

BUSINESS MODEL CHANGES IN GREEN CONSTRUCTION: A LITERATURE REVIEW

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Recently, concepts such as green or sustainable construction have been much emphasized in the literature. At present there is no systematic study on how these changes in the construction industry are expected to alter the business model of a construction-related company. This paper is the first attempt to remedy this situation by providing an overview of changes of business model elements as they have been dealt within the construction literature. The paper derives a set of constructs and reviews papers and books published after 1990. The preliminary results indicate that a) any business model element can change as a consequence of green construction; b) partner networks, core competency, value configuration and cost structure may be the most likely elements to change and c) some business model element and their changes may “go in pairs” such as core competency, value configuration and partner network on the one hand, and value proposition, cost structure and core competency on the other hand.

Keywords: business model, green changes, green construction, sustainability.

INTRODUCTION

This paper reviews the literature on green construction in order to investigate how elements of business models of construction-related companies change when introducing innovations related to green construction. Construction-related companies include an array of different types of firms, ranging from pure manufacturers such as materials producers, to dedicated service providers, such as architectural consultants. This paper refers to green construction as sustainable construction in an ecological sense where the focus is on construction processes rather than the physical building per se. Although some scholars may differentiate between the concepts of ecologically sustainable construction and green construction, for the present purpose the terms can be used interchangeably.

From an innovation perspective, green or sustainable construction has gained increasing attention as an important aspect of sustainability (e.g. Brundtland Report 1987, CIB 1999). An influential definition of sustainable construction is the definition proposed by Kibert at the First International Conference on Sustainable Construction in 1994: “[Sustainable construction is] the creation and responsible management of a healthy built environment based on resource efficient and ecological principles” (Kibert 1994, CIB 1999).

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Green construction is often mixed up with the notion of green building. In English the term “building” can imply both process and product hence it is necessary to make a distinction between the two. Table 1 shows different combinations of product-process through green and non-green perspectives. This paper focuses on the green construction process as shown in quadrant 1.

Table 1: Product-process matrix in green perspective

	Construction (process)	Building (product)
Green	green construction (1)	green building (2)
Non-green	conventional construction (3)	conventional building (4)

This definition of green construction implies that the different stages of a construction process, including implementation, delivery of product, and to some extent maintenance of the building are of importance for green construction. From a business perspective, when a construction-related company changes its activities so that its business logic is altered, it means that its business model has changed. In particular, when a construction company undertakes green changes, we expect that at times there will be some major changes in the firm’s business model.

Business model characterizations tend to stress that a firm’s business model should be understood as the logic of how the firm creates and appropriates value. Like any other firm green construction companies need to be able to profit from the value they create but the difference is that they need to do so in a green manner. Key issues therefore include whether the business logic of green construction companies differ from other construction companies and in what ways construction companies change their behaviour as they become greener. Unfortunately, while there is a growing amount of papers and books on green construction such as Kibert (2005), as far as we are aware, there is not any paper that explicitly analyses green construction from a business model perspective. This implies that our understanding of these processes is poor at best. Thus, investigating green construction and the changes it brings into elements or the entire business model of a firm should be important to investigate. As the first step to remedy this shortcoming, this paper reviews publications to infer how they have implicitly analyzed business models of green construction. In particular, the purpose of the paper is to review green construction publications to investigate what elements of the business model might change when a construction-related company undertakes green changes, and investigate if there are any specific relations among different business model elements changes. To do this, the paper reviews green construction peer-reviewed papers or books.¹

The paper is organized as follows. The next section characterizes a business model and its constituting elements, followed by a discussion of sustainability. This is done to provide a better conceptualization of how to infer business model changes from the green construction literature. Subsequent sections present the paper’s methodology, including the sampling procedure, before presenting the results. Finally, the discussion and derived conclusions are presented.

Business models

Many scholars and companies have recently found the business model to be a useful concept. A business model can be seen as a firm’s intended or actual responds to a set

¹ At present, twelve publications are reviewed.

of basic questions on how value is created or appropriated (Magretta 2002). In any business model the value creation and value capture elements are treated as core concepts whether explicitly or implicitly. From our perspective, the business model differs from the strategy concept in that it relates to how firms create and profit from its innovations relative to its customers, but does not explicitly analyze the plans, decisions and actions of direct competitors.

In recent years, there has been a rapidly growing interest in refining and applying the concept of business models to integrate earlier approaches including operations management and marketing. A frequently quoted business model definition has been given by Osterwalder *et al.* (2005). Based on a review of the business model literature they defined a business model as: "... a conceptual tool that contains a set of elements and their relationships and allows us expressing the business logic of a specific firm."

Their paper is useful for the present purpose because it characterizes nine elements (building blocks) which exhaustively cover the business model. They are: 1) Value proposition, 2) Target Customer, 3) Distribution Channel, 4) Relationship, 5) Value Configuration, 6) Core Competency, 7) Partner Network, 8) Cost Structure and 9) Revenue Model, see Table 2. This characterization is thus a useful tool as it allows for separate observation of green construction changes in individual business model elements element.

In the case of construction-related companies, we can expect some aspects of the business model elements to be more affected than the others when a company undertakes green construction. In order to map changes in business models, it is required to define what is meant by green construction and to get to know its drivers and implications.

SUSTAINABILITY AND GREEN CONSTRUCTION

The scope and nature of green construction is a heterogeneous phenomenon and is presently not very well defined. Nonetheless, in the context of construction-related companies, here it is argued that it is useful to rely on a provisional definition in the sense that green changes refer to changes that bring products and production processes closer to sustainability requirements. To be able to understand what green construction is, it is essential to define sustainability.

A frequently quoted definition for sustainability is: "...meeting the needs of the present without compromising the ability of future generations to meet their needs" (Brundtland report, 1987). Perhaps the most interesting connotation in the sustainability definition is the relation between present and future. In fact the emphasis is on usability of resources in the future while allowing for contemporary consumption as well. Construction products such as buildings are supposed to stand for long time, so it seems necessary that both process and material which are employed to build a construction product be consistent with environment.

Two concepts that embed green are "green technology" and "green engineering". Ritter (2003) defines green engineering as follows: "Transforming existing engineering disciplines and practices to those that lead to sustainability. Green Engineering incorporates development and implementation of products, processes, and systems that meet technical and cost objectives while protecting human health and welfare and elevating the protection of the biosphere as a criterion in engineering solutions." This definition can be a good starting point in defining the green construction since it contains a broad view which embraces products, processes and

systems that are to connect and guide engineering disciplines towards sustainability. Based on the definition of green technology, for example, Kibert (2005) believe that sustainability and green are inter-changeable.

METHOD

Initially sustainability papers and books were identified by an ad hoc list of search words. These were studied to understand the topic and to delineate “green construction” in terms of common and important concepts. These concepts were subsequently used to analyse relevant papers and books. To systematically select papers the SCOPUS database was used to search for publications that used one or several of “sustainable, green, environmental, ecological” in their abstracts in combination with one or both of “construction, building.”^{1,2}

Papers that were only about the finished building were removed. Third, we focused on peer-reviewed journal articles, books, reports or printed conference proceedings that were cited in at least three peer-reviewed journal articles. Of these, the 12 cited articles or books published between 1990 and 2010 were selected. Presently, a non-randomized subsample of 11 articles in different reputable journals and one book has been read to provide a deeper understanding of the literature at hand.

RESULTS

At times there are differences between green construction and conventional construction simply because they follow different rules and techniques. For example Kibert (2005) argues that in green construction the term “building demolition” would be replaced by “building deconstruction”. Green changes are based on sustainability and environmental considerations. These innovations can consist of offers in terms of new functionalities or fulfilment of wants and needs in a novel non-trivial manner. This means that green construction can change the value proposition (element 1) of the companies’ business models. See Table 4.³

Porter and van der Linde (1995) have studied the environment-competitiveness relationship and tried to come up with new conception towards it. They claim that environmental standards can lead to innovation which reduces the disposal costs for the user and that regulation which includes recyclability of products can result the designs that allow valuable materials to be recovered more easily after disposal of the product. These changes can affect the value configuration element as well as the cost structure element of the companies’ business models (elements 5 and 8).

On the role of innovation in the construction industry, Keast and Hampson (2007) assert that the viability of the construction industry relies on the ability to foster and transfer innovative products and practices. In case of green building for example, an innovative product can be a window glass which is able to admit useful rays for daylight and heat while not letting in harmful ones. Obviously, all construction processes are not green and in order to make them green, most likely a construction-related company is required to keep up with novel and innovative solutions. For a construction-related company this can imply a change in the operations and the skill set of its R&D department and/or its relation to external resource or knowledge

¹ The research is under progress.

² This gives a total amount of 456 papers limited to the topics “energy” or “building” (June 29, 2010).

³ Some authors and the list are abbreviated because of lack of space.

sources. This means that both the core competency and the partner network elements of the companies' business model can be expected to change (element 6 and 7).

Table 2: Elements covered by selected publications in green construction

Authors	Covered Elements	Comments (Focused on)
Kibert (2005) "Sustainable Construction"	1,5,6,8	Green building and its properties.
Mehta (2001) "Reducing the environmental impact of concrete."	1,5,6,8	Cement industry and its effects on environment.
CIB definition (1994)	1,5,6,8	Resources usage and life-cycle costs.
Bossink (2004) "Managing drivers of innovation in construction networks"	5,6,7	Drivers of construction innovation were addressed.
Gluch <i>et al.</i> (2009) "An absorptive capacity model for green innovation and performance in the construction industry"	7	Role of partner network as a source of knowledge sharing and innovation.
Lam <i>et al.</i> (2009) "Factors affecting the implementation of green specification of green specifications in construction"	5,6,7	Stakeholder involvement and also technical resources and techniques.
Bröchner (2010) "Construction contractors as service innovators"	6, 7	Patterns of innovation, R&D, competency and stakeholders' roles in construction.
Ambec and Lanoie (2008) "Does it pay to be green? A systematic overview"	1, 2,7,8,9	How a company would benefit from being green and the brand value.
Keast and Hampson (2007) "Building Constructive Innovation Networks: Role of Relationship Management"	7	Role of partner network and as a source of knowledge sharing and innovation.
Winch (1998) "Zephyrs of creative destruction: understanding the management of innovation in construction"	6,7	Innovation and R&D patterns in construction.
Porter and van der Linde (1995) "Toward a new conception of the environment-competitiveness relationship"	5,8,9	Role of environmental regulations on innovation, its contribution in cost and revenue.
Michelsen and de Boer (2009) "Green procurement in Norway; a survey of practices at the municipal and county level"	3,4,7,9	Green building and sustainability. Advantages of green building, its relation to environment.

For the partners in construction network to be involved in a knowledge transfer process, it is reasonable to consider advantages and gains which motivate and encourage them to take part in collaborations.

This issue also was brought up by Winch (1998) who argues that without a gain-sharing approach, where rewards are divided and split between clients and the actors in the project coalition, incentives for innovation in construction cannot be improved. Then he continues that one of the most important opportunities for moving towards such an approach is provided through the shift from competitive tendering to partnering affecting the revenue model (element 9) and partner network (element 7). In line with this argument, Gluch *et al.* (2009) claim that external knowledge source is

related to inter-organizational relationships and formalized communication routines between different parties involved in a construction projects.

What can be inferred from Winch (1998) and Gluch *et al.* (2009) is that a construction-related company per se cannot be the only source of innovation and other methods of innovation such as open innovation which requires the collaboration of other parties in the construction network should also be considered. A company needs to discuss issues regarding new changes in contract details and exchange knowledge and information to expand its knowledge base. By doing so new ideas float into a company and would form a basis for innovative approaches.

Table 2 indicates that there are at least four important reasons for construction-related firms to be engaged in green construction: First, resource scarcity can cause increase in resource prices, and may trigger companies to implement green construction. Consequently, the target customer (element 2) may change. Second, environmental issues and customers' awareness of environmental matters push construction-related firms to comply more with new environmentally-friendly contract specifications which might affect the distribution channel (element 3). Michelsen and de Boer (2009) who have studied the Green Public Procurement (GPP) in municipalities in Norway realized that there is a clear correlation between the size of the municipalities (client) and the focus on green procurement implying that bigger municipalities are more focused on green. This illustrates that relationship (element 4) may differ depending on who the target customer is.

Third new rules and regulations on environmental issues set by governments are assumed as strong drivers making construction-related company and their suppliers to make changes in methods they use to perform their activities, including distribution channels and their core competency elements in their business models. Fourth is the reputation which is brought about by "green" products and processes. Green products and processes might signal prestige to customers. This prestige can be valuable to probably a portion of the customer segments who are willing to pay for green. This niche market will be ready to pay the extra cost of greenness incurred to the construction-related company, implying changes in the value proposition element and potentially the target customer. All these drivers form a new orientation towards green construction. To explain how construction-related firms react to external drivers Zahra and George (2002) suggest that new legislations and rules, lack of resources or relative increase in their prices are assumed as triggers for construction companies. These triggers might lead the company towards more innovative ways of performing their activities, including changes in their value configuration and cost structure (element 5 and 8). Lam *et al.* (2009) suggest five factors which lead to successful implementation of green specifications: 1) Green technology and techniques, 2) Reliability and quality of specification, 3) Leadership and responsibility, 4) Stakeholder involvement and 5) Guide and benchmarking systems. They show that the role of green technology and techniques and stakeholder involvement are equally important and are of greater importance for implementing green construction than the other three. Green technology and techniques factor refers to all routine and techniques required for implementing green construction. Green technology and techniques can be connected to both the core competency and value configuration (elements 5 and 6) since both routines and knowledge required for green construction and also the way that resources are configured lie in this factor. In another word it is expected that correct implementation of green construction would affect both core

competency and value configuration elements of a business model of construction-related company.

Stakeholder involvement also refers to involvement and cooperation of all parties who are involved in a construction project as subcontractors or suppliers; a so-called partner network (element 7). Without cooperation and involvement of the partner network, successful implementation of green specifications which lead to green construction seems difficult, if not impossible. To make partner network involved it is necessary that all parties to be able to come up with consensus on what is meant by green specifications and all partners know their roles and responsibilities. In doing so, close collaboration is highly required. Therefore it is expected that the partner network element of a business model of a construction-related company will be affected in implementation of green construction and that this element is a key player in performance of green construction.

To provide a brief summary of the discussion above, Table 2 was created to illustrate some important concepts that can be used in green construction publications. It should be noted that neither the table is exhaustive in terms of its coverage of relevant concepts, nor are the concepts necessarily mutually exclusive.

DISCUSSION

This paper started with the assumption that depending on the nature, magnitude and the innovative intensity in green construction processes, changes in the orientation of the current business of a construction-related company may be required. Such changes were expected to be reflected in a construction-related company's business model in that one or more of the firm's business model elements, at times could be expected to change. The previous section came up with three preliminary results.

- 1) Any element of a business model can change as a result of green construction.
- 2) There are some indications that combinations of business model element changes can be expected to be more common than others because one business model element change can require or bring changes to other elements.
- 3) The core competency and the partner network elements are the most investigated.

First, while all business model elements can change, the importance and difficulty of changing different business model elements are not yet understood. However, we argue that it is important that further research proceeds to systematically analyse all of the business model elements relative to green construction.

Second, the preliminary results shown in Table 2 suggest that by undertaking green construction it may be expected that several elements of a business model in a construction company will be affected simultaneously. One such combination is value configuration/core competency/partner network while another would be value proposition/cost structure/core competency. How can we understand these.

In general, if a construction-related company innovates, often its value proposition element changes. A major green change can therefore radically change the value proposition in terms of a shift from a product to a service or a new functionality package of the new product or service compared to earlier offers. To do so, the company may need to create or acquire new knowledge. This can either take place through changing its core competency, re-combining its existing resources or by drawing on external knowledge sources. For example, for large construction firms, R&D is an internal knowledge source and knowledge generator body. For these

companies R&D is a central aspect of the creation and use of the firm's in-house competency. Thus R&D is a major aspect of a firm's core competency element.

On the other hand, if the new problems are complex and costly to solve a way for the firm to deal with this is by creating and drawing on its partner network. Thus the firm may draw on external knowledge sources for innovation by collaboration with other parties in a partner network. This can be in form of partnership or contracts or in a general form as open innovation and can be directly connected to the partner network element of a business model.

In turn, any changes in routines of R&D in a construction company might imply that the resources are being rearranged and reconfigured; this in turn implies that the value configuration of a business model might be affected. For successful implementation of green construction, five factors were recognized to be of high importance which two of them are equally important and much more important than the other factors (Lam *et al.* 2010): 1) Green technology and techniques and 2) Stakeholder involvement. Green technology and techniques refer to all routines and technology needed to implement green construction. Green technology which is more of technical aspect is related to the knowledge required to implement green construction and hence can be connected to the core competency element. Routines is by nature more related to arrange and rearrange of resources available to implement green construction, therefore it can be connected to the value configuration element of business model.

This discussion has some support in the literature. Ambec and Lanoie (2008) suggest an analytical framework for reducing environmental impacts consisting seven strategies that could results in increased revenues or reduced costs for a company. Three channels for increasing revenue can be directly applicable to green construction and also can be connected to business model elements of a construction-related company. Better access to certain markets as first increasing revenue channel corresponds to the target customer element. In the construction industry context, target customer in a business model specifies a segment of market or a population of customers who will pay for and care for green. This segment can include bodies such as government and governmental organizations or even NGO's who wish to pay for green construction and are interested in supporting green construction. As an example for better access to certain market, a construction-related company which has undertaken green construction can expect more revenues through GPP offered by mostly governmental clients (customer). This source of revenue is not available for other construction-related companies who are not green.

According to Ambec and Lanoie (2008) the differentiating channel as second revenue increasing channel is more likely to work when 1) customer is willing to pay more for green, 2) information regarding the green product [process] is credible and available and 3) the process [process] is hard to imitate. The three conditions seem to hold true for green construction and their customers. Green construction is not an easy process to imitate as it requires knowledge acquisition and learning and is not normally acquired through off-the-shelf style. Therefore, a direct relation between target customer, value proposition and revenue model in a business model of a construction-related company is expected.

Construction-related companies when thinking about undertaking green construction, in one hand, might consider the costs of undertaking it which might vary in nature but they evolve around creation/acquisition of green knowledge and its implementation. On the other hand, every construction-related company do not have enough capital to

bear the costs of green construction, hence obtaining funds will be an issue. In light of government and NGO's support for environmentally- friendly and green solutions, such as GPP policies, it is likely that construction-related companies enjoy the financial supports and ease of taking funds and loans from public and private sectors such as banks to invest on green construction. This will greatly reduce the cost of capital. This issue is directly connected to the partner network element of a business model and is consequently related to the cost structure of a business model.

Third, there seems to be much emphasis on the importance and the role of both core competency and partner networks. While these are both likely to be important for green construction, it is not known to if and in what ways partner networks for green construction differ to conventional construction partner networks.

CONCLUSION

This paper has reviewed green construction publications to investigate what elements of the business model change when a construction company undertakes green changes, and investigate if there seems to be any specific relations among different business model elements changes. Our preliminary results showed that any business model elements can change and that partner networks were the most emphasized in the literature followed by core competency and value configuration, and cost structure. Some relations among business model element changes that seem to be of great importance include core competency, value configuration and partner network on the one hand and value proposition, cost structure and core competency on the other hand.

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