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Construction Management for Sustainability

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ABSTRACT: Sustainability is getting more and more attention till the 1980s. Organizations should not only focus on profit and expansion, but do this in a way, which will not compromise the chances of the next generations. As projects are getting more attention throughout different sectors, sustainability should be implemented within the project management lifecycle and not only for the output.

Sustainable construction projects are expanding in the market and green codes and standards are advancing giving the ground for development of technology and materials applied. With every new material and technology utilised in the field, also risks are growing. The importance of risk management in sustainable construction projects is thus increasing and more experience and expertise is needed. So, the purpose of this thesis is to examine and gain deeper understanding of project related risks in sustainable construction projects in companies operating in built environment. It is crucial to gain knowledge of good practices within the industry to be able to propose further investigation of the subject that could improve the existing risk management and sustainable construction project goals.

KEYWORDS: Construction Waste, Cost Overrun, Green building, Issues in construction, Sustainable construction, Time Overrun, *Building infrastructure, construction industry, resources consumption, carbon discharge, sustainability*

I. INTRODUCTION

On an international level, the construction industry is a major economic contributor within developed countries and is a rising market for developing nations (Eid, 2004, p.2). Despite a slow-down in the rate of the productivity, the construction industry remains the largest industrial sector in the community, ahead of the food and chemical industries and it is crucial in producing investment goods (Eid, 2004, p. 20). "Performance of a project has always been an important issue in the construction industry" (Pheng & Chuan, 2006, p. 25).

Every construction project consists of specific phases that traditionally are covered in most of the literature available about the area of knowledge and these phases are seen in the model below.

Usually the phases following the project close-out are disregarded and not taken into the consideration of the project management overall plan. Across the individual construction project life cycle, sustainability performance is an indispensable aspect in attaining the goal of sustainable development (Shen et al., 2007, p. 273). According to World Commission on Environment and Development (WCED, 1987) sustainability is commonly defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs"(cited in Bansal & DesJardine, 2014, p. 71), a concept that is accepted in many fields of study that include a sustainable approach.

Thus, sustainability has been adopted by many companies through their mission statement and strategy (Sánchez, 2015), to cope with corporate objectives in an era that is demanding social and environmental approach. Leading companies in different sectors are measuring and taking systematic steps to manage their sustainability impact; recognizing the way that a reorientation towards sustainable development is essential for ensuring their long-term viability.

The life cycle of a building infrastructure or rehabilitation goes through several major stages such as designing, planning, construction, maintenance and more others where sustainability needs to be maintained in each stage. In the words of Mastruciet al. (2017), for guaranteeing regenerative limitation of the natural resources usage, precautionary development in the construction industry is highly needed.



The concept of sustainable development originated in the early 1980s and set guidance measures for the correction of market failures, ensuring regenerative capacity of renewable resources, avoidance of cumulative pollutions, steering product processes towards greater eco-efficiency including the substitution of renewable resources and a precautionary approach to development. The term sustainable development itself has many interpretations (Barrow, 1997; Lutzkendorf and Lorenz, 2005). The most common and famous definition is defined by the Brundtland Report (1987, p. 24) as: "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs".

II. LITERATURE REVIEW

[1] The Way Forward in Sustainable Construction: Issues and Challenges Jamilus Md Hussin¹, Ismail Abdul Rahman, AftabHameedMemon:

Construction industry is one of the most significant industries that contribute toward socio-economic growth especially to developing countries. The nature of the industry are fragmented, unique and complex which always face chronic problems like time overrun (70% of projects), cost overrun (average 14% of contract cost), and waste generation (approximately 10% of material cost). It is also regarded as one of the largest polluters to our environment. Traditional practices of construction process and management are found unable to control unprecedented challenges including the carbon emission issue. These challenges accent the need for practitioners to rethink and improve the construction process and technology. This shows that the construction industry has a major potential in the advancement of sustainable development by addressing issues related to the economic, social, and environment.

[2] Sustainable Construction Trends in Journal Papers Bo Xia; JianZuo; Peng Wu, YongjianKe:

Sustainable construction is gaining worldwide attention and has inspired research to identify and solve the problems involved in its implementation over a project lifecycle. While an impressive number of papers have been published on the topic to date, little has been done to review these papers to identify current research status or provide guidance for future research. This paper reviews existing sustainability papers in 12 internationally renowned construction journals.

Based on a three-stage literature review, sustainability papers published in these journals from 2000 to 2012 are analyzed in terms of the annual number of papers published and the research interests involved. The number of sustainability related papers in construction increases from 30 papers in 2000 to 127 papers in 2012, which shows an increasing trend in sustainability topics.

[3] Project Managers' Role in Sustainable Building Process, MAHVIN DELNAVAZ:

Providing all residences of a community with a better quality of life by developing of environmental, social and economic aspects has been focused in sustainable development for decades. In order to achieve the sustainable development, the construction industry is an important sector that should adopt the sustainability concept. Sustainable construction faces some challenges in adopting new processes and working methods due to the new technologies that require some changes in the process and considering risk. Learning about new tasks, actors and roles is necessary to overcome the challenges. The role of project managers requires particular attention among the other stakeholders because project managers are in a special position at project level.

[4] Sustainability in Project Management Competencies: Analyzing the Competence Gap of Project Managers A.J. Gilbert Silvius, Ron P. J. Schipper:

Sustainability is one of the most important challenges of our time. How can we develop prosperity, without compromising the life of future generations? Companies are integrating ideas of sustainability in their marketing, corporate communication, annual reports and in their actions. More recently, the concept of sustainability has also been linked to project management. Projects are "instruments of change" within organizations, which play an important role in the realization of sustainable business processes and practices. Project managers are therefore important "change agents" in organizations that have a strong influence on the sustainability of organizations. However, the standards of project management fail to address the role project managers' play in realizing sustainable development and project managers are lacking the competences to consider the sustainability aspects of their projects. For the implementation of sustainability in organizations, it is crucial that this competence gap is closed by the standards of project management competencies. This paper reports a literature-based analysis of the coverage of the competencies required for considering sustainability aspects, in the standards of project management competencies.



[5] **Environmental Guidelines for Major Construction Sites, EPA publication:** The Environmental Guidelines for major Construction Sites provides a useful sourcedocument to help prepare and implement an environmental management plan for major construction sites.

The purpose of these Guidelines is to provide developers, contractors and government agencies involved with commissioning or constructing freeways, major roads or major development projects with: information how to avoid and minimize environmental impact, which is preferable to the less cost-effective option of controlling or treating discharges to the environment, or undertaking remedial action.

III. METHODOLOGY OF WORK

Research is to contribute to a special field of issues with something unknown, unpredictable, generalized and/or interdependent to the main body of knowledge. To achieve this contribution in a systematic way it is essential to approach the performance of the research with appropriate and scientifically approved methods as explained by Atkin and Wing "Knowing which path to follow, which tools and techniques to apply, and how to make sense of findings are the fundamental prerequisites of good research and, likewise, good researchers."

To perform a decent research Robson (2002) identifies five inter-related phases to design a research:

1. Purpose – what is the achievement,
2. Theory – the theory which the study is based on including the design of research and the analysis of findings,
3. Research questions – what is the statement of possible findings and what the expectation of these findings is,
4. Methods – how to collect, analyse and validate the findings and how to show its reliability
5. Sampling strategy – how, where and when the input data should be collected and how the sample should be justified.

IV. METHOD APPROACH

During the performance of this research, a combination of method approaches were adopted; literature reviews, development of assessment model and validation of assessment model with case studies from different stages of the life-cycle of construction works. This was done in a context of construction sustainability with client and project manager perspective.

1. Literature review

Literature studies have been undertaken covering definitions and concepts of sustainable development in general and sustainability in construction works in particular. Further on, an overview of useful indicators of sustainability for building construction, different assessment techniques and assessment tools adapted to buildings and its performance are made. Finally, an overview of some relevant management systems adapted to construction works is made. The literature covers international peer-reviewed journals, scientific reports, conference proceedings from the Sustainable Building conference series, and books. The literature review has been used as input for validating an assessment model, which has been developed in the context of construction management systems in line with concept of sustainable development. The validation was performed by means of case studies encompassing different stages of construction works lifecycle. As visualized in Figure 2.3, sustainability in construction works is by this research defined as a result of blending the context of construction works, its associated management systems and the concept of sustainable development.

2. Model developing

During the phase of model developing, an assessment model approach was developed with respect to a client's desired level of sustainability during a project process. It has been developed with respect to present theories and practical usefulness. The development process included a conceptual model containing purely environmental aspects of construction work management (Persson, 2001) through a set of applications where additions such as sustainability construction works concept, stakeholder analysis, management systems and links to other facility developments or processes were added (Persson, 2002; Persson, 2003; Persson and Olander, 2004; Persson et al, 2005; Persson et al, 2008a; Persson et al, 2008b). The model is based on principles of environmental management systems, i.e. as the principles of ISO 14001.

The phase of model developing also contained a development of a simplified scheme (Persson, 2001) of how to assess site dependent sustainability aspects of a Facility in accordance to a simplified version of standard environmental impact assessment, EIA, e.g. as described in The Swedish Environmental Code (2000). This scheme was intended as a



compliment to the assessment model and was applied in Persson (2002), Persson (2003), Persson and Olander (2004) and Persson et al (2005).

3. Conducting analysis

The analysis process is to validate the developed interdisciplinary process-orientated model with the ISO 15392 (2008) and the terms derived from the literature studies. The case studies' different significant data were aimed to validate the model with the ISO standard. The result of this validation is then put in a bigger context of sustainability of construction works, derived from the literature studies, to be discussed if the findings from the particular cases could be generalized to be valid to sustainability of construction works entire life-cycle. Further on, if the result of the generalization could lead to usability of the developed model to estimate range of sustainability of such construction works.

VI. CONCLUSION

Construction industry has been growing rapidly and plays a vital role in the economic growth of a country. It helps in improving the quality of life of its citizens by providing the necessary socio-economic infrastructure such as roads, hospitals, schools and other basic & enhanced facilities. However, it also generates implications to the environment and social aspect of the country. Most of the projects are designed in a traditional manner without consideration to energy & environmental impacts and natural resources conservation which resulted in detrimental wastage affecting our ecological integrity. The findings of the study could be divided in three parts. Firstly, on the macro level, the progress towards sustainability in construction works is rather slow, in spite of the short timescale before potential irreversible damage occurs from climate change. In the long run it is not enough to sustain on the level of present environmental depletion, it has to be a regenerative development. By these means it is time for action by transferring current and new knowledge from the research community into an adaptive and practical framework for implementation. This knowledge must be complete with clearly defined economic incentives and the gap between researchers and practitioners must be bridged with arguments of economic value. It is also very important to bridge the gap of knowledge transfer in both directions between industrialized and developing countries, as local decisions and solutions affecting the built environment have both local and global impact. On the meso level, it is crucial to transfer knowledge horizontally, when a real estate change owner, thus the information of work done so far on sustainability improvements be transferred to the new owner. This could be done by voluntarily business agreements; governmental subsidies regarding property value/taxation or by legislation of mandatory information/ indicators following the property's lifecycle by registration of title.

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