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Precautionary Construction Management for Sustainability

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ABSTRACT: Precautionary construction management for sustainability is most important thing. 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. By adopting sustainable construction, it can reduce the overall energy use and maximize potential for renewable energy supply, minimize waste, conserve water resources, enhance water quality, incorporate water sensitive design and minimize vulnerability to flooding, minimize polluting emissions to water, air and soil and minimize noise and light pollution.

KEYWORDS: Construction Waste, Cost Overrun, Green building, Issues in construction, Sustainable construction, Time Overrun.

I. INTRODUCTION

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". "In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damages, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." This principle is a very important part of how to handle sustainability in practice when scientific proof is interpreted differently or does not cover the actual issue. In Sweden the principle was enshrined in the Swedish Environmental Code (2000). Sustainable construction could be interpreted in many different ways. The term covers a broad and complex interaction between involved stakeholders, aesthetic, and functionality and material interactions. Construction itself could imply everything between site-specific activities to the creation of human settlement. Sustainability, on the other hand, should imply a holistic view, "the whole is more than the sum of its parts" with relationships and interactions between humans, society, the biosphere, economy and the state of technology. CIB (International Council for Research and Innovation in Building and Construction) defined sustainability in construction through the Agenda 21 for Sustainable Construction as about reaching sustainable development through environmental, socio-economic and cultural aspects. It is divided into three parts:

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1. Management and organization,
2. Product and building issues, and
3. Resources consumption.

Management and organization is a key aspect of sustainable construction according to CIB (1999). This part contains technical aspects as well as those of social, legal, economic and political nature. It is a complex issue because of the interdependency of the above aspects and because of the number of different stakeholders involved in the construction process. The challenge involves the construction process, but also the environmental effects, human resources issues, innovation of new solutions of construction methods, knowledge transfer in the project, demands from stakeholders, common standards and relevant legislation.

II. LITERATURE SURVEY

[1] The Way Forward in Sustainable Construction: Issues and Challenges JamilusMd 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

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“changeagents” 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 constructions 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.

[6] Management of sustainability in construction works, Urban Persson, LUND University:

The present global environmental condition is a consequence of the increasing consumption of natural resources whose depletion exceeds what is physically possible to sustain in the long term. The construction sector is a considerable contributor to this resource depletion and sustainability is adopted in the form of the theory of ecological modernization. The implementation depends to varying extents on sustainability demands at the global, national, regional, local, corporate and individual levels. In addition, there appears to be a lack of new knowledge transfer from the international research community to local construction project

Managers, particularly in the process of construction works in line with the objective of sustainability. According to environmental legislation, it is the client who is the responsibility party, performing activities as owner and administrator of construction works.

[7] Risk Management in Construction Industry -A Case Study, A. Suchith Reddy:

The Study investigated to acquire an overall idea about risk and its consequences in construction field and the process required for its management. The effect of risk on assessment of a project is discussed along with the tools and methods adopted to manage risk in construction industry. The objective of the research topic “Risk Management in Construction Industry” is to explore the effective way for implementation of risk management in construction industry, to consider the different types of risk management techniques applied to alleviate risk, to identify the use of implementation of the risk management, to determine the factors that can influence the applications of risk management in the project life cycle, wherein to categorize the principles adopted in Risk Management. I have conducted a survey on the following aspects of it, a) Identify, characterize, and assess threats involved in the construction industry b) Assess the vulnerability of critical assets to specific threats. c) Determine the risk (i.e. the expected consequences of specific types of attacks on specific assets). d) Identifies ways to reduce those risks. e) Prioritize risk reduction measures based on a strategy.

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,

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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.

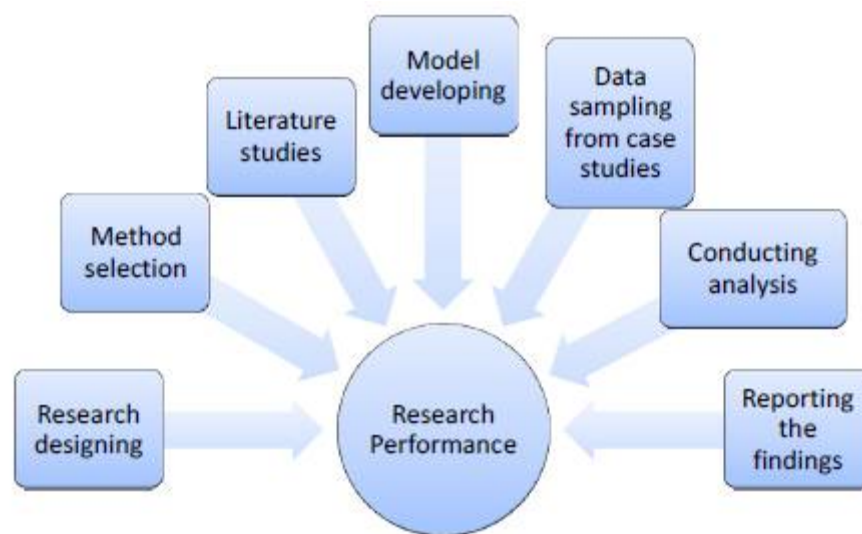


Figure 1: Input in this research' performance.

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 has 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.

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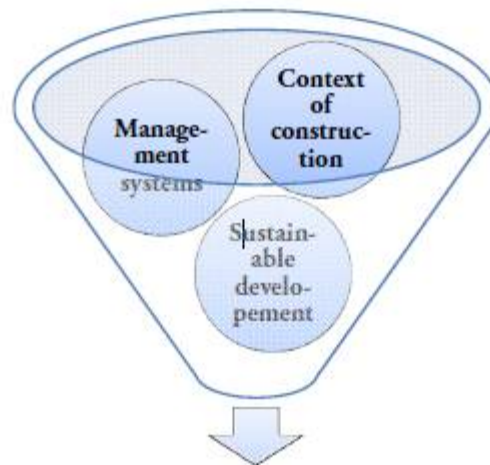


Figure 2: Blending concepts and context.

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.

V. FIELD APPLICATIONS

1. Over the years, mankind's development of a large industrial capacity and its ability to create new technologies that turn easier society's daily life has been a mark of innovation era. In many developing industries, technologies are incorporated into daily life by becoming indispensable to the modern lifestyle. Waste production has been increasingly alarming throughout the world, standing as a major problem to be solved. In

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- order to achieve life quality and be able to provide favourable environmental conditions to future generations, it is indispensable to become conscious about environmental effects of all mankind's production activities.
2. It is vital to promote and encourage an environmental sustainability culture development: meeting society's demand of industrial and technological products with the indispensable proper disposal of their products at the end of life, that is, discard minimizing environmental impacts on the completion of its life cycle. Some measures have been taken over recent years, with the intention of minimizing the generation of environmentally hazardous waste in the world, emphasizing the relevance of changes in production processes. In the specific case of construction, begins to be aroused interest from external factors. Among them, there is the availability of solutions to minimize negative environmental impacts identified and applicable management tools.
 3. Methods for evaluating environmental performance of the construction industry and increased competition in the industry and customer requirements are also seen as elements boosters, which come to be added to increase environmental awareness at the part of builders. Similarly, as many construction companies have implemented quality management systems that have brought them considerable benefits, it increases their interest in introducing environmental elements into existing systems. However, there are few builders that are committed to environmental issues. Still, environmental solutions have begun to be applied in enterprises, although this does not ensure continuous improvement and sustainable development of the sector.
 4. Despite its recognized economic impacts to the country such as: high job creation, income and viability of housing, infrastructure, roads and others; in the construction sector one still lacks a firm policy for disposal of solid waste, mainly in urban centres. The need to take the RCC not only results in a desire to economize. This is a fundamental attitude towards the preservation of our environment. The important thing to be improved in this sector is the management process, with the decrease in solid waste generation and appropriate management of the same construction site, building awareness of the actors involved, creating the methodology.
 5. It is noteworthy that is necessary a change of culture among all those involved in the process of IC, indicating the importance of preserving the environment we live. Therefore, it is notorious the necessity of a mentality change in the aspect of environmental sustainability at the IC sector's stakeholders, in order to fortify and develop a responsible conduct, aware of the relevance of preserving and extracting as better as possible the environment's resources

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 macrolevel, 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

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title. Finally, on the micro or construction works project level, there is need for an easy and user-friendly framework for managing the issues of sustainability in an already complex context such as a construction works project. It is essential to apply a 'many-small-steps' approach towards sustainability. The proposed STURE method and the connection to STEPS maturity roadmap on a corporate level and the combinations of the above-mentioned ISO-standards are a way of structuring stakeholder demands or outcomes of expectancy.

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