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Factors affecting the implementation of green specifications in construction

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ABSTRACT

Green specifications constitute one of the important elements in green construction. New sustainability requirements and changing priorities in construction management have spurred the emerging green specifications to a faster pace of development. A cross-sectional survey has been conducted in Hong Kong in 2007 to identify principal factors leading to the success of preparing green specifications. Based on extensive construction management literature, 20 variables concerning sustainable construction were summarized. Using the Mann–Whitney U-test, the subtle differences between stakeholders in specifying construction work have been detected even with the high consistency of the responses among the groups. Moreover, five independent factors for successful specification of green construction have been categorized by factor analysis. They are related to (1) green technology and techniques, (2) reliability and quality of specification, (3) leadership and responsibility, (4) stakeholder involvement, and (5) guide and benchmarking systems. Whilst the first and fourth factors are generally more important, different stakeholder groups have different emphases. The results of the survey have been validated against established principles.

1. Introduction

The building industry consumes one-half of the world's physical resources (RCA website). According to data published by the United Nations Environment Programme, the building sector accounts for 30–40% of global energy use (UNEP, 2007). Yet, the lucrative investment returns brought about by property development prompt developers to build in anticipation of demands as a global business. Spurred by the ever-rising needs for infrastructure and leisure, construction activities are changing land forms quickly. Natural resources are being depleted at a rate faster than their replenishment, hence giving rise to an outcry for sustainable development. Many governments are taking a regulatory stance in trying to curb direct environmental pollution, but non-statutory means can be an effective supplement to achieve sustainable construction since most organizations prefer to have room for flexibility in their business operation. Increasingly, designers produce building designs which are environmentally friendly and voluntary assessment schemes (such as BREEAM and LEED) are deployed to verify that their claims are well made. At the contract level, apart from drawn information, client requirements used to be made explicit through specifications, both in the public and private sectors. The prescriptive approach of specifying has enabled the client and his consultants to stipulate materials and workmanship in accordance with environmentally friendly practice. The uprising trend of performance specifying as an alternative (e.g., for curtain walling) has also provided opportunities for contractors to innovate (Lam et al., 2003), but then specifiers should incorporate "green" requirements to achieve sustainability of construction resources. Yet, specifiers adopt different approaches in specifying green elements, with a varying level of competence (Lam et al., 2008). For example, in a survey of UK architects by the Designing for Sustainability Group in 2002, only 46% reported on having experience of specifying recycled materials (Chick and Micklethwaite, 2002).

Apart from the variability in technical competence, the problems with existing specification practice are associated with the unclear delineation of responsibilities amongst stakeholders and the infrequent use of reliable templates (Lam et al., 2007). These problems have caused disputes and inconsistency of work quality in the construction process. When stakeholders wish to achieve sustainable construction through the use of green specifications, these problems must be mitigated and a lucid understanding of the factors involved in successful implementation of green specifications

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is essential. The objectives of this paper are therefore to identify the mentioned factors for better development of green specifications. Following a literature review on sustainable construction principles and green specifications, the results of a survey on green specification implementation factors carried out in Hong Kong are reported. The factors resulting from statistical analysis have been validated against established principles. This approach resembles that of the Grounded Theory, in that the empirical survey findings (i.e., the five factors affecting the implementation of green specifications) help to build up a green specification framework, which is a further step to be taken in the research study.

2. Literature on sustainable construction and green specifications

Through a comprehensive literature review, a list of twenty features (adopting the word of "attributes" as in social science) has been compiled as the possible factors leading to the successful implementation of green specifications. In accordance with the established principles of managing sustainable development (e.g., BS8900, 2006), the twenty attributes in respect of the preparation of green specifications were provisionally classified under four headings for the purpose of a subsequent questionnaire survey: (1) stakeholder involvement, (2) leadership and responsibility, (3) principles and techniques, as well as (4) feedback and building public confidence. The rationale of the classification is discussed below and the twenty attributes under four categories are shown in Appendix A.

2.1. Stakeholder involvement

Following the increasing popularity of quality management systems in the construction industry in the mid-90s, a system-based approach to sustainability was proposed by Holmberg (1998), Robert (2000), Eccleston and Smythe (2002) as well as MacDonald (2005). Protocols published by the British Standards Institution emphasize the importance of identifying the roles and concerns of the stakeholders.

Fenn et al. (1997) pointed out that incompatibility of interests amongst stakeholders caused conflicts and disputes in construction. Notwithstanding, Berke (2002) advocated the holistic inclusion of different interests from stakeholders and involving the public in planning. Incorporating the various interests of stakeholders should be extremely important for the preparation of green specifications.

To enable stakeholder involvement, the preparation of green specifications should be carried out with top management's directives and participation by stakeholders. Examples of such participation include the publication of green product directories (e.g., www.eco.com.au) and web-based sharing of commentaries (e.g., www.greendragonfilm.com).

2.2. Leadership and responsibility

The leadership and responsibility of industry stakeholders should play significant roles in the success of green specifications, in that common objectives (such as reducing energy consumption and pollution arising from construction activities) can be engendered through a decision-making process well managed by business leaders, who act as champions.

Under social principles, Robert et al. (2002) listed standards and legislation as two of the tools for achieving sustainability. However, in a country as big as China, there may be a lack of practical understanding of sustainability, which prohibited the development and enforcement of legislation for sustainable construction (Sha et al., 2000). Using green specifications as a contractual means to address the strict requirements in evolving green standards and requirements appears to make more business sense due to the inherent flexibility of the contract mechanism to cater for individual cases.

Swift (1999) believed that professionalism should hold paramount the welfare of the public, and avoiding conflicts of interest is an important part of professionals' efforts to gain the trust of the public. Prevention of bias towards particular products or processes should be vital for specification preparation.

Liability and uncertainty are two barriers for environmental initiatives in green specifications. Pollution is one of the common exclusions in professional liability insurance as listed by Rubin (1994). Potential liability on the detrimental effects of unconventional products as a result of specifying would affect the premium of professional liability insurance and hence the decision of specifiers on green initiatives.

Uncertainty and risk associated with new green technology is common. Flanagan et al. (1987) admitted that risk is common in life cycle costing. Pearce and Vanegas (2002) identified that risk associated with reliability and effectiveness of a new product prevents many professionals from specifying green or sustainable building materials. Risk adversity is also common among clients. In the Barbour Report 2003, although one-third of the client respondents expected sustainability and life cycle costs to become more important, only 4% of all clients frequently specified innovative products. The low enthusiasm towards green specifying may be attributable to clients' risk adversity (Barbour Index, 2004). Hence, reducing anxiety towards the risk associated with green specifications through a fair allocation of responsibilities should increase their use.

2.3. Principles and techniques

Traditionally, the construction industry mainly focuses on the use of techniques for reducing pollution or increasing efficiency to meet the regulatory requirements or reduce cost. Mora (2007) noticed that sustainable construction can refer either to the building process or to the built object. Green specifications set out the building processes or the requirements of the materials resulting in the final built object serving its occupants' needs in a sustainable manner. In the survey design that follows, seven attributes concerning energy saving, mitigation of environmental impacts and the use of available technologies for the successful preparation of green specifications are summarized under the heading of green technology and techniques.

In accordance with high level directives such as those promulgated in the European Union (e.g., for Integrated Pollution Prevention and Control) or China (e.g., the eleventh Five Year Plan), a willingness to specify available advance green technology for construction purpose should be an important attribute for green specification preparation.

Life cycle assessment with considerations of environmental impacts, energy and material flow is the main principle of most published guides for green specifications, e.g., the BRE Green Guide to specifications (Anderson and Shiers, 2002), the Guideline Specifications by GreenBuilding (2007) and the Federal Green Construction Guide for Specifiers (WBDG, 2007). Customized tools such as the Building for Environmental and Economic Sustainability (BEES) approach as developed by Lippiatt (1999) in the US or the Life Cycle Energy Analysis software as developed by the Electrical and Mechanical Services Department, Government of the Hong Kong Special Administration Region (EMSD, 2008) are available for construction stakeholders. The results of life cycle assessment may be used for costing, benchmarking and option selection.