

PAPER • OPEN ACCESS

## Strategizing contractor firms to deliver green construction projects: conceptual framework

To cite this article: Ayisha Powmya *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **601** 012027

View the [article online](#) for updates and enhancements.



**IOP | ebooks™**

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the **collection** - download the first chapter of every title for free.

# Strategizing contractor firms to deliver green construction projects: conceptual framework

Ayisha Powmya<sup>1\*</sup>, Nazirah Zainul Abidin<sup>1</sup> and Nurul Sakina Mokhtar Azizi<sup>1</sup>

<sup>1</sup>School of Housing, Building and Planning, University Sains Malaysia (USM), 11800, Pulau Pinang, Malaysia

\*Corresponding author: [ampowmya@gmail.com](mailto:ampowmya@gmail.com)

**Abstract.** Delivering green construction (GC) projects is not an easy task for inefficient or inexperienced contractor due to added requirements. This paper conceptualizes firm strategies in delivering green projects by focusing on enhancing firm resources. Journal articles with keywords such as ‘green construction’, ‘green project’, ‘sustainable construction’, ‘resources and capabilities’, ‘contractor strategies’, and so forth in the title, abstract or keywords of the publications were reviewed. Articles published from 2000 to 2018 in Scopus database were selected. The current literature on firm resources mainly focused on four assets (personal, financial, technological and organizational) and four capabilities (technical, innovative, managerial competency and collaborative). These assets and capabilities are necessary for contractor firms to survive in the industry. Capitalizing on these resources, this paper proposes seven strategies: human resource strategy, innovation strategy, financial strategy, smart collaboration strategy, environmental pro-activeness strategy, management enhancement strategy and information and communication strategy, for contractor to effectively deliver green project. Using Resource Based View (RBV) and Resource Mobilisation Theory (RMT), a conceptual framework is produced connecting firm resources and Resource Mobilisation Strategies (RMS). This paper shall benefit contractors and academician as it extended the knowledge on firms’ resources and recommend ways to strategize green delivery.

## 1. Introduction

Contractors implement responsible construction practices to support environmental sustainability at construction site. However, GC project construction may appear to be an uneasy task for inexperienced and incompetent contractor in that type of projects due to the use of green technology, additional design requirements and rigorous practices at site. The level of contractor firm success depends on their resources and processes, in addition to management practices used during implementation of technologies [1]. Contractor firm’s internal strength such as competence, knowledge to do the job and financial arrangements are very important to ensure successful project delivery [2]. Strategies are the patterns of decisions that organisations plan to execute for achieving stated and desired objectives [3]. Strategy provides direction and focus for the organisation. An organizational capability is its ability to perform a task using its resources to achieve its goals [4]. This indicates that resources will influence strategies of firms. While commitment of efforts and resources from contractors is generally influenced by pressure exerted by environmental regulations and stakeholder demands [5], resources account as key factors affecting the adoption of GC practices in



projects. Contractor firms are likely to have greater need for resources and RMSs in order to be able to deliver GC projects.

Although there have been attempts to identify enablers of green project construction, the existing works have only managed to provide fragmented insights into practical strategies of contractor firms to implement green project construction using firm resources as basis. The aim of this paper is to systematically review related researches on contractor firm resources and strategies to provide an overall summary of current body of knowledge and to present a conceptual framework for strategizing contractor firm resources to deliver GC projects using RBV and RMT. The conceptual framework is produced from extensive literature review obtained from scopus database. The timeframe of 2000 to 2018 was chosen for the sample, since the year 2000 shows growth in research work on green projects. The framework relates contractor firm resources to RMSs in order to ensure successful construction of green projects.

## **2. Contractor and green project involvement**

Construction contractors who are responsible for practical realization of designs play critical role in achieving environmental sustainability of construction projects [5–7]. Although all parties involved in construction project should cooperate, being the implementers of construction projects, it is imperative for the construction firms to be knowledgeable and well equipped to deliver GC projects. For a contractor to be able to adopt green practices in its organization, factor such as managerial concern is an important driver [5]. As such, improvement in environmental performance of construction projects is due to the resources and strategies of contractor firm.

## **3. Research approach**

The objectives of this paper are to provide information on contractor firm resources and strategies to deliver GC projects. Scopus search engine was selected as most of the research papers in construction, management and engineering are archived in Scopus. Literatures from 2000 to 2018 were selected using keywords such as ‘green construction’, ‘green project’, ‘sustainable construction’, ‘resources and capabilities’, ‘contractor strategies’, and so forth in the title, abstract or keywords of the publications. The literatures were explored to identify resources of contractor firms delivering GC projects and the RMSs to be adopted by contractor firms engaged in green project construction. Finally the findings of the review were summarized. The resources of contractor firms which are basis of RMSs are presented in the next section.

## **4. Contractor firm resources**

Contractors’ responses to the government imposed requirements and project stakeholders’ pressure differ according to the capability of firm in tackling varied issues. Firms use resources as input factors to conceive of and implement their strategies [8, 9]. Efficient use of resources will lead to better competitive ability, diversification of good and services and growth potential.

For contractor firms to deliver GC projects, they need to ensure the employees are knowledgeable and able to cope with the technological sophistication and complexity of green projects [5, 10]. Financial assets are assets relating to company’s finance capital base and turnover and profitability which are indicators of the financial strength of a contractor firm [11]. Realization of strategic plans requires investment-in facilities, knowledge, personnel, and so on. Financial capital base is of primary importance for contractors as they are responsible to pay suppliers [12]. Hence, cash flow forecast and budget allocation is essential for green project delivery. Technological assets of firm such as information technology resources and plants and equipments which are necessary for physical realization of projects [9]. In the implementation of the GC projects, GC technology is the foundation [13] as green projects are more sophisticated than conventional projects [14]. Appropriate IT systems are also necessary to deliver and communicate the information from green consultants to the project team members [15]. Organizational policies, its procedures for planning and control, and its environmental management system constitute the organizational assets. Environmental protection

being one of the major project success criteria requires contractor firms' environmental protection plan [11, 16]. Therefore, presence of Environmental Management System (EMS) has been identified as helpful for GC project [17]. Thus, organizational assets which relate to organizational infrastructure such as sustainability policies, procedures and Environmental Management System (EMS) are required for GC project success. High technical capability of contractor firms is critical to achieve environmental objectives of GC projects [4]. A firm with strong technical capabilities can certainly deliver a GC project at a lower cost because it understands GC project needs, relevant technologies to such project and able to identify suitable green material suppliers [18]. Innovative capability is a firm's ability to develop new products and processes and to achieve superior technological and/or management performance [19]. Research & Development facilitates transition to GC by continuous development of new products and processes [20]. Contractor firms should have strong innovation capability to undertake a GC project successfully [21]. Managerial competency is important for contractor as they are responsible to plan, manage and oversee all construction activities. Since GC projects are embedded with innovative practices, contractor requires managerial competency to operate within the acceptable standards of GC [21]. Ingenious collaboration skills promote goal alignment and helps to reduce counterproductive behavior, more frequent and open sharing of information, the exchange of expertise and resources [22]. The Table 1 shows the resources required by contractor firms, which are identified from literatures.

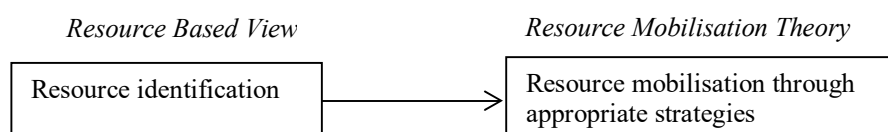
**Table 1.** Resources of contractor firms delivering green development projects.

	[20]	[22]	[11]	[10]	[23]	[15]	[9]	[21]	[14]	[5]	[24]	[17]	Frequency
1			√	√			√	√		√			5
2			√				√						2
3			√			√	√		√				4
4			√									√	2
5			√				√						2
6	√						√	√					3
7							√	√			√		3
8	√	√			√			√					4

1=Personnel assets; 2=Financial assets; 3=Technological assets; 4=Organizational assets; 5=Technical capability; 6=Innovative capability; 7=Managerial competency; 8=Collaborative capability

## 5. Resource Based View and Resource Mobilization Theory

RBV, in the field of strategic management emphasizes that every firm possesses a unique resource bundle that influences its strategic choices [25]. The researchers recognized that the RBV is the most appropriate theoretical background on which the resources of contractor firm engaged in GC project delivery can be explored. However, RBV is unable to explain what routines are applied by contractor firms to mobilise the firm resources. Effective mobilization of resources leads to success of a social movement [26]. RMT is the dominant philosophy in the study of social movement which emphasizes the importance of resource mobilization in order to advance a social movement's motives [27]. Hence, the researchers observed that RMT need to be associated with RBV. This is illustrated in Figure 1.



**Figure 1.** Theoretical model.

## 6. Resource Mobilisation Strategy of contractor firms

Contractor firm strategies in this study are planned actions of firms to improve resources which facilitate green project construction [28]. Resource mobilisation is activities carried out to prepare and organise resources. RMS may trigger firm's actions towards quality improvement, better GC technologies application and reduction of any negative environmental impacts during construction processes [29]. This is supported by [10] who indicated through empirical test that innovation strategies are to be triggered within firms to obtain complete effect of any GC policy on firms' business performance. Resources that are required for contractor firms engaged in GC project delivery have been explained in section 4. Firms need to devise appropriate strategies to ensure smooth flow and effective utilization of resources during project implementation [12]. This paper proposes seven strategies: human resource strategy, innovation strategy, financial strategy, smart collaboration strategy, environmental pro-activeness strategy, management enhancement strategy and information and communication strategy, for contractor to effectively deliver green project.

Human resource strategy is concerned about managing human aspects of a firm [30]. Experience of technical personnel within the contractor firm boosts its performance [31]. Periodic training programs conducted have potential effect on environmental performance of construction projects [6]. A well-designed reward system could help to promote employees towards performing environmentally sound practices [15]. Investment in R&D activities can help to improve green practices' innovations which in turn can help to score more points during green certification and have higher "return on investment" [6]. Dedicated budget allocation for promoting GC goals would also influence green project delivery [1]. Construction firms could benefit from conventional contractual elements such as surety bonds and insurance policies as their financial strategies [13] and it is necessary to maintain a strong balance sheet to continually secure surety bonds for ongoing project procurements [30]. Collaboration with international firms engaged in GC that are well experienced and have adopted GC would be prudent for knowledge base of contractor firms [21]. It is necessary for contractors to take initiative to collaborate with government bodies and international/national green building councils for better understanding as well as for their advocacy in implementation [21]. Early involvement of suppliers in GC projects would be advantageous as it enables suppliers to understand the needs of clients and contractors and provide more value to them [14]. Environmental performance of GC projects would be enhanced through effective compliance to environmental regulations [32]. Adopting an EMS showcases a firm's high level of environmental ambitions in the project. This would improve its corporate environmental image which in turn help attracting potential clients [17, 33]. Separate GC department to provide the expert knowledge, resources and support for their LEED projects would be beneficial [1]. Designers' involvement in the construction stage and contractors' involvement in the design stage could act as most effective ways to solve the complicated issue [32]. It is critical to provide uninterrupted flow of information to avoid any miscommunication. The information provided by green consultants should be clearly communicated to project team members at proper timing to update their knowledge to construct green buildings [15]. Sufficient communication channels are required to be provided to communicate effectively. Maintaining GC project database and regularly benchmark their green building performance with their competitors would help improve the capacity of the contractor to understand, develop and implement its project specific green building goals [1]. Thus, the conceptual framework of contractor firm resources and RMSs to deliver GC projects is as shown in Figure 2.

<b>Contractor Firm Resources</b>		<b>Resource Mobilisation Strategies</b>	
<b>Personnel asset</b>	<ul style="list-style-type: none"> <li>• Qualified and experienced staff in green project</li> <li>• Skilled project manager</li> </ul>	<b>Human resources strategy</b>	<ul style="list-style-type: none"> <li>• Recruit new staff with green experiences.</li> <li>• Training of employees.</li> <li>• Reward employees.</li> </ul>
<b>Financial asset</b>	<ul style="list-style-type: none"> <li>• Finance capital base</li> <li>• Turnover and profitability</li> </ul>	<b>Financial enhancement strategy</b>	<ul style="list-style-type: none"> <li>• Allocate sufficient budget.</li> <li>• Use surety bonds.</li> <li>• Use insurance policy.</li> </ul>
<b>Technological asset</b>	<ul style="list-style-type: none"> <li>• IT resources</li> <li>• Plants and equipments</li> </ul>	<b>Technology innovation strategy</b>	<ul style="list-style-type: none"> <li>• Engage in Research &amp; Development</li> </ul>
<b>Organisational asset</b>	<ul style="list-style-type: none"> <li>• Sustainability policies and procedures</li> <li>• Environmental Management system</li> </ul>	<b>Information and communication strategy</b>	<ul style="list-style-type: none"> <li>• Develop green project database.</li> <li>• Provide sufficient communication channels.</li> </ul>
<b>Technical capability</b>	<ul style="list-style-type: none"> <li>• Technological knowledge to use available technological assets</li> <li>• Capability to communicate technically in projects</li> </ul>	<b>Smart collaboration strategy</b>	<ul style="list-style-type: none"> <li>• Partnership with material suppliers</li> <li>• Collaborate with international green construction firms.</li> <li>• Collaborate with governmental environmental regulatory bodies.</li> </ul>
<b>Innovative capability</b>	<ul style="list-style-type: none"> <li>• Capability to create new knowledge or new product</li> </ul>	<b>Environmental pro-activeness strategy</b>	<ul style="list-style-type: none"> <li>• Comply with sustainability legislations and EMS.</li> </ul>
<b>Managerial competency</b>	<ul style="list-style-type: none"> <li>• Capability to manage technological aspects</li> <li>• Capability to manage financial aspects</li> </ul>	<b>Managerial efficiency strategy</b>	<ul style="list-style-type: none"> <li>• Establish separate green construction department.</li> <li>• Coordinate with designers during construction stage.</li> <li>• Involve with designers during design stage.</li> </ul>
<b>Collaborative capability</b>	<ul style="list-style-type: none"> <li>• Capability to adapt to collaborated firms</li> <li>• Capability to adopt collaborated firms' practices</li> </ul>		

**Figure 2.** Conceptual framework of Resource Mobilisation Strategy of contractor firms to deliver green projects.

## 7. Conclusions

Contractor firms' strategies are shaped as a result of their resources. In order to encourage transition towards GC, adequate analysis along with in-depth understanding of contractor firm resources is necessary for selecting appropriate RMS. Contractor firms with resources such as personnel assets, financial assets, technological assets and organizational assets, technical capability, innovative capability, managerial competency and collaborative capability have more tendencies to deliver GC projects successfully. In addition, it is necessary to adopt appropriate strategies to ensure capitalization of firm resources to deliver GC projects. Policies and procedures of contractor firm that are targeted on project delivery need to transform to realize firm resources for GC project delivery. Therefore this study provides a broader view for policy makers when trying to adopt appropriate strategies. This paper presents a conceptual framework to cater to the RBV of strategy development and RMT. The

adoption of the framework improves contractors' resources to deliver GC projects. However, further research is required to understand the process of RMS. The model used in this study is not validated by real cases. Further research is required to empirically test and validate the conceptual model developed by this study.

## 8. References

- [1] Ofori-Boadu A, Owusu-Manu D, Edwards D and Holt G 2012 Exploration of Management Practices for LEED Projects : Lessons from Successful Green Building Contractors *Struct. Surv.* **30** 145-162
- [2] Tarawneh S 2004 Evaluation of Prequalification Criteria- Client Perspective: Jordan Case Study *J. Appl. Sci.* **4** 354–363
- [3] Price A D F 2003 The Strategy Process Within Large Construction Organisations *Eng. Constr. Archit. Manag.* **10** 283-296
- [4] O'Regan N and Ghobadian A 2004 The Importance of Capabilities for Strategic Direction and Performance *Manag. Decis.* **42** 292-313
- [5] Qi G Y, Shen L Y, Zeng S X and Jorge O J 2010 The Drivers for Contractors' Green Innovation: An Industry Perspective *J. Clean. Prod.* **18** 1358-1365
- [6] Li Y Y, Chen P H, Chew D A S and Teo C C 2014 Exploration of Critical Resources and Capabilities of Design Firms for Delivering Green Building Projects: Empirical Studies in Singapore. *Habitat Int.* **41** 229–235
- [7] Tan Y, Shen L and Yao H 2011 Sustainable Construction Practice and Contractors' Competitiveness : A Preliminary Study *Habitat Int.* **35** 225-230
- [8] Hitt M, Ireland R and Hoskisson R 2009 *Strategic Management: Competitiveness and Globalization: Concepts & Cases* (Mason, OH: South-Western)
- [9] Isik Z, Arditi D, Dikmen I and Birgonul M T 2009 Impact of Corporate Strengths/Weaknesses on Project Management Competencies *Int. J. Proj. Manag.* **27** 629–637
- [10] Eiadat Y, Kelly A, Roche F and Eyadat H 2008 Green and competitive? An Empirical Test of The Mediating Role of Environmental Innovation Strategy *J. World Bus.* **43** 131–145
- [11] Alzahrani J I and Emsley M W 2013 The Impact of Contractors' Attributes on Construction Project Success: A Post Construction Evaluation *Int. J. Proj. Manag.* **31** 313–322
- [12] Kuwaiti E A, Ajmal M M and Hussain M 2017 Determining Success Factors in Abu Dhabi Health Care Construction Projects: Customer and Contractor Perspectives *Int. J. Constr. Manag.* **18** 1–16
- [13] Yu Z, Lu C and San B 2014 *Application of Green Construction Technology in Construction Projects* In: International Conference on Construction and Real Estate Management (ASCE, Kunming, China) pp 389–397
- [14] Mokhlesian S 2014 How Do Contractors Select Suppliers for Greener Construction Projects? *The Case of Three Swedish Companies Sustain.* **6** 4133–4151
- [15] Hwang B G and Tan J S 2012 *Sustainable Project Management for Green Construction: Challenges, Impact and Solutions* In: World Construction Conference 2012-Global Challenges in Construction Industry (Colombo, Sri Lanka) p 9
- [16] Shen L, Lu W and Yam M C H 2006 Contractor Key Competitiveness Indicators : A China Study *J. Constr. Eng. Manag.* **132** 416–424
- [17] Varnäs A, Balfors B and Faith-Ell C 2009 Environmental Consideration in Procurement of Construction Contracts: Current Practice, Problems and Opportunities in Green Procurement in The Swedish Construction Industry *J. Clean. Prod.* **17** 1214–1222
- [18] Mayer K J and Salomon R M 2006 Capabilities, Contractual Hazards, and Governance: Integrating Resource-Based and Transaction Cost Perspectives *Acad. Manag. J.* **49** 942–959
- [19] Rangone A 1999 A Resource-based Approach to Strategy Analysis in Small-medium Sized Enterprises *Small Bus. Econ.* **12** 233–248
- [20] Albino V, Berardi U 2012 Green Buildings and Organizational Changes in Italian Case Studies

*Bus. Strateg. Env.* **21** 387–400

- [21] Mensah S, Ayarkwa J, Nani G 2015 Towards Enabling Construction Organizations' Adaptation to Environmental Sustainable Construction in Developing Countries *Adv. Soc. Sci. Res. J.* **2** 84–100
- [22] Allred C R, Fawcett S E Wallin C, Magnan G M 2011 A Dynamic Collaboration Capability as a Source of Competitive Advantage *Decis. Sci.* **42** 129–161
- [23] Fergusson H, Langford D A 2006 Strategies for Managing Environmental Issues in Construction Organizations *Eng. Constr. Archit. Manag.* **13** 171–185
- [24] Robichaud L B and Anantatmula V S 2011 Greening Project Management Practices for Sustainable Construction *J. Manag. Eng.* **27** 48–57
- [25] Chen P H, Ong C F, Hsu S C 2016 The Linkages between Internationalization and Environmental Strategies of Multinational Construction Firms *J. Clean. Prod.* **116** 207–216
- [26] Oliver C 1997 Sustainable Competitive Advantage: Combining Institutional and Resource-Based Views *Strateg. Manag. J.* **18** 697–713
- [27] McCarthy J D and Zald M N 1997 Resource Mobilization and Social Movements: A Partial Theory *Am. J. Sociol.* **82** 1212–1241
- [28] Manley K McFallan S, Kajewski S 2009 Relationship between Construction Firm Strategies and Innovation Outcomes *J. Constr. Eng. Manag.* **135** 764–771
- [29] Chen Y, Tang G, Jin J, Li J, Paillé P 2015 Linking Market Orientation and Environmental Performance: The Influence of Environmental Strategy, Employee's Environmental Involvement, and Environmental Product Quality *J. Bus. Ethics.* **127** 479–500
- [30] Cheah C Y J and Garvin M J 2004 An Open Framework for Corporate Strategy in Construction *Eng. Constr. Archit. Manag.* **11** 176–188
- [31] Aje O I, Odusami K T, Ogunsemi D R 2009 The Impact of Contractors' Management Capability on Cost and Time Performance of Construction Projects in Nigeria *J. Financ. Manag. Prop. Constr.* **14** 171–187
- [32] Li Y Y, Chen P H, Chew D A S, Teo C C, Ding R G 2011 Critical Project Management Factors of AEC Firms for Delivering Green Building Projects in Singapore *J. Constr. Eng. Manag.* **137** 1153–1163
- [33] Zhang X, Wu Y, Shen L 2015 Embedding “Green” in Project-Based Organizations : The Way Ahead in The Construction Industry? *J. Clean. Prod.* **107** 420–427