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Review article

Drivers for green building: A review of empirical studies

Amos Darko [a, *], Chenzhuo Zhang [a, b], Albert P.C. Chan [a]

[a] Department of Building and Real Estate, The Hong Kong Polytechnic University, 11 Yuk Choi Rd, Hung Hom, Kowloon, Hong Kong
[b] College of Civil Engineering and Architecture, Zhejiang University, Hangzhou, Zhejiang 310058, China

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ABSTRACT

This paper presents a comprehensive literature review of what drives the adoption of green buliding (GB) practices among construction stakeholders. The review is based on literature that have been published in peer-reviewed journals. Through a systematic review of the literature, authors are able to identify generic drivers for stakeholders to pursue GB. A total of 64 drivers were identified from reviewing 42 selected empirical studies. The paper presents a classification framework for the GB drivers. The framework comprises five main categories of GB drivers: external drivers, corporate-level drivers, property-level drivers, project-level drivers, and individual-level drivers. The US, Australia, UK, India, and China have been the leading countries in GB drivers research. Survey and descriptive statistics have seen widespread use in examining GB drivers. While there is scope for more detailed investigations on GB drivers in developed countries, much more scope exists in developing countries. This paper would enhance policy makers' and advocates' understanding of drivers for GB and help to further promote the GB concept. As a result of the checklist and framework on GB drivers, this paper also lays a solid foundation for researchers to further probe into the topic and add to the knowledge base.

Contents

* Corresponding author.
E-mail address: amos.darko@connect.polyu.hk (A. Darko).

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1. Introduction

The construction industry has a profound impact on the natural environment, public health, economy, and productivity (US Green Building Council (USGBC, 2003)). Globally, the construction industry consumes 40% of total energy production, 12–16% of all water available, 32% of nonrenewable and renewable resources, 25% of all timber, 40% of all raw materials, produces 30–40% of all solid wastes, and emits 35–40% of CO_2 (Berardi, 2013; Son, Kim, Chong, & Chou, 2011), which has resulted in a rising global awareness of the importance of sustainability in the construction industry (Kibwami & Tutesigensi, 2016; Wang, Toppinen, & Juslin, 2014). Due to the demand for more sustainable or green buildings (GBs), the past decade has witnessed an increased interest in GB concepts and practices across the globe (Gou & Xie, 2016). A GB usually refers to a building that considers and minimizes its impact on the natural environment and human health, utilizes considerably less water and energy than a non-GB, generally has higher levels of indoor air quality, and accounts for some measure of the lifecycle impact of choices amongst different kinds of building materials, furnishings, and furniture (Yudelson, 2009a). Thus, implementing GB offers several environmental, economic, and social benefits to the construction industry, which Ahn, Pearce, Wang, and Wang (2013) synthesized to include prevention of global warning and climate change, minimizing CO_2 emissions and other pollutants, protecting the ecosystem, use of renewable natural resources, improving health, comfort, and well-being, alleviating poverty, improving economic growth, raising rental income, decreasing healthcare costs, etc. While these are only some benefits, they demonstrate that GB provides an opportunity for the construction industry to contribute to the sustainable development of the world through the implementation of sustainable building solutions (Butera, 2010).

Despite reports that barriers, such as higher cost and lack of knowledge, information, and awareness, are faced in the GB movement (Aldossary, Rezgui, & Kwan, 2015; Gan, Zuo, Ye, Skitmore, & Xiong, 2015; Shi, Zuo, Huang, Huang, & Pullen, 2013), the sustainability benefits of GB and other governmental and non-governmental actions (such as development of practical tools for measuring the sustainability performance of buildings, policies and regulations, and provision of incentives) serve to move GB to the mainstream national and international developmental agendas. There are empirical studies reporting various specific influences driving the current push towards GB development in different countries (e.g., Ahn et al., 2013; Qi, Shen, Zeng, & Jorge, 2010; Serpell, Kort, & Vera, 2013). These studies show that a number of identifiable drivers and mutual benefits with different priorities, according to country or region, for diverse stakeholders exist. Besides meeting regulatory requirements and attracting incentive packages, many stakeholders and organizations also make the efforts to adopt GB practices in response to, for example, the need to conserve energy, improve their corporate culture and image, improve their marketability, respond to customer demand, and lower operating and maintenance costs. These drivers have significant influences on the decisions of stakeholders to implement GB practices (Qi et al., 2010). However, drivers for GB in general are seldom reviewed and classified. In this study, the term 'drivers' refers to the persuasions that encourage adoption of GB practices, and is defined to include both the potential benefits of GB and actions/decisions outside the benefits that lead or motivate people to engage in green implementations. A general view of these drivers is essential to understand how GB can be made more popular and successful. This paper presents a systematic literature review of GB drivers, with its focus and objectives discussed in the following section.

1.1. The current research

There is a need to review the existing knowledge of the driving forces behind the adoption of GB, so as to broaden the understanding of academics and industrialist on the drivers. Realizing this need, Falkenbach, Lindholm, and Schleich in 2010 reviewed the research that had been conducted on the drivers for environmentally sustainable buildings (Falkenbach, Lindholm, & Schleich, 2010). However, with more than half a decade passed, changes in stakeholder perceptions on and attitudes towards these drivers as well as emergence of new drivers are likely. As such, the main aim of this study is to complement Falkenbach et al.'s work in a number of ways. First, examining Falkenbach et al.' s work, they acknowledged the fact that for different construction stakeholders, the drivers for adopting GB are dissimilar and, hence, focused on reviewing the literature concerning only the real estate investor's drivers for investing in GB. It would be useful to review the drivers from the perspectives of different groups of stakeholders, because such a review would play a critical role in developing more generic drivers to widely promote the adoption of GB. Second, different from Falkenbach et al. (2010), this review is exclusively based on empirical studies on GB drivers that have been published in academic (peer-reviewed) journals. Thus, conference papers, unpublished research works, and industry reports are excluded. The rationale behind this is that although the other sources of information are useful, for academics, especially firsthand researchers, to gain an in-depth understanding of the research trend and development in a particular research area, in order to significantly contribute to the body of knowledge on a specific topic, academic journal papers are more suitable (Hong, Chan, Chan, & Yeung, 2012; Tsai & Wen, 2005). This information source focus provides a more refined literature review and better direction for researchers and practitioners on academic information concerning GB drivers, which is fundamental to conduct more efficient and effective further research on the topic and promote GB. Third, this review covers more recent academic research works on the topic than Falkenbach et al. (2010).

Building on the previous work by Falkenbach et al. the main objectives of this review are to identify and classify the drivers for GB in general. The paper systematically reviews a total number of 42 selected papers that were identified through a comprehensive literature search, using Scopus. The outcomes of this paper would deepen the understanding of policy makers and advocates on the drivers for implementing GB practices and provide direction for decision- and policy-making efforts regarding the promotion of GB. The paper would also be useful for researchers to design further empirical studies on GB drivers for different stakeholders in different locations, because of the developed checklist and framework of drivers abounded in the literature.

2. Research methodology

This research is based on a systematic literature review focusing on relevant past empirical studies on the drivers for implementing GB practices. Literature review has been widely used in construction management (CM) research as a typical methodology for advancing knowledge on specific topics (Chan, Scott, & Chan, 2004; Li, Shen, & Xue, 2014). As mentioned earlier, this review is exclusively based on relevant papers published in academic journals. A systematic literature search was performed, using the Scopus search engine, to retrieve the relevant papers for this review. Elsevier's Scopus was selected for this study based on the following four reasons: (1) it has been widely used in similar review studies in the CM domain (Li et al., 2014; Osei-Kyei & Chan, 2015); (2) most of the research papers in the field of engineering, management,