Proposing a Strategic Framework and Rating Tool for Sustainable Infrastructure in Developing Countries

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ABSTRACT

Construction in developing countries, among the Latin American region, is an industry that accounts for around two hundred billion dollars annually, responsible for millions of jobs and a significant portion of the GDP. In a region where civil infrastructure is a driver for development, construction represents in average 6% of their Gross Domestic Product. The negative impact on the environment of the construction industry has been widely documented in the developed countries. The challenge for the developing countries is to respond to the demands of lack of infrastructure in a way that is socially and ecologically responsible.

Rating systems provide and effective framework for assesing building environmental performance and integrating sustainable development into construction processes. Existing frameworks focus to analyze the impact only for buildings. A holistic approach involving the participation of industry, government and academia is a key strategy success.

The objective of this research is to develop a strategic framework and a rating system for sustainable infrastructure implementation and measure in developing countries. The final purpose is that this framework serve as a reference for policies creation in the region and the rating system as a tool for official certification for civil infrastructure of all kinds and complexities.

INTRODUCTION

Ali and Nsairat (2009), recognized that rating systems provide and effective framework for assesing building environmental performance and integrating sustainable development into construction processes. It can also can be used as a management tool to apropiately address environmental concerns during the design, construction, and operations phase. Furthermore, the development of rating systems should be based on studying the strenghts and weakness of the most recent practices of the developed countries. Life Cycle Assesment (LCA) provides an effective methodology for evaluating the environmental load of processes durign their lyfe cycle, although most of LCA case studies have been done in developed countries but there are no comparable studies in literature from developing countries, especially in Latin America (Ortiz, Castells, & Sonnemann, 2009). Moreover, the existing frameworks focus to analyze the impact of buildings, the construction environment encompasses a wide categories of infrastructure, a comprehensive sustainable development framework should account for the impact of civil infrastruture of all kinds and complexities. Efforts to develop sustainable infrastructure rating systems in developing countries have to include the individual location, cultural, political, environmental and economical issues that arises in those particular regions. A holistic approach involving the participation of industry, government and academia is a key strategy for the succes of such a policy development.

RESEARCH OBJECTIVES

Although the main objective of this research is to develop a framework for sustainable development and rating system for infrastructure in developing countries, various authors have defined several enablers to formulate sustainable development strategies, these constitute the objectives to reach the goals of this research. The objectives are divided on specific and general objectives, specific objectives are those which can be accomplished in the short term, they form the basis upon the framework and rating systems are founded, these objectives will be accomplished in this thesis. General long term objectives are conceived thinking on the further scope and socialization of this research, it draws the path for the future and ensures the applicability of the specific objectives.

The specific, short term objectives, establish benchmarks for comparison, provide an initial assessment, and constitute the framework for developing sustainable infrastructure policies:

- Conduct an exhaustive review of the most relevant publications of best practices of sustainable infrastructure development from developing countries.
- Provide an inventory of assessment tools appropriate for developing countries.
- Establish the impact of the construction industry in developing countries.
- Develop a life cycle analysis for existing key construction technologies, materials and procedures.
- Develop a vulnerability index.
- Identify categories, indicators, and parameters that will be used in the rating system.
- Propose a sustainable infrastructure rating system and assessment tool appropriate for developing countries.
- Identify sustainable policies enforcement problems.

• Identify heritage and cultural issues that may hinder or help sustainability.
• Propose regulatory tools (e.g. financial incentives, laws, ordinances) to encourage sustainable construction.
• Publish the findings of this research on a relevant journal with a high level of impact.

The general, long term objectives map the way forward, they ensure the applicability of the specific objectives and promote continuous improvement of the framework:
• Use the developed framework and apply it on pilot projects.
• Promote technology transfer between developing and developed countries institutions, establish research networks.
• Update existing regulations to enable sustainable constructions.
• Establish national accreditation and certification institutions for sustainable infrastructure.

METHODOLOGY

The development of the rating system for sustainable infrastructure is based on a survey and a life cycle assesment. The survey consis of a two round questionnary usign the Delphi technique, approximately 100 participants have been selected, representing government, academia and industry. This questionnary is product of an exhaustive review of the existing rating systems from which a set of 125 strategies divided in 9 categories (Site, Energy, Water, Materials, Indoor Environment, Transportation, Economic, Management and Social) where collected. This strategies are presented to the participants, they are asked to rate them according to their impact considering two different location for the project, highlands and coastal environments. On the second round of the survey, the participants will be presented with the results of the first round, and will be asked to reconsider their choices. This will converge into a set of weighted credits from which the impact of construction can be measured. The output will show, if according to professional opinions, a project will have a different impact considering its location.

The resutlts of the survey will be used to identify key construction activities that may have a greater impact on social, economical and environmental aspects of a specific region, they will serve as an input to a life cycle assesment model for a typical infrastructure project. The output of the life cycle assesment wil be tested for correlation to the output of the survey, to identify consistency between opinions and model predictions.

RELEVANCE

Latin America is facing an unprecedent development in infrastructure, the need to account for the social, economical and environmental impact of construction is imperious. Existing frameworks have shown to be defficient measuring the performance and meeting the objectives of existing sustainability rating systems. Furthermore, an effective rating system should account for the individual location, social and environmental issues that arise in different location, this cannot be a one use for all tool. Individual countries should develop their own weights for sustainability ratings credits, and national accreditation institutions created to provide local recognition of sustainable project. The results of this research can be replicated to different countries to validate the framework. The political implication of this research are to influence existing regulation, a sustainable infrastructure rating system can be proposed by a government institution, enforcing mandatory requirements and other optional requirements for higher levels of certification.

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