable building projects, (Horman et al., 2006; Salkin et al., 2012). Several sustainability factors for assessing sustainability have been developed; Lim (2009), suggested some sustainability factors and the impact its implementation has on road infrastructure projects, also sustainable factors for assessing built infrastructural projects were suggested by Ugwu and Haupt, (2007) in their research work; these built infrastructure categorised under project management, economy, resource utilisation and the environment.

Several means of monitoring sustainability in projects have been developed, sustainability indicators have been developed by various authors to monitor sustainability at various levels in a project, Dasgupta and Tam in 2005 developed a sustainability indicator (Technical sustainibilty index) based on existing research, also (Ugwu et al., 2006) in their research work proposed a sustainability indicator called the Sustainability appraisal in infrastructural projects.

CIVIL ENGINEERING PROJECTS

Various civil engineering projects impacts on the environment, Zhang, Wu and Shen, 2014 reported that construction projects expend a large amount of energy, resources, land and water, this leads to consumption of resources and energy. To achieve a sustainable development in construction projects, it is necessary to have a sustainable performance across the project's life cycle, (Shen et al., 2007), due to the evolving interest in the preservation of nature, construction projects are faced with the challenge of producing a sustainable project, for a construction project to be termed sustainable it must consist of social, economical and environmental factors (Abidin, 2008). In implementing sustainable projects, previous research work has indicated that although it can be time consuming, the cost of its implementation is not as expensive as it seems. Cost, time and quality has been generally described as an essential factor in measuring the performance of construction projects, (Chen and Chen, 2004), for construction projects to be completed on time is a requirement, although previous research prove that construction projects are hardly completed on time, (Hussin, Rahman and Memon, 2013), Amu and Adesanya, 2011 reported that with a total of 3, 407 projects in Nigeria, 1812 were abandoned, 1517 were delayed while only 24 projects were completed on time, also in Vietnam, it was recognised by their government that the completion of projects on time especially government funded projects was a hassle, (Le-Hoai, Lee, and Lee, 2008). Towhid and Amiruddin, (2012) identified that the cause of the delay in project delivering is inadequate planning, delay in design approval, disagreement with design report.

FEASIBILITY

Notwithstanding, advancing the sustainability in any business area has gotten to be progressively vital and at the operational level inside organizations. In accordance with this advancement, there is a developing worry that social and financial issues have been exceeding natural issues in the current practice of directing project feasibility study, (Jorgensen, 2008). Shen et al., (2010) described feasibility study as a priority before commencing project design and construction, also mentioned in their research work is that the progress of a project is directly affected by the efficiency of the feasibility study.

PLANNING

Planning is very essential in projects, for a project to be executed successfully it has to be planned properly, (Nowak and Nowak, 2013), linked the success of project to the righ plan at the beginning of the project, alsoLitman and Burwell, 2006 reported in their work that the need for organised planning in different sectors is brought about by the emphasis on sustainability with respect to human activities. Every project is different and because of this it is difficult to estimate the duration of the planning process, (Schute, 2005). There are various factors that affect the planning of projects, some of these factors are financial, environmental and internal issues that have to do with the project teams such as misinterpretation and lack of understanding, lack of cooperation among team members, in Sozuer and Spang (2014) research work, planning process (duration and cost) is not only affected by financial issues but also government law on sustainable environment (protecting the habitat), so many other factors were indicated also to affect the planning process

DESIGN

Due to lack of integrated structured procedure for sustainable assessment, designers use their previous background in designing projects to make judgements on new project design, (Ugwu et al., 2006). Sustainability issues due to different factors that arise during various projects can be addressed at the design stage. Negative and positive aspects in design are identified at an early stage through the use of sustainable appraisal, this early detection makes it easy for problems to be addressed and also to further modify and improve the project design, (Kumar, Rouquette and Lerner, 2012), Mulder (2006) described sustainability with regards to design in his research work as an attribute a design ought to meet rather than a extra precedent. Issues surrounding sustainability should in this manner be considered by engineers amid all design phases of a project through generally incorporated supplements to the ordinary methodology

IMPLEMENTATION/BUILDING

Few researches recommended that while implementing construction projects, sustainable principles should be embraced, as this can contribute to profit making, (Turk, 2009), however cost appears to be an issue when implementing sustainable civil projects, Zhang, Wu and Shen, 2014 identified cost as the most important factor which affects project teams when they make decision, cost was also identified in their research work to be increased during sustainable (green) construction implementation, Ofori and Kien, 2004 reported in their research also that in implementing sustainable constructions, cost was seen as a limitation. Numerous designers are not eager to push the limit particularly when it implies they need to move the ordinary method for development and wander into another domain of

engineering which may bring about more forthright expenses, (Abidin, 2008). The term ‘ green’ has been used generally to describe sustainability and protection of the environment either by using recycling materials and / or environmental materials in our daily activities. Green has been introduced in the construction industry as a means to reduce the harm imposed on the environment, in the implementation of this ‘ green’ construction, four areas of concentration were listed; the proper utilisation of energy and natural resources, the use of environmental friendly equipments, recycling and environmental awareness, (Zhang, Wu and Shen, 2014), Shi et al., 2013 describes green construction as the use of technology and scientific management to ensure safety and proper utilization of natural resources in engineering construction and also to reduce the adverse effect the construction process would have on the environment.

In implementing green construction, three factors were identified to limit the effectiveness of these; cost increase, added time and a finite amount of green resources, Shi et al., 2013.