

**IMPLEMENTING GREEN BUSINESS
MODELS IN THE UK
CONSTRUCTION INDUSTRY:
OPPORTUNITIES AND
CHALLENGES**

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IMPLEMENTING GREEN BUSINESS MODELS IN THE UK CONSTRUCTION INDUSTRY: OPPORTUNITIES AND CHALLENGES

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Dedication

To my parents

Abbreviations

BCG	Boston Consulting Group
BM	Business model
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CCC	Committee on Climate Change
CIRIA	The Construction Industry Research and Information Association
CPD	Continuous Professional Development
CSR	Corporate Social Responsibility
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DJGSI	The Dow Jones Global Sustainability Index
EIB	European Investment Bank
EPs	The Equator Principles
EPE	European Principles for the Environment
FL	Financial logic
FSC	Forest Stewardship Council
GBM	Green business model
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVP	Green value proposition
ICT	Information and Communication Technology
IRP	Interpretive ranking process
IS	Information Systems
ISM	Interpretive structural modelling

IT	Information Technology
KA	Key activities
KR	Key resources
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
MIT	Massachusetts Institute of Technology
NPPF	National Planning Policy Framework
OECD	The Organisation for Economic Co-operation and Development
RBV	Resource Based View
RICS	Royal Institute of Chartered Surveyors
SAP	Standard Assessment Procedure
SME	Small to Medium Enterprise
TG	Target group
UKGBC	UK Green Building Council
UN	United Nations
UNDESA	United Nation Department of Economic and Social Affairs
VP	Value Proposition
WCED	World Commission on Environment and Development
WRAP	Waste and Resources Action Programme

Abstract

Green business models (GBMs) have the potential to deliver a much better performance compared to conventional business models (BMs) in this age of sustainability. The question of how construction companies can transform their BMs based on green value propositions is both highly relevant for management and poorly understood to date.

This study empirically investigates GBMs transformations in the UK construction industry. The study closely scrutinises how GBMs are defined and understood by adopting a set of defined five elements from business and management literature: namely, green value proposition (GVP); target group (TG); key activities (KA); key resources (KR); and financial logic (FL). It also identifies changes, benefits, and challenges associated with GBMs to ultimately propose a guideline for GBMs implementation. It adopts a qualitative method to provide a diagnostic exploratory study and conducts 19 semi-structured interviews with academics and managers from various construction companies. This study applies thematic analysis as the main data analysis technique and further analyses and validates the findings by utilising interpretive structural modeling (ISM) and interpretive ranking process (IRP) techniques. ISM and IRP techniques are novel contributions to GBMs and construction research. The emergent findings are then validated and refined by conducting structured interviews with 4 academics and 1 director from a contractor practice.

A BM is considered to be green when a business changes element (s) of its BM to create and capture a business opportunity or a proposition for TGs that provides environmental improvement coupled with economic benefits. The key findings reveal that GBMs can link environmental sustainability with economic success in a systematic manner. They show that GBMs transformations require strong change capabilities and radically influence the way in which companies conduct business. In addition, they demonstrate the interrelation between the different GBMs elements and show that the GVP and FL represent the foundation of GBMs. The challenges that emerged from this research include: government constraints; financial constraints; industry constraints; company constraints; and lack of demand. However, the ISM analysis demonstrates that government policies are the root challenges that hinder GBMs transformations. Despite the challenges posed, GBMs have the potential to deliver credibility, financial and long-term viability benefits for construction companies. The study proposes and validates a

guideline for GBMs implementation for the UK construction industry. The guideline starts with creating top-management receptiveness and support the importance of capturing green demand to be converted into GVPs. It also stresses the importance of out-sourcing of some of the KA and KR and highlights the function of marketing and promotions. In addition, the guideline includes various reviewing and monitoring points to be fed to the top-management.

Although the BMs and GBMs are new in the construction discipline, this research, as far as can be established, is one of the few empirical academic works introducing and defining GBMs in the construction context. This study contributes originally to GBMs research by developing a structured relationship between the different GBMs elements and by ranking the elements with reference to benefit areas. The relationship between the GBM elements informs construction managers that the smallest details are not vital in a GBM instead how every element of it fits together as a whole reinforcing system is important matter. Consequently, the different elements of the GBM should never be analysed or developed in isolation. To capture economic benefits offered by environmental sustainability, construction companies need to concentrate on greening the whole BM rather than products and processes only. Finally, the study draws a list of recommendations for increasing GBMs uptake and suggests further research opportunities, particularly in the areas of GBMs elements and networks.

Key words: Business models, construction industry, environmental sustainability, green business models, UK.

Chapter 1. **INTRODUCTION**

1.1. The emergence of green business models

1.1.1. The green evolution

The days when climate change and global warming were theories are long gone. Today climate change and global warming have become a real threat by evidence shown in: heat waves, extreme weather events, and rising sea levels. A major global challenge of this century is how to tackle climate change and reduce carbon emissions.

As the debate around how to address climate change challenges intensifies, many industries and sectors are beginning to adopt green ideas. According to Sommer (2012) climate change has become a new market driver for businesses, hence the topics of climate change and sustainability have more and more become a priority for politics, media, and the public at large. This trend is also reflected in increased communication about sustainability which is evident through publications of corporate responsibility reports by different companies (Bansal & Roth, 2000). Another trend is that sustainability is not considered solely a threat anymore. Instead, many companies are starting to view sustainability as an opportunity to gain a competitive advantage over their closest rivals and to create economic values (Esty & Winston, 2009). For example, the Dow Jones Global Sustainability Index (DJGSI) tracks the financial performance of world leading sustainability-driven companies and according to Tan et al. (2011), DJGSI companies have outperformed the standard Dow Jones Global Index by 15% per year over the period 1994-2000. Elsewhere the FTSE4Good index rates companies on their environmental and social performance. FTSE4Good companies have achieved better performance than conventional FTSE100 companies historically (Tan et al., 2011). Such examples demonstrate the positive relationship between sustainability practice and business performance, thus leading to improved investment opportunities. In a related vein, Park and Ahn (2012) stated that the changing attitudes toward greener growth and sustainable development potential in the financial market are classified as critical factors when assessing companies' long-term competitiveness and profitability.

It is anticipated that addressing the economic values of sustainability activities will motivate more and more companies to adopt sustainability activities.

Esty and Winston (2009) stated that smart companies seize value creation and competitive advantage through addressing environmental challenges such as climate change. Also they regard climate change as a politically debatable issue since the costs of addressing the problem and not addressing it could be very high. For instance, the British government's Stern Review (2006) on the economics of climate change recommended that it made economic sense to aim to avoid the worst effects of climate change.

According to Sommer (2012), sustainability is no longer thought of as a matter of philanthropy at the level of the companies. Instead, companies are starting to view sustainability as a source of competitive advantage and a source to create economic value. However, the core question yet to be answered is: Do sustainability practices as such create value for the company or not? It seems reasonable to claim that a company should at least seek to develop its sustainability performance as long as this will create value for the company in the long run. In practice, it is unrealistic to expect businesses to improve their environmental performance beyond that point, at the expense of economic value (Sommer, 2012). Nevertheless, businesses are at the forefront of tackling sustainability issues because they are a great source of innovation. The role of businesses can be clearly captured from the following statement: *"We cannot achieve a more equitable, prosperous and sustainable future without business engagement and solutions."* Ban Ki-Moon, United Nations Secretary – General (UN, 2013) pp.2. Market-based approaches have emerged to actively tackle sustainability issues (Krämer & Herrndorf, 2012). These approaches aim to harness the capabilities of private-sector players to resolve global problems and have gained credibility in recent years.

Overall progress in sustainability has thus been gradual rather than radical so far, in that most companies have ceased to fundamentally challenge their business models with regard to sustainability (Beltramello, Haie-Fayle, & Pilat, 2013; Sommer, 2012). However, recent studies demonstrate a shift in this passive approach towards a more active and revolutionary approach. For example, MIT Sloan Management Review and Boston Consulting Group (BCG) conducted a survey with more than 2,600 executives, managers, and thought leaders from around the world and from a wide range of

industries in the Sustainability & Innovation Global Executive Study (David Kiron, Kruschwitz, Reeves, & Goh, 2013). The survey revealed that 23% of those respondents changed their business model because of sustainability and also generated profits from their sustainability-related activities and decisions.

1.1.2. The origins of the business model concept

The business model (BM) concept has emerged during the end of the twentieth century and has been associated with the e-business phenomenon. Many people attribute the success of some dot-com firms such as eBay and Amazon to the creation of new BMs (Malone et al., 2006). Therefore, the e-business movement originated the BM as a new unit of analysis and management concept (Osterwalder, 2004). The BM may tentatively be defined as *a blueprint of the value proposition offered to the customer, the way the business organises itself to create and deliver that value and generate profits from it* (Sommer, 2012 pp. 4)-a detailed discussion on the concept is presented in Chapter 3. In spite of its roots and origins, the concept continues to be considered useful by different disciplines. For example, Burkhart et al. (2012) suggested that BMs are popular and useful in the fields of strategic management and information systems. Lambert and Davidson (2013) recognised the BM concept as a distinctive management research topic which can be relevant to different contexts and industries. In addition, Teece (2010) stated that the BM concept is relevant for researchers trying to examine the logic behind economic value creation. Recently, the BM has gained popularity in construction research and started with the introduction of ICT and e-commerce in the construction context (Pan & Goodier, 2011). Various studies relate the BM to value creation and capture, with emphasis on customer's role (Aho, 2013; Pekuri, Pekuri, & Haapasalo, 2013).

The challenge of global sustainability has the power to radically transform many industries with the construction industry being no exception (Sommer, 2012). Therefore, this study suggests that the BM approach can bring systematic and radical change to how construction companies can respond to the sustainability challenge (Aho, 2013). In addition, the BM concept can be utilised to distinguish real sustainability opportunities from 'greenwashing' and help with seizing these opportunities (Sommer, 2012). In other words, the BM can guide companies to become sustainable and more competitive.

1.1.3. Green business models

There is no doubt that sustainability will lead to fundamental changes in the business world (Esty & Winston, 2009) with the construction businesses being no exception. Naturally, the resulting new business environment brings about enormous opportunities and challenges that can shake the competitive landscape of industries to the core. *“Thus, hesitant managers should be asking themselves: How do sustainability issues influence the future success of our current business model? And: How can we adapt them to best mitigate the risks and take advantage of opportunities arising from sustainability issues?”* (Sommer, 2012 pp.5). Green business models (GBMs) can be a means towards competitive sustainability because they are based on green value proposition creation to customers and capture of profit and reputation. In addition, Henriksen et al. (2012) provided a definition for GBMs as follows: *“Green business model innovation is when a business changes part(s) of its business model and thereby both captures economic value and reduces the ecological footprint in a life-cycle perspective”*.. According to Sommer (2012), GBMs can be considered as an intersection between two research domains: namely, BMs and environmental sustainability. This research adopted this view to establish a common ground in understanding and defining GBMs in the construction context. The GBMs are covered in more detail in Chapter 3, in which a definition, key elements, and prototypes are presented.

Sommer (2012) stated that GBMs often require substantial investment of capital and other resources and are intertwined with the existing business environment in complex ways. GBMs therefore tend to conflict with conventional business practices and structures. For this reason, many business leaders, including those in construction, overlook the potential benefits associated with GBMs and fail to question their existing business logic and investment decisions with regard to sustainability issues. This study aims to help rectify this situation and assist management in understanding GBMs transformation and development, thereby accelerating the transition towards an environmentally and more sustainable economy.

1.2. Purpose of this study

1.2.1. Current state of research

Megatrends such as climate change, resource scarcity, and a shift in market preferences towards increased emphasis on environmental and social performance are creating new challenges to the traditional supply-side group of the construction industry. For all groups involved in the construction process, these challenges can create additional risks as well as new opportunities (Lützkendorf, Fan, & Lorenz, 2011).

There is an increasing consensus that the sustainability agenda and green practices are in high demand in the construction industry, not only for its return on investment, but also because being environmentally responsible can boost a project's profile and the developer's reputation, resulting in a market edge over its competitors (Fehrenbacher, 2010). Consequently, new concepts have emerged to express sustainability in the construction context. These concepts include: green construction; sustainable construction; and ecological construction. Green construction refers to practices and processes that are environmentally friendly, resource efficient, energy efficient, and generate less waste (Arif et al., 2009). Green construction differs from conventional construction, in terms of the processes, designs, and materials used (Mokhlesian & Holmen, 2012). It adds tangible and intangible values to the construction services. The tangible values can be a higher profit as a consequence of lower internal costs, lower consumption of materials, and resource efficiency, while the intangible values can be a lower environmental impact, increased reliability, brand value, and reputation (Arif et al., 2009; Fiedler & Deegan, 2007).

The major drivers behind the adoption of green practices in the construction context are: legislative, ecological, and economic drivers. These three groups of drivers, and in particular the economic drivers, for example client requirements, have encouraged the construction industry to create green value propositions - their products or services are more environmentally sound when compared to conventional practices (Mokhlesian & Holmén, 2012). A company may derive a reputational value from green services by changing the criteria that are most relevant to the customer through for instance revised environmental processes and practices which both redefines the competition and helps customers to become green (Sommer, 2012). Also cost savings, in the operational phase of a building with green features, have encouraged more stakeholders, including clients,

to ask for green buildings because they see long-term economic benefits (Bartlett & Howard, 2000).

The current state and trend of environmental sustainability in the construction industry is mainly dealing with greening the industry through adopting environmental management systems. The current research is focused on regulatory compliance as a main driver for green construction and supported the environmental regulations as a tool towards a greener industry (Ball, 2002; Qi, Shen, Zeng, & Jorge, 2010; C. Tam, Tam, & Tsui, 2004; V. W. Y. Tam, Tam, Zeng, & Chan, 2006). However, this research is more concerned with the economic benefits offered by environmental sustainability (Revell & Blackburn, 2007; Vatalis, Manoliadis, & Charalampides, 2011). This approach is believed to be the way forward to adopting greener approaches by construction companies.

1.2.2. Research gap

As mentioned above, environmental sustainability can indeed facilitate economic success for companies. However, the link between the two is complex, and there is a trap that companies may engage in many disconnected environmental initiatives and practices that fail to tap the full economic potential which environmental sustainability offers (Sommer, 2012). Similarly, companies may find it difficult to convert abstract environmental strategies into viable business concepts that can be delivered through companies' operations and structures, to ultimately create sustained profits. This research proposes the BM concept to overcome these problems. This proposal has some support in the literature. For example, Sommer (2012) suggested that the relatively new concept of BMs is central to deal holistically with the complex economic nature of environmental sustainability – a task that conventional management often fails to fulfil satisfactorily. BMs provide a better understanding on how green or environmental value is captured, turning into profitable products and services and how to deliver satisfaction to customers (DBA, 2012). In addition, Wells (2013) stated that technological innovation alone is unlikely to resolve all sustainability challenges. A more fundamental and dramatically different approach is needed to create and even demand new BMs as part of the broader transition towards sustainable development and a low carbon future.

To profit or capture value from environmental activities and practices, the comprehensive transformation of the BM has to be at the heart because BMs are at the

core of shaping all company activities (Sommer, 2012). However, it seems there are no explicit studies on what changes are common or required in the construction companies' BMs when they are involved in green practices or projects (Mokhlesian & Holmén, 2012). The aim of this research is to fill this gap by identification and mapping BM changes relative to green or sustainable activities in the construction context, through a survey of literature and empirical data.

Aho (2013) argued that the majority of sustainable construction research efforts have focused on improving design strategies, design tools, and alternative design processes, and on developing systems, products and technologies. These approaches only address isolated parts of BMs. What is missing is how companies can systematically create and lead fundamental transformations of their conventional BMs to make them green and profitable. A large omission of the research is therefore in BMs and industry structure transformation (Aho, 2013). This research aims to fill that gap, both in terms of the lack of theoretical foundation as well as by proposing a guideline that can assist companies wishing to develop GBMs.

1.2.3. Research statement

1.2.3.1. Aim and objectives

This research aims to understand and implement GBMs in the UK construction industry.

To satisfy the overall aim, the following research objectives have been set:

1. To understand the link between environmental sustainability and economic success in the construction industry through the BMs lens
2. To define, establish, and conceptualise the elements of a GBM
3. To identify challenges and benefits associated with GBMs
4. To propose a guideline for GBMs implementation.

1.2.3.2. Research questions

The central research question is formulated as follows:

How can construction companies successfully make fundamental changes to their business model(s) based on green value propositions, thereby improving or sustaining economic performance?

The central research question leads to a number of related theoretical and practical sub-questions that need to be answered in order to deliver a robust work on the issue:

1. How can BMs be used systematically as a management tool to address the effects of environmental sustainability on economic viability of the construction companies?
2. What constitutes a GBM?
3. What are the challenges and benefits associated with GBMs?
4. How can the implementation of GBMs be facilitated in the UK construction industry?

1.2.4. Definition of scope

The construction industry has narrow and broad definitions, as signified by Pearce (2003). The narrow definition restricts attention to on-site activities performed by contractors, while the broad definition tends to include the supply chain for construction materials, products and assemblies, and professional services such as architecture, management, consultants, engineering design, surveying, and perhaps facilities management, property developers, clients, and end-users. The wider definition has the potential to draw attention to economic and environmental activities that directly depend on the narrower definition of the construction industry which focuses on contractors. The narrow and the wide definitions can be seen to complement each other. Therefore, both definitions are legitimate for the purposes of understanding and developing GBMs, and both are adopted in this thesis.

Wirtz (2010) suggested that the BM concept can be applied at different levels such as industry, company, and business unit. This study will consider the BM at company level as the unit of analysis and will cover various companies that represent the whole construction industry as explained above. In addition, the BM of a construction company is better understood by senior managers and directors hence those are the target individuals during the data collection process. Considering heterogeneous sample, will establish common language regarding GBMs and facilitate better understanding of their characteristics at the industry level.

The growing dominance of sustainability has led to the growing use of term “green”. In this regard, the term “green” is used and misused in many ways. In most case, it can

even include social aspects and considerations (Sommer, 2012). The study will concentrate on the environmental definition of “green” and consider other aspects of sustainability just if they are part of a collective green value proposition. Green activities that are unrelated to the core business are not in its scope.

The term “green business model” is used instead of “sustainable business model” and “business model for sustainability” because they are relatively too broad in scope (Sommer, 2012). In addition, the term “green business model” means that the green value proposition is a main stream to conduct a business which is relevant to this study. Finally, this study is based on empirical data from practitioners, experiences, and practices in the UK construction industry, thus its findings may have reflected the UK context and circumstances only. However, the principles that will be discussed may be replicable elsewhere, albeit with cautious modifications.

1.3. Original contributions

The main contributions of the research are summarised below:

- It justifies the relevance of BMs to link environmental and economic sustainability in a systematic manner
- It presents a clear definition and explanation of the BM and GBM concepts
- It introduces and adapts GBM elements to the construction context
- It maps the practical changes associated with GBMs transition
- It develops the relationship between various GBM elements
- It identifies various challenges facing GBMs and generates the relationship between them, to highlight the root challenges
- It establishes the key benefit areas associated with GBMs
- It ranks the different GBM elements with reference to key benefit areas to signal which elements have the dominant role in delivering various benefits to companies
- It proposes a guideline that can assist construction management in GBMs transformations and implementation.

1.3.1. Related publications

The original contributions of this study are supported by the following publications:

- Abuzeinab, A., & Arif, M. (2014). Stakeholder engagement: A green business model indicator. 4th International Conference on Building Resilience, Incorporating the 3rd Annual Conference of ANDROID Disaster Resilience Network, MediaCity UK, Salford, United Kingdom, 8th -11th September 2014.
- Abuzeinab, A., Arif, M. & Thompson, W. (2014). Green business models in the UK construction sector: Empirical study. Proceedings of the 2014 Industrial and Systems Engineering Research Conference, 31st May – 3rd June, 2014, Montréal, Canada.
- Abuzeinab, A., & Arif, M. (2014). Emergence of the business models in the building and construction literature. The 2014 CIB W55/65/89/92/96/102/117 & TG72/81/83 International Conference on Construction in a Changing World, 4th – 7th May, 2014, Sri Lanka.
- Abuzeinab, A., & Arif, M. (2013). Business model reconfiguration in green construction: A theoretical perspective. Paper presented at the 11th IPGRC 2013 International Post Graduate Research Conference, University of Salford, Media City, UK, pp.68.
- Abuzeinab, A., & Arif, M. (2013). Sustainable construction capabilities: A Local Authority perspective. Paper presented at the 11th IPGRC 2013 International Post Graduate Research Conference, University of Salford, Media City, UK.
- Abuzeinab, A., & Arif, M. (2013). A conceptual green business model for construction companies: An empirical evaluation. Paper presented at the 8th Annual Green Economics Institute Conference, University of Oxford, Worcester College, UK, pp.36-40.

1.4. Structure of the thesis

Figure 1-1 summarises the structure of this thesis. It is organised into five parts: after this introduction (Part 1), Part 2 constitutes the theoretical foundation and perspective of this study. Part 3 presents the methodology and research design. Part 4 draws upon

empirical data collection and analysis of GBMs and extends the theoretical part towards a practical guideline for management. Finally, a conclusion, recommendation, and future outlook are provided in Part 5.

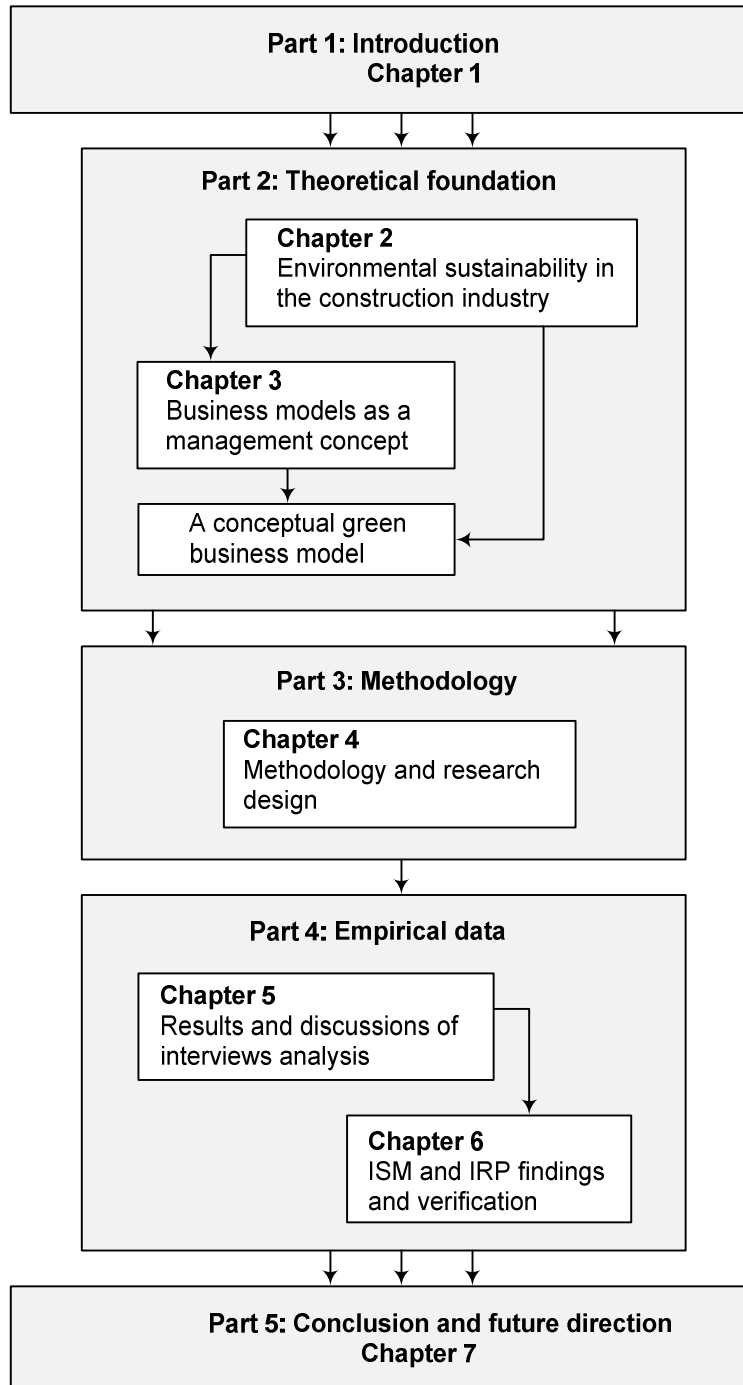


Figure 1-1 Thesis structure

Following this introduction, the rest of the thesis is organised as follows (Figure 1-1): **Part 2** constitutes the theoretical foundation which is divided into two chapters. **Chapter 2** presents a review of environmental sustainability in the construction industry. Sustainability is defined in a broader sense relevant to sustainable development dimensions. Sustainable construction in the UK context is also presented, with emphasis on the environmental dimension. The driving forces for environmental sustainability are briefly discussed and the response of the construction industry to the sustainability agenda is presented. Finally, the economic benefits associated with it are highlighted, to identify limitations and opportunities.

Chapter 3 reviews the emergence of business model concepts in the business and management disciplines as well as in the building and construction disciplines, to facilitate better understanding of green value creation and value capture. The definition of the business model, its main elements and its relationship to strategy are presented. Justification of the business models approach is also presented. Special attention is given to future direction of the business model in the building and construction disciplines. The link between environmental sustainability and business models is introduced: a conceptual green business model.

Part 3 includes **Chapter 4** which discusses the research methodology. Philosophical stances, approaches, and research methods are presented. Research design is also discussed, with emphasis on qualitative data collection and analysis techniques. Semi-structured interviews are the main instrument of data collection. In addition, purposive and convenient sampling techniques are used to obtain a representative sample. Three various data analysis techniques are utilised to overcome the single data collection limitations. The data analysis techniques include: thematic analysis, interpretive structural modelling (ISM), and interpretive ranking process (IRP). Finally, the limitations of the methodology are discussed.

Part 4 starts with **Chapter 5**, which presents the data collection and analysis. The profile of the interviewees and interview process are presented. **Chapter 5** also presents the findings from the interviews which were analysed by a means of a thematic analysis. The findings are organised into five major themes. Each theme has various sub-themes which emerged from the data analysis.

Chapter 6 builds on the findings from Chapter 5 and utilises the ISM technique to examine the relationship between GBM elements and to understand the mutual influences among the GBM challenges. The technique results in the development of two ISM-based models for GBM elements and challenges respectively. In addition, this Chapter applies IRP to rank the GBM elements with reference to key benefits. It also proposes a guideline for GBMs implementations and includes discussions on the research findings and implications. In addition, it validates the ISM-based model for GBM elements and the guideline for GBMs implementation by a means of structured interview with five experts.

Part 5 comprises **Chapter 7** which concludes with a recapitulation of the findings and contributions of this study, and discusses its recommendations and the possibilities for future research avenues.

1.5. Summary

In this Chapter, the context, motivation, and focus of the research have been provided. It has presented the background to the green movement, BM, and GBMs development and explained the main terms that will be used throughout the thesis. The purpose of the study is also presented, including the research gap. The Chapter has stated the aim, objectives, central research question, and sub-questions that need to be answered. In addition, the boundary of the study has been defined. This was followed by a summary of the research, from its design to data collection and analysis. In addition, original contributions have been presented with related publications. Finally, the structure of the thesis is revealed. The next two Chapters provide the theoretical perspective of this study and present the relevant research domains.

Chapter 2. ENVIRONMENTAL SUSTAINABILITY IN THE CONSTRUCTION INDUSTRY

2.1. Introduction

As stated in the previous chapter, environmental sustainability represents the first research domain that relevant to GBMs. Therefore, it is essential to highlight the important issues related to sustainability in general and to environmental sustainability in particular. The current chapter aims to report these issues.

This Chapter starts with new trends in viewing sustainability and sustainability definition in Section 2.2 and 2.3 respectively. Section 2.4 and 2.5 present an overview of sustainability in the construction context with emphasis on environmental sustainability. Section 2.6 includes the major drivers of adopting green practices, coupled with the benefits of addressing environmental impacts. The response of the construction industry to sustainability agenda is summarised in Section 2.7 In addition, Section 2.8 links the environmental performance and economic benefits and concludes with building the business case for environmental sustainability.

2.2. Emerging trends

In recent years, a growing interest towards sustainability has gathered momentum due to rising oil prices, the global financial crisis, and the global warming phenomenon (Arif, Egbu, Haleem, Kulonda, & Khalfan, 2009; Renukappa, Egbu, Akintoye, & Goulding, 2012). Some established companies such as General Electric have completely changed their previous discard of sustainability and currently consider it an integral part of their business strategy and future growth. Nonetheless, many other companies still regard sustainability to be a side or periphery issue and few act proactively in order to create and derive values from it (Sommer, 2012). Investors and financial markets are paying attention to sustainability which is evident from the launch of sustainable indices by the FTSE and Dow Jones (Fowler & Hope, 2007). This demonstrates the importance of seeking a sustainable approach in conducting business.

Another growing interest is that sustainability is not considered solely as a threat anymore. Instead, more companies view sustainability as an opportunity to gain a competitive advantage over their closest rivals and create economic values (Esty & Winston, 2009). Therefore, it is the aim of this chapter to support the notion that addressing sustainability, and more precisely environmental sustainability, makes economic sense too. One of the major challenges associated with sustainability in business both to academics and practitioners, is to define it because sustainability is a difficult and elusive concept to explain. Hence, sustainability is defined next.

2.3. Sustainability definition

The concept of sustainability has generated a large array of concerns in the last decades which encouraged some to develop alternative terminologies to express some of the same concerns regarding present and future living and development. For example, while governments and private sector organisations have tended to use the term ‘sustainable developments’, academics have adopted the term ‘sustainability’ in similar contexts (Robinson, 2004). The Brundtland Report (WCED, 1987) popularised and produced the most widely used definition of sustainable development: *“Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.”* Although we talk about sustainability all the time, people from regulatory bodies, businesses, and clients still view sustainability from different perspectives. For example, a recent survey showed that among senior managers and business leaders who regarded themselves as novices in sustainability matters, sustainability is often defined as ‘business viability’, while more expert executives in the sustainability domain define it in accordance with Brundtland’s definition (Maurice Berns, 2009a). Similarly, the UK Government has defined sustainable development as *“ensuring better quality of life for everyone, now and for generations to come”* (DEFRA, 2005). According to (Raynsford, 1999), the UK government approach to sustainable development was underpinned by four major themes which were: social progress, protection of the environment, stewardship of resources, and promoting economic prosperity together with a stable level of employment. However, Ivankova (2010) argued that both definitions have been criticised for not being able to provide clear guidelines for business action. Indeed, Chiu (2003) argued that although it is easy to understand the concept of sustainable

development, its implications on policies, businesses, and individual behaviours are often too complex to grasp.

There is a consensus that sustainability has three aspects or dimensions: namely, environmental, economic, and social. Some approaches focus only on the environmental or social or economic considerations, while others attempt to cover all three aspects simultaneously (Renukappa, Egbu, Akintoye, & Goulding, 2012). Another popular interpretation of sustainability and practical definition provided by sustainability pioneer John Elkington has become better known as the 'triple bottom line', where companies should complement their attention to the financial bottom line and economic prosperity with consideration of the environmental and social bottom lines. This view argued that the financial bottom line needs not to suffer from an integrated and expanded management and businesses focus on sustainability (Sommer, 2012). However, the translation of the triple bottom line concept into practice has proven to be difficult for most businesses (Renukappa et al., 2012). A more practical approach to sustainability is that each discipline or study attempts to develop its own operational definition to reflect a context specific requirement. For example, Osmani and O'Reilly (2009) looked at housing sustainability from a zero carbon lens. This approach may fuel the diverse range of work that defines sustainability but at the same time it may not be possible to develop a unified definition that addresses and takes into account different requirements for different disciplines. In the last decade, the concept of sustainable development and sustainability attracted many criticisms. Robinson (2004), for example, has compiled three considerable criticisms. Firstly, the concept is vague in that it means many different things to different people and organisations. Secondly, it attracts hypocrites who use the language of sustainability to defend unsustainable activities. Thirdly, it fosters delusions in that it fails to acknowledge that the current rates of economic growth are unsustainable and that it draws attention away not only from the need to develop new ways of how people can deal with the natural world but also from the need for radical political and social change. Nevertheless, these concepts provide a new perspective to interpret and possibly steer radical change in all aspects of human and natural lives including construction industry development and activities.

The rapid growth of the sustainable development concept has influenced the construction industry in the form of new practices and concepts such as sustainable construction, green construction, and green buildings. The relationship between

sustainable development and the construction industry has emerged for two reasons; firstly because the industry is of high economic significance and has strong environmental and social impacts and secondly because it has always lagged behind other industries and sectors (Myers, 2005). The purpose of the next section is to discuss the concept of sustainability as it relates to the construction industry, with focus on the UK, where this study is conducted.

2.4. Sustainability agenda in the UK construction industry

The construction industry provides the context for most human activities. The quality of the built environment has a huge impact on the quality of people's lives (Raynsford, 1999). In the UK, construction is a major sector of the national economy. Rhodes (2014) stated that the construction industry accounts for 6% of the economic output and provides employment for 6.5% of the population. Therefore, the construction industry has an important role to play in achieving sustainable development goals. The concept of sustainable construction has emerged to express this role. While the traditional approaches of the construction industry focused on cost, time and quality issues, sustainable construction adds the issues of minimising resource consumption and negative environmental impacts, creating healthy buildings, and ensuring quality of life (Sev, 2009). Consequently, the construction industry will not only focus on the initial capital investment but also on the entire lifecycle of the building.

There are numerous definitions for sustainable construction, for example *"the creation and responsible management of a healthy built environment based on resource efficient and ecological principles."* (Kibert, 1994). This definition is considered one of the earliest definitions which was proposed during the First International Conference on Sustainable Construction in Tampa, Florida, US (Hill & Bowen, 1997). Other scholars defined sustainable construction in a way that reflects the basic sustainable development dimensions: namely, environmental, economic, and social aspects. This can be found in a definition by Essa and Fortune (2008) in which sustainable construction is a construction process that brings environmental responsibility, social awareness, and economic profitability to the built environment strategies and practices. Sev (2009) argued that sustainable construction must rely on three principles: design for human and environment, life-cycle design, and resource management. The Marrakech Task Force

on Sustainable Buildings and Construction set up by the UN Department of Economic and Social Affairs (DESA) defines sustainable construction as: *“The construction that brings about the required performance with the least unfavourable ecological impacts while encouraging economic, social and cultural improvement at local, regional and global level”* (UNDESA, 2010, p. 3).

In the UK, several government initiatives supporting sustainability in the construction industry have been developed and published (DETR, 2000; Pearce, 2003; SBTG, 2004). However, the Pearce Report paints a clear picture about the relationship between the construction industry and sustainable development. Pearce suggests that the industry can be assessed by looking at direct and indirect outcomes of construction activities on the economy, environment, and society. He also developed a model clarifying the contribution of the industry to sustainable development, as presented in Figure 2-1.

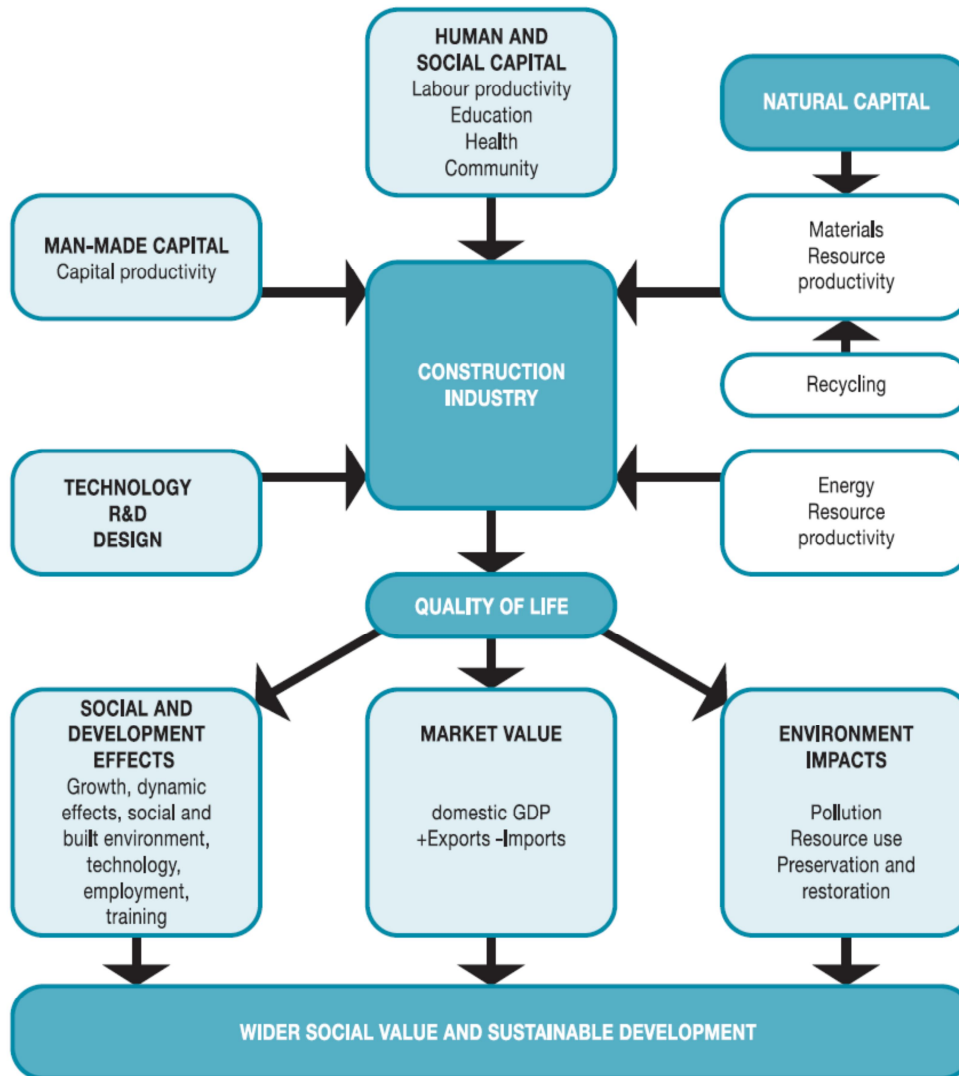


Figure 2-1 Model of construction and sustainable development - Pearce schema (Pearce, 2003)

Figure 2-1 presents a novel approach to sustainable construction based on economic and capital accounts. It shows the interaction between various components of the industry's capital approach to sustainable development.

Sustainable construction in the UK is understood as the application of sustainable development to the construction industry. For example, the Department of the Environment, Transport and the Regions (DETR) has set out an industrial strategy for sustainable construction (Building a Better Quality of Life) to be achieved by:

- being more profitable and more competitive
- delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users

- respecting and treating stakeholders more fairly
- enhancing and better protecting the natural environment
- minimising consumption of energy (especially carbon-based energy) and natural resources (DETR, 2000).

This strategy has been superseded by the Review of Sustainable Construction 2006. In 2008, the UK government launched the Strategy for Sustainable Construction which does not provide a clear definition for sustainable construction. However, the strategy establishes the link between the UK Government's Sustainable Development Strategy and the construction industry. It supports the long-term vision of sustainable construction by: providing clarity to businesses about the existing regulations and initiatives; achieving sustainability in specific areas through setting higher standards; and taking the sustainable construction agenda forward through making specific commitments by industry and Government. In addition, this strategy has proposed a set of primary targets related to the 'ends' and 'means' of sustainable construction. The 'ends' relate directly to sustainability issues such as climate change, water, biodiversity, waste, and materials. The 'means' relate to processes to help achieve the 'ends' and includes the following: procurement, design, innovation, people, and better regulation (HMG, 2008b). Furthermore, various measures have been developed to assess and evaluate sustainable buildings. For example, the Building Research Establishment Environmental Assessment Method (BREEAM) was introduced by the Building Research Establishment (BRE) in 1990 as the first voluntary building assessment method in the world. BREEAM addresses wide-ranging environmental and sustainability issues such as management, health and well-being, land use and ecology, water, energy, transport, material and waste, and pollution. A weighting system is applied in order to obtain the final BREEAM rating which is awarded as: "Excellent", "Very good", "Good", and "Pass" (Arif, Bendi, Toma-Sabbagh, & Sutrisna, 2012; Potbhare, Syal, Arif, Khalfan, & Egbu, 2009). BREEAM has five major schemes for certification. These schemes can be summarised as follows (BRE, 2014):

- BREEAM Communities: covers the planning stage of communities
- BREEAM New Construction 2011: covers the design and construction of new buildings (non-domestic)
- Code for Sustainable Homes: covers the design and construction of domestic buildings

- BREEAM In-Use: covers in-use assessment of an existing building
- BREEAM Refurbishment: covers refurbishment and renovation.

Responsible construction companies, therefore, are called upon to address sustainability issues to enhance the poor public image of the industry. Robinson (2004) outlined a vision of sustainability that is problem-centred and that integrates environmental, economic, and social dimensions. This vision is therefore adopted to discuss sustainable construction dimensions in the subsequent sections.

2.4.1. Environmental sustainability

The environmental perspective of sustainable construction has been gathering momentum in recent studies. Its impact can be summarised in the following areas:

- Waste creation: negative impacts of waste creation are diverse including harming the surroundings by hazardous pollution, taking up land resources for waste landfill, and wasting natural resources. The UK government has introduced the Landfill Tax and Aggregate Levy to reduce waste generation. This legislation has encouraged major contractors to develop waste management policies and practices (Pitt, Tucker, Riley, & Longden, 2009).
- Energy use: the construction of a building is an energy demanding process that consumes energy at each stage, from site clearance to operation and maintenance throughout the life cycle. Improving the energy efficiency of the building results in reduced energy consumption and a reduction in carbon emissions, a basic cause of environmental problems. Reduced energy use ultimately improves overall environmental performance of the building. According to Pitt et al. (2009), the built environment is responsible for 50% of total UK energy consumption.
- Water use: the construction industry can improve water usage in building by incorporating water efficient technologies such as low-water flush toilets and reduced flow taps. These measures can achieve an estimated 20% improvement in water efficiency (Pitt et al., 2009). In addition, rain water harvesting techniques can contribute to efficient use of water.
- Pollution and bio-diversity: the Building Research Establishment (BRE) defined pollution from construction as *“particles, noise, vibration and vaporous*

discharges.” Measures should be taken to eliminate this potential pollution. In addition, the construction industry should consider enhancing or at least better protecting biodiversity (Pitt et al., 2009).

Environment and sustainability are often used interchangeably because the adverse impact of climate change and environmental degradation are evident and therefore actions were needed immediately to protect the environment. In addition, environmental lobbying has been established long enough to demand for mandatory and voluntary standards. The environmental dimension in the construction sector is mainly concerned with reduction in carbon emissions and transition to a low carbon sector. This concern reflects the UK legal obligation to reduce carbon emissions by at least 80% compared to the 1990 baseline by the year 2050 (HMG, 2008a). Energy also dominated the debate of reducing the environmental impact of construction activities with various regulations and initiatives concentrating on energy consumption, building performance using various measures, and alternative clean energies. Energy performance policies and standards are mainly developed and guided by the Building Regulations and the Standard Assessment Procedure for Energy Rating for Dwellings (SAP) (Lowe & Oreszczyn, 2008). Resource efficiency is also one of the important parameters in defining environmental sustainability. Emphasis is given for resources used during the construction stage, such as building materials consumption and water usage (Xue, 2012). The reason for this can be the assumption that it is easy to quantify and assess the impact during the construction stage. This is usually done by the provider company which has enough resources to carry out the necessary assessments and to ensure compliance. Resource efficiency in the construction stage often results in significant waste reduction. Waste and Resources Action Programme (WRAP) acts as the main delivery organisation working in the UK to help implement resource efficiency priorities. WRAP works closely with resource intensive sectors including the construction sector to come up with practical solutions that work and make a real difference. The efforts and initiatives on resource efficiency and waste reduction resulted in the emergence of the circular economy concept. The circular economy has evolved as an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, obtain the maximum value from them while in use, then recover and redevelop products and materials at the end of each service life, as presented in Figure 2-2. Another important parameter of

environmental sustainability is renewable energy and resources. For example, the National Planning Policy Framework (NPPF) encourages the use of renewable resources, such as renewable energy development within the 12 core planning principles (DCLG, 2012). In addition, the government introduced a Feed-In Tariffs (FITs) scheme in 2010 as a financial incentive to encourage renewable energy generation uptake. A similar scheme is being introduced for heat generation: the Renewable Heat Incentive (RHI).

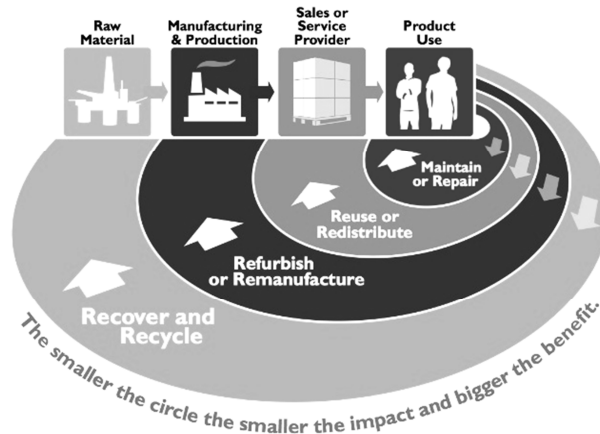


Figure 2-2 Circular economy illustration (Source Google image)

The figure above presents the concept of a circular economy where resources are used efficiently to generate less waste. Raynsford (1999) argued that the public acceptability of the construction industry is dependent on the industry commitment towards the environment. The green construction concept is therefore used widely to denote this commitment. Green construction refers to practices and processes that are environmentally friendly, resource efficient, energy efficient, and generate less waste (Arif et al., 2009). However, Kibert (2007) argued that green construction or sustainable construction can be used interchangeably. For the purpose of the study, the concept of 'green construction' will be used throughout this thesis to denote the environmental activities and practices. More details and justification of the environmental focus are presented in Section 2.5.

2.4.2. Economic sustainability

The construction sector has the potential of substantial growth opportunities with the global construction market predicted to grow by over 70% by 2025 (Construction, 2025). The economic aspect of sustainable construction focuses on the importance of

stable economic growth by using resources efficiently and adopting measures from rewarding employment through to competitiveness and trade (Essa & Fortune, 2008; Vatalis et al., 2011). Considering sustainability has the potential to enhance a company's profiles, improve the relationships with stakeholders, and improve perceptions of the construction industry among customers (Alkhaddar, Wooder, Sertyesilisik, & Tunstall, 2012; Essa & Fortune, 2008; Fehrenbacher, 2010; Roberts & Sims, 2008). In addition, companies can attract investment and government funding by focusing on sustainability issues.

In the economic dimension, sustainability is concerned with the substitution of natural to human-made capital wherever possible. The construction industry has a major role to play in this substitution, although there is intensive debate around the issue of the degree to which human-made capital can be a substitute for the natural capital (Hill & Bowen, 1997). Sev (2009) stated that the attainment of sustainability goals relies on an economic shift from the initial capital investment to the entire lifecycle of the buildings. This shift will ensure the provision of affordable and durable buildings for clients and end-users. However, Vatalis et al. (2011) argued that buildings are generally financed with shorter timing horizons driven by demands and this conflicts with sustainable construction goals which are generally longer term. According to Hill and Bowen (1997), the economic dimension of sustainable construction requires companies and their practitioners to:

- Ensure affordability for intended beneficiaries by reducing the overemphasis on technical issues
- Promote employment creation where projects are located to ensure that some of the financial contribution of a project remains local
- Use full-cost accounting and real-cost pricing to set prices and tariffs for products and services to achieve more efficient use of resources and more equitable development
- Enhance competitiveness in the market place by adopting policies and practices that enhance and support issues of sustainability

- Choose and work with an environmentally responsible supply chain which can demonstrate environmental performance.

In summary, some emerging economic concepts of sustainable construction are as follows: integration of short-term return and long-term profits; value for money; green value; improved efficiency measures which means maximum output with minimum input; stakeholder collaboration between demand and supply sides; and business pattern changes from a linear process to a cyclic process (Khalfan, 2000; Revell & Blackburn, 2007; Vatalis et al., 2011).

2.4.3. Social sustainability

The social dimension of sustainable construction is based on the notion of equity or social justice (Hill & Bowen, 1997). In addition, social sustainability focuses on providing high customer satisfaction; responding to the needs of people; improving the quality of human life and the human living environment, which includes culture, health, and education; implementing skills training and capability enhancement for disadvantaged people; and working closely with employees, suppliers, clients, and local communities (Essa & Fortune, 2008; Hill & Bowen, 1997). The social dimension of sustainable construction is perhaps the most difficult component to address and translate into individual projects and developments because of the inherent ambiguity and interpretative flexibility of social sustainability which cannot be fully overcome (Boström, 2012).

Social sustainability gained popularity in the UK when the Social Value Act came into force on 31st January, 2013. It demands that people and organisations who commission and procure public services maximise and add social value by, for example, offering additional work experience, placements, and apprenticeships for local people. A major developer may offer to contribute to a local project or infrastructure to enhance living standards when applying for planning permission to develop a housing or commercial site in a particular local authority area. Hill and Bowen (1997) summarised and compiled social principles of sustainable construction as follows:

- Improving the quality of human life by ensuring adequate consumption of basic needs such as food, shelter, health, education, and beyond that by ensuring comfort, identity, and choice

- Developing provision for social self-determination and cultural diversity in development planning and execution
- Protecting human health through a healthy and safe working environment. This can be achieved by planning and managing the construction process to reduce the risk of accidents, and carefully managing the use of substances which are harmful to human health
- Developing human resources as a long lasting legacy for the construction industry
- Seeking fair or equitable distribution of the social costs of construction and, where this is not achieved, determining fair compensation for people or communities affected by construction processes and operations
- Seeking equitable distribution of the social benefits of construction and, where this is not possible in the intended use of a facility, seeking to maximise benefits which arise during the construction process, such as employment and training opportunities
- Pursuing intergenerational equity so that social, environmental, and financial costs of current construction are not passed on to future generations.

Companies are generally acknowledging their contribution to the social aspects of sustainability through corporate social responsibility initiatives (CSR). According to Renukappa et al. (2012), CSR is a way of doing business that is based on ethical principles and a creation of positive impacts not only for financial shareholders, but for all stakeholders. Consequently, it is often used as a means of measuring companies' commitment and progress towards sustainability (Myers, 2005). CSR aims at creating conditions where social and environmental benefits can be addressed simultaneously to help drive a business forward. It is worth noting that CSR is a voluntary action initiated by companies, however, delivery is not easy and requires a combination of factors.

In summary, sustainable construction relies heavily on long-term goals and objectives. The dilemma facing the industry is therefore how to embrace long-term goals while addressing short and medium goals. The challenge is to find new BMs for the industry

where social and environmental benefits go hand in hand with affordable costs and higher profits.

2.5. Why environmental sustainability focus?

In this study, the chosen focus lies in the environmental sustainability aspect and the economic benefits associated with it. However, this is not to suggest that the other dimensions of sustainability can be ignored. It is simply a reflection of the statement that environmental sustainability in general, represents the largest opportunity for businesses and it is also the easiest to identify for the purpose of this study (Sommer, 2012). In addition, construction industry players attempt for sustainability have been strongly focused on environmental considerations (Guy & Kibert, 1998; Lützkendorf & Lorenz, 2005; Tan, Shen, & Yao, 2011). This focus will highlight the business benefits of environmental practices, which in return will attract more construction companies to adopt these practices. As suggested by Sommer (2012), the focus on environmental sustainability should not conceal the fact that companies who wish to pursue sustainability proactively need to adopt a holistic and integrated approach on environmental, economic, and social aspects of sustainability.

2.6. Driving forces

Existing research shows that there are many different drivers behind the adoption of green practices (Arif et al., 2009; Chavan, 2005; Lützkendorf & Lorenz, 2005). In most cases, climate change and environmental degradation are classified as the major driver and then sub drivers follow (Bansal & Roth, 2000; Isiadinso, Goodhew, Marsh, & Hoxley, 2011; Roberts & Sims, 2008).

From the existing literature, the driving forces for environmental sustainability in the construction context can be grouped into three major categories: namely, ecological responsibility, legislation, and economic opportunities, as illustrated in Figure 2-3.

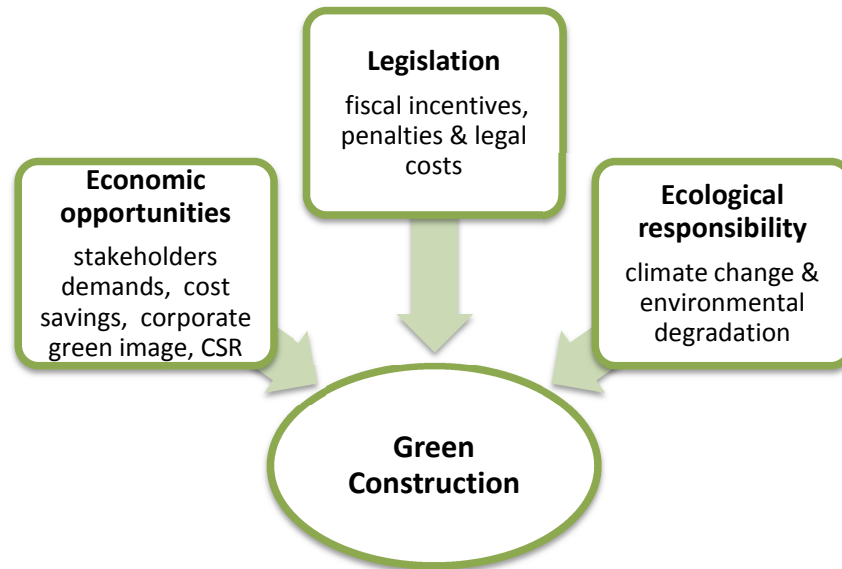


Figure 2-3 Driving forces of green construction

Figure 2-3 above summarises the driving forces of green construction. This suggests that construction companies adopt sustainable practices to comply with legislation, to acquire economic and market benefits including competitive advantage, and to improve ecological balance.

The potential impact of climate change and the need to reduce carbon emissions and other greenhouses gases (GHG) play a major role for businesses globally, with the construction industry being no exception (Alkhaddar et al., 2012). These issues have encouraged companies to be ecologically responsible. Companies face the challenge of reacting to constantly changing and growing environmental concerns. For example, the building sector including homes and non-residential buildings (commercial and public) is responsible for 35% of UK total GHG emissions. The UK Green Building Council (UKGBC) has stated that the construction industry generates one-third of all waste in the UK and that 30% of emissions from operating buildings can be cut by cheap and simple measures (Alkhaddar et al., 2012). According to the UK Committee on Climate Change (CCC), there are significant opportunities to reduce emissions from the building sector by improving energy efficiency, using low-carbon sources for heating, and decarbonising the electricity supply (CCC, 2008).

The importance of legislation in inducing green practices in construction has been widely recognised and documented by different scholars (Arif et al., 2009; Isiadinso et

al., 2011; Liu, 2006; Qi et al., 2010). Fiscal incentives, penalties, and legal costs have punctuated the importance of complying with legislation. The UK government is forcing the green agenda with a number of fiscal incentives. For example, the Climate Change Levy is a tax on the use of energy by businesses and it also offers credits for use of renewable sources for energy and energy efficiency schemes. Building regulations also address the sustainability issues through the Sustainable and Secure Buildings Act 2004 with emphasis on energy and water efficiency and conservation (Pitt et al., 2009). In addition, companies can avoid costly capital refits by keeping ahead of legislation (Bansal & Roth, 2000). This proactive approach has helped some of the UK's largest construction companies to shape policies and regulations.

Economic opportunities have also been instrumental in inducing green construction. For example, stakeholders, mainly clients, increasingly require the supply side to adopt sustainable policies and practices in the construction processes (Bennett & Crudgington, 2003; Engineers, Parkin, Sommer, & Uren; Holton, Glass, & Price, 2008; Qi et al., 2010; Tan et al., 2011), and achieve cost savings through reduction in energy costs and waste minimisation (Arif et al., 2009). Moreover, government funds can be obtained by adopting sustainable and green construction agendas (Essa & Fortune, 2008) and revenues can be improved through green marketing opportunities (Bansal & Roth, 2000). Promotion of corporate green image and CSR are instrumental in encouraging companies to evaluate their role in society and to attract more clients through communicating their ethical efforts (Arif et al., 2009; Fiedler & Deegan, 2007). The economic opportunities for environmental sustainability in the construction context are discussed in more detail in Section 2.8.

2.7. The response of the construction industry

As described earlier, the construction industry has a significant environmental impact (refer to Section 2.4.1 for further details). Consequently, protecting the environment has become one of the key issues for the construction industry across the globe. The industry began to notice environmental sustainability as a central part in strategic management of business (Kjaerheim, 2005; Lozano, 2008; Park & Ahn, 2012). The following sub section briefly outlines the major trends of the environmental sustainability practices in the construction context.

2.7.1. Trends in practising environmental sustainability

Tan et al. (2011) proposed a framework for implementation of sustainable construction practice and they were able to identify, from the literature, the important sustainable practices. Although their study was only concentrated on contractors, it is relevant for the major environmental sustainability trends in the construction sector as a whole. From their study, the major trends can be summarised in Table 2-1 below but are not exhaustive.

Table 2-1 Trends in practising environmental sustainability

Environmental sustainability trends	Principles
Compliance with environmental legislation	To comply with different governmental legislations. For example in the UK: Landfill Tax, Climate Change Levy, and Aggregates Levy.
Design and procurement	To improve the project's whole life value through green design to achieve energy efficient buildings and the promotion of best practice procurement throughout the supply chain.
Specification and materials	To specify green materials and renewable materials (usually be the architect/designer) to be used in a given project.
Technology and innovation	To enhance the company's capability for technology and innovation to increase the environmental sustainability for both the process and its resultant assets.
Organisational structure and process	To alter the organisational structure and process to facilitate the implementation of environmental policy and strategy.
Education and training	To increase business commitment to environmental practices through raising awareness, education, and training to stimulate staff participation.
Measurement and reporting	To develop a measurement and reporting system or use existing performance indicators and benchmarks such as environmental management systems to evaluate companies' environmental performance and then identify areas for improvement.

In general, companies may follow one of the above practices (see Table 2-1) or may combine more than one. However, these practices only address isolated parts of business models. What is missing is how companies can systematically carry out

fundamental transformations of their business models to make them green and profitable at the same time. This study aims to fill this gap, particularly in terms of the lack of theoretical foundation as well as by proposing a guideline for green business model implementation that subjects itself to validation by construction industry practitioners and academics.

2.8. The relevance of environmental sustainability for economic success

Nowadays environmental sustainability advocates are rarely ridiculed. On a generic level, many companies find claims of its importance and benefits self-evident. For example, the financial benefits of efficiency measures such as energy and waste minimisation are self-evident for most companies. In addition, the existing literature identified cost savings as a major driver for the green agenda (Arif et al., 2009; Chavan, 2005; Dainty & Brooke, 2004). A major trend in the literature is that environmental practices are good for a companies' image and are a source of competitive advantage (Akadiri & Fadiya, 2013; Lützkendorf et al., 2011; Wasiluk, 2013). Furthermore, no major company today can describe itself as a business entity concerned with quality and overlook their impact on the environment.

According to empirical findings of a study conducted by Vatalis et al. (2011) in Greece, the economic benefits in sustainable construction can be found in five major areas (starting with the most important). First, reduction in energy usage. Second, innovation in sustainable construction. Third, protection of the natural and social environment. Fourth, providing a healthy comfortable living environment. Finally, success for developers and occupiers. Furthermore, Kibert (1994) suggested that correct consideration of environmental impact coupled with whole or life cycle costs will result in true long-term value for the client and better sustainable development. He also raised the need for better understanding of 'green' buildings to appreciate the benefits for both business and the environment.

The cost is frequently cited in green construction literature. The reason for this is likely to be due to the widely held belief that going green is associated with high cost (Vatalis et al., 2011). However, this was challenged by (Bartlett & Howard, 2000). They demonstrated that cost consultants overestimate the capital costs of energy efficient

measures and at the same time underestimate the potentials for costs savings and value added as trade-offs.

On the other hand, going green is a means of reducing the cost of capital by accessing public and private funding and it reduces the cost of running and maintaining the building over its life-cycle (Mokhlesian & Holmén, 2012). For this reason, life cycle cost (LCC) is frequently associated with environmental sustainability (Kloepffer, 2008). LCC is an economic model to evaluate a project's life cycle. The objective of LCC analysis is to choose from a series of alternatives to attain the lowest long-term cost of ownership. Many companies in green construction realise substantial savings in internal cost structure by implementing environmental improvement measures. Such improvements will lead to lower costs of compliance by reducing costs related to emissions; treatment costs and taxes, productivity developments, more efficient processes and new market opportunities which can also result in increased revenues (Lankoski, 2006; Nidumolu, Prahalad, & Rangaswami, 2009; M.E. Porter & Van der Linde, 1991, 1995; Sinclair-Desgagné, 1999). Consequently, the cost and revenue have to be taken together - lower internal costs will lead to increased revenues.

Yet, despite all the ink spilt and words spoken, green values are still relatively poorly appreciated widely in the construction context. For example, Hamid and Kamar (2012) stated that one of the challenges of adopting sustainable construction is that companies do not know how to act upon the sustainability value. They suggested that: *"although the values are generally at the right place, the problem is how to enact them."* Therefore, this research suggests that the business model concept can be a means to resolve this challenge.

2.8.1. Building the business case for environmental sustainability

The term 'business case for sustainability' refers to the question how *"the competitiveness and business success of a company [can] be improved with voluntarily created outstanding environmental and social performance"* (Schaltegger & Wagner, 2006 cited in Sommer, 2012). Although environmental and social aspects seem intertwined in this definition, the following summary focuses on environmental performance only.

According to Sommer (2012), value creation levers for environmental sustainability can be grouped into three categories: namely, profits, tangible and intangible assets, and risk. These categories determine the economic success of the company. However, value creation levers never produce isolated effects, which may be one of the reasons to explain the complications in proving the positive link between environmental performance and economic success. Key value creation levers mentioned in the literature, for the above mentioned categories, are specified below but are not extensive.

Value creation levers for generating profits can be that some green brands are capable of commanding a price premium or increase customer's loyalty (Esty and Winston, 2009). In addition, companies may profit from their green efforts by entering new markets or competing on environmental goods and services markets. Despite the many ways to reduce the internal costs, for example by using energy and other resources more efficiently, companies should not necessarily limit their search for profits only on cost bases. A company with strong environmental credibility can lobby for stricter regulations and markets with eco-minded customers, in that way putting less environmental aware rivals under pressure and gaining a stronger competitive advantage (Sommer, 2012).

Value creation levers for creating tangible and intangible assets can be related to the general belief that most benefits associated with superior environmental performance are intangible assets. Therefore, reputation is a key asset. For example, the construction managers may seek to collaborate with environmental groups because of their desire to be associated with another company that has a green reputation- brand (Fiedler & Deegan, 2007). Brand has been long recognised as creating demand and positively affecting future sales. Furthermore, potential benefits can be traced to the area of human resources. Environmental sustainability can be used to increase productivity of staff by boosting employee morale and helping to recruit and retain talent. Moreover, environmentally proactive companies may be able to gain competitive advantage by deploying new technology and accumulating internal knowledge, expertise, and routines that are difficult to imitate by competitors or which may take longer for them to possess such capabilities (Sommer, 2012).

For risk management value creation levers, managing environmental risk is mainly about reducing potential damage like lawsuits and attacks by activist groups which may

lead to brand damage and consumer boycotts. For companies, the management of environmental risk has some visible benefits. For example, reduction in capital cost and insurance premiums, and it may help companies to score better in sustainability indexes such as the DJSI (Sommer, 2012).

Building a robust business case is essential to recognise environmental sustainability as a significant business opportunity. This entails a systematic assessment of the value creation levers mentioned above and potentially extra ones depending on the circumstances. However, building the business case for sustainability is often challenging because many of the major value creation levers are hard to express in financial terms. Another reason can be that sometimes companies' business practices are not compatible with selling green value propositions and may fail to deliver the desired outcomes. Therefore, many companies will first need to acquire 'green competencies' in order to develop and operate a successful green business model.

In summary, opportunities are still untapped to their full potential and there are associated challenges. These intertwined issues will be elaborated upon from the data analysis in Chapter 5.

2.9. Summary

This Chapter has presented a brief review of environmental sustainability in the construction context. It has defined sustainability and showed three common dimensions of it: namely, environmental, economic, and social. The sustainability agenda in the UK construction industry is also discussed. The focus of this study is on environmental sustainability because it fits the purpose of defining GBMs. Then driving forces of the green construction were discussed, followed by a review of responses of the construction industry and the main trends in practising environmental sustainability. In addition, this Chapter highlighted the economic benefits associated with environmental performance and concluded with building the business case for environmental sustainability. The next Chapter presents the BM concept as a means towards creating and capturing green value propositions.

Chapter 3. **BUSINESS MODELS AS A MANAGEMENT CONCEPT**

3.1. Introduction

The previous Chapter reviewed the economic benefits associated with environmental sustainability. However, the link between the two is complex in nature and there is a possibility that companies will engage in various disconnected environmental initiatives that often fail to tap the full economic potentials which environmental sustainability offers. Simultaneously, companies may find it difficult to convert abstract environmental strategies into viable business concepts. Therefore, this study proposes to use the business model (BM) concept to overcome these problems.

This Chapter presents an overview of BMs in the business, management, building and construction disciplines. It starts with an introduction to BM origins, clarifying the relationship between BMs and strategy, defining the BM, and reporting the BM elements (Section 3.2). In addition, this Chapter explores how building and construction research has dealt with BMs and highlights the benefits of BMs approach (Section 3.3). Section 3.4 justifies the adoption of BMs in this study. Section 3.5 conceptualises a GBM to be applied in the empirical stage before summarising the Chapter in Section 3.6.

3.2. Emergence of business models in the business and management disciplines

The BM concept has been mainly developed within information systems and strategy research from the mid-1990s. However, Teece (2010) provided examples of BMs from pre-classical times as far as 1890, with the illustration of an American example of BM innovation of the Swift and Company 'reengineering' the meat packing industry. The existing BM was dependant on cattle shipped alive and then slaughtered in the target markets and the meat sold by local butchers. The company leader replaced this BM by a new and innovative BM where the cattle were slaughtered in a central area and distributed as ready meat by refrigerated freight cars to distant markets. This example of the meat packing industry demonstrated that BMs have been central to trading and

economic behaviour. In addition, Teece argued that BMs lack theoretical foundation in economics or business studies with the exception of a few indirect studies. Quite simply, there is no established place in economic theory, marketing science, and organisational and strategic studies for BMs with limited research on new organisational forms. He argued that new organisational forms can be a component of a BM but organisational forms are not actually BMs. Furthermore, Teece stated that the study of BMs is an interdisciplinary subject which has been abandoned despite its importance.

The BM was one of the greatest buzzwords of the Internet boom in the mid 1990s and it has been disseminated since then. From that time, ideas revolving around the concept have resounded with scholars and business practitioners as documented by different scholars (Afuah, 2004; Osterwalder, Pigneur, & Tucci, 2005; Shafer, Smith, & Linder, 2005; Timmers, 1998; Zott, Amit, & Massa, 2010). More precisely, the BM is popular among e-business (Amit & Zott, 2001; Osterwalder et al., 2005; Timmers, 1998). In other words, the e-business boom originated the BM concept as a new unit of analysis in strategic management disciplines (Sommer, 2012). In spite of its roots and origins, the concept's effectiveness is not limited to dot-coms (Linder & Cantrell, 2001) cited in (Sommer, 2012). For example, Burkhart et al. (2012) suggested that BMs are popular and useful in the fields of strategic management and information systems. In addition, Lambert and Davidson (2013) recognised the BM concept as a distinctive management research topic which can be relevant to different contexts and industries. Moreover, (Osterwalder, 2004; Teece, 2010) suggested that the BM concept is relevant for researchers trying to examine the logic behind economic value creation and it can guide companies to become sustainable and more competitive. According to (Wirtz, 2010), the BM concept can be applied at different levels such as industry, company, business units, and product level.

Nevertheless, the empirical use of the BM concept has been criticised for being ambiguous, superficial, and not grounded in theory (Hedman & Kalling, 2003). Michael Porter stated that *"the business model approach to management becomes an invitation for faulty thinking and self-delusion"* (cited in Sommer, 2012). In order to utilise the BM concept and to reduce the ambiguity around the concept, it becomes necessary to clarify the relationship between BMs and strategy. The next section aims to help remedy this situation.

3.2.1. Business models and strategy: What's the difference?

The BM concept extends central ideas in business strategy and its related theoretical foundations. However, the BM needs to be distinguished from the business strategy (Sommer, 2012). Business strategy plans for the future success of a business in a competitive and dynamic environment (M. E. Porter, 2008). In contrast, the BM can be viewed as its translation into a logical framework for economic value creation (Osterwalder, 2004). Teece (2010) argued that a BM is more generic than a business strategy and in order to protect competitive advantage resulting from designing a new BM, the coupling between strategy and BM analysis is essential. Consequently, the business strategy and BM are interlinked.

Furthermore, Zott et al. (2010) identified two main differentiating factors between a BM and a business strategy. Firstly, strategy is more concerned with competition, whereas a BM is more concerned with value creation, cooperation and partnership. In general, the business strategy of a firm focuses on value capture and competitive advantage, while the BM combines a dual focus on sustainable value creation and value capture. Secondly, the focus of the BM is on the value proposition with emphasis on the customer role, which is less evident in the business strategy literature. This view is also echoed by Seddon & Lewis (2003) where they stated that the BM is more concerned with the core logic that enables a particular firm to create value for both its customers and stakeholders and proposed a detailed definition of a BM in relation to strategy, which is, *“A business model is an abstract representation of some aspect of a firm's strategy; it outlines the essential details one needs to know to understand how a firm can successfully deliver value to its customers.”*

Moreover, Sommer (2012) defined the business strategy as a principle plan for the future success of a business in a dynamic and competitive environment. In contrast, the BM can be viewed as a logic or blueprint of a strategy to be implemented through organisational structures, processes and systems, thereby creating and capturing economic value. A similar position is held by Casadesus-Masanell and Ricart (2010), who viewed the BM as a translation of a realised strategy of a particular firm. Therefore, the BM concept is important when translating business strategy into business process. In other words, the BM concept can be viewed as a mediator between business strategy and the operational level of a firm.

To determine the competitiveness of a firm, three aspects need to be considered. These three aspects are the: business strategy, BM, and operational model (Sommer, 2012). The relationship between them is depicted in Figure 3-1.

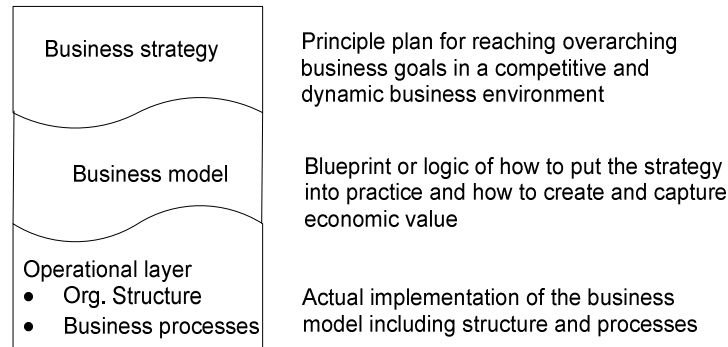


Figure 3-1 Relationship between business strategy, BM, and the operational layer adapted from Sommer (2012)

In a related vein, Casadesus-Masanell and Ricart (2010) presented an integrative framework to distinguish and relate three concepts of strategy, BM, and tactics. Their framework is divided into two stages. Stage 1 or the strategy stage is where a firm chooses the BM through which it intends to compete in the marketplace and the BM refers to the logic of the firm, the way it operates and how it creates value for its stakeholders. Stage 2 or the tactics stage refers to tactical choices made from amongst those available to employ, depending on the BM choices at Stage 1. It is worth noting that the tactics stage is similar to the operational model mentioned earlier, but it implies more conscious decisions (Sommer, 2012). Casadesus-Masanell and Ricart (2011) argued that finding an effective way to compete in the marketplace depends on manager's understanding of the difference between strategy, BMs, and tactics, while taking into account how they interact. In brief, scholars argue that to unlock the potential of BMs, they need to be clearly defined and not to be seen in isolation from strategy (R. Casadesus-Masanell & Ricart, 2010; Sommer, 2012; Teece, 2010). Detailed definitions and elements of the BM are presented next.

3.2.2. The business model definitions and key elements

The purpose of this section is to present some definitions and key elements from the literature. Definitions bring clarity and the key elements establish a common language. As stated above, the BM concept is often used in e-business research. Therefore it

becomes vital to cover the concept as conceived by e-business literature. From e-business research, two schools of thought can be identified. The first school aims at defining and describing the components of an e-business model. The other school aims at developing descriptions of a particular e-business model (Hedman & Kalling, 2003). It can be argued that these two schools of thought are complimenting each other, since the first one is concerned with a more general classification of e-business model while the second one is concerned with specific e-business models and is looked at it in greater detail. With regard to the first school of thought, Timmers (1998) defined an e-business model as: *“An architecture for the products, service and information flows, including a description of the various business activities and their roles.”* In the same context, Amit and Zott (2001) described three components of e-business models to create value through utilisation of business opportunities. The components include: content, structure, and governance of transactions. In addition, Gunatilake and Liyanage (2010) offered a list of components containing scope, customer value, connected activities, capabilities, implementation, price, revenue sources, and sustainability and as suggested by Hedman and Kalling (2003), this list is relevant to both e-business and conventional business models. The other school of thought on e-business describes specific BMs and explains how businesses can use the Internet to interact with customers and stakeholders and how value is created for them. For example, (Weill & Vitale, 2001) cited in (Hedman & Kalling, 2003) defined eight e-business models based on a systematic analysis of several case studies and they explained how each model works by defining the way it makes money, the core competencies, and the critical factors or capabilities required.

A comprehensive literature review on BMs is conducted by (Zott et al., 2010) through searching and critically reviewing articles published in leading academic and practitioner-oriented management journals, during the period of January 1975 - December 2009. Their review revealed that scholars do not agree on what a BM is and that the literature is growing in silos, according to the subject of interest, to the respective researchers. In addition, the review demonstrated that academic research on BMs seems to lag considerably behind practitioner-oriented journals such as the Harvard Business Review, the MIT Sloan Management Review, and the California Management Review. Nevertheless, they were able to identify four emerging common

themes amongst the BM literature. The four emerging themes can be summarised as follows:

1. The BM is a new unit of analysis;
2. BMs emphasise a system-level, holistic approach towards explaining how firms do business;
3. The conceptualisation of BMs is usually dependent upon organisational activities;
4. BMs seek to explain how value is created and captured.

These four themes can demonstrate the usefulness of the BMs concept in understanding businesses and companies' behaviour. Similarly, Nenonen and Storbacka (2010) conducted a comprehensive literature review of the studies, providing conceptualizations of BMs and again they were able to identify five similarities in defining them:

1. The BM explains how the firm creates value for its customer;
2. It explains how the firm yields a profit from its operation;
3. It illuminates the external relationship that the firm has with various actors in its value network;
4. It illustrates the resources and capability foundation of the firm;
5. It explicates the major strategic decisions made by the firm.

As stated earlier, the BM is a relatively new concept that lacks a unified definition. However, the agreed concept about the BM is related to value creation for customers and value capture. Therefore, it promotes dual focus on value creation and value capture (Afuah, 2004; Nielsen & Bukh, 2011; Osterwalder & Pigneur, 2002; Zott et al., 2010). In addition, Slywotzky (1996) provided a detailed definition: the business model is the entirety of how a company selects its customer, differentiates and defines its offerings, defines the tasks it will deliver itself and those it will outsource, how it channels its resources and selects a market, creating value for its customers and how it will capture value (profit). In general it is the entire system for delivering value to customers and earning a profit from that particular activity. This view resonates with the definition provided by Osterwalder (2004) based on a synthesis of literature on the e-business model. According to him, the BM is a conceptual tool that consists of a set of elements

and their relations which enables a company to express the logic of earning money. It portrays the value that a company offers to target customers and the architecture of the firm and its partners for creating, marketing and delivering this value, in order to generate sustainable and profitable revenue streams. Furthermore, Osterwalder proposed nine BM building blocks, or BM elements, grouped into four pillars, as depicted in Table 3-1 below.

Table 3-1 Business model elements

Pillar	Building blocks of business model	Description
Product	Value Proposition	Gives an overall view of a company's bundle of products and services that are of value to the customer
	Target Customer	A segment of customers a company wants to offer value to
Customer Interface	Distribution Channel	A means of getting in touch with the customers
	Relationship	Describes the kind of link a company establishes between itself and the customer
Infrastructure Management	Value Configuration	Describes the arrangements of activities and resources that are necessary to create value for the customer
	Capability	The ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer
Financial Aspects	Partner Network	A voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer
	Cost Structure	The representation in money of all the means employed in the business model
	Revenue Model	Describes the way a company makes money through a variety of revenue flows.

In Table 3-1 above, the *Product* pillar describes what is offered to the customer; the *Customer Interface* pillar describes the customer and how the offering is delivered; *Infrastructure Management* deals with value creation aspects for the customer and can include value created internally or externally with aid of partners, and finally the *Financial Aspects* pillar outlines how the company plans to make money with its BM. Moreover, (Osterwalder & Pigneur, 2010) developed a visual representation of BMs that is well known as the BM canvas. The BM canvas tool is internationally

acknowledged as a practical tool to analyse companies' BMs (see Figure 3-2 for details).

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
	Key Resources		Channels	
Cost Structure			Revenue Streams	

Figure 3-2 Business Model Canvas (Osterwalder & Pigneur, 2010)

As illustrated in Figure 3-2 above, the BM canvas gives a company a simple yet powerful tool to understand its current BM, in order to systematically challenge the ways it does business and thereby enables the company to think differently and create new alternative BMs.

Johnson, Christensen, and Kagermann (2008) suggested further details to defining the BM concept, by proposing that a BM consists of four interlocking elements that work together to create and deliver value. Their work is particularly important due to the perspective on how established companies can transform their BMs. The four elements are:

1. Customer value proposition (CVP) which is the way to create value for customers. This element is the most important one;
2. Profit formula is the blueprint that explains how the company creates and captures value for itself while providing value for customers too;
3. Key resources are assets such as people, technology, and facilities required to deliver the value to the targeted customers. The emphasis here on the key resources for a specific company which creates competitive differentiation;
4. Key processes could be operational and managerial processes that enable a particular company to deliver value in an effective way.

The four elements are illustrated in Figure 3-3 for more detail.

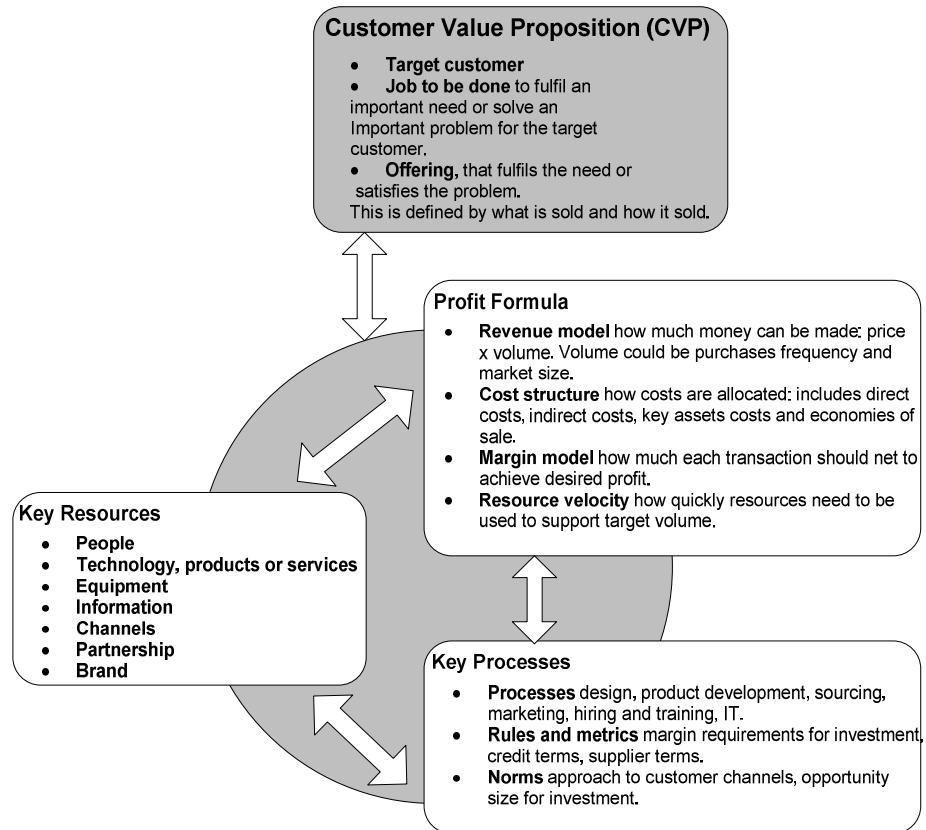


Figure 3-3 The elements of a business model adapted from Johnson et al. (2008)

Figure 3-3 above illustrates the four elements of BMs and that each element is comprised of several sub elements, with their explanations being provided.

In summary, “*A business model describes the rationale of how an organisation creates, delivers, and captures value.*” (Osterwalder & Pigneur 2010, p.14). This definition provides a simple working definition and reflects the fundamentals of BMs, hence it will be adopted in this research.

3.2.3. Application of business models

This section aims to provide different examples from the literature where the BM concept is applied to demonstrate the effectiveness of such a concept. The examples will be provided below, but are not exhaustive, rather illustrative.

3.2.3.1. The business model as a source of competitive advantage

Competitive advantage is identified as an advantage that a company has over its rival competitors, allowing a company to sustain profits or retain more customers than its competitors. The principle goal of the majority of business strategies is to attain a sustainable competitive advantage (O'Farrell, Kitchens, & Moffat, 1993; Ormanidhi & Stringa, 2008; M.E. Porter, 1998).

Successful companies create and sustain value by doing things differently from their competitors. According to (Pekuri et al., 2013), the viability of for-profit companies is related to the way they capture value and consequently generate profits. In addition, (Shafer et al., 2005) argued that the viability of companies relies on performing two essential functions which are 'creating value' and 'capturing value'. The literature of BMs is populated with different stories of how a good BM is essential to every successful company. Magretta (2002) even argued that when a BM is hard to imitate and changes the economics of an industry, it can create a competitive advantage. In addition, Al-Debei and Avison (2010) suggested that digital businesses can enhance their competitive advantage by adopting a suitable BM which can improve their ability to respond quickly to rapid environmental changes. Furthermore, different scholars highlighted the importance of BMs innovation in achieving competitive advantage. For example, (Johnson et al., 2008) suggested that BM innovation in general is increasingly significant for success, rather than service or product innovation. Hamel (2000) cited in (Pekuri et al., 2013) even argued that BM innovation is the only way to outperform the competition, even temporarily. In the literature, there is thus a clear relationship between the BM of a company and its innovation activities (Boons & Lüdeke-Freund, 2013). In general, scholars (Mitchell & Coles, 2003; Morris, Schindehutte, & Allen, 2005; Teece, 2010) agreed that if the BM is sufficiently differentiated to meet particular customers' segment expectations and is difficult to replicate, it can become a source of competitive advantage.

Innovating and transforming BMs are difficult tasks because only a few managers understand their companies existing BMs (Johnson et al., 2008). These tasks can become easier by proper BM analysis using a set of key defined elements. According to Pekuri et al. (2013), the key defined elements can give managers a practical tool to recognise, design, and evaluate BMs, and most significantly, to analyse the interdependencies between the elements. In short, the BM concept has become a

management tool that is currently used in virtually all kinds of companies to create a competitive advantage.

3.2.3.2. The business model in the field of information systems (IS)

The existing BM research mainly tends to define the concept in the context of the study, to establish its elements, and to suggest practical approaches to benefit from BMs in that context. For example, Al-Debei and Avison (2010) developed a framework of the BM for the IS discipline, based on a comprehensive review of the IS, e-Business, e-Commerce, the technology industry, and business management literature. In developing this framework, they defined the BM concept, developed four BM dimensions with their elements, organised modelling principles, placed the BM within the digital business, and explored functions of BMs within digital organisations. Their approach can be regarded as a comprehensive and novel approach, hence it will be relevant as an application of BMs.

In recent years, the business world has experienced a huge transformation from the traditional ways of doing business to the new ways of digital business. This transition is governed by a high level of competition, a dynamic environment, uncertainty, and knowledge and information creation and innovation. Therefore, the traditional and simple processes in doing business are not relevant in this new and complex era. The world of traditional business is characterised by two aspects which are business strategy and business operation. However, when applying these two aspects in the digital business, a gap can be identified which calls for new ways of thinking. Scholars believe that BMs have the potential to fill this gap.

Al-Debei and Avison (2010) developed the V⁴ BM dimensions which form the basis of designing, analysing, and evaluating BMs in IS-related domains. These dimensions explain the primary components of the BM concept and include the following:

- Value proposition dimension relates to what a digital organisation offers, including products or services with their related information;
- Value architecture dimension comprises tangible and intangible organisational assets and core competencies or the infrastructure and its configuration of a given digital organisation, including technology;

- Value network dimension represents the inter-organisation and cross-company relationship where value is created and enabled by collaboration and coordination between different companies, stakeholders, and parties; and
- Value finance dimension depicts information related to economic and finance design of the business model, including costing structure, pricing method, and revenue model.

Although the authors developed four different dimensions of BMs, they highlighted the interdependent relationship between these dimensions. This view is fundamental in BMs thinking because they provide a systematic and consistent tool for explaining the business logic. Furthermore, the authors suggested three main roles of BMs within digital businesses and organisations. Firstly, the role of BMs as an alignment instrument between the different organisational layers including strategy and business processes, with IS. However, for digital businesses to survive, the strategy, BM, and business processes with their IS, should be regarded as a harmonised bundle that needs to be reviewed continually to respond to the external environment as well as stakeholder interests. Secondly, the function of BM as a mediating framework between the strategic goal and technology innovation. In this function, the BM is perceived as the main reason behind a technologies' success or failure in a given digital organisation. Therefore, the value of digital innovation can be captured by utilising the BMs concept. Finally, the role of BMs as knowledge capital to enhance an organisation's innovation capability and decision-making practices to ultimately enable the organisation to achieve sustainable competitive advantage. This function suggests that an organisation's understanding of its BM with an explicit depiction of it will be a distinctive form of knowledge and crucial asset to this organisation.

3.2.3.3. The business model in project businesses

This section aims to present an application of the BM concept in the project-based context to demonstrate the effectiveness of such a concept in different disciplines. Scholars applied the BM concept to understand the project business logic. This application can be because of the following two reasons: firstly, project-based companies have expanded into a wide range of industries such as consulting and professional services, cultural and sport industries, and the construction industry. Secondly, the inclusion of services in project businesses has forced modern companies

to find new ways of doing business. For example, Artto (2010) used multiple case studies to study six project-based companies operating in different industries such as construction, telecom, energy, and shipbuilding. The main aim of the study was to identify and categorise the BMs in these different companies. They were able to identify 19 BMs that further clustered into three main categories based on the organisational entity. The three categories are as follows:

- BMs for single projects: these models target individual projects and aim at efficient delivery of technical knowledge and equipment. They also tend to focus on internal matters of projects rather than external matters and clients' involvement. Individual projects involve many players, hence these business models have flexibility to incorporate other business models of different players within a project's delivery. The value proposition in this category is limited to certain products and their related services such as logistics, manufacturing, and service support during operation.
- BMs for project networks: this category offered systems integration of other companies' activities by using engineering and organisational network competences. These BMs have focused on clients' strategic benefits by combining both products and services, hence the models require an understanding of clients' need and ability to provide flexible offerings in various integration settings. In addition, they are characterised by a complex and demanding organisational setup and relationship because they link the project suppliers to clients and other stakeholders. Therefore, these models span beyond the single company boundaries and integrate network partners and other external stakeholders.
- BMs for business networks: the BMs in this category include a large network of actors which interact with other related stakeholder and BMs. Therefore, these models create value for several actors including clients, contractors, and subcontractors and aim at profitable growth for the involved actors. A challenge that often occurs here is the creation and alignment of a new alliance of organisational actors who trust each other and are devoted to a common project aim, connecting them technologically, economically, and socially. The BMs seek long-term benefits by developing a closer and more sustainable client

relationship and offering complete solutions. The findings in this category indicate that, in general, project-based companies operating in the same business networks or industry have similar business models. These findings demonstrate the systematic nature of BMs, hence managers can benefit from it to challenge the way they conduct the business and to develop new value creation and capture logics.

The overall findings of the three categories of BMs suggested that a company may have several BMs. However, the BM research mainly tends to address the concept at the level of the entire company or at the level of the business unit of a company, which will be applied in this research. Having presented an overall backdrop of the emergence of the BMs in the business and management disciplines, the following section presents the BMs development in the building and construction disciplines.

3.3. Emergence of the business models in the building and construction disciplines

The BM research in the building and construction disciplines is as yet, in its embryonic stage at this point of time. This proposition is based on two reasons:

Firstly, previous researcher's works such as (Aho, 2013; Pan & Goodier, 2011) who stated that the knowledge and theoretical development of the BM in the construction context seems to be very much under-developed. For example, (Pan & Goodier, 2011) searched for articles from Jan 1990 – Nov 2010 that included the terms 'business model' and 'construction' using the EBSCO and the informaworld databases. Although some of the searched articles provide an implicit description of the BM based on the context of the study, none of these provide an explicit definition of the BM. Thus the concept of BMs seems to have been borrowed from business and management fields to building and construction fields by default. However, the above scholars argued that the borrowed concept in the building and construction research appears to lag behind the theory development in the business and management research.

Secondly, a search for articles from 1990 to 2013 that include the terms 'construction' and 'business model' in their title, abstract, keywords, or subjects using the EBSCO database, SCOPUS, and Google Scholar. A sample of 18 articles that are deemed relevant for this review, are presented in this section. Table 3-2 summarises the

searched articles and shows the publication outlet and any description of the BMs provided.

Table 3-2 Construction and business model literature

Author/ Year	Explicit description of business models	Implicit description of business models	Gap identified	Publication outlet
Aho (2013)	“The business model defines the architecture, principles, logic and capabilities that an enterprise applies for creating, delivering and capturing value” (p.113)		This paper makes the case for performance-based BMs and sets conditions for BMs to enable transformation of the construction industry towards sustainability. Although the paper has presented explicit definition for BMs, it did not include what constitute a BM which is key in the transformation process. This gap is addressed by the current research.	Building Research & Information
Pekuri et al. (2013)	“A good business model defines the way a company operates, how it creates value for its customers and how it captures value from its operations to make a profit” (p.13)		The paper is concerned about how managers from contractor companies understand the BM concept. It suggested that the BM can be useful for contractors to assess how they provide value for clients in the selected markets. This paper covers a generic value creation analysis. However, the current study concentrates on green value creation and capture covers the GBMs across the whole sector to	Australasian Journal of Construction Economics and Building

		paint a holistic picture about them.	
Wasiluk (2013)	<p>“The CS [Corporate Sustainability] literature also highlights that firms need to manage their financial and non financial resources, including their IC [Intellectual Capital], in order to respond to the challenges of operationalising SD [Sustainable Development] into practice. For example, several frameworks document the phases a company progresses through as they operationalise SD into their business model” (p.103,104)</p>	<p>This paper is advocating intellectual capital to drive organisational change to sustainable BMs. However, the paper is silent on what are BMs and what the difference between normal and sustainable BMs. The current research addresses these issues.</p>	Journal of Intellectual Capital
Sweetser (2012)	<p>“A well-understood business model that could improve the uptake of energy savings retrofits is that of guaranteed savings performance contracts. Essentially removing the capital risk through a performance contract eliminates an owner’s capital requirement for a long term contract based on energy savings” (p.348)</p>	<p>This paper supports performance-based BMs but it does not include explicit definition and details about BMs. Therefore, it assumes that BMs are understood by default and this not the case. The current research presents a clear definition of BMs and suggests who they can be transformed into GBMs.</p>	ASHRAE Transactions
Mokhlesian and Holmén (2012)	<p>“To put it simply, a business model is articulating the logic and providing data and other evidence that shows how a business creates and delivers value to customers by the</p>	<p>This paper analysed green construction from the BM lens by adopting a set of defined BM elements. The paper was based on literature review only unlike the current study</p>	Construction Management and Economics

	architecture of revenues, costs, and profits associated with the business enterprise delivering that value” (p.762)	which covers both theoretical and empirical data. In addition, the paper suggested that the elements of the BM are interlinked. The current research went a step further and demonstrated the interrelation through empirical data.	
Pan and Goodier (2011)	“The business model in offsite construction research is also a unit of analysis in addition to the product, firm, industry, or network levels. Such an approach emphasises a systematic perspective on taking up offsite in housebuilding businesses; encompasses organisational activities; and seeks to explain both value creation and value capture in the process of housing delivery”	This paper adopted the BM approach to facilitate offsite uptake of housing delivery. Although the paper has generated insights about BMs, it has not presented the elements of the BM that are considered central to deal with the concept.	Journal of Architectural Engineering
Wong, Thomas Ng, and Chan (2010)	<p>“Timely diversification and appropriate adjustments in business models are crucial to manage transformations and changing business environment of the construction industry” (p.261)</p> <p>“This alliancing business model could also be adopted by SMEs to alliance with large companies to seize business opportunities</p>	In this paper, there is no clear definition about BMs.	Habitat International

	elsewhere” (p.262)		
Tykkä et al. (2010)	“A similar development is apparent in the Swedish, Estonian, and Norwegian cases where incumbent construction actors were restricted by their traditional behaviours, which opened opportunities for new business models including close interaction of clients to production processes” (p.204)	Although the paper has emphasised the role of clients on new BMs, it has not identified the BMs.	Forest Policy and Economics
Li, Li, Skitmore, Wong, and Cheng (2009)	“Developers need to rethink their business model and create a new form of competitive advantage in order to survive” (p.567)	There is no definition included about what is the BM.	Construction Management and Economics
Ekholm and Molnár (2009)	“New business models, such as strategic partnering will stimulate communication and cooperation in product development” (p.439)	There is no definition included about what is the BM.	Journal of Information Technology in Construction - Special Issue
Hong-guang, Yun-he, Chen-yang, and Qiang (2009)	“Business models mainly relate to basic profit business ways, objects and contents of service...” (p.3014)	This paper has developed a specific electronic BM for construction enterprises. Therefore, this BM is only relevant for e-commerce.	Information Science and Engineering 1 st International Conference
Li, Guo, Skibniewski, and Skitmore (2008)	“Through the use of virtual prototyping (VP) technology, the lean production process engaged in the IKEA business model (IKEA model) is studied and implemented in a real-life construction	There is no definition included about what is the BM.	Construction Management and Economics

	project” (p.991)		
Boddy, Rezgui, Cooper, and Wetherill (2007)	“We have also envisioned a business model that allows the small to medium enterprise, typical of the construction sector, to participate in what would otherwise be the preserve of the largest, wealthiest and most technologically advanced organisations in the industry” (p.677)	There is no definition included about what is the BM.	Advances in Engineering Software
Brady, Davies, and Gann (2005)	“It has recently been suggested that the future of the construction industry lies in adopting a new business model based on the concept of integrated solutions” (p.571) “In summary, the key features in moving towards an integrated solutions business model are developing new approaches to creating a customer value, building new capabilities – especially in systems integration – and harnessing learning to allow the firm to exploit economies of project repetition” (p. 574)	There is no definition included about what is the BM.	Building Research & Information
Seaden, Guolla, Doutriaux, and Nash (2003)	“do typical Canadian construction firms behave according to the current competitive advantage business model?” (p.604)	There is no definition included about what is the BM.	Construction Management and Economics
Duyshart, Walker,	“concentrates on the business model content and	There is no definition included about what is the	Construction and

Mohamed, and Hampson (2003)	objectives, briefly indicates the evaluation framework that was used to evaluate ICT effectiveness” (p.179)	BM.	Architectural Management
Anumba and Ruikar (2002)	“Electronic commerce business models are reviewed and the enablers and barriers to their uptake in the construction sector presented” (p.265)	There is no definition included about what is the BM.	Automation in Construction
Cheng, Li, Love, and Irani (2001)	“It is proffered that the proposed e- business model not only will benefit those organisations who operate in the construction supply chain, but may also be useful to other types of business-to- business e- commerce when cooperation between business partners is necessary to improve organisational performance and gain a competitive advantage” (p.69)	There is no definition included about what is the BM.	Logistics Information Management

The majority of articles reviewed refer to BMs without explicit definition. In general, BMs are associated with the following words: progress, uptake, transformations, change, new, future, improve, opportunities, seize, and rethink. For example, (Sweetser, 2012) referred to the BM in seeking solutions for retrofits building and he suggested that guaranteed savings performance contracts’ BMs could support the uptake of energy savings. In addition, (Wong et al., 2010) approached BMs as a means towards managing transformation and changing the business environment of the construction industry to support sustainable development. They have also recommended the alliance BM between SMEs and large companies to seize business opportunities. Furthermore, (Tykkä et al., 2010) referred to close interaction of clients to production processes at timber frame firms in the construction sector, as a new BM. Similarly, (Ekholm &

Molnár, 2009) referred to strategic partnering as a new BM to encourage cooperation and communication in product development.

Terms such as ‘competitiveness’ and ‘competitive advantage’ are populating the literature of BMs in building and construction research. Typical statements reported include (Li et al., 2009) who studied real estate firms in China in which the BM is understood as a form of competitive advantage and they recommended that developers need to create a new form of competitive advantage and rethink their BM to survive in the market. In addition, an earlier study by (Seaden et al., 2003) of strategic decisions and innovation in construction, in which they referred to the BM in developing their conceptual model of innovation analysis. However, their reference was merely based on the competitive advantage theory, has been criticised for its ambiguity (Green et al. 2009, cited in (Pan & Goodier, 2011), unlike the first example of real estate firms in China.

More recent studies have presented a clearer definition of the BM which has originated from business and management fields; such studies include (Aho, 2013; Mokhlesian & Holmén, 2012; Pan & Goodier, 2011; Pekuri et al., 2013). A common definition of the BM was noticeable in these studies: value creation and value capture. For example, (Aho, 2013) stated *“The business model defines the architecture, principles, logic and capabilities that an enterprise applies for creating, delivering and capturing value”* (p.113).

Even though there are limited articles that deal with the BM in the building and construction context, the trends of research can be drawn from them. These trends can be summarised as follows: Firstly, early papers of BMs started with e-business, e-commerce, and ICT movements in the construction context (for more details refer to (Anumba & Ruikar, 2002; Cheng et al., 2001; Duyshart et al., 2003). Secondly, some studies associated BMs with competitive advantage but without a clear definition of them (for more details see (Li et al., 2009; Seaden et al., 2003). Thirdly, studies that referred to BMs in different topics but without an implicit definition of a BM which account for the vast majority (examples can be found in (Boddy et al., 2007; Brady et al., 2005; Li et al., 2008; Wasiluk, 2013). Finally, recent studies present an explicit definition of BMs and deal with BMs as a main theme and focus of the study (examples can be found in (Aho, 2013; Mokhlesian & Holmén, 2012; Pan & Goodier, 2011;

Pekuri et al., 2013). The final trend demonstrates the relevance and importance of BMs approach in the construction field.

3.4. Why the business model approach?

The existing literature reflects the growing appreciation of the BM in the building and construction disciplines. Such a growing appreciation is quite evident in sustainability studies. For example, (Mokhlesian & Holmén, 2012) analysed green construction from the BM perspective. They have argued that such a perspective facilitates better understanding of green construction processes and helps to separate green construction from “greenwashing”. Their approach was particularly useful in explaining how and why construction firms can be successful, in terms of creating and capturing value when engaging in green construction. In a related vein, (Aho, 2013) suggested that the future of sustainable construction research is in industry structure and BM transformation and he argued that the current research omitted these niche areas. Therefore, the BM concept can explain sustainability in terms of creating value and how value is defined (Abuzeinab & Arif, 2013a). In addition, the BM can help companies to transform their abstract environmental strategies into viable business concepts. Furthermore, concentration on the BM can help better evaluation of current construction companies’ BMs and assess their future suitability regarding sustainability aspects and competitiveness. However, it is vital for studies in this field to define BMs explicitly to reduce the ambiguity around the concept. According to (Magretta, 2002), the BM focuses on how the elements of the system come together as a whole. In other words, the BM approach will bring systematic and radical change on how companies can transform to respond to ever changing environments.

As presented earlier in this chapter, this research suggests the BM concept to facilitate better understanding of green value creation and value capture. The next section presents a conceptual GBM that will be modified and tested by empirical data from the UK construction industry practitioners, as detailed in Chapter 5. According to Sommer (2012), GBMs are an intersection between two research domains: namely, environmental sustainability and BMs. This research has adopted this view in understanding GBMs.

3.5. A conceptual green business model

In the literature, there has not so far, been an established, internationally recognised definition of a GBM, nor has there previously been any structured way of describing these concepts as a whole (Henriksen, Bjerre, Almasi, & Damgaard-Grann, 2012). There are many terms in the public and academic debate about how companies can improve their business to become greener and how they are categorised as green companies from processes or the end result of products and services.

Sommer (2012) discussed GBMs from a theoretical perspective as well as from an empirical perspective of seven case studies. According to him, a GBM can be defined as *“a business model that represents a significant improvement (discontinuous leap) in overall environmental performance relating to its entire value chain system vis-à-vis that of conventional business model (i.e., the reference case). This improvement is directly attributable to the business model through the alternative design and configuration of business models elements”* (p. 106). In addition, Henriksen et al. (2012) defined it as *“Green business model innovation is when a business changes part(s) of its business model and thereby both captures economic value and reduces the ecological footprint in a life-cycle perspective.”* To develop the current understanding of GBMs, the reduction of the ecological footprint can include changes to a firm’s products, services, processes, and policies, such as reducing energy consumption and waste generation, using renewable resources, and implementing an environmental management system (Bansal & Roth, 2000). The two definitions suggested that GBMs have lower environmental impacts or have improvements on the environmental performance – whatever form this might take. Furthermore, the definitions stated the change to the original BM elements to reach a GBM. These definitions form the basis to introduce a GBM concept into the construction sector. The starting point will always be the analysis and assessment of the existing BMs in a particular construction company to be able to move to a GBM and it becomes vital to develop the BM elements to be applied in this research.

The logic of the concept starts with dividing the BM into two value perspectives: value creation and value capture (Sommer, 2012). Key resources and key activity elements constitute the value creation perspective, while the value proposition and target group elements constitute the value capture perspective. Value creation and value capture

involve financial arrangements such as cost and revenues. Thus, a fifth element is added: financial logic (Abuzeinab & Arif, 2013b; Sommer, 2012). Figure 3-4 illustrates the BM elements applied in this research. It is crucial to understand that all elements are interrelated, as indicated in the Figure next.

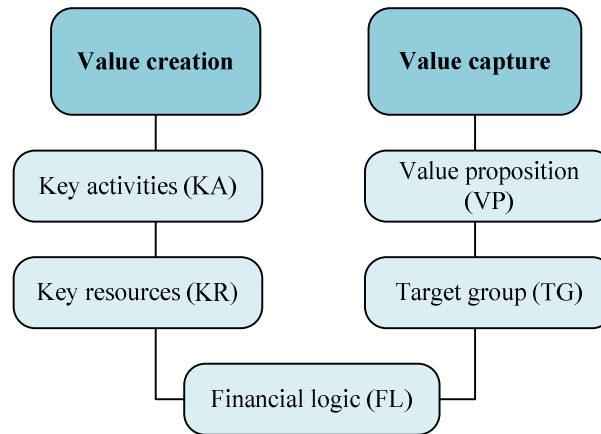


Figure 3-4 BM elements applied in this research

From Figure 3-4 above, it can be seen that GBMs have two value perspectives that are based on a green value proposition. Companies need to assemble a bundle of resources and activities which, when combined, will create value for customers or users. This combination will be done partly within the company and partly externally (Mokhlesian & Holmén, 2012). The outcome will be a green value proposition that will be offered to customer segments or target groups and generate revenue streams. This determines the value capture for the company (Aho, 2013). It is worth noting that the conceptualisation of this model relied heavily on Sommer's (2012) work because his approach was built on well-known previous work and research such as Osterwalder (2004), Osterwalder & Pigneur (2010), Johnson et al. (2008), and Johnson (2010). The following subsections provide brief details of the BM elements applied in this research and gives ideas on transforming these elements into green elements.

3.5.1. Value proposition (VP)

Over the past 20 years, the value proposition (VP) term has been used widely in academia and industry settings but without considering the concept in depth (Frow & Payne, 2011). These scholars tried to fill this gap by mapping the existing research on VP and they were able to identify four major themes as follows:

- Value map to identify a value frontier which can help companies developing VPs and hence enhance competitive positioning;
- “Delivery of value” where VP is defined by customer experience results in dealing with a particular company compared to competitors. Therefore, this theme is based on experimental, interactive, and relationship perspectives;
- Three alternative approaches to VP including: the benefits a company provides to customers, the benefits compared to competitive offerings, and the key benefits appreciated and valued by customers; and
- Four broad categories of VPs including: economic, functional, emotional, and symbolic.

From the above four themes, the VP is mainly associated with customers and competitive positioning. Therefore, the VP can be considered as a unique offering that a particular company delivers to its customers and because this offer is unique, it can position the company in a competitive position compared to its rivals. This view on the VP resonates with the marketing literature view which uses VPs and connects it with the values a company delivers to its customers to meet and satisfy their needs (Anderson, Narus, & Van Rossum, 2006). The business literature provided similar views on the VP and defined it as follows: “*A value proposition describes how a company’s offer differs from those of its competitors and explains why customers buy from the company*” (Lindic & Silva, 2011). However, customers do not buy a product or service characteristics *per se*. Instead they buy the benefits a product or service brings. According to (Lindic & Silva, 2011), the major problem of the VP is that companies often consider it in terms of what they offer to their customers, rather than what the customers really value.

GBMs can distinguish themselves by the appropriate VP based on environmental sustainability (Esty & Winston, 2009). For instance, a company may derive a reputational value from green services, reset the criteria that are most relevant to the customer through environmental processes and practices and redefine the competition by helping customers to become green (functionality). Consequently, functionality means to fulfil an important need for a given customer. Once we understand the need and all its dimensions, we can design the offering. The offer will be more appealing for

a given customer because the function is designed with the real need in mind. VPs are thus always to be seen in conjunction with the next element, the target group (Johnson et al., 2008; Sommer, 2012). In addition, green VPs can help retain talented employees who will appreciate their responsible products and services.

3.5.2. Target group (TG)

According to Sommer (2012), an attractive VP alone is not enough for market success, without a sound understanding of relevant target groups (TG). In this study, the TG is extended to incorporate the stakeholder who has direct impact on the two value perspectives of the business model, such as regulators, investors, and communities who have specific requirements to be addressed.

The TG presents the company's view on identifying and choosing relevant groups that the VP is intended to appeal to. An identification of the TG can be a means to systematically increasing green business models' markets by developing group-specific marketing strategies and campaigns. However, it is crucial for companies to understand the needs and preferences of the group that has been targeted. The ultimate goal of the TG identification is to promote green VP benefits and values, hence the potential clients/users are fully aware of its distinctive advantages. In order to accomplish this goal, it is vital to recognise the values, needs, preferences, and behavioural choices of the specific TG (Zenker, 2009). Companies need to understand the importance of targeting not only existing, but also potential clients for their green VPs. Given the scepticism of many clients towards green business models, it becomes crucial for companies to channel their resources and expertise to attract and convince targeted groups.

GBM can create value by offering superior value/ green differentiation to groups that are already defined, or by facilitating access to new customer targets and by founding deeper customer relationships (eco-minded customers).

3.5.3. Key activities (KA)

The key activities (KA) of a business consist of procedures and processes by which a given company adds value, procures resources, and produces products and services to a TG (Betz, 2002). In other words, KA refer to procedures and processes that are necessary to produce value and/or address the needs of clients or solve their problems. In addition, (Osterwalder & Pigneur, 2010) defined KA as the most important activities

that need to be performed to create customer value. Furthermore, the KA can describe the core business of a given company. The success of companies depends on managerial and operational activities that allow them to deliver value in a way they can successfully be repeated and result in an increased sale. The managerial activities can be environmental planning, development, training and budgeting, while the operational activities can be manufacturing, sales, and services (Johnson et al., 2008). Companies can use their KR to perform business activities in a unique way which will differentiate them from the competition.

GBM will need modification of management activities to accommodate their new elements, and it also influences the operational activities and processes, for example a given company may change from a product-based operation to a service-based operation.

3.5.4. Key resources (KR)

Key resources (KA) are available assets that are owned, controlled, and accessed by a company and can be categorised as tangible, intangible and human. Six main types of resources are adapted from Johnson et al. 2008 and discussed below:

People, human assets or employees with their experience, training, relationships and insights are a crucial factor for any company. A well-motivated and inspired workforce can greatly improve efficiency and compensate for BM design flaws through commitment. A GBM can greatly motivate employees by improving the company image. According to Steger (2006), environmental sustainability can be used to improve productivity by boosting employee morale and help recruiting and retaining high-quality creative people.

Brand, although not always the case, some green brands are effective at commanding a higher price, increasing customer's loyalty and boosting sales. Some companies are differentiating themselves as environmental leaders.

Knowledge can relate to any BM element to be of value. Examples include knowledge and information on customer preferences, or the company's environmental footprint. Knowledge is often dependent on IT, but is frequently associated with the knowledge stored in an employees' head.

Technology can relate to processes and play a critical role in all clean/ green technology business models. It includes tradable know-how like licenses and the systems that a firm uses to run its businesses.

Physical assets can be a powerful source of competitive advantage and can include property and equipment.

Partnerships are a special and important case in that they can provide access to all the other resources listed above. Partnerships such as a deep relationship to a key partner or complicated supply chain can be argued to indicate a valuable resource in itself.

Some scholars suggest that the foundation of the KA construct is in the resource – based view (RBV) which regards each company as a bundle of resources (Al-Debei & Avison, 2010; Barney, 2001). The RBV emphasises the strategic importance of resources and how these resources integrate to generate value for customers. This will eventually result in sustainable competitive advantage to the company possessing the resources. However, possessing the resources is not enough to compete in the market, these resources need also to be organised, combined, and configured in an appropriate manner (Hedman & Kalling, 2003; Koruna, 2004). In fact, resources configuration demonstrates a company's capability to combine the various assets in a way that allows an efficient and effective roll-out of its products or services. Based on this discussion, we argue that the KR element of a GBM needs to represent company resources, their configuration, and the consequential core competencies.

3.5.5. Financial logic (FL)

Financial logic (FL) is about the economic side of the BM. It contains a cost structure and revenue model, which together determine profitability for a given BM (Osterwalder, 2004). According to (Al-Debei & Avison, 2010), the BM seems to be strongly associated with economic and financial arrangements and designs within companies. For many people, the concept is merely used to address financial arrangements including revenue generation. Nevertheless, this research suggests that the BM is more comprehensive and that financial logic represents only one element of the concept. Many companies in GBMs realise substantial savings in the internal cost model by using input factors and energy more efficiently, by using environmentally-friendly substitutes and recycling waste, or by reducing cost related to emissions, like treatment costs and taxes (Lankoski, 2006). One important revenue model in the

environmental sustainability context is the servicing concept. This concept aims to substitute selling physical products and material use with the provision of services. It helps the environment by facilitating a more efficient use of resources. The revenue comes from a steady stream of service charges rather than product sales (FORA, 2010; Sommer, 2012).

In summary, developing a GBM requires a balance of different and often conflicting design requirements guided by the five elements discussed above. It is also worth noting that the GBM approach represents an activity system to create and capture green VPs. When looking at how to transform a company BM into a green one, it is crucial to think of it as a system. Changing one element of the BM will in most cases, affect one or more other elements and so on. Therefore, making these types of changes and transformations often takes a long period of time, since entire systems are altered. GBMs can increase the development and uptake of a more radical and systematic environmental approach that is important for the long-term transformation towards a greener construction industry. In fact, the Construction 2025 strategy which was jointly developed by HM Government and the construction industry, highlighted the need for a radical and transformational change (HMGovernment, 2013). This change can be achieved by concentrating on GBMs.

However, developing new BMs that are based on green value creation and capture has proved to be a hard task and there are challenges associated with these GBMs transformations. This research aims at developing a guideline to help the transformations. Therefore, the five elements discussed above were used at the data collection phase to find how the construction industry practitioners understood them. It was also essential to document how these elements have changed and transformed as a result of green practices and activities. During the data collection phase, the researcher asked about the fundamental changes which have happened within the sample companies, to inform new transformers how to prepare for these changes. Finally, the researcher collected data on benefits and challenges associated with GBMs. By collecting this information, the researcher was able to propose a guideline for the transformation process. The data collection and analysis are discussed in more detail in Chapter 5 and 6. To give more details on GBMs transformation, a simplified and schematic overview is presented in Figure 3-5 below.

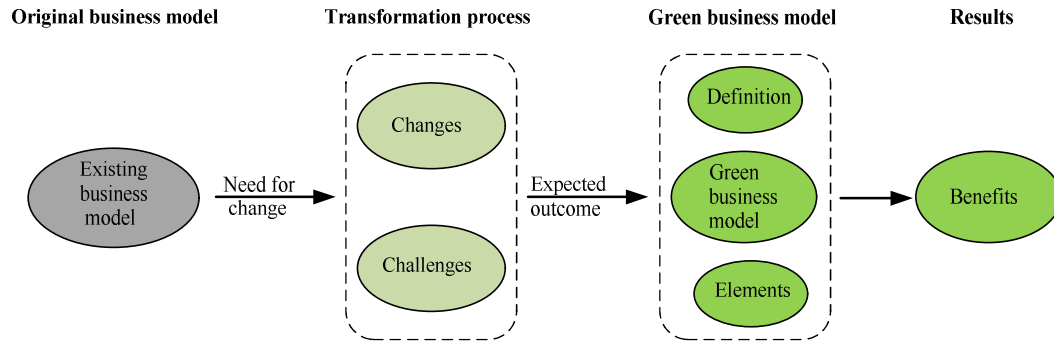


Figure 3-5 GBMs transformations

From the Figure above, we assume that any construction company has an existing BM. The existing BM will need to transform to a green one as a result of many driving forces such as legislation, ecological responsibility, and more importantly economic opportunities. This transformation will lead to fundamental changes within the company and also there will be challenges to be resolved including internal and external challenges. When companies go through these changes and overcome the challenges, a GBM will be formed and developed. The limited literature on GBMs suggested directions of research to serve as a common language (Beltramello, Haie-Fayle, & Pilat, 2013b; Henriksen et al., 2012; Sommer, 2012). These directions pointed to the importance of a clear definition as well as common elements of GBMs. Finally, companies achieving GBMs transformations will reap benefits that need to be identified and documented at the data collection phase. It is believed that the benefits will motivate more companies to transform their BMs and facilitate further uptake of GBMs within the construction context.

3.5.6. Green business models prototypes

GBMs share common characteristics to create green value or improve environmental performance and capture value. Green value creation can include resource efficiency, renewable inputs, low pollution, less waste, and smart need satisfaction. Value capture can include cost, quality, innovativeness, reputation, ethics, and political and public support (Sommer, 2012). When combining these two value perspectives, typical GBMs can be derived. Table 3-3 provides a non-exhaustive list of BMs which have sometimes overlapped with green potential.

Table 3-3 Examples of business models with green potential

Type	Description	Examples
Low carbon models	Reducing the carbon impact of construction products and services	Natural ventilation of buildings Highly insulated buildings
Efficiency models	Resource efficiency in construction makes best use of material, energy, and water	Efficient appliances to reduce energy usage Low-water flush toilets
Low waste models	Construction processes and services are improved and innovated by reducing waste, reusing, and recycling	Offsite construction Reverse logistics
Dematerialisation models	A physical product or process is replaced by a digital format, hence saving resources	Video conferencing Paperless architectural drawings and office solutions
Smart models	Usually IT-enabled processes allowing better need fulfilment	Smart metering Sensor technologies
Life cycle models	Considering the life cycle impact of construction services and products. Life cycle models include the operation phase or may include the whole impact from raw materials	Life cycle assessment (LCA) Life cycle cost (LCC)
Renewable models	Use of renewable material and energy sources such as solar and wind	Renewable energy
Performance contracting	Guaranteed energy or resource savings where no up-front capital is needed from the customers. Providers benefit from the savings and sustained jobs.	Energy performance contracting for buildings
Green consulting models	Companies offer their expertise in environmental protection and performance to other companies	Eco-efficiency services

3.6. Summary

This Chapter has presented a review of business models (BMs). It has shown that the BM concept is emerging as a new unit of analysis and is promoting dual focus on value

creation and value capture. Definitions of the BM and its relation to strategy have been discussed. Also the BM in building and construction research has been reviewed to justify the use of the concept in this research. The Chapter has also presented the conceptual green business model (GBM) consisting of five elements: namely, value proposition (VP), target group (TG), key activities (KA), key resources (KR), and financial logic (FL). Finally, it concluded with prototypical BMs with green potential which can help in developing robust models in the future. The next Chapter deals with the research methodology and justifies the method adopted and data collection and analysis techniques.

Chapter 4. **METHODOLOGY AND RESEARCH DESIGN**

4.1. Introduction

This Chapter sets out the nature of this research and the way in which the research design evolved. It justifies the philosophical stance adopted by the researcher. It explains the research approaches and research methods and justifies the reasons behind adopting the qualitative method. In addition, it outlines the research design which includes data collection and analysis techniques. The advantages of the techniques adopted are discussed, along with their limitations. The research population and the sampling techniques are also discussed. Finally, the methodological limitations are presented.

4.2. What is research methodology?

Research methodology explains the procedural framework by which the research is conducted (Amaratunga et al., 2002). It links the different research components together in a coherent manner. These components are the research questions or hypothesis, the conceptual approach to the topic, and approaches and methods to be adopted in achieving the research aim and their rationale. In addition, Ding (2008) defined the methodology as a combination of various techniques used to inquire and investigate about a specific situation. Many factors drive the appropriate research methodology for a particular research, such as the topic to be researched and the specific research questions being primary drivers (Amaratunga et al., 2002). Therefore, in research design, the main issue is whether the researcher has made sensible decisions about the methods, considering the aim of the study, the questions being examined, and the resources available, including time (Amaratunga et al., 2002). A robust methodology is essential to achieve the research aim and objectives. Therefore, Table 4-1 shows existing choices of methodology components and justifies the selection made by the researcher.

Table 4-1 Summary of methodological choices and justification

Choices	Types	Selection	Justification
Ontology	Objectivism	Subjectivism	GBMs are highly influenced by managers views and interpretation of value propositions and what will be appealing to specific clients. To reveal these views and establish common language, it was appropriate to select subjectivism reasoning.
	Subjectivism		
Epistemology	Positivism	Interpretivism	The researcher was looking at possible ways of obtaining knowledge about GBMs. This was done by understanding the views and experiences of supply and demand actors. Therefore, the study adopted interpretivism stance.
	Interpretivism		
Research approach	Inductive	Abductive	GBMs are new topic in general and particularly in the construction research. Therefore, the abductive approach provided deep insights into them and allowed for generating new knowledge. It was also appropriate during the validation process where the knowledge was already generated and needed to be validated and refined by experts.
	Abductive		
	Deductive		
Research method	Quantitative	Qualitative	To cover the subject of GBMs comprehensively, it was essential to select qualitative method because it produced a wealth of detailed data on a small sample. In addition, the study was exploratory in nature and little was known about the subject under investigation.
	Qualitative		
	Mixed method		
Sampling	Probability sampling:	A combination of	The researcher has a clear idea of what sample unit are needed because GBMs are understood and designed by senior managers and directors. Therefore, the researcher designed the eligibility criteria for inclusion in the study. The researcher
	Random		
	Cluster		
	Non-probability		

	sampling:	purposive and	then asked those who met the criteria to
	Convenience	snowball	name others who would also be eligible
	Quota		and willing to participate in this study.
	Purposive		
	Snowball		
Data collection	Interviews		This technique is suitable to discover
	Questionnaire		views, perceptions, and opinions of
	Documents	Interviews	managers about GBMs. It also allows for
	Observation		conversation between the researcher and
			the participants to establish common
			understanding of GBMs.
Data analysis	Grounded theory		The researcher aimed at extracting
	Content/ thematic		meaning from the interviews by looking
	Statistical	Content/	for themes that were relevant to certain
		thematic	categories designed in advance such as
			challenges and benefits associated with
			GBMs. The opinions of the interviewees
			were analysed and interpreted to derive
			answers for the research questions.

Table 4-1 summarised the appropriate methodological choices and their justification based on the study requirements. Detailed choices and their reason of selection are explained in the sections below. The methodology is also driven by certain ontological and epistemological assumptions which are often known as research philosophies or paradigms (Easterby-Smith, Thorpe, and Jackson, 2012; Saunders, Lewis, and Thornhill, 2012). The following sections will highlight these assumptions and explain the methodology that will be adopted in conducting the research, as guided by the overall methodology framework of this study, shown in Figure 4-1.

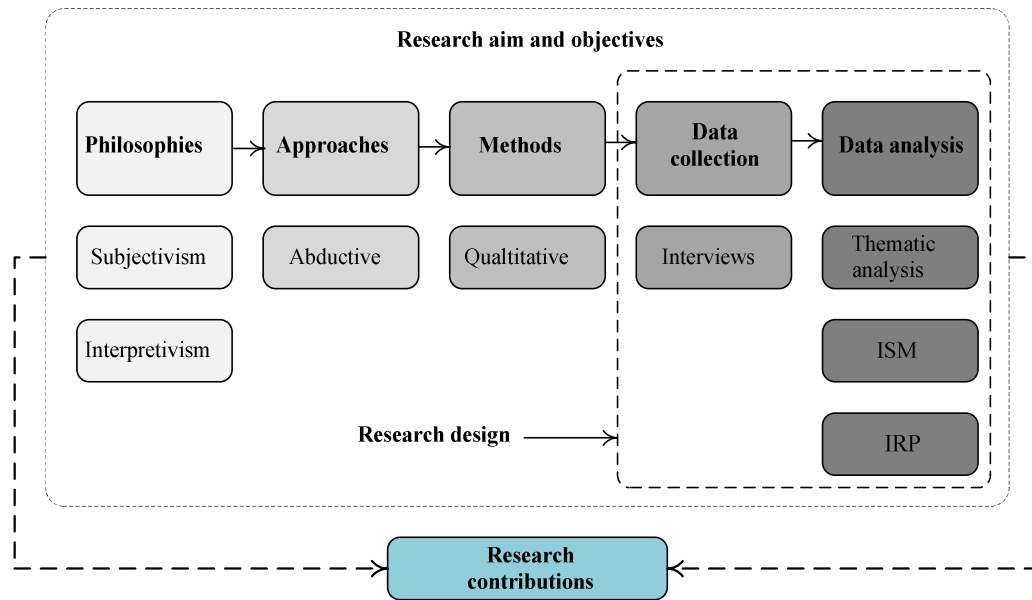


Figure 4-1 Methodology framework of this study

The Figure above presents the different components of this research. Data collection techniques are the most obvious and visible components and features of any research project. However, Easterby-Smith, Thorpe, and Jackson (2012) argued that data collection techniques are highly dependent on decisions and assumptions that are progressively less visible, such as philosophies. As illustrated in the framework above, data collection in this research is driven by philosophies, approaches, and methods. The main traditions of the research philosophies are presented next.

4.3. Research philosophies

Research philosophy is concerned with the development of knowledge and the nature of that knowledge and contains important assumptions about the way in which the researcher views the world and the reality. These assumptions will determine the research approaches and the methods. In addition, the research philosophy is influenced by practical considerations but the main influence is likely to be the researcher's particular view of the relationship between knowledge and the process of knowledge development (Saunders, Lewis, and Thornhill, 2012). According to Easterby-Smith, Thorpe, and Jackson (2012), the research philosophy is important for three reasons: firstly, it helps to clarify the research design; secondly, it helps the researcher to identify the appropriate research design under the given circumstances; and finally, it helps the

researcher to create research designs which may be outside his/her past experience. Therefore, understanding philosophical assumptions can both increase the quality of the research and contribute to the innovativeness of the researcher. Two major underlying assumptions about research philosophy are ontology and epistemology, which are recognised by different researchers as the main traditions (Blaikie, 2007; Easterby-Smith, Thorpe, and Jackson, 2012). These assumptions are explained in the following subsections respectively.

4.3.1. Ontology

The ontology stance is concerned with the nature of reality. This discusses the assumptions that researchers have about the way the world operates and the commitment held to specific views. It also raises the question of what is the nature of the social reality to be investigated. Bryman (2004) stated that ontological assumptions are concerned with; *“questions on whether social entities can and should be considered objective entities that have a reality external to the social actors, or whether they can and should be considered social constructions that can be built up from the perceptions and actions of social actors.”* (pp. 16). Ontology is focused around the respective merits of two contrasting positions of the nature of reality: objectivism and subjectivism.

Objectivism portrays the position that social phenomena and their meanings exist independently from the social actors. On the other hand, subjectivism portrays the position that social phenomena and their meanings are created by social actors (Saunders, Lewis, and Thornhill, 2012). In addition, subjectivism is often associated with the term social constructionism: *“it is necessary to explore the subjective meanings motivating the actions of **social actors** in order for the researcher to be able to understand these actions”* (Saunders et al., 2008, pp 111, emphasis added). Therefore, social constructionism views reality as being socially constructed.

The current research aims at developing a green business model framework through exploring the existing green business models and how they have been developed. The choice and type of green business model is highly influenced by the client's demands and the manager's view, for a given company, in interpreting these demands. Hence it is vital for this research to explore the social actor's motivations and views in order to understand the green business model's actions and consequently the subjectivism stance has been adopted to achieve the aim of this study.

4.3.2. Epistemology

The epistemology stance concerns what constitutes acceptable knowledge in a particular field of study (Saunders, Lewis, and Thornhill, 2012). It also answers the question of how we know about the social reality and possible ways of obtaining knowledge about it. In addition, Easterby-Smith, Thorpe, and Jackson (2012) defined epistemology as the different ways of investigating the nature of the social and physical world. The two contrasting positions of epistemology are positivism and interpretivism.

Positivism is a position that advocates the application and methods of the natural and physical scientist. It works with an observable and measurable social reality. In other words, the social world exists externally and its properties should be measured objectively, rather than being inferred subjectively (Easterby-Smith, Thorpe, and Jackson, 2012). In contrast, interpretivism advocates that it is important for the researcher to appreciate differences between humans in our role as social actors. It emphasises the difference between conducting research among people rather than objects (Saunders, Lewis, and Thornhill, 2012). The heritage of this stand of interpretivism comes from two intellectual traditions: namely, symbolic interactionism and phenomenology. In symbolic interactionism, humans are in a continual process of interpreting the social world around them. Phenomenology explains the ways in which humans make sense of the world around them (Saunders, Lewis, and Thornhill, 2012). As stated in Amaratunga et al., (2002), *“phenomenological (interpretive science) inquiry uses qualitative and naturalistic approaches to inductively and holistically understand human experience in context-specific settings”* (pp.19). Therefore, this approach tries to understand and explain a phenomenon, rather than look for external causes and fundamental laws.

In the forgoing discussion, the current research aims to understand and explain the green business model concept in the construction context. It also aims at understanding the relevant stakeholder experience and choice of a green business model and their views on how the fundamental changes of their company’s business model took place as a result of green value propositions. Therefore, this study is more akin to the interpretivism view. The philosophical stances of this study will inform and influence the next component of this research: research approaches.

4.4. Research approaches

Research approaches play a significant role in answering research questions (Blaikie, 2010). When researchers set out to answer research questions, they are challenged with the task of choosing the best research approach to answer them. In this respect, Bryman (2012) identified two main factors guiding researchers in this selection task: namely, the question of what form of theory the researcher is referring to, and the purpose for which the data in question was to be used i.e. theory-testing or the development of a new theory. Saunders, Lewis, and Thornhill (2012) classified research approaches into the deductive and inductive approach. The deductive approaches is when researchers develop a theory and hypothesis (or hypotheses) and design a research method to test the hypothesis, while in the inductive approach researchers collect data and develop a theory as a result of the data analysis. However, they also suggested that there is a possibility of combining research approaches, which is often referred to as the abductive approach. Table 4.1 presents the logic of the three research approaches.

Table 4-2 The logic of three research approaches

	Deductive	Inductive	Abductive
Aim	To test theories, to eliminate false ones and corroborate the survivor	To establish descriptions of characteristics and patterns	To describe and understand social life in terms of social actors' meanings and motives
Start	From more general (<i>generalisation</i>) to more specific Identify a regularity to be explained Construct a theory and deduce a hypothesis	From specific and close understanding of the research context (accumulate observations or data) to more general understanding	Discover everyday lay concepts Produce a technical account from lay accounts

Finish	Test the hypotheses by	Use these laws as patterns	Develop a theory and
	matching them with	to further explain	elaborate it iteratively
	data explanation in the that	observations	
	context		

Source: Blaikie (2010) and Saunders et al. (2012)

This research suggests using the business model perspective to understand the green value creation and capture in the construction context. The business model is a relatively well established discipline in management and business studies. In other words, this research borrowed the business model concept from management and business disciplines to explore and test it in a new discipline. This can be seen as a deductive approach but because the concept has been tested in a new context, it will be more appropriate to adopt an inductive approach to contribute to the limited theoretical research on business models in the construction disciplines and then build a robust green business model. Hyde (2000) suggested that qualitative researchers can adopt both inductive and deductive approaches. He stated that: *“extreme induction could deprive the researcher of useful theoretical perspectives and concepts which can help guide exploration of a phenomenon; extreme deduction could preclude the researcher from developing new theory”*. Advocating either extreme is undesirable” (Hyde, 2000, pp. 88). Relying on Saunders et al. (2012) and Bryman’s, (2012) explanation of the abductive approach as a combination of both approaches, this research lends itself to be abductive, although (Christensen, 2001) do not agree with this explanation. According to Blaikie (2010), abductive approaches are usually associated with the interpretivism stance, which is also true for the current study.

4.5. Research methods: Quantitative and qualitative methods as research traditions

For many years there were two basic research methods: the quantitative and qualitative methods. According to Bryman (2012), the quantitative method entails the collection of statistical data and positioning the researcher as an independent observer, which is also known as the scientific method. Quantitative methods are understood to be repeatable and capable of isolation from reality without compromising the cause and effect

relationship being investigated. On the other hand, the qualitative method tends to be concerned with words rather than numbers, and observation to express reality, and attempts to describe people in natural settings (Amaratunga et al., 2002). The findings of qualitative research are focused on revealing the qualities of phenomena rather than their static measurement. The qualitative method covers the subject of study comprehensively. It produces a wealth of detailed data on a small sample and the data collection is not restricted to predetermined categories or themes (Hyde, 2000; Ko de and Norbert, 1998). The inherent flexibility of qualitative studies and their potential for revealing complexity were particularly relevant to this research, since the topic of investigation was complex in nature. In addition, qualitative data has often been advocated as the best approach for discovery and exploring a new area (Amaratunga et al., 2002). These features are aligned with the nature of the current research. The features of the qualitative and quantitative methods can be found in Table 4-2.

Table 4-3 Claimed features of qualitative and quantitative methods (Amaratunga et al., 2002)

Quantitative	Qualitative
Inquiry from the outside	Inquiry from the inside
Underpinned by a completely different set of epistemological foundations from those in qualitative research	An attempt to take account of differences between people
Are they simply different ways to the same end?	Aimed at flexibility and lack of structure, in order to allow theory and concepts to proceed in tandem
Involves the various states of the scientific research	The results are said to be, through theoretical generalisation, “deep, rich and meaningful”
The results are said to be “hard generalisable data”	Inductive-where propositions may develop not only from practice, or a literature review, but also from ideas themselves
	An approach to the study of the social world, which seeks to describe and analyse the culture and behaviour of humans and their groups from the point of view of those being studied

This research uses well established BM elements in business, management, and economic disciplines to test and explore this concept in the construction context. To test

the business model concept in the construction context, an in-depth insight and flexibility are needed at the same time. Therefore, qualitative methods were adopted to provide a diagnostic exploratory study (Ko de and Norbert, 1998).

4.6. Research design

The research design can be described as a plan that “*guides the investigator in the process of collecting, analysing, and interpreting observations. It is a logical model of proof that allows the researcher to draw inferences concerning casual relations among the variables under investigation*” (Nachmias & Nachmias, 1992, pp 77-78, cited in Yin, 2008). Consequently, the research design can be divided into two distinctive stages: data collection and data analysis.

The design of this research, including sources of empirical data, was heavily influenced by the nature of the main research question -“How can construction companies successfully make fundamental changes to their BM(s) based on green value propositions, thereby improving or sustaining economic performance?”- and the existing literature. Seminal works were identified to make informed decisions about how to progress in the research. For example, Sommer (2012) carried out a comprehensive work on green business model transformations and conducted 7 case studies to develop a management framework for such business models. He argued that semi-structured interviews were the best means of data collection for this type of research. Furthermore, in 2009, the MIT Sloan Management Review started an annual survey for business for sustainability globally with emphasis on business models. However, before designing the survey, MIT conducted detailed interviews with experts to inform the survey questions and key areas to be included (Maurice Berns, 2009a). Therefore, this research conducted semi-structured interviews with 19 participants from the construction industry, academics and managers. Detailed profiles of the interviewees are presented in the next Chapter.

To give an initial idea of the process of a GBM development and transformation, a simplified, schematic overview is presented in Figure 4-2. In addition, this schematic overview informed the data collection phase and interview questions.

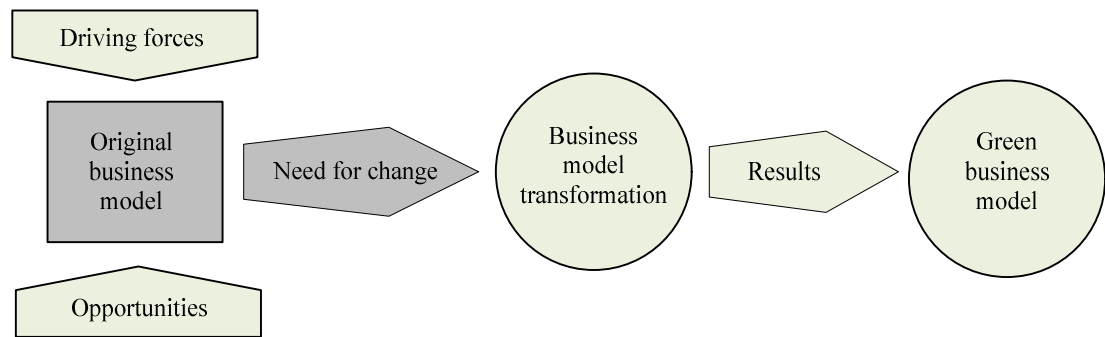


Figure 4-2 Schematic overview of GBM development

As outlined in Figure 4-2 above, the GBM development can be triggered by driving forces and opportunities associated with environmental sustainability. These triggers will challenge the original BM which will need to be changed. Then the transformation process will take place which ultimately results in a new green business model. In practice, the transformation process is difficult to achieve and will require major investment in terms of time, money, and people.

In this particular study, the researcher is interested in exploring the economic benefits associated with environmental sustainability through a BM lens, and achieving an in-depth understanding of green value creation and value capture. In addition, the research is concerned with changes in construction companies' BMs when they go green and these changes are usually initiated and designed by decision makers in a given company, hence an interpretivism stance adopted.

4.6.1. Data collection techniques

Interviews are widely used in social research and resonate well with qualitative methods. Interviews are commonly categorised into three typologies: structured, semi-structured, and unstructured. These typologies can be linked to some extent to the depth of response required and to the degree of standardisation of the interview. The structured interviews are typically a questionnaire with fixed questions where the response to most of the questions has to be selected from small list. Semi-structured interviews allow much more flexibility of response, with a conversational style between the interviewer and the interviewee. Unstructured interviews are often called in depth

interviews, where the participants are extremely free to respond to the broad topic of the interview with minimal prompting from the interviewer (Fergusson & Langford, 2006).

As mentioned earlier, detailed semi-structured interviews were conducted. The semi-structured interview was relevant to this research since it is conducted with a fairly open manner allowing focused, conversational communications, and new questions to be brought up during the interview, based on what the interviewee says (two-way communication). The conversational communication is the key criteria because GBMs are relatively new in the construction context, thus the research will need inputs, credits, and insights from experts in the field. According to Easterby-Smith et al. (2012), the interview helps to gain insights into social and organisational realities through discovering the views, opinions, and perceptions of both individuals and groups. In this study, the researcher prepared interview questions that cover the major topics to be covered, with default wording and an order for the questions. However, the flexible nature of semi-structured interviews allowed the researcher to ask follow up questions based on interviewees answers to generate a better understanding of the research topic (Appendix A).

The target sample was purposive sampling to achieve representativeness and snowball sampling. A purposive sampling technique uses participants who are both accessible and willing to participate in the study. Purposive sampling is mainly associated with qualitative studies and can be defined as selecting units such as individuals based on particular purposes, to answer the research questions (Renukappa et al., 2012). The profile of interviewees was chosen according to the following selection criteria:

- Senior/managers in the construction industry
- Relevant experience in sustainability strategies and practices
- Relevant experience in business development and strategic plans
- A decision maker regarding sustainability issues, for example, being able to initiate and implement future plans
- Ideally, a sustainability manager, expert or officer.

These participants commented on the GBM elements, reflected on terms used, discussed the relationship and importance of the elements, and reported the BM changes in their companies when involved in green practices and initiatives. The obtained qualitative

data was in the form of drivers, challenges, benefits, and changes in their BM when these companies started green activities. Furthermore, structured interviews were used to collect data to refine and verify the emergent findings.

4.6.2. Data analysis techniques

There is no universally accepted set of conventions for qualitative data analysis corresponding to those associated with quantitative data (Robson, 2011). Therefore, it is essential for qualitative researchers to choose and justify analysis techniques. Data analysis techniques refer to a range of ways in which data can be made sense of and attached to meanings. Easterby-Smith et al. (2012) suggested that most techniques of analysis can be used for a wide range of data. However, it is important that the researcher adheres to analysis techniques that are consistent with the philosophical and methodological choices of the study. Acknowledging the philosophical and methodological assumption explained above, this research adopted various qualitative analysis techniques. These techniques included thematic analysis, interpretive structural modelling, and interpretive ranking process, which are covered in more detail in the next subsections.

4.6.2.1. Thematic analysis

The analysis is focused on extracting meaning from the interviews which were analysed by means of thematic analysis. The thematic analysis refers to an analytical approach involving examination of discussions to establish meanings and intentions (Pavic, Koh, Simpson, & Padmore, 2007). It presents experiences, meanings, and the reality of participants. It also refers to qualitative content analysis which has been used in construction research (Harty et al., 2007). According to (Sev, 2009), qualitative content analysis is the basic approach for analysing and interpreting narrative data. They defined narrative data or text data as data which comes in many forms and from a variety of resources. For example, focus group interviews, open-ended questions and written comments on a survey, case studies, and documents and reports. Individual interviews are also a form of narrative data, which is the case for this study. This technique was adopted, given that the data collected in this qualitative study is in the form of narrative data (interviews). Social researchers suggest that the thematic analysis is a generic approach to qualitative data analysis. Thematic analysis has various advantages that encouraged this research to adopt such a technique. Thematic analysis

tends to be: flexible, a relatively easy and quick technique to learn, accessible to researchers with little experience of qualitative research, communicated without major complications, and used in a wide range of disciplines.

Robson (2011) proposed guidelines and steps for carrying out thematic analysis as follows:

1. Becoming familiar with the data
2. Generating initial themes
3. Identifying themes
4. Constructing thematic networks
5. Integration and interpretation

In this study, step 1 was achieved through transcribing the interviews (Appendix B) and reading the data several times, as well as listening to the audio recorded materials. The researcher wrote down any impressions, and initial ideas, and developed a summary contact form (Appendix C). The approach to step 2 was by focusing the analysis by question, which means putting all the data from each question together. This approach allowed for better comparisons between different answers, to identify consistencies and differences. Step 3 was built on the previous step where interview questions considered the themes to be examined. The interview questions were predetermined through established existing empirical research (Sommer, 2012; Maurice Berns, 2009a) because (Kibert, 2007) suggested that the use of predetermined themes equates to some kind of triangulation. The main themes which guided this study were as follows: understanding GBM; GBM elements; organisational changes associated with green practices; GBM benefits; and GBM challenges. The main themes were organised and presented on what the sub-themes are about, to fulfil step 4 requirements. For example, the GBM benefit theme proved to contain three sub-themes: namely, creditability, financial, and long-term viability. These sub-themes emerged purely from the interaction with the data which is mainly used in the grounded theory approach. The combination of predetermined and emerged themes demonstrates that this research was sensitive and accountable to the data analysis. In step 5, the researcher reported and presented the findings with clear connections to the existing literature where connections were possible. While the thematic analysis steps are presented here sequentially, this should

not be taken as implying that the process is linear. There was much flexibility where the results of a later step promoted the researcher to return and rethink earlier steps.

Nvivo software was used to present the themes and manage all the data, and to allow the coding and retrieval of text segments indexed to specific themes. Therefore, the function of NVivo in this study was organisational only to ease the process and it has not been used to carry out the detailed analysis. The data analysis details and findings are further discussed in the next Chapter.

4.6.2.2. Interpretive structural modelling (ISM)

ISM is a well-established method for recognising relationships among specific elements/ items which define a problem or an issue. ISM originates as an interactive group learning process, however individuals can also use it. In this process, a set of directly or indirectly linked elements are structured into a systematic model. ISM can be defined as a process aimed at assisting human beings to better understand a problem. It functions as an organisational method and adds a structural value to a problem. In this research, ISM is used to complement the qualitative method to facilitate a better understanding of the different GBM elements and challenges. In other words, this research relied on five GBM elements that were identified from previous studies and used them within the construction context. The findings revealed that these elements are highly interlinked therefore it was essential to structure these relationships. The findings also indicated that there are five major challenges facing GBM transformation. ISM is utilised to understand the relationships between the challenges and to develop insights into a collective understanding of these relationships.

ISM is characterised by four distinctive features as follows: it is interpretive and subjective in nature where a group of experts or managers decide and spell out whether and how the different elements are interrelated; it is structural by extracting the overall structure from the set of elements that have mutual relationships; it is a modelling tool because the relationships and overall structure are illustrated in a diagram model; finally it helps to impose order and direction on the relationship of various elements relevant to a specific issue or problem. This study has used explicit quotations and opinions that were captured during the interview process about the relationship between GBM elements and challenges to develop an ISM model for both of them. Although there were no direct questions about these relationships, interviewees highlighted them in

different questions throughout the interview. This research has used thematic analysis as the primary method to analyse the data. It can be suggested that it was acceptable to rely on interviewees' answers to determine the relationship between the different GBM elements and challenges. It is worth noting that the ISM method is a novel approach in business models research and particularly in the GBM area. Prior research claimed that the strength of BMs stems from the interrelationship between the different elements that constitute the business model. However, there were no empirical studies to support this claim hence this research contributes to this area.

ISM is a powerful and established qualitative tool which can be applied in various disciplines. For example, Ravi and Shankar (2005) have investigated the interaction among reverse logistics barriers by applying the ISM method. Bolanos et al. (2005) applied the ISM method in improving the decision making process among strategic groups working in different functional areas, while Thakkar et al. (2006) integrated the ISM methodology and Analytic Network Process (ANP) in the development of a balanced scorecard (BSC) for a real life case company in India. In addition, Singh et al. (2007) have utilised this technique to model critical success factors for implementation of advanced manufacturing technologies (AMTs). Luthra et al. (2011) explored various barriers in implementing green supply chain management (GSCM) in the Indian automobile industry through the application of ISM. Beside these, Talib, Rahman, and Qureshi (2011) applied the ISM approach to understand the interaction among total quality management (TQM) barriers in organisations. Finally, a recent study conducted by Haleem et al (2012) analysed the critical success factors of world-class manufacturing practices by relying on the ISM technique.

The various steps involved in the ISM method are extracted from (Attri, Dev, & Sharma, 2013; Ravi & Shankar, 2005; Shahabadkar, 2012) and are illustrated in Figure 4-4 below. ISM starts with the identification of variables/ elements that are relevant to a problem or issue. Then a contextual relationship is chosen such as drive or influence. A structural self-interaction matrix (SSIM) is then developed, based on a pair-wise comparison of variables/ elements. The SSIM is converted into a reachability matrix (RM) and its transitivity is checked. Once transitivity checking is complete, a matrix model is established. Finally, the partitioning of the elements and an extraction of the structural model called the ISM is derived.

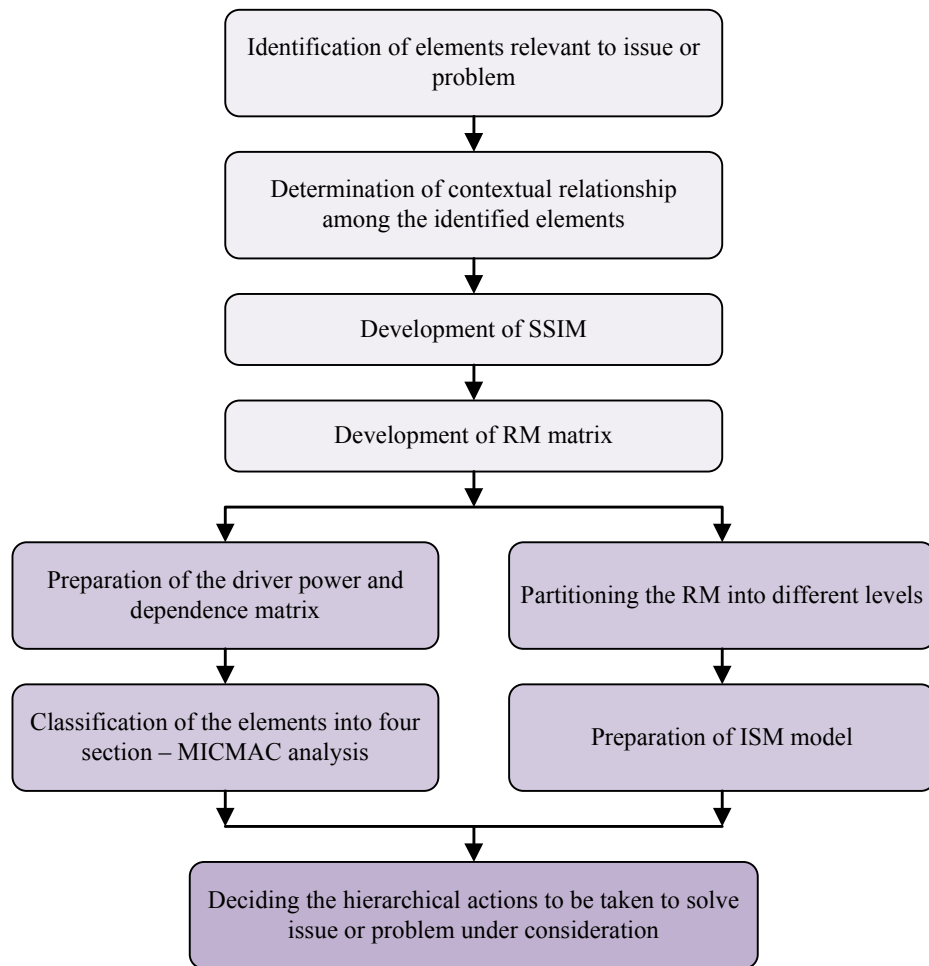


Figure 4-3 ISM method steps

Figure 4-3 presents the various steps involved in the ISM method to eventually develop the ISM model. These steps are utilised to develop an ISM-based model for GBM elements and challenges and are discussed next in more detail.

Step 1: identification of the elements which are relevant to the problem: This can be done by a literature review, survey, or group exercise. In this study, the GBM elements were identified based on previous studies, while the GBM challenges emerged from the data analysis.

Step 2: Establishing the contextual relationship between elements and challenges: This usually is decided by experts through group problem solving techniques such as brainstorming. This research relied on data analysis where interviewees demonstrated relationships between the variables under consideration. The contextual relationship of ‘drive’ was chosen for the GBM elements. This means that an element drives and

influences another element. With regard to GBM challenges, a relationship of ‘alleviate’ was chosen, which means one challenge needs to be resolved before the next challenge can be resolved.

Step 3: SSIM: Keeping in mind the contextual relationship for each variable and the existence of a relationship between any two variables (i and j), the direction of the relationship is questioned and denoted by one of four symbols. The four symbols are as follows: (1) V for the relationship from variable i to variable j (2) A for the relationship from variable j to variable i (3) X for both direction relationships (4) O for no relationship between the variables. After identifying each relationship between the variables, an SSIM matrix will be developed and finalised.

Step 4: RM: For this step, SSIM is converted into RM by substituting the four symbols of V, A, X, and O by 1s and 0s to form the initial RM. The rules for this substitution are as follows: (1) If the (i,j) entry in the SSIM is V, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0. (2) If the (i,j) entry in the SSIM is A, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1. (3) If the (i,j) entry in the SSIM is X, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1. (4) If the (i,j) entry in the SSIM is O, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0. Following these rules, the initial RM is prepared and checked for transitivity - transitivity of the contextual relationship is a basic assumption in ISM which states that if element A is related to B and B is related to C, then A is related to C. 1* entries are included to incorporate transitivity to fill the gap, if any, in the opinions collected during development of the SSIM. After incorporating the transitivity concept as described above, the final RM is obtained.

Step 5: Level partitions and ISM model: From the final RM, for each variable, a reachability set and antecedent sets are derived. The reachability set consists of the variable itself and the other variables that it may impact on, whereas the antecedent set consists of the variable itself and the other variables that may impact on it. Thereafter, the intersection of these sets is derived for all the variables, and levels of different variables are determined. The variables for which the reachability and the intersection sets are the same, occupy the top level in the ISM hierarchy. Once the top-level factor is identified, it is removed from consideration. Then, the same process is repeated to find

the factors in the next level. This process is continued until the level of each factor is found. These levels help in building the ISM model. Then arrows are added to the model and the direction of the arrow denotes the relationship between the variables.

Step 6: Drive power and dependence matrix to classify variables into four clusters

– **MICMAC analysis:** The driving power of a variable is the total number of variables including itself which it may help achieve (summing up the number of variables in the rows), while the dependence is the total number of variables, which may help in achieving it (summing up the number of variables in the columns). Based on the driving power and dependence, the variables will be classified into four clusters of autonomous, dependent, linkage, and independent/ driver. Autonomous variables generally appear as weak drivers as well as weakly dependent, and are relatively disconnected from the system. These variables do not have much influence on the other variables of the system. Dependent variables have weak drive power but strong dependence power which means that they have the least influence on other variables. Linkage variables have strong drive power as well as strong dependence power. These variables are unstable in the fact that any action on these variables will have an effect on others and also a feedback effect on themselves. Finally, independent/ driver variables have strong drive power but weak dependence power and are called ‘key variables’. These variables are usually based at the bottom of the ISM hierarchy and drive the rest of the variables and can be called the root variables.

4.6.2.3. Interpretive ranking process (IRP)

IRP is a novel ranking method that combines and uses the strength of both the logic choice process with the intuitive process of decision-making. It builds on the strength of a pair-wise comparison approach which minimises the reasoning overload. It also relies on an interpretative matrix as a basic tool and paired comparison of interpretation in the matrix to generate the ranking model. Sushil (2009) suggested that IRP is a powerful method when compared to the existing logic methods such as the Analytic Hierarchy Process (AHP). The AHP depends on an expert judgment about the importance of one element over another one in a pair-wise comparison, along with its intensity. However, the interpretation of these is left in an implicit manner with the expert and thereby the interpretive logic of a decision remains opaque to the implementer. On the other hand, the IRP method presents clearly the interpretive logic of the decision as the expert is

supposed to spell out the interpretive logic for dominance of one element over the other for each pair-wise comparison. This logic is usually documented on the knowledge base for future use by decision makers. In addition, IRP does not require the extent degree of the dominance which is difficult to be interpreted and its validity is questionable. Instead, it makes an internal validity check via the vector logic of the dominance relationships by developing a dominance system graph.

Sushil (2009) stated that the interpretive approach to decision-making has been used by different authors who use different constructs such as organisational culture, mental models, sense making, managerial frames, critical thinking and argument mapping. He also presented the steps of the basic IRP process which are illustrated in Figure 4-4 and explained next in more detail.

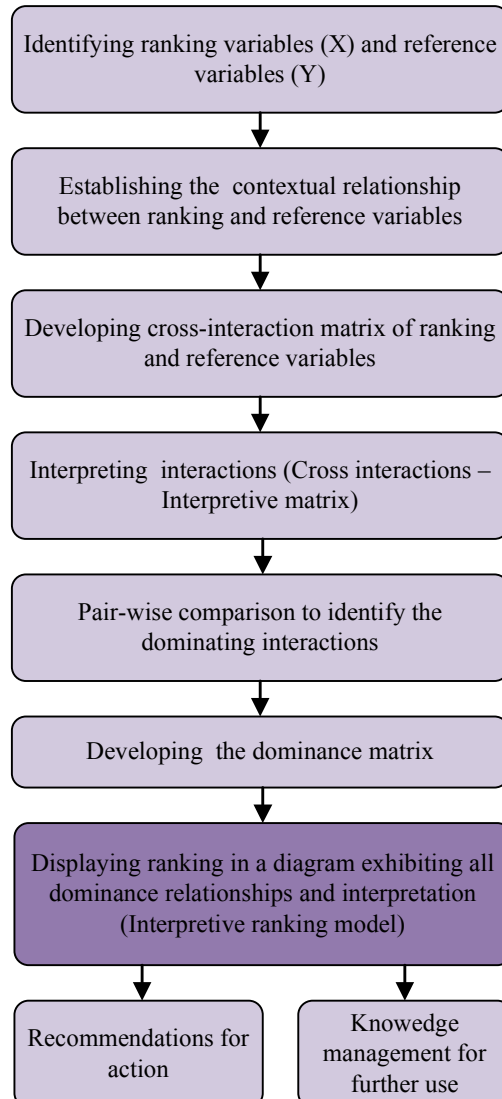


Figure 4-4 Steps of IRP

Step 1: Variables identification: the first step in this process is to identify two sets of variables. One set will comprise the alternatives to be ranked, and the other set will comprise the criteria that are to be used for ranking the alternatives. In this research, the ranking set consists of five 'GBM elements' and the reference set consists of three 'benefit areas'. The five GBM elements are: GVP, TG, KA, KR, and FL, while the three benefit areas are: B1, B2, and B3. This will be explained in detail in Chapter 6. The decision problem is designed to rank GBM elements with reference to their dominance and influence on various benefit areas.

Step 2: Contextual relationship: this step can be considered the backbone for IRP and needs great attention. In this study, the contextual relationship is the 'influence of GBM elements in different benefit areas'. The elements having more influence will be ranked higher. These relationships have been extracted from the interview analysis. Although there were no direct questions about these relationships, the researcher was able to document them during the analysis process.

Step 3: Cross-interaction matrix: this matrix will be dependent on the previous step, and the relationships developed can be presented as a binary matrix. In the binary matrix, '1' denotes relationship between the two variables while '0' denotes no relationship. In other words, the binary matrix questions the existence of a relationship between each GBM element and the benefit areas. In some cases all the pairs of interactions might exist, thus making the cross-interaction matrix a 'unit matrix'.

Step 4: Interpretation of interaction: the binary matrix can be converted into a cross-interaction -interpretive matrix by interpreting the interactions with entry '1'. That means all the possible interactions between the pair(s) of variables are to be interpreted in terms of the contextual relationship. The interpretive matrix becomes the essential data for comparison for the purpose of ranking of the variables. In the case of GBM elements and benefits, the interpretation was based on interviewee responses.

Step 5: Pair-wise comparison: The interpretive matrix is used as a basis to pair compares the ranking variables with reference to the reference variable(s) one by one. It is worth noting that the GBM elements (ranking variables) are not directly compared, rather their interaction with reference to. the benefit (reference variables) is compared.

All the dominating interactions will be summarised in the dominating interaction matrix, as explained in the next step.

Step 6: Dominance matrix: The numbers of dominating interactions will be summarised in the form of a dominance matrix, which gives the number of cases in which one ranking variable dominates or is being dominated by another ranking variable. The concept of a dominance matrix is taken from the fuzzy set techniques. The sum of rows gives the total number of cases in which the individual ranking variable(s) dominates all other ranking variables. The sum of a column indicates the total number of cases in which a particular ranking variable is being dominated by all other ranking variables. The difference of the number dominating in a column and the corresponding number being dominated in a row gives the net dominance for a ranking variable. The positive net dominance will mean that the variable under consideration has more numbers dominating than being dominated, while the net negative dominance will suggest that the concerned variable is being dominated in a higher number of cases than dominating other variables. The variable having net positive dominance in the maximum number of cases is ranked 1, followed by lower numbers of dominance relationships. The variables with more negative net dominance will be ranked lower, as these are being dominated more by other variables.

Step 7: Interpretive ranking model: The ranks obtained will be diagrammatically represented in the form of an 'Interpretive Ranking Model'. This model displays the final ranks of the ranking variables.

The IRP application is presented and explained further in Chapter 6, with an illustration of ranking GBM elements with reference to various benefit areas.

4.7. Methodological limitations

Research projects are highly characterised by various degrees of limitations and constraints including resources and time. However, methodological limitations have the highest impact among others because they can influence the application and interpretation of research results. Therefore, it becomes crucial to identify these limitations to ensure validity of the results. The limitations of this study are summarised below.

Lack of prior conceptual and empirical research on GBMs in the construction context has forced the researcher to look at other disciplines such as management and business to develop a deep understanding of the concept and its associated benefits and potentials. Therefore, it was not possible to compare the final results with studies in the same context although these results were comparable with other disciplines and confirmed some of the important theoretical claims about GBMs. In addition, Sommer (2012) study on GBMs, which was conducted in a different discipline, used case study methodology to gain insights into this new research arena. However, this methodology proved to be difficult for the researcher because of limited access to companies. Therefore, it was only possible to follow the data collection technique of Sommer study which was semi-structured interviews. The researcher initially set a target of 30 interviews but could not achieve this target (only 19 interviews were conducted), although the data collection lasted for almost one year. It is worth noting that the 19 participants were from a heterogeneous sample of six different groups from the construction industry to represent various views and satisfied the selection criteria (refer to Section 4.6.1.). The various interviews conducted for this study allowed for a more holistic understanding of what is happening in the wider context of the UK construction industry in terms of GBMs.

The researcher collected the main data through semi-structured interviews only. A single data collection technique can be considered as a potential limitation, in particular in qualitative research. However, the researcher solved this by means of having a heterogeneous sample; by using three techniques for data analysis; and by conducting structured interviews for validation to bring more insights to the findings. Furthermore, the findings were compared with relevant available studies and there were similar conclusions which demonstrate the validity of the research findings.

Finally, in ISM and IRP methods, the contextual relationships are usually obtained through a learning workshop or focus group of experts. However, this study utilised these methods during the data analysis stage and therefore it was not possible to follow the classic approach. To ensure the quality of the ISM and IRP results, this research relied only on explicit relationships as highlighted by the participants. In addition, the aim of utilising these methods was to add value and create structure for the different GBM elements and challenges. Hence, we argue that the results obtained were rigorous and consistent with available theoretical foundations of GBMs.

4.8. Summary

This chapter has discussed the research methodology and consequently the research design. It has identified the main drivers of the research methodology which are the research topic and the specific research questions. The research philosophy including the ontological and epistemological assumptions has been justified. This study lends itself towards the ontological subjectivism stance which resonates well with the epistemological interpretivism stance. In the research approach, this study followed the abductive approach as a combination of both inductive and deductive approaches. In addition, quantitative and qualitative methods have been explained, with emphasis on qualitative methods for their potential in revealing complexity. Accordingly, qualitative techniques were adopted to provide a diagnostic exploratory study. Details of the research design have been provided, including data collection and analysis techniques, with semi-structured interviews being the primary instrument for data collection. Three different data analysis techniques were adopted which include thematic analysis, ISM, and IRP, in order to overcome the single instrument limitations of data collection. The various techniques adopted here have enriched the results and generated insights into the research topic. Finally, the limitations of the methodology have been identified to ensure that results and findings were valid and rigorous.

Chapter 5. **DATA COLLECTION, RESULTS, AND DISCUSSIONS**

5.1. Introduction

The literature reviewed in Chapter 2 and 3 showed that GBMs have the potential to provide a better understanding of green value creation and capture. GBMs can help on more radical and systematic transformations of the construction industry towards a low carbon future. In addition, Chapter 3 presented a conceptual GBM transformation framework that guided the research methodology in Chapter 4 and influenced the research design for the empirical part. This Chapter therefore deals with the application of the research methodology and the empirical findings obtained from the data collection and analysis.

The Chapter is divided into four major sections. Section 5.2 details the interviewee selection criteria, their profiles, and the process of conducting the interviews. Section 5.3 explains the method of qualitative analysis. Section 5.4 provides the data analysis and its interpretation around five major themes. Section 5.5 summarises this Chapter.

5.2. Managers' interview details

As described earlier in Chapter 4, purposive sampling techniques were used in this study and data were collected through semi-structured interviews which may be used to attain a realistic picture of an individual's view in a real context (Renukappa et al., 2012). In depth face-to-face interviews were conducted with 19 professionals which were samples from six groups of stakeholders in the construction industry in the UK. More precisely, Academic (A), Architect (AR), Consultant (CS), Contractor (C), Other including property development and procurement (O), and Client (CL). Of these 19 interviews, three interviews were conducted via telephone and in addition, two interviewees provided written responses to the questions. Interviews typically lasted for one hour at the interviewee's place of work. The interviews were audio recorded, at the interviewee's consent, then transcribed and coded. The contacts for these interviewees were obtained by the researcher through attending different events and conferences on

sustainability and green buildings. A research information sheet with an interview question guide was sent to the potential participants. After their agreement to participate in the study, the date and place of interview were agreed according to the interviewee's preferences. The websites of all the participants' companies were reviewed in order to be familiar with their main activities and approach to sustainability. This has helped the slight alterations of interview questions accordingly and thorough information about each participant's companies was gained.

On the interview day, the interviewee was given a reminder about the research purpose and main areas of investigation. Then the consent form was introduced to the interviewee. It outlines how the data will be dealt with and the assurance of anonymity of the participant's identity. The participants were asked to sign the consent form. Typically the interview began with general questions such as the type of business, job role, responsibilities, years of experience, and size of company. This information helped set the scene and provided some context to the interviewees' answers (Appendix A). All of the interviewees had considerable experience in the construction industry; in particular they had relevant experience on green issues, with some of them having 'environmental' or 'sustainability' in their job titles. A detailed description of the interviewees' profiles is presented in Table 5-1 below.

Table 5-1 Interviewee's details – Total of 19 participants

No	ID	Type of business	Job title	Years of experience	Size of company
1	A1	University	Professor	15	2500
2	A2	University	Professor	15	2500
4	AR1	Architects	Architect & director	20	6
5	AR2	Architects	Associate architect	20	6
6	AR3	Architects	Associate architect	14	110
7	AR4	Architects	Associate director architect	9	12
3	CS1	Consultancy	Freelance consultant	36	1
8	CS2	Property and construction consultancy	Environmental manager	5	350

9	C1	Contractors	Director	50	50
10	C2	Contractors	Sustainability manager	17	800
11	C3	Contractors	Senior sustainability manager	14	5000
12	C4	Contractors	Senior sustainability manager	12	6000
13	O1	Others – Property development	Construction director	36	16
14	O2	Others - Procurements	Sustainability manager	8	50
15	CL1	Clients/ Local Authority	Capital programme director	40	10.000
16	CL2	Clients/ University	Associate director operations & facilities	36	260
17	CL3	Clients/ University	Building surveyor	20	245
18	CL4	Clients/Local Authority	Operational facilities manager	15	10.000
19	CL5	Clients/ University	Environmental & sustainability officer	10	250

5.3. Method of analysis

A combination of thematic coding and interpretation was used to analyse the qualitative interviews. Thematic coding was used as a decisive link between the original raw data and the researcher's theoretical concepts. This approach has helped in organising the highly unstructured textual interviews since the interviewees referred to the same themes in various questions. Coding identifies one or more isolated passage of text or other data items that cover the same theoretical or descriptive idea (Gibbs, 2002). For example, interviewees did not explicitly address some themes but the researcher was able to capture these themes in the discussion during the interviews. Following the coding principles, the textual data in each transcript was broken into five (5) key themes as detailed in Table 5-2 below. The aim was to capture common characteristics and to explore possible relationships, which formed a basis for the interpretations.

Interpretation entails explaining the findings by answering ‘why’ questions, illuminating particular results, and putting patterns into an analytic framework (Patton, 2005).

Table 5-2 Key themes of the research

	Key themes	Description
1	Understanding and definition of GBMs	Definition and examples of GBMs from the interviewees’ perspective - <i>Section 5.4.1.</i>
2	Green business models elements	Consists of five major elements: namely, Green Value Proposition (GVP); Target Groups (TGs); Key Activities (KA); Key Resources (KR); and Financial Logic (FL) - <i>Section 5.4.2.</i>
3	Changes	Changes associated with the implementation of green practices and initiatives - <i>Section 5.4.3.</i>
4	Benefits	Tangible and intangible benefits can be gained from GBMs - <i>Section 5.4.4.</i>
5	Challenges	Internal and external challenges to be resolved to unlock the potential offered by GBMs - <i>Section 5.4.5.</i>

5.4. Findings from interviews

This section explores the contents of the findings from the interviews and analyses them qualitatively. Although frequencies of occurrences of responses will imply a degree of relevance, however, due to the rich nature of qualitative data, specific cases and occurrences will also be considered and the findings will reflect this. The following subsections describe and report the main themes as perceived by the participants.

5.4.1. Understanding and definitions of GBMs

This study aimed at defining and proposing a guideline for GBM transformations hence it became vital to document and assess the current understanding and views of the construction professionals on the subject. The data revealed that the professionals had a good understanding of the green and sustainability agenda. Their companies have commitments, defined goals, and policies in place, but still have much work to do on the action steps such as implementation, measurement, and communication. It was clear that ‘green business model’ as a term, is not frequently used in these target

professionals' companies, while as a concept or a management tool it is used differently than what is typical in other sectors or within the literature of management and business. Typically, the concept is used as a tool to describe the value creation and capture logic. These results are consistent with an empirical study conducted on a small sample of Finnish construction companies. Although the study was about BMs and not GBMs, it demonstrated the absence of BMs thinking as a whole in the construction context (Pekuri et al., 2013).

To capture the general perceptions of the UK construction sector on the concept of GBMs, interviewees were asked to define a GBM term. They believed that such a definition is wide in nature and is not straight forward to answer and it depends on how 'green' is defined in the first place, because the term 'green' is used and misused in many ways. In most cases, 'green' can even include social aspects and considerations. Companies, policy makers and consumers view green from different angles and use different sets of variables to choose the pathway of going green (Arif et al., 2009). We can see two trends on interviewees' answers on defining GBMs. The first trend is that some managers were in favour of providing definitions. The second trend is that other managers were in opposition because they believed definitions can create confusion and make GBMs something that stands alone. These two trends are discussed below.

Interviewees mainly defined a GBM from the outcome perspective, whether the outcome is a green building or a green product or services. In addition, some of them regarded a GBM as a model that helps people and organisations to address the global challenge of 'sustainability' and to enhance the long-term, profitable survival of industry. Furthermore, the interviewees highlighted the strong relationship between the environmental improvements and the economic success of companies in a green business model, but how to create models that can deliver both remains the main barrier.

The participants provided some examples of what can be classified as a GBM: namely, whole life cost and closed loops. These examples are consistent with some case studies reported from Nordic countries on GBM innovation, such as life-cycle models, which include various categories with respect to what part and how much of the value chain is 'greened' by the model. Examples reported are: green supply chain management, take back management, and cradle-to-cradle models (Henriksen et al., 2012). In addition, one

of the interviewees (CL3) suggested that a green business model *“is a model that would consume the least natural resources of the planet”* in the process and in the end products or services.

CS2 defined it as *“one which internalises externalities.”* From his perspective, successful companies develop an account for profit and loss of the natural capital and they benefit from acknowledging their environmental impact. Moreover, some of the interviewees demonstrated a thorough understanding of the term and they have been using it to define and capture green opportunities and propositions. For example, C4 reported they have green business officers in the whole market in which they operate and their function is mainly to develop a classification, from the company perspective, for green businesses or opportunities. Another important function for those green business officers is to help the company to win green projects. This view is more aligned with the focus of green business models, as suggested by the literature, in which it can be used as a management tool to create value for customers and capture this value in terms of profits and reputation (Sommer, 2012).

C1, from the contractor group, provided a detailed definition based on his expertise in environmental risk consultancy that he had thought of establishing about 15 years ago but he did not receive positive reactions and therefore he decided it was rather too advanced at that time: *“A green business model should: inform, advise, service and equip people and organisations to help them address the global challenge of 'sustainability'. It should also: aim to deliver a new, improved, simpler way to handle environmental (risk) management; provide service/s to assess, research, monitor and manage environmental issues (risk); deliver sound, rapid solutions to enhance the long-term, profitable survival of industry, commerce, & public enterprise; help focus individual concern for sustainable development through the workplace; link environmental common-cause with individual personal development; complete projects safely, securely, on time and within budget; and do all of the above economically and profitably.”*

The academic (A2) stated *“a green business is not a very green business, it is just a greener business than it was, so a green business model is something around how you make the business greener. I think the level of greenness depends on lots of things.”*

Therefore, from the interviewee's perspective, a greener business model is one that will

provide a good start for businesses, hence attracting more companies to engage in green activities. The construction industry is yet to overcome the perception of green costing more (Abuzeinab & Arif, 2013a; Revell & Blackburn, 2007).

Nevertheless, some of the interviewees had concerns in using the term 'green' because this means an exclusive green solution which is not enough to tackle the global issue of sustainability. For example, AR1 provided a definition aligned with the "triple bottom line" view. He defined it as having *"three profit lines: financial profit, social profit, and environmental profit, so instead of having a single profit line with pounds and pennies, it has three profit lines and companies need to show profit in each of them - that is a green sustainable business model."* Along the same lines, AR2 pointed out that *"the concept of a green business model can be understood as something external to businesses and he hoped that green issues, environmental issues, and ethics could be deeply rooted within the business, but has to accept that the business structure and model of the company will have many other things, not just simply green or environmental issues."* He argued by using such a term, this implies segregation of other issues in the business such as viability of businesses. Although they had concerns about the exclusive meaning of 'green', they believed that the green solution or the green issue is an important and a large portion of the sustainability agenda but is not all of it. In addition, they indicated the importance of the financial dimension of the green business model.

Some of the managers interviewed (CL1 and O2) were in opposition to the term 'green business model'. Their opposition stems from the widely held belief that green or environmental issues are something different and strange. According to them, by using such a term, it continues to deal with 'green' as a separate strand and not as the mainstream of doing business, yet one of them argued that when companies start or engage in green activities they may put more emphasis on stakeholders' engagement and the ability to define the intangible benefits associated with green business models, but principally everything will be the same as for any good business.

From the above, GBMs can be defined according to the following characteristics:

- They address the global challenge of 'sustainability'
- They are 'greener' business models than existing models

- They are models that consume the least natural resources of the planet
- They provide a business opportunity or a proposition that makes financial sense and also has an inherent environmental or social benefit: the opportunity needs to be defined and captured by companies from external customers and to be converted internally to a product or service that is of value to customers.

Furthermore, Jing and Jiang (2013) suggested that GBMs have three common characteristics including environmental benefits, service-orientation, and non-technological innovation. Since the aim of this study is to develop a GBM, the scope is limited to the environmental sustainability and the economic benefits associated with it. The scope reflects the fact that environmental sustainability generally represents the largest opportunities for companies and it seems the easiest to identify and quantify for the purpose of GBMs development (Sommer, 2012). A definition for green business models can therefore be:

A business model is considered to be green when a business changes element (s) of its business model to create and capture a business opportunity or a proposition for TGs that provides environmental improvement coupled with economic benefits. The environmental improvement can include, but is not limited to, changes to products, services, processes, and policies, such as reducing energy consumption and waste generation, using renewable resources, and implementing an environmental management system.

This definition can provide an outline for companies to start with, however the detailed GBM can be agreed on, on a project to project basis. For example, a contractor may provide low waste models, low pollution models, renewable models, and health models in a given project or may combine more than two in another project, based on client's needs.

Generally, it can be said that the more elements of a BM which are changed and have a green result and the more deeply a green change is taking place within the individual elements of the BM, the greener the BM and the higher potential for creating radical green transformation (Henriksen et al., 2012). Having presented and defined the term and concept of GBMs, the next section deals with the elements that constitute a GBM.

5.4.2. GBM elements

From the above definition, we are assuming that any construction company has a business model which includes five major elements: namely, VP, TG, KA, KR, and FL. Any change in these elements to greener elements will classify the company as one that has a green business model. Details of these elements are illustrated in Figure 5-1 from the interview results.

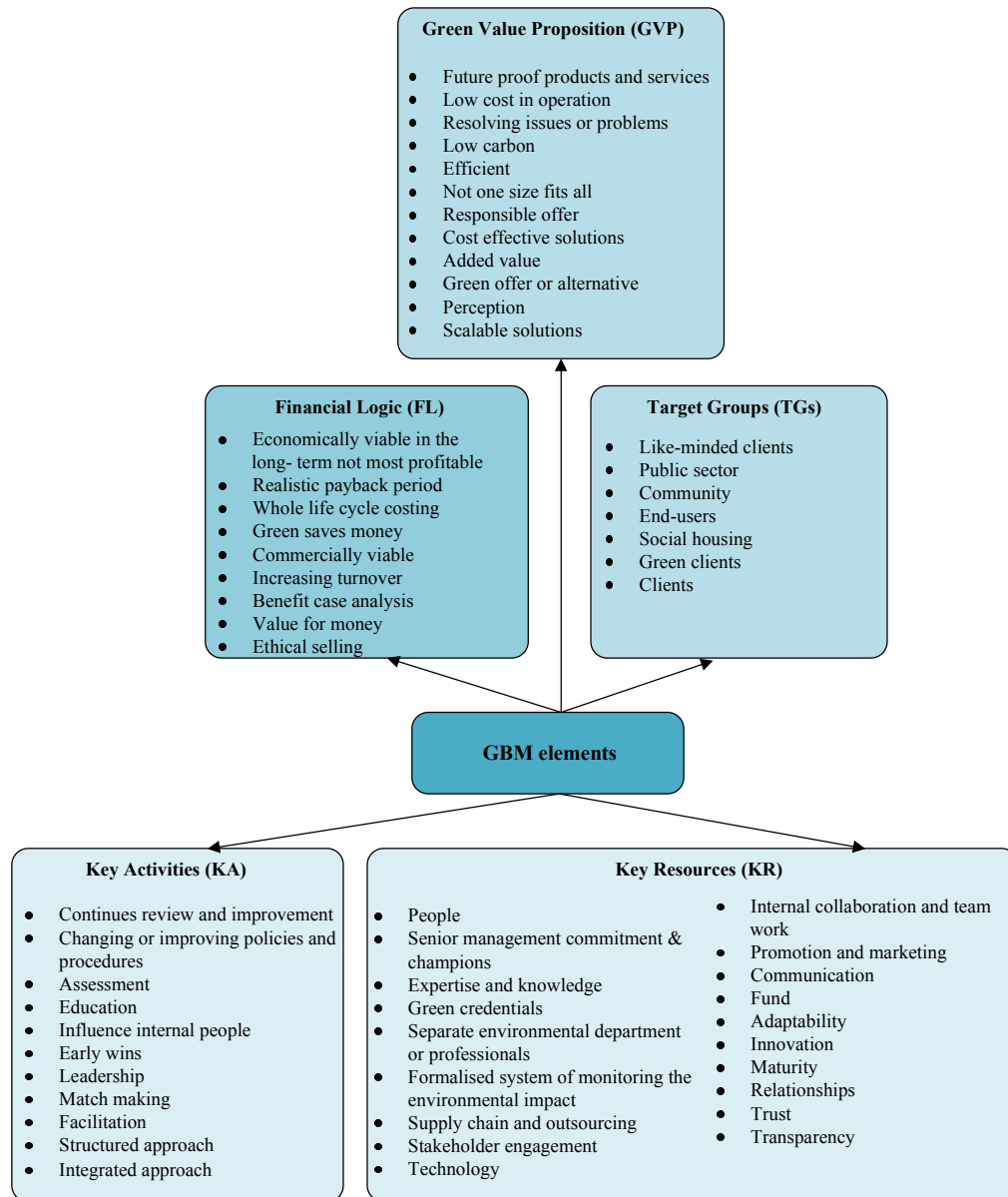


Figure 5-1 GBM elements

The Figure above summaries the interviewees' answers to each GBM element. The elements were developed from the literature, then interviewees' answers were used directly to populate each element. In other words, the bullets in the Figure refer to the direct answers of the participants.

The next subsections deal with each element in detail, as perceived by the participants, and conclude with interpretations. It is worth noting that all successful business models have consistent elements. These elements reinforce each other, therefore it becomes vital to deal with the following five GBM elements as a consistent whole system rather than isolated elements (Sommer, 2012).

5.4.2.1. Green value proposition (GVP)

Current market drives a GVP with increasing expectations from the public at large. The GVP is mainly related to products and services offered by a particular company and what is more appealing to clients. Participants expressed the GVP differently and used a wide range descriptions to explain it (refer to Figure 5-1 above for more details). Typical descriptions included the resilience of the products and services, or the GVP being future proof, especially in today's world where we are faced by a scarcity of resources. In addition, the GVP offers low costs in operation and this is highly relevant to the clients who maintain an ownership of their buildings. Another description, provided by the participants, related to that fact that some companies do offer the GVP to solve a client's or a market's problem. For example, C1 from the contractor group stated *"relate offering more closely to resolving issues created by legislation/regulation."*

The GVP can also be described as a low carbon and efficiency value. The participants confirmed the importance of achieving low carbon targets for future development. For example, the UK sets targets to reduce the GHG by a fifth of current levels by 2020 and the construction industry has a huge part to play in these reductions because 50% of UK GHS emissions come from running buildings and 10% of UK emissions come from producing building materials. Another example is the Green League which has two main categories to rank universities and within each category there are several sub categories. The first category is policy where carbon management is a sub category. The second category is concerned with performance and again a sub category is dedicated to carbon emissions. The above examples can demonstrate the importance of carbon

issues. All of these can be clearly related to the fact that carbon dioxide - CO₂ is a major contributor to climate change which is widely accepted as being a reality and identified as the global threat of the 21st century. On the efficiency side, the GVP is often described as a cost effective solution where companies strive to reduce waste and improve processes which will result in lower internal costs and hence a lower price for clients.

The GVP is described by the participants as a responsible offer where supply/provider companies will offer the clients what they need and they will acknowledge all the advantages and disadvantages that come with the GVP. Therefore, companies will have a responsibility towards its clients by offering the best value.

Some of the participants suggested that companies can have two offers which are a standard offer and a green offer where they emphasise all the added value that can be achieved through the GVP.

One of the participants suggested that the perception of a particular company of the GVP is vital to pass on to clients and to meet their expectations. This result is echoed in a previous research conducted by Abd, Hamid and Kamar (2012). They stated that one of the challenges of adopting sustainable construction is that companies do not know how to act upon the sustainability value *“Although the values are generally at the right place, the problem is how to enact them”* (Cited in Abuzeinab and Arif, 2013).

AR1 from the architect group raised an important point in which he stated that *“We deliver practical and deliverable solutions that are scalable.”* The feature of scalability is important because green solutions are yet to be considered as a unique solution and in most cases are hard to replicate.

It can therefore be concluded in view of the foregoing that:

- The GVP is related to the offer and the unique selling point of a product or service. To offer the GVP to a potential client, it becomes vital for the provider company to understand the GVP well. This understanding plays an important role and thus each one of the companies has to know *‘why we are doing it’*, because clients in general *‘buy why you do rather than what you do’*.
- The GVP should be created to meet clients’ need or to solve their problems. Good companies have the ability to tailor the GVP according to clients’ need

and they acknowledge there is no single model or solution to the green problems. In other words, the GVP starts externally from clients' need but it needs to be created internally by the provider. Although the GVP is always triggered by clients, companies can approach and inform potential clients of the benefits of the GVP, hence accessing new markets.

- With the rise of fuel prices, cost savings, in the operational phase of a building with the GVP, have encouraged more stakeholders including clients to ask for green because they see a long-term economic benefit (Bartlett & Howard, 2000). This is pertinent for the clients who maintain an ownership of their buildings and who have an interest in their building performance such as local authorities, universities, or clients who have large physical assets to maintain. In addition, there are successful examples of owner-occupier models where the owner concentrates on the building performance and life cycle cost rather than the capital cost. However, commercial developers who build to sell may not be interested in how their buildings perform. Therefore, new ways of valuing property are needed as well as more incentive schemes or tax breaks for well performing environmental buildings.
- Capturing value or profiting from green activities is always related to the GVP. Therefore, developing scalable GVPs is vital for companies' survival.
- In order to achieve a full uptake of the GVP, it is essential to educate the market and the clients to appreciate what green value has to offer from an ethical view to cost effective and future proof products and services.

The GVP is thus always associated with TGs. The following section explains the TGs as reported by the participants and deduces the findings at the end of it.

5.4.2.2. Target groups (TGs)

A TG describes the segment of clients whom a company wants to offer value to. Generally the TG can refer to the external and most importantly the critical stakeholder of a particular company. Details of the participants' answers can be found in Figure 5.1.

The participants constantly cited the public sector as a main target client for the GVP, as a result of self-imposed regulations. In particular, they highlighted that the estate rationalisation agenda, where the public sector is expected to maximise savings through

rapid rationalisation of the estate, has raised the need for building performance measures (Government Estate Strategy, 2013). For example, CS2 from the consultant group stated *“but particularly we are finding we are getting more work from the public sector. They seem to have a bit of money to spend on this and they are the actual driver to do it.”* Furthermore AR3 from the architect group said *“public sector clients are more interested in the GVP due to imposed self-regulations- not deemed commercially viable for most of the property market.”*

One of the participants suggested that the TG should be an end-user. The suggestion stems from the widely held belief that the end-user reaps all the benefits of a building with the GVP, whether it is an efficient building or low carbon building or whatever the case might be, depending on clients' need. According to some of the participants, there are green clients who strive for the GVP and it will always be their first option. These clients can play an important role and they can help to have a wider adoption of the GVP through the demand and supply side. Social housing providers were also mentioned in the interviews as strong clients for the GVP, but their primary motive are to reduce the energy bills for their tenants because higher energy bills will result in failure of some tenants to pay their rent. In most cases, a reduction in the energy bill will result in a reduction in carbon emissions. The embedded benefit can be, therefore, a reduction in carbon impact.

CS1 from the consultant group highlighted the importance of considering the whole community, as the TG of a given company *“Has to be the community. If you make your target group less than the community then you are not sustainable.”*

However, C2 from the contractor group expressed a different view regarding the TG. *“I would say our target groups are internal so it is a case of for example one of the key people that we want to influence is supply a chain director so that we can address the procurement of sustainable materials and how we assess the supply chain for example for its sustainability.”* This view reflects confusion between the TG and KR. Companies need to distinguish clearly between the TG (clients) and the internal/ external resources needed, including human resources, to create the GVP for the TG. Furthermore, AR2 from the architect group has similar views to C2 because he mentioned the construction suppliers as the one of the TGs. This again creates the same confusion as explained above.

It can be deduced from the views of the participants that companies need to do the following:

- Communicate and engage with their existing clients to meet their expectations
- Found a deep relationship with clients
- Facilitate access to new target clients
- Hunt and search for like-minded or eco-clients.

It is worth noting that the TGs should be understood as the company choice for relevant clients to which the company GVP is intended to appeal.

To create the GVP for the relevant TGs, companies need to perform certain activities and need internal and external resources. Section 5.4.2.3 explains the activities which need to be performed by companies, while Section 5.4.2.4 details the resources needed and used by the participants' companies.

5.4.2.3. Key activities (KA)

The KA refers to the most important activities which need to be performed to create value to clients. It mainly explains the core business of a given company, whether it is design, consultancy or procurement works. However, companies which transform their business models to a greener one will have some similarities in some aspects of the key activities to be performed. This section reports the common key activities suggested by the participants and as performed by their companies. Direct quotations and answers to the KA can be found in Figure 5-1 above.

Continuous review and improvement was an important activity and was voiced by different participants. Companies constantly review their approach, implementation methods, and the end results. O1 stated *"It is an evolving model [referring to the green business model], mapping through. A clever company keeps an eye on the process."* Changing or improving policies and procedures was also part of the continuous review and improvement and was considered as an important aspect. C2 from the contractor group gave an example on how these changes take place in their company: *"I said one key target is the management system and that changes policies and procedures. The procedure might be something small, for example the whole business is moving to*

smarter waste which is an online tool for collecting and reporting waste data so that requires a change in our form that we use.”

In addition, assessment activities were considered to be a major activity performed by green companies. Extensive assessment activities of their own environmental impact and carbon footprint were part of the day-to-day activities. These services were also provided to their clients. The environmental and carbon accounts of a given company, are vital to compete for public sector projects. For example, CS2 from the consultant group pointed out that they became ISO40001 certified (the environmental management system) because they lost a tender from the public sector, *“so it is very easy decision for business to make to invest in it [referring to the ISO40001 certificate] to win the work.”*

The participants from the architect and academic groups voiced education as an important activity. Education within the business creates a receptive environment from the top management level to the staff level. This approach will prepare managers and staff for clients’ engagement from the early stage of any project. When companies’ actors are well educated and informed, they will be able to educate clients, therefore creating a larger pool of acceptance of green business models. In a related vein, Beltramello, Haie-Fayle, and Pilat (2013a) analysed 55 case studies of new business models that are relevant for green growth. The case studies confirmed the value of education in fostering eco-innovation.

Furthermore, companies need to influence internal people and drive the green agenda from top-down and bottom-up. For example, C2 from the contractor group indicated that most of the environmental practices were initiated by their employees on the site rather than by the top managers in the company and in most cases, the strategic goals were influenced by these practices. This clearly demonstrates the importance of being open to enlisting staff at multiple levels for improved results and engagement, to gather ideas and promote cultural change.

One of the participants suggested *“early wins”* activities where companies can see some quick results by reducing waste or improving energy efficiency. This approach will motivate companies to adopt green practices on a larger scale because they can see some tangible benefits to their financial bottom line.

The participants from the client group explained their leadership activities. The leadership was more apparent within the local authority professionals because they are

expected to lead the community and drive the green agenda. In addition, architects described the leadership and match making activities where they take the lead in their supply chain. The architects were pairing some companies to benefit from each other or because they see potential of good service or products by bringing them together. For example, AR1 stated *“we do match making so we bring technologies together, we often bring people together. We do not have always have a role in that sometimes we do, sometimes we do not but because most of the time we bring people together. We have a role in the process.”* The same concept was expressed by O2, yet with a different name: *“facilitation activities.”*

The participants confirmed the importance of having *“structured activities”* to reach a GBM. These structured activities need to be planned well by the top management with involvement of all company staff and then implemented and monitored for future improvement. Furthermore, most of the participants’ companies performed their activities using an integrated approach of internal and external actors. These companies work with their supply chain and adopt collaboration approaches in most of the activities performed.

It can therefore be concluded from answers to the aforementioned theme, that companies change their KA to reflect the transition to GBM. The principle difference between GBM and conventional business models is that the former performs its activities in a more environmentally friendly manner by for instance, generating less waste, using renewable sources, and consuming less energy (Abuzeinab & Arif, 2013). It was clear that the participants’ companies were actively altering the KA to echo their environmental commitments.

Lessons learnt from the KA can be summarised below:

- The KA for GBMs are characterised by discoveries and continuous improvements
- Companies need to start early to get the full benefits of GBMs
- Education is an important KA because GBMs are often the result of multidisciplinary approaches, drawing on a wide range of technical and scientific (as well as non-scientific) education
- Companies need to measure and assess everything they perform

- GBMs can be facilitated by systematic, structured, and integrated activities.

For a construction company to perform in a greener manner, it needs appropriate resources to do so. These resources are covered in more detail next, from the participants' perspective.

5.4.2.4. Key resources (KR)

KR refers to the assets required to offer and deliver value to clients. The participants confirmed the importance of having in-house resources as well as being able to access external resources by forming partnerships with other companies. The interviewees engaged thoroughly and reported the KR they use and need for their green practices and initiatives which will form the basis for GBMs transformation. The participants' answers to this theme were illustrated in Figure 5-1.

The participants highlighted the importance of senior management commitment, the overall corporate commitment, and commitment within the strategic plans. In general, GBMs are triggered by top management champions. It starts from the top and then integrates within the whole company's operations. Many managers, within the sample interviewed, noted the establishment of separate environmental departments or separate managers with environmental/ sustainability in their job title. It was evident that these departments or managers were actively encouraging and implementing environmental reform among their companies by professionalising the understanding of various environmental issues and by using not only the top-down approach, but also bottom-up approach. Having the support from all the employees across the board from different roles and positions who are working together to support the strategy, will help the effectiveness of GBMs. Therefore, qualified employees with their knowledge, training, impartiality, relationships, and insights are a crucial resource for any company. Employees' collaboration and team working at all levels are also important resources for GBMs, as indicated by the participants. This is followed by communication to all staff members with clear messages of the major principles in the company. In this regard, technology can make it easier to communicate information. In addition, trusting the staff was seen to be the backbone of any company's ethos because they actually come to work to do a good job. With this mind-set, companies can maximise the outputs from staff and can benefit from their ideas. Furthermore, companies need to invest in employees who interact and engage with stakeholders, such as clients and relevant

external bodies and individuals, because GBMs are still evolving and more emphasis is needed on staff who can handle, promote, and market them well.

One of the interviewees (CS1) brought up an important issue as he mentioned that the culture of the company is fundamental to move to the green solution and it should be taken into account as a crucial resource too. The culture of the company will defeat the strategy, as he said *“culture eats strategy for breakfast.”* He highlighted that companies need to get the culture right and the strategy, business plan, and the rest will make the company stronger on the journey to green transformation. Nevertheless, *“changing the culture is the longest and hardest thing to do and might take 10 years.”* Other interviewees echoed the same notion in which they expressed that GBMs may be incompatible with the existing culture of a company. Indeed, this is an important area and it may explain the low uptake of GBMs on a larger scale. In addition, the importance of the major cultural transitions towards a greener future has been included in the literature. For example, Wells (2013) argued that the major challenge in achieving sustainability is to transform the existing and everyday production and consumption behaviours. Wells’ argument implies a radical change in the existing culture of both the supply and demand side in order to achieve a sustainable future.

All the participants were of the opinion that green credentials are an important resource for companies. The market and public have a certain expectation and demand when it comes to the environmental agenda and these demands and expectations are expected to increase in the future. Therefore, a company with strong green credentials can lobby and compete for stricter regulations and markets. However, one of the interviewees felt that green credentials are the most vulnerable resource of all resources. The interviewee argued that green credentials demands a lot of track records, high profile projects and time to build but it can be ruined in no time. This result may present depressing findings for those seeking to develop and transform their business models into greener ones. Yet, it represents the realities of running a company in a sector where environmental blunders are a source of value damage.

Technology is a vital resource which can be used to develop GBMs. The participants highlighted the role of technology in being able to communicate well internally and externally. Furthermore, technology has helped them to develop formalised systems for

measuring and monitoring the environmental performance and impact of their companies.

Innovation and adaptability are seen as critical resources too, as well as being open to the changes required, such as changing working practices. In a recent research conducted by Deloitte, the outcome revealed that sustainability leaders are more than 400% more likely to be considered innovation leaders. The research showed that sustainability drives innovation (Deloitte, 2012).

The participants indicated that funding is a critical resource in particular, if a GMB promises long-term profits at the expense of short-term cash flow or if the company is in a turnaround situation. In general, GBMs are perceived to involve more capital costs and upfront investment. Therefore, securing and accessing funding for GBMs is of paramount importance for companies. Funding can be secured partially from the company itself especially the large ones and partially from external funds with the help of the government and funding bodies.

Within the sample, it was evident that the longer companies are committed to the green agenda, the more actions they take in all areas of the development and transformation of their existing business model to reflect their commitment. Companies with green maturity are in a better position to champion for green projects and to win more bids from the public sector. These mature companies can be an aspiration for others who want to start the green transition. It might be beneficial to flag these companies and to learn best practices from them.

According to the participants, companies have to accept that not all the KR can be available internally and there will be a lot of external partnerships and collaboration forms. For example, some of the participants explained their collaboration with certain professional networks that have specialised expertise in environmental issues. A typical comment was, *“If you think that in your company you have everything you need, you are totally self-sufficient you need nothing from the outside world then you are mistaken. You have a false view because you start to believe you have the right answers.”* Consultant (CS1).

However, the above resources are not static. They need continuous review and improvement and without this review and improvement, a company may fall into the

trap of not being ahead of the important resources and issues that may arise as the GBMs mature.

It can be easily deduced as such in view of the answers to the KR that:

- Wherever the need for change is recognised, eventually it will be up to the senior management's commitment to create and offer the suitable resources internally and externally for the company. The role of top management commitment is vital for GBMs growth, thus creating receptiveness for change within the top levels of the company.
- The role of employees as strong supporters of GBMs is important. Companies need to support the employees' skills to foster growth and innovation, which can be achieved through engagement.
- People and skills are important area for improvement but it will be difficult for companies to fulfil it alone. Therefore, collaboration and partnership between companies, universities, and government is highly recommended for green transition.
- Green credentials are crucial for companies and will play an important role in attracting the right people and skills. It will also allow companies to access funding and support from the government and other relevant bodies.
- Companies should work more closely with their supply chain to ensure that they adhere to the same principles. Larger companies may provide support for their supply chain and partners for better results.

Having presented the findings on KR, the following section presents the last element of the GBM: FL.

5.4.2.5. Financial logic (FL)

FL describes the financial assessment of all the means employed in the business model. The participants were of the opinion that finance is an important element when it comes to GBMs. They thought it is important to have a long-term view on the FL to unlock opportunities offered by GMBs. FL should be a balance between cost and advantage of green. In addition, companies need to distinguish clearly between the GVP in terms of short, medium, and long-term returns. These participants described FL in terms of a

“realistic payback period”, “whole life cycle costing”, “green saves money”, “commercially viable”, “increasing turnover”, “value for money,” “benefit case analysis”, and “ethical selling.”

The architect (AR1) described the FL of his company in pursuing a green/sustainability agenda as follows: *“economically viable in the long-term not most profitable.”* This description demonstrated a deep understanding of the whole philosophy of the green movement and transition. This view has been supported by the academic (A1) where he stated that the economic sustainability means *“the sustainable creation and investment of wealth as a result of business activities.”* Companies need to create wealth but at the same time they need to invest in a better future. Despite the agreement among the participants on having a long-term view on FL, some of them asserted the importance of having realistic and short-term payback periods on the green investment. The participants cited examples of implementing energy and water consumption measures which resulted in good returns over a shorter period of between 2-3 years.

The participants frequently noted the whole life cycle costing as the FL of moving to GMBs. In most cases, companies sell GBMs to existing and potential clients on the promise of a reduction in the running costs of their buildings. Also within the sample, some of the companies have converted their buildings into green buildings to save on maintenance and running costs. However, according to some interviewees, clients are not interested in the whole life cycle cost unless they have some sort of ownership of a building.

The participants confirmed that their companies adopted GMBs to respond to a market demand and they are convinced this demand will increase in the future. Therefore, the FL is related to increasing turnover and improving revenues. Nevertheless, the interviewees argued that more investment is needed in their green capabilities and resources for better opportunities. For these companies, early moves and proactive approaches will position them in a better place in the market and consequently increase demands and margins.

The architects and contractors explained that green solutions can deliver value for money through many aspects such as “value engineering,” “cost effective standard products and systems,” and “getting things ‘Right First Time’.”

The clients from the local authority felt it is vital to consider the wider benefits of a green solution because there may not be always a financial case for doing so. Their view is a reflection of the public sector ethos where environmental and sustainable solutions have always been in favour for them but it can be difficult for companies with profit orientation to agree with their views. Nevertheless, one of the contractors (C3) noted that “*we ethically sell it [referring to GVP] to a customer.*” He argued that the FL is always the lower cost but if that is not the case, then the GVP can be sold based on ethics, and again the main clients of this contractor were the public sector.

From the above, the following can be suggested for the FL element:

- Companies in general need to stress long-term goals over short-term goals
- Companies need to balance the short-term and long-term returns and benefits
- Case studies with clear payback periods are needed to convince more companies to move to the GBMs, which means a clear distinction between different GBMs and their payback periods (short, medium, and long-term)
- New ways of investment are needed but these require a strong partnership between all parties, from government and financial institutions, to the industry and construction companies
- Companies need to save some of the money which comes from the near-term wins to invest in the green transition.

The results revealed the importance and the influence of each GBM element. However, The significance of the GBM concept stems from its systematic character – it is not about details of isolated elements, but how the elements are interrelated and how they strengthen each other to form a well-functioning entire system (Pekuri et al., 2013). GBMs encourage the application of system thinking where the component parts of any system can be best understood in the context of relationships with other components and other systems, rather than in isolation (Pullen et al., 2010). This was evident from the results as well because the participants explicitly highlighted these relationships in different examples. Hence, it is essential to analyse the relationships that exist among GBM elements. For this, ISM method is utilised to evolve mutual relationships among these elements. By analysing the GBM elements using this method, we may extract

critical elements that support the GBM transformation. More details on this can be found in the next Chapter.

5.4.3. Changes associated with the implementation of green practices/initiatives

Interviewees were asked to report all the changes in their companies when they implemented green practices or initiatives. The aim was to capture any common changes and to form similar patterns of changes which occurred within the sample. Surprisingly, there were a lot of similarities that can be grouped broadly into five major categories. These categories are: policy and principles; awareness, empowerment, and buy-in; publicity; structure; and working stream and practices as illustrated in Figure 5-2. Each of these major categories of changes is discussed in the subsections below.

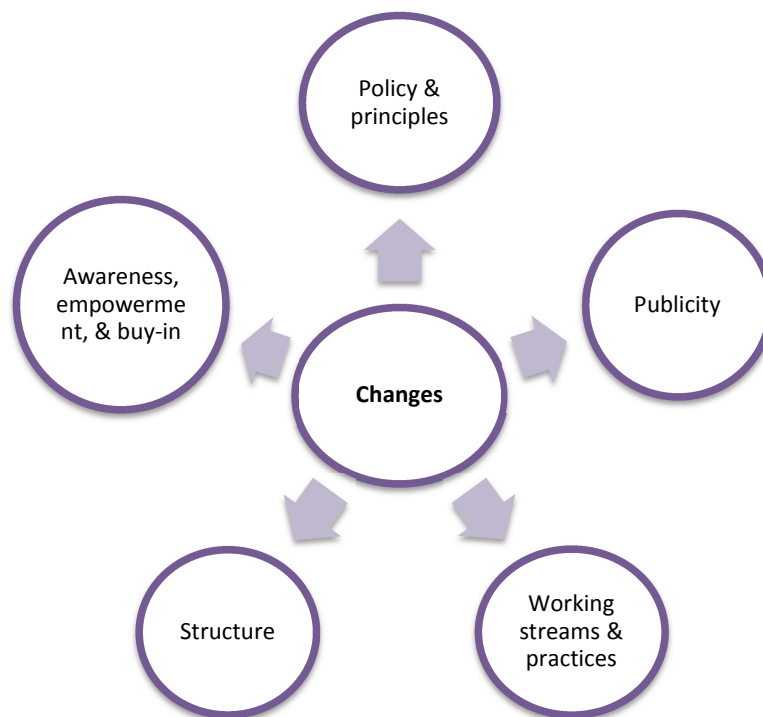


Figure 5-2 Changes associated with the implementation of green initiatives/practices

The Figure above presents the five categories of common changes associated with green transition within the participants' companies. Descriptions and examples of these changes are presented next.

5.4.3.1. Policy and principles

AR1 from the architect group stated that *“in your article of association and the manifesto of the business that you start with that [referring to green] as a first principle positioned in every respect and that what we are trying to do.”* He argued that if a company starts with that mind-set it will be more beneficial than absorbing the green agenda as it comes. Therefore, green has to be the principle for doing business in every respect. Companies need to position themselves as a green organisation which means making the green agenda internally driven therefore it becomes the mainstream practice of a business.

A green journey is usually initiated as a reaction to growing risks which can be regulations and uncertainties and it is characterised by discoveries. From the interviewees' answers, the internalisation of green issues can be achieved by two decisions or approaches. Firstly, an ethical decision responding to the overwhelming scientific data about climate change and environmental degradation. Secondly, a market decision to seize the green opportunities and demonstrate proficiency levels in offering green solutions. Alternately, a company may internalise the green issues by a combination of the above two approaches.

5.4.3.2. Awareness, empowerment, and buy-in

There was consensus that relevant training and in-depth knowledge related to green issues were major changes in companies to increase the level of awareness among managers and employees. For example, the architects AR1, AR2, and AR4 have done different training to achieve lower environmental impact buildings such as looking at offsite construction and code for sustainable home assessor training. In addition, the training has to be updated to respond to the market demands because green issues are still evolving and developing. AR1 pointed out that architects need to change their approach to designing buildings in order to achieve a green building. They need to adopt a “fabric first” approach where they will establish “anchor information” related to performance of the building envelope, for example a U-value for the windows and roof can be established early in the design stage and has to be fixed until the construction stage. In addition, the participants felt there was a lot of collaboration between the internal business units both vertically and horizontally. The contractors gave examples where they have received bright ideas from their staff. They highlighted

that staff were empowered to participate in the green transition. C3 from the contractor group stated *“Most great ideas which may save money may improve the business, do not come necessarily from the sustainability team. We kind of help empower people but most of the good ideas and abilities come from staff. Basically they see a problem or challenge and they want to do something about it and they are empowered to do that.”* This approach can be seen as empowerment for staff who can promote the green solution and this allows them to participate in finding innovative solutions.

An interesting finding of this study was that the professionals who are involved in green practices tend to think differently and find new ways to improve the environmental performance of their companies. They seem more eager to learn from others who are already mature enough when it comes to green.

5.4.3.3. Publicity

Within the sample, it was evident that companies were actively publicising and communicating the benefits and the outcomes of being green. The publicity was carried out internally by the company to get more people on board, and externally with clients. The participants highlighted that they started to promote the green solution to clients and that when a client approaches them, they offer a standard offer and also a green offer communicating all the benefits associated with the latter. This approach has helped clients to make an informed decision. Typical comments were: *“we then publicised: this good for our environmental strategy and we said to people what we did and what the savings are.”* Client (CL4). CL3 confirmed the same point: *“I suppose it is better communicating the outcomes of sustainability to an organisation and if you are able to do that, it will increase people’s buy-in from the organisation, so it is a way of self-generating enthusiasm”*.

5.4.3.4. Structure of the company

The company structure was changed by establishing a specialist unit or environmental/sustainability officer’s position to drive the agenda with some sound professional approaches. Some companies have a dedicated unit and others have a dedicated individual. This merely depends on the size of the company. Not only can there be the specialist unit or individuals, but also some voluntary roles within the staff, such as an environmental champion and then it is made part of each individual’s job description. This view is echoed in other empirical findings in companies in which sustainability

practices are contributing to profits and so called “Harvesters.” The findings reported lessons learnt, such as: Harvesters usually change the organisational structure or adopt new structures and establish the position of sustainability officer (D. Kiron et al., 2012).

The participants reported another change in the structure where the operational units or individuals responsible for environmental sustainability have to report at the strategic level. In many cases there will be a strategic board manager to look after the operational levels.

5.4.3.5. Working stream and practices

Another vital change rests on changing the working stream and practice. The changing working practice can be by adopting a collaborative approach and embracing technology. Technology has a vital role to play in the changing process, such as sensor technology which can help achieve more efficient consumption of energy and water and influencing behaviour to promote a low carbon culture and efficient practices. The architects have provided an example where they adopted offsite construction as a new method of design because they believed it will provide better environmental performance.

In addition, one of the clients explained the way his company has changed the way of procurement, where they started to procure only from suppliers who match specific criteria, to ensure those suppliers are committed to the green agenda.

Furthermore, one of the contractors pointed to the change which results from adopting new ways of environmentally friendly practices. For example, his company is adopting zero waste and circular economy practices, therefore his company started to approach buildings differently and looked at ways to recover and demolish buildings in a way that is aligned with these new practices.

Companies started to change the way people work and operate by introducing more flexible working patterns to reduce the travel miles and by investing on online facilities for collaboration.

According to CS1, best practice will be by establishing key performance indicators and making them part of business measures and then developing some sort of carbon/environmental accounting which will be within the overall accounting system of the company. These measures are vital to move to a green solution or approach.

Based on the aforementioned answers, the following can be suggested on how companies may change as a result of adopting green practices:

- Companies have to accept that moving to GBMs will bring significant changes to the way companies work
- Companies not only need to change themselves in response to environmental considerations, but they also need to become more collaborative with stakeholders inside and outside of the company
- The change starts from the strategic level (policy) to the operational level but it may be triggered by the people at the operational level
- The changing process needs to be constantly developing and companies need constantly to review their approach and find alternatives or best ways to deliver the green solution.

A key observation among the sample companies is that when these companies started to offer the green solution to clients, they started working on their own carbon footprint. Some of them moved to paperless documentation, some adopted the application of 're-use, recover, recycle', and others changed their lighting to LED and converted their building to highly insulated buildings. This can be seen as an embedded benefit of the green solutions.

5.4.4. Benefits of GBMs

The participants believed and convinced that GBMs offer benefits to companies and their clients. Despite the various examples of companies involved in this study, there was a consensus on the list of benefits offered by GBMs. To varying degrees, green companies are taking advantage of three key benefits of a focus on environmental sustainability: namely, credibility/ reputation benefits; financial benefits; and long-term viability benefits, as summarised in Figure 5-3.

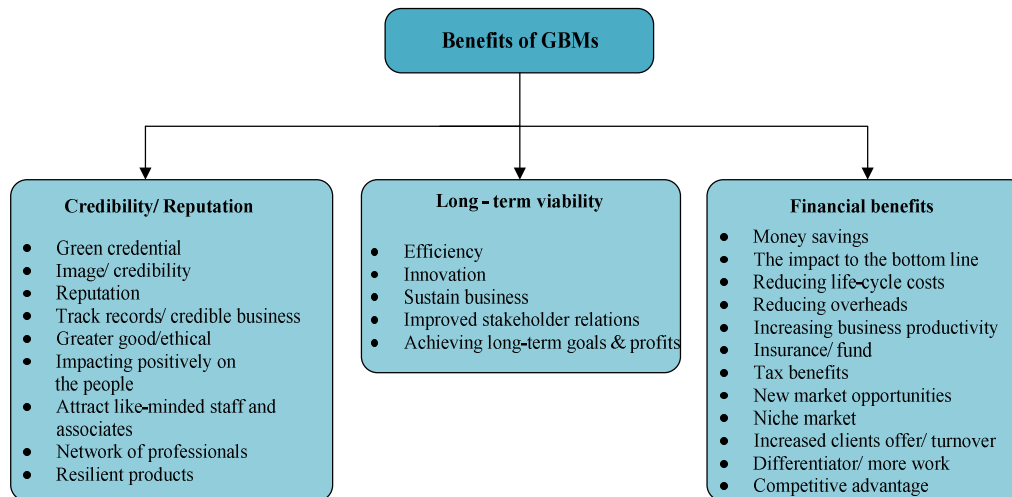


Figure 5-3 Benefits of GBMs

In Figure 5-3, the benefits of GBMs are organised by the researcher, into three key benefits. These key benefits are highly influenced by the participants' answers and are summarised next.

5.4.4.1. Credibility/ reputation benefits

The intangible benefits are important including the brand and reputation benefits. Positive perceptions of a brand, based on its green credentials, can be of great benefit to a company. The participants were of the opinion that pursuing green will improve the image of their companies among clients and the public at large and will demonstrate their commitment to environmental issues. Companies can promote their green credentials in the green or niche markets and at the same time improve relationship between the supply and demand sides. In general, companies involved in green practices have a great sense of feeling good and doing the right thing. Typical comments were: *“it makes us feel good about what we do or by another way we make money and we feel good about it. It is truly sustainable development.”* (O2 from the others group - Procurement). Similarly, C2 from the contractor group confirmed that *“the staff involved in building green buildings generally have a sense of achievement [.....] so that is quite positive at the individual level and employees of the business.”*

The credibility of a given company can also result from producing more resilient products and services. Therefore, companies may be able to bid for more projects as a result of this.

Many participants explained the importance of having a track record of delivering green solutions because there is an increasing demand, in particular from the public sector. For example, AR1 from the architect group highlighted that *“the most important thing is being perceived as being a knowledgeable and a credible business or outfit that can deliver these solutions that when you say something is possible that is possible because you have done the hard work of working out that it is possible.”*

Finally, the participants claimed that their environmental commitments have helped them to attract like-minded staff and clients.

5.4.4.2. Financial benefits

Within the professionals interviewed, it was evident that there were two trends of answers concerning the financial benefits. The first trend highlighted the financial benefits positively and gave examples of these tangible benefits, while the second trend argued that the financial loss outweighed the gains. For the second trend of answers, environmental practices are just a matter of compliance but not deemed profitable for companies.

Money savings or cost savings were reportedly important benefits for both the supply and demand side. In terms of the supply side, the cost savings can be gained through efficiency measures to run the business. In addition, going green is a means of reducing the cost of capital by accessing public and private funding and by lowering the cost of compliance. For the demand side, the cost savings result from reducing the cost of running and maintaining the building over its life-cycle. Thus, reducing life-cycle costs can be regarded as one of the major motives and benefits associated with environmental sustainability and that the stakeholders, and particularly clients are more concerned with the whole life assessment and benefits of a product or service, which was less evident before the green movement.

However, most participants felt that the cost savings mainly go to the end-user or the occupier of the building. For example C3 from the contractor group stated *“The benefit here is for the occupier of the building so they have a cheaper energy and utility cost over the whole life without being exposed to rising gas and electric costs.”* Similarly, CL4 from the client group confirmed the money savings for their buildings as a local authority *“The economic benefits are the savings, savings from water control, from*

energy control from the power perfectos, the hand driers saved us a huge amount of money on paper towels.”

The participants believed also on the benefit of increasing business productivity by being able to attract more businesses and clients. Furthermore, the participants confirmed that GBMs are a strategic differentiator for companies to compete in the marketplace. They acknowledged the importance of having environmental advantage over rivals. Typical comments were: *“there are companies who take a more proactive approach to these things because they do see it as something that can differentiate themselves on environmental issues.”* Client (CL1). *“Winning work: green as a differentiator improves our business, improves our performance.”* Contractor (C3).

The financial benefits can also be gained from entering new markets where green practices are in high demand. The participants stated they have been asked to provide environmental services. For example, one of the consultants explained that they offer environmental consultancy on an ad-hoc basis but because of the increased demand at the moment, his company started to take a more proactive approach on reaching clients.

Nevertheless, there was one architect within the sample who indicated that environmental issues are currently not offering financial benefits. He pursued the green agenda to reduce the participation in unsustainable practices. This can be attributed to the fact that this architectural practice has just started the green practices, therefore it might be a matter of time before they realise the financial benefits. The same architect admitted being green will increase clients' offers and reduce fuel costs and overheads for their business.

Based on the responses, it can be seen that environmental sustainability offers new market opportunities and green credentials seem vital for companies. In general, these companies' managers were positive about it and also reported that one of benefits is the close work between internal company units and that environmental sustainability brought them together since it needs more collaboration.

5.4.4.3. Long-term viability benefits

Almost all the participants highlighted the long-term benefits associated with GBMs. Indeed, this is an area where business benefits and the green agenda may chime: pursuing

the green agenda will sustain the business in the future. Therefore, a long-term vision will help GBMs to flourish.

Efficiency and innovation have always been associated with the green movement and have been seen as important benefits too, by the participants. Most innovative ideas have come as a result of improving environmental performance, for example light sensors to improve efficiency and reduce energy consumption. Furthermore, green companies have a good relationship with their stakeholders. This can benefit companies to have sustainable revenues and to stay in the market for longer.

Finally, companies will be able to achieve long-term goals and profits by promoting green and will be able to sustain themselves in the market in the future. Below is a statement made by one of the participants in relation to this issue: *“If you do not keep up to speed with environmental issues, you will be a dinosaur, you will expire.”* O1 from the other group (Property development).

The long-term viability can be highly useful in stimulating companies to adopt GBMs.

Based on the above discussion, it can be deduced, on the benefits of the GBMs theme, that:

- Companies need to value intangible benefits such as reputation because a meaningful portion of a GBM may relate to intangible benefits
- Companies need to balance the short and long-term benefits
- Companies need to consider the long-term viability of their existence by adopting GBMs.

The benefits of going green are reported in the literature. There is a strong consensus that improved image is the principle benefit of addressing green issues (Alec, Adam, Jarrod, & Nishani, 2012; Maurice Berns, 2009a; Vatalis et al., 2011). Other benefits reported include: cost savings; competitive advantage; employee satisfaction or retention; and innovation. However, the long-term viability benefit, which emerged from this research, is not reported explicitly, therefore it can be regarded as a new benefit of GBMs.

Chapter 6 applies IRP to rank the various GBM elements with reference to each benefit area presented above. This ranking will help understanding the influence of each

element when it comes to benefits for companies. It will also help managers to make an informed decision about investment plans of GBMs elements.

5.4.5. Challenges of GBMs

Participants compiled the major challenges from their point of view and from some of the practical issues which faced them. However, these challenges can be traced in five major categories include government, financial constraints, industry constraints, company constraints, and lack of demand. The five categories are covered in more detail next and are depicted in Figure 5-4.

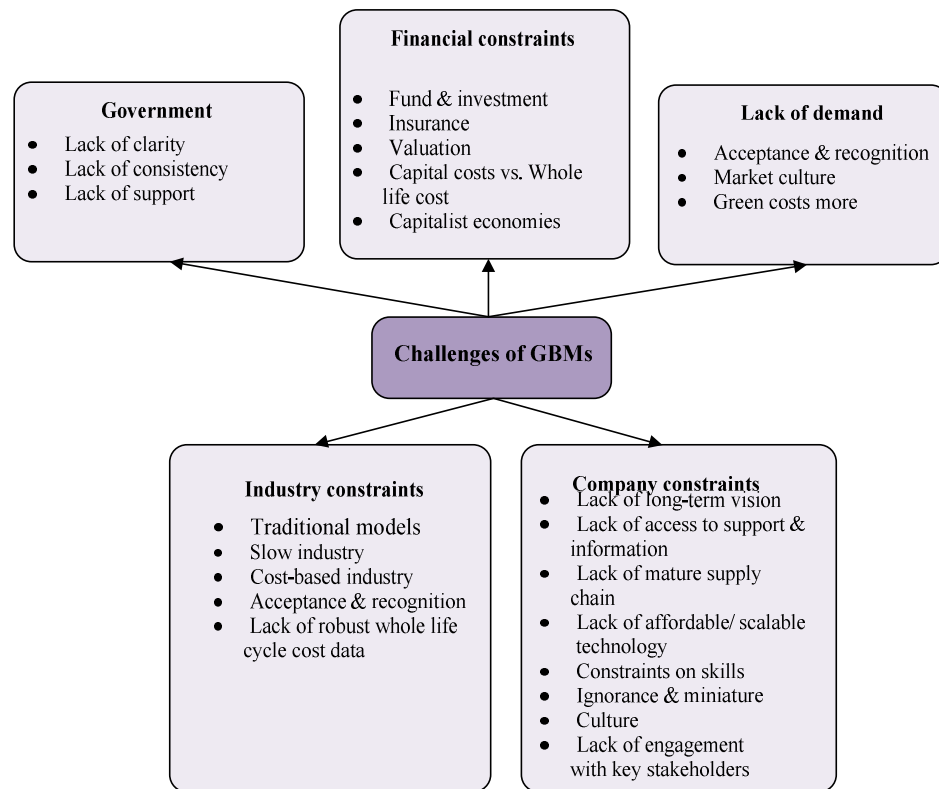


Figure 5-4 GBMs challenges

Figure 5-4 presents the challenges of GMBs. This suggests that there are five major challenges which may face the emergence and growth of GBMs. Therefore, relevant stakeholders need to acknowledge and highlight these challenges to find radical solutions.

5.4.5.1. Government

The importance of legislation in inducing green transition has been widely recognised by the participants. However, some of the participants were concerned about the unadvised policy makers in imposing immature regulations. In addition, they highlighted the damages caused to their companies by changing government policies. For example, C1 mentioned that the government required that all timber for government funded projects should use only the Forest Stewardship Council (FSC) Chain of Custody timber and products. Consequently his company invested in this matter to do so; however the government relaxed this requirement to allow other timber to be used. AR3 stated *“A lot of time wasted when regulation changes.”* Furthermore, CS2 from the consultant group talked about the importance of consistency on legislation by saying, *“more lobbying for stronger clearer legal direction.”* According to CS2, the Landfill Tax was a good example of a single piece of legislation that understood this and implemented well and has encouraged major contractors to develop waste management policies and practices.

Therefore, it might be effective for policy makers to engage thoroughly with the key industry players or the green gurus who have demonstrated their leadership by best practices, to impose the best possible legislations. It might also be vital for the government to be clear and consistent on legislation, however this can be difficult to achieve in practice because green issues in general are still evolving practices. In addition, the government can provide more financial incentives to companies that perform better in environmental terms. Furthermore, financial penalties can be taken from the abusers. In a related vein, Bilsen, Blondiau, Debergh, and Lukach (2013) conducted a study on behalf of the European Commission to recommend practical policies for promoting green and innovative BMs. This study recommended the use of a ‘policy pilot’ to create adequate and consistent policy outcomes. It recommended the introduction of policies on a small-scale, hence policy makers can benefit from policy learning practices and engagement with relevant stakeholders. This approach will help assessing the effectiveness of a particular policy before up- scaling, while avoiding the financial implications and risks from large-scale programmes.

The role of the government on hindering or helping green business models has support in the literature. According to Revell and Blackburn (2007), government is a major driver of green issues within the UK. It is evident that regulations were actively

encouraging environmental reform among companies. As a result, there has been an increase in the number of regulations such as the Landfill Tax, Climate Change Levy, and Aggregates Levy.

5.4.5.2. Financial constraints

The participants explicitly and thoroughly addressed financial constraints as a major roadblock to the GBMs. Different opinions were captured in the interview discussions and were summarised in five major answers which include: funding and investment; insurance; valuation; capital costs vs. whole life cost; and capitalist economies.

Funding and investment is a major obstacle for construction companies. Financial resources and the amount of money which will be available in the future to build, concerned the participants. In the future, there might be a need for different ways of building which are more sustainable and involves communities further. It may have different forms of ownership like cooperative ownership hence the construction companies have to be more innovative in the way the buildings work. Funders will have greater expectations in the future in terms of environmental responsibilities and impacts of potential investment developments or projects and they might play a vital role in developing green models by their investment conditions that favour greener solutions. The international financial institutions have initiated two major environmental and social standards which have a great bearing on major projects that they fund. These are the Equator Principles (EPs) and the European Principles for the Environment (EPE). EP is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. The main target of EPs is emerging markets, unlike EPE which is targeting the Member States of the EU and the European Economic Area countries, together with the EU Acceding, Accession, Candidate and potential Candidate Countries (Bulgaria, Romania, Croatia, and Turkey). The EPE was launched by the European Investment Bank (EIB) with the endorsement of the European Commission. The EPE aims at protecting the environment and promoting sustainable development globally (Tolson, 2008). Both the EPs and EPE drive the environmental and social agenda in the target markets and this demonstrates the emergence of the funders/ financial institutions' role in green issues.

Insurance is a major hindrance especially in finding appropriate cover for recycled materials and contents. C4 from the contractor group gave an example where his

company was willing to use some recycled glass on a project but clients were against it, although it will save them a fortune. Clients were mainly concerned about the insurance of the project. C4 pointed to the difficulties on finding insurance cover for reused or recycled materials in general, by saying *“trying to get a warranty or insurance on a piece of reused steel is very difficult and of course everybody shies away from it.”*

According to the participants, the current valuation method of buildings does not necessarily reflect the importance of the green agenda. C1 from the contractor group said that if the construction industry is to appreciate the GVP, then new approaches to valuing properties are needed. *“New ways of valuing property (possibly life cycle related), but this needs change in the approach of the whole property sector, starting with RICS (Royal Institute of Chartered Surveyors) and Mortgage Lenders.”* Contractor (C1). Most participants agreed with C1 on considering the life cycle cost when valuing green properties. This agreement can be referenced back to the main benefit associated with green buildings, which is the reduction in the operating costs. It can be suggested that financial institutions need to work more closely with construction professionals to develop valuation systems akin to this notion. In addition, the participants were concerned about the capital costs needed for green transition. In most cases there will be an investment needed at the beginning to go green. The payback periods also need to be considered, as usually companies prefer a shorter time span for payback. This means in order to move forward, either to target shorter payback periods or to find a way of funding the upfront capital investment. However, the reduction on whole life cycle costs can outweigh the capital costs, which will make it more justifiable for investors.

The capitalist economies hinder the full green transition because these economies focus on large financial returns only. For example, CL3 from the client group felt that *“it will very difficult to try and change the economic models certainly in the sort of capitalist economies, just like this country, to try and change the business investment model so that you are asking people to invest for little or no return. It is going to be incredibly difficult.”* Correspondingly, the architects highlighted that a major barrier to the green agenda was the capitalist markets where money comes first and they suggested maintaining the economic drivers in order to move forward. *“We do work within a capitalist society and pounds and pennies speak louder than any environmental issue, so that one needs to be one of the drivers there.”* Architect (AR3).

5.4.5.3. Industry constraints

The participants admitted that inherited problems and traditional models within the construction industry have hindered the green transition. A2 from the academic group described the construction industry as a slow industry to change and therefore legislation is needed to move forward. He also talked about the dominance of cost rather than performance. The contractors C1 and C4 have agreed with the academic on the lack of performance or value models. For example, C4 stated *“it feels like the industry [referring to the construction industry] is not really incentivised to deliver best value. I think it is incentivised to deliver low cost but I do not think its necessarily incentivised to deliver best value.”* One of the architects (AR1) confirmed the issue of the traditional models in the construction industry where *“most buildings are commissioned by a developer with the aim of selling it on as quickly as possible. When you got that model, the developer wants to design it as cheaply as possible and build it as cheap as possible and sell it for as much profit as possible. That is the traditional model.”*

The participants also highlighted the lack acceptance and recognition of GVPs and the associated benefits. For example, C3 from the contractor group talked about the challenge of *“letting the industry [referring to the construction industry] recognise the value in a sustainable offering by asking the right question of contractors you work with, rather than perhaps just go for the cheapest.”* Furthermore, C4 discussed the difficulties on convincing clients to use a recycled content in a project and on finding insurance cover for a used material. These issues can be overcome by educating the whole construction industry and society on the value of green solutions.

It is also rare to find companies or individuals in the construction industry who can look beyond the capital investment or cost to the whole life cost. This paradox can be solved by long-term planning for green business models which requires major changes in current practices. The necessary investment to change can be financed by short-term profits or green quick wins, “low-hanging fruits.” On the same note, one of the contractors (C2) argued that there is a lack of robust whole life cycle cost data. The lack of robust data can dramatically affect clients’ choices and approaches. Therefore case studies are needed in this area, which can be developed between academia and industry.

5.4.5.4. Company constraints

For the companies, domination of short-term profit seeking and vision is a major barrier. Companies need to replace the capital cost dilemma with the life cycle cost. This can be linked to the issue of lack of robust data on the whole life cycle cost analysis in the construction industry as a whole. (For more detail refer to section 5.4.5.3 above.)

For professionals at the company level, they need to stay at the cutting edge of the major green issues and they need to communicate that to the relevant stakeholders and clients by sending the right message. In addition, a mature supply chain is a real hindrance for companies and also green technology which needs to be affordable and scalable. However, C3 from the contractor group explained true engagement with their supply chain, where the parent company supports the suppliers to bring about innovation for them. This can be a solution for the lack of supply chain involvement on green issues. Similarly, the UN Global Compact report in 2013 declared supply chains as a roadblock to improved performance and found that only 18% of large companies assisted their supply chains with setting and reviewing goals which adhere to Global Compact principles.

The most important hindrance, as declared by AR1, is that *“we need to change the intellectual understanding that there is no ‘silver bullet’ to a green solution. It is multiple factors and all of them need to be given an appropriate weight.”* He argued that a green solution has a combination of energy demand, energy supply, efficiency, supply chain, and designing appropriateness. However, the weight of each one will depend on the circumstances, in that one idea might be more dominant than another and apparently in different environments, that ingredient might be less. Hence there is no single solution, but rather it needs multiple solutions.

AR2 explained the difficulties in finding knowledgeable staff who have the essential skills on green issues. Similarly, C1 from the contractor group talked about lack of skills on ‘eco-professionalism’. The participants highlighted the spread of ignorance of professionals in the construction industry when it comes to green business models. For example, CS2 from the consultant group stated *“Internally [referring to the internal challenge regarding GBMs] miniature that the biggest issue as an example would be a staff member who has been here for 40 years. He or she will still think its a trend so*

environmental issues are going to go away so internally you get a lot of miniature.” He argued this can be solved by an incentive scheme. Nonetheless, the issue of ignorance of professionals and staff can be linked to lack of knowledge, education, and skills. Accordingly, companies’ investment in training is essential if the GBMs are to flourish.

The culture of the company was one of the hindrances addressed by the participants. For example, CL1 from the client group talked about the importance of having a positive culture around the green agenda, where people are willing and wanting to do something about it and he argued that it is vital to create this culture if it does not exist in an organisation. *“The culture of an organisation is absolutely fundamental, it is going to be a culture grown. If it does not exist it is going to be culture grown that will switch people into recognising to be part of what they do every day and that very much where the council is and been working on that for very long time.”* CL1 from a Local Authority (client group).

Lack of engagement with key stakeholders was also an obstacle to GBMs from the participants’ perspective. Staff, suppliers, and clients are among the critical stakeholders for participants’ companies. Staff and supplier buy-in can bring opportunities and allow the full uptake of GBMs. Clients’ engagement will develop improved satisfaction levels, and in turn will help foster demand. The demand category is covered in more detail next as the final challenge of GBMs.

5.4.5.5. Lack of demand

The demand hindrances, from the participants’ perspective, are the broader acceptance of the market because the construction industry up to now has struggled with green business models, hence a broader understanding of the benefits of green solutions is needed. Furthermore, the broader economic drivers need to be maintained, particularly in capitalist markets and societies because it will be difficult to rely only on the ethical motives. With clients, the challenge rests on the cost associated with the green solution and usually they are not prepared to pay more just for the sake of green. This brings the dilemma of financial investment and who will pay for the extra cost of green.

The participants also explained the cultural challenges that reside mostly in the consumption patterns which inhibit transformation towards green business models and hinder communities from fully contributing to this process. The popular culture needs to accept and recognise the green solution. This gap can be bridged by better

understanding from the supply side professionals of the cultural settings they operate in and communicating the appropriate messages. It is important to overtly promote GBMs through various means, ranging from robust evidence and case studies, to availability of ‘open’ literature and information supported by recognised professional bodies. In addition, media can play an important role in developing programmes and documentaries to support the green transition.

Five categories of challenges of GBMs emerged from this study: namely, government, financial constraints, industry constraints, company constraints, and lack of demand, are consistent with an empirical study conducted by the OECD. The study was about new BMs for green growth in order to draw up policy recommendations. In this study, key barriers to green growth were reported including: lack of market demand; limited access to the necessary financial resources; barriers resulting from government policies; lack of knowledge and human resources; and constraints related to intellectual property rights (Beltramello et al., 2013a). In addition, this study highlighted the major role that the policy makers can play to achieve green growth through BMs innovation.

During the interview discussions, it was evident that the five categories of challenges reported above are closely linked. Therefore, it was vital to structure the relationship between these challenges to be able to extract the most crucial challenges that hinder GBMs development and transformation. The next Chapter utilises the ISM method to identify the root challenges and to obtain a more holistic picture in understanding them.

5.5. Summary

This Chapter has presented the empirical findings of the interview analysis. Semi-structured interviews were conducted with 19 managers from the construction industry, both academics and practitioners. The Chapter started with the interviewees’ details with purposive sampling being the selection method of the participants. Then the method of analysis is presented briefly and the rest of the Chapter has analysed the results.

The findings which emerged from the interviews were organised into five major themes, as follows:

- i. Understanding and definition of GBMs: A GBM can facilitate better understanding and analysis of the value creation and value capture. It can also

help with more radical transformation of the construction industry. In this theme, we were able to extract a generic definition of GBMs which can be a starting point of departure.

- ii. GBMs elements: Five elements were developed from the literature: namely, GVP, TGs, KA, KR, and FL. The findings were used to obtain a picture of what these elements meant to the construction industry for academics and practitioners. The findings revealed that most of the participants had a similar understanding of the elements to those found in the literature. However, there were instances in which confusion between TGs and KR was apparent.
- iii. Changes: It was important to capture the changes which have happened and are expected to happen within the sample companies. This approach will give guidance on the green transition, therefore companies and relevant individuals can make informed decisions about GBMs and their requirements. The findings suggested five major changes including: policy and principles; awareness, empowerment, and buy-in; publicity; structure; and working stream and practices.
- iv. Benefits: From the results, it was clear that GBMs have the potential to benefit companies in three major areas: credibility/ reputation benefits; long-term viability benefits; and financial benefits.
- v. Challenges: The findings suggested five major challenges to the GBM: namely, government, financial constraints, industry constraints, company constraints, and lack of demand. It becomes vital to overcome these challenges if GBMs are to thrive.

Chapter 6 further analyses and validates the findings of this Chapter by a means of utilising ISM and IRP methods.

Chapter 6. **ISM AND IRP RESULTS, DISCUSSIONS, AND VALIDATION**

6.1. Introduction

Chapter 5 identified and explained green business model (GBM) elements, benefits, and challenges. The data analysis revealed the close interaction among different GBM elements as well as challenges. Consequently, examining the interaction will provide valuable insights, allowing us to obtain a holistic picture about GBM transformations. This Chapter aims to examine the relationship between GBM elements, to understand the mutual influences among the GBM challenges, and to rank the GBM elements with reference to key benefits. To achieve these aims, this Chapter utilises interpretive structural modelling (ISM) and interpretive ranking process (IRP) methods. ISM is used to develop a hierarchical structure for analysing the interactions among GBM elements and challenges, while IRP is used to examine the dominance of relationship of GBM elements against various benefit areas for businesses.

Following this introduction, the Chapter is divided into six major sections. Section 6.2 is divided into two subsections that detail the ISM for GBM elements and challenges respectively. In Section 6.3, IRP is explained and discussed. Section 6.4 proposes a guideline for GBMs implementation while Section 6.5 details the implication of the study. In Section 6.6, the findings are validated by a means of structured interviews with five experts before we wrap up in Section 6.7.

6.2. Interpretive Structural Modelling (ISM)

The ISM method organises a set of different directly related elements into a comprehensive structured model. (For more details of ISM technique refer to Chapter 4) According to (Attri et al., 2013), the ISM method is characterised by the following:

- i. It is interpretive because the judgement of a certain group or experts decides whether and how the different elements are interrelated;

- ii. It is structural on the basis of mutual relationship; an overall structure is extracted from the complex set of elements;
- iii. It is a modelling technique, since the specific relationships and overall structure are portrayed in a digraph model;
- iv. It helps to impose order and direction on the complexity of relationships among various elements of a system; and
- v. It is mainly intended as a group learning process, but individuals can also use it.

In Section 6.2.1, the ISM method is utilised to evolve mutual relationships among GBM elements and to identify those elements which influence other elements (driving elements) and also those elements which are most influenced by other elements (dependence elements). By analysing the GBM elements using this model, we may extract critical elements that support the GBM transformation. The same method is applied to analyse the interaction among GBM challenges to gain a holistic view on understanding the barriers that hinder GBM development. (For more details refer to Section 6.2.2.)

6.2.1. ISM for Modelling GBM Elements

Chapter 5 presented GBM elements and their sub elements that were developed from the literature and the interview analysis. (For more details refer to Section 5.4.2.) From the interviews, it was evident that there were direct and indirect relationships between GBM elements. These relationships will help describing the GBM transformations more accurately than the individual elements taken in isolation. Therefore, ISM develops insights into collective understanding of these relationships. The various steps involved in the ISM method are discussed and applied next.

6.2.1.1. Identifying GBM elements

As presented in the previous chapters, five key elements were identified. Details of these elements and their descriptions are explained in Table 6-1.

Table 6-1 GBM elements

	GBM elements	Description
1	Green Value Proposition (GVP)	Describes products and services offered by a particular company and what is more appealing to clients/ stakeholders.
2	Target Group (TG)	Describes the segment of clients/stakeholders whom a company wants to offer value to.
3	Key Activities (KA)	Refers to the most important activities which need to be performed to create value to clients.
4	Key Resources (KR)	Refers to the key assets required to offer and deliver value to clients.
5	Financial Logic (FL)	Describes the financial assessment of all the means employed in the GBM.

Having listed the GBM elements under consideration, the next step aims at establishing the relationship between these elements.

6.2.1.2. Developing a structural self-interaction matrix (SSIM) for GBM elements

The ISM method suggests the use of expert opinions in developing the contextual relationship among the variables under consideration. For this purpose, each interview was examined extensively to establish the pair-wise relationships between the different GBM elements. The interview analysis revealed and demonstrated that there were strong relationships between GBM elements. Based on the analysis, a contextual relationship of “drive” is chosen here. Although there were no specific questions about the contextual relationships during the interviews, the interviewees highlighted these relationships explicitly. The matrix below presented the pair-wise relationships among GBM elements and four symbols were used to denote the direction of the relationship between the elements (i and j):

1. V: element i will drive element j;
2. A: element j will be driven by element i;
3. X: element i and j will drive each other; and
4. O: element i and j are unrelated.

Table 6-2 presented the SSIM with different symbols relevant to each pair-wise relationship.

Table 6-2 SSIM

No.	GBM elements	1	2	3	4	5
1	GVP		X	V	X	X
2	TG			X	X	X
3	KA				X	A
4	KR					X
5	FL					

From the matrix above, it was clear that the GBM elements were related therefore we did not use the symbol (O) which indicates the absence of a relationship. This can be due to the claim that the significance of a GBM concept stems from the strong connection between the elements that strengthen each other to form a well-functioning entire system.

An explanation of the contextual relationships as extracted from the interview analysis and should prove useful in gaining a deep understanding of these relationships. In other words, the existence of a relationship between any two elements and the direction of the relationship is questioned. As presented in the Table above, there are 10 relationships identified. Each relationship will be explained below by the cell number. For example, the relationship between the GVP and TG is presented in cell 1-2, while the relationship between the GVP and KA is presented in cell 1-3.

1. **Cell 1-2: The relationship between the GVP and TG:** Some of the participants suggested that the GVP drives the TG while others suggested that the TG drives the GVP. For example, CL5 from the client group stated that: *“the client would be interested in that [referring to GVP] because they will get the benefits of a more efficient building that reduces the energy cost and might be a better environment for the users of the buildings, so it is more fit for purpose.”* This statement suggested that the benefits associated with GVP can play an important role in driving clients (TG) to demand the GVP from companies. C3 from the contractor group supported this idea by suggesting that *“green buildings [can be a form of the GVP] attract great rent perhaps and attract tenants [TG] that are attracted by lower operating costs.”* In contrast, C2 from

the contractor group talked about the importance of clients (TG) in driving GVP: *“I would say we deliver with response to client requirements so we could probably build greener buildings but we build the greenest building that the client wants and can afford.”* CL1 from the client group agreed with C2 by stating: *“I think clients are very critical of this because the client is at the top of the chain and if an organisation is working for a client, the client has the ability to influence decision making and policy and a lot of organisations would change the way they work to satisfy a very major client.”* An interpretation of the above statements can therefore be that the GVP and TG drive each other and hence are denoted as X in cell 1-2 (Table 6-2).

2. **Cell 1-3: The relationship between the GVP and KA:** According to CL1 from the client group, the implementation of green practices (can be a form of the GVP) has led the organisation to change the working streams (KA). Examples included the changes in the procurement process and estate rationalisation. In addition, C4 from the contractor group explained the changes to the KA performed by his company. These changes were mainly influenced by the GVP. For example, C4’s company introduced a zero waste practice which can be classified as the GVP here. This GVP has forced the company to revise every working practice from procurement to demolition. It can be therefore assumed that the GVP drives the KA, but not vice versa and thus is denoted as V (Table 6-2).
3. **Cell 1-4: The relationship between the GVP and KR:** Some of the participants believed that the ability to provide the GVP can result in building a reputation and green credentials (KR). From the analysis, it was clear that the introduction of the GVP will lead to recruiting an environmental/ sustainability manager or team (KR), depending on the size of the company. At the same time, the participants confirmed the importance of having senior management commitment (KR) to drive the GVP. Therefore, the GVP and the KR drive each other and hence are denoted as X in Table 6-2.
4. **Cell 1-5: the relationship between the GVP and FL:** C2 from the contractor group asserted the importance of providing the GVP: *“the marketing benefits of having a few very high profile buildings [can be a form of the GVP] that counts*

a lot in terms of profitability and intangible benefits.” This statement claimed that the GVP has the potential to drive profitability (FL). Another example was mentioned by one of the clients (CL5), in which the proof of carbon reductions (can be a form of the GVP) can result in attracting more funding (FL). The opposite was also captured from the data analysis. Some of participants confirmed that one of the important motives to create the GVP is the expected cost savings which can be attributed to a reduction in operating costs or to lower compliance risks. In addition, C3 from the contractor group highlighted the importance of developing a financial case (FL) for the GVP: *“good financial commercial management [FL] with experts and technology are the main practices and capabilities needed for GBMs.”* It can be deduced from the foregoing that the GVP and FL drive each other and consequently are denoted as X in Table 6-2.

5. **Cell 2-3: the relationship between the TG and KA:** O2 from procurement, indicated that the change of its company’s activities was mainly driven by clients’ demand: *“we turned to the retrofit brokerage [KA for this company] service because landlords [main clients for this company or their TG] are interested in refurbishment projects commonly known as retrofits and again we just analysed that we have got a lot of expertise.”* Some of the participants suggested that education (one of the KAs performed by different companies which offer green alternatives) of clients and end-users (TG) on green issues can lead to more client demand. For example, A2 from the academic group said: *“educate [KA] the market [TG] that if you bring the sustainability for a sustainable building, the life time cost for the whole building may be reduced.”* The above statements indicated that TG and KA drive each other and hence are denoted as X in the matrix above (Table 6-2).
6. **Cell 2-4: the relationship between the TG and KR:** CS2 from the consultant group pointed out that their client base (TG) has demanded them to implement an environmental system (KR). *“..... pressures coming through from our clients, particularly from the public sector [.....] if we wished to tender for work then we have to be able to demonstrate that we are managing our environmental impact [.....] because if we do not have the information which I generate, we would not win work.”* CS2 (consultant group). However, most of the

participants believed that having the KR such as expertise and knowledge, and green credentials can lead to more clients (TG). For example, AR2 from the architect group stated that: *“actually lack of understanding of our clients [TG] so one of our objectives is always to stay ahead [KR] of where our client [TG] base is and being able to inform them with the key issues related to construction, it was obviously environmental sustainability.”* Another example was reported by O2 from the procurement group: *“clients [TG] are coming to us to enquire about this kind of technology because we have got a good reputation [KR] in this area.”* In summary, the TG and KR drive each other and thus are denoted as X (Table 6-2).

7. **Cell 2-5: The relationship between the TG and FL:** O2 from the procurement group stated that: *“we are responding to the market demand [TG]. We are increasing turnover [FL] and we are doing our generation stuff on the back of it and we are helping that market to develop.”* This statement demonstrated that TG can drive FL. In addition, some of the participants suggested that cost is a major driver/ barrier to clients. This was captured by AR1 from the architect group in which *“clients [TG] are generally open if it [referring to GVP] does not cost [FL] them much.”* Therefore, FL can be a strong driver for the TG. The participants suggested that clients are demanding the GVP because they are driven by cost savings on the operation or by financial incentives provided by the government. An interpretation of the above statements can therefore be that the TG and FL drive each other and consequently are denoted as X in Table 6-2.
8. **Cell 3-4: The relationship between the KR and the KA:** From the data analysis, it was clear that the KA and KR are closely interlinked, which means they drive each other. For example, one of the important KAs for GBMs was continuous review and improvement. For companies to perform these activities, they invest in resources such as staff and formal systems. At the same time, the KR can drive the KA. For example, C4 from the contractor group indicated that green credentials (KR) drive the type of the work (KA) for a given company. Therefore, the KR and KA drive each other and hence the relationship is denoted as X in the matrix above (Table 6-2).

9. **Cell 3-5: The relationship between the KA and FL:** It was evident from the data that the KA is driven by the FL but not vice versa, and thus is denoted as A (Table 6-2).
10. **Cell 4-5: The relationship between the KR and FL:** C4 from the contractor group reported that: *“I think we are developing away from just waste management and percentages of recycling to how much work we are winning and have a green edge The green edge [KR] gives us a better margin [FL].”* At the same time, C4 claimed that: *“in recent times we have actually been given proper budgets, we have proper air time with communication and funding departments.”* The above reports and claims indicated that the KR and the FL drive each other and consequently are denoted as X in Table 6-2.

6.2.1.3. Developing a reachability matrix (RM) from SSIM

The RM was obtained by converting the SSIM into a binary matrix by substituting V, A, X, O by 1 and 0 as per the case. The rules for the substitution of 1s and 0s are the following:

1. If the (i,j) entry in the SSIM is V, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i,j) entry in the SSIM is A, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i,j) entry in the SSIM is X, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.
4. If the (i,j) entry in the SSIM is O, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Following these rules, the RM for the GBM elements are shown in Table 6-3. There was no transitivity in this study, hence the RM will be used for further calculations.

Table 6-3 RM matrix

No.	GBM elements	1	2	3	4	5
1	GVP	1	1	1	1	1
2	TG	1	1	1	1	1
3	KA	0	1	1	1	0
4	KR	1	1	1	1	1
5	FL	1	1	1	1	1

Table 6-4 presents the final RM. In this table, the driving power and dependence of each GBM element are also presented. The driving power of an element is the total number of elements including itself, which it may help achieve, while the dependence is the total number of elements, which may help achieving it. Based on the driving power and dependence, the GBM elements will be classified into four clusters of autonomous, dependent, linkage, and independent/ driver elements. This classification and its implications are explained in more detail in the next step (6.2.1.5).

Table 6-4 Final RM

No.	GBM elements	1	2	3	4	5	Driver power
1	GVP	1	1	1	1	1	5
2	TG	1	1	1	1	1	5
3	KA	0	1	1	1	0	3
4	KR	1	1	1	1	1	5
5	FL	1	1	1	1	1	5
Dependence		4	5	5	5	4	23/23

6.2.1.4. Classifying GBM elements – MICMAC analysis

Based on the driver power and dependence power generated in Table 6.4, the GBM elements were classified into four clusters, as shown in Figure 6.1 below. This

classification was done to identify the key elements that drive the GBMs' transformation and development.

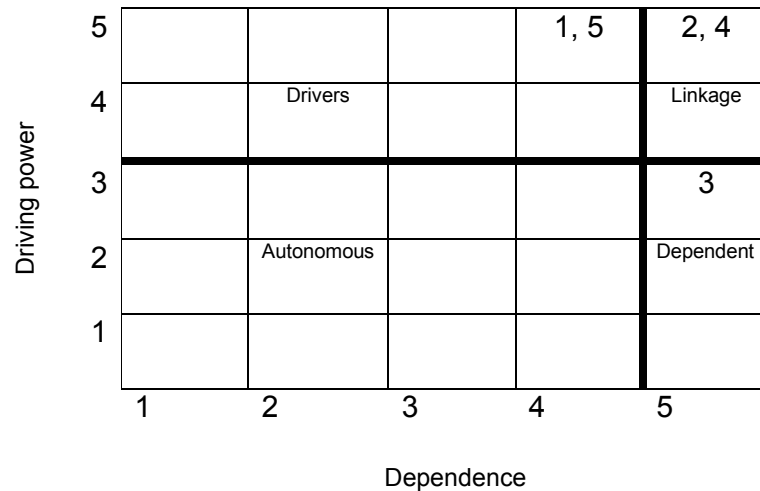


Figure 6-1 Driving power and dependence diagram

The major findings of this classification (Figure 6-1) were as follows:

1. The diagram indicated that there is no critical element that comes under an autonomous cluster. Autonomous elements generally appear as weak drivers as well as weakly dependent, and are relatively disconnected from the system. These elements do not have much influence on the other elements in the system. This result supported that GBM elements are well connected and form an entire whole system (Sommer, 2012).
2. The KA was a weak driver but strongly dependent on other elements. The KA element represents the desired objective for any company and was classified as a dependent element. The objective for companies involved in green practices is to perform all activities in a greener manner. However, performing in a greener manner will depend on the resources available, such as management commitment, staff, and knowledge. It will also depend on finance, on clients and what they want, and on the type of offer which companies intend to create for a given market.
3. The TG and KR were the linkage elements that had a strong driving power as well as strong dependence. These elements were unstable because any action on these elements will have an effect on others and also a feedback effect on themselves.

4. The GVP and FL appeared to be having strong driving power but weak dependence power. Therefore, they were classified in the independent/ driver cluster. These elements will help companies to achieve their desired objectives.

It was observed that an element with a very strong driving power called the key elements, where it classified into the cluster of independent/ driver or linkage elements. The key elements here are: the GVP, FL, TG, and the KR.

6.2.1.5. Partitioning the RM into different levels

From the final RM, the reachability and antecedent set for each GBM element were derived. The reachability set consisted of the element itself and the other elements, which it may help to achieve, whereas the antecedent set consists of the element itself and the other elements which may help in achieving it. After finding the reachability and the antecedent set for each element, the intersection of these sets was derived for all elements. The element for which the reachability and the intersection sets were the same in the first iteration was assigned as the top-level element in the ISM hierarchy. Similarly levels were identified for other elements by iteration of this process. As the top-level element was at the top of the ISM model, it will not help to achieve any other element. Once the level was identified for an element, it was discarded from the list of remaining elements. Table 6-5 presented the first iteration which showed that three elements (TG, KA, and KR) were found in the first level. Therefore, they were removed from consideration in iteration 2, as detailed in Table 6.6. Iteration 2 showed that both the GVP and FL were found in the second level. The iterations 1 and 2 segregated the GBM elements in a hierarchy of two different levels. These levels helped in developing the ISM model in the final step.

Table 6-5 Iteration 1

GBM element	Reachability set	Antecedent set Intersect	Intersection set	Level
1	1, 2, 3, 4, 5	1, 2, 4, 5	1, 2, 4, 5	1 st
2	2, 1, 3, 4, 5	2, 1, 3, 4, 5	2, 1, 3, 4, 5	
3	3, 2, 4	3, 1, 2, 4, 5	3, 2, 4	
4	4, 1, 2, 3, 5	4, 1, 2, 3, 5	4, 1, 2, 3, 5	
5	5, 1, 2, 3, 4	5, 1, 2, 4	5, 1, 2, 4	

Table 6-6 Iteration 2

GBM element	Reachability set	Antecedent set Intersect	Intersection set	Level
1	1, 5	1, 5	1, 5	2 nd
5	5, 1	5, 1	5, 1	2 nd

6.2.1.6. Developing of an ISM model for GBM elements

From Table 6-5, it is seen that the TG, KA, and KR were found at level I. Thus, they will be positioned at the top-level of the ISM hierarchy. The bottom-level of the hierarchy included the GVP and FL because they were found at level II, as presented in Table 6-6. The final ISM model for the GBM element was shown in Figure 6.2 below. The arrow direction indicated the relationship between the different elements. For example, the relationship between the GVP and KR was a two way relationship, as explained in step 6.2.1.2 and 6.2.1.3. Therefore, an arrow pointing in both directions was used to denote this relationship, while the relationship between the GVP and KA was only one direction, in which the GVP drove the KA. Therefore, an arrow pointing from the GVP to the KA was used.

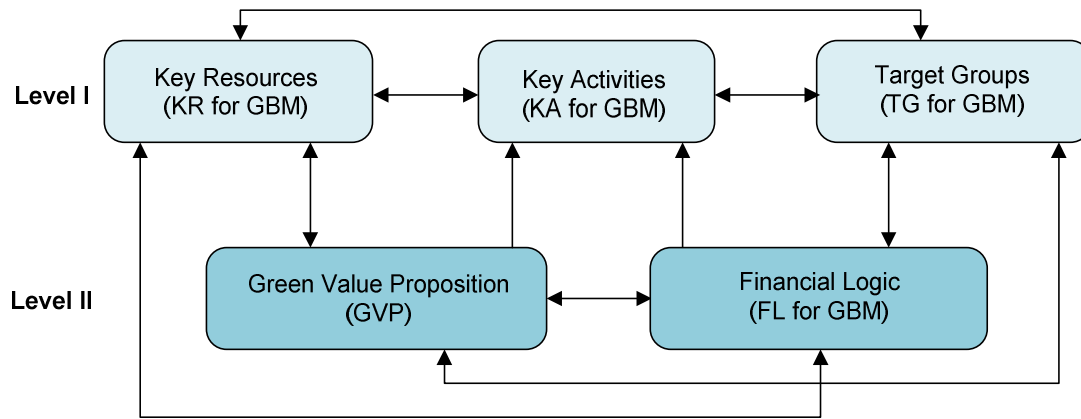


Figure 6-2 ISM - based model for the GBM elements

The ISM developed in Figure 6-2 was useful for identifying and illustrating relationships among the GBM elements that define a GBM. It imposed an order on these elements which can form the basis for managerial insights when developing GBMs.

6.2.1.7. Discussion

The ISM model showed the strong connections between the different GBM elements and that each element had a form of relationship with the rest of the elements. These connections demonstrated the systematic nature of GBM elements that will help construction companies to transform and develop desired business models, based on green value creation and capture. The model confirmed the claims in the literature about BMs in which they should be considered as a whole system rather than isolated elements (Magretta, 2002; Pekuri et al., 2013). Indeed, the great strength of BMs is as a planning tool because it focuses attention on how all the elements fit into a well-functioning whole. This research established the relationship between different GBM elements in a novel manner, through a single systematic model offering a practical guide in deciding the priority for GBMs transformations. It also validated the theoretical claims of interconnected elements by relying on empirical data to develop the ISM model. The driver-dependence diagram in Figure 6-1 supported this validation because there were no autonomous elements that were relatively disconnected from the system. The absence of autonomous elements indicated that all the five identified elements influence the development of GBMs. Therefore, it is suggested that management should pay serious attention to all GBM elements. The ISM method provides tremendous value

to the decision makers since it imposes order and direction on the complexity of relationships among the GBM elements. The insights generated from the ISM method are discussed in more detail next.

The model indicated that the GVP and the FL formed the base of the ISM hierarchy, implying higher driving power and hence were classified as driver elements in Figure 6-1. Therefore, the GVP and the FL were crucial elements and may be treated as the foundation for GBM transformation and development. These two elements drove each other as well as driving the rest of the GBM elements. Consequently, company managers should focus on creating green offers (GVP) and most importantly, should focus on different finance options (FL). This finding also indicated that companies may not offer the GVP unless there was a strong business case for doing so. It is worth noting that the GVP represented the value capture perspective of the GBM, and the FL represented both value creation and capture perspectives. Therefore, it becomes vital for construction companies to start with value capture in planning for GBMs transformations. In other words, they should start with a clear vision of the end results and transform accordingly because the ultimate goal for them is usually offering GVP to targeted clients/ stakeholders.

The literature on green and sustainable construction is filled with great examples of how offering the right GVPs will have positive impacts on companies. For example, a highly valued green reputation, improved stakeholder relationships between the demand and supply side, innovation opportunities, reducing life-cycle cost, efficiency, increased business productivity, and achieving long-term profits (Alec et al., 2012; Bartlett & Howard, 2000; Hodges, 2005; Liu, 2006; Vatalis et al., 2011; von Paumgarten, 2003). Yet, despite all the ink spilt and words spoken, green values are still relatively poorly appreciated more widely in the construction context. Abd. Hamid and Kamar (2012) even stated that one of the challenges of adopting sustainable construction is that companies do not know how to act upon the sustainability value. This research suggested that the GBM concept can be a means to resolve this challenge because, as explained above, the concept focuses on how the elements are interrelated and how they reinforce each other. The main problem might not be with the green value itself, but rather with how it interacts with the rest of the elements. Therefore, applying a GBMs approach may help to gain a holistic picture on green growth within the construction context.

Beltramello et al. (2013b) documented various case studies of GBMs within OECD countries. The results revealed that finance was a major contributing factor for GBMs growth. They found that much of the financing comes from inside companies and some comes from parent companies, however they still suggested that government has a major role to play in developing policies to support different access to finance. Therefore, it can be suggested that construction managers have to be creative on designing different FL and finding new ways of finance for GBMs transformation but they will still need support from the government and the construction sector in large. Furthermore, it is essential to understand what is at the origin of the lack of finance. In some cases, the main bottleneck is a lack of experienced managers with the necessary business skills, rather than access to funding as such.

The KR, KA, and TG were the elements that depicted the ultimate aim of GBMs and were positioned in the top-level of the ISM model. These elements appeared to be dependent on the base of the ISM model elements: namely, the GVP and FL. It means when managers and decision makers develop and design successful GVPs and FLs, the rest of the elements will follow easily and hence GBM transformations can be achieved. Having presented the ISM method for GBM elements, the next section details the same method to understand the mutual influences among GBM challenges. The ISM method will identify driving challenges which can aggravate a few more challenges and will identify independent challenges which are most influenced by driving challenges.

6.2.2. ISM for modelling GBM challenges

This section and the following subsections models GBM challenges. The section applies the above rules, as detailed in Section 6.2.1 and its subsections. The interview analysis highlighted the relationship between the different GBM challenges, however the ISM method provided a structured approach to modelling these relationships. The steps of the ISM are repeated below to develop an ISM model for GBM challenges.

6.2.2.1. Identifying GBM challenges

The participants identified many challenges to GBM transformation and development, as detailed in the previous chapter (Section 5.4.5). These challenges were grouped into five categories and are presented in Table 6-7 below.

Table 6-7 GBM challenges

	GBM challenges	Description
1	Government constraints	Refers to challenges caused by government legislation or lack of support.
2	Financial constraints	Refers to any financial hindrances internally within the company or externally from financial institutions and their lack of support for GBM.
3	Industry constraints	Describes the challenges at the whole construction industry level.
4	Company constraints	Describes the challenges that can be found at the company level.
5	Lack of demand	Refers to the clients and their lack of GBMs demands.

6.2.2.2. Developing SSIM for GBM challenges

The interviews were analysed closely to identify any existing pair-wise relationships. Based on the analysis, a contextual relationship of “alleviate” is chosen here and four symbols were used to denote the direction of relationship between any two challenges (i and j):

1. V: challenge i will alleviate challenge j;
2. A: challenge j will be alleviated by challenge i;
3. X: challenge i and j will alleviate each other; and
4. O: challenge i and j are unrelated.

Table 6-8 below presents the SSIM with different symbols relevant to each pair-wise relationship.

Table 6-8 SSIM

No.	GBM challenges	1	2	3	4	5
1	Government constraints		V	V	V	V
2	Financial constraints			X	V	V
3	Industry constraints				V	V
4	Company constraints					V
5	Lack of demand					

From the matrix above, it was clear that all the challenges were related therefore we did not use the symbol (O) which indicates the absence of a relationship. This justifies the need to conduct an ISM analysis to give these challenges order and to identify the root ones. Once the root challenges are identified, then resources and efforts can be channelled to alleviate these challenges first.

The contextual relationship between GBM challenges was extracted from the interview analysis, as presented earlier. Table 6-8 presented 10 existing relationships that are explained below by the cell number. The participants felt that the government has the power and the potential to alleviate all the challenges faced by GBM transformation.

1. **Cell 1-2: The relationship between the government constraint and financial constraints:** According to the participants, the government can influence the financial institutions to provide or ease funding for GBMs.
2. **Cell 1-3: The relationship between The government constraint and industry constraint:** A2 from the academic group suggested that the construction industry needs legislation to transform and appreciate GBMs and he claimed that: *“I think it is a slow sector [referring to the construction sector] to change to anything. I think incredibly slow and that is why you need legislation, legislation can drive opportunities.”* From that data analysis, it was evident that government efforts and consistent regulations can alleviate the construction industry’s constraints and can encourage the industry as a whole to transform to a greener one.
3. **Cell 1-4: The relationship between the government constraint and company constraints:** This was highlighted by A1 from the academic group. A1 argued that a construction company may not be involved in GBMs because it will assess the competitors and if they do not provide GBMs, then the company may not find the justification to do so. Therefore, he claimed that the construction industry is demanding for more restricted regulations from the government to encourage more companies to buy-in to the green agenda.
4. **Cell 1-5: The relationship between the government constraint and lack of demand:** CS2 from the consultants group said that *“I do not really believe in market forces to address these issues, so I think that environmental improvement needs or a green business model needs to be pushed more centrally from central*

government.” CS2 asserted that it will be difficult to rely only on market demands to move forward with GBMs. He suggested that the government needs to play its role in pushing GBMs forward. In summary, the government constraints have an influence over the rest of the challenges, as explained above and hence the relationships denoted as V in the matrix above (Table 6-8). It is worth noting that the participants did not mention that the rest of the challenges - financial constraints, industry constraints, company constraints, and lack of demand – can alleviate government constraints.

5. **Cell 2-3: The relationship between financial constraints and industry constraint:** This has dominated the participants’ answers, in which they suggested that the biggest barrier for the construction industry is the cost and the finance of GBMs. For example, AR1 from the architect group raised an important point. AR1 suggested that the funders can demand a more sustainable/ green approach from the construction industry and then will be able to see a radicalisation of the industry. In addition, C1 from the contractor group argued that a change on the valuation and investment approach towards more life cycle assessment can alleviate the industry constraints and can attract more players within the industry to appreciate GBMs. At the same time, he argued that it is important for the construction industry to be involved in finding new ways of investment and valuation. Therefore, it can be suggested that financial constraints and industry constraints can help alleviate each other and thus the relationship is denoted as X (Table 6-8).
6. **Cell 2-4: The relationship between financial constraints and company constraints:** This was captured clearly from the data analysis. Most of the participants suggested that it was difficult to convince their companies to do something green without a clear business case for doing so. For instance, C3 from the contractors group suggested that when a green practice requires an upfront investment, as a sustainability manager, C3 has to provide a business case for the financial department in the company. CS2 from the consultant group agreed with C3, as he explained that demonstrating a financial return on any environmental/ green initiative will help him win the company’s approval. It can be summarised that the financial constraints can alleviate company constraints and consequently is denoted as V in Table 6-8.

7. **Cell 2-5: The relationship between the financial constraints and lack of demand:** The participants attributed the lack of demand to the lack of finance and funds. They suggested that the cost associated with green practices was a major barrier for clients. For example, AR1 from the architect group stated that: *“Clients are generally inspirationally and naively green until they see the costs. All will do what they can so they usually overly open but not always able to deliver; some are, but not always.”* Therefore, it can be suggested that financial constraints can alleviate the lack of demand and hence is denoted as V in the matrix above (Table 6-8). Clients can demand GBMs if they are offered financial incentives such as tax breaks and access to funds that favour GBMs.
8. **Cell 3-4: The relationship between the industry constraint and company constraint:** The participants felt that the construction industry lacks the view and the recognition of GBMs, which will influence companies in general to offer GBMs. Therefore, overcoming industry constraints will alleviate company level constraints and thus the relationship is denoted as V (Table 6-8).
9. **Cell 3-5: The relationship between the industry constraints and lack of demand:** The participants believed that industry constraints have a strong influence on the lack of demand. For example, C2 from the contractor group argued that the lack of life cycle cost data from the construction industry influenced the lack of clients’ demand. It can be deduced that industry constraints can alleviate company constraints and lack of demand but not vice versa, as was evident from the data and consequently the relationships denoted as V in Table 6-8.
10. **Cell 4-5: The relationship between company constraint and lack of demand:** According to C4, the lack of demand can be stimulated through a better understanding of clients’ need from the provider company and then translating that need into a viable offer. AR2 from the architect group agreed partially with C4. AR2 claimed that as a company, they do have influence on clients but acknowledged that the influence is limited by clients’ understanding and aspirations. In addition, AR2 suggested that companies can have a strong influence over clients by educating them. In summary, company constraints can

alleviate the lack of demand and hence the relationship denoted as V in the matrix above (Table 6-8).

6.2.2.3. Developing RM from SSIM

The RM was obtained by converting the SSIM into a binary matrix by substituting V, A, X, O by 1 and 0 as per the case. The rules for the substitution of 1s and 0s are the following:

1. If the (i,j) entry in the SSIM is V, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i,j) entry in the SSIM is A, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i,j) entry in the SSIM is X, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.
4. If the (i,j) entry in the SSIM is O, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Following these rules, the RM for the GBM challenges is shown in Table 6-9.

Table 6-9 RM matrix

No.	GBM challenges	1	2	3	4	5
1	Government constraints	1	1	1	1	1
2	Financial constraints	0	1	1	1	1
3	Industry constraints	0	1	1	1	1
4	Company constraints	0	0	0	1	1
5	Lack of demand	0	0	0	0	1

Table 6-10 presents the final RM. In this table, the driving power and dependence of each challenge are also presented. The driving power of a challenge is the total number of challenges including itself, which it may help alleviate, while the dependence is the total number of elements, which may help alleviating it. Based on the driving power and dependence, the challenges will be classified into four clusters of autonomous, dependent, linkage, and independent/ driver challenges. This classification and its implications are explained in more detail in the next step (6.2.2.4).

Table 6-10 Final RM

No.	GBM challenges						Driver power
		1	2	3	4	5	
1	Government constraints	1	1	1	1	1	5
2	Financial constraints	0	1	1	1	1	4
3	Industry constraints	0	1	1	1	1	4
4	Company constraints	0	0	0	1	1	2
5	Lack of demand	0	0	0	0	1	1
	Dependence	1	3	3	4	5	16/16

6.2.2.4. Classifying GBM challenges – MICMAC analysis

Based on the driver power and dependence power generated in Table 6-10, the GBM challenges were classified into four clusters as shown in Figure 6-3 below.

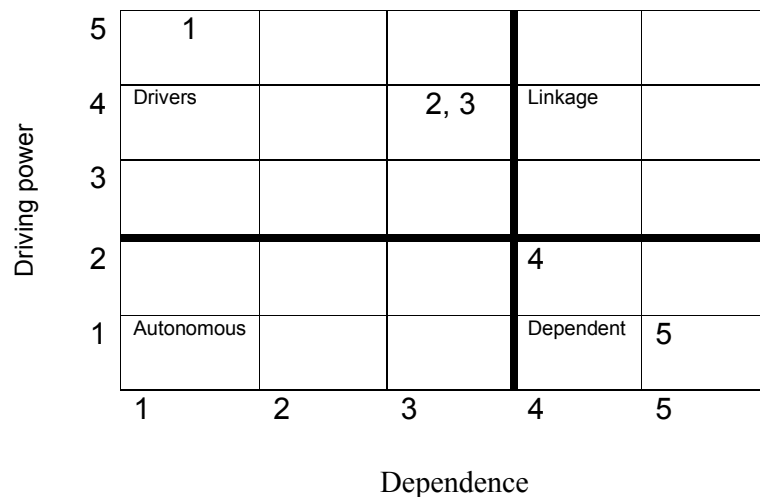


Figure 6-3 Driving power and dependence diagram

The major findings of this classification (Figure 6-3) were as follows:

1. The diagram indicated that there is no challenge that comes under an autonomous cluster. Autonomous challenges generally appear as weak drivers as well as weakly dependent, and are relatively disconnected from the system. These challenges do not have much influence on the other challenges of the system.

2. The lack of demand and company constraints have a weak driver power but strong dependence therefore they were classified as dependent challenges. The dependent challenges mean other barriers need to be addressed and removed before their removal.
3. The linkage cluster did not include any challenges. Linkage challenges have a strong driving power as well as strong dependence. These challenges are unstable because any action on these challenges will have an effect on others and also a feedback effect on themselves.
4. The government constraints, the financial constraints and the industry constraints appeared to be having strong driving power but weak dependence power. Therefore, they were classified in the independent/ driver cluster. The removal of these challenges will result in removing the other two challenges.

6.2.2.5. Partitioning the RM into different levels

From the final RM, the reachability and antecedent set for each barrier were derived and then the intersection of these sets was identified, as presented in Table 6-11. The challenge for which the reachability and the intersection sets were the same in the first iteration was assigned as the top-level element in the ISM hierarchy. Similarly levels were identified for other elements by duplication of this process. Once the level was identified for a challenge, it was discarded from the list of remaining challenges. Table 6-11 presented the first iteration which showed that lack of demand was found in the first level. Therefore, it was removed from consideration in iteration 2, as detailed in Table 6-12. Iteration 2 showed that company constraint was found in the second level. Similarly, iteration 3, presented in Table 6-13, showed that the financial constraints and the industry constraints were found in the third level. Consequently, the government constraints became the fourth level challenge. The iterations 1, 2 and 3 segregated the GBM barriers in a hierarchy of four different levels. These levels helped in developing the ISM model in the final step.

Table 6-11 Iteration 1

GBM barrier	Reachability set	Antecedent set		Level
		Intersect	Intersection set	
1	1, 2, 3, 4, 5	1	1	
2	2, 3, 4, 5	2,1, 3	2, 3	
3	3, 2, 4, 5	3, 1, 2	3, 2	
4	4, 5	4, 1, 2, 3	4	
5	5	5, 1, 2,3, 4	5	1 st

Table 6-12 Iteration 2

GBM barrier	Reachability set	Antecedent set		Level
		Intersect	Intersection set	
1	1, 2, 3, 4	1	1	
2	2, 3, 4	2,1, 3	2, 3	
3	3, 2, 4	3, 1, 2	3, 2	
4	4	4, 1, 2, 3	4	2 nd

Table 6-13 Iteration 3

GBM barrier	Reachability set	Antecedent set		Level
		Intersect	Intersection set	
1	1, 2, 3	1	1	4 th
2	2, 3	2,1, 3	2, 3	3 rd
3	3, 2	3, 1, 2	3, 2	3 rd

6.2.2.6. Developing the ISM model for GBM challenges

From Table 6-11, it was seen that the lack of demand was found at level one. Thus, it will be positioned at the top-level of the ISM hierarchy. This challenge will not help alleviate any challenge. The rest of the challenges have been positioned in the hierarchy, reflecting their levels, as presented in Table 6-12 and 6-13. The final ISM model for GBM challenges is shown in Figure 6-4 below. The arrow direction indicates the relationship between the different challenges. For example, the relationship between the financial constraints and the industry constraints was a two way relationship. Therefore, an arrow pointing in both directions was used to denote this relationship, while the relationship between the company constraints and the lack of demand was only one direction, in which the former can alleviate the latter. Therefore, an arrow pointing from the company constraints to the lack of demand was used.

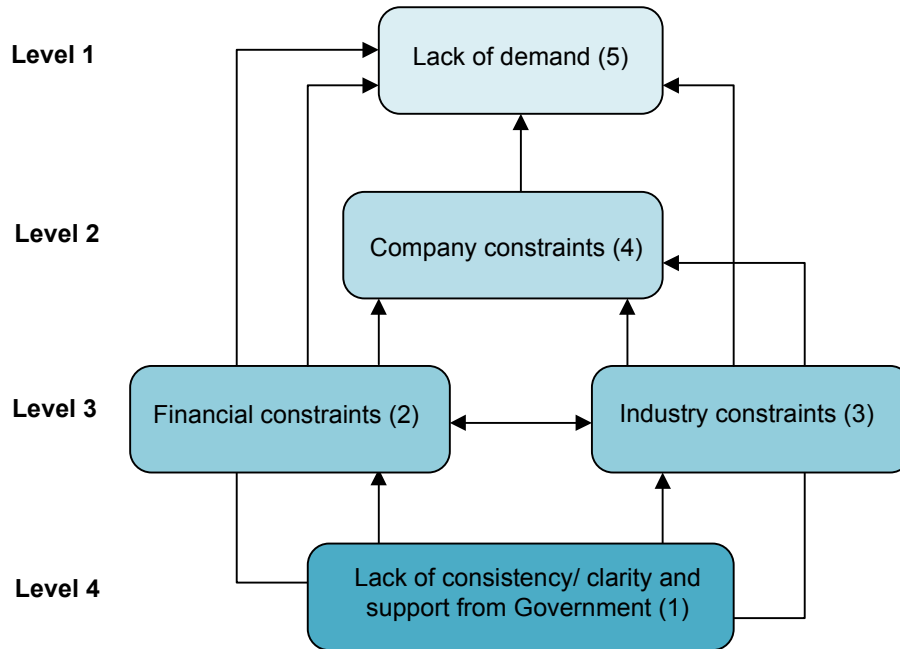


Figure 6-4 ISM - based model for the GBM challenges

It was observed from Figure 6-4 that the government constraints (challenge 1) was a significant challenge to GBMs transformation as it came in the base level of the ISM model. On the other hand, the lack of demand (challenge 5) was the GBMs challenge on which the effectiveness of GBMs depends because it came at the top level of the ISM model.

6.2.2.7. Discussion

The challenges hindering the GBMs transformations pose considerable threats both for managers and policymakers in the construction industry. Some of the major challenges have been presented here and put into an ISM model to analyse the interaction between them. These challenges need to be overcome for the success of GBMs transformations. The ISM-based model, developed in this study, provides management with a more realistic representation of the problems in green transformation. Several studies presented and documented various challenges hindering GBMs transformation and green growth but none of these examined the co-dependence between the challenges (Beltramello et al., 2013b; Häkkinen & Belloni, 2011; Lam, Chan, Chau, Poon, & Chun, 2009; Opoku & Ahmed, 2014; Zhang, Platten, & Shen, 2011). This study not only identified GBMs challenges based on empirical data, but also identified the relationships between them which can be considered as a novel contribution. The observations from the ISM model and driver-dependence diagram, which give important managerial insights and implications, are discussed below.

The government constraint was a very significant challenge at the bottom level of the ISM model, implying higher driving power. The government constraint, such as lack of consistency and clarity (challenge 1) leads to the financial constraints of lack of funds and insurance (challenge 2). In addition, the government constraint leads to the constraints at the construction industry level (challenge 3), where the industry still lacks acceptance and recognition of GBMs.

The financial constraints (challenge 2) and industry constraints (challenge 3) were interrelated. Good financial support is essential for the construction industry to recognise the true value of GBMs. At the same time, availability of robust data and good business cases from the industry will encourage different financial providers to invest in GBMs. Lack of financial and industry support will result in constraints at the company level (challenge 4). Therefore, before alleviating challenges 2 and 3 it will be difficult to alleviate challenge 4. The role of finance in the construction sector and green growth cannot be ignored. This was evident during the global financial crisis where the sector was adversely affected. In the green context within the sector, there is a widely held belief that going green is associated with high cost and financial hurdles (Vatalis et al., 2011). Thus, more effort is needed to eliminate the financial constraints, to unlock opportunities offered by GBMs.

Without the support of government, financial providers, the construction industry, and construction companies, it will be difficult to encourage the demands for GBMs. The ISM model above demonstrated that clients are not to be blamed for lack of GBMs. It also demonstrated that a large pool of support is needed for GBMs' transformation and uptake.

In summary, the construction industry is fast moving towards green transformation and GBMs are obvious candidates to lead this movement. Accordingly, the identification of the challenges affecting the transformation of GBMs assumes great importance. This can support top management in deciding the priorities hence it can proactively take steps in combating these challenges.

6.3. Interpretive ranking process (IRP) for GBM elements and benefits

The IRP evolved by combining and using the strengths of two techniques: namely, intuitive and rational choice which are used widely in the decision-making process. The IRP takes advantage of the analytical logic of the rational choice technique and couples it with the strengths of the intuitive technique at the elemental level. It is also rooted into the strength of a paired comparison approach to minimise the cognitive overload. In the following subsection, the IRP is used to examine which GBM element has a more dominant impact on various benefit areas for construction businesses.

6.3.1. Identifying GBM elements to be ranked with reference to benefits

As explained in Chapter 4, the first step in the ranking process is to identify two sets of variables. One set is comprised of variables that are to be ranked and the other set is comprised of reference variables. In this research, the ranking set consists of 'GBM elements' and the reference set consists of 'benefits' for companies, as shown in Table 6-14 below.

Table 6-14 Variables of GBM elements and benefit areas

Components	Variables
GBM elements	GVP - Green value proposition
	TG - Target group of GBMs
	KA - Key activities for GBMs
	KR - Key resources for GBMs
	FL - Financial logic of GBMs
Benefit areas	B1 - Credibility/ Reputation
	B2 - Financial
	B3 - Long-term viability

In the Table above, there are five GBM elements: namely, GVP, TG, KA, KR, and FL and three benefits: namely, B1, B2, and B3. The decision problem is aimed at ranking the GBM elements with reference to their influence on various benefits to companies.

6.3.2. Establishing the contextual relationship between GBM elements and benefits

Once the variables are identified as in the previous step, the next step would be to clarify the contextual relationship between them. In the case of this study, the contextual relationship is the 'influence of GBM elements in different benefit areas'. The elements having more influence will be ranked higher. These relationships have been extracted from the interviews because the participants highlighted the different relationships explicitly and implicitly. By reading the interviews several times, the researcher was able to document these relationships to strengthen the findings.

6.3.3. Developing a cross-interaction matrix of GBM elements and benefits

A cross-interaction matrix questions the existence of a relationship between each GBM element and the benefit areas. A binary matrix can represent the cross-interaction of variables with '1' indicating a relationship between the pair of variables and '0' indicating no relationship. Table 6.15 below presents the cross-interaction matrix.

Table 6-15 Cross-interaction matrix (binary matrix)

	B1	B2	B3
GVP	1	1	1
TG	0	1	0
KA	1	1	0
KR	1	1	1
FL	0	1	1

6.3.4. Interpretation of interactions

The cross-interaction- binary matrix is converted into a cross-interaction -interpretive matrix by interpreting all the interactions with entry '1' in terms of the contextual relationship. For example, (GVP, B1) is interpreted as 'GVP will enhance a companies' reputation' as shown in Table 6-16. As mentioned earlier, these relationships and interpretations were obtained from the interviews conducted with the construction industry practitioners. The interpretive matrix becomes the essential data for comparison, for the purpose of ranking the variables.

Table 6-16 Interpretive matrix

	B1	B2	B3
			GVP will help business viability
GVP	GVP will enhance a companies' reputation	GVP will increase a companies' turnover	because it is future proof
		TGs will buy companies' products & services which will result in enhancing financial returns	
TG			
		KA will help in achieving cost savings	
KA	KA will enhance credibility		
	KR will build reputations	KR will give differentiation and	KR will help efficiency which
KR			

	eventually will result	enables businesses to
	in enhancing	survive
	financial returns	
		FL will help
FL	will help	businesses to be
FL	increasing turnovers	economically viable

6.3.5. Pair-wise comparison

The interpretive matrix is used as a foundation to pair compares the GBM elements (ranking variables) with reference to the benefit areas (reference variables), one by one. For example, the GBM element GVP is compared with the GBM element TG with reference to various benefits, B1, B2, and B3 respectively and the interpretive logic of the dominating interaction between GVP and TG with reference to the various benefit areas which are recorded in the knowledge base, and presented in Table 6-17. It is worth nothing that the GBM elements (ranking variables) are not directly compared, but rather their interaction with reference to the benefit (reference variables) is compared. All the dominating interactions are summarised in the dominating interaction matrix, as shown in Table 6-18.

Table 6-17 Interpretive logic – Knowledge base – ranking of GBM elements with reference to benefits

Paired comparison	Interaction with benefit	Interpretive logic
GVP dominating TG	B1	TG is not having any direct impact
	B3	TG is not having any direct impact
GVP dominating KA	B1	GVP has more influence than KA in enhancing a companies' reputation
	B2	GVP is more important in generating revenues
	B3	KA is not having any direct impact
GVP dominating KR	B2	GVP contributes more to generating sales and revenues compared to KR
GVP dominating FL	B1	FL is not having any direct impact
TG dominating GVP/ KA/ KR	B2	TG has the greater power to buy green products and services, thus enhancing financial

		benefits for companies
KA dominating TG/ FL	B1	Responsible KAs have more influence to enhance credibility of companies
KR dominating GVP/ TG/ FL	B1	Reputation is classified as an intangible KR
	B3	KR has more influence in helping companies to survive by improving efficiency
KR dominating KA	B1	Reputation is classified as an intangible KR
	B2	KR has more influence in improving financial returns
	B3	KA is not having any direct impact
FL dominating GVP/ KA	B2	A well designed FL will increase revenue generation
	B3	FL has more influence in securing viability of companies
		KA is not having any direct impact
FL dominating TG	B3	TG is not having any direct impact
FL dominating KR	B2	A well designed FL has more influence in securing financial benefits than KR

Table 6-18 Dominating interaction matrix

	GVP	TG	KA	KR	FL
GVP	---	B1, B3	B1, B2, B3	B2	B1
TG	B2	---	B2	B2	---
KA	---	B1	---	---	B1
KR	B1, B3	B1, B3	B1, B2, B3	---	B1, B3
FL	B2, B3	B3	B2, B3	B2	---

6.3.6. Developing the dominance matrix

The numbers of dominating interactions are summarised in the form of a dominance matrix, which gives the number of cases (benefits) in which one GBM element (ranking variable) dominates or is being dominated by another GBM element (ranking variable). In Table 6-19 below, the dominance matrix of the GBM element with reference to the benefits for businesses is given. The sum of rows gives the total number of cases in which the respective GBM element dominates all other GBM elements. The sum of a column indicates the total number of cases in which a particular GBM element is being dominated by all other GBM elements. The difference of number dominating in column 'D' and the corresponding number being dominated in row 'B' gives the net dominance for a GBM element (D - B). The GBM element having the highest net positive dominance in the maximum number of benefits is ranked 1, followed by the next lowest and so on. For example, in Table 6.18, the KR had highest net positive dominance and was ranked 1, the GVP and FL were ranked 2 with a net positive dominance of 2, the TG was ranked 3 with a net negative dominance of -3, and the KA was ranked 4 with a net negative dominance of -7. The sum of all net dominances for various GBM elements should come out to be zero, (2-3-7+6+2=0), as presented in the table below. This can be used as a cross-check to validate the dominance relationships.

Table 6-19 Dominance matrix - Ranking of GBM elements with reference to benefits

						No. Dominating (D)	Net Dominance (D - B)	Rank Dominating
	GVP	TG	KA	KR	FL			
GVP	—	2	3	1	1	7	2	2
TG	1	—	1	1		3	-3	3
KA	—	1	—	—	1	2	-7	4
KR	2	2	3	—	2	9	6	1
FL	2	1	2	1	—	6	2	2
No. being Dominated (B)	5	6	9	3	4	27 (Total Interactions)		

6.3.7. Interpretive ranking model

The interpretive ranking model displays the final ranks of the GBM elements diagrammatically. This model displays the final ranks of the ranking variables. Figure 6-5 illustrates the ranks of GBM elements with reference to various benefit areas. The arrows in the diagram represent the benefits in the cases where a particular GBM element was dominating the other GBM elements. For all the GBM elements, the numbers dominating and numbers being dominated were summarised within brackets. It also interpreted how each GBM element was influencing various benefit areas.

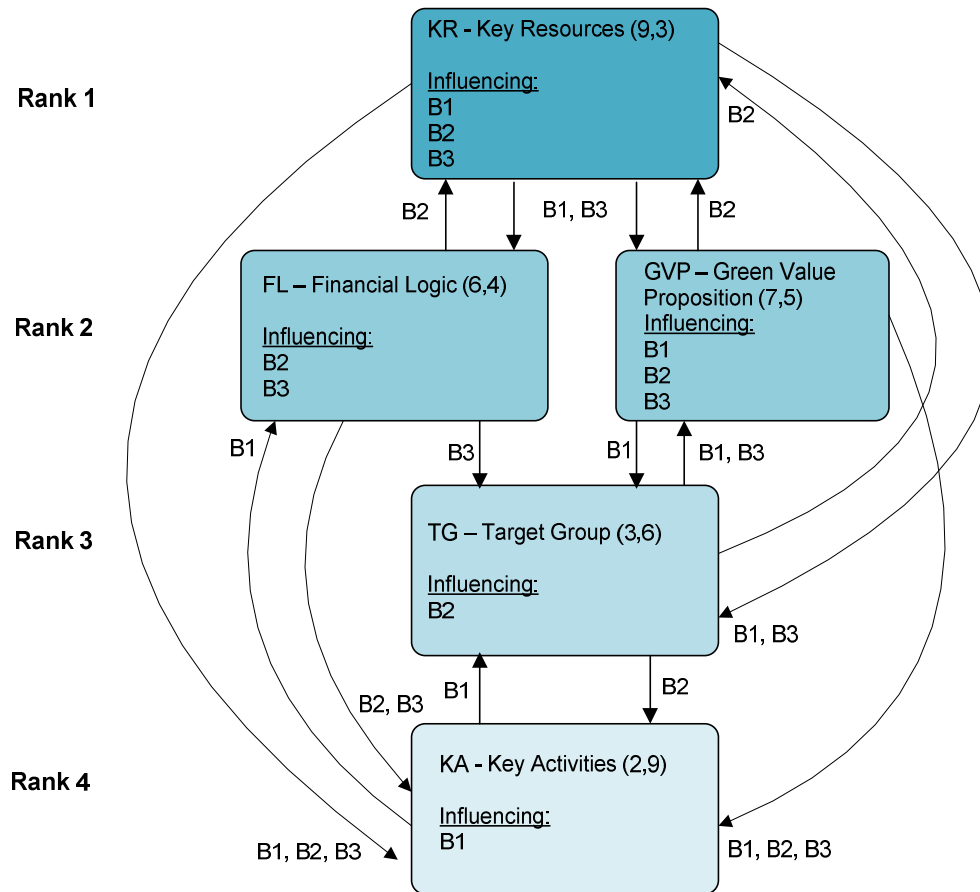


Figure 6-5 Interpretive ranking model for GBM elements with reference to benefits

The ranking model shown in the figure above interpreted the influence and dominance of various GBM elements on the benefit areas. This model will be helpful in developing GBMs to enhance the benefit areas which are the ultimate goal for companies.

6.3.8. Discussion

From the IRP model in Figure 6-5 above, the KR has proved to be an important GBM element that influences all benefit areas including: credibility/ reputation (B1), financial benefits (B2), and long-term viability (B3). When companies decide to develop GBMs or offer GVPs, they usually modify and acquire key assets in doing so. These assets or resources will become essential in achieving the aforementioned benefits. The importance of resources is also supported in the literature and is better known as RBV. The RBV suggests that a company can utilise its resources and capabilities to create competitive advantage, which ultimately will result in superior value creation. It also gives the resources a major role in helping companies to achieve higher organisational performance (Kraaijenbrink, Spender, & Groen, 2010). The difference between the RBV and the KR of GBM is that the former focuses on the internal resources only while the latter includes internal and external resources. Therefore, it can be argued that the KR has a more inclusive nature and at the same time represents only one element of the GBM however it proves to be more influential on benefit gaining for businesses. The inclusive nature of the KR can facilitate alliance and partnership relationships that are core themes in the construction research agenda (Fiedler and Deegan, 2007; Khalfan, McDermott, Li, and Arif, 2008). Companies in partnership can come together and access different resources that may be difficult to own and control internally. Another support for resources, and particularly human resources, was found in the recently published Construction Strategy 2025. The strategy begins with a clear vision of where the UK construction will be in 2025 and positions people at the centre of the debate, with the aim of increasing workforce capability in the construction industry. For construction companies, it is important to look at the KR needed for GBMs as a prerequisite to gaining various benefits, rather than a roadblock. It is also much more feasible for companies to exploit opportunities using existing resources in a new way rather than trying to acquire new resources for each different opportunity. For example, Casadesus-Masanell and Ricart (2011) argued that successful BMs are self-reinforcing by accumulating resources. The leaders of these BMs gathered those resources not by buying them, but by making smart choices such as reputation, asset utilisation, and production experience. These findings may motivate more construction companies to transform their BMs into green. It is also worth noting that these findings tell managers

to develop and obtain the KR, but they are silent on how this can be done as it goes beyond the scope of the study.

The GVP and FL were at Rank 2 on influencing benefits gains for businesses. The construction literature emphasised the benefit of offering GVP such as innovation opportunities, reducing life-cycle cost, efficiency, increased business productivity and achieving long-term profits (Alec et al., 2012; Bartlett & Howard, 2000; Vatalis et al., 2011). The interpretive ranking model illustrated in Figure 6.5 above partially agreed with these findings, where it showed that the GVP has influenced all benefit areas (B1, B2, and B3). However, the model did not position the GVP at Rank 1 as one would expect, instead it positioned the KR first, as explained above. The model's findings signified the importance of offering the GVP but also suggested that it should not be expected to benefit businesses directly but instead it will be the KR that is developed to offer the GVP. Consequently, offering GVPs can be a means towards acquiring and developing valuable KR to eventually benefit businesses and at the same time internalise GBMs. The FL appeared to influence only two benefits (B2 and B3) because it focuses on cost and pricing which are major contributors to profit making and viability of businesses. A well designed FL can lead to sustained businesses and new opportunities and eventually to tangible benefits. However, the construction industry has been hard hit by the economic downturn which has affected the FL of the industry. Therefore, it becomes crucial to create conditions such as access to finance and payment practices to enable the industry to thrive and invest in people and technology (KR).

The TG was ranked as the third important element influencing benefit areas for businesses. It influenced only one benefit (B2) which came as surprise because clients/stakeholders (TG) have been at the spotlight for long time and they have been blamed for all the slowness of the green movement in the industry (Opoku & Ahmed, 2014; Pitt et al., 2009). The influence of the TG on financial benefits (B2) stems from the power of clients in buying the GVP and hence improving sales returns for companies. However, the TG appeared to have less influence on the long-term viability benefits and it can be significant for companies to realise that the viability of their businesses depends mainly on internal rather than external elements. This implies that construction companies should take full responsibility in enhancing and sustaining their businesses by securing appropriate resources, designing finance, and offering the GVP. To increase the TG's influence on businesses viability, it might be useful to deal with clients as 'the

stakeholder' rather than 'the paying customer' (Walker, 2000). The quality management (ISO 14000 dedicated to environmental management issues) suggested that stakeholders can provide valuable information about how they are affected by the GVP and can co-operate with those delivering the output.

The KA is positioned in the final rank (Rank 4) and appeared to have the least influence on benefit areas compared to the rest of the GBM elements. It mainly influenced the reputation benefits (B1) which can be due to the direct link between how companies perform and their reputation in doing so. For example, a construction company which has a GBM will perform its activities in a more environmentally friendly manner by for instance, generating less waste, using renewable sources, and consuming less energy. The implication of these findings might be of interest to construction companies because it seems that the core business (KA) does not have a major impact on benefits. In other words, a construction company may perform any KA as long as it adheres to environmental requirements and still gains various benefits through the rest of the GBM elements such as KR, GVP, and FL. At the same time, it is essential to consider the GMB elements as a whole and well reinforced system.

In summary, the relationship which developed between the GBM elements and various benefit areas using the IRP techniques can be considered as a novel approach, contributing towards the appreciation of GBMs. The youthfulness and murkiness of the GBM concept poses enormous challenges to academics and practitioners alike, particularly within the construction context. This study aimed at addressing some of these challenges and shedding some light on the concept and its associated benefits.

6.4. A guideline for GBMs implementation

The empirical findings from Chapter 5 and this Chapter are accumulated to propose a guideline to be used by construction companies managers. Despite the non-linear nature of GBMs implementations, it is still worthwhile to define specific phases to structure the tasks that need to be completed when developing and implementing GBMs as if they were in fact linear. The aim of this guideline is to help busy managers to understand and follow an easy outline which can then be adapted to address more complex situations. The guideline is illustrated in Figure 6-6 and explained next.

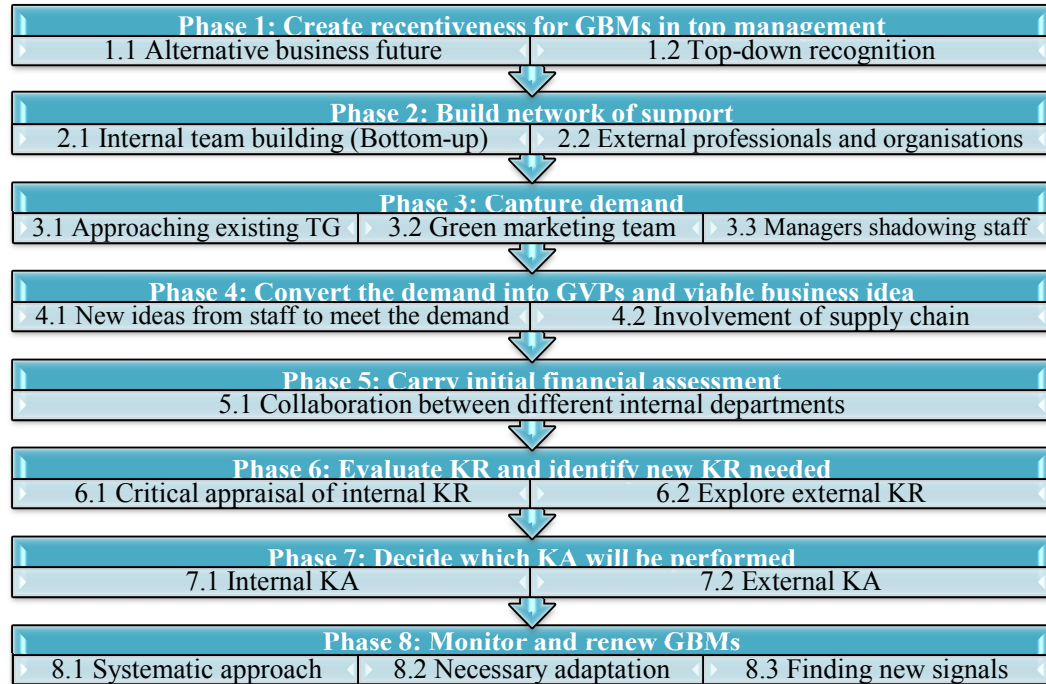


Figure 6-6 A guideline for GBMs implementation

As presented in the Figure above, the guideline is comprised of eight distinguished phases as follows:

Phase 1: Create receptiveness for GBMs in top management

The findings suggested that there is great ambiguity surrounding GBMs therefore it is important to conceive this ambiguity by managers as something to be embraced rather than feared of and avoided. In addition, GBMs involve major yet deliberate change that requires the full buy-in of top management. For these reasons, Phase 1 is concerned with creating receptiveness among the top management team. Phase 1 can be achieved by addressing alternative business future with scenarios of green growth and low carbon future as demanded by the market and legislation. It can also be achieved by creating top-down recognition and acceptance. Phase 1 aims at creating champion and leadership within the construction companies to embrace opportunities offered by GBMs.

Phase 2: Build network of support

The empirical findings showed that the top-down approach is not enough for GBMs growth. Beside this, a large pool of support is needed internally and externally and hence Phase 2 addresses this idea. Phase 2 builds the base of critical supporters such as team members who are keen to take the GBM challenge and external professionals and

organisations that have the necessary knowledge and expertise of GBMs implementation. The base of supporters is essential because GBMs are characterised by uncertainty and lack of information which can be major roadblocks for the construction companies to unlock the potentials of GBMs.

Phase 3: Capture demand

This Phase is of high importance and projects outward to capture clients (TG) demands. It requires great effort and involvement of both staff and management teams. It starts with the existing TG to assess their current needs and even to predict future needs and demands. However, it assumes good relationship between a given construction company and their clients base. Public clients can be always a good start point to capture their green demands due to self-imposed regulations and incentives.

Different team members can shadow each other to maximise the outcome of this Phase. In addition, managers can shadow their staff to capture and understand the demand. It is initially important to create a dedicated team to capture green demand and green business opportunities until the whole company is mature enough to capture these demands. It is also important to develop a system allowing staff and managers to record the captured demand for future use and appraisal. These recorded demands can be invaluable learning base.

Phase 4: Convert the demand into GVPs

Once the demand has been captured, Phase 4 is used to develop and generate new GVPs and business ideas. Both the creativity of staff members as well as the supply chain should be utilised to think of new or better ways to meet the demand by adopting environmentally friendly practices. For the construction companies, it is essential to accept that not each demand can be converted into GVPs due to various reasons that can be beyond their territory.

Phase 5: Carry initial financial assessment

Phase 5 is crucial to justify the business case and to bring different departments within the business together. It is essential to involve financial departments from an early stage to ensure consensus between the finance, marketing, and environmental opportunities departments. It is also beneficial that the different departments have a level of commercial awareness and being able to build initial business case for each GVP. In

this Phase, it is crucial for decision-makers not to oversimplify this exercise because it will lead to GBMs flaws.

Phase 6: Evaluate KR and identify new ones needed

Phase 6 critically assesses which KR will be valuable to create a specific GVP. It also identifies outsourced KR needed to create the value. It may be more feasible for construction companies to smartly exploit opportunities using existing KR in a new way rather than trying to acquire new KR for each different opportunity.

Phase 7: Decide which KA will be performed

Phase 7 is not only concerned with implementing the actual GBMs activities, but also includes dealing with the impact of the GBMs. New activities need to be reinforced while old ones may be discontinued. The KA may prove not viable to be performed within the company hence managers should be prepared to explore external alternatives.

Phase 8: Monitor and renew GBMs

During Phase 8, the success or failure of the GBM is monitored in a well-designed flexible system. Since no GBM implementation is perfect, adaptation will be expected. Eventually, new signals may be found that can trigger new GBMs implementation.

6.5. Contributions of the study

The extant research on BMs has not extensively investigated the concept of BMs and its benefits in the construction context (Pearce, 2003). In addition, the development of GBMs in the construction context has been a neglected area of study. This was evident by the absence of the literature dealing explicitly with this area of research in the construction discipline. Therefore, this study reviewed the literature across other disciplines to initially explore and understand BMs leading to a better understanding and definition of GBMs. The intention of this review was to promote learning to understand the economic complexity of environmental sustainability in the construction context. Therefore, this study justified the relevance of GBMs to link environmental and economic sustainability in a systematic manner. Furthermore, this study advocated the market drivers and forces to encourage the environmental reform in the construction industry by addressing the benefits associated with GBMs. Market-based approaches

have gained credibility recently to tackle sustainability issues (Krämer & Herrndorf, 2012).

The benefits of adopting GBMs approach are summarised from previous research and as follows:

- GBMs have the potentials to deal holistically with the complex economic nature of environmental sustainability (Sommer, 2012)
- GBMs can help translating abstract environmental strategies into viable business ideas (Sommer, 2012)
- GBMs provide a better understanding on how green or environmental value is captured, turned into profitable products and services and how to deliver satisfaction to customers (DBA, 2012)
- GBMs acknowledge the interdependencies between their different elements in which a change in one GBM element can affect the whole model (Pekuri et al., 2014)
- GBMs can systematically create and lead fundamental transformations of conventional BMs to make them green and profitable (Beltramello, Haie-Fayle, & Pilat, 2013; Sommer, 2012).

To embrace these benefits, it was essential to clarify and explain the GBM concept. As a result, this research presented a clear definition of GBMs based on the literature survey and construction practitioners perspective as follows:

A BM is considered to be green when a business changes element (s) of its BM to create and capture a business opportunity or a proposition for TGs that provides environmental improvement coupled with economic benefits.

It can be said that the more elements of a BM which are changed and have a green result and the more deeply a green change is taking place within the individual elements of the BM, the greener the BM and the higher potential for creating radical green transformation (Henriksen et al., 2012). The definition stated a change on BM elements to move to a GBM, hence it was crucial to identify these elements. Accordingly, this research introduced and adopted five GBM elements from the business management literature into the construction context (Section 3.5). The GBM elements give a

construction company a simple yet powerful tool to understand its current BM in order to systematically challenge the ways it does business and thereby enable the company to think differently and create new alternative GBMs. Furthermore, the GBM approach provides the decision-makers with tools based on the principle that systematic analysing and transforming of the GBM elements is one of the best routes to an optimal decision regarding environmental issues. Moreover, GBMs supplement the other predominant approaches such as integrated solutions and lean construction that aim to improve the performance and value creation competency of the construction industry (Pekuri et al., 2014). However, the GBM approach goes one step further and considers and assesses the value capture competency by taking clients (TG) into account when creating the value. It also offers a systematic perspective to analyse value creation and value capture activities which is less evident in integrated solutions and lean construction approaches (Pekuri et al., 2014). A key to develop a successful GBM is to respond and address the requirements of specific TG. By adopting the GBM approach, the construction industry may detach itself from the currently dominating cost-driven approach and be able to focus more on delivering value for its clients.

The study mapped the practical changes within construction companies that associated with GBMs transition to portray a reasonably clear picture for potential companies that consider implementing GBMs. It developed a structured relationship between the various GBM elements by utilising ISM technique (Section 6.2.1). The ISM technique empirically demonstrated the systematic nature of the GBMs elements, hence encouraging wider adoption of system thinking to sustainability studies. System thinking suggests that the component parts of any system can be best understood in the context of relationships with other components and other systems, rather than in isolation (Pullen et al., 2010). The resulting ISM-based model for GBMs element (Figure 6-2) has visualised the GBM and changed the nature of the concept from intangible business logic to a more effective management tool which can be used for understanding and describing the business logic of a company involving in green practices.

This study contributed originally to GBMs research by ranking the different GBM elements with reference to key benefit areas to indicate which elements have the leading role in delivering various benefits to companies (Section 6.3). This ranking was obtained by using the IRP technique that is new to the construction and GBMs research

(Figure 6-5). This study not only identified GBMs benefits but also recognised the various challenges facing GBMs development (Section 5.4.5). It also generated the relationship between these challenges by applying ISM technique to highlight the root challenges (Section 6.2.2).

The focus on developing integrated and sustainable approaches in the construction industry has resulted in a shift in attention from the assessment of problems to the formulation of solutions that will meet both the present and future aspiration of the industry (Aho, 2013). The need to focus on solutions applies just as much to GBMs. However, this is taking place against the background of limited research about the full extend and significance of GBMs. This study can be considered as one that contributing to this area and may pave the way for future related studies.

6.6. Validation and refinement of the findings

Based on the empirical results, this study developed a two level relationship ISM-based model for GBM elements in this Chapter (see Section 6.2.1). In addition, the study proposed a guideline for GBM implementation (see Section 6.4). To verify the relevance of these findings, feedback from academic and practitioners was sought to confirm and refine the findings or otherwise reject them. Some of the participants were selected from the main data collection phase that demonstrated detailed knowledge and familiarity with GBMs and expressed their willingness to be contacted for further participations. To maximise the effectiveness of the outcome of this study, new participants were selected based on their academic knowledge and experience of GBMs and relevant areas of research such as the construction economics and sustainability. In general, BMs and GBMs are relatively new disciplines in the construction context in particular in the UK. Therefore, it proved difficult to find highly specialists experts in these areas. Nevertheless, the participants in this validation phase were contacted in advance and provided with the relevant information to ensure that they have some degree of familiarity with the subject under investigation. In most cases, a pre-interview meeting was organised to discuss the relevant issues of the study and to clarify what is required during the validation phase. It is worth noting that the academics were selected based on their track records and heavy involvement with the construction industry. Table 6-20 details the participants profile.

Table 6-20 Participants profile for the validation phase

ID	Type of organisation	Job title	Participated in the main data collection
AC1	University	Chair of Construction and Property Economics	No
AC2	University	Deputy Head of School	No
AC3	University	Associate Head for Enterprise & Engagement	No
AC4	University	Professor of Real Estate Business	No
C1	Contractor	Director	Yes

A validation form was provided to the participants containing a summary of the ISM-based model for GBM elements (see Figure 6-2) and the guideline proposed in this Chapter (see Figure 6-6). It is presented in Appendix D for further clarification.

The validation form contained a structured set of questions on key issues such as: the relationship between the different GBM elements; the representation of GBMs development; the usefulness of GBMs elements to the construction practitioners in green growth; and the usefulness and easiness of the implementation guideline. The validation form also contained a question about final suggestions and comments to give the participants an opportunity to express any further views.

6.6.1. Validation of the ISM-based model for GBM elements

The participants were asked whether the ISM-based model reflects the practical relationships exist among the different GBM elements and portrays a true picture of GBMs development. This question was aimed at establishing a system view of the entire relationships among the different GBM elements. It was also aimed at verifying the usefulness of the five elements used in this study. In addition, the participants were invited to add any missing elements and suggest ways of improvement for the model. Finally, they were asked how the model can be made useful for the construction industry practitioners to assist them in green growth. These questions generated an interesting discussion and helped in improving the final model. The findings are

presented next and organised into three themes as follows: GBMs elements and their relationships; surroundings of the model; and practicality of the ISM-based model for GBM elements.

GBMs elements and their relationships

There was a consensus that the ISM-based model for GBM elements represents a simple and high-level illustration of the essential elements that required in transforming construction companies BMs. For example, AC4 who is an established academic of BM research confirmed that the elements used in this study are among the most used elements in BMs research and he did not suggest adding any further elements. According to him, *“In general, this model has most of the often used business model element.”* The participants felt that the model has the potential to explain the way in which construction companies operate and it may help managers to realise the way their business is running. This was a good starting point for ensuring that the model represents what it sets out to represent.

The ISM-based model was organised into two levels (see Figure 6-2) with level II being the foundation level of the model and includes the driving elements of the GBM. The participants agreed with this division and felt the GVP and FL are essential for the whole GBM transformation and development in particular in the context of the construction industry consequently companies should start from level II and proceed to level I. to increase the clarity of the model in this study, AC4 suggested to incorporate the often used terms of value creation and capture. He believed that these terms are easily understood in the BM and GBM disciplines. As a result, we used these terms to categorise the elements of the GBM in the final version of the ISM-based model as portrayed in Figure 6-7. It is worth noting that these terms have been used in conceptualising the GBM in Chapter 3 (refer to Figure 3-4 for more details).

AC3 viewed the model as follows:

“It’s a defensible model, which is level 2, understand what you’re doing and whether there’s a need for it, whether you will make any money. Level 1 is execute it and internal processes. That makes sense to me, butwould target groups sit in that level 1?”

He suggested that the TG can be considered as a marketing function that is subset of the KA performed by companies. Another suggestion was that to position the TG as an external element to the model because both KA and KR are internal functions where companies have considerable control over them unlike the TG. As explained in previous chapters, the GBM focuses on how the elements of the system come together as a whole (Magretta, 2002). In other words, it is not about the details of isolated elements; rather, it is about how these elements reinforce each other to produce an overall systematic approach for green value creation and capture. In addition, the incorporation of value creation and capture in the final version of the model (Figure 6-7) will facilitate better understanding of these elements, reduce the ambiguity around the TG element, and draw boundaries for the model. Nonetheless, AC3 argued that the radical nature of GBMs may not best fit the construction industry because its response to the environmental issues tends to be reactive, discontinuous, and ad-hoc.

According to AC3,

“Construction companies tend not to be very radical because they are quite risk averse, so what happens is the price of landfill goes up so they put a new landfill process in place, or they have a demand for doing something differently from building regulations so they change that process. So they are more iterative and incremental, rather than looking at their whole business. They may look as if they’re doing it, they say, we are now really green, but on the whole it is generally quite a piecemeal approach, and that is something to do possibly with the culture of the construction industry.”

However, we suggest that the GBM focus is not only on radical transformation but also on systematic transformation where the improvement and change of one element may result in changing another element. In addition, the GBM strength stems from its concentration on value creation and capture with emphasis on clients role. This is highly relevant to the construction industry because its services are generally triggered by clients. Furthermore, there is a growing interest in the construction discipline to adopt GBMs thinking and approaches in particular within sustainability arenas demonstrating an emerging new area of research and justifying the gap that this study intends to fill (Aho, 2013; Mokhlesian & Holmén, 2012). The final version of ISM-based model for GBM elements is shown in Figure 6-7 below.

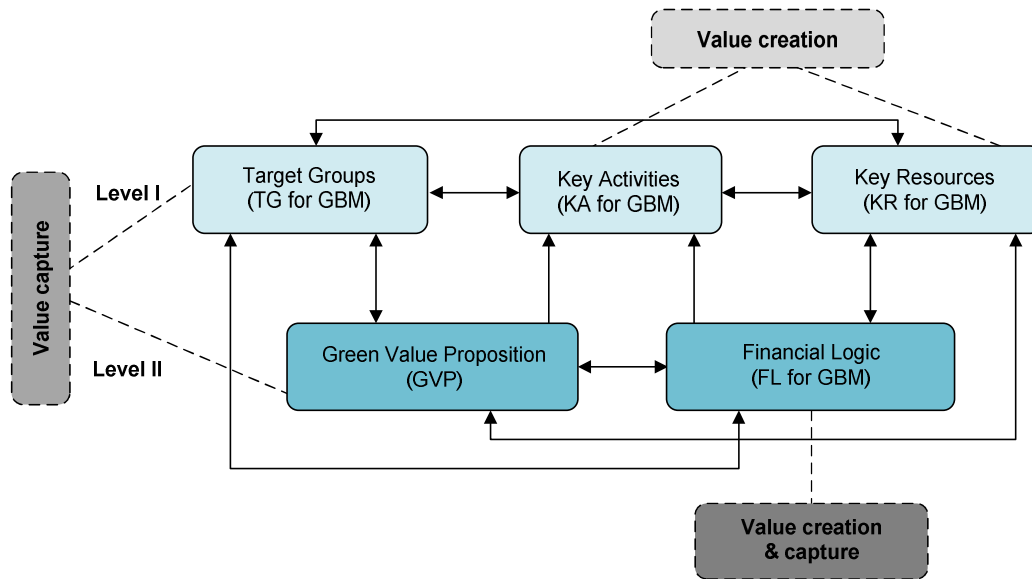


Figure 6-7 Value creation and capture of GBM elements

Figure 6-7 presents the final version of the ISM-based model for GBM elements incorporating the value creation and capture perspectives of the GBM as suggested by AC4. In this model, KA and KR elements constitute the value creation perspective while the GVP and TG elements constitute the value capture perspective. Value creation and value capture involve financial arrangement such as cost and revenues (FL). For example, a construction company may assemble a bundle of resources and activities which, when combined, will create value for clients or users. This combination will be done partly within the company and partly externally. The outcome will be a GVP that will be offered for customer segments and generate revenue streams. This determines the value capture for the company.

ISM-based model for GBM elements and its surroundings

C1 argued that the model should incorporate critical drivers of GBMs such as champions for both construction companies and clients. AC2 added to this and suggested that the model seems inward looking and do not reflect the dynamism and context in which the construction industry operates. He indicated that the model needs to address the surroundings and the current fast-changing environment. He stated that:

“I call it the permeable system. They are not watertight; a company doesn’t operate in isolation. It is so influenced by the environment, the market

behaviour of competitors, of clients, change in legislation, in social attitudes. All these things affect what goes on internally and they evolve over time and move on.”

It can be suggested that the aim of this simple model is to capture the essence of transforming a BM into a green one. It also aims at highlighting the interrelationship between the elements of the GBM to eventually help companies to achieve radical transformation of their BMs based on green values. Furthermore, the focus on just five elements will generate a clear picture of the GBMs development and transformation. These five elements concentrate on the main characteristics of GBMs and not on individual GBMs initiatives and practices that may require more detailed explanations. Another important aspect of these elements is that they provide a common language of GBMs. By providing a common language for GBMs, the GBM elements allow construction companies to tap into the insights of green value creation and capture. Although there is a rational behind concentrating on the GBM elements, it was essential to embrace the participants views on highlighting the wider construction business environment. Therefore, Figure 6-8 was developed to present the relationship between the GBM of a construction company and the wider business environment.

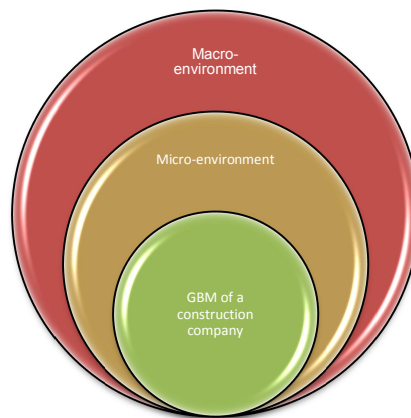


Figure 6-8 The GBM and the business environment

In Figure 6-8, the macro-environment includes political/ legal, economic, social/cultural, technological, and environmental factors. These factors are in constant change and the company has no control over them however agile companies can react fast to macro-environment. On the other hand, the micro-environment comprises of suppliers, competitors, clients, and relevant stakeholders. Companies have some degree of control over the micro-environment unlike the macro-environment. Consequently,

the GBM of a construction company will be affected by these two environments. It is worth noting that the GBM is fully controllable to the company although it includes external elements such as TGs (clients) and suppliers (sub-element of the KR) that are part of the micro-environment. However, companies can influence clients and suppliers by building strong relationships and communicating effectively. For these reasons, this study has concentrated on the GBM elements only because these elements can generate insights to the construction companies and can help them to organise themselves internally to be better prepared for the wider business environment.

Nevertheless, we felt that an overall schematic view of the whole GBM development incorporating the findings from Chapter 5 and taking into consideration the views of the participants, AC2 and C1, may paint a true picture and reflect the complexity of GBMs development exercise. This schematic view as shown in Figure 6-9 is an application of the theoretical GBMs transformation developed in Chapter 3 (see Figure 3-5 for more details).

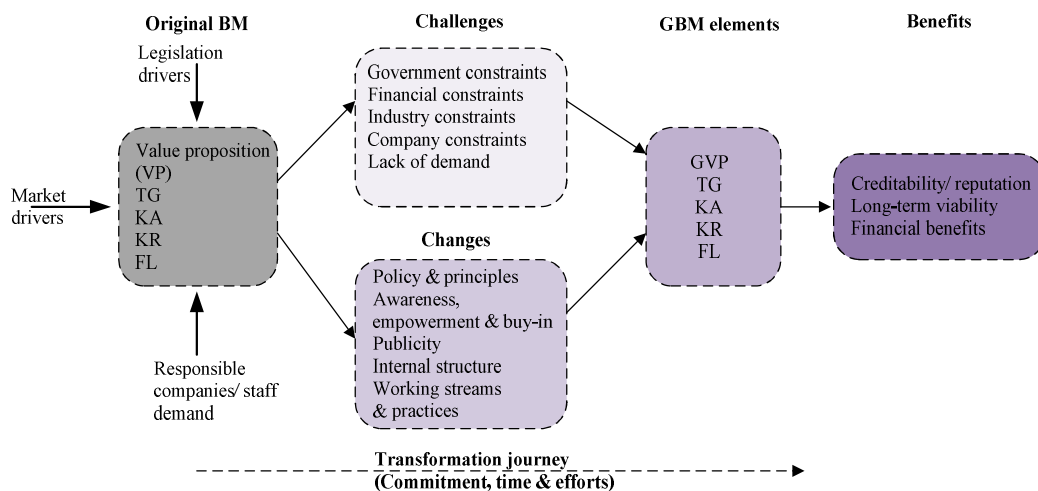


Figure 6-9 Overall schematic view of GBM developments and transformations

The Figure above shows an overall schematic view for GBM transformations. The existing BM of a construction company can be triggered by external, internal drivers or a combination of both to be transformed into a green one. Legislation and market opportunities constitute the external drivers while the internal drivers range from top management commitment and responsibility to staff demands. Nevertheless, there are enormous challenges that companies need to overcome during the transformation journey. Acknowledging these challenges will help managers to make an informed

decision. In addition, there are essential changes that will take place across the company in different levels. Then deeper changes will happen on the individual elements of the BM based on green value creation and capture. It is also necessary to take into consideration that a change in one element will lead to change in other elements. Although the transformation journey will entail commitment, integrity, efforts, and time, the benefits expected are not to be overlooked.

Practicality of the ISM-based model for GBM elements

Some participants suggested that the model developed in this study can be practical by incorporating quantifiable measures and metrics. For example, AC1 stated that:

“if you’re talking about value it means that something is quantifiable as far as I am concerned. If it is quantifiable and measurable then that shows how the value changes and you can start talking about targets. In anything to do with financial, economic aspects you need to show that it’s something that can be evaluated, produced targets, or certainly it will allow measurement of how things have changed.”

According to AC1, value indicates an accountable entity therefore he was expecting a form of financial metrics. He also suggested the integration of social return on investment (SROI) metrics to be able to measure and manage the full spectrum of green value that construction companies create and consequently the value they capture. Accordingly, the value creation and capture need to be converted into monetary terms where possible. AC3 and AC4 had the same views in showing some hard figures to be able to convince practitioners from the construction industry to buy-in to GBMs. AC3 added that the metric will help in signalling success and demonstrating the effectiveness of GBMs to the market and hence encouraging wider adoption.

As stated previously, GBMs research is a relatively new and emerging area of enquiry and in particular within the construction discipline. There is a paucity of quantitative empirical research available to inform the current study. Therefore, this study is a first step towards developing GBMs that are based on green value creation and capture with focus on clients requirements and fulfilment of their aspirations. It is an exploratory study aimed at defining GBMs through a set of well-known elements as found in previous studies and shedding some lights on the general characteristics of GBMs and their benefits and the challenges associated with them. The future research can include

more details by identifying individual GBMs and apply and quantify these elements to generate insight. It may be beneficial to allocate weight for each element with assistance from experts within the construction industry to measure these elements.

6.6.2. Validation of GBMs implementation guideline

The guideline was organised into eight phases as explained in section 6.4 (see Figure 6-6 for more details). The participants were invited to evaluate the guideline in terms of its easiness and usefulness to the construction practitioners. They were also invited to suggest any improvements to the guideline including re-order of the phases. The findings are presented next.

Main features and description of the guideline

The guideline was well received by the participants as the phases included essential information about the implementation of GBMs. For example, AC2 stated that the guideline visualises what construction companies do in terms of green value creation. Therefore, it will help managers to realise the green transformation that may be carried out in isolated steps and efforts. Furthermore, the guideline gives structure to the essential steps of GBMs implementation. AC4 added that the guideline has a similar composition of the traditional Demings quality circle or total quality management (TQM) guidelines. AC1 had a strong support to the guideline without any reservation or comments. He said it was easy to understand with clear and relevant phases to GBMs implementation.

However, AC3 argued that the linear representation of the guideline does not reflect the complexity associated with GBMs implementation in practice. This has been acknowledged in Section 6.4 where we clarified that despite the non-linear nature of GBMs implementations, it is still useful to define particular phases to structure the tasks that need to be completed when developing and implementing GBMs as if they were in fact linear. In addition, this guideline is more concerned with GBMs readiness and facilitating for GBMs development than to provide specific pre-planned steps for each GBM implementation because this will be company dependent. AC3 also suggested that the guideline needs to include a model of change management as follows:

“What the guideline suggests slightly that we do this, we do that, and actually it is more complicated than that. I understand that you have to do all of those

things, then you will be in a situation whereby you have more of a critical path running through, there are some tasks that are more iterative. Your guideline does need to reflect that, even if this is your top headline guideline you actually need to have another model that reflects the nature of the process and is executed as a change management exercise.”

There are similarities between the guideline for GBMs implementation and change management. For example, both practices are often initiated and driven by top management; they are influenced by internal and external factors such as motivation and competition; and they lead to radical success if they managed and executed well. However, change management focuses mainly on soft issues such as leadership, culture, and motivation (Sirkin, Keenan, & Jackson, 2005). On the other hand, GBMs adopt more holistic approach combining soft and hard issues such as resources, activities, and financial results.

Furthermore, AC4 suggested that the guideline may be useful if it can encourage companies to respond fast to the changing environment in particular in GBMs area. According to him, *“World changes so fast in this area that a more direct Demo-or-Die test at the beginning would help companies to react fast.”* As stated earlier, GBMs research is in its infancy at this moment of time. It is an evolving area and we have to consider the time needed before reaching well tested GBMs. However, it is often useful to be from the first-movers towards GBMs to reap the benefits offered by green value creation.

AC2 confirmed the importance of all the phases included within the guideline and he asserted that the top management commitment and recognition can play a vital role in developing GBMs. He also supported the involvement of supply chain in converting the demand into GVPs because as he stated *“the construction is the contribution of many parties, so you cannot be independent.”* In addition, he suggested that to swap the position of Phase 6 and 7 where the KA to be performed needs to be positioned before the KR needed as follows:

“You could turn that the other way round actually: you first decide the activities, what you’re going to do, then you identify the resources, then the activities you will offer is what your market intelligence tells you is required. You don’t create the resources and say, what do we do with them. You provide

the activities which is services to the clients, that you believe there will be a market for. Then you build up the resources.”

Figure 6-7 above has shown the mutual relationship between KA and KR elements and it may prove difficult to decide on which one comes first in the guideline. Nevertheless, these phases can help in understanding and identifying the range of available options to construction companies when implementing GBMs.

Moreover, AC2 confirmed the importance of Phase 8 where GBMs will be monitored and renewed. He added that the outcome has to be continually reported to the top management as to inform if the expectations being met or if there are opportunities for improvement. AC2 stated that:

“That takes you right back to there, to inform the top management as to how its behaving – is it working, are expectations being achieved, does it need to change? If you’ve over-estimated or under-estimated how this will work, that will need to change. So it’s continually feeding back to close the circle and monitoring.”

It seems that AC2 advocated the importance of highest level of management in supporting GBMs implementation. For this reason, he believed in *continually feeding back to the highest level of seniority*. He also said that managers who implement or clients who demand GBMs have some degree of risk acceptance because there are uncertainties associated with GBMs as well as trial and errors attempts and periods. However, risk averse companies may find it difficult to engage in GBMs implementation and development. According to AC2:

“Some companies are very risk averse and want someone else to try it first, watch what they do, if it works we might try and do it but we don’t want to be the first as its risky and might go badly wrong. If it fails then we haven’t lost anything, if it’s successful then we have to run to catch up with them but we get an advantage from their experiences. Different organisations behave in different ways.”

Consequently, it may be useful to encourage sharing best practices and emphasising the benefits for companies as a result of adopting GBMs and it may also help to stimulate

the market and create enough demand to encourage hesitant companies to tap into these green market opportunities.

In brief, the participants supported the guideline and did not have any significant issues with its layout and the various phases included. The findings from these validation interviews, such as representing the guideline in a non-linear format and incorporating feedback to the top management, are gathered to inform the final version of the guideline as shown in Figure 6-10 below.

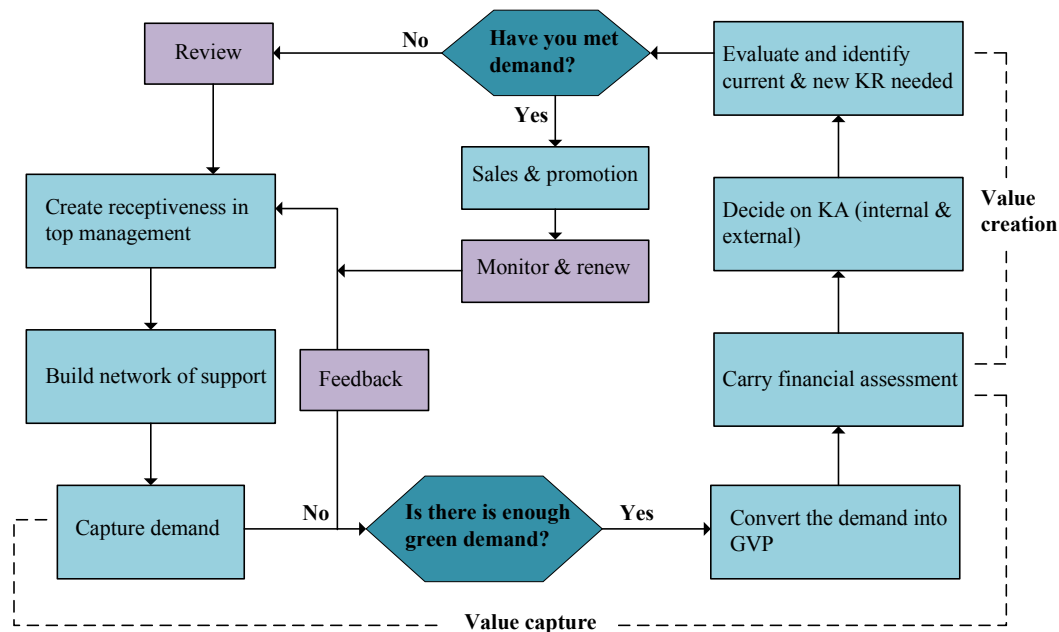


Figure 6-10 Modified guideline of the GBMs implementation

The Figure above presents the final version of the guideline as informed by the interview findings. The starting point for the guideline is the top management where receptiveness can be created by anticipating alternative business future in terms of green value creation. Managers need to evaluate the critical drivers of green future such as legislation, financial incentives, and clients demand. Therefore, the reasoning behind GBMs adoption is vital and needs to be identified and critically evaluated as how it will impact the business. In some cases, this top recognition may already be there and consequently it will need to be transferred to staff at the internal level. Staff buy-in plays a major role in implementing GBMs hence establishing communication and engagement channels will be the means to gaining acceptance and understanding of

GBMs implementation. It can be suggested that the greater the involvement of staff in the implementation process the greater the commitment to the company and the better the performance. In addition, bottom-up approach can generate commitment to the process of GBMs implementation through involvement and ownership in its formation. Once this has been achieved, it is crucial to reinforce and build the same support with external bodies and professionals to exchange knowledge and learn from best practices available. Top-down-bottom-up receptiveness and buy-in is a positive sign that the company is ready to dive in demand capture and understanding. It is assumed that the broad understanding of clients demand have been covered at the starting point to create a culture of recognition about the importance of GBMs demand and how it can be met given the available resources of the company. This phase captures demand from either existing or future potential clients (TG). By doing this, companies will have ideas of services that will be potentially appealing to the TG. The demand then will be converted into GVPs where financial assessment will be carried out to build strong business case. Then GVPs will be created by performing certain activities and using certain resources. However, it is essential to recognise that green value creation may involve external parties such as suppliers because it will not be always feasible to perform everything internally. Sourcing-out can improve the efficiency and quality of services because the pressure of a competitive market would lead to improved performance on cost and quality. Reaching these phases will indicate that the demand has been met but if not then a review will be carried out to inform the top management thus informed decisions can be made. On the other hand, if the demand has been met then sales and promotion will start to capture the value. Companies should realise that they will be selling benefits of GVPs rather than features. This approach will encourage TGs to appreciate GVP because it fulfils their needs while providing benefits such as future proof services. It is worth noting that monitoring GBMs is important phase and should be conducted in regular bases to assess success and renew the GBMs before they are outdated due to their evolving nature.

In short, this guideline intends to enable construction companies to reach an understanding of the complexity of the issues concerned and identifying the range of available options for GBMs implementation. It is worth noting that this guideline provides a generic and abstract outline for GBMs implementation to serve as a template to the construction managers. In practice, managers will need to add detailed tasks for

each phase and aim for a specific GBM to maximise the potentials of the current guideline.

6.7. Summary

This Chapter built on Chapter 5 where GBM elements, benefits, and challenges were discussed from the participants perspective. It utilised the ISM and IRP methods that are extensively used in developing mutual influences among different variables and in identifying the dominance relationships respectively. It commenced with the various steps of the ISM method for both GBM elements and challenges. In addition, the ISM method demonstrated that the GVP and FL were the driving elements in GBM transformation and the government was the crucial challenge that hindered the transformation.

The Chapter also applied the IRP method to rank the GBM elements with reference to key benefit areas. The IRP model revealed the KR as the most important GBM element when evaluated against benefit areas for construction businesses. This study showed that the IRP is a more powerful method compared to the ISM because it goes one step further and considers the relationship of GBM elements with reference to various benefit areas. Based on the findings of this study, this Chapter has proposed a guideline for the construction managers to implement GBMs. The guideline was outlined in eight different phases in a linear format to ease its utilisation. The Chapter has discussed the implications of the study. Finally, the Chapter has validated the findings by presenting interview results with relevant academics and practitioners. The validation phase has led to modification of both ISM-based model for GBM elements and the guideline for GBMs implementation.

Chapter 7. **CONCLUSION AND FUTURE DIRECTION**

7.1. Introduction

This study has demonstrated the lack of business models (BMs) and in particular green business models (GBMs) research and thinking within the construction context which was presented in Chapters 1 and 3. Hence, the study was aiming to define GBMs and their elements and then propose a guideline for GBMs implementation for the UK construction industry. To achieve this aim, five research objectives have been developed with relevant research questions to be answered in Chapter 1.

This Chapter reviews the achievement of the research aim and objectives in Section 7.2. Section 7.3 revisits the original contributions of this study while Section 7.4 presents the limitations. Based on the findings, Section 7.5 draws up a list of recommendations to increase uptake of GBMs in the construction context. Section 7.6 suggests future research before wrapping up.

7.2. Review of research aim and objectives

In this study, GBMs are viewed as an intersection between environmental sustainability and the BMs domains. Therefore, the aim of this study was achieved through several specific research objectives including both domains. The key findings are synthesised below with respect to the original research objectives and their related questions as stated in Chapter 1:

Objective 1- Understanding the link between environmental sustainability and economic success in the construction industry

In order to understand the underpinning principles of environmental sustainability and identify implications for economic viability of the construction industry, it becomes vital to review and document previous studies. Consequently, we have conducted a literature review on a ranging spectrum of topics under the overarching umbrella of sustainability. This has supported the first part of the theoretical foundation in Chapter 2 that aimed to review environmental sustainability in the construction industry. This chapter has focused on the link between environmental performance and economic

benefits to build the business case for environmental sustainability. This focus highlighted the business benefits of environmental practices which in turn will attract more construction companies to adopt these practices. It revealed that value creation levers for environmental sustainability can be profits, tangible and intangible assets, and risk. To build the business case, construction companies need to carry out a systematic analysis of these value creation levers and may need to include other levers as well. However, this has proved to be difficult in practice because many of the major value creation levers are hard to express in monetary terms and thus may not be appealing to companies. As a result, many companies engage in various disconnected environmental initiatives and practices that often fail to tap the full economic potentials of environmental sustainability. The chapter has also demonstrated the importance of acquiring green competencies in order to develop and operate successfully when creating green value propositions (GVPs). The green competencies can be marketing and communicating the benefits offered by GVPs. An important finding from this chapter was that green values are still not tapped to their full potential in the construction context. It was suggested that the BM concept can facilitate green value propositions uptake and harness their benefits.

Objective 2 – Documenting the emergence of business models

Objective 1 has demonstrated that there is a possibility that construction companies will engage in various disconnected environmental initiatives that often fail to tap the full economic potentials which environmental sustainability offers. These disconnected activities address only isolated parts of the BM. What is missing is how companies can systematically create and lead fundamental transformations of their conventional BMs to make them green and profitable. With this background, objective 2 was aiming to investigate through the literature, the role of BM in dealing holistically with the complex economic nature of environmental sustainability. Chapter 3 has discussed in detail the emergence of BMs, both in business management and construction disciplines. This chapter has documented various definitions of BMs and adopted the common definition that relates to value creation and capture with emphasis on the customer's role. In addition, it has clarified the relationship between BMs and strategy and concluded that they are closely interlinked. It has also shown that BMs can be seen as a mediator between business strategy and the operational level of the company. The findings revealed that BMs provide a better understanding on how green or

environmental value is captured, turned into profitable products and services and how to deliver satisfaction to customers. It also suggested that BMs have been applied in various studies such as competitive advantage, information systems (IS), and project business studies. Furthermore, it recommended that definitions of BMs will bring clarity and the key elements of BMs will establish a common language among different studies.

In recent years, the call to examine BMs in the construction context has been growing louder and is accompanied by a call to utilise them in sustainability studies. The importance of the BM stems from its focus on how the elements of a system come together as a whole. In other words, the BM approach will bring systematic and radical change on how construction companies can transform to respond to ever changing environments in this age of sustainability. The objective stated above has helped in achieving the next objective (Objective 3) because the GBM research is as yet in its embryonic stage at this point in time. Hence, this study has contributed to this area, both theoretically and empirically.

Objective 3 – Defining and conceptualising green business models and their elements

To achieve this objective, Chapter 3 has reviewed GBMs as an intersection between environmental sustainability and BMs. The objective was achieved partly through the literature in Chapter 3 and partly through the empirical data as presented in Chapters 5 and 6. The literature has limited definitions of GBMs with two major empirical studies being identified. The definitions provided by these studies suggested that GBMs have an improvement on overall environmental performance – whatever form this might take. Furthermore, the definitions stated the change in the original BM elements based on GVPs to reach the GBM. Consequently, the starting point will always be the analysis of the existing BMs in a particular construction company to enable it to move to a GBM.

Elements of the GBM were adopted from business management research. These elements were as follows:

- Green value proposition (GVP) is a unique offering that a particular construction company delivers to its clients and because this offer is unique, it can position the company in a competitive place compared to its rivals. However, the major problem of the GVP is that companies often consider it in terms of what they

offer to their clients rather than what the customers really value. Hence, this element needs to be always seen in conjunction with the next element.

- Target group (TG) represents the company's view on identifying and choosing relevant groups that the GVP is intended to appeal to. An identification of the TG can be a means to systematically increase GBMs' markets by developing group-specific marketing strategies. It is worth noting that the GVP and TG constitute the value capture perspective of the GBM.
- Key activities (KA) refer to procedures and processes that are necessary to produce value and/or address the needs of clients (TG) or solve their problems. They can also describe the core business of a given company.
- Key resources (KR) are available assets that are owned, controlled, and accessed by a company and can be categorised as tangible, intangible and human. The major KR needed for GBMs are people, knowledge, brand, technology, and partnership. The KR and KA represent the value creation perspective of the GBM.
- Financial logic (FL) is about the economic side of the GBM. It contains a cost structure and revenue model, which together determine profitability for a given GBM. This element is essential to both value perspectives.

Chapter 6 elaborated further on these elements and built on the findings from Chapter 5 to illustrate the relationship between the GBM elements. The Chapter utilised interpretive structural modelling (ISM) to evolve mutual relationships among these elements. The ISM analysis revealed that all the above elements are interlinked. The GVP and FL formed the base of the ISM hierarchy, implying a higher driving power and hence were classified as driver elements. Therefore, the GVP and the FL were crucial elements and may be treated as the foundation for GBMs transformation and development. The KR, KA, and TG were the elements that portrayed the ultimate aim of GBMs and were positioned in the top-level of the ISM hierarchy. These elements appeared to be dependent on the base of the ISM hierarchy elements. The implication of the ISM hierarchy is that when managers and decision makers develop and design successful GVPs and FL, the rest of the elements will follow easily and hence GBMs will flourish. The ISM hierarchy of GBM elements was validated through structured

interviews with five experts from academia and construction practitioners. The resultant ISM-based model for GBM elements was well received by those experts with overall positive comments about it. One of the experts suggested that to incorporate the value creation and capture perspectives on the model while others suggested to show the position of the model with regard to the wider construction context and surrounded environment. As a result, we modified the final version of the ISM-based model for GBM elements taking the above suggestions into consideration.

Objective 4 – Identifying challenges and benefits of green business models

Due to the lack of specific GBMs literature, it was essential to achieve this objective through the empirical data. However, the results obtained were assessed against existing studies that were relevant to environmental sustainability in general.

The challenges associated with GBMs were presented in Chapter 5 and grouped into five major categories as follows:

- Government constraint refers to challenges caused by government legislation or lack of support
- Financial constraints refer to any financial hindrances internally within the company or externally from financial institutions and their lack of support to GBMs
- Industry constraints describe the challenges at the whole construction industry level
- Company constraints describe the challenges that can be found at the company level
- Lack of demand refers to the clients and their lack of GBMs demands.

These challenges can be found in sustainability studies in general. However, this study used ISM to deal with these challenges holistically and to identify the root challenges that influence others, as presented in Chapter 6. The study not only identified GBMs challenges from an empirical perspective, but also identified the relationship between them which can be considered as a novel contribution. The ISM hierarchy was divided into four levels with government constraint being at the bottom level and hence indicating that the lack of consistency and clarity from government was the driving

challenge for the rest of the challenges identified. Financial and industry constraints were at the same level, thus indicating mutual influence and were less important when compared to the government. Company constraints were positioned after financial and industry constraints, indicating that these two challenges need to be alleviated first before company constraints can be alleviated. At the top-level of the ISM hierarchy was the lack of demand, hence indicating the least power to hinder GBMs development. The findings above demonstrated that clients are the not to be blamed for lack of GBMs. It also demonstrated that a large pool of support is needed for GBMs uptake and growth. In contrast to the most common view of government as a major driver of environmental reform in the UK, the ISM results revealed that the government is the root challenge to GBMs development.

This study empirically identified various benefits which can be gained when developing GBMs. These benefits were summarised in three areas which were: credibility benefits, financial benefits, and long-term viability benefits. It was recommended that construction companies will need to value intangible benefits such as credibility or reputation because a meaningful portion of a GBM may relate to intangible benefits. In addition, construction companies will need to balance short- and long-term financial returns to unlock opportunities offered by GBMs. Identifying the benefits of GBMs may constitute a promising way towards GBMs development and growth.

To offer more insights on the benefits offered by GBMs, Chapter 6 utilised an interpretive ranking process method (IRP) to rank the different GBMs elements, with reference to the benefits presented above. In the IRP results, KR achieved the top rank and influenced all the benefit areas. For construction companies, it is important to look at the KR needed for GBMs as a prerequisite to gain various benefits, rather than as a roadblock. It is also much more feasible for companies to exploit opportunities using existing KR in a new way rather than trying to acquire new KR for each different opportunity. This result may encourage companies to view GBMs as a business opportunity rather than a threat. It is worth noting that this result also tells managers to develop and obtain the KR, but they are silent on how this can be done as it goes beyond the scope of the study.

The four objectives, presented above, were then integrated to achieve the final objective. The final objective proposes a guideline that aimed at assisting construction companies management in implementing GBMs.

Objective 5 – Proposing a guideline for green business models implementation

Construction managers have to embrace ambiguity and accept that GBMs are characterised by a discovery driven approach. The guideline is summarised below and consists of eight phases. For more details on this, refer to Chapter 6.

1. Create receptiveness for GBMs in top management (inward looking)
2. Build a network of support internally and externally (inward/outward)
3. Capture demand (outward projecting)
4. Convert demand into GVPs and viable business ideas (outward/inward)
5. Carry out an initial financial assessment (inward)
6. Evaluate KR and identify new KR needed (inward/outward)
7. Decide which KA will be performed (inward/outward)
8. Monitor and renew GBMs.

GBMs require bold decision-making under conditions of great uncertainty, coordination of complex networks of individuals and organisations, consideration of hidden systematic effects, and adaptation to unpredictable events. Therefore, managers and their networks of support have to find and highlight any new signals and trends when implementing GBMs.

Furthermore, the guideline was validated by conducting structured interviews with five experts from academia and construction industry practitioners to gain insights in its usefulness and easiness. The experts supported the guideline and its layout where they indicated that it helps construction companies to realise what they are doing in terms of green value creation and capture and it also gives structure to their efforts. Nevertheless, some of the experts recommended to represent the guideline in a non-linear format to capture the complexity associated with GBM implementation in practice. Consequently, the guideline was refined in line with process mapping format to reflect a true picture of GBM implementation.

7.3. Original contributions of the study

This study has contributed to the body of knowledge in several ways (stated in Chapter 1) that are broadly divided into three major areas, as outlined in this section.

Theoretical contributions

Prior studies showed an absence of GBMs thinking and research in the construction context. To fill this gap, the current study has examined the existing literature thoroughly in Chapter 3 to identify current patterns of construction GBMs research. The study has documented the emergence of GBMs both in business management and construction disciplines. It provided a list of relevant studies and developed a chronological table to show the development of GBMs research in the construction context. In addition, it summarised the current research trends and suggested future directions for construction GBMs research.

Methodological contributions

This study introduced ISM and IRP to the GBMs research as relevant techniques to qualitative research. The application of ISM and IRP was clearly presented in Chapters 4 and 6 allowing possible replication. In addition, these research techniques are relatively new to the construction discipline. The techniques empirically demonstrated the systematic nature of the GBMs elements, hence encouraging wider adoption of a systems approach to sustainability studies.

Practical contributions

In recent years, GBMs have been gaining momentum and have been adopted by practices in the Nordic and OECD countries as a means to support green growth. This study was based on empirical data from the UK construction industry, thus reflecting a new practical application and dimension of GBMs. Furthermore, the study proposed a guideline for GBMs implementation which will be beneficial to construction companies and their leaders. The guideline was validated through experts interviews and was well received by them. The findings of these interviews were accumulated to improve the final version of the guideline. It can be suggested that the guideline will help transition of construction companies from a current state to a desired green future state.

7.4. Implications

This study has informed both research and practice in several ways as discussed next.

Implications for research

- This study provides an in-depth understanding of GBMs not previously published in the construction management literature and allows for developing further research topics. The limited prior research is far from offering such an agenda
- This research developed a theoretical frame for future BMs research in the construction context. The frame suggests that studies should start with explicit definition of BMs and their elements to reduce the ambiguity around the concept. Elements of the BM will provide a common language for researchers and enhance quality of future studies
- The study contains the basic elements of any BM that included in most of the alternative proposals in the literature and strengths the notion that BMs have a central role in creating and capturing value. These ideas are relatively new to the construction research
- Previous studies suggested that the strength of GBMs stem from the interrelation between the various elements constitute a GBM. This study demonstrated this interrelation by applying ISM technique based on empirical data and thus supporting the potential of GBMs approach
- Recently, there has been a growing interest among researchers to adopt systems thinking views to understand sustainability. The current study informs researchers in this field by proposing GBMs as a systematic means to link environmental and economic sustainability. It also demonstrates this systematic nature by applying ISM technique based on pair-comparison of GBM elements and hence paving the way for future research of similar nature
- Market drivers can play a significant role in addressing environmental problems as argued by different scholars. This research advocates this approach by concentrating on the economics of environmental problems through green value creation and capture to promote wider adoption of GBMs.

Implications for practice

- The construction industry has addressed the issue of sustainability extensively by greening products/services and processes. However, this not enough for companies to fully capitalise the promise of environmental sustainability. Therefore, this research goes beyond products/services and processes to a wider greening of the whole BM to benefit from environmental practices
- As sustainability trends and challenges continue to shake the foundation of our current BMs, incremental efforts will become less effective in enabling companies to transform and succeed. In this context, GBMs will support radical transformation and have the potential to transform the whole industry
- Green value creation and capture require careful planning from managers to work effectively. To achieve this, managers need to understand their current value creation and capture logic as a system. Therefore, the GBM elements give managers a simple yet powerful tool to understand the current BM in order to systematically challenge the ways they do business and thereby enable the managers to think differently and create new alternative GBMs
- Understanding the existing BMs can be knowledge capital and crucial asset for construction companies managers to enhance their competitive positions by building green competencies
- Managers should understand that the smallest details are not vital in a GBM but how every element of it fits together as a whole reinforcing system is important matter. Consequently, the different elements of the GBM should never be analysed or developed in isolation. The hidden systematic effect of these elements is crucial to successful GBMs
- GBMs concentrate on clients role and consider the value from their perspective. By adopting the GBM approach, the construction industry may detach itself from the currently dominating cost-driven approach and be able to focus more on delivering value for its clients and thus increasing their satisfaction which is less evident in the industry
- GBMs represent marketable environmental practices that can be a means towards successful green growth and convert abstract environmental strategies into viable business ideas to be operationalised through companies structure and process

- Construction companies can make significant progress towards sustainability through their own GBMs, but ultimately companies can only be sustainable when the whole system in which they operate in is sustainable. For this reason, the study has identified challenges expand beyond the immediate company level to facilitate company-level and system-level sustainable growth
- This research identified tangible and intangible associated with GBMs. This will help in building the business case and justifying the uptake of green. It will also help the industry actors in selling green value propositions to existing and potential clients
- The guideline proposed in this study positions top-management as the main driver and champion to push GBMs throughout the companies and stakeholder networks. As GBMs become more embedded within these networks, the role of top-management becomes less important.

7.5. Limitations

Although the main aim and objectives of this research were met, this section highlights the limitations of this study as summarised below:

- Despite the importance of GBMs approach in facilitating better understanding of green value creation and capture, it remains fundamentally under-researched topic particularly in the construction context. This has implication on finding comparable construction studies that would have influenced the results of the current research. In addition, no adequate quantitative empirical data available yet to support or reject the qualitative extrapolations that have been presented in this study
- The scope of the study deals with the whole value chain of the UK construction industry. Although the researcher has strived to cover the whole value chain players during the data collection, it proved difficult to include every player such as material suppliers and manufactures. Nevertheless, the study has covered diverse players including architects, consultants, contractors, clients, procurement, and property developer
- The research is focused primarily in the UK construction industry and is relied on empirical data from UK only. A comparative study would expand and

generalise the findings to cover countries outside the UK and would generate more meaningful results to be replicated in different contexts

- The validation phase of this research was primarily intended to gather equal views from practitioners and academics. Although the researcher had strived to find practitioners to validate the findings, only one director from a contractor company participated in this phase along with four academics. The academics were selected based on their long association and involvement with the industry. Yet, this can be considered as a limitation for the validation because the resultant ISM-based model of GBM elements and the guideline for GBM implementations are targeting construction practices and managers. A wider practitioners-oriented validation would generate more insight on how these findings will serve the GBMs development in practice. It was anticipated that the practitioners will assess the importance of the ISM-based model of GBM elements and will reflect if it serves its purpose as a management tool to increase the uptake of GBMs. Practitioners will explain how their companies connect the five elements of the GBM to their green value creation and capture attempts. It would be interesting to explore if construction companies encourage their clients (TG element) to take responsibility for their consumption because GBMs require a shift to less consumption patterns. This challenges the traditional profit making approach that encouraging higher consumption levels. In addition, more practitioners-oriented views will reveal the actual relevance of GVP and FL as foundation elements and will explain if there is a shift from traditional models of FL such as price-per-unit to new models that fit with green values. It was also anticipated that the practitioners will be able to evaluate the guideline against their current efforts of green value creation and capture to find out how it will work in a real life scenario. From their experience, they will be able to suggest basic normative requirements for each phase that need to be met for successfully implementing GBMs.
- With respect to the proposed guideline of GBMs implementation, the level of abstraction is still high. This owing to the uncertainty, broad scope, and high complexity of environmental sustainability.

7.6. Recommendations

Based on the theoretical and empirical findings, the following recommendations are aimed at increasing GBMs uptake and transformation within the UK construction industry:

1. Construction companies should be prepared to change and transform their BMs to take full advantage of the economic success of their environmental sustainability efforts
2. Understanding how target groups (TGs) or clients think about GBMs and what they are willing to pay for in connection to green value propositions is vital. Companies should use this information to determine whether targeting current or new clients with green value propositions (GVPs) is a viable option
3. The development of GBMs requires more than technological innovation and increased regulations. It requires an engagement with different stakeholders including governments, financial institutions, construction industry leaders, client groups, community, and individuals
4. Financial institutions are major stakeholders that can influence GBMs growth in the future by investing in performance-oriented models and allowing access to finance for construction companies that perform and innovate better in environmental terms
5. The public sector in the UK is among the largest construction clients and building owners. Public sector clients can make a considerable difference in the market place by supporting GBMs development. Utilising public expenditure as a steering mechanism will have a much larger and faster market impact than utilising legislative means.

7.7. Future direction

The following areas are recommended for further work on this topic:

- The guideline can be tested to reveal important new insights both about the general nature of GBMs and about their specific occurrences

- The research provided a definition and explanation of five elements that constitute the GBM from theoretical and empirical perspectives. Developing a comprehensive set of indicators for each element may be worthwhile to obtain a clear picture about GBMs and their development
- The construction industry may be better understood from a network perspective because it involves various actors during the life cycle of a project. A future research can be conducted to explore how the BMs of different actors can work together to create value for customers and capture profit from this value. Network BMs will reveal insights about the industry and overcome the fragmentation associated with the construction sector
- The study identified the government as the primary barrier to GBMs transformation although previous studies suggested that it is the major driver for environmental reforms within the UK construction industry. A future research can be carried out to investigate the role of the government and policy makers in more detail, to either support or reject this result
- The construction industry is historically blamed for short-term profit seeking and cost based BMs. It is easy to see that differentiating price levels by delivered performance has traditionally not had much space in the construction value chain. A detailed research on performance-based GBMs may do justice for the industry and help to alleviate this inherited association.

7.8. Concluding remarks

This study has suggested the concept of BMs to understand the effect of environmental sustainability on economic viability of construction companies. It has proposed a guideline for GBMs implementation in the UK construction industry. The guideline provides construction management with the relevant elements and information to assess the existing BM regarding environmental sustainability issues. The GBMs elements are introduced from the management and business discipline to the building and construction discipline in a novel approach by using two different methodological techniques: namely, ISM and IRP. The guideline also provides simple yet defined elements to be transformed in order to achieve GBMs. The study empirically established the relationship between the different GBM elements and supported the

theoretical claims about the systematic nature of GBMs and the importance of dealing with the different elements as a whole reinforcing system rather than isolated ones.

GBMs definitions as envisioned in this research do not rely on the ethical and moral enlightenment of companies leaders, but are based on economic reasons that will predominantly appeal to even the most hard-nosed managers. It is hoped that the outcomes of this research will be of interest to construction industry practitioners, academics, policy makers, and financial institutions.

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Appendix A: Semi-structured interview guide

Date:.....

PhD Study: A Framework for Green Business Models Transformation within UK Construction Sector

A. General information:

1. Type of organisation/business.....
2. Job title.....
3. Responsibilities/ Areas of expertise.....
4. Years of experience.....
5. Size of company (total head counts).....

B. Drivers and Benefits of Green Business Models:

6. Does environmental sustainability currently offer significant untapped opportunities in your company? Why are they untapped? Do they have the potential to change your company? Please give details and examples
7. What are the major green issues facing your organisation currently and in the future and how you respond/will respond to them?
8. Why your organisation is adopting green strategies/practices?
9. What are the greatest benefits (tangible/intangible) to your company in addressing green issues? Please list the economic benefits as well, starting with the most important
10. How your organisation has changed when implemented green practices?
11. Which organisational capabilities & management practices are most critical for green business models?

C. Business Model Elements

12. In light of your green business models, please explain the followings:
 - i. What is your value proposition?
 - ii. Who are the target group?
 - iii. What are the key activities that you perform?

iv. What are the key resources that you use/need?

v. What is your financial logic?

13. How elements of the business model have changed and will change as a result of green strategies/practices? What conditions need to change for green business models to be economically viable?

i. Value proposition

ii. Target group

iii. Key activities

iv. Key resources

v. Financial logic

14. Which one of the following group is more interested in the economic benefits of environmental sustainability? Why? Please give details

i. Property developer companies

ii. Design and consultant companies

iii. Contractors and subcontractors companies

iv. Clients

v. Others, please specify

15. How environmental issues will affect the competitiveness of your company?

16. Please give an example of profitable environmental sustainability practices or practices with potential profitable environmental sustainability? (Can include example from your company or competitors or even virtual example)

17. How important is stakeholder management for green business models? Please list the critical stakeholders to your company

18. How you can develop a clear “Business Case” for environmental sustainability?

19. Which challenges would need to be resolved in order to realise a green business model?

20. How would you define the term Green Business Model?

21. What important topics have we missed in defining and exploring profitable/intangible benefits associated with environmental sustainability and how it impacts/changes business models?

Appendix B: Sample of transcribed interview

Date: 18/7/2013

PhD Study: Developing a Green Business Model for the Construction Companies

A. General information:

1. Type of organisation/business: Architects
2. Job title: Architect and Director
3. Responsibilities: everything
4. Years of experience: 20 years
5. Size of company (total head counts): we are about third of what we used to be, so we are about 6 at the moment.

B. Drivers and Benefits of Green Business Models:

6. Does environmental sustainability currently offer significant untapped opportunities in your company? Why are they untapped? Do they have the potential to change your company? Please give details and examples

That is very large question and I am not going to be difficult in my response but it is not an easy thing to answer. on one level what do you mean by environmental sustainability, do you mean very green low carbon solution or even zero carbon solutions as the market perceive those products, for example passive house do we see it as untapped opportunity but if I thought a passive house was something that I would be going for I would say yes passive house is rubbish because it so my epic and its description on what it is trying to do, it is creating a super insulated structure or a house that provides a green low carbon environment in terms of heating and that kind of stuff but that is all it does so for me sustainability is a broader subject and carbon reduction is a part of that but it is not all of that and if you balance up social, economic and environmental sustainability factors it might be that you go for a higher or you go for more a damaging environmental elements because it delivers a better social sustainability or better economic sustainability so I would say to you in the first instance I questioned about your questions because it really depends on what you mean if you mean by that general green buildings as defined by the building regulations or as defined by the code for sustainable homes, yes there is an opportunity there but there is

always an opportunity, the green market is emerging, it is going to be very powerful big market there is a lot of space in that market to operate. Has it changed our business? Yes it has, it changed in reverse if you like, we started as a very very green company I did a deployment in Cambridge on the business case for sustainability it was yearlong course where we looked back in the days 10 years ago developing the economic metrics to show that in terms of long term investment a green sustainable solution is the way to go because it provides a longer term profit stream effectively and that profit is wrapped in 3 ways one is financial profit two is social profit and three is the environmental profit so I worked very hard in looking at the commercial and business case for sustainability, we pitched as a green practice very early on and the market laughed at us because it did not know what we are talking about, when I say we stopped being a green practice I mean we stopped advertising ourselves as a green practice we describe ourselves as a practice that did sustainable design and we allowed the definition of sustainability to be agreed on a sort of project by project bases, we could be a very green practice and everything we do is green but we could not have any clients we tried for the past three years it was just too new. Now would we do that again? We would not we moved on from there. Did I answered your question?

Researcher: I am concentrating on the environmental sustainability practices because it somehow can be quantified and there some proven that there are benefits associated with it, for example the cost savings in the long run. Interviewee: but who will get the benefits of the cost benefits? Researcher: end-users and also the benefit for companies in attracting more businesses. Interviewee: possibly, you have to be quite careful here because very few buildings are commissioned by the owner - occupier, most buildings are commissioned by developer with aim of selling it on as quickly as possible, when you got that model, the developer wants to design it as cheaply as possible build it as cheap as possible and sell it for as much profit as possible that is the traditional model. Unilever company few years ago designed a new headquarter building in Leatherhead they are the owner - occupier and that building has to achieve BREEAM excellent or thing like that but that was full of sustainability features both environmental sustainability and social sustainability that is a good example of an owner- occupier writing their own brief.

Interviewee: Do I think the market is becoming more aware of sustainability and the value of a green solution and does that has popular culture catchy, does pop culture

wants to buy green now? Yes they do and if you have green building with a high environmental rating you will find probably an agent will tell you this: it will rent or sell better than one that does not so I would say in the last 2 or 3 years the market understanding of green issues has matured sufficiently that is becoming a market driver for the first time in terms of office buildings and that type of buildings in terms of the house it is going in the same direction may be still a little bit behind the curve but it is going in that direction so is the question is there any untapped market opportunity? Yes there is but what we have to do, we might wait for the market to catch up. The demand is driven by the market, the market demands is the product that it thinks it needs if the market thing is need a green building it will demand it but all the market thinks it needed and what demand it. So the science says one thing the science says we should be in a war fitting who cares about the science that a matter for scientists to care about it, the general population is 50 years behind the scientists in terms of their understanding so the market demands and who pays for those things, the market pays.

Researcher: can we do anything about stimulating the market by showing the benefits or we will just wait for the market demands?

Interviewee: well that depends, we are trying to do that so what we do we have standardised that why we been to Salford University, we looked at building offsite and offsite techniques as a means to credit standardised house product, standard house product has different elevation treatments but the plans are exactly the same so by stream lining the design and go for fabric first solution using sips and things like that we are trying to stimulate different approaches to housing where you buy a product as the same you buy a car with just different features rather than buying a bespoke house each in every time so we are trying to stimulate the market in that regard and we have been for 10 years and we just about to get some success.

Generally architects will get commissions because they have track records in delivering green solutions if you look at they pioneered that spent years probably 15 years or 20 years pioneering his knowledge and he is now a green guru with international reputation and deservedly so but most practices just do what they told to do they clever enough to say if a client says I need a very green building they will say I will give you that they know how to do that and go and get information from, most clients do not do that, they want to do a green building.

7. What are the major green issues facing your organisation currently and in the future and how you respond/will respond to them?

Energy supply more than anything else, the cost of energy and the counter point to that is the cost of renewable energy and the counter point to that is the technology required to allow a low energy house affordable technology not fancy silly kind of one off technology for passive house simply not deliverable this where I got annoyed with the pursue of green agenda, you throw that money in a project to get the most greener house in the world we have 240,000 devastating homes I am not really interested in passive house for 1 or 2 examples in the UK very clever well done here a star so what 1 or 2 people living in a low carbon house big deal, what we need is affordable technology that can house 240,000 people in slightly less carbon efficiency than the passive house I will take that in a day because at the moment there are 240,000 people are living in a terrible conditions, in terrible buildings in terrible parts of the UK and we have not looked at the global issues, so who cares quite frankly who cares about the passive house it is an intellectual pursued that is interesting for academics with all due respect but it does not provide a solution to the housing problems so what we pursuing here we pursuing social sustainability agendas that allows people to live in decent homes and to be able to use less electricity and therefore have lower heating and electric bills because that can do the greater good for largest amount of people or we going to have some fancy hippy to live in a passive house somewhere and feel to be smug about themselves. So where we going to go that the decision we as the business have to make so to answer your question we do not pursue the niche market we pursue the problem market. The problem market is how do we house people affordably or still producing lower carbon homes that will have a lower demand on energy that is the question for us. Sorry I get very stride about those things.

8. Why your organisation is adopting green strategies/practices?

Do we have the choice! Researcher: I do not know because some companies still not doing anything. Interviewee: People who do not do anything: they do not do anything for 2 reasons either ignorant they do not know or laziness because anybody who understands how important those narratives are will do something even my kids tell me to recycle. Sustainability or environmental sustainability is a supplement reduce your

own carbon footprint reuse what you can and recycle only after that so if you follow that simple mantra it actually gets you through 90% of the question.

So we adopt these strategies because it is ethically the correct thing to do because the scientific data is overwhelming and because there are market opportunities on doing so. It is a very carefully crafted market opportunity is not a market opportunity in way that there is a market for bread we need to produce 10 billion of breads a day or whatever it is the bread people make in terms of the green economy you need to say I am going to produce this solution for this portion of that market and that portion of that market is pretty small at the moment and it will grow and at the moment you going to find your clients and that is the hardest part is finding the clients who will do it because most people would not or they would say I want to pay the minimum.

9. What are the greatest benefits (tangible/intangible) to your company in addressing green issues? Please list the economic benefits as well, starting with the most important

The most tangible benefits are: the understanding and the recognition that the design and technology that we employ works and it does effectively result in reduction in carbon or reduction in energy demand or whatever the case might be, that gives us track records and the market likes to buy track records, the market buys a track records in doing Y X and Z and if we have track records in delivering low carbon the market will come to you because you have track records in doing so interestingly we employed people here who just moved out of Build Masters to our practices and to other practices and they are much more knowledgeable about the green issues than we are but they are unable to use because the market I operate in does not demand as much as they demand in Build Masters and even if we offered it I do not want to offer it so is not a question of we do not offer it, we are happy to offer it but do not want it so it about planning your plan. The intangible benefits are that you get a reputation and reputation is key and track records, it makes you feel good about yourself it makes you feel that you are making contribution and becoming a sensible and solid citizen but the most important thing is being perceived as being knowledgeable and a credible business or outfit that can deliver these solutions that when you say something is possible that is possible because you done the hard work of working out that it is possible so there is a lot of people talking about green who do green wash you can do this and that yes you

can but when you look at the cost of delivering these things like a passive house yes you of course you can do that but the cost is so prohibitive that is going no more than one solution so we aim at being seen as a business that delivers cost value on the green solution that we propose so we will never propose and I would be surprised if we ever proposed a passive house solution to a client but we would propose very green solutions that are not going to threaten his budget and sometimes we bring a green technology below the offer so he does not think that he is buying a green house because he does not understand it but he will be buying a green house because we just done it silently so there is a visible and invisible when it is visible it is very clear and it is requirement by the client to be visible but the invisible because we know it is the right thing to do we do not tell people about it we just stick it to the building and the reason that he does not find about because it does not cost more.

The economic benefits to clients they will get the benefit of whole life cycle costing which will going to reduce their carbon or energy requirement or whatever the case might be they get that benefit knowingly or unknowingly by the time they will realise the benefits and whether they attributing that benefit to us is another matter. The benefit to us is we slowly maturely increase our reputation for being able to produce solutions that work so in architecture reputation is everything really. Regent Rogers and Norman Foster they have a huge reputation because they have shown that they can do it.

10. How your organisation has changed when implemented green practices?

What it takes to be green: in your article of association and the manifesto of the business that you start with that as a first principle position in every respect and that what we are trying to do did we ever succeed but that we are trying to do is that we started from that position rather than having to absorb it down stream. There are quite a lot of evidence now that if you designed a traditional building and then try and make it green after planning or something like that it is going to cost you a great deal more but if you designed a building to be green from the start it is going to cost you a great deal less. we have a big health centre on site at the moment and we fought extremely hard with the contractor to approach it in a particular way with regard to a frame system that we have a very clear u-value for the walls and we can stabilise the u-value for the efficient very early on the design this had numerous effect on how the design moving forward so what happened was that we took 25% of cost out of the AME budget

because the AME guys are punch of monkeys and what they do they say ok we do not have the walls are going to perform so they over design the stuff by huge factor so by stabilising the wall performance on a fabric first principle which the principle we always started we start as a sustainable solution and change it if we have to we do not have to over design the AME the u-value for wall is X and will remain X for the duration of the building and it will not change the windows are going to have performance Y and the roof will perform this way you have much more clearer criteria and data to do your own calculation and there is a consequence on that and some banning on head over many months so we reduced the cost considerably that how we started that how we implemented in terms of the market and if the market wants to see us as 14001 or whatever is called is recognised environmental standards for corporate it deals with waste management and how you run your business and it does not actually deal with how you design your supply chain if you want to be a green business you need to design your supply chain to be green. For architects green building is the easy bit, all you have to do is to design a green supply chain which is much harder. The building is clearer and more stable as a design challenge in designing a sustainable supply chain.

11. Which organisational capabilities & management practices are most critical for green business models?

Start from first principles start with the green from the beginning from the very first start of the design idea it must start as a green building from that very first line on paper. the very first word must be about how greener is going to be if you start with that and drag that through all various penetration of the design process you will retain the vast majority I would argue so that is how you do it and the ability to that the ability to communicate with your clients and your design team about the importance of item X and Y why we have to prioritise this bit over that bit because very often in approaching a green design you load the data going into design differently as it would be with a traditional model where there is much more incremental additional information as we go through stages a b c d and so on with green approach you settle you decide key factors on day 1 and they remain stable and you work around it so you will have what we call anchor information we have to have a wall u-value is X or to best achieve using this system or design the building around this system. One of the biggest wastage of design area is that the architect would say I do not know what is going to be build of so will allow wall cavity of 300 or 350 because I do not know what is going to

be and the building goes in design with variables in mind what is going to do is take the variables out the wall is going to be build of that for these reasons and get the client buy-in early on and if you get that buy-in early on to key packages, key elements of the design it is much more easy to deliver a sustainable green solution that really it an intellectual process rather than management process. It is about how you identify the key things and you cannot achieve everything so you need to choose the important.

C. Business Model Elements

12. In light of your green business models, please explain the followings:

i. What is your value proposition?

We deliver practical and deliverable solutions that are scalable again not to hummer about the passive house too much, passive house is not scalable that why I rejected it in a few years times it might become scalable when the knowledge improves but at the moment achieving that is one off so we aim to deliver scalable solutions our ethos or our catch phrase is design for intelligent construction what that mean is that you design with the output in mind as much as the design so if the house is going to be delivered and constructed as much as how the house is going to look and feel. So design for intelligent construction summed that up and this our value proposition.

ii. Who are the target group?

In a more focused level is going to be individuals looking for cost effective solutions to big problems or even little problems rather than throwing lots of money in individual projects and then circumstances you need scalable solutions for challenges and problems that are have scale to them if you like.

iii. What are the key activities that you perform?

We do three things route 1 is traditional architectural services which is bespoke design one off prototype. Route 2 is one we call design for intelligent construction so it might have aspects of repeatable design it might have aspects of technology integration which are fixed and we design around that it might involve key partners in the supply chain for instance we identified key supplier for Structural Insulated Panels sips exclusively we will work to develop a product that take the best out of your material rather than one that we can know we can build it out of anything let us build it out of this and make sure that zero waste or very low level of waste and the efficiencies and the economy of the

design are based on detailed understanding of the material or the system that we use rather than just the architectural side that we must do that is route 2 and that the future. Route 3 in terms of how we do that we do match making so we do are like dating agency or lonely heart club so we bring technologies together we often bring people together. We do not have always role in that some time we do sometime we do not but because most of time we bring people together we have role in the process. So that how we do it.

iv. What are the key resources that you use/need?

We use people this very important the right people, right technology for instances everyone is talking about BIM at the moment as a future there is no question, 3D design we started in 1995 most people they think they are clever by doing it in the last few years and I say welcome to my world we been doing it for 20 years but technology is increasingly a big part of that effect we are just doing big IT upgrade just to make our BIM performance better and I am just want to point out here is that one of the difference between public sector and private sector generally speaking the public sector will demand higher level of green design and higher level of BIM so the public sector in the UK sets the agenda the private sector might do it as one off example building kind of thing but generally speaking they will only be compliant the private sector will be compliance the public sector in the UK during the fine best practice or encourages the best practice. In the UK BIM is mostly headed with the public sector.

v. What is your financial logic?

This an important point we do not pursue profit for the sake of profit, we want to be economically viable in the long term to be economically viable does not mean that you must maximise your financial profit it means that you must create a sustainable business case which will give you profits but might not be the maximum profit so I would say our financial logic that would be economically viable in the long term not most profitable.

13. How elements of the business model have changed and will change as a result of green strategies/practices? What conditions need to change for green business models to be economically viable?

Conditions need to change are insurance and legislation whether the building regulation demands it or code for sustainable homes demands it when the clients want the passive house or whatever is it that is when you do it I would say in the market the thing that define the level of green provision are the building regulations more than anything. Have you ever heard if equator principle: this very interesting I think anyway the equator principles are set of sustainability standards set by the big banks for projects over 15 million dollars in order to qualify for loans or funding or project funding of that scale you need to satisfy the equator principles by in large the equator principles exceeds building regulations by a Gazillion miles so I asked the bankers why they would make a demand for a green solution or sustainable solution in their funding at the level of the developing world this only limited for the developing world but they do not make the same demand as in established countries like France or Germany and they said that the reason we do not make that demand is assumed the regulation in environmental are sufficiently good to exceed those equator principles but it is not so at the moment the green whatever green level we achieve is driven through legislation and that what the private sector has to beat per minimum however the funders for our development of houses or buildings placed anything that close to equator principles in the funding regime we would see a radicalisation of the construction industry I think this part of the solution to move forward that the funders and the insurer they need to start making more demands on the design of building and the impact of the build environment on climate change however the big thing to watch out is that generally speaking even if you start with green solution at the beginning it is got to cost a little more when a none green scheme even now sadly this not the case but the general rule of thumb putting renewable or whatever will cost more money so it is always good to have high loft requirements but it will means less will get delivered but it costs more and is going to be a period of longer tension between the cost of green solution and the ability to deliver that costly effectively.

i. Value proposition

We shifted our view away from the environmental sustainability because we believe there is little purchase now building regulations are slowly maturely increasing the bars we shifted our focus to social sustainability.

ii. Target group

- iii. Key activities
- iv. Key resources
- v. Financial logic

If the question does a green business models makes a difference? No it does not I think it is part of the solution it is not just one of the elements, I think what is going to change or will allow green business models to flourish is a shift in our behaviour in terms of our consumer behaviour in terms of our energy to cultural shift that have to take place philosophical value and communities spiritual values the religious values and the essence in these religions is to look after your fellow man be steward to your fellow man and to the world and at the heart of the solution to the green agenda is a stewardship obligations a care obligation to our fellow man and to our planet and till that value is gained more deeply and more profoundly in the popular culture of the western world the eastern world and the whole world and the consumer market until that obligation of care is defined we will not have flourishing green business models or sustainable models because capitalism or green economies will go so this not I do not believe in the heart of my heart this a technical issue I think it is a value issue, value issues philosophical issues spiritual issues deeply personal human issue rather than being outside “Ghandi said be the change you want to see in the world” start of what we do as people. So my business case my green business case is a function of my own personal values an expression of my own values a link to the application of my personal values but if I am not green person myself my business model will not be green.

14. Which one of the following group is more interested in the economic benefits of environmental sustainability? Why? Please give details

- i. Property developer companies (4) they are generally driven by greed and profits they are not interested in sustainability except of people like Igloo and Urban Splash to certain degree they are much more economic viability or long term viability ethos whereas Barclays home or Barrettes or whoever else who are for profit so the maximisation of profit is their principle objective they will do green stuff if it suits their agenda not if it challenges that agenda so property developer are the least interested.
- ii. Design and consultant companies (1) are the most interested because this part of our function and training we are taught to work for certain principles we also taught the

logic of the value of pursuing excellence of pursuing excellence regard less it makes economic sense or not to our clients.

iii. Contractors and subcontractors companies (3) are becoming increasingly more powerful in the delivery of green solutions and they are seeing major gains and benefits of doing so most importantly of health and safety so it more about social sustainability not so much about green sustainability so the H&S and CDM and all these things are came in as results in reduction on construction site and made those environment better places to work. That is social sustainability but still part of the broader environmental conditions.

iv. Clients (2) are generally inspirationally and naively green until they see the costs all they will do what they can so they usually overly open but not always able to deliver some are but not always.

v. Others, please specify: people who can really drive the agenda are celebrities and popular culture figures so pop culture has enormous role to play here if you look at clever marketers companies and how they get us to start buying whatever they want us to buy they do it cleverly through demographic analysis and careful study of people and they give us a little messages in the buying phones or other things those guys really good the big part here in the delivery of the message but it is a scary message. what we need is Brat Bit or Lady Gaga the people who less technically educated about the science of climate change to be able to get it we need a Coca Cola sign the icons even though the wind turbine serves a very little green purpose at all and they probably costs more carbon to produce and they will ever save it is an icon and it reinforces the message and that is why they are important.

15. How environmental issues will affect the competitiveness of your company?

It is part of what we do now it is nothing new it is part of day-to-day agenda. One of the reasons of we do what we do is that we want competitive edge we looking at standardising the offsite solutions in more and more what we do not only because it gives us a niche in the market building our reputation but also it is a green solution.

16. Please give an example of profitable environmental sustainability practices or practices with potential profitable environmental sustainability? (Can include example from your company or competitors or even virtual example)

A Fabric first principle at the beginning of every design will save you money and will save you carbon other things are like video calls and video conferencing will save you travel and all that stuff. Carbon footprint stuff for architects and designers is about a building that delivers high environmental performance value without constraining the occupants too much so people do not know how to live in a green building we designed building and we actually put under floor heating in and radiators the radiators do not work because we have been told that some of the people do not believe that there is heating in if they do not see the heating there are people out there they do not like change they like to see what they can see you can tell them that all things are there but they are not interested so change management is a huge issue but on the design level fabric first I would say if I to legislate something in terms of the construction sector fabric first has to be the one element that transforms the environmental performance of the building.

17. How important is stakeholder management for green business models? Please list the critical stakeholders to your company

Critical stakeholder to our company first of all will be our staff, suppliers and clients. So our primary stakeholder is our staff and clients we would turn away some clients that we disagree for some ethical issues we will not work for Tobacco company will not work for army dealers we might do work for army because they have a civic function so we will turn some clients away equally we will turn some staff away if they do not meet our requirements more importantly what we do we do a lot of this we examine the supply chain choose companies that align with standards that we want to that we want our buildings to have looking at the market who the best in class who the next best and choosing those guys and working with them to come with a greener solutions.

Stakeholders and clients are generally open if it does not cost them much our job is to provide the stuff in a demystified way that what we do we are mystery merchants totally have to take the mystery out of it and make it understandable.

18. How you can develop a clear “Business Case” for environmental sustainability?

Be clear about your objectives most importantly be clear respect the human values that you decide for yourself respect Ghandi be the change you want to see if you want to be a green business say we are a green business and we will make every decision we make

will be full to true to a green filter we might not always get it to work the way we wanted to work but we will always try so if you set out in that way you just do it naturally it sounds simple but it is true.

Researcher: From your own point of view if companies are not driven to green agenda by values that means that they will never succeed?

Interviewee: They will find it harder but they will never succeed no I know some companies who puts photovoltaic panels they benefited from government subsidies to put those voltaic on roofs and they have made a lot of money from supplying green technology to houses and schools did they do that because they are green people or they saw it as an easy way to make money I think it is the latter what is happening is as the green economy matures it becomes easier in some ways to make money from it particularly in the areas of subsidies but the primary motivation is still they want to make profit it is not about delivering green solutions so again it comes out of personal value systems if my business is about green solutions then I will make decisions to support that this about making profit and I am happy to do that through provision of green technology but my primary motivation to make profit does not matter what I make the profit through green technology or none green technology I am pursuing profit I am not pursuing an agenda or greenness. Are there opportunities on the green market? Yes, are they profitable? Yes, is that means more people will become green? No just they will make green money.

Researcher: Is that better then to make money from green?

Interviewee: It is a sort of false feel good I do agree that it is better to drive your money from better sources and ethics this the ethic of business the ethics here is we are trying to drive our money from green sources fantastic they will make a profit and show that their profits come from green sources there is no question about that there is huge market over there but it is an ethically decision in the first instance not a technical decision. It is fundamentally an ethical issue rather than technical issue. Green money is better than the red money there is no question and there is more opportunities opening right there but still is fundamentally defined by your ethics.

19. Which challenges would need to be resolved in order to realise a green business model?

I think three things more mature supply chain, a green technology, a broader acceptance of the market and I mean by that both the construction market we as construction industry still struggling with this but a broader market the cultural market so a better understanding of the market in this broader sense of the benefits of the green solutions so there is a popular culture sell and technical sell simultaneously and I think most important thing that we need to change is an intellectual understanding that there is no silver bullet to a green solution it is multiple factors all of them need to be given an appropriate weight it is like eco system it is like Gaia model there is an eco system of ideas and depending on the circumstances one idea might be more dominant than the other apparently in the different environments that ingredient might be less but they all in the mix they all there which is the combination of energy demand and energy supply and efficiency and supply chain and designing appropriateness there is no single solution it is multiple solution that intellectual understanding needs to be better understood.

From your own perspective, how you define a green business model?

It is got three profit lines: financial profit, social profit and environmental profit so instead of having a single profit line pounds and pennies it has three profit lines and you need to show profit in each of them that is a green sustainable business model. Triple bottom line accounting is the closets generic model to a sustainable business model because I take issue with you that is about a green solution exclusively, the green solution is a big portion of it but is not all of it.

20. What important topics have we missed in defining and exploring profitable/intangible benefits associated with environmental sustainability and how it impacts/changes business models?

I think you need to broaden the scope of your research to be able to narrow it latter on and what I mean by that is a very agreeable and understandable by an architect to look at it as a design and technology. The environmental issues are actually scientific but the solutions are economic I would argue I do not know what they are because you still have to take capitalism on and big financial market stuff I do not know about these stuff what if do know is that if we started to finance our developments and our lives in a different way we would deal with some of these issues very differently so like the pursued of cheap first of cost rather than value you heard this argument many times why

we do that? Again it socio-economic I think the solution is in socio-economic world because in the technical world I actually think that we have enough clever scientific type of people to come up with technology we need to solve the problems as we see them what we do not have is the mean to implement them so it is about how we implement things and unless you are able to touch on those things your study will be under nourished and you need to reference that stuff I would argue.

Appendix C: Summary contact form

Initial: PD

Contact date: 24/10/2013

Filling date: 24-25/10/2013

1. What were the main issues or themes that struck you in this contact?

energy conversation

cost driven/ cost reductions

public bodies such as councils and universities are leading organisation on green

taking the leads/ doing the right thing

power perfectors

strong link between environment and economic sustainability

2. Which themes/categories did the contact bear on most centrally?

lack of Knowledge

very little training on sustainability/ most of people are self taught

payback periods of green technologies (7-10 years will be attractive for property holders)

3. What new themes/ideas were suggested by the contact?

green agenda: is a combination of financial benefits and public perception

critical stakeholder: can challenge the organisation to change/ look at its practice

4. Anything else that struck you as salient, interesting or important?

his definition of critical stakeholder

civic responsibility of government bodies

moral high ground

rationalise the estate

5. Observations / concerns

Appendix D: Validation feedback form

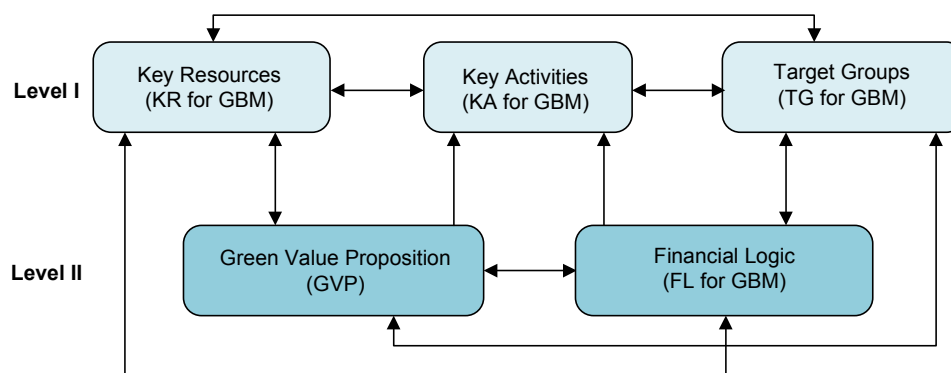
1. Background

Green business models (GBMs) have the potential to deliver a much better performance compared to conventional business models (BM) in this age of sustainability. The question of how construction companies can transform their BMs based on green value propositions is both highly relevant for management and poorly understood to date. This background has motivated the current research.

The research scrutinised how GBMs are defined and understood by adopting a set of defined five elements from business and management literature to ultimately propose a guideline for GBMs implementation within UK construction industry. It conducted 19 semi-structured interviews with academics, architects, consultants, contractors, property development, procurement, and clients. Based on the analysis, the research proposes a definition, a relationship model between the elements, and a guideline. This document is part of the validation process and requires inputs from construction professionals.

2. Green business models (GBMs)

Definition: *A business model is considered to be green when a business changes element (s) of its business model to create and capture a business opportunity or a proposition for target groups that provides environmental improvement coupled with economic benefits.*



GBM elements and their relationship

Green value proposition (GVP) is mainly related to products and services offered by a particular company and what is more appealing to clients

Financial logic (FL) describes the financial assessment of all the means employed in the business model

Key resources (KR) refer to the assets required to offer and deliver value to clients

Key activities (KA) refer to the most important activities which need to be performed to create value to clients. It mainly explains the core business of a given company, whether it is design, consultancy or procurement works

Target group (TG) describes the segment of clients whom a company wants to offer value to.

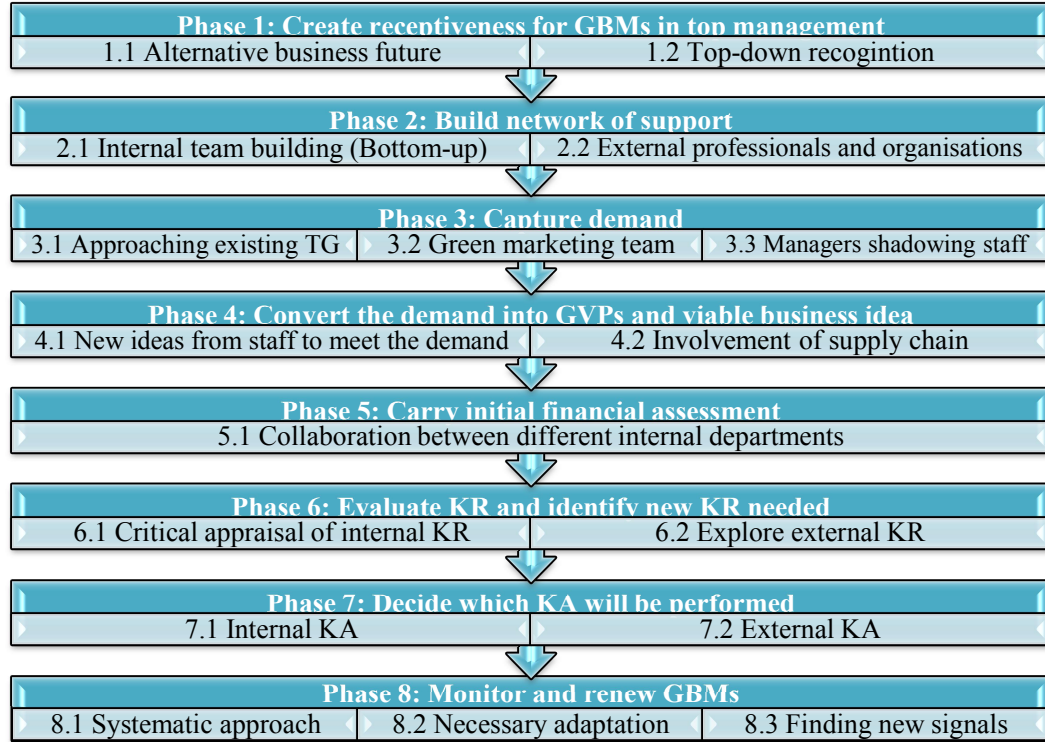
In the above figure, green value proposition (GVP) and financial logic (FL) are the foundation elements and therefore construction companies should start with them in order to develop green business models. This means when managers and decision makers develop and design successful GVPs and FLs, the rest of the elements will follow easily and hence GBMs can be achieved.

Q1: Does the above model reflect the relationships which exist between the different GBMs elements? If not, would you please suggest how this can be done?

Q2: From your perspective, do you think this model represents a true picture of GBMs development? If not, would you please suggest any modifications?

Q3: How this model can be made useful for the construction industry practitioners to assist them in green growth?

3. Guideline for GBMs implementation



Guideline for GBMs implementation

Q4: Would you describe the above guideline as being useful and easy to understand? If not, would you please suggest any improvements or re-order of the phases?

Q5: Any final comments or suggestions?

Thank you for your time!

Amal Abuzeinab

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