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Sustainable building development in China – A system thinking study

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Abstract

The demand for sustainable building is increasing rapidly throughout the global construction marketplace. However, the real success of sustainable building development depends on the concerted effort of different stakeholders. Without knowing the drivers and barriers, it is difficult to introduce pragmatic policies and strategies to promote such development. While sustainable building development in China is still at an infancy stage, its experience should help other developing countries to develop a road map for developing sustainable buildings. In this paper, twelve semi-structured interviews with senior managers of listed real estate developers in China were conducted. The results indicated that government regulation, incentives and CEO's vision are the key drivers of sustainable building development. The most significant barriers identified by the interviewees are the additional costs due to sustainable initiatives, lack of customers demand and lack of mature green supply chain. To better understand the system structures causing these management problems, a causal loop diagram was developed to identify the relationships and the causal influences between the elements of the sustainable building development sector. Finally, a suite of effective sustainable strategies is proposed based on the findings.

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Keywords: Sustainable building; system thinking; causal loop diagram; drivers; barriers

1. Introduction

Sustainable buildings are regarded as one of the most effective solutions to address various global issues such as climate change, human health, social impact, renewable energy, etc. Such development requires the most efficient and least disruptive use of energy, land, water and resources [1]. According to McGraw-Hill Construction's latest

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Smart Market Report – “World Green Building Trends” [2], the demand for sustainable buildings is increasing rapidly throughout the global construction marketplace, without being limited to one geographic region or economic state. The report also pointed out that the market of sustainable building has been shifted from “push” to “pull” and sustainability has become a worldwide business imperative.

In China, the strain on energy and natural resource along with environmental degradation during recent years alerts Chinese government and business enterprises to promote a sustainable building practice which seeks to strike a balance between economic, social and environmental performance [3,4]. The Chinese government first released the Three-Star Green Building Evaluation Standard in 2006. Then in 2012, the Ministry of Finance and the Ministry of Housing Urban and Rural Development published “The Implementation Opinion Regarding Accelerating Promotion of National Green Building Development” which sets an aggressive target to have 30% of all new construction meeting the green building standard by 2020. It is expected that the market of new sustainable buildings would worth between US\$220-400 billion by then [5]. In view of such an ambitious goal, it is imperative to have the real estate developers actively participated in the sustainability practices to lead the best practice. However, most developers especially those listed companies would put their profit and shareholders’ interest at the first place. Therefore, what key barriers they are confronting and how to motivate them to develop more sustainable buildings become the key questions for this paper.

2. Literature Review

2.1. Drivers and Barriers

Various studies have addressed barriers and drivers during the process of delivering sustainable buildings. Williams & Dair [6] identified that the major barriers for sustainable building in England included a lack of consideration of sustainability measures, real and perceived costs and inadequate expertise and powers. Pitt, Tucker, Riley & Longden [7] suggested that fiscal incentives/penalties and regulations were the two most important drivers of sustainable construction, which were consistent with “affordability” as the biggest barrier identified. Häkkinen and Belloni [8] concluded that the major barriers for promoting sustainable buildings in Finland were the steering mechanisms, economics, a lack of client understanding, process, and underpinning knowledge. On the other hand, the major drivers were clients’ awareness about the benefits of sustainable building, development and adoption of methods for sustainable building requirement management, sustainable building tools mobilisation, designers’ competence and team working, and development of new concepts and services. Bond [9] investigated the barriers and drivers of sustainable building in Australia and New Zealand and suggested that the initial costs of sustainable features, a lack of consumer information, and people’s reluctance to change are the main barriers for improving building energy efficiency. Instead, an appropriate mixture of government regulation, greater use of energy saving technologies and behavioural change are the major drivers to reduce CO₂ emissions. Zhang, Platten, & Shen [10] examined the costs and barriers in the process of developing Chinese sustainable property projects. They recognised that ‘active’ design strategies are more expensive than the passive design strategy, and the major barrier is the higher costs and this has hindered the widely application of sustainable technologies in the construction industry in China. Another research in China [11] identified that additional cost, incremental time and limited availability of green suppliers and information are critical barriers to foster a sustainable construction practice. These factors are similar to previous researches in Hong Kong [12] and in China [4]. Ahn, Pearce, Wang, Y., & Wang, G. [13] also investigated the main drivers and barriers of sustainable design and construction in the US construction industry. Energy conservation, improving indoor environmental quality, environmental/resource conservation, and waste reduction were the most important drivers while the most noteworthy barriers were first cost premium of the project, long pay back periods from sustainable practices, tendency to maintain current practices, and limited knowledge and skills of subcontractors.

Although these researches identified the barriers and drivers encountered during the sustainable building development, most of them failed to capture the underline relationships of these factors as well as the causes and effects among them in a systematic way. Thus, this paper seeks to apply a causal loop diagram to capture the

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