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Barriers to MNEs green business models in the UK construction sector: An ISM analysis

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ABSTRACT

The environmental and economic benefits of green business models (GBMs) are considerable if current barriers can be identified and ways of overcoming them developed. In this study, barriers to GBMs are identified by conducting a qualitative study. Nineteen semi-structured interviews were conducted with selected UK construction sector experts from academia and industry and the results were obtained by applying thematic analysis. Five major categories of barriers emerged: government constraints; financial constraints; sector constraints; company constraints; and lack of demand. To understand the collective impact of these barriers, the interpretive structural modelling (ISM) method was used. The ISM-based model showed that government constraints are driving the rest of the barriers followed by financial and construction sector constraints equally then the by company constraints. Surprisingly, lack of demand appeared to have the least significance in hindering GBM transformation compared to the rest of the barriers. The results present a clear picture of the green construction market relevant to multinational enterprises (MNEs) intending to enter the UK. MNEs are therefore influenced by the government on strategic planning and capability building for GBMs. Effective engagement with the government will generate institutional advantages resulting in legitimacy and trust for MNEs in the UK markets.

1. Introduction

Climate change is one of the main global challenges and is critical for multinational enterprises (MNEs) in many sectors (Pinkse and Kolk, 2012). MNEs have cross-border activities that are shaped by different contextual and institutional drivers and barriers (Lundan, 2010). Therefore, an essential part of the strategic behaviour of MNEs is to identify these drivers and barriers for intended entry markets. In this paper, the UK green construction market is considered an entry market for MNEs. The UK government has a binding legal obligation to reduce carbon emissions, a major contributor to climate change, by at least 80% of the 1990 baseline by the year 2050 (HMG, 2008). The construction sector has a significant contribution in this area because buildings are responsible for 50% of total UK energy consumption of which carbon emissions is major source (Pitt et al., 2009). Regulatory means, such as building regulations, building codes, and green labelling, have been essential environmental reform instruments (Alkhaddar et al., 2012). To reduce waste creation, the government has introduced the Landfill Tax and Aggregate Levy (Pitt et al., 2009). Hence, MNEs need to be aware of the aggressive regulations and to follow them before entering the UK green construction market.

To address the multiple challenges of climate change and global sustainability, economic development will require a transformative change of different sectors towards a low carbon future. This transformative change is difficult to achieve in the construction sector because it is characterised by a complex value chain with various actors that may have conflicting interests, and hence, the responsibility to address global challenges is dispersed through the value chain (Kohler, 2008; Häkkinen and Belloni, 2011). A green business model (GBM) has the potential to effect this transformative change as it provides environmental improvement coupled with economic benefits (Sommer, 2012). The GBM describes the logic of how a construction company creates, delivers, and captures green value (Aho, 2013).

However, developing GBMs requires substantial investment and support from different parties expanding beyond a company's boundaries. The literature has identified key barriers to the

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development of GBMs (FORA, 2012) which can be broadly categorised into contextual/institutional and organisational barriers. The contextual/institutional barriers include regulatory barriers; lack of initial capital investment and lack of demand where as the organisational barriers include difficulty of GBMs to align with existing business models (BMs) and systems, lack of knowledge and capability, and dominance of short-term profit seeking (FORA, 2012, 2010). In order to address the various barriers, FORA (2012) argues that policy intervention has a major role to play by developing relevant policies, providing access to finance, and stimulating market demands. For the construction sector, the barriers addressed within the literature are focused on sustainable/green construction and buildings but not inclusively for GBMs. Typical barriers found are: affordability, lack of client awareness and demand, lack of proven successful cases, lack of business case understanding, lack of aligned standards, and regulations barriers (Pitt et al., 2009).

Previous research has explored the concept of BM as a framework for analysing and understanding sustainability in general (Aho, 2013; Mokhlesian and Holmén, 2012) and energy efficiency in particular (Al-Saleh and Mahroum, 2014), including renewable energy (Strupeit and Palm, 2015) and BM innovation for energy renovation for housing in Nordic countries (Mahapatra et al., 2013). However, research dealing with barriers to GBMs in the construction sector is not available as the development of GBMs is a relatively new proposition (Al-Saleh and Mahroum, 2014). Previous research has neither addressed the question of barriers to GBMs for the construction sector, nor whether there is a relationship between these barriers that creates a complex situation for construction value chain actors.

As a first step towards understanding the collective impact of GBM barriers, the objectives of this paper are to empirically identify barriers to GBMs in the UK construction sector and to develop a structural model by applying the interpretive structural modelling (ISM) method. ISM is suitable for this research because it analyses the interrelationship among the variables of a specific problem based on experts' judgements (Attri et al., 2013). The analysis offers novel insights into the interrelationship which exists between these barriers that has led to a complex situation where one barrier influences others. Furthermore, the method applied for structuring the relationship between the barriers provides an insight into GBMs and construction research. These insights are particularly valuable for policy makers who wish to leverage GBM development through regulatory reforms for the construction sector. They are also valuable for MNEs willing to enter the UK green construction market.

The remainder of this paper is structured as follows: the next section presents the theoretical background of the paper and has two parts. Part one reviews MNEs in construction while part two establishes the basic understanding of GBMs and their barriers. Research methods are presented in Section 3 where two qualitative methods are used: semi-structured interviews and ISM. Section 4 presents the development of ISM model. Next section discusses the findings. . In Section 6, we discuss the research implications to MNEs intending to enter the UK green construction market. The paper concludes with Section 7 which summarises the findings of the paper and reinforces the importance of further consideration of collective impact of external and internal barriers in GBM debates.

2. Theoretical perspective

2.1. Multinational enterprises (MNEs) in construction

MNEs and international construction terms are used interchangeably within construction research to describe a construction company that undertakes projects/construction-related activities outside its home-country (Ofori, 2003; Yang and Lu, 2013). In this paper, the term MNEs will be used throughout to denote the above.

According to Drewer (2001), MNEs emerged historically to satisfy the demands of a host country lacking in sufficient construction resources. For example, the construction boom during the 1970s of oil-rich countries in the Middle East was due to the ability of these countries to attract MNEs to meet the increasing construction demands of new buildings and facilities (Ofori, 2003). Haigh and Sutton (2012) investigated the role of MNEs in post-disaster buildings and infrastructure demands by conducting an exploratory qualitative study. The study showed the benefits offered by MNEs to the host country in post-disaster situations. The benefits were: efficiency; higher quality buildings within time and budgets; technological transfer to the local communities; staff development, and experience of local enterprises. However, the study showed concerns regarding MNEs using the disaster as an opportunity to enter new markets and to sustain long-term presence that can impact the ability of local enterprises to secure construction work due to imbalanced competition. Regardless of the historical necessities of MNEs, they continue to grow, owing to advances in communication, knowledge, technology, transport, open competition, and new emerging green markets (Ngowi et al., 2005; Yang and Lu, 2013).

The majority of research on construction MNEs has focused on competitiveness and performance of contractors globally. For example, Ngowi et al. (2005) reviewed the globalisation of the construction industry to suggest strategies for small companies in developing countries to benefit from the international construction market. In addition, Ofori (2003) reviewed different frameworks for analysing and comparing performance of international contractors. Ye et al. (2009) studied the international construction competition trend over the period 1981 to 2008. Furthermore, Han et al. (2010) analysed common strategies of sustainable growth of leading global contractors. However, there is no research available dealing with MNEs in construction in relation to climate change and sustainability. The current research aims to bridge this gap by identifying barriers to GBMs in the UK. Based on the results, recommendations will be made for MNEs wishing to enter the UK market. The next section reviews GBMs and their major barriers.

2.2. Green business models (GBMs) and their barriers

GBM as a term is relatively new to construction research (Al-Saleh and Mahroum, 2014), although terms sharing similar meanings with GBMs can be found in construction literature. For example, Aho (2013) used the term added value BMs to describe sustainability models. Funkhouser et al. (2015) used the term BM innovation to study community solar energy. However, most of the studies available describe GBMs through defined elements (Mahapatra et al., 2013; Selberherr, 2015; Walravens, 2015). This research follows this tradition and adopts five essential elements of GBMs as synthesised by Sommer, one of the few authors who delivered comprehensive empirical work on GBMs (Sommer, 2012). In addition, the theoretical framework of Sommer's work is well grounded in the BM construct as developed by (Osterwalder and Pigneur, 2010; Osterwalder, 2004). The five elements are: green value proposition (GVP); target group (TG); key activity (KA); key resources (KR); and financial logic (FL). These elements can be categorised based on two value perspectives: value creation and value capture. The KR and KA elements constitute the value creation perspective, while the GVP and TG elements constitute the value capture perspective. Value creation and value capture involve financial arrangements such as cost and revenues. The fifth element is: FL (Sommer, 2012).

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The few studies that do exist and deal with barriers to GBMs have focused on a specific GBM. For example, Strupeit and Palm (2015) investigated barriers to customer-sited solar photovoltaics (PV), as a GBM, by conducting a comparative study in Japan, Germany, and the United States. Key barriers investigated include long payback periods; capital costs, deployment of the PV on site, and customer concerns about PV reliability. In addition, Al-Saleh and Mahroum (2014) focused on market barriers to energy efficiency, as a GBM, such as misplaced incentives, imperfect competition, and regulatory and economic policies. They also stated that these market barriers provide a justification for policy intervention. Richter (2013) investigated barriers for distributed PV from the German utilities perspective. The results highlighted various barriers; including lack of products and services, lack of demand; lack of competency, and lack of profitability. The current study differs from these studies in two ways: firstly, it focuses on generic GBMs relevant to the construction sector as guided by this definition: GBMs create and capture green value propositions that provide environmental improvements and economic benefits at the same time. Secondly, the study deals not only with barriers but also with the relationship between these barriers for the development of p a collective understanding of the root barriers to be tackled at the outset.

FORA (2012) identified barriers to introducing new BMs to support green transformation with focus on the Nordic countries. The FORA study provides a holistic view on GBM barriers with reference to different industries, including construction. The study also identified contextual and organisational barriers to be overcome. According to FORA (2012), the contextual barriers include lack of market-pull factors, lack of capital investment, difficulty of new BMs to mesh well with the existing systems and the need for supporting systematic change of infrastructure and technology, legislation barriers, and lack of client readiness and understanding of GBMs. On the other hand, the organisational barriers include traditional mind-set and lack of knowledge on sustainability, lack of successful cases on GBM, lack of alignment among different functions of the organisation, and lack of capabilities in R&D. FORA (2012) suggested that these barriers can be alleviated by strengthening the role of policy in supporting new GBMs. Although this study provides useful insights into GBM barriers, it is a theoretical study of cross industry analysis. This paper, however, empirically investigates barriers to GBMs with a specific focus: the construction sector.

3. Materials and methods

The objectives of this study were to identify barriers to GBMs for the construction sector and to structure the relationship between these barriers to provide a better understanding for MNEs intending to enter the UK market. Since the study was exploratory in nature and little was known about the subject under investigation, it was essential to select qualitative methods because they produce a wealth of detailed data on a small sample (Amaratunga et al., 2002; Hyde, 2000). Nineteen semi-structured interviews were conducted with academics and managers from various construction companies in the UK, as presented in Table 1. The participants were grouped by their expertise: academic (A), architect (AR), consultant (CS), contractor (C), other (O) including property development and procurement, and client (CL). All the interviewees have considerable experience in the construction sector; in particular they had relevant experience on green issues, with some of them having 'environmental' or 'sustainability' in their job titles. The websites of all the participants' companies were reviewed in order to be familiar with their main activities and approach to sustainability. The interviewees were asked the following questions:

Q1. Which challenges would need to be resolved in order to realise a GBM?

Follow up questions were asked on the relationship between the challenges reported.

Data was analysed manually in a qualitative manner by identifying emerging themes from the interviews to identify the barriers to GBM transformations. The interviews are transcribed and the authors have examined them closely and categorised them. The categories have been cross-checked on group discussions between the authors and fellow researchers. The identified barriers are then structured into a visual model by using interpretive structural modelling (ISM) to reveal the collective impact of the barriers. ISM is next explained in more details.

Of the 19 interviewees above, five interviewees (AR1, AR2, C2, C3, and C4) work with MNEs. All the interviewees were selected for their expertise and knowledge of environmental practices within the construction sector. Some of the interviewees have sustainability/environment within their job title as presented in Table 1.

3.1. Interpretive structural modelling (ISM)

According to Attri et al. (2013), ISM is a well-established method for recognising relationships among specific elements that define a problem. ISM originates as an interactive group learning process, although it can also be used by individuals. In this process, a set of directly or indirectly linked elements are structured into a systematic model. ISM is utilised to understand the relationships between the barriers and to develop insights into a collective understanding of these relationships.

ISM is an established qualitative tool which can be applied in various disciplines. For example, Luthra et al. (2011) explored various barriers in implementing green supply chain management (GSCM) in the Indian automobile sector through the application of ISM. Talib et al. (2011) applied the ISM approach to understand the interaction among total quality management (TQM) barriers in organisations. Haleem et al. (2012) analysed the critical success factors of world-class manufacturing practices by relying on the ISM method.

The various steps involved in the ISM method are extracted from (Attri et al., 2013; Ravi and Shankar, 2005; Shahabadkar, 2012) and are as follows:

Step 1. Identification of variables affecting the system under consideration

Step 2. Development of a structural self-interaction matrix (SSIM) which depicts dependence among all possible pairs of elements by choosing a contextual relationship showing which elements influence others

Step 3. Reachability matrix is developed from the SSIM and the matrix is checked for transitivity. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a variable X is related to Y and Y is related to Z, then X is necessarily related to Z

Step 4. Classification of variables based on their driving and dependence power using MICMAC (Matriced'Impacts croises-multipication applique' and classment) analysis

Step 5. The reachability matrix obtained in step 4 is partitioned into different levels

Step 6. Based on the relationships given above in the reachability matrix, a directed graph is drawn and the transitive links are removed

Step 7. The ISM model developed in step 6 is reviewed to check for conceptual inconsistency and necessary modifications are made.

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Table 1
Interviewee profile.

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

4. ISM model development

4.1. Identifying GBM barriers

The participants identified many barriers to GBM transformation and development. These barriers were analysed manually by applying thematic analysis as presented in section 3. The grouping of the categories was carried out by the research team and was influenced by previous research as presented in Section 2.2 above. The barriers are presented in Table 2 below.

4.2. Developing SSIM for GBM barriers

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

1 V: barrier i will influence barrier j but not in both directions;
2 A: barrier j will influence barrier I but not in both directions;
3 X: barriers i and j will influence each other; and
4 O: barrier i and j are unrelated.

Table 3 below presents the SSIM with different symbols relevant to each pair-wise relationship.

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

The contextual relationship between GBM barriers was obtained from the participants. The participants felt that the government has the power to remove all the barriers faced by GBMs transformation. Table 3 above presented 10 existing relationships that are explained below by the cell number.

1. **Cell 1–2: The relationship between the government constraint and financial constraints:** All the participants stated that: *" 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 remove 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

Table 3
SSIM.

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

Table 2
GBM barriers.

	GBM barriers	Quotations from interviewees
1	Government constraints	*Lack of clarity, lack of consistency, lack of support*
2	Financial constraints	*Fund & investment, insurance, valuation, capital cost vs. whole life cycle cost, capitalists economies*
3	Sector constraints	*Traditional models, slow industry, cost-based industry, acceptance & recognition, lack of robust whole life cycle cost data*
4	Company constraints	*Lack of long-term vision, lack of access to support & information, lack of mature supply chain, lack of affordable/scalable technology, constraints on skills, ignorance & miniature, culture, lack of engagement with key stakeholders*
5	Lack of demand	*Acceptance & recognition, market culture, green costs more.*

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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 barriers, as explained above and hence the relationships denoted as V in the matrix above (Table 3). It is worth noting that the participants did not mention that the rest of the barriers - financial constraints, industry constraints, company constraints, and lack of demand – can remove 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 influence each other and thus the relationship is denoted as X (Table 3).

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 influence company constraints and consequently is denoted as V in Table 3.

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 influence the lack of demand and hence is denoted as V in the matrix above (Table 3).

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 influence company level constraints and thus the relationship is denoted as V (Table 3).

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 influence 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 3.

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 influence the lack of demand and hence the relationship denoted as V in the matrix above (Table 3).

4.3. 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 barriers is shown in Table 4.

Table 5 presents the final RM. As there is no transitivity, the RM matrix and final RM will be same. It is evident from SSIM that all the interactions are i to j except one. Table 4 has been represented to

Table 4
RM matrix.

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

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Table 5
Final RM.

No.	GBM barriers	1	2	3	4	5	Driver power
1	Government constraints	1	1	1	1	1	**5**
2	Financial constraints	0	1	1	1	1	**4**
3	Sector 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**

show the calculation of driving and dependence power as an important step of ISM method. Hence, it has been re-named as Table 5 because it includes this calculation. The driving power of a barrier is the total number of barriers including itself that it may influence. The dependence power is the total number of elements that may help in alleviating it. Based on the driving and dependence power, the barriers can be classified into four clusters: autonomous, dependent, linkage, and independent/driver barriers. This classification and its implications are explained in more detail in the next section.

4.4. Classifying GBM barriers – MICMAC analysis

Based on the driver power and dependence power generated in Table 5, the GBM barriers were classified into four clusters as shown in Fig. 1 below.

The major findings of this classification (Fig. 1) were as follows:

1. The diagram indicated that there is no barrier that comes under an autonomous cluster. Autonomous barriers generally appear as weak drivers as well as weakly dependent and are relatively disconnected from the system. These barriers do not have much influence on the other barriers of the system.
2. The lack of demand and company constraints have weak driver power but strong dependence, and are therefore, classified as dependent barriers. The dependent barriers mean other barriers need to be addressed and removed before their removal.
3. The linkage cluster did not include any barriers. Linkage barriers have a strong driving power as well as strong dependence. These barriers are unstable because any action on them will have an effect on others and also a feedback effect on themselves. Although the diagram has indicated that the financial constraints and sector constraints were positioned in the middle between linkage and driver clusters, these constraints cannot classified as linkage because they have weak dependence power. Therefore, it will be appropriate to classify them as drivers.
4. The government, financial, and sector 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 barriers will result in removing the other two barriers.

4.5. 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. The barrier 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 barriers by duplication of this process. Once the level was identified for a barrier, it was discarded from the list of remaining barriers. Table 6 presented the first iteration which showed that lack of demand was found in the first level. Therefore, it was removed from consideration in iteration

Table 6
Iteration 1.

GBM barriers	Antecedent set			Level
	Reachability set	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	1st

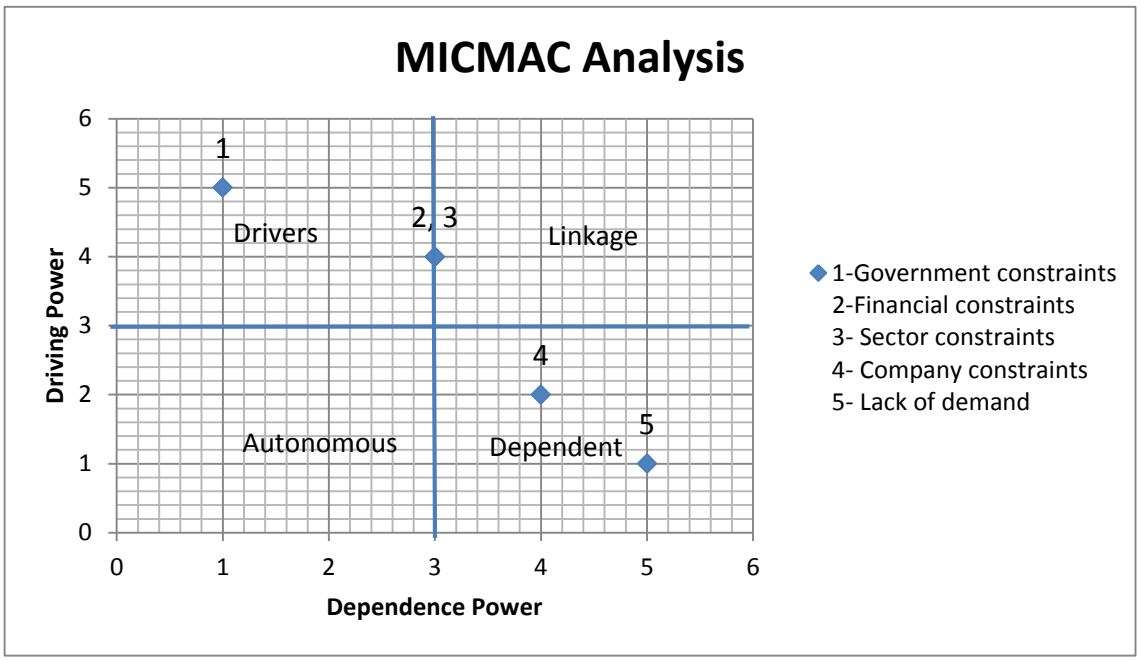

Fig. 1. Driving power and dependence diagram.

2 as detailed in Table 7. Iteration 2 showed that company constraints were found in the second level. Similarly, iteration 3, presented in Table 8, showed that the financial constraints and the sector constraints were found in the third level. Consequently, the government constraints became the fourth level barrier. 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.

4.6. Developing the ISM model for GBM barriers

From Table 6, 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 barrier will not influence any barrier. The rest of the barriers have been positioned in the hierarchy, reflecting their levels, as presented in Tables 7 and 8 The final ISM model for GBM barriers is shown in Fig. 2 below. The arrow direction indicates the relationship between the different barriers. For example, the relationship between the financial constraints and the sector 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 influence the latter. Therefore, an arrow pointing from the company constraints to the lack of demand was used.

It was observed from Fig. 2 that government constraints (barrier 1) were a significant barrier to GBM transformation as it came in the base level of the ISM model. On the other hand, lack of demand (barrier 5) was the GBM barrier on which the effectiveness of GBMs depends because it came at the top level of the ISM model.

5. Discussions

5.1. Government constraints

The importance of legislation in inducing green transition has been widely recognised by the participants. However, some of the participants were concerned about unadvised policy makers imposing immature regulations. In addition, they highlighted the damage caused to their companies by changing government policies. For example, C1 mentioned that the government required that all timber for government funded projects only use 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 suggested *"A lot of time is wasted when regulation changes."* Furthermore, CS2 from the consultant group talked about the importance of consistency in 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 was understood, well implemented 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 sector 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, although 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 imposed on abusers. In a related vein, Bilsen et al. (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, allowing policy makers to benefit from policy learning practices and engagement with relevant stakeholders. This approach will help in 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 in 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 have actively encouraged environmental reform among companies and, as a result, there has been an increase in the number of regulations, such as the Landfill Tax, Climate Change Levy, and Aggregates Levy.

5.2. Financial constraints

The participants explicitly and thoroughly addressed financial constraints as a major roadblock to 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 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 involve communities further. It may have different forms of ownership, such as cooperative ownership. Hence, the construction companies have to be more innovative in the way 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 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 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

Table 7
Iteration 2.

GBM barriers	Antecedent set			Level
	Reachability set	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	2nd

Table 8
Iteration 3.

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

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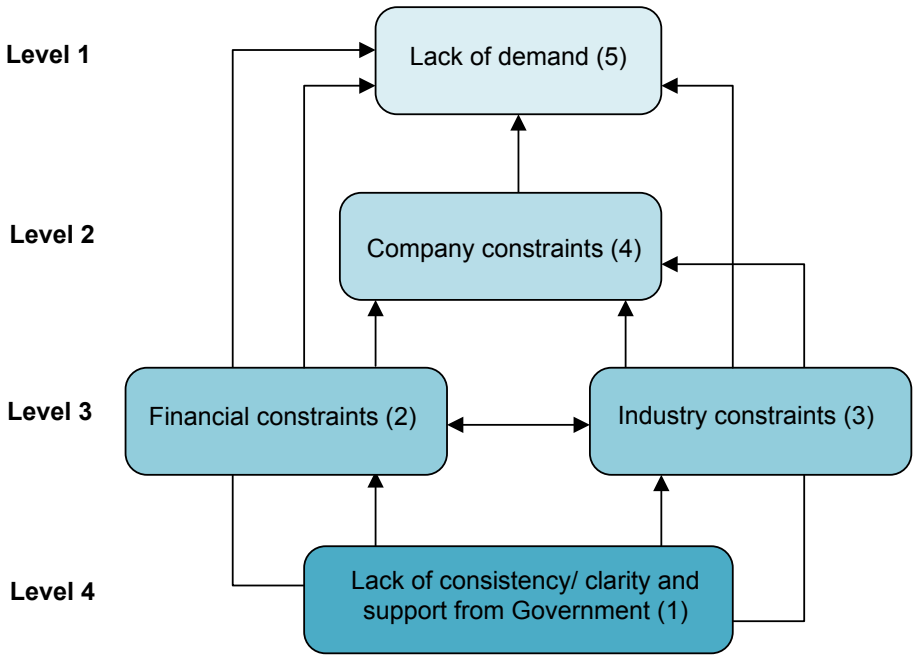

Fig. 2. ISM - based model for the GBM barriers.

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 recycled glass on a project, but the clients were against it, although it would 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, 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 sector is to appreciate the GVP, then new approaches to valuing properties are needed. *"We need new ways of valuing property (possibly life cycle related), but this requires a change in the approach of the whole property sector, starting with RICS (Royal Institute of Chartered Surveyors) and Mortgage Lenders."* 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 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. Hence, in order to move forward, either targeting shorter payback periods or finding a way of funding the upfront capital investment is required. However, the reduction on whole life cycle costs can outweigh the capital costs, which will make it more justifiable for investors.

Capitalist economies hinder full green transition because these economies focus on large financial returns only. For example, CL3 from the client group stated that, *"It will be very difficult to try and change the economic models, certainly in capitalist economies like this one. To try and change the business investment model so that you are asking people to invest for little or no return 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 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).

5.3. Sector constraints

The participants admitted that inherited problems and traditional models within the construction sector have hindered green transition. A2 from the academic group described the construction sector as a slow sector to change, and therefore, legislation is needed to move forward. He also talked about the dominance of cost rather than performance. Contractors C1 and C4 agreed with the academic on the lack of performance or value models. For example, C4 stated, *"It feels like the sector [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 it's necessarily incentivised to deliver best value."* One of the architects (AR1) reiterated the concern about traditional models in the construction sector 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 cheaply as possible and sell it for as much profit as possible. That is the traditional model."*

The participants also highlighted the lack of acceptance and recognition of GVPs and the associated benefits. For example, C3 from the contractor group talked about the barrier of, *"Letting the sector [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 of convincing clients to use recycled

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content in a project and on finding insurance cover for a used material. These issues can be overcome by educating the whole construction sector and society on the value of green solutions.

In the construction sector it is also rare to find companies or individuals 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 in 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 that can be developed between academia and industry.

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 sector as a whole. (For more detail refer to section 4.3 above.)

As regards professionals at the company level, they need to stay at the cutting edge of the major green issues and 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. The green technology is another hindrance because it is not 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 what is required is 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 sector when it comes to GBMs. For example, CS2 from the consultant group stated, *"Internally [referring to the internal barriers regarding GBMs] ignorant 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 it's a trend so environmental issues are going to go away so internally you get a lot of ignorance."* He argued that 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, a company's investment in training is essential if 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. If it does not exist it should be grown that will switch people into recognising to be part of what they do every day and that is very much where the council is and we have been working on that for very long time."* (client group CL1 from a Local Authority).

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. The client's 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 barrier of GBMs.

5.5. Lack of demand

The demand hindrances, from the participants' perspective, are the broader acceptance of the market. The construction sector has struggled with GBMs up to now; 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 where it will be difficult to rely only on 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 raises the dilemma of financial investment and who will pay for the extra cost of green.

The participants also explained the cultural barriers presented mainly by consumption patterns which inhibit transformation towards green business models and hinder communities from fully contributing to this process. Clearly, popular culture needs to accept and recognise the green solution. The gap can be bridged by better understanding by professionals from the supply side of the cultural settings they operate in and communication of 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 growth.

Five categories of barriers of GBMs emerged from this study: government constraints, financial constraints, sector constraints, company constraints, and lack of demand. These are consistent with an empirical study conducted by the OECD. The study related to new BMs for green growth in order to draw up policy recommendations. 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., 2013). In addition, this study highlighted the major role that the policy makers can play to achieve green growth through BM innovation.

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

6. Research implications

Several studies presented and documented various barriers hindering GBMs transformation and green growth but none of

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these examined the co-dependence between the barriers (Beltramello et al., 2013; Häkkinen and Belloni, 2011; Lam et al., 2009; Opoku and Ahmed, 2014; Zhang et al., 2011). ISM method has been successfully applied in different disciplines such as the green supply chain (Luthra et al., 2011), quality management (Mahajan et al., 2016), disaster risk reduction (Trivedi et al., 2015; Yadav and Barve, 2015), and manufacturing (Haleem et al., 2012). However, it is less evident in the construction discipline and GBMs. This study presents a novel contribution to the ISM method. The observations from the ISM model and driver-dependence diagram (Fig. 2), which give important managerial insights and implications, are discussed below.

The government constraints were a significant barrier at the bottom level of the ISM model implying higher driving power. The government constraint such as lack of consistency and clarity (barrier 1) leads to the financial constraints of lack of funds and insurance (barrier 2). In addition, the government constraint leads to the constraints at the construction sector level (barrier 3) where the sector still lacks acceptance and recognition of GBMs. This non-market barrier has a major impact on MNE related strategy (Kolk and Pinkse, 2008). For MNEs, it is essential to understand climate change related policies relevant to the construction sector. This is consistent with the general literature of MNEs. Lundan (2010) stated that MNEs have begun to engage with governmental institutions in a greater variety but there is lack of research in the different forms of capabilities and strategies that are needed for MNEs to deal with non-market context in different host countries. According to Lundan (2010), MNEs can gain institutional advantages by engaging with formal government-related institutions that can result eventually in legitimacy and trust in the host country. In addition, Lundan (2010) suggested that MNEs may need substantial institutional advantages to be able to benefit from their existing advantages, such as asset and transactional advantages. It is, therefore, recommended that MNEs need to understand the existing policies relating to climate change developed in the UK. However, they also need to take into consideration that these policies are seen as inconsistent by construction professionals. Since GBMs are evolving, MNEs have to accept the risk of policy changing and its implications on strategies and capabilities development. MNEs can help in this situation by transferring knowledge and expertise that may have worked elsewhere (Haigh and Sutton, 2012).

The financial constraints (barrier 2) and construction sector constraints (barrier 3) were interrelated. Financial support is essential for the construction sector to recognise the true value of GBMs. MNEs may have an advantage on financial issues because they have access to finance in their home country and other hosts countries where they perform activities. MNEs have also accumulated experience in finance management and ability to reduce transaction costs (Kolk and Levy, 2004).

At the same time, availability of robust data and good business cases from the sector will encourage different financial providers to invest in GBMs. Lack of financial and sector support will result in constraints at the company level (barrier 4). Therefore, before removing barriers 2 and 3 it will be difficult to remove barrier 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 construction 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 sector, 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. Therefore, clients can be used as a driver by MNEs where they can respond to market demands through their accumulated experience of efficiency market power (Lundan, 2010) and through their "green" firm-specific advantages in response to environmental pressures in different hosts countries (Kolk and Pinkse, 2008). The ISM model also demonstrated that a large pool of support is needed for GBM transformation.

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 is sustainable. For this reason, the study has identified barriers expanding beyond the immediate company level to facilitate company-level and system-level green growth.

In summary, the construction sector is fast moving towards green transformation and GBMs are obvious candidates to lead this movement. Accordingly, the identification of the barriers affecting the transformation of GBMs assumes great importance. This can support top management in deciding the priorities, and hence, proactively take steps in combating these barriers. MNEs may be in a better position to combat these barriers because they benefit from certain advantages that are less observed in traditional companies. For example, Lundan (2010) stated that the advantages of common governance are driven by multinationality itself because MNEs are effective in coordinating cross-border assets and activities. The advantages of common governance result in organisational effectiveness in dealing with different challenges.

7. Conclusions

This paper has empirically investigated barriers to GBMs for the construction sector. Semi-structured interviews were conducted with 19 experts representing academia and practices, including MNEs. By applying thematic analysis, the barriers which emerged from the analysis were grouped into five major categories: government constraints, financial constraints, sector constraints, company constraints, and lack of demand. The results demonstrated that GBM development requires a large pool of support ranging from government to financial institutions. In addition, the role of the construction sector as a whole cannot be overemphasised. The traditional models of the sector that are based on cost rather than performance and value need to be modified. Furthermore, promotion of GBMs across the sector needs considerable efforts.

The barriers have been then put into an ISM model to analyse the interaction between them. 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 barriers hindering GBMs and green growth but none of these examined the co-dependence between the barriers. This study has provided novel insights for both construction companies and policy makers on the relationship between the barriers of GBMs and distinguishes between the driving barriers, such as government constraints (i.e. which influence the other barriers) and dependent barriers, such as lack of demand (i.e. which are influenced by others). The paper has shown the ISM-based model's potential usefulness in providing a critical framework for thinking about GBMs and for a new policy debate. For MNEs intending to enter the UK construction market this qualitative study has highlighted some recommendations, such as the importance of non-market forces and the ability to gain institutional advantages by effective engagement with the government and the advantage of accessing external fund to overcome financial constraints imposed by UK financial institutions.

Despite the novel insights provided by this study, it has some

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limitations. The research is reliant on empirical data from the UK only. However, we argue that the results obtained are useful to similar developed countries.

The study has identified the government as the primary barrier to GBM transformation although previous studies suggested that it is the major driver for environmental reforms in response to climate change within the UK construction sector. Future research can be carried out to investigate the role of the government and policy makers (non-market barrier) in more detail to either support or reject this result. In follow-up studies, it seems worthwhile to develop a guideline for MNEs on aligning their GBMs to country-level issues relating to climate change.

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