

**GREEN PROJECT DELIVERY FRAMEWORK
FOR CONTRACTING FIRMS IN OMAN**

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**GREEN PROJECT DELIVERY FRAMEWORK
FOR CONTRACTING FIRMS IN OMAN**

by

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LIST OF ABBREVIATIONS

ARZBRS	ARZ Building Rating System
BEPAC	Building Environmental Performance Assessment Criteria
BIM	Building Information Modelling
BREEAM	Building Research Establishment's Environmental Assessment Method
BS	British Standards
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CEDBIK	Cevre Dostu Yesil Binalar Dernegi
CRI	Carpet and Rug Institute
DC	Dynamic Capability
EEWH	Ecology, Energy Saving, Waste Reduction, and Health
EIA	Environmental Impact Assessment
ERP	Enterprise Resource Planning
ESGB	Evaluation Standard for Green Building
FA	Factor Analysis
GBCC	Green Building Certification Criteria
GBI	Green Building Index
GCC	Gulf Cooperation Council
GD	Green Development
GDS	Green Delivery Strategies
GPD	Green Project Delivery
GPS	Global Positioning System
GRIHA	Green Rating for Integrated Habitat Assessment

GSAS	Global Sustainability Assessment System
HVAC	Heating, Ventilation, and Air Conditioning
HK-BEAM	Hong Kong Building Environment Assessment Method
HQE	Haute Qualite Environment
ICT	Information and Communication Technology
ISO	International Organization for Standardization
KMO	Kaiser-Meyer-Olkin
LEED	Leadership in Energy and Environmental Design
LEED-AP	Leadership in Energy and Environmental Design-Accredited Professional
LIDAR	Light Detection and Ranging
MEMS	Micro-electromechanical systems
NABERS	National Australian Built Environment Rating System
NCSI	National Centre for Statistics and Information
OCCI	Oman Chamber of Commerce and Industry
OGBC	Oman Green Building Council
OHSAS	Occupational Health and Safety Assessment Series
OMBEC	Oman Building Environmental Certification
OSC	Oman Society of Contractors
OSE	Oman Society of Engineers
OPEN	Oman Professional Engineers Network
PCA	Principle Component Analysis
PQP	Project Quality Plan
QA/QC	Quality Assurance/Quality Control
QMS	Quality Management System

RFID	Radio-Frequency Identification
RO	Rial Omani
SAP	Systems, Applications and Products
SBAT	Sustainable Building Assessment Tool
SC	Sustainable Construction
SD	Sustainable Development
SDG	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
TRC	The Research Council
TREES	Thailand's Rating of Energy and Environmental Sustainability
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change Conference
US	United States
USD	United States Dollar
USGBC	United States Green Building Council
VOC	Volatile Organic Compound
VoIP	Voice over Internet Protocol

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RANGKA KERJA PENYIAPAN PROJEK HIJAU UNTUK FIRMA BINAAN DI OMAN

ABSTRAK

Projek pembangunan hijau (GD) di Oman semakin meningkat tetapi masih ketinggalan di belakang negara GCC yang lain. Disebabkan oleh kerumitan projek GD, kontraktor perlu memahami keupayaan dan menyusun strategi dalam menjayakan penghantaran projek. Penyelidikan ini bertujuan untuk membangunkan rangka kerja Penghantaran Projek Hijau (GPD) untuk kontraktor utama di Oman dengan mengadaptasikan komponen teori Keupayaan Dinamik (DC). Penyelidikan ini menggunakan pendekatan kaedah campuran. Melalui soal selidik dengan 108 kontraktor di Oman, 7 strategi penghantaran projek konvensional (objektif pertama) telah dikenalpasti. Kemudian, sesi temu bual dengan 14 responden yang berpengalaman dengan projek GD telah dijalankan untuk mencapai baki empat objektif: motivasi untuk GD, cabaran, strategi GPD, dan faktor sokongan. Terdapat empat motivasi utama (pembangunan reputasi, kelebihan daya saing, nilai sosial dan etika, dan kuasa pihak berkepentingan), enam cabaran utama (ketidacukupan pembangunan kemahiran, kurang campur tangan kerajaan, limitasi perolehan bahan, limitasi penyelarasan dan dokumentasi, perubahan amalan, dan kesukaran pematuhan penarafan hijau), empat strategi GPD utama (pengurusan manusia, pendekatan inovatif, kualiti, keselamatan dan perlindungan alam sekitar, dan kecekapan pengurusan) dan enam faktor sokongan utama (sokongan pengurusan, kewangan, kerajaan, teknologi, manusia dan luaran). Melalui penemuan ini, rangka kerja GPD disediakan untuk mengaitkan pelbagai komponen penting dalam memastikan penghantaran projek GD dengan baik.

GREEN PROJECT DELIVERY FRAMEWORK FOR CONTRACTING FIRMS IN OMAN

ABSTRACT

Green development (GD) projects in Oman are gaining momentum but still far behind other Gulf Cooperation Council (GCC) countries. Due to the complexity of GD projects, contractors need to understand their capability and strategize in ensuring successful project delivery. This research aims to develop Green Project Delivery (GPD) framework for main contractors in Oman by adapting the components of Dynamic Capability theory. This research adopted a mixed-method approach. Through survey with 108 contractors in Oman, 7 conventional project delivery strategy (first objective) were identified. Next, interview sessions with 14 respondents with GD projects experience achieved the remaining four objectives: GD motivations, challenges, GPD strategy, and the supporting factors. There are four main motivations (reputation development, competitive advantage, social and ethical value, and stakeholders' forces), six main challenges (insufficient skills development, lack of government intervention, limitation in materials procurement, documentation and coordination limitation, change of practices, and difficulty in green rating compliance), four main GPD strategy (people management, innovative approach, quality, safety and environmental protection, and management efficiency) and six main supporting factors (management support, financial support, government support, technology support, people support, and external support). Through these findings, GPD framework is presented connecting various important components in ensuring proper GD projects delivery.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduces the background of the research and discusses the issues which motivated the study via research problem identification which led to research questions formulation. The chapter presents the research aim and objectives. It also briefs the methodology adopted for the study and scope of the research. Lastly it discusses the significance of the research and guides the thesis.

1.2 Background of the Research

The construction industry represents a large and valuable sector in every country's economy (Albino & Berardi, 2012; Hwang, Shan, & Lye, 2018). However, the evidence of the negative impact of construction on the environment is mounting. For example, construction activities account for 35% of waste to landfill (Ghaffar, Burman, & Braimah, 2020), 36% of global energy consumption and 39% of annual green-house gas emissions at global level (United Nations Environment Programme (UNEP), 2018) and contribute substantially to the loss of agricultural land, deforestation and pollution (X. Zhang, Wu, & Shen, 2015). With this realisation, the construction industry reacts positively to address the unfavorable environmental impacts of its activities by introducing sustainable or green concept as an effort to be innovative in technological advancement and future generation needs (Chan, Darko, & Ameyaw, 2017).

Green Development (GD) projects employ sustainable construction principles in its development, whereby the development projects are constructed using best practices starting from sourcing of raw materials to demolition and disposal of waste

(Jingxiao Zhang, Li, Olanipekun, & Bai, 2019). This makes GD projects environmentally, socially and economically sustainable. The demand for green construction grew rapidly with the ratification of the Kyoto Protocol in 2005, which committed the member states to collectively reduce emissions (Al-Badi, Malik, & Gastli, 2011) via various legislative and fiscal restrictions. Many countries highlight sustainability as one of the top priorities towards the effort to preserve the environment for the future generation while using the resources to meet the needs of humans today. Different green building certification schemes are deployed worldwide to encourage the promotion of a sustainable built environment and the adoption of green building best practices such as the United Kingdom (UK)'s Building Research Establishment Environmental Assessment Method (BREEAM) (Li, Chen, Chew, & Teo, 2014), the United States of America (US)'s Leadership in Energy and Environmental Design (LEED) (Azouz & Kim, 2015) and the Hong Kong's Building Environment Assessment Method (HK-BEAM) (X. Zhang, Shen, & Wu, 2011). Worldwide, many local governments are adopting green building standards, introducing various regulations or providing permits for sustainable construction (Robichaud & Anantatmula, 2011; Sabbagh, Mansour, & Banawi, 2019). A study done by Dodge Construction Network (2021) indicated that worldwide, 28% construction industry professionals are currently involved intensively in GD projects while another 42% are planning to focus more on GD projects by 2024. The United Nations (UN)' Sustainable Development Goals (SDGs) 2030 have also included green buildings as part of their agenda (United Nations, 2015). Out of 17 SDGs, 9 goals are related to green building aspects.

Although there is an upward trend of GD projects all around the world (Dodge Construction Network, 2021), conventional building practices are still dominating the construction industry especially in developing countries (Safinia, Al-Hinai, Yahia, &

Abushammala, 2017). However, with the undisputable benefits of green constructions, these developing countries are beginning to take heed of this worldwide change and make effort to instigate action to improve their built environment quality through transformation of construction activities from conventional to green (Sabbagh et al., 2019). Transformation requires various efforts. In construction industry that involves various activities and people, change could take time to bloom. For those countries who are at the infantile stage of green projects transformation, actions by all stakeholders are important to push the acceptance and implementation faster.

The Gulf Cooperation Council (GCC) region, which consists of six countries namely Sultanate of Oman, Kingdom of Saudi Arabia, United Arab Emirates (UAE), Qatar, Kuwait and Bahrain, have varying level of GD implementation. With heavy focus on infrastructure development, most of the GCC countries have experienced massive boom in their construction industry in the last 10 years in association with rapid diversification from oil, flourishing economy and rapid population growth of both expatriates and citizens (Ventures onsite, 2019). Economic diversification in the GCC has contributed to an increase in contract awards in residential, education, healthcare, transport and energy sectors. Construction sector has shown a growth of 7% from the year 2018 to 2019 in GCC region (Ventures onsite, 2019) and attracted more international companies to enter the GCC construction sector (Alpen Capital, 2015). In terms of GD projects though, Saudi Arabia has the most LEED certified projects, with 656, Oman is in the fourth position with 18 projects (United States Green Building Council (USGBC), 2022). In their effort to push GD project, rating tools such as Pearl rating system for Estidama in UAE (Sabbagh et al., 2019), Mostadam in Saudi Arabia (Younis, 2020) and Global Sustainability Assessment System (GSAS) in Qatar (GORD, 2017) that suit to their climate have been developed. Although Kuwait has less number

of certified projects than Oman, they have recorded much higher percentage of increase in LEED registered projects in last decade (USGBC, 2022). Oman is moving at slower pace due to poor knowledge of public on green building, lack of motivations from government and highly subsidised electricity (Al-Badi & Al-Saadi, 2020).

The construction industry in Oman has registered an average annual growth rate of 5% during 2017-2019 (ReportLinker, 2021). With the Omani construction market valued at \$17.5 billion in 2020, growth rate of more than 4% is expected during the Tenth Five-Year Development Plan 2021-2025, although growth contracted sharply during 2020 due to COVID-19 (BusinessWire, 2021). As construction continues to progress, the impact on the environment is beginning to be felt. Rapid urbanization and socio-economic growth in GCC including Oman has resulted in escalation of domestic energy consumption per capita (Al-hathloul, 2004; Munawwar & Ghedira, 2014). Oman has experienced scattered flooding due to poor drainage system (Muscat Daily, 2022), waste handling issue (Al-jebouri, Shaaban, Raman, & Rahmat, 2017; Powmya & Abidin, 2014), scarcity of resources (Al-Amri, 2021) and destruction of natural flora and fauna (Ministry of Education, 2010). Realising the importance of sustainable concept in the construction sector, Tenth Five-Year Plan (2021-2025), has placed resource optimisation as highly important aspect for future development projects (Project Oman, 2020). The Law for the Protection of Environment and Combating Pollution is constituted through Oman's Royal Decree No 114/2001 (Arshad & Petrou, 2017). Oman also committed to reduce greenhouse gas emissions by 2% from 2020 to 2030 at the 2015 UN Framework Convention on Climate Change Conference (UNFCCC) (Zafar, 2016). Oman Green Building Council (OGBC) was setup in the year 2012 to promote and support Oman's green movement (Powmya & Abidin, 2014). Positive outcomes have been recorded from the actions by OGBC with the support from

the government agencies and private organisations such as Oman Tourism Development Company, Be'ah and AVERDA.

Despite those efforts, Oman is still one of the countries dominated by conventional practices. Although the concept of green construction has been introduced in Oman, it is still lagging compared to its neighboring countries. As such, to promote more GD in Oman, all stakeholders need to step up in its green building effort by ensuring green concept is applied at planning, design, and construction phase. Any policy and direction from the government can support the movement towards green, but the strategies, demand and commitment from the client, consultants and contractors will be the driving force to deliver greener construction industry outputs.

This research focuses on GD projects in Oman and how to deliver them successfully. Although all stakeholders have their role to play in contributing toward GD performance, this research shall focus on contractors only. Contractors are major participants of the construction industry as they are the ones who transform buildings on paper into actual buildings. Due to the direct responsibility of contractors, their experience and capability are crucial to the successful execution of a construction project (Iyer, Kumar, & Singh, 2020). Capability here refers to the potential of a contractor to procure, mobilize and manage resources to execute a project with acceptable standard, budget, and time. Being project builders, contractors can contribute towards achieving green projects by intertwining their technical expertise with green concepts. At construction sites, the contractor's awareness, knowledge, and preparedness on green practices has the greatest impact in delivering green building or infrastructure (Whang & Kim, 2015). To achieve the green building or infrastructure status, one must meet the standard required by the green certification body such as LEED, BREEAM or GSAS. Thus, as contractors delivering GD projects, they need to

ensure the delivery process is executed to meet the given standard. Due to added complexity of green projects, green buildings experience less successful project delivery (Jingxiao Zhang et al., 2019). As such, contractors need to strategise to ensure the project is delivered as required by the client and ensure it achieves the targeted rating tool level (Darko & Chan, 2018). Tan, Ochoa, Langston, & Shen (2015) highlighted those comprehensive strategies shall improve contractors' competencies in environmental and social management, and consequently lead to overall success. These strategies are implemented to their fullest extent through utilisation of the supporting factors, which need to be explored. To enable efficient delivery of a project, contractors must be prepared to overcome any potential challenges. Identification of challenges is vital to minimise or avoid them to ensure contractors can respond to the demands of GD project delivery (Abidin, Yusof, & Othman, 2013). Integrating green concept within their strategic management and be the first movers in new technologies can make the contractors to be the winners in the market (Tan et al., 2015). However, the factors that motivate them to engage in GD project need to be explored to understand the reason for their shift towards GD project delivery as it contributes to GD project success.

As such, this research shall focus on project delivery framework which covers a few components such as motivations to pursue GD projects, challenges facing in GD project delivery, strategies for successful delivery of GD projects and their supporting factors. This research shall provide guidance for contractors to deliver successful GD projects by overcoming the hindrances and optimising their supporting factors to push Oman into greener construction.

1.3 Problem Statement

The Sultanate of Oman is experiencing rapid construction development to achieve its vision and five-year development plans. Oman launched its Tenth Five-Year Plan 2021-25 with an approved annual budget of Omani Rial 12.1bn (\$31.5bn) for the year 2022 to cover its final component of Vision 2040 (The National, 2022). Oman's construction sector is expected to continue growing because of government's diversification plans towards tourism, education and healthcare, transport and infrastructure projects (Rousseau, 2019). Oman's infrastructure competitiveness ranking is 25th globally and 3rd among GCC (Alpen Capital, 2015). In the area of green development, its government, with the support from professional entity, have been proactively encourage construction industry players to pursue more green buildings and infrastructure. For example, The Research Council (TRC) was established in the year 2005 to promote innovation including green building. The OGBC was set up in 2012 to promote green building concept and provide environmental protection. Oman government has built prototype green buildings such as Eco-house (Saleh & Alalouch, 2015). However, even with these proactive actions, Oman is still far behind other GCC counterparts in green progress. As at the end of 2021, only 18 buildings have been certified out of the 51 registered under LEED as compared to Saudi Arabia which has 697 green certified buildings (USGBC, 2022). Oman also still does not have its own green rating tool (Al-jebouri et al., 2017) and has been using LEED as preferred rating tool. OGBC are collaborating with the local authorities to establish their pilot rating system for homes, which are called the Oman Building Environmental Certification (OMBEC) (Al-jebouri et al., 2017). Having customised green rating tool can be the impetus to attract more interest and readiness towards green building. As evidence is Malaysia for example, the number of green buildings being developed increased

exponentially and their interest on the concept garnered the positive momentum after the introduction of Malaysian GBI (Wira, Shafiei, Abadi, & Osman, 2017).

The construction industry is estimated to be responsible for about 35% of global carbon emissions (Windapo, 2014). The resource-intensive construction industry consumes 40% of the raw materials, 16% of the water, and 25% of the timber in the world annually (Darko & Chan, 2018). Construction industry activities produces considerable amount of dust, wastewater, noise, and a major waste generator (Kolaventi, Tezeswi, & Siva Kumar, 2020). With more evidence of the construction-related environmental impacts in the country, Oman needs to speed up in generating wider acceptance for greener constructions. The impacts of past unsustainable construction have resulted in loss of habitat, flooding, draining of wadi and disruption of natural scenery in Oman (Muscat Daily, 2022; Nebel & Aurel, 2016). Poor quality buildings with cheap materials and unsustainable construction practices have a detrimental impact on the Omani urban economy (Nebel & Aurel, 2016). Apart from experiencing water scarcity and periodic draughts (Muscat Daily, 2022), the residential sector has been identified as major energy consumer, taking almost half (47%) of the total electrical energy for air conditioning (Authority for Public Services Regulation (APSR), 2020). Omani construction waste is estimated to be 3 to 5 million tonnes per year (Prabhu, 2017). Relying on the government to promote GD through their own public projects will not be adequate as GD implementation needs to have wider practitioners. It requires involvement and commitment from various stakeholders and growth of demand from the private clients and buyers.

For construction practitioners to venture into green projects, they need some motivation. Awareness of green projects may not be adequate to push them towards its practices, although it will be a good start. According to Chan et al (2017) and Hwang,

Zhu & Tan (2017), the awareness of green buildings needs to be injected in the industry to spark interest. Successful green building is a way to create further awareness of its potential and benefits. Competitiveness among developers, consultants, and contractors in developing green buildings should be heightened to move the industry into greener direction (Azeem, Ullah, Thaheem, & Qayyum, 2020). In Oman, where most construction practitioners are still preferred to build conventionally (Safinia et al., 2017), recognizing what could steer them towards GD projects would be the logical move. In Hong Kong for example, financial incentive had been introduced by the government to motivate construction practitioners to construct GD projects (Fan, Chan, & Chau, 2018). Similarly, subsidies have been provided to encourage green projects among developers in the US and UK by the local governments (World Green Building Council (WGBC), 2013). Being the first movers in GD projects can position the construction practitioners as construction industry leaders (Tan et al., 2015). Thus, the right motivation is important to divert the interest of the Oman's construction practitioners from conventional to green.

Construction project delivery process includes involvement of client, consultants, and contractors. Consultants design consists of environmentally friendly materials along with energy efficient building layout. It is common knowledge that contractors are responsible for converting buildings on paper to tangible bricks and cement. In doing so, the contractors must mobilise various resources, manage, control and monitor a multitude of activities and liaise with multi-disciplinary people. Inherent within these actions, is the underlying expectation that the contractor shall be responsible to ensure the project is delivered to the client as per contract (Li, Song, Sang, Chen, & Liu, 2019). In Oman, past performance of the project contractors indicated the need for better performance. For example, Alnuaimi & Mohsin (2013) and

Elawi, Algahtany, & Kashiwagi (2016) identified that poor contractor performance has been the reason for delay in project delivery. Lack of efficient managerial and administrative skills, limited knowledge and lack of capabilities to manage big projects have led to failures of some Omani owned Small and Medium-sized Enterprises (SMEs) (Central Bank of Oman, 2014). As the Omani contractors cannot perform, large projects are undertaken by foreign firms Loch (2016). In a similar line, majority of the GD projects in Oman are delivered by international contractors. Oman government also mostly awarded projects to international contractors due to their lower costs, experience, and international building standards (Oxford Business Group (OBG), 2020). Although the government enjoys short term benefits of projects delivered by international contractors, the economy would be better served if contractors based in Oman are given priority. Al-jebouri et al. (2017) indicated that having a strict guideline to be adhered to by the contractor will ensure the quality of the final product. The guideline will set certain standards that the contractor must achieve for the project. Learning through this compliance will become the ladder for enhanced skills and competency. Thus, one way to improve contractor performance is by experiencing managing projects with strict requirements, such as compliance to green rating tools. Oman contractors who venture into GD projects will have new sets of skills and knowledge that will make them better builder and widely experienced.

It is common to expect that the contractors shall build according to the design given by the project designers (architects and engineers). Although in some procurement systems, the contractors are beginning to take bigger role in design aspect, most procurement is still heavily relied on this conventional way of passing the baton when it comes to design of the building. Designer's knowledge, experience and innovativeness supported successful and effective GD project delivery (Li, Song, Sang,

Chen, & Liu, 2019). However, recent studies indicated many designers had blindly incorporated innovative green technologies in their design which turn out not workable or ineffective when it comes to actual implementation during construction stage. This indicates a gap in understanding between design on paper and live construction (Li & Zhang, 2018). This creates problems for the contractors when executing the project. Moreover, complexity of GD projects demands more efficient management and presents various technical challenges than traditional construction projects during construction stage (Li et al., 2019). Contractors must implement sustainable construction practices such as minimisation of waste generation on construction sites, waste management, using recycled aggregates and using timber from specified sources. Dung, Truong, Hieu, Hung, & Nazird (2020) identified lack of legal regulations and technical codes, late establishment of green project team, difficulty to comprehend the owner's green goals, difficulty in competent sub-contractors' selection and shortage of green materials and products in market were the top five challenges faced by the contractors in Vietnam. Similarly, Oman contractor is expected to face challenges when venturing into GD projects. However, these challenges can also hamper interest for GD projects, if they are not tackled properly. Having a clear mindset of what to expect when developing GD project and anticipating the potential challenges would prepare the contractors with proactive and reactive strategies.

Strategy is crucial in ensuring an effective execution of any action towards the intended target. The concept of strategy and strategic planning has gained importance in the construction industry due to the increasing requirement for resource efficiency (Tan, Shen, & Yao, 2011). Construction firms must consider strategic concepts to be able to operate effectively in the emerging industry context (Cakmak & Tas, 2012). Green construction process and materials differs from traditional construction.

Therefore, implementation of GD project can necessitate major changes in the structure and process of construction firms (Ahn & Pearce, 2007; Albino & Berardi, 2012). Several authors have argued that delivering GD projects using traditional methods lead to problems due to complex design, and the documentation and procedures (Ayman, Alwan, & McIntyre, 2020; Raouf & Al-Ghamdi, 2019a). W. Shen et al. (2017) suggested that contractors need to continuously improve their competencies for delivering GD projects. Moreover, execution of GD project varies in different locations because of different construction practices and the market maturity (Venkataraman & Cheng, 2018). The challenges facing contractors must be addressed by adopting appropriate strategies to deliver a successful GD project. Loch (2016) reported that only a quarter of the total projects are delivered by Omani contractors alone while another 40% of the projects are delivered by Omani contractors in a partnership with foreign contractors. To promote more successful contractor firms, they need to strengthen from within by improving the resources and capabilities through appropriate strategies to deliver quality projects. Most contractors may have little knowledge on how to deliver GD projects effectively and efficiently (Li et al., 2019). Lack of skills, experience, management capability and evidence of poor project performance indicate problems in optimizing their resources and capabilities to deliver projects efficiently. Mokhlesian & Holmén (2012) opined those strategies need to change in a significant manner when construction firm is engaged in GD project. Supporting factors drive attainment of firm's strategies (Barney, 1991; Wernerfelt, 1984). Therefore, supporting factors of contractor firms need to be identified as they are crucial elements in strategy implementation.

In Oman, green concept in construction is at infancy stage, with many developers and contractors prefer to continue developing in conventional way (Al-

jebouri et al., 2017). The demand for GD projects is still low as compared to other GCC countries, although efforts have emerged from the government and non-governmental organisation to promote green in construction. To make wider acceptance of green buildings and infrastructure, private sectors need to take a more proactive role in promoting GD projects. Contractors are one of the stakeholders that can make a significant impact on GD project delivery. The reluctance of local contractors to venture into GD projects enables the international contractors to swoop in and secure the projects, which is a loss to local contractors and deprives benefits to the local market (OBG, 2020). Thus, to compete, the local contractors need to move from the traditional way of doing business and follow the change in construction trends. There are large contractors that have ventured into green buildings. Understanding what motivates the contractors to deliver GD projects, the challenges they faced, what support they need and ultimately, how they strategise to deliver successfully will create learning opportunity for other contractors. Learning from their experience will be the impetus towards positive change in general acceptance of GD projects. Past studies related to GD project are scarce in Oman as green progress in the country is still at its infancy. Identification of conventional project delivery strategy would provide a basis for further exploration of GD project delivery strategy adapted by the Omani contractors. A framework will guide contractors to transform from conventional to green.

Based on the above, the study attempts to answer the following research questions:

- 1) How can contractors deliver conventional projects successfully?
- 2) What are the factors that would influence GD project delivery?
- 3) How can contractors strategise in delivering GD projects successfully?

1.4 Research Aim and Objectives

This research aims to develop Green Project Delivery (GPD) framework for contractors in Oman.

To achieve the aim, 5 objectives have been outlined:

1. To identify conventional project delivery strategy by contractors in Oman.
2. To determine the motivations to pursue GD projects among Omani contractors.
3. To investigate the challenges in delivering GD projects.
4. To explore the GPD strategy adapted by the Omani contractors.
5. To relate the supporting factors with the GPD strategy executed by the contractors.

1.5 Scope of the Research

This study focuses on green project delivery in Oman. From literature and using Dynamic Capability (DC) theory, several components crucial to enable holistic comprehension of green project delivery has come to light. This serves as the main scope of this research. The components are the conventional project delivery strategies, motivational factors, challenges, GD project delivery strategies and supporting factors. Apart from this, to understand the issues in hand, this research also explores the progress of construction industry in Oman, issues related to environment, GD project progress in Oman and contractors' involvement in green practices. Two constants that govern this research are contractors' experience and GD projects. The study adopted a mixed method approach to develop GPD framework for contractors. The mixed method was appropriate to understand the complex nature of GPD strategy transformation of contractor firms. The Phase 1 quantitative study is conducted through probability sampling of the top grade (International, Excellent and Grade 1) contractors registered

under Oman Chamber of Commerce and Industry (OCCI) in Oman who are expected to involve as main contractors of projects. The Phase 2 qualitative study only involved top-grade contractors who have experience in delivering registered or certified LEED projects. In this phase, purposive sampling is adopted to gather information from the experts who fit the purpose of the investigation.

1.6 Brief of Research Methodology

This research is based on subjectivism perspective because it seeks the perception of the construction contractors. Pragmatist paradigm is used as it is appropriate to first identify the strategies adopted by contractors to deliver successful conventional projects through quantitative method and then investigate the changes in strategies to deliver GD projects through qualitative method. This research adopts an exploratory approach to gain insight into contractor firm strategies to deliver successful GD projects. The ‘how’, ‘why’ and ‘what’ research questions of this study can be best answered through exploratory approach.

The study was conducted in two stages. In Phase 1, a survey with conventional contractors has been conducted to identify the strategies applied by them to ensure successful delivery of projects in Oman. This finding will serve as a point of reference in developing questions for the Phase 2 interview. It will also enable a comparison to be made between the delivery strategy applied by the GD contractors with conventional contractors. Respondents are gathered from the top grade (International, Excellent and grade 1) contractors registered under the OCCI. A total of 512 contractors out of the 5497 contractors who are active in the year 2020 and fall under the top grades category were approached to participate in this study. There are 108 contractors participated in the study. Pilot study was conducted prior to the survey to test appropriateness of

questions and identify flaws or limitations within the survey design. The purpose of the study, the brief of questionnaire contents, anonymity of respondents and confidentiality of the responses were informed to participants involved through a written permission letter sent via email. The questionnaire consisted of two sections. Section A sought demographic information and section B collected quantitative data on contractor firms' delivery strategies for successful conventional projects. The questionnaire consisted of a web-link to Google form, which is an online platform for designing and distributing questionnaires. The data gathered was analysed using Statistical Package for Social Sciences (SPSS).

Phase 2 is a qualitative approach in which interviews were conducted with contractors who have delivered or are currently constructing GD projects registered or certified under LEED. As of end of 2020, all GD projects in Oman only pursued LEED certification. There are 51 LEED registered or certified projects in Oman, and all main contractors of these projects have been invited as interview respondents. A total of 14 interviews were conducted representing 14 different GD projects. This interview focused on exploring contractors' motivation for pursuing GD projects, the challenges they faced, the strategy and support factors needed for effective project delivery. The study adopted a semi-structured interview approach as the aim of the inquiry was more of fact-finding and needed a style that was flexible. A cover letter which stated the purpose of the study was sent to the respondents via email. The data was analysed using NVivo12 software.

This research adapted DC theory to support the formulation of a new theoretical framework, which establishes the theme of the research. DC theory is deemed appropriate for this research as it instigates change and progress by transforming current levels of performance into new heights. Through this theory, the direction of the

research was focused on 4 main components: motivational factors, challenges, strategies and supporting factors, which combined to become the newly proposed Green Project Delivery Framework.

1.7 Significance of the Research

Successful project delivery improves the contractor's profit margin and reputation, thus improving their opportunity for more projects in the future. Faith and trust in the contractor will improve if projects are completed successfully. GD projects open avenue for new market territory and being able to deliver them successfully, strengthen their position in the industry. The significance of this research can be seen from 3 angles: contractors; projects and nation. This study is especially important for contractors as it represents a major step in the empowerment of local contractors which would reduce dependency on international contractors in Oman for GD project. Contractors can comprehend GPD framework to deliver successful project in the context of Omani construction industry. With more successful GD projects being completed, it creates wider interest in the green concept as more construction practitioners can experience the benefits of building sustainably. This can push up the demand for green projects at national level, making their way to be at par with other GCC countries in green movement. Constructing GD projects requires strict compliance with the intended rating tool, such as LEED. When delivering LEED's GD projects, the requirements set by the rating tool necessitate the contractors to learn fast, be more efficient and strengthen their capability through various actions to adapt to the changes needed. The fast-learning curve will make GD contractors more competent in project delivery, which is not limited to GD projects, but the knowledge and skill can be applied to non-GD projects as well. Successfully completed project enhances contractor

relationship with consultant and client, raising confidence level for the local contractors. The strategy identified from this research can be emulated by other contractors to be more competitive, while the supporting factors deemed important for contractors to deliver successfully can be further improved by the government and industry at large. Being motivated to pursue GD projects is crucial to encourage the sense of willingness and thus develop commitment and readiness to make the change. By understanding what motivates the contractors to get involved in GD projects, the government and industry players can create or instigate the condition that makes GD more appealing and attractive. The challenges uncovered provide insights into the difficulties experienced by the contractors and would themselves open grounds for further actions, efforts, and research. The agenda of green building and infrastructure in Oman has been part of Oman' vision 2040, which has been formulated in line with SDG 2030 goals. Thus, by promoting more green building practices and strengthening contractors' capability to deliver green building, this research would assist in achieving the country's vision.

1.8 Terminologies Adopted

This section defines the list of terminologies adopted in this research.

- i) Green Development project: A development project proposed for construction aiming to achieve a required green certification. A development project is designed to deliver a specific output aiming to improve the economic and social conditions of people. The term development is used to encompass both building and infrastructure projects.
- ii) Green Delivery Strategies (GDS): Actions and plans by the contractor firms to bring them success in green development project delivery, within a changing market environment, to meet the needs and expectations of clients. The planned

actions help them to achieve their organisational goals such as to be competitive among other firms.

- iii) Green Project Delivery: It is a process of construction, completion, and handover of a project to client with the achievement of intended green certification. Green project delivery requires more processes than conventional projects such as additional site precautions, use of energy efficient methods and use of green building materials in order to achieve green objectives.
- iv) Dynamic Capability Theory: DC theory deals with the ability of an organisation to identify and assess new opportunities, implement the necessary course of action to seize those opportunities and finally to continuously transform/renew its resource base in pursuit of improved effectiveness.

1.9 Structure of Thesis

The thesis comprises of 7 chapters. Chapter 1 introduces the research by describing the background of the study, explaining the research problem, establishing the research aim and objectives, informing the research methodology, outlining the scope of research, highlighting the research significance and presents the study organisation.

Chapter 2 focuses on the literature review. It introduces Oman construction industry and how its environment been affected by the construction activity. This chapter explains the concept of green in construction, its progress around the world and GCC region. The contractors' role in delivering green projects is explained before venturing into the motivations in pursuing green buildings. Challenges, support factors and strategies related to GD project delivery are elaborated before theoretical framework is presented.

Chapter 3 discusses the research methodology. The philosophical stance that forms the basis for overall research framework design is explained before deliberating on the data collection method, sampling technique and data analysis method. The chapter includes the questionnaire design, validity, and reliability.

Chapter 4 presents the findings of the survey. The demographic information of the respondents and the contractor firm strategies to deliver successful conventional projects are presented.

Chapter 5 presents the findings of the interview. It begins with respondents' background information followed by the presentation on motivations of contractor firms to pursue GD projects, challenges faced by them to deliver GD projects, GPD strategy of contractor firms and supporting factors of GPD strategies.

Chapter 6 discusses the integrated findings of both quantitative and qualitative results. It includes the delivery strategy of conventional project, motivations to pursue GD projects, challenges in delivering GD projects, GD project delivery strategy, relationship of challenges and supporting factors with GPD strategy and GPD strategy framework.

Chapter 7 concludes the research by summarising the research objectives' achievement, contributions of the research, limitations of the study and future research recommendations are put forward.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature relevant to the topic of interest, including the development of theoretical framework. The chapter focuses on 4 aspects: construction industry in Oman and its impact to the environment; contractors' roles in project delivery; Green Development (GD) projects and development of theoretical framework. Apart from that, the strategies for delivering construction projects are also reviewed to establish how the contractors have previously ensured successful delivery. By focusing on GD projects and how they have been delivered, this chapter also delves deeper into motivation factors, challenges and supporting factors. The last part of this chapter presents the theories adopted in the present study along with theoretical framework.

2.2 Oman Construction Industry and its Impact on Environment

Construction industry contributes toward the national economy around the globe. Likewise, the Omani construction industry is also critical for their economy to flourish. The physical development of construction projects such as buildings, roads, and bridges is the measure of a country's economic growth (Alzahrani & Emsley, 2013). Direct and indirect employment opportunities are also the positive impact of construction activities (Zuo & Zhao, 2014). This section discusses the construction industry progress, environmental impacts of construction industry and environmental issues in Oman.

2.2.1 Construction Industry Progress in Oman

Oman is a developing country in which the construction industry is one of the promising sectors that contributes nearly 9% to Gross Domestic Product (GDP) (Project Oman, 2020). As part of the government's strategy to diversify economy away from oil and gas, the construction sector in Oman has been buoyant over the last few years (The World Bank, 2019; Townsend, 2017). Oman government's impetus on tourism has seen a fair amount of tourism projects. An amount of Rial Omani (RO) 193 million (United States Dollar (USD) 501 million) has been allocated for tourism projects in the budget 2022 to ensure the socio-economic development along with economic diversification (Kutty, 2022). Oman will keep pursuing its diversification plan through their expenditure in tourism and manufacturing sector projects to be in line with Vision 2040. To cater for the growing population, the government is spending heavily on social infrastructure including housing, education, and health sector (Alpen Capital, 2015). This is also to attract private investment to the economy. According to experts, the new law, which enable expatriates in Oman to own real estate is expected to bring substantial economic benefits to the sultanate (Townsend, 2017). Rapid urbanization, a fast-growing middle class and housing loans availability at low interest rate are driving Oman's housing sector construction activity (Alpen Capital, 2015).

Oman's construction industry continues to face numerous challenges, ranging from a lack of technical and management know-how to a lack of financial, material, and equipment capital base. Amri & Marey-Pérez (2020) have acknowledged inefficient contract management and inexperienced workers as the causes of delays and cost overruns in Omani construction projects. According to National Centre for Statistics and Information (NCSI), Majority of construction workers in Oman are inexperienced expatriates from low-income countries such as Bangladesh, India and Pakistan (Oman

Observer, 2022). Several projects are delayed in Oman including Muscat International Airport project with a delay of over two years (Shaibany, 2015). Such delays of megaprojects will slow down Oman's economic development. Insufficient workers, poor construction planning, financial condition and insufficient experience of contractor are causes of megaproject delays in Oman (Oyegoke & Al Kiyumi, 2017). This may be attributed to the contract award system in Oman, where contract is awarded to lowest bidder instead of best bidder.

The Tender Board was established in 1972 to supervise the government project procurement in Oman. Revised tender law came into effect in 2008 through Sultani Decree 36/2008 (Dallas, 2009). The Oman Chamber of Commerce and Industry (OCCI), a public utility organization, was established in 1973 to regulate industrial and trade interests (Oman Chamber of Commerce and industry (OCCI), 2020). Various professional bodies such as Oman Society of Engineers (OSE), Oman Society of Contractors (OSC) and Oman Professional Engineers Network (OPEN) are attempting to improve the industry's performance by hosting seminars, workshops, and conferences for their members. In a nutshell, with various efforts from the government, professional bodies and private sectors, Oman construction industry has seen positive upward trends in the last five decades (Ministry of Education, 2010). However, this rapid growth in the industry has begun to make an impact to the environment, which is discussed next.

2.2.2 Environmental Impacts of Construction Industry

The construction activities provide buildings and facilities to satisfy human requirements and play a crucial role in urbanisation. However, the construction industry has a massive negative impact on the environment and its resources. L. Y. Shen & Tam (2002) reported that construction projects were regarded as a major contributor to

environmental impacts as they affect the environment in numerous ways across their life cycle. Construction industry activities without sufficient attention to environmental protection shall lead to irreparable damage to the environment. In the process of developing a construction project, the extraction of fossil fuels and minerals can alter the biological characteristics of land plots. Deforestation and land reclamation for new development projects can alter the living environment, preventing native species and plants from surviving. In Hong Kong seas in 1989, for example, there were 200-400 Chinese White Dolphins. However, it was claimed that the number has decreased to 40-100 due to the reclamation of land for the new airport in Chek Lap Kok (X. Zhang et al., 2015). During the construction stage the negative impacts of construction include the noise, dust, traffic congestion, water pollution, toxic gas and waste disposal (Gurgun & Koc, 2020; X. Zhang, Wu, & Shen, 2012). Construction projects consume large quantities of natural resources. A significant amount of energy is utilised for the manufacture of building materials and components.

Upon completion, the impact of building on environment continues. According to the World Economic Forum, buildings account for 40% of global energy consumption (Tricoire, 2021). Developing and operating buildings deploy almost 40% of the global material and generate 25% of global waste (Mokhlesian & Holmén, 2012). Various manufactured building materials and components contain a significant amount of energy (X. Zhang et al., 2015). Construction site activities consume energy for lighting, tools, and equipment operation. During building use, energy is consumed for lighting and the operation of various appliances. Buildings are responsible for 33% of greenhouse gas emissions resulting in global warming (Tricoire, 2021). Moreover, global carbon emissions from buildings will reach 42.4 billion tonnes in 2035 (Zuo & Zhao, 2014). The impacts are not only during building construction but also while