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Linking the environmental practice of construction firms and the environmental behaviour of practitioners in construction projects

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ABSTRACT

The notion that the construction industry can contribute to environmental sustainability has increased the demand for environmental sustainability in the sector. Research has shown that environmental quality is associated with human behaviour. Therefore, minimising waste generation and energy consumption in construction projects is important. This study investigates the influence of the environmental practice of construction firms on practitioners' environmental behaviour during project implementation. Data for the study are obtained from a sample of 375 architectural, engineering, and contracting firms in Malaysia. The partial least squares technique is used for data analysis. The results indicate that firms' energy efficiency and waste management practices have a positive effect on the environmental behaviour of practitioners during project implementation. The results imply that when construction firms are engaged in energy efficiency or waste management activities, an increase in environmental behaviour will occur in the projects in which these practitioners are involved. This study is one of first attempts to investigate the relationship between the environmental practices of construction firms and the environmental behaviour of professionals during project implementation within the construction industry. The findings are useful for construction practitioners in terms of exerting environmental behaviour in project implementation, which is essential for facilitating environmental sustainability in the construction sector.

1. Introduction

The severe pollution and exploitation of scarce natural resources caused by the construction industry is well documented (Hillestad et al., 2010). Fuertes et al. (2013) indicated that the construction industry is a main source of air, water, and noise pollution. In 2008, the European Union recorded a total of 859 million tons of waste generation from construction activities, which is more than one-third (37.56%) of all waste produced by economic activities (Eurostat, 2013). In China, construction-related activities account for 45.5% of the overall energy consumption (Zhaojian and Yi, 2006) and 25% of the overall solid waste (Lu and Tam, 2013). Buildings, as the major output of the construction industry in Malaysia, consumed 40% of annual energy and released up to 30% of energy-related greenhouse gas emissions (MIGHT, 2014). These problems demonstrate the great potential of the construction industry to contribute to environmental sustainability (ES) by minimising the negative effects of construction activities (Birkeland, 2014).

One of the main challenges in implementing ES in the construction industry is that most construction activities that harm the environment are dependent on a construction project team that has unique characteristics (Bakker, 2010; Pich et al., 2002). A construction project team is established to perform a certain task (e.g., constructing buildings and infrastructure such as highways, power

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plants, or bridges) and will be dissolved once the task is completed (Bakker, 2010; Brockhoff, 2006). This temporary characteristic hinders learning from past experiences and knowledge sharing among key players (Tyssen et al., 2014). As an unsurprising result, the construction industry has progressed little in terms of environmental performance, and the number of projects that have adopted ES is limited (Shi et al., 2014; Zainul Abidin et al., 2013). Moreover, a construction project team is a heterogeneous organisation consisting of a project owner or client, architects, engineers, and contractors (Shi et al., 2014). Architects and engineers (AEs) provide professional services such as design and project management and interact with contractors as client representatives (Lu et al., 2013). During the design stage, AEs provide advice on materials and technology for use in the project (Low et al., 2014). AEs also monitor the work of the contractor and subcontractors and the overall implementation of the project until completion (Shi et al., 2014). Generally, contractors are involved in a project during the construction phase and are responsible for implementing the actual construction work, including site management and the supervision of subcontractors' work (Yong and Mustaffa, 2013). In the construction phase, the use of machinery and heavy equipment for activities such as excavation, earthworks, concreting, and lifting, create significant environmental drawbacks (Waris et al., 2014). Furthermore, construction activities produce waste and consume significant amounts of energy and resources that contribute to the sector's largest share of the total negative impact on the environment (Guggemos and Horvath, 2006). Therefore, the environmental behaviour (EB) of the aforementioned practitioners (architects, engineers, and contractors) during project implementation is important in promoting ES. Regulations and technology are insufficient for promoting ES in the construction industry but lack a contribution from all players to ensure that their actions do not harm the environment (Hakkinen and Belloni, 2011). AEs have the capacity to propose the ES agenda when advising clients on the appropriate materials and technology for a project (Hoof and Dijken, 2008). Similarly, contractors can support ES by implementing responsible construction practices during project implementation (Shen and Tam, 2002).

Presently, evidence from the literature is lacking on whether the environmental practices (EPs) of firms have an effect on the EB of practitioners at project level. Existing studies on ES in the construction sector do not focus on whether the EP observed at construction firms will lead to similar behaviour on construction projects. Most studies on the environment in the construction industry concentrate on the implementation of environmental system in various construction organisations (e.g., Ahn et al., 2013; Zainul Abidin, 2010; Zainul Abidin et al., 2013). Ahn et al. (2013) explored and ranked the motivators and hindrances for sustainable construction and design in the US construction industry. They revealed that indoor environmental quality, energy conservation, resources conservation, and waste reduction are the key drivers for sustainable construction and design, whereas project start-up costs, long pay back periods for sustainable practices, the tendency to use conventional practices, and a lack of knowledge and skills of contractors are the main barriers. Zainul Abidin (2010) studied the implementation of ES in client organisations and investigated the drivers and barriers to ES in the Malaysian construction industry (Zainul Abidin et al., 2013). Rodriguez et al. (2011) assessed ES implementation with regard to resources, positions, duties, and power in Spanish civil engineering projects. They identified inadequate training, experience, and resources as the barriers that prevent true commitment to improving the deteriorating EP of construction companies. A few studies that concentrate on the implementation of an environmental system at the project level exist. Gangolells et al. (2014) analysed the effectiveness of waste management in construction projects to improve on-site environmental performance. Similarly, Fuertes et al. (2013) formed an environmental impact causal model that functions as a decision-making tool to reduce the adverse environmental impact of construction sites. Weston (2011) reviewed the actual planning applications for construction projects to justify whether such projects should be subjected to an environmental impact assessment (EIA). The results suggested that many local planning authorities that participated in the study do not apply EIA because of a lack of knowledge and training.

Little is actually known about the influence of the EP observed in construction firms on the EB of practitioners during project implementation. Fuertes et al. (2013) indicated the insufficient evidence on EP in the construction sector. The few studies on the relationship of EB in two different places focused on EB at the workplace and at home (e.g., Thogersen and Olander, 2003; Littleford et al., 2014). Thogersen and Olander (2003) investigated whether people will implement EB consistently between their workplace and their homes and revealed that the consistency of EB in these places depends on the perceived similarity between the behaviour in both places and on the perceived importance of behaving in an environmentally responsible way. Littleford et al. (2014) recently investigated the effect of the lighting and computer use behaviour of workers in an office on their behaviour at home. This study revealed that insufficient evidence exists to prove such an effect. To fill this gap in literature, the present study investigated whether the EP observed in construction firms influences the EB of practitioners in construction projects. Specifically, this study aims to investigate whether the EP in construction firms can lead to the development of EB in construction projects.

In acknowledgement of the major opportunities that a construction project has for improving their environmental performance, the present study adopts a different track by using the construction firm and construction project as research focus. Theoretically, this study extends existing knowledge that focuses on ES at only one specific level, either the organisational level (Ahn et al., 2013; Zainul Abidin, 2010; Zainul Abidin et al., 2013) or the project implementation level (Gangolells et al., 2014; Rodriguez et al., 2011; Weston, 2011). The present study also broadens the scope of Thogersen and Olander (2003) and Littleford et al. (2014) to include the effects of construction firms on projects in the construction sector, which scholars have indicated as a major environmental polluter.

The practical contribution of the paper is information on the effectiveness of environmental campaigns for firm EP. Demonstrating the relationship between firms' EP and EB during project implementation may motivate construction firm managers to implement EP within their firms to improve the EB of practitioners during a construction project, which could cause the widespread implementation of ES in the industry. The findings will also serve as a guide to augment the industry's ES initiatives and facilitate the achievement of the broader goal of sustainability in the construction industry.

2. Literature review

This section provides an overview of the underlying theoretical framework for this study. The environmental behaviour in construction projects and environmental practices of construction firms are reviewed.

2.1. Environmental behaviour in construction projects

Construction projects have been heavily criticised for their contribution to land, air, and water pollution and for their waste,