

A BUSINESS MODEL ONTOLOGY FOR CONSTRUCTION CONTRACTORS

Dilani Niroshika Abeynayake

178086U

Degree of Doctor of Philosophy

Department of Building Economics
Faculty of Architecture

University of Moratuwa
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Thesis submitted in partial fulfilment of the requirements for the degree of
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DECLARATION

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the PhD thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of the supervisor: **Ch. QS. Prof. (Mrs) B. A. K. S. Perera**

Signature of the supervisor: *UOM Verified Signature*

Date : 12.07.2022

Name of the supervisor: **Dr (Mrs) Chandanie Hadiwattage**

Signature of the supervisor: *UOM Verified Signature*

Date : 12.07.2022

DEDICATION

*I would like to dedicate this thesis
to my parents, husband, son and daughter
for their endless support, and unconditional love.....*

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ABSTRACT

Today's hostile business environment, economic uncertainties and external shocks make construction companies vulnerable to business failures. In facing such challenges, contractors' businesses should be with informed decisions, enabling management of complicated supply chains, strategic partnerships, featured and complex project scopes, tight programmes and numerous project participants while serving clients with high expectations. A Business Model (BM) is fundamental to the success of any business, supporting high-quality business decisions. Hence, contractors must develop their business by adopting proper BMs. However, in construction industry, it is still a novel concept with relatively few ontologies to support contractors in designing their BMs. Thus, this research aimed to propose a developed and validated BM ontology for the construction context to facilitate contractors designing BMs. This research was positioned on pragmatism philosophical stance and followed abductive approach. The Research Questions (RQs) were answered through a multi-method qualitative study. Phase I data were collected through multiple case studies by interviewing two top managers from each case and analysing the websites. Case study results were used in the subsequent qualitative survey conducted among 15 construction business experts.

A BM development process with five stages toward improved BM application was identified by reviewing the literature on BM evolution. The absence of stage-wise BM development in the construction industry urged following the BM development process to develop a BM ontology for contractors, enabling BM design. Construction Business Model (CBM) was defined following a systematic process under literature review, which was empirically validated for compatibility and comprehensibility, completing Stage 1 of the BM development process. During Stage 2, thirty-four elements constituting the Construction Business Model Ontology (CBMO) were identified and classified based on their relationships, roles and positions. One 'Desired Element', one 'Inherent Element', three 'Shared Elements', two 'Bridging Elements', and four 'Value Pillars' with their respective 'CBM Elements' and 'CBM Sub-elements' were explored. In addition, new elements, e.g. 'Professionalism', 'Key Subcontractors', 'Construction Expertise' and 'Workmanship', were introduced concerning contractors' business. Describing parameters for each CBMO element were established at Stage 3, and CBMO was developed considering established relationships of CBMO elements at Stage 4. A step-by-step guide with guiding questions for CBMO would help contractors design their CBMs. Validation of the CBMO with two groups using a sample scenario confirmed its clarity, understanding and significance by providing a business case's big picture and common language. CBMO enables handling clients and stakeholders, using specified processes, handling risks, choosing strategies, utilising resources and promoting value-based competition in the construction industry.

Keywords: Business Model Development Process; Construction Business Model Definition; Construction Business Model Ontology; Construction Contractors

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LIST OF ABBREVIATIONS

BIM	- Building Information Modelling
BM	- Business Model
BMC	- Business Model Canvas
BMO	- Business Model Ontology
BMRS	- Business Model Research Schema
BMTC	- Business Model Transformation Canvas
CAQDAS	- Computer-Aided Qualitative Data Analysis Software
CB	- Construction Business
CBM	- Construction Business Model
CBMO	- Construction Business Model Ontology
CBMOS	- Construction Business Model Ontology Skeleton
CBR	- Case-Based Reasoning
CIDA	- Construction Industry Development Authority
CM	- Contracts Manager
CPD	- Continuous Professional Development
D & B	- Design and Build
DGM	- Deputy General Manager
ERP	- Enterprise Resource Planning
GBM	- Green Business Model
GDP	- Gross Domestic Product
GM	- General Manager
HIT	- Health Information Technology
ICT	- Information and Communication Technology
IS	- Information Systems
ISO	- International Organisation for Standardisation
IT	- Information Technology
MBA	- Master of Business Administration
MNE	- Multinational Enterprise
QMS	- Quality Management Systems
RDA	- Road Development Authority
SM	- Senior Manager
SME	- Small and Medium Enterprise
SWOT	- Strengths, Weaknesses, Opportunities and Threats

1. INTRODUCTION

1.1. Background

The construction industry is one of the main engines that drive global economic development, contributing to approximately 13% of the world's Gross Domestic Product (GDP) and a sizable proportion of most countries' GDP (Ribeirinho et al., 2020). The products and services of the construction industry can solve specific business or operational needs of customers (Brady et al., 2005). As a result, the construction industry creates core businesses comprising a supply of professional knowledge or design (e.g., consultants including architects, engineers and quantity surveyors, project management, and management contracting services), manufacturing or production of building materials and building components, erecting (e.g., principal contractors and sub-contracting services) or a mixture of some, or all of the above (Gajendran et al., 2013). The construction industry is becoming more complex due to urbanisation, different stakeholder involvement, rapid technology development, and sustainability concerns (Kimiagari & Keivanpour, 2018), thereby making it more difficult to manage than any other industry (Jamil et al., 2008).

Assaad and El-adaway (2020) further distinguished the construction industry, highlighting its characteristics, e.g., fragmentation, adversarial industry structure, sensitivity to economic cycles, and high competitiveness due to high-profit margins and relative ease of market entry. Construction businesses also confront continuous challenges externally due to intensifying competition, economic uncertainties, and influence by the regulatory bodies, and internally due to featured increase in project scope, shorter construction deadlines, and limited budgets (Antunes & Gonzalez, 2015). Moreover, Mokhlesian and Holmen (2012) identified construction businesses as project businesses that differ from other businesses due to their limited time, a higher degree of uncertainty, involvement of adversarial relationships among actors, competitive tendering, and limited possibilities for standardisation. Therefore, construction businesses are in a riskier situation than their counterpart in almost any other industry, leading to the inability to achieve desired objectives (Abdul-Rahman et al., 2015).

Currently, construction companies try to adopt different concepts, methods, and tools like Enterprise Resource Planning (ERP), Building Information Modelling (BIM), and Lean Construction as solutions for construction industry challenges. However, the success of implementing such solutions is doubtful as their implementation challenges are still encountered in the literature. For instance, Gamil and Rahman (2019) found that financial restrictions, improper introduction, and lack of awareness are the main challenges of BIM implementation, and Ahmed et al. (2021) identified lack of awareness, poor management, and inadequate resources are the top-ranked challenges to implement Lean Construction. However, the BMs show how to collaborate and implement new trends and technologies in the construction practice (Berg et al., 2019) and address questions like what resources and competencies are utilised and how

revenue streams are created (Aho, 2013). Therefore, when businesses are viewed from new perspectives or when implementing new business decisions, the support of a suitable Business Model (BM) is necessary (Al-Debei & Avison, 2010). Pekuri et al. (2014) stressed that rigorous thinking about creating value for customers is essential for construction companies to avoid suffering from the effects of the industry's highly sensitive economic cycles. As per Mirarab et al. (2020), value creation affects the sustainability of organisations, maximisation of profit, customer retention, business goals fulfilment, and revenue generation. Further, in businesses with a wide range of stakeholders, such as construction businesses, BMs can support mapping value flows by identifying stakeholder relationships (Attanasio et al., 2022). The creation and capture of non-monetary dimensions of value, e.g. project quality, client satisfaction, learning and knowledge development, knowledge sharing, and societal influence, lead to business sustainability in the longer term (Bos-de Vos et al., 2019). In addition, Pekuri et al. (2014) identified the requirement of focusing on added value for customers via adopting the BM concept into the construction industry. On the other hand, such value needs to be considered and understood by all business stakeholders through BMs (Uusitalo & Antikainen, 2018).

Businesses with no BMs can fail despite having new business ideas, adequate resources, a talented team, and market opportunities (Morris et al., 2005). *"A BM tells which activities should be executed, by whom and how the players can be connected together"* (Anwar, 2018, p.6). Teece (2010) improved the understanding of the BM concept, describing it as an architecture of revenues, costs, and profits connected with the business creating and delivering value to customers while providing data and evidence that demonstrate how to create such value. Thus, the significance of BMs has been widely recognised due to their multiple roles (Baden-Fuller & Morgan, 2010). For example, BM acts as a logic of value creation and capture (Casadesus-Masanell & Ricart, 2010; Martins et al., 2015) while playing a vital role in explaining an organisation's performance (Zott et al., 2011).

Moreover, BMs convey to companies how to compete, interface with customers, form relationships, use their resources, and capture value to sustain (Magretta, 2002). Further, it acts as a common language among stakeholders while reducing complexity as an integrative term (Arend, 2013), a source of industry changes in responding to external shocks (Martins et al., 2015), and a source of competitive advantage (Zott & Amit, 2008). Hence, it is accepted that businesses will either fail to deliver or capture value from their products, services, or business perspectives without employing well-developed BM (Teece, 2010).

BMs are implemented by following the BM process, mainly consisting of three stages: (i) BM design, (ii) BM finance, and (iii) BM implementation, where the management of a company can define their business logic to respond to market circumstances and design a suitable BM at the BM design stage, prepare a financial structure for the designed BM at BM finance stage, and the BM is applied to the company's business structure and business process during the BM implementation stage (Osterwalder, 2004). Though the product design generally focuses on identifying a set of

interdependent physical components and features towards clients' satisfaction (Amit & Zott, 2015), designing BMs must cover a high degree of internal and external configurations (Nenonen & Storbacka, 2009). As per Nenonen and Storbacka (2009), improved value creation can be achieved by identifying and analysing suitable design elements of the BM and modifying the unsuited design. Furthermore, Al-Debei and Avison (2010) highlighted that BM design must be compatible with both internal variables (e.g., strategy) and external variables (e.g., size and nature of the customer base, level of competition, laws and regulations, market opportunities, and technological advancements).

Osterwalder and Pigneur (2010) developed a world-famous visual tool called *Business Model Canvas (BMC)* to easily describe and design organisations' BMs. Several researchers used the BMC with extensions and adjustments in their studies. For instance, Joyce and Paquin (2016) extended BMC to enable the perspective of sustainability by considering economic, environmental, and social impacts, whereas Dudin et al. (2015) adjusted BMC allowing effective budgeting by looking at current and forthcoming changes in the external environment and consumer demand. To this end, the BMs require modelling to show it to interested parties (Verstraete et al., 2017). However, BMC was developed as a tool based on the Business Model Ontology (BMO) by Osterwalder (2004).

Gordijn et al. (2005) identified several uses of a BM ontology other than the tools, e.g., BMC, as a visualisation of business, as an evaluation method for BM instances, as a change methodology, and as classification of BM instances and other applications like navigation of BMs. In fact, BM ontology is a framework presented as a shared language for visualising, assessing, and changing BMs (Fielt, 2013). As D'Souza et al. (2015) stated, BM ontologies are primarily used to design BMs while conceptualising and evaluating BMs. Hence, practitioners can visualise and communicate their business ideas using BM ontologies (Bengtsson & Hansen, 2018). Accordingly, the usefulness of BM ontologies for improving BM application in a particular field creates an interest in identifying the emergence of BM ontologies in the BM literature.

The literature proves that few researchers have developed frameworks or processes concerning the evolution of the BM concept through literature surveys. For instance, Pateli and Giaglis (2003) developed an explanatory framework concerning BM research sub-domains, Gordijn et al. (2005) and Osterwalder et al. (2005) categorised the evolution of the BM concept in the disciplines of Information Systems (IS), e-business, software business, and computer science, into five phases, and Wirtz (2016) identified three main phases for BM development with different stages at each phase. Consequently, it was identified that the emphases made in all these studies are convergent with common aspects. Thus, at first, BMs were defined; secondly, different lists of BM elements were proposed; thirdly, BM elements were described in detail; and finally, before application of the BM concept, the elements of BMs are modelled conceptually and proposed BM frameworks like BMO (Pateli & Giaglis, 2003; Gordijn et al., 2005; Osterwalder et al., 2005; and Wirtz, 2016). Hence, these phase-wise actions provide a process for BM development towards improved practical

applications of the BM concept where the need for a BM ontology is emphasised as a pre-requisite.

In essence, the above brief explanation stressed the significance of applying the BM concept for business success and the requirement of a BM ontology to facilitate the improved application of the BM concept in the construction business. Ultimately, the phases; defining BM, listing BM elements, describing BM elements, and developing a BM ontology, could be followed as a guide in developing BM ontology for a particular business domain.

1.2. Problem Statement

Though the BM concept is widely used in other disciplines (e.g., Information systems, e-Business, and e-Commerce) and other sectors (e.g., telecommunication and software industry) to design, compare, analyse, and communicate the business logic of different companies (Pekuri et al., 2015; and Al-Debei & Avison, 2010), only a few research works have examined the use of BM concept concerning the construction industry—for instance, Brady et al. (2005), Pan and Goodier (2012), Pekuri et al. (2013), Christian and Lars (2013), Brege et al. (2014), Pekuri (2015), and Van den Brink (2016). Regrettably, as discussed above, the phase-wise BM development is absent in the research studies of the construction business. Therefore, a BM definition concerning the construction industry is lacking, although Abuzeinab et al. (2014) specifically provide a generic definition for green BMs.

Most studies (e.g., Pan & Goodier, 2012; Christian & Lars, 2013; Brege et al., 2014; Liu et al., 2017; and Lessing & Brege, 2018) have focused their BM research on off-site construction, industrialised buildings, and modular prefabrication. These are similar to product manufacturing and are intended for specific purposes in the construction industry rather than the core business of construction contractors. Further, some other studies (e.g., Duyshart et al., 2003; Brady et al., 2005; Mokhlesian & Holmen, 2012; Pekuri et al., 2015; Van den Brink, 2016; Ling & Li, 2016; and Das et al., 2019) have focused on change and innovation of BMs related to specific areas, e.g., ICT adaptation for construction (Duyshart et al., 2003), suitability of integrated solutions (Brady et al., 2005), BM prototypes for the circular construction industry (Van den Brink, 2016), and transformation of construction enterprises into Industry 4.0 (Das et al., 2019). In parallel, the study of Liu et al. (2017) investigated the relationships between BM innovation and its drivers for technologically shifting modular fabrication in the Chinese construction industry. Differently, Pekuri et al. (2013) looked at how managers understand and deploy the BM concept in the Finnish construction industry. In this light, previous studies fail to offer a BM ontology to explain how to design BMs in the construction industry.

Construction contractors play a significant role in the construction industry, and their business is the main business in the industry involving erection of construction projects. Therefore, construction organisations must be successful in their businesses to survive in the dynamic and highly competitive construction business environment

(Odediran et al., 2013). Being an actor in a project-based industry, the construction contractors provide their service mainly or entirely for construction projects (Eriksson, 2013). Subsequently, each construction project creates a new business for construction contractors. Hence, the failure in a single construction project can severely affect their business (Lu et al., 2008). Jang et al. (2020) recognised that the complex and turbulent nature of the construction industry due to economic globalization makes construction contractors vulnerable to business failures. As per Assaad and El-adaway (2020), construction contractors face frequent failures due to incompetent planning and business decisions, limited experience in the business, poor marketing skills, fierce competition, and poor relationships with customers and stakeholders.

Furthermore, the construction industry tends to be particularly exposed to economic cycles and external shocks. Hence, the COVID-19 pandemic causes havoc on the construction industry, making it perform unsatisfactorily (Ribeirinho et al., 2020). Limitations in imports, exchange rate increases and restrictions for execution due to the pandemic mainly affected construction contractors in Sri Lanka, requiring effective supply chain management, financial management and proper business planning with informed decision-making to emerge through the crisis (Ranasinghe & Pathirana, 2021).

To face such issues and avoid business failures, construction contractors need to adapt proper BMs functioning as a planning tool (Magretta, 2002), a knowledge capital (Al-Debei et al., 2008), a source of competitive advantage (Zott & Amit, 2008), a source of change (Martins et al., 2015), a cognitive tool of visualization and a common language (Arend, 2013). Further, applying BMs will help deal with such difficulties in construction businesses and provide a means of identifying, describing, and analysing various value networks available (Arend, 2013).

Thus, construction companies require designing and adopting appropriate BMs to be more competitive, successful and sustainable in their businesses. However, Pekuri et al. (2013) identified that construction business managers deploy the BM concept differently than what is confirmed in other business practices and academia. Further, business managers have failed to make better decisions when defining their value propositions, looking for ways to reach the customers, organising the company's value network, choosing partners, and many other similar matters. Thus, the BM concept will also become a helpful tool (Osterwalder, 2004) for construction business managers if adequately adopted. However, Fjeldstad and Snow (2018) argued that the managers could only benefit from the BM concept in decision-making and strategising if they clarified the concept in a more interpretable and actionable manner.

Also, an organisation would benefit from its BM only if it is the most appropriate BM for the business (Arend, 2013). Hence, BM ontologies help practitioners visualise and communicate their BM ideas (Bengtsson & Hansen, 2018) and present as a shared language for describing, visualising, assessing, and changing BMs (Fielt, 2013). Furthermore, as per Osterwalder (2004), a business model ontology has the strengths of creating a big transparent picture of a business and approaching and understanding

the fundamental questions to support designing BMs. Developing a common language, accepted definition, and a shared understanding is vital to enhance BM research and application (Ritter & Lettl, 2018), specifically for specific business domains. Therefore, construction business managers must provide BM ontology to design better BMs related to the construction business options, projects and ideas.

Verstraete et al. (2017) reasoned that modelling is more useful when the projects become more complex. Therefore, developing a BM ontology is vital for actively assisting construction contractors in designing, visualising, and changing BMs successfully and effortlessly. However, the absence of a BM ontology developed specifically for construction contractors is a global issue and highly affects the developing countries' settings, e.g., Sri Lanka. Sri Lankan construction contractors are also facing many challenges and business failures due to insufficient concern for business development, unwillingness to acquire new technologies and methods and incapability to manage many projects in parallel (Gimhan et al., 2019).

Thus, complementing the highlighted gap in the knowledge and practice, this research addresses the research problem of “How to contextualise BM concept to construction contractors' business via developing a BM ontology for the construction context?”

1.3. Research Aim

This research aims to **propose a developed and validated Business Model ontology for the construction context to facilitate contractors in designing Business Models (BMs).**

1.4. Objectives

The objectives have been set as follows to achieve the aim:

1. Critically review the literature on the BM concept to interpret the gaps, particularly on construction industry application (OB1)
2. Define BM corresponding to the construction business to scope BM ontology development particular to the contractors' business (OB2)
3. Investigate BM elements essential for a BM ontology applicable to construction contractors' business (OB3)
4. Analyse the BM elements identified above (OB3) for establishing parameters to describe BM elements (OB4)
5. Establish relationships among BM elements for developing a BM ontology applicable to construction contractors' business (OB5)
6. Propose a developed and validated BM ontology for construction contractors' business, facilitating BM design for different construction business ideas/options (OB6)

1.5. Research Methodology

A comprehensive literature survey was conducted to uncover theoretical explanations related to the research area and focus on the research gap in identifying research questions based on research objectives. Subsequently, the conceptual framework was developed, requiring tests with empirical data. Even though the research problem was to address a global issue, this study was conducted in the Sri Lankan context, which has a GDP of USD 84.0 billion with 2.3% annual growth (Central Bank of Sri Lanka, 2020). In addition, the Sri Lankan construction industry contributed 7.5% to its GDP in 2019 and 6.78% in 2020 (Central Bank of Sri Lanka, 2021).

Pragmatists believe in the existence of many ways to interpret the world and the inability to visualise the entire picture of the study with a single perspective (Saunders et al., 2019). Thus, considering the nature of business-related research, this study adopted a pragmatism philosophical view by selecting appropriate methods to answer each RQ.

As per Saunders et al. (2019), the abductive approach could modify existing theory when the research topic is rich with information in one context but less information in the researching context. Hence, this study was conducted under the abductive approach by combining inductive and deductive approaches. The nature of the research tends to use multi-method qualitative choice where both interviews and documentary reviews act as data sources. However, the impossibility of finding a sizeable reliable sample restricts the use of quantitative data.

Yin (2013) described a case study as an in-depth inquiry of its actual setting, exploring or challenging the existing theory. Hence, the case study strategy was used in Phase I with multiple cases, that is, eight of the highest-graded contractors in Sri Lanka who were selected based on purposive sampling. A pilot study was conducted to ensure the appropriateness of questions of the interview guideline and the way of conducting interviews under case studies. The findings from case studies in Phase I were used for further inquiry through a qualitative survey in Phase II with construction business experts selected based on pre-defined criteria. These two research strategies contributed to achieving objectives 2, 3, 4, and 5. The sixth objective was achieved by applying a sample scenario to the developed Construction Business Model Ontology (CBMO) and validated with two groups of construction business managers of two construction organisations.

Thematic analysis was used for analysing the collected qualitative data manually and via Nvivo software. In addition, the software packages EdrawMax and Edraw MindMaster were utilised for data display, including creating flowcharts, mind maps, and workflow diagrams.

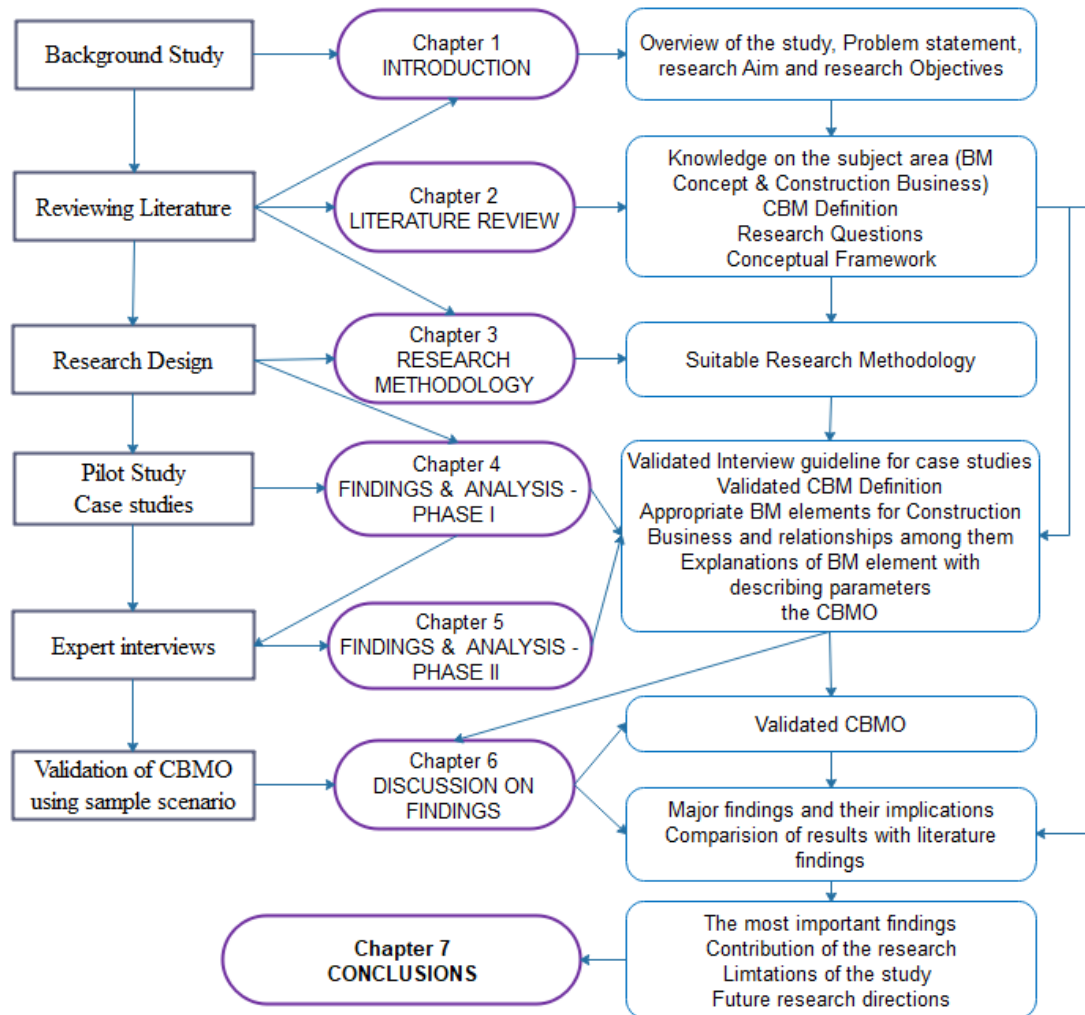
Finally, conclusions were drawn, summarising the achievement of objectives followed by recommendations and future research directions.

1.6. Structure of the thesis

Figure 1.1 illustrates the thesis structure, including research stages, the breakdown of the thesis with seven chapters, and study outcomes discussed under each chapter.

Figure 1.1

Structure of the Thesis



The thesis consists of seven (07) chapters as follows;

Chapter 1 provides an overview of the thesis by presenting the research context and problem statement found through background study and initial literature review, study aim and objectives, an overview of research methodology, study significance, and thesis structure.

Chapter 2 directs to a thorough general knowledge of the research area, explores previous studies related to the BM concept and construction business, identifies research gaps, and establishes Research Questions (RQs). This chapter ends with developing a conceptual framework.

Chapter 3 rationalises the Research Methodology, including the research design adopted for this study.

Chapter 4 and **Chapter 5** are the empirical parts of the research. The chapters present, describe, and interpret research findings and learnings from the data and provide evidence for RQs. Chapter 4 explores appropriate elements for the CBMO and relationships among them through multiple case studies. Chapter 5 clarifies and further describes the BM elements for the CBMO and their relationships via expert interviews and develops the CBMO. Chapter 5 also presents validation of the developed CBMO demonstrated with a sample scenario under two cases.

Chapter 6 discusses the research findings by collating the results of the inquiries given in Chapter 4 and Chapter 5.

Chapter 7 concludes the research findings on achieving the aim and objectives of the research and provides final comments on all points of argument. Furthermore, chapter 7 presents the research limitations, contributions, recommendations, and possible further research work for the future.

1.7. Significance of the study

The findings of this study could enhance the construction business managers' understanding of the BM concept concerning the construction industry. A definition for the Construction Business Model (CBM) was developed following a systematic process that provides a basic understanding of CBMs. The Construction Business Model Ontology (CBMO) was developed, enabling construction contractors to design their CBMs efficiently and comprehensively. As a result, construction contractors' business logic for each business case can be easily explained and communicated. The Step-by-Step guide for the CBMO enhances the use of the CBMO.

CBMO also enables stakeholder identification and handling, including clients, use of processes, setting and handling risks, choosing appropriate strategies, gaining competitive advantages and utilising resources and capabilities. Also, this study introduced the contractor's menu of value inputs to promote value-based competition among contractors. Therefore, this study presents a valuable contribution to the knowledge theoretically and practically in construction business and construction industry contexts.

2. LITERATURE REVIEW

2.1. Introduction

This chapter provides a base for the detailed literature review, further establishing the research focus discussed in Chapter 1 by filtering existing Business Model (BM) literature. Initially, the chapter introduces the construction industry, emphasising the Sri Lankan construction industry. Then, with an introduction to the concept of “value” in the construction business, this chapter moves on to discuss the multi-characters of BM to emphasise the importance of BMs for business organisations. Next, the evolution of BM is discussed based on the different phases/areas proposed by several authors. Subsequently, research studies on BMs related to the construction industry are mapped and reviewed, ensuring the absence of proper BM development pertaining to the construction business. Finally, the rest of the literature review explores BM development stages while incorporating construction business into each stage towards developing a conceptual framework.

2.2. Introduction to the Construction Industry

The construction industry is one of the bigger industries in the world, contributing to approximately 13 % of the world’s Gross Domestic Product (GDP). Still, the construction industry has recorded around 1% productivity growth annually for the past two decades (Ribeirinho et al., 2020). Therefore, it has been considered as an industry with poor performance, characterized by slow productivity growth, low levels of customer satisfaction, frequent failures, and limited digitalization (Ribeirinho et al., 2020). Thus, the construction industry's output mainly relies on the performance of construction contractors (Gimhan et al., 2019).

Sri Lanka showed a GDP of USD 84.0 billion as a developing country, with a 2.3% annual growth in 2020 (Perera & Gunatilake, 2020). The Sri Lankan construction industry contributed 7.5% to its GDP in 2019 and 6.78% in 2020 (Central Bank of Sri Lanka, 2021). Pathirana (2020) stated, based on sources, that 188,877 workers are involved in the Sri Lankan construction industry, while 680,000 people, directly and indirectly, depend on the industry. The Sri Lankan construction industry is considered an extremely competitive industry consisting of international and local construction companies (Ranasinghe & Pathirana, 2021).

The construction contractors play a significant role in the Sri Lankan construction industry, having the strengths of adequate experienced professionals, competitiveness with international contractors, technical know-how, and sufficient machinery and equipment (Gimhan et al., 2019). However, the Sri Lankan construction contractors have not adequately given their attention to overcoming their main weaknesses, e.g. poor financial management, insufficient concern for business development, unwillingness to acquire new technologies and incapability to manage many projects parallel (Gimhan et al., 2019).

On the other hand, construction projects constitute the business failures or successes of construction firms in the construction industry as project-based businesses (Assaad & El-adaway, 2020). As a main contributor to the construction businesses, contractors have to work in a more complex and competitive business environment, requiring improvements to their business to survive and remain competitive (Jang et al. 2020).

2.3. Concept of Value in the construction business

Construction companies' ability to adapt to internal and external environmental challenges and their ability to overcome them will result in their survival. Tanko et al. (2018) added that the inability to identify clients' value systems largely affected construction contractors' business survival.

The concept of "value" is a key element in marketing where customers seek the highest value from the products or services when choosing them (Morar, 2013). Hence, the businesses in the construction industry also need a greater emphasis on delivering better client value (Aliakbarlou et al., 2018). Identification of the clients' values and ensuring effective client satisfaction through the services of the construction contractors are essential for the success of construction projects (Rahman & Alzubi, 2015).

Furthermore, in facing challenges, e.g. the Covid-19 pandemic, construction companies must use mechanisms to identify ways in which value can be created through better-informed decision-making processes (Ranasinghe & Pathirana, 2021). However, construction contractors must attempt to keep the balance between value-added and the cost incurred (Perera & Gunatilake, 2020). Different methods and concepts (e.g, Value chain management, lean construction and value management) available for adding value to the construction industry by minimising its challenges are mainly focusing on the project level rather than examining them from a business perspective. However, the Business Model (BM) concept is associated with the business perspective considering value proposition, value creation and delivery and value capture (Chesbrough, 2007a; Fielt, 2013; Bocken et al., 2014; Zhao et al., 2018).

BMs can also support mapping the value flow of businesses by identifying stakeholder relationships, including customers and other wide range of stakeholders who contribute to value creation and other value dimensions (Attanasio et al., 2022).

Pekuri et al. (2014) identified the usefulness of the BM concept in analysing and managing the value creation of a construction company. The value is not only important from the customers' perspective, but also it plays a major role in businesses (Morar, 2013). Therefore, as project-based firms, construction companies must capture value from their projects through monetary and non-monetary dimensions (Bos-de Vos et al., 2019).

The next discusses the significance and roles of BMs beneficial to businesses, including construction business.

2.4. Significance and role of Business Models (BMs)

A Business Model (BM) is developed because of a need to compress the essential features of a business into a short descriptive document by which a business judgment could be made (Rasmussen, 2007). Accordingly, the BM is designed to answer a series of questions essential to any business. As such, a BM addresses five key questions, i.e. (i) how the enterprise's value proposition is defined, (ii) to whom value is created, (iii) how value is created, (iv) what resources and competencies are utilised, and (v) how revenue streams are created (Aho, 2013). Primarily, as per Chesbrough (2007a), "at its heart, a BM performs two important functions, i.e., (i) value creation and (ii) value capture" (p.12). Thus, a good BM can produce value propositions compelling to customers, attain applicable cost and risk structures, and enable significant value capture (Teece, 2010). A company's or an industrial sector's main BM defines and evaluates the service that the company/industry sector actually delivers to its customers and how the price level of that service is defined (Aho, 2013).

As stated by Magretta (2002), "a good business model remains essential to every successful organisation, whether it is a new venture or an established player" (pp.3-4). Magretta further explained this with the "story of Dell Computers", i.e., "BM of Dell Computers", which is used by Dell as a basis for employee communication and motivation. This results in everyone in Dell seeing their jobs within a large context, thereby creating the kind of value the firm requires. Accordingly, BM acts as a common language among stakeholders to reduce complexity (Arend, 2013) and as a narrative device by describing the business as a story and validating the selection of entities that need to be considered (Doganova & Eyquem-Renault, 2009). Nonetheless, Bock and George (2011) blame the narrative perspective provides vagueness in BM development and deployment as it focuses only on story-formation and sorts narrative commonalities. However, as a generic level descriptor, BM shows how a company organises itself to create and distribute value profitably and distinguishes and sorts firms by revealing different types of business behaviour (Baden-Fuller & Morgan, 2010).

Playing a role as a source of competitive advantage, BM supports strategic decision-making in gaining a competitive advantage (Zott & Amit, 2008) while responding to internal changes in the organisation and external shocks as a source of change (Martins et al., 2015). This evidence proves that the high-quality business decisions to enhance competition and the ability to face rapid environmental changes are supported by implementing suitable BMs (Al-Debei & Avison, 2010). For instance, famous businesses, i.e., South-West Airlines, Google, Disney, and Toyota (Baden-Fuller & Morgan, 2010). Therefore, as Cavalcante et al. (2011) highlighted, BMs must be stable to develop company activities and flexible in allowing changes.

One of the most attractive facts about BM is that it can map and manage complexities in information-intensive environments. The BMs' characteristics such as transferability, transparency, tracking, scalability, and robustness help when properly operating in complex environments and dealing with parties that differ widely in their

capabilities, interfaces, and motives (Arend, 2013). Accordingly, Arend recognised BM as a cognitive tool for visualisation for easily spotting and addressing gaps and inconsistencies in the overall business operations. Also, Bock and George (2011) and Amit and Zott (2001) illustrated BM as an opportunity facilitator, which acts as an intermediary in the opportunity creation process facilitating opportunities. Bock and George (2011) further explained that BM is the design of organisational structures to enact a specific opportunity, with layers of business activities between opportunity identification and organisational formation. For instance, in situations where sustainability and digitalisation are essential, the BMs can show how to collaborate and implement trends and digital technologies in construction practices (Berge et al., 2019). Further, BMs provide directions when undertaking new structures of organising transactions with non-traditional ownership, exchanging goods, and dealing with greater complexity and uncertainties, e.g., multilevel and interdependent contacts among various parties (Arend, 2013).

BM connects or disconnects different entities to create new entities as a calculative device (Doganova & Eyquem-Renault, 2009). However, as a planning tool, BM focuses on how all elements of the system fit into a working whole (Magretta, 2002). According to Bullinger et al. (2016), the proper BM has the crucial link between a company and market success. Nevertheless, Doganova and Eyquem-Renault (2009) and Baden-Fuller and Morgan (2010) contradictorily mentioned that BMs of a particular company might be copied, imitated, or compared as nutshell descriptions; therefore, BMs play an exemplar role. However, as per Al-Debei et al. (2008), BMs become an intangible and tactical knowledge asset for supporting strategic decision-making to gain a competitive advantage. Hence, BM is identified as a knowledge capital (Al-Debei et al., 2008).

This view is echoed in the study of Al-Debei and Avison (2010), identifying BM as a strategic-oriented knowledge capital that demonstrates how businesses perform to achieve strategic objectives. Consequently, BMs give a set of decisions enforced by the firm's authority, acting as a constellation of decisions so that the firm's employees can be led by the procedural norms, bureaucratic structures, and the firm's incentive structures (Casadesus-Masanell & Heilbron, 2015).

Interestingly, Sabatier et al. (2010) compared the BM with "recipe", where ingredients are the variety of BM elements, e.g., resources, capabilities, technologies, and customers. Further, the recipe theme combines resources used to produce a particular outcome to deliver the value proposition. Similarly, as per Baden-Fuller and Morgan (2010), the recipe notion of BM demonstrates the organisation and integration of the main elements of the firm's activity to produce a particular outcome, following a set of rules. Other firms can also obtain recipes from ideal-type BM examples that have already been tested and followed with minor changes (Baden-Fuller & Morgan, 2010).

Besides the role as a recipe, BM plays a scientific role while acting in the scientific sense as model organisms for investigation and acts as a scale model for new business enterprises by showing their feasibility and worth to the partners (Baden-Fuller &

Morgan, 2010; Doganova & Eyquem-Renault, 2009). The study of Al-Debei and Avison (2010) reveals that BMs give diverse utility by acting as a conceptual tool of alignment, which provides central coordination among organisational layers. It fills the gap between those layers and as an interceding framework that mediates between technological artefacts and the fulfilment of strategic goals and objectives.

Ultimately, it is imperative to deploy an appropriate BM for a business to gain rewards from its multivalent roles, even though the distinctive features of superior BMs are not yet agreed upon (Casadesus-Masanell & Ricart, 2010). Further, BMs can play different roles for different firms for different purposes and mostly play multiple roles simultaneously (Baden-Fuller & Morgan, 2010). Accordingly, Table 2.1 summarises the different roles of BM as discussed above.

Table 2.1

Multivalent roles of the Business Model

Character/role	Function	Ref.
Narrative device	Describes and validates the selection of entities to be taken into account, focusing on story-formation and cataloguing	[5] [9]
Planning tool	Focuses on how all elements of the system fit into a working whole	[2]
Calculative device	Connects or disconnects existing entities to create new entities, which will then play the characters of the BM story	[5]
Generic level descriptor	Provides how a company organises itself to create and distribute value profitably.	[7]
Conceptual tool of alignment	Fills the gap between corporate strategy and business processes to provide central coordination among those organisational layers.	[6] [3]
Interceding framework	Mediates technological artefacts and the fulfilment of strategic goals and objectives.	[6]
Strategic-oriented knowledge capital	Demonstrates how businesses are performed and strategic objectives are achieved.	[6]
Cognitive tool of visualisation	Spots and addresses gaps and inconsistencies in the overall business operations.	[10]
Opportunity facilitator	Intermediately assists in the opportunity creation process.	[1] [9]
Common language	Combines stakeholders by reducing complexities and improving understanding.	[9]
Source of change	Responds to internal changes of the organisation and external shocks.	[12]
Source of competitive advantage	Supports strategic decision-making in gaining a competitive advantage.	[4]
Exemplar role	Might be copied, imitated or compared.	[7] [5]
Scientific role	Acts in the scientific sense as model organisms for investigation.	[7]
Scale model	Shows feasibility and worth to the partners of new business enterprises.	[7] [5]
Recipe	Combines resources to produce a particular outcome to deliver a value proposition.	[8]

Character/role	Function	Ref.
Knowledge capital	Supports strategic decision-making to provide the organisation with a competitive advantage as an intangible and tactical knowledge asset	[3]
Constellation of decisions	Gives a set of decisions that are enforced by the authority of the firm	[11]
[1] Amit and Zott (2001), [2] Magretta (2002), [3] Al-Debei et al. (2008), [4] Zott and Amit (2008), [5] Doganova and Eyquem-Renault (2009), [6] Al-Debei and Avison (2010), [7] Baden-Fuller and Morgan (2010), [8] Sabatier et al. (2010), [9] Bock and George (2011), [10] Arend (2013), [11] Casadesus-Masanell and Heilbron (2015), [12] Martins et al. (2015)		

Finally, as concerned by Casadesus-Masanell and Ricart (2010), the strategy has been the primary element of competitiveness over the past few decades, even though the BMs fuel the sustainable advantage of businesses. Therefore, the terms ‘BM’ and ‘Strategy’ cannot be used interchangeably as they are not similar (Magretta, 2002). Consequently, after having explored and discussed the significance and roles of BM, the term ‘Strategy’ in business literature is required to be distinguished from the term ‘BM’ in the next section.

2.5. Business model vs strategy

BM is the firm’s logic of creating value for its stakeholders, while strategy takes BM to compete in the marketplace (Casadesus-Masanell & Ricart, 2010). However, BM can also become a source of competitive advantage through BM innovation, where BM innovation is the result of strategy (Boons & Lüdeke-Freund, 2013). Table 2.2 summarises the points distinguishing strategy and BM in the literature.

Table 2.2

Business Model vs Strategy

BM	Strategy	Ref.
Provide the answer to “How to make money?”	Provide the answer to “Where to place a BM and how and when to use it?”	[7]
More concerned with value creation	More concerned with a competitive advantage	[4]
Focuses on value creation and value capture	Focuses on value capture and competitive advantage	[6]
BM can be conceived as an abstraction of a firm’s strategy	A firm’s strategy is always attached to its competitive environment	[2]
BMs could be used for designing strategies with different combinations	Strategy decides which BM is to be used or which modifications to the BM is to be done	[2] [3]
BM describes what a company really is at a given time	The strategy reflects what the company aims to become	[5]
BM is becoming a powerful tool for improving the execution	Strategy differentiates the business, creating a competitive advantage	[1]
[1] Magretta (2002), [2] Seddon and Lewis (2003), [3] Casadesus-Masanell and Ricart (2010), [4] Zott et al. (2011), [5] DaSilva and Trkman (2014), [6] Abuzeinab and Arif (2014), [7] Stefan and Branislav (2016)		

As given in Table 2.2, Abuzeinab and Arif (2014) identified that the BM focuses on creating value for value capture, whereas the strategy captures value through competitive advantage. Magretta (2002) also has a similar view that BM improves business execution while the strategy differentiates the business by generating a competitive advantage. Accordingly, BM's primary concern is to create value, but the strategy mainly concerns a competitive advantage (Zott et al., 2011).

DaSilva and Trkman (2014) state a different way to separate BM and strategy where the strategy reflects what the company aims to become, while BM describes what a company is indeed at a given time. However, as per Teece (2010), BM is more generic than strategy due to its features, i.e., transparency and imitating easiness. According to Seddon and Lewis (2003), strategists could use different combinations of BMs to create new strategies. Such strategies can then be used for planning for which BM is to be used or any BM modifications required even at contingencies (Casadesus-Masanell & Ricart, 2010).

Accordingly, BM can be considered an abstraction of a firm's strategy, which is always firmly attached to the firm's competitive environment (Seddon & Lewis, 2003). Hence, the competitive advantage of designing a BM can be achieved by combining strategy and BM (Teece, 2010). After clarifying the BM compared to the commonly used business term 'Strategy', exploring the evolution of BM in the literature has become necessary to seek the research gap.

2.6. Evolution of the business model concept

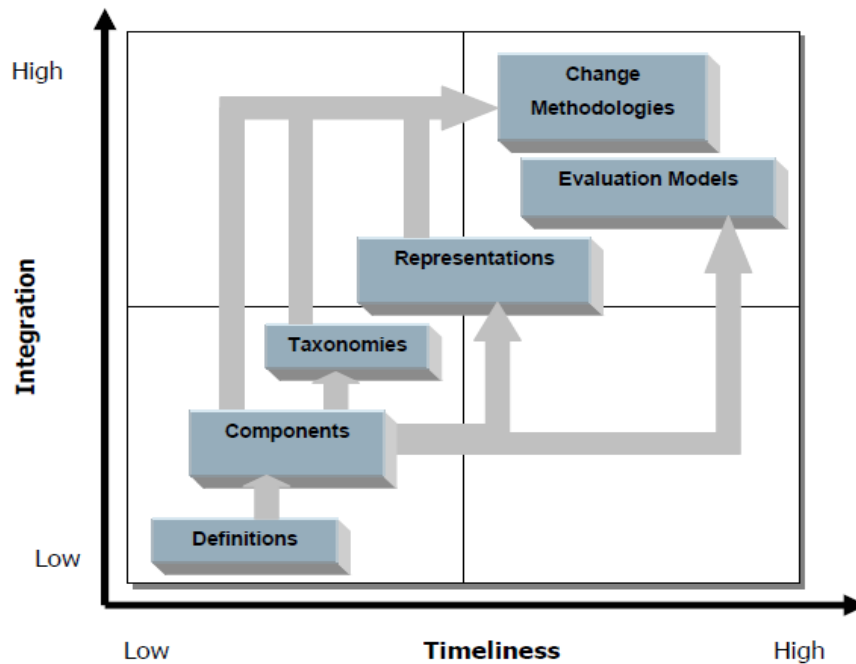
With the advent of the internet in the mid-1990s, the BM concept became prevalent. Since then, the concept has boomed among scholars and business practitioners (Osterwalder et al., 2005; Zott et al., 2011).

Pateli and Giaglis, in 2003, attempted to explore how the BM concept emerged and developed an explanatory framework for BM development within the literature (as shown in Figure 2.1). As per Figure 2.1, the framework consisted of six sub-domains: (i) definitions, (ii) components, (iii) taxonomies, (iv) representations, (v) change methodologies, and (vi) evaluation models.

The Y-axis of Figure 2.1 is labelled 'Integration', which measures how each sub-domain builds upon other sub-domains. For example, suppose a sub-domain is relatively independent. In that case, the integration is low. If it is strongly related to and dependent on a prior understanding of other sub-domains, the integration is high. The X-axis of Figure 2.1 is labelled as 'Timeliness' to measure the degree to which a sub-domain requires further investigation and how the sub-domains emerge one after another. For instance, matured and well-researched sub-domains are low in timeliness.

Figure 2.1

The framework for BM concept development with sub-domains



Source: Pateli and Giaglis (2003)

Pateli and Giaglis (2003) used arrows to highlight the interrelationships between sub-domains. Table 2.3 presents different concerns under each sub-domain identified by Pateli and Giaglis (2003).

Table 2.3

Concerns under BM research sub-domains

Research Sub-domain	Research domain concern
Definitions	Defining the purpose, scope, and primary elements of a BM
Components	Break down into fundamental constructs and then rank specification of BM components
Taxonomies	Possible categorisations of BMs into several typologies based on various criteria
Representations	Propose several possible instruments or/and representational formalisms for visualising the primary components of a BM and their interrelationships
Change Methodologies	Formulate guidelines, describe steps, and specify actions to be taken for either changing BMs or choosing an appropriate BM
Evaluation Models	Identify criteria for either assessing the feasibility and profitability of BMs or evaluating a BM against alternative or best practice cases

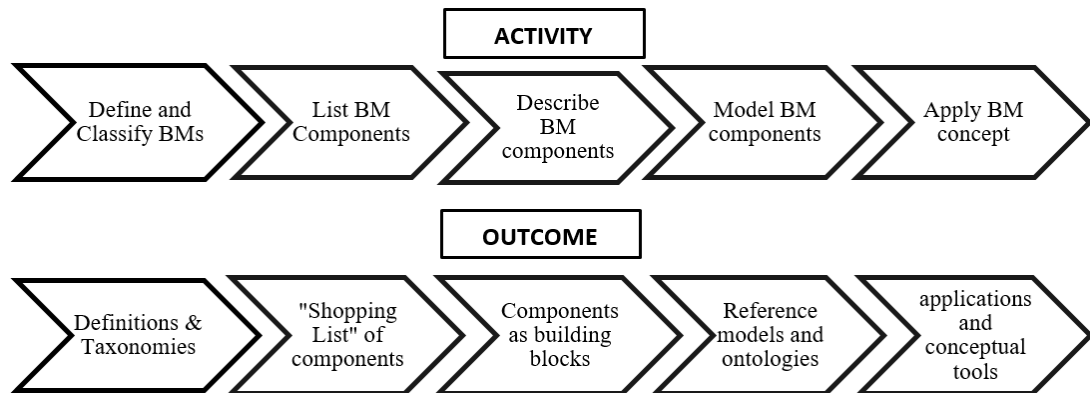
Source: Adapted from Pateli and Giaglis (2003)

Besides Pateli and Giaglis (2003), few other scholars also attempted to explore how the BM concept emerged. Osterwalder et al. (2005) initially found that the term ‘business model’ first appeared in an academic article published in 1957 and the title and abstract in 1960. Osterwalder et al. (2005) carried out a survey of journal articles

to study the evolution of BM. Pertaining to the survey, the authors categorised the evolution of BM research into five (05) phases, as shown in Figure 2.2, also illustrated by Gordijn et al. (2005).

Figure 2.2

Evolution of the BM concept



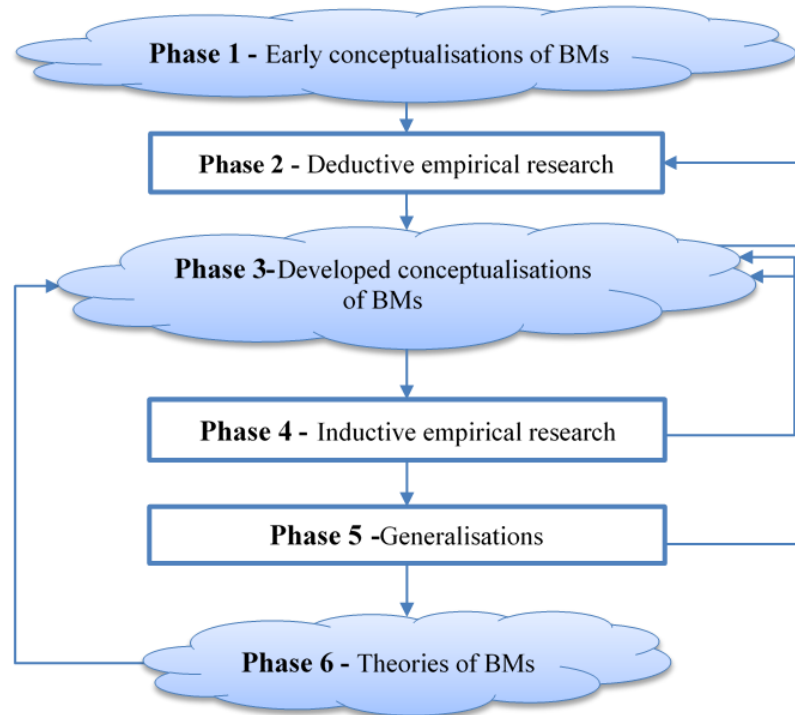
Source: Gordijn et al. (2005) and Osterwalder et al. (2005)

As identified by Gordijn et al. (2005), when the term BM started to become prominent, several authors proposed definitions for BM, which is the first phase of BM development. Then, in the second phase, lists of elements to the BMs were proposed, and some studies (e.g. Timmers, 1998; Hedman & Kalling, 2003) included those lists in the definitions. Later, in the third phase, detailed descriptions for BM elements were observed while conceptually modelling the elements of BMs in the form of ontologies or reference models started in the fourth phase. Finally, such reference models/ontologies were applied in specific areas for different purposes: for designing, analysing and evaluating BMs; for visualising BMs; and for changing and innovating BMs (Gordijn et al., 2005).

In 2006, Lambert proposed a framework for future research towards building theories related to BMs called as *Business Model Research Schema (BMRS)*, as illustrated in Figure 2.3. The present study considered this framework as it provides another process of BM development, even though it concerns theory building based on the BM concept.

Figure 2.3

Business Model Research Schema (BMRS)



Source: Lambert (2006)

According to Lambert (2006), Phase 1 includes simple conceptualisations of BMs, including definitions, BM elements, and typologies. The next phase (Deductive Empirical Research) represents deductive research, where the conceptualisations form the basis for classifying data. As a result, the original concepts are developed and refined in Phase 3. During Phase 4, variables covering all collected data and relevant BM variables are selected. General patterns of configurations of BM variables can be speculated from the taxonomies, and superficial relationships between variables can then be hypothesised and tested to generalise in Phase 5. Finally, BM theory can be developed with generalisations.

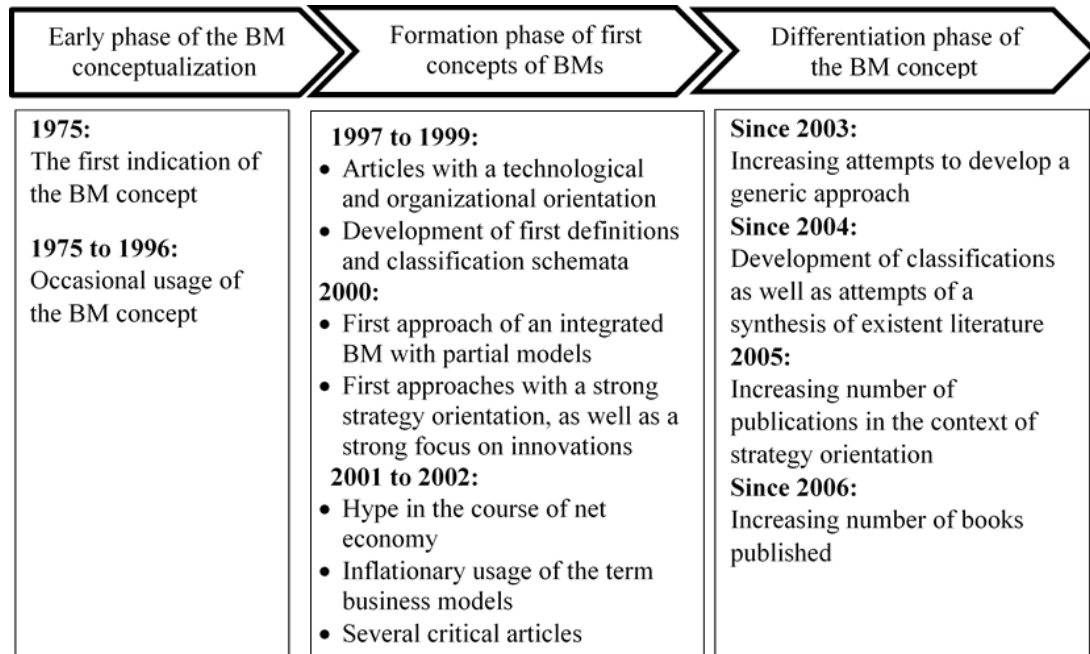
Even though a specific process with phases was not identified, Zott et al. (2011) explained the emergence of BMs with e-businesses, highlighting the evolving areas of BM development as BM definitions, descriptions of generic e-business models and typologies, components of e-business models, and BM representations. Understanding the composition of firms engaged in novel ways of doing business is an attractive area for researching BMs in e-businesses (Zott et al., 2011). Accordingly, Zott et al. (2011) further identified the two areas of evolving BM concept with less concern for empirical testing: (i) defining and representing generic (e-) business models and/or (ii) developing typologies and taxonomies.

Figure 2.4 illustrates another view of BM development phases proposed by Wirtz (2016), where the BM concept development is divided into three phases. Here, the

essential points of the BM concept development within the individual development phases are outlined based on different periods of years.

Figure 2.4

The course of the development phases of BM



Source: Wirtz (2016)

As per Figure 2.4, the early phase only indicates the BM concept. Afterwards, the BM concept was identified at the formation phase based on different perspectives (technological, organisational, and strategy) while giving initial definitions and classifications. This phase was earlier analysed by Wirtz, Pistoia, Ullrich, and Geottel (2015), assigning selected publications related to the BM concept for the three basic perspectives, i.e. (i) technology, (ii) organisation, and (iii) strategy, based on the time. However, since the three basic perspectives were referred simultaneously after 2000, the allocation became complex. Therefore, Wirtz et al. (2015) explained the BM concept development in another way where the uses of BMs emerged, (i) from a very unspecific manner, (ii) in the sense of process modelling, (iii) as a management tool, and (iv) as an integrated presentation of the organisation contributing to the success of management in the decision-making process.

Ultimately, Wirtz (2016) identified the phase since 2003 as the differentiation phase following a functional-oriented approach and presented five criteria for the development of a generic BM approach based on the Business Model Research Schema (BMRS) proposed by Lambert (2006):

- I. Definitions of BMs showing its extent and understanding
- II. Intention and use of the BM concept

- III. Degree of abstraction, i.e., industry, company, or strategic business unit, indicated by the levels
- IV. Possible division of BMs to reduce their complexity indicated by the number of components
- V. Correlations among BM components indicated by the interactions

Unfortunately, the above studies failed to provide a clear picture of BM concept development or emergence since 2006. Therefore, 133 articles related to the BM concept were briefly analysed (refer Annexure 2.1) to cover the BM concept emergence from 2006 to 2020. The articles were allocated into five-year periods: 2006 to 2010, 2011 to 2015, and 2016 to 2020.

As a result, seven (07) areas of BM development could be identified: (i) BM change and innovations, (ii) Sustainability in BMs, (iii) Different types of BMs, (iv) BM concept concerning different theories and views, (v) Clarifications of BM concept, (vi) BM management and implementation, and (vii) BM design development. Table 2.4 provides the number of articles during the three five-year periods used for analysis and how those articles were allocated for the above seven areas with their percentage contribution to each area of BM development.

Table 2.4

Contribution of BM articles to BM development areas from 2006 to 2020

Areas of BM development	Articles (total numbers 133)					
	2006 - 2010		2011 - 2015		2016 - 2020	
	Nos	Percentage	Nos	Percentage	Nos	Percentage
BM change and innovations	10	29%	25	37%	10	31%
Sustainability in BMs	2	6%	12	18%	5	16%
Different types of BMs	6	18%	6	9%	1	3%
BM concept in relation to different theories and views	5	15%	10	15%	8	25%
Clarifications of BM concept	5	15%	7	10%	2	6%
BM management and implementation	3	9%	3	4%	1	3%
BM design development	3	9%	4	6%	5	16%

Table 2.4 permits to argue that the BM development areas, BM change and innovations, sustainability in BMs, different types of BMs and BM management, and implementation occur during its application stage after designing BMs. Further, when applying the BM concept, the researchers established the importance of comparing and combining different theories with the BM concept, showing growing attempts throughout the period.

Still, some studies concerned the development of BM design aspects during this phase. Accordingly, three efforts could be found from 2006 to 2010 in developing generic approaches, e.g., Reference ontology for BMs (Andersson et al., 2005), Tractable

representation of BMs (Casadesus-Masanell & Ricart, 2010), and the Business Model Canvas (BMC) (Osterwalder & Pigneur, 2010).

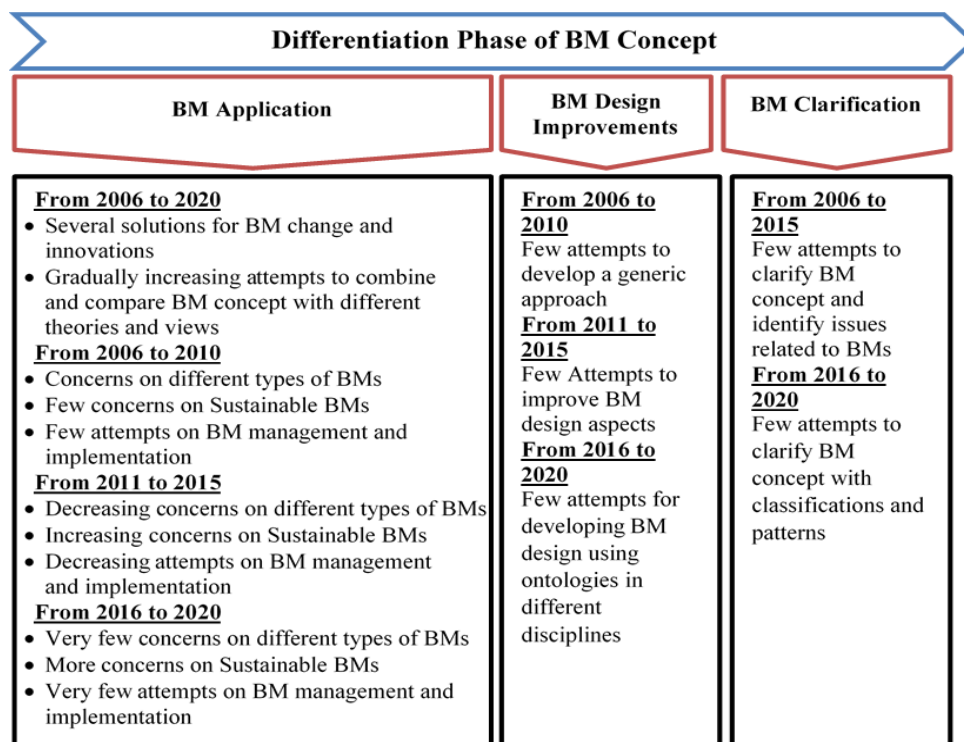
On the other hand, during the 2011 to 2015 period, four attempts to improve the BM design process through different methods were identified. For instance, consider Computer-Aided Design for BM design (Osterwalder & Pigneur, 2013), introduce antecedents of BM Design (Amit & Zott, 2015), and the use of BMC (Dudin et al., 2015; Dalby et al., 2014). Furthermore, further clarifying the BM concept by seeking issues related to the BM concept continued since 2006 in a few studies, which gradually declined towards 2020.

Accordingly, this study identified that during the period from 2006 to 2020, various aspects of the BM concept were concerned. Hence, similar to Wirtz (2016), this period was also considered the Differentiation Phase of the BM concept. Furthermore, it is also evident that during the Differentiation Phase, BM application issues and improvements, e.g., BM innovations, changes, and renewals, were discussed, together with BM design improvements and further clarifications of the BM concept.

Figure 2.5 presents the extended Differentiation Phase from 2006 to 2020 with sub-concerns: BM application, BM design improvements, and BM clarification. The main aspects of the BM concept development are listed under each sub-concern, considering different time periods.

Figure 2.5

BM concept development from 2006 to 2020



In a nutshell, BM concept development was identified in different phases by Pateli and Giaglis (2003); Gordijn et al. (2005); Osterwalder et al. (2005); Lambert (2006); and Wirtz (2016), while Zott et al. (2011) explored the evolving areas for BM concept. However, the emphasis made in all these studies is convergent. Therefore, it is worth mapping the phases suggested by them and this study to ascertain the typical stages of the BM development process.

2.7. Business model development stages

The evolution of the BM concept in the literature shows the roadmap for improved application of the BM concept. Hence, the BM evolutionary phases/areas/domains identified by Pateli and Giaglis (2003); Gordijn et al. (2005); Osterwalder et al. (2005); Lambert (2006); Zott et al. (2011); and Wirtz (2016) were mapped to identify common stages forming roadmap for BM development, as presented in Table 2.5.

As per Table 2.5, the 2nd, 3rd, 4th, and 5th stages are common to all studies, which proceed from defining BM to developing BM ontologies or representations. The BMRS proposed by Lambert (2006) provides a structured method for researching the BM concept to build theories, consisting of additional three phases: inductive empirical research, generalisations, and developing the BM theory. As Lambert (2006) declared, the first three phases of Gordijn et al. (2005) are part of the BMRS Phase 1. Further, the fourth phase of Gordijn et al. (2005), ‘model BM elements’, represents Phase 3 of the BMRS. However, the fifth phase of Gordijn et al. (2005), ‘apply BM concept using BM models’, does not form a part of the BMRS (Lambert, 2006). Therefore, BMRS could be considered as a BM development process towards building theories related to the BM concept rather than the BM development towards adapting the BM concept to real-life business.

On the other hand, the early phase Wirtz (2016) proposed is considered the first stage of BM development. ‘Define and classify BMs’, endorsed by all researchers, is taken as the 2nd stage. All studies have discovered the stage ‘listing and describing BM components/elements’ under one or two phases. This study recognised them as two different stages – the 3rd stage and 4th stage.

Table 2.5

Mapping of the evolutionary phases of BM research proposed in different studies

Stage	References						
	Towards BM adaptation				Towards developing BM theories		
	[a] & [b]	[c]	[d]	[e] and Analysis under this study	BMRS by [f]		
1				BM Indication	Early phase		
2	Define and classify BMs	Definitions Taxonomies	Definitions of generic e-BMs and typologies	Definitions & classifications of BM	Formation phase Differentiation phase (Develop a generic BM approach)	definitions BM elements BM typologies	Early conceptualisations of BMs
				Definitions			
				Aims			
				Levels of abstraction			
3	List BM elements	Components/elements	Components/elements of e-BMs	Components/elements of BMs			
4	Describe BM elements						
5	Model BM elements as ontologies	Representations	BM representation	Interactions			Deductive empirical research Conceptualisations of BMs
6	Apply the BM concept using BM Models	Change Methodologies Evaluation Models		BM applications	The extended Differentiation phase identified in this study (Figure 2.5)		
7			BM issues and clarifications				
8			BM design improvements				
							Inductive empirical research
							Generalisations
							Theories of BMs

[a]Osterwalder et al. (2005), [b] Gordijn et al. (2005), [c] Pateli and Giaglis (2003), [d] Zott, et al. (2011), [e] Wirtz (2016), [f] Lambert (2006)

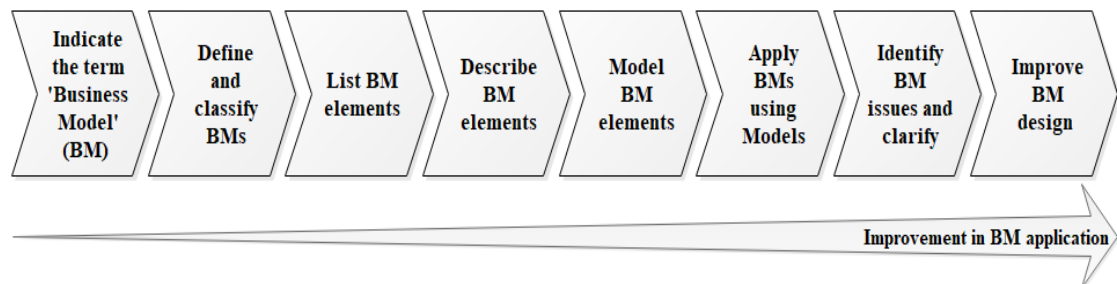
Each study in Table 2.5 revealed different forms for modelling BM elements: BM ontologies and reference models (Osterwalder et al., 2005; Gordijn et al., 2005), representations (Pateli & Giaglis, 2003; Zott et al., 2011), interactions (Wirtz, 2016), and conceptualisations (Lambert, 2006). Thus, ‘modelling BM elements’ is considered under the 5th stage. ‘Apply BM concept using models of BM elements’ proposed by Gordijn et al. (2005) and Osterwalder et al. (2005) is considered the 6th stage. The extended Differentiation phase suggested in this study also consists of BM applications as a sub-phase concerning BM change and innovations, sustainability in BMs, different types of BMs, comparison with other theories and views, and BM management and implementation.

Similarly, the last sub-domains proposed by Pateli and Giaglis (2003), i.e., Change methodologies for understanding and structuring the change of a firm’s BM and evaluation models for evaluating and assessing BMs, are also included in the BM concept application. Along with BM applications, different issues related to the BM concept were identified, requiring further clarifications to the BM concept, which is considered the 7th stage. The 8th stage considers the BM design improvement methods.

Since BMRS focuses only on representing scientific research in building theories and not on applying the BM concept (Lambert, 2006), the last three phases proposed by Lambert (2006), i.e. (i) inductive empirical research, (ii) generalisation, and (iii) BM theory development, are not taken as a part of BM development towards improved BM application. Finally, Figure 2.6 illustrates the roadmap for BM development toward improved BM application.

Figure 2.6

Roadmap for BM development



The applicability of the above eight stages within the scope of this study is discussed below to set up a BM research development toward improved BM application in the construction business.

The first stage is considered pointless to mention in the BM development process in this study because the BM concept is indicated in almost all disciplines, including the construction business. Furthermore, as already discussed, past researchers have also addressed the 2nd, 3rd, 4th, and 5th stages in establishing the BM concept, irrespective of their fields of interest and the time required to complete the process. Thus, it can be argued that the proper application of the BM concept in the construction business requires following the 2nd, 3rd, 4th, and 5th stages before expecting improved application

of the BM concept in the industry. Accordingly, the 6th stage can be considered the ultimate destination, which focuses on improving BM application in the construction business.

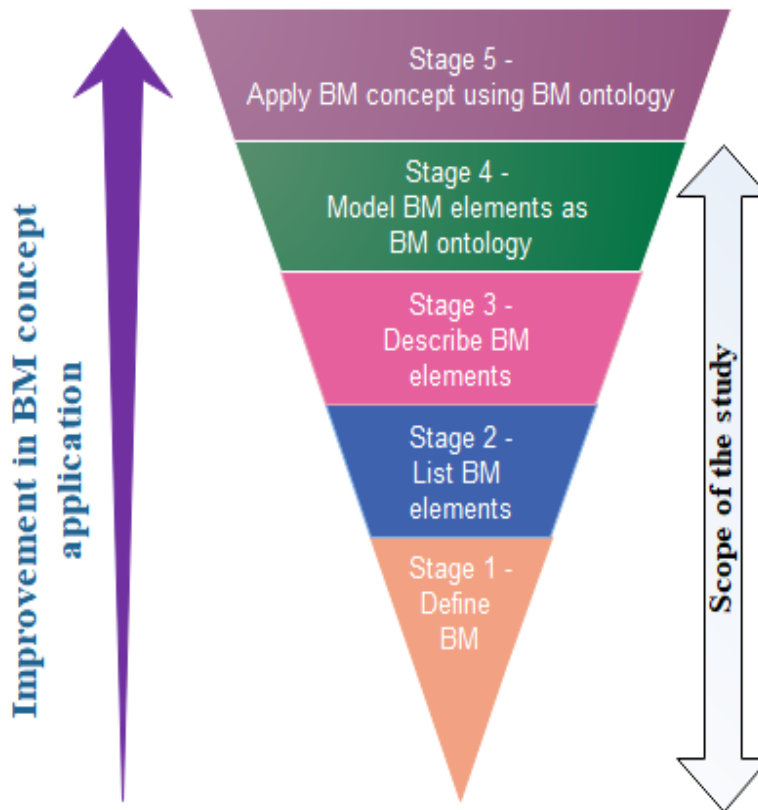
Modelling BM at the 5th stage could be achieved by developing Business Model ontologies (Osterwalder et al., 2005; Gordijn et al., 2005), reference models (Osterwalder et al., 2005; Gordijn et al., 2005), representations (Pateli & Giaglis, 2003; Zott et al., 2011), interactions (Wirtz, 2016), and conceptualisations (Lambert, 2006). However, according to literature, the tools developed based on BM ontologies have been mostly applied in business, e.g., information systems, e-business, software business, and computer science. The most compelling example is the *Business Model Canvas* (BMC), the well-known and widely used supportive tool created by Osterwalder and Pigneur in 2010. This tool was created based on the Business Model Ontology (BMO) developed by Osterwalder in 2004. Thus, ‘BM ontology’ is selected as the form of modelling BM elements for improving BM application in the construction business.

The last 7th and 8th stages are superior to the application of the BM concept because issues of BM concepts may occur while applying BMs, thus requiring further clarifications and effective methods for improving their design. However, some disciplines still seek BM design improvements through ontology development. For instance, the fields of Health Information Technology (Gand & Esswein, 2018) and social businesses (Todaria et al., 2020) focus on particularly designing BMs through ontologies. Hence, the BM development process within the scope of this study defines BM, lists BM elements, describes BM elements, develops BM ontology, and then applies the BM concept using the BM ontology.

Figure 2.7 is created as the BM development process for this study with five stages toward BM application betterment. Figure 2.7 shows the gradual development of the BM concept in a particular field where continuing development of the BM application could be achieved by implementing each stage of the process in the given sequence. This process portrays that ‘the development of a BM ontology’ is the prerequisite for the proper BM application or improving BM application in any field. However, BM definition, list of BM elements, and BM element specifications must be adequately understood to develop a BM ontology.

Figure 2.7

BM Development Process



As literature evidenced, the stages shown in Figure 2.7 is followed mainly by disciplines, e.g., information systems, e-Commerce and e-Business and sectors, e.g., telecommunication and software industries, where the BM concept has been mostly investigated and applied as per Al-Debei and Avison (2010). Thus, examining the compatibility of BM research related to the construction industry with the stages of the BM development process (Figure 2.7) is vital to explore the literature gaps, particularly in construction industry application.

2.8. Construction industry-related business model research

The concept of BM is being widely used in disciplines connected with information systems, i.e., e-business and e-commerce, and in the telecommunications industry and software industry to design, compare, analyse, and communicate the business logics of different companies (Pekuri et al., 2015; Al-Debei and Avison, 2010). However, only a few studies have used the concept in the construction industry. Table 2.6 indicates how the BM studies related to the construction industry comply with the BM development process.

Table 2.6 summarises the research focuses of those studies to correctly understand the extent to which they could comply with the stages of the BM development process (also refer Annexure 2.2).

Table 2.6

Mapping BM research studies related to the construction industry with stages of BM development process

Ref.	Research Focus	BM development Stages				
		1	2	3	4	5
Cheng et al. (2001)	To propose a BM framework for an e-business infrastructure to support supply chain activities in the construction	X	✓	✓	✓	✓
Duyshart et al. (2003)	To explore the implementation strategies and benefits of BM for ICT adaptation in construction	X	X	X	X	X
Brady et al. (2005)	To identify whether integrated solutions BMs work in construction	X	X	X	X	X
Grimscheid and Rinas (2012)	To design a cooperative BM for capitalising on the opportunities offered by the industrialisation of construction in Switzerland	X	X	X	X	X
Mokhlesian and Holmén (2012)	To identify the changes in BM elements as a consequence of green construction	X	✓	✓	X	X
Pan and Goodier (2012)	To address off-site construction to BMs and map the relationship between the BMs in UK house building and the different types of off-site technologies	X	X	X	X	X
Aho (2013)	To find out the requirement of industry structure transformation and BM innovation for sustainable construction.	X	X	X	X	X
Christian and Lars (2013)	To find out how BM for off-site system deliveries could be developed to enhance off-site manufacturing practices	X	X	X	X	X
Pekuri et al. (2013)	To explore how managers understand and deploy the BM concept in the Finnish construction industry.	X	X	X	X	X
Thuesen and Hvam (2013)	To develop new BMs in construction based on off-site system deliveries resulting in radical value increments for the users, companies and society as a whole.	X	X	X	X	X
Abuzeinab et al. (2014)	To establish a common understanding and definition of Green BMs	✓	X	X	X	X
Abuzeinab and Arif (2014)	To investigate principles for engaging stakeholders in the context of the UK construction industry as a means towards achieving a green BM transformation	X	✓	X	X	X
Brege et al. (2014)	To analyse the BMs of industrialised multi-story buildings and test how prefabrication could form the basis of a construction firm's BM.	X	✓	✓	X	X
Goulding, Rahimian, and Sharp (2014)	Develop a roadmap for BMs focusing on three major areas of off-site construction : process, technology and people and their impact on design, manufacturing and construction.	X	X	X	X	X
Pekuri et al. (2014)	To illustrate how the BM approach can be used in analysing and managing the value creation of a construction company	X	✓	✓	✓	✓
Pekuri (2015)	To understand the role of BMs and their applicability in construction business management	X	X	X	X	X
Pekuri et al. (2015)	To investigate project selection in the context of business management with the specific aim of understanding the role of BMs in project selection	X	X	X	X	X

Ref.	Research Focus	BM development Stages				
		1	2	3	4	5
Van den Brink (2016)	To create the mutual development of the circular economy theory and BM prototypes for the circular construction industry.	X	✓	✓	X	X
Ling and Li (2016)	To develop a framework of BMs for foreign firms offering construction-related consultancy services in China	X	✓	✓	✓	✓
Abuzeinab, Arif and Qadri (2017)	To identify barriers to Green BMs in multinational enterprises in the UK construction sector	X	X	X	X	X
Liu et al. (2017)	To develop a BM innovation model to respond to major technological shifts in modular prefabrication and construction.	X	X	X	X	X
Zhao, Chen, Pan, and Li (2017)	To develop an AHP-ANP–fuzzy integral integrated network for evaluating the performance of innovative BMs for Sustainable Buildings.	X	X	X	X	X
Zhao, Hwang and Lu (2018)	To provide an analytical structure to identify BM innovations in real-life Zero Carbon Building (ZCB) cases and develop a typology of BM innovations for delivering ZCBs	X	✓	✓	X	X
Brunoro, Giulio, Luig, Jansen, and Bizzarri (2018)	To illustrate the potential of an optimized energy-saving approach at a district level within the collective self-organized (CSO) housing : Oriented Business Model and Application	X	X	X	X	X
Lessing and Brege (2018)	To analyse the primary characteristics of the different BMs applied by industrialised building companies.	X	✓	X	X	X
Berg et al. (2019)	To investigate the archetypical BMs in the construction value chain	X	✓	✓	X	X
Das et al. (2019)	To present "BM Transformation Canvas" that aids in mapping the transformation of construction businesses due to Industry 4.0 scenarios of globalisation, industrialisation and digitalisation.	X	✓	✓	✓	✓
Das, Perera, Senaratne, and Osei-Kyei (2020)	To develop a construction BM Transformation Canvas (BMTC) to map the transformation of construction enterprises in Industry 4.0.					
		01	11	09	03	03

Abuzeinab et al. (2014) specifically provide a generic definition for Green Business Models (GBM) based on the opinions of construction managers having experience in green issues. Nevertheless, no attempt has been made to define BMs in relation to the construction business. This definition particularly addresses the global challenge of ‘sustainability’ with the least consumption of natural resources and provides a business opportunity to make financial sense and environmental or social benefits.

As portrayed in Table 2.6, five studies (Cheng et al., 2001; Pekuri et al., 2014; Ling & Li, 2016; Das et al., 2019, 2020) have modelled BM elements under Stage 4 by following Stage 2 and Stage 3 of BM development process, without developing separate ontologies. Accordingly, Ling and Li (2016) described six BM components identified by Morris et al. (2005) and developed a framework for BM concerning foreign firms offering construction-related consultancy services in China. An early study, Cheng et al. (2001), developed a transmission and communication model for an e-business infrastructure to support supply chain activities in construction by listing and describing e-BM components. Likewise, Das et al. (2019) and Das et al. (2020) developed a Business Model Transformation Canvas (BMTC) by suitably modifying nine building blocks of BMC of Osterwalder and Pigneur (2010) to support mapping transformation of construction businesses due to Industry 4.0 scenarios of globalisation, industrialisation, and digitalisation.

Such information indicates that the frameworks developed in these studies basically serve specific purposes in the construction industry and do not consider the core businesses of construction contractors. However, the framework developed by Cheng et al. (2001) and BMTC by Das et al. (2019) could be considered change methodologies in the BM application stage, which occurred after the BM ontology development.

Zhao et al. (2017) developed a model for evaluating the performance of innovative BMs for sustainable buildings using the AHP and ANP approaches representing evaluation models of BMs during the application stage. Therefore, both evaluation models and change methodologies are not BM ontologies/frameworks for designing BMs regarded in the scope of this study.

Pekuri et al. (2014) focused on construction contractors’ business solely on analysing and managing the value creation. The authors described three BM components and developed a framework demonstrating how the BM approach helps create value by considering three cases in the Finnish construction industry. However, Pekuri et al. (2014) have not adequately justified selecting only three elements, i.e. (i) offering, (ii) value creation system, and (iii) revenue model, and have not established relationships among the elements.

On the other hand, without attempting to develop an ontology, a reference model, or a framework, some authors listed BM elements identified by previous authors and described them according to their area of study. For example, Mokhlesian and Holmen (2012) took the nine BM elements from the study of Osterwalder et al. (2005) and described them with necessary changes to green construction, while Van den Brink

(2016) described Bocken and Short (2016)'s BM elements concerning a circular construction industry. The study of Brege et al. (2014) also belongs to Stages 2 and 3, as it presents BM constructs including three BM blocks and five BM elements related to industrialised multi-storey buildings. Furthermore, how prefabrication forms the basis of a construction firm's BM was tested by showing the potentials for the competitiveness and profitability of industrialised buildings. Similarly, Lessing and Brege (2018) labelled strategic orientations and BM development for industrialised building companies by applying three BM blocks of Brege et al. (2014) to real-life BMs.

Zhao et al. (2018) identified eight BM elements related to BM innovations for Zero Carbon Buildings (ZCBs), and descriptions for each element were extracted from case studies of ZCB projects. Berg et al. (2019) correspondingly used four BM elements and evaluated BMs' characteristics of four parties in the construction value chain, i.e., (i) architect, (ii) engineer, (iii) supplier, and (iv) contractor. In addition, Abuzeinab and Arif (2014) categorised the themes for displaying effective stakeholder engagement practices to help Green BMs implementation while mentioning five Green BM elements identified from previous studies. These studies attempted to find relevant BM elements related to different types of BMs or for specific areas in the construction industry, taking BM elements from previous studies. However, no evidence proved the selection of BM elements for a particular purpose.

Surprisingly, fifteen studies could not be placed at any stage of the BM development process, as shown in Table 2.6. This proves that the BM concept in the construction industry is not adequately established with ontology developments. However, they have investigated the BM concept with different issues and areas in the construction industry, as illustrated in Table 2.6. Therefore, all these studies can be considered under other aspects of BM application, e.g., developing different types of BMs, BMs in specific areas in the construction industry, BM innovation, BM change, and combining the BM concept with other construction-related theories. Yet, these studies cannot be placed under the 5th stage of the BM development process: applying the BM concept using BM ontology or framework.

Accordingly, Duyshart et al. (2003) developed a BM, particularly for ICT adaptation on construction projects with a case study, and Grimscheid and Rinas (2012) developed a cooperative BM to apply in the Swiss Precast Concrete (SPC) industry without following stages of BM research development process. Abuzeinab et al. (2017) searched for barriers to GBMs concerning Multinational Enterprises (MNEs) in the construction industry and discovered five significant barriers: (i) government, (ii) financial constraints, (iii) sector constraints, (iv) company constraints and (v) lack of demand. Simultaneously, Liu et al. (2017) tried to identify the relationships between Business Model Innovation (BMI) and its drivers in the Chinese construction industry during the technological shift of modular prefabrication. Considering the same area, Christian and Lars (2013) found a way of developing new BMs with essential value increments for the users, companies, and society for construction based on off-site system deliveries. Recently, Brunoro et al. (2018) proposed a method to guide an SME

on how the BM optimise energy savings within the Collective Self-Organised housing. Though these studies cannot place within the BM development process, their attention is necessary when applying the BM concept in the construction industry.

Pekuri et al. (2013) disclosed the construction managers' perspectives on the BM concept and revealed that construction managers neither understand the concept correctly nor use any similar value creation method in their businesses. Then, Pekuri, et al. (2015) focused on understanding BMs' role in the decision-making process related to project selection in construction companies, which, at that time, was not generally examined as a phenomenon in industry practices. Authors found that any specific BM does not guide project selection. Thus, modelling BM to use in decision-making for a particular business idea or phenomenon in relation to construction business seems lacking in the construction industry.

In contrast, Brady et al. (2005) tried to find the applicability of integrated solutions BMs in the construction industry as a different type of BM requiring change. Additionally, Aho (2013) researched identifying prerequisites towards sustainable construction and revealed that transforming the industry's BM(s) to provide value to the customers and society is a fundamental prerequisite for sustainability. Thus, these can be related to the change methodologies and evaluation models beyond the scope of this study.

Likewise, as depicted in Table 2.6, most researchers (Pan & Goodier, 2012; Christian & Lars, 2013; Thuesen & Hvam, 2013; Brege et al., 2014; Goulding et al., 2014; Liu et al., 2017; Lessing & Brege, 2018) have focused their studies to off-site construction, industrialised buildings, and modular prefabrication, which are somehow similar to products manufacturing business. However, this study focuses on construction contractors' business as the construction expertise/services provider.

Table 2.6 further illustrates the nonexistence of proper development of BM concept and BM ontologies for the construction business, enabling the design, change, and innovation of construction-related BMs. Thus, the construction industry can be considered a BM research infant industry, where very little research could be found on the BM concept compared to other fields. Hence, critically reviewing literature related to the stages of the BM development process (refer Figure 2.7) clarifies the path of adopting the BM concept in the construction industry with a proper mechanism. Accordingly, the next five sections discuss the stages of the BM development process concerning the construction business.

2.9. Stage 1 - Define 'Business Model' in relation to the construction industry

The BM needs to be defined at the first stage of the BM development process, concerning the particular business domain, after identifying the requirement of such a definition.

2.9.1. The necessity of defining business model for the construction business

The term ‘Business Model’ has frequently been misused by both academics and practitioners in diverse fields (DaSilva & Trkman, 2014). Particularly, Pekuri et al. (2013) found that the managers in construction do not understand the BM concept adequately. Further, Arend (2013) highlighted that the lack of any consistent definition of the BM is one of the limiting concerns of the theoretical value of the concept as some level of consensus regarding the concept is required to improve on its theoretical value in a particular field. However, several attempts have been made to define BMs for fields/industries, e.g., Information Systems (IS), e-businesses, software, and telecommunication.

Many scientific articles and papers have attempted to understand a business model. However, no generally accepted definition is available (Aarntzen, 2016), despite various opinions and understandings (DaSilva & Trkman, 2014). Therefore, researchers frequently adopt idiosyncratic definitions to fit their study purposes (Zott et al., 2011).

Correspondingly, this study requires a BM definition related to the construction business acceptable for the focus of this research. On the other hand, as per Mokhlesian and Holmen (2012), construction businesses differ from other businesses due to time constraints, adversarial relationships, uncertainty, and less standardisation, making construction businesses project businesses. Therefore, it could be argued that Construction Business Model (CBM) requires a specific definition.

According to Al-Debei and Avison (2010), complex and unique businesses should have explicit BMs. Yet, reviewing the nature of BMs and determining components of a BM and its composition satisfactorily for a particular field is difficult without a clear definition (Morris et al., 2005). Hence, the CBM requires a definition as the construction industry becomes increasingly complex, making its management difficult without special skills, techniques, and capital (Jamil et al., 2008). Furthermore, a good understanding of the BM concept will facilitate its industrial applications and improve its adaptation by the companies. Therefore, a CBM definition is necessary to practically apply BMs in the construction business. Moreover, adding a comprehensive definition to the BM knowledge domain related to the construction business provides a solid base for continuing the construction BM research.

BM literature related to other fields provides many different definitional views (refer Annexure 2.3) for BM. Still, BM studies related to the construction industry have not attempted to develop a unique definition for BM concerning construction businesses.

However, Abuzeinab et al. (2014) have proposed a generic definition for Green Business Model (GBM) in the construction industry:

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

environmental improvement can include, but is not limited to, changes to products, services, processes, and policies, such as reducing energy consumption and waste generation, using renewable resources, and implementing an environmental management system.” p.5.

This definition is given full consideration to Green aspects and specifies the requirement of changes in BM elements towards environmental improvements to become Green. Further, as per Abuzeinab et al. (2014), ‘Green’ is to be dealt with as a separate aspect and not the main way of doing business in the construction industry. Hence, this definition cannot provide a common understanding of BMs in construction businesses.

Abuzeinab et al. (2014) analysed the answers from experienced managers in green construction to the question: “Define a green business model?” Then, a generic definition for GBMs in the construction industry was developed based on a theoretical perspective. However, this method’s effectiveness in developing a definition for a CBM is questionable due to the unawareness of the BM concept among construction business managers. Hence, this study has recognised the requirement of a systematic methodology to define CBM, as discussed in the next section.

2.9.2. The process for developing Construction Business Model (CBM) definition

Within a voluminous BM literature, BM has received several definitions. Most such definitions were given as a brief introduction to BMs concerning the particular study (refer Annexure 2.3). Al-Debei et al. (2008) developed a definition for BM in Information Systems (IS) by analysing selected BM definitions/descriptions in the literature. The authors proposed the reasons for establishing a BM and a few guidelines by quoting necessary sentences from the selected definitions. These quotations act as a basis for developing a more comprehensive definition for IS business. Wirtz et al. (2015) presented their own definition for a BM by embedding a dynamic view and referring to content-related aspects of structure, task, and purpose of a BM identified from different BM definitions in the literature.

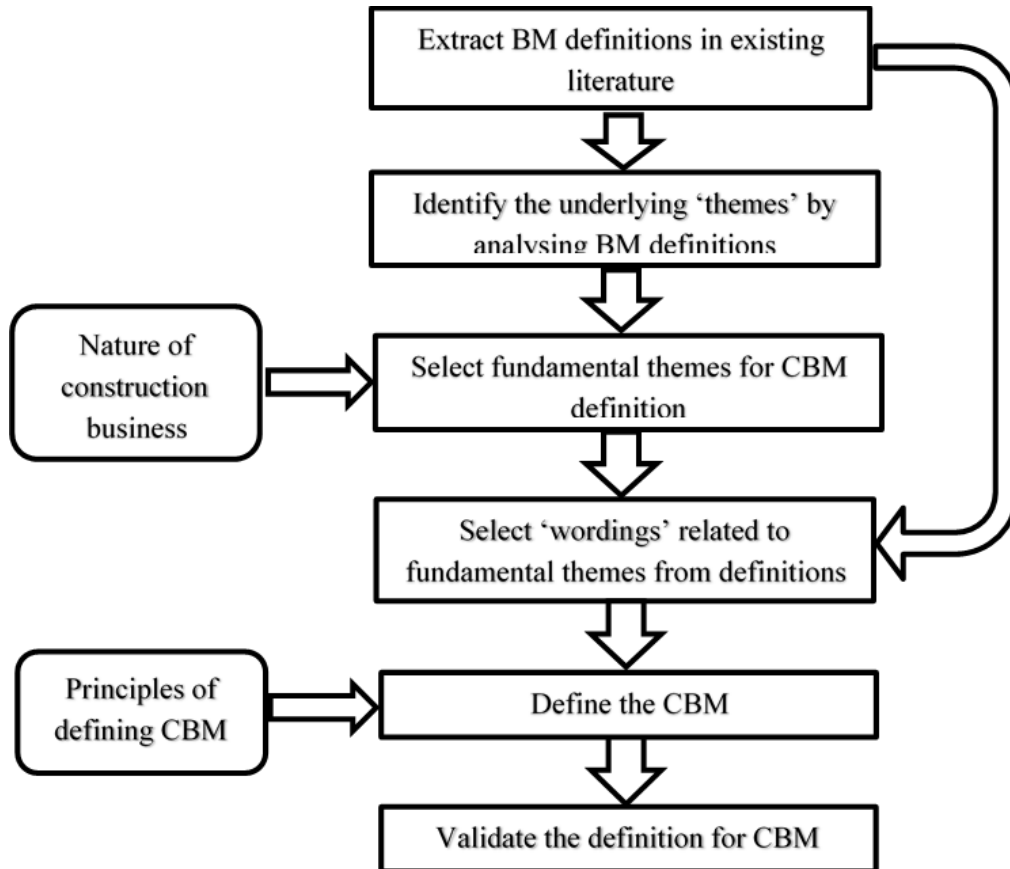
Therefore, this study recognised the requirement of a systematic process for developing a BM definition for a particular field or area. Accordingly, a systematic process for developing a Construction Business Model (CBM) definition is created, as shown in Figure 2.8.

Wirtz et al. (2015) stated that analysing existing literature definitions is essential to understand a term comprehensively. The studies of Al-Debei et al. (2008) and Al-Debei and Avison (2010) initially selected different BM definitions from the literature. Therefore, the first step of the BM definition development process is to extract the BM definitions given in the literature, which has many definitions for BMs. Subsequently, different underlying ‘themes’ within the definitions could be identified by analysing the selected BM definitions as the second step. Similarly, Al-Debei and Avison (2010)

assigned ‘thematic indicators’ by analysing the main ‘themes’ of each extracted BM definition. However, a separate definition for BMs was not given. On the other hand, Al-Debei et al. (2008) took them as ‘basis’, and Wirtz et al. (2015) considered them as ‘aspects’.

Figure 2.8

Process of developing Construction Business Model (CBM) definition



Determining whether the identified themes are appropriate for that field or area is necessary when developing a BM definition for a particular field or area. Al-Debei et al. (2008) stated that BM definitions should be comprehensive and concise. Hence, in developing CBM definition, feeding the nature of the construction business is vital for particularising. Thus, compatibility with the construction business is discussed, and the ‘fundamental themes’ relevant to the CBM are identified in the third step. Step 4 selects wordings/sentences to denote each ‘fundamental theme’ from existing literature to develop the CBM definition. Finally, the definition for CBM was developed to satisfy the following essential characteristics and principles:

1. A definition should represent the importance of BMs and the main reasons for developing a BM (Al-Debei et al., 2008),
2. The definition should be comprehensive but concise (Al-Debei et al., 2008),
3. It should enable better performance of the organisation than that of the rivals (Al-Debei et al., 2008),

4. The definition should be unambiguous, and
5. It should ensure that it fits with the uncertain, complex, and rapidly changing industries (Al-Debei et al., 2008), e.g., the construction industry.

The BM definition for the construction business was developed through five steps and discussed in the following sections. The proposed CBM definition is validated empirically in the 6th step, as discussed in Chapters 4 and 5.

2.9.2.1. Step 1 -Extraction of existing business model definitions

Since there is no generally accepted definition for the term “Business Model (BM)”, it is challenging to demarcate the nature and elements of a BM and determine what constitutes a good BM (Morris et al., 2005). Hence this section focuses on bringing order to the various perspectives of the BM concept.

At the most basic level, BMs are concerned with a sense of profit generation. Hence Stewart and Zhao (2000, p.290) define a BM as “*a statement of how a firm will make money and sustain its profit stream over time*”. In broad terms, BM can be described as an architecture of revenues, costs and profits connected with the business creating and delivering value to customers while providing data and evidence demonstrating how to create such value (Teece, 2010). Consistent with this perspective, Aho (2013) also identified the BM as an enterprise’s architecture for creating, delivering, and capturing value.

Likewise, many scholars have promoted prudent definitions for the BM. Zott and Amit (2008) define the BM as “*a structural template of how a focal firm transacts with customers, partners, and vendors; that is, how it chooses to connect with factor and product markets*” (p.3). As per Arend (2013), BM is a useful representation of how an organisation creates value by transforming and transferring substances using available factors. Frankenberger et al. (2013) defined the BM as a unit of analysis to describe how a firm’s business works, while Beattie and Smith (2013) identified it as a system-wide description of how companies do business.

Forty-nine definitions relating to the different perspectives of the BM concept were extracted from the literature through a comprehensive search (presented in Annexure 2.3). Thus, the selected definitions cover almost all viewpoints from which the BM concept has been observed. In addition, the definitions’ time frame ranges from 1998 to 2018.

BM literature contains different BM definitions (refer Annexure 2.3). However, various definitions of BMs produce the same picture concerning the BM’s primary purpose, that is, value creation and value capture (for instance, Petrovic et al., 2001; Chesbrough, 2007; Johnson et al., 2008; Teece, 2010; Casadesus-Masanell & Ricart, 2011; Aho, 2013; Martins et al., 2015; and Reim et al., 2015).

In contrast, a varied picture prevails within definitions: Shafer et al. (2005) need BM to analyse, test, and validate a firm’s strategic choices, and BM addresses changes and innovations as per Demil and Lecocq (2010). It is the design of organisational structures to enact a commercial opportunity, as per Bock and George (2011), while

Kindstrom and Kowalkowski (2014) defined it as a collection of decisions enforced by the company's authority on its employees. As per Beattie and Smith (2013), Frankenberger et al. (2013), and Bocken et al. (2014), BM pictures how firms do business.

Accordingly, definitions of BM in the literature vary widely, and the next section analyses the definitions to identify the underlying 'themes' of each definition.

2.9.2.2. Step 2 - Analyse business model definitions to identify underlying 'themes'

According to Shafer et al. (2005), many different perspectives form BM definitions. Identifying the underlying themes of definitions is significant for defining the BM in a particular context because the researchers often consider only a few areas relevant to them rather than the whole picture (Al-Debei & Avison, 2010). The keywords used in each definition were noted down to understand the main 'themes' behind each definition while observing the character of BM emphasised in each definition, as shown in Table 2.7. As per Table 2.7, the definitions for BMs evolve around ten underlying 'themes': (i) value-based (V-b), (ii) stakeholder-based (Sh-b), (iii) revenue-based (Rv-b), (iv) process-based (Pr-b), (v) strategy-based (Str-b), (vi) resource-based (Rs-b), (vii) dynamicity-based (Dy-b), (viii) opportunity-based (Op-b), (ix) elemental-based (El-b), and (x) causality-based (C-b).

Table 2.7 presents how the ten themes are distributed across all definitional views, highlighting that all BM definitions are related to one or more of these underlying themes.

Fielt (2013) identified BM as the value logic of an organisation representing creating, delivering, and/or capturing value. In 25 of the 49 definitions, the term 'value' is mentioned mainly in the forms of value proposition, value creation, value delivery, and value capture, indicating the importance of including 'value' in the BM definition. Zott et al. (2011) also recognised the theme 'value' as a part of a generic BM because most descriptive contributions highlight it. The "value-based" theme, therefore, was identified as one underlying theme.

Successful companies have operational and managerial processes, including recurrent tasks to deliver value to customers (Johnson et al., 2008). Processes also yield performance benefits with the cleverer deployment of resources to offer superior efficiency and effectiveness to the firm (McGrath, 2010). In addition, companies create value for customers by configuring inside and outside activities and processes (Dubosson-Torbay et al., 2001).

Table 2.7*Analysis of the keywords of the identified BM definitions in the literature*

	Reference	Emphasised Character	Extracted keywords from given Description/definition to BM	Theme										
				V-b	Sh-b	Rv-b	Pr-b	Str-b	Rs-b	Dy-b	Op-b	El-b	C-b	
1	Timmers (1998, p.2)	An architecture	business actors and their roles, sources of revenue, potential benefits		✓	✓						✓	✓	
2	Petrovic et al. (2001, p.2)	A core logic	creating value	✓										
3	Magretta (2002,p.4)	A story	customer, customer value, make money, deliver value, appropriate cost	✓	✓	✓								
4	Hedman and Kalling (2003, p49)	A term	Components, customers, offers, resources, activities and organization, supply of factors and production inputs, competitors, dynamics		✓		✓	✓	✓	✓			✓	
5	Seddon and Lewis (2003, p.246)	An abstract representation	firm's strategy, essential details, deliver value and customers	✓	✓			✓						
6	Osterwalder (2004, p.15)	A conceptual tool	elements and their relationships, earning money			✓							✓	
7	Osterwalder et al. (2005, p.5)	A conceptual tool	set of objects, their concepts and relationships										✓	
8	Shafer et al. (2005, p.203)	A model	strategic choices					✓						
9	Andersson et al. (2005, p.1)	A model	main actors, values transferred	✓	✓									
10	Brousseau and Penard (2006, p.82)	A pattern	production and exchange of goods and services, various costs and revenue streams, become viable, basis of the income, sense of being self-sustainable			✓	✓	✓		✓				
11	Kallio et al. (2006, p.282-283)	Means	create value, the flow of information, industry participants, value chain, customers, partners, competitors and the government	✓	✓		✓	✓						
12	Chesbrough (2007, p.12)	A model	value creation, value capture, series of activities, raw materials	✓	✓	✓	✓		✓					

	Reference	Emphasised Character	Extracted keywords from given Description/definition to BM	Theme										
				V-b	Sh-b	Rv-b	Pr-b	Str-b	Rs-b	Dy-b	Op-b	El-b	C-b	
13	Rajala and Westerlund (2007, p.118)	A way	creating value, customers, market opportunities, profit, actors, activities and collaboration.	✓	✓	✓	✓					✓		
14	Al-Debei et al. (2008, p.8-9)	An abstract representation	core products and/or services, interrelated architectural, co-operational, and financial arrangements, presently and in the future, strategic goals and objectives			✓	✓	✓			✓	✓		
15	Johnson et al. (2008, p.60)	A model	Create value, deliver value, interlocking elements,	✓			✓						✓	
16	Zott and Amit (2008, p.3)	A structural template	customers, partners, and vendors, factor and product markets		✓			✓	✓					
17	Amit and Zott (2009, p.4)	A content, structure, and governance of transactions	create value, business opportunities	✓			✓					✓		
18	Demil and Lecocq (2010, p.231)	A blueprint/ A tool	core BM components, change and innovation								✓	✓	✓	
19	Doz and Kosonen (2010, p.371)	A cognitive structure	create value, internal structure and governance	✓	✓		✓	✓						
20	Gambardella and McGahan (2010, p.263)	An organization's approach	revenue, reasonable cost, assumptions, create and capture value.	✓		✓	✓	✓						
21	Itami and Nishino (2010, p.364)	A composition	a business system, a profit model, elements			✓	✓						✓	
22	Kujala et al. (2010, p.98)	A model	supplier's revenue and profit generation			✓								
23	McGrath (2010, p.248)	A model	a change, strategies				✓	✓			✓			
24	Sabatier et al. (2010, p.433)	A recipe/ portfolio concept	BM elements, ingredients, the combination of resources, deliver value propositions	✓					✓				✓	
25	Teece (2010, p.173)	Architecture	revenues, costs and profits, creating and delivering value, customers	✓	✓	✓	✓							

	Reference	Emphasised Character	Extracted keywords from given Description/definition to BM	Theme										
				V-b	Sh-b	Rv-b	Pr-b	Str-b	Rs-b	Dy-b	Op-b	El-b	C-b	
26	Bock, and George (2011, p.24)	A design	Organizational structures/ commercial opportunity		✓							✓		
27	Casadesus-Masanell and Ricart (2011, p.9)	A logic	operates, creates and captures value, stakeholders, competitive marketplace	✓	✓		✓	✓						
28	Mason and Spring (2011, p.1033)	A frame	front-line workers, contextually appropriate ways and practices		✓		✓							
29	Onetti et al. (2012, p.24)	A Way	Activities, focus, locus and modus		✓		✓	✓	✓					
30	Aho (2013, p.113)	An architecture, principles, logic and capabilities	creating, delivering and capturing value	✓		✓	✓							
31	Arend (2013, p.2)	A useful representation	create value, available factors, transforming and transferring matter	✓		✓	✓		✓					
32	Baden-Fuller, and Mangematin (2013, p.419 and p.424)	A stripped-down characterization	Cause-effect relationships, customers, the organization and money		✓	✓	✓							✓
33		A 'manipulable instrument'	cause and effect											
34	Beattie and Smith (2013, p.15)	A system-wide description	how companies do				✓							
35	Boons and Lüdeke-Freund (2013, p.10)	A plan	a new venture, profitable, communication, different actors		✓	✓								
36	Fielt (2013, p.92)	A value logic	value proposition, customer, creates and captures customer value, economics dimensions, organizational architecture, and an interrelated set of elements	✓	✓	✓	✓						✓	
37	Frankenberger et al. (2013)	A unit of analysis	a firm works				✓							
38	Mutka and Aaltonen (2013, p.168)	A model	creates and captures values, strategic choices, organisational architecture and the economics	✓		✓	✓	✓						
39	Nielsen and Lund (2014,p.2)	A concept	unique value proposition, implemented	✓			✓							

	Reference	Emphasised Character	Extracted keywords from given Description/definition to BM	Theme											
				V-b	Sh-b	Rv-b	Pr-b	Str-b	Rs-b	Dy-b	Op-b	El-b	C-b		
40	Kindstrom and Kowalkowski (2014)	A collection of decisions	authority, employees		✓										
41	Casadesus-Masanell and Heilbron (2015)	A tool	visualize changes, internal transparency, service opportunities, necessary changes					✓		✓	✓				
42	Martins et al. (2015, p.17)	A distinct and strategic construct	strategic construct, value creation and capture	✓		✓	✓	✓							
43	Reim et al. (2015, p.65)	An architecture	value creation, delivery and capture mechanisms	✓		✓	✓								
44	Upward and Jones (2015, p.11)	A description A Logic	organization's existence, who does, what does, in future, how does, success		✓		✓	✓	✓	✓	✓	✓			
45	Wirtz et al. (2015, p.41)	A simplified and aggregated representation	products and/or services, relevant activities, marketable information, value-added components	✓			✓	✓					✓		
46	Stefan and Branislav (2016, p.72)	A model	company resources, a process, produce values to customers, earnings for the firm, an elementary sense	✓	✓	✓	✓		✓						
47	Anwar (2018, p6)	A Story	activities, players, connected together		✓		✓								
48	Ritter and Lettl (2018, p.1)	A model	an actor, value network or supply chain, inputs, outputs, goals	✓	✓	✓	✓	✓	✓						
49	Zhao et al. (2018, p.2)	A mediating construct	technological artefacts, strategic business goals, the creation of economic value	✓		✓		✓		✓	✓				
				25	23	22	31	19	9	8	9	10	2		

As depicted in Table 2.7, most definitions (31) highlight the “process-based” theme via processes, activities, arrangements, and practices. Thus, for example, the definitions developed by Rajala and Westerlund (2007), Chesbrough (2007a), McGrath (2010), Onetti et al. (2012), Beattie and Smith (2013), and Stefan and Branislav (2016) mention “processes”.

Table 2.7 illustrates that more than 20 definitions include the terms ‘stakeholder’ and ‘revenue’. The stakeholder-based theme becomes prominent when various stakeholders of a business, e.g., customers, partners, competitors, and the government and their associated roles, are considered when defining BM (Timmers, 1998; Hedman & Kalling, 2003; Rajala & Westerlund, 2007; Casadesus-Masanell & Ricart, 2011; Mason & Spring, 2011). Chinyio and Olomolaiye (2010) identified stakeholders as those who affect and are affected by an organisation and its activities, functions, goals, development, and even survival. On the other hand, authors, e.g., Timmers (1998), Magretta (2002), Osterwalder (2004), Kujala et al. (2010), Teece (2010), Baden-Fuller and Mangematin (2013), Boons and Ludeke-Freund (2013), and Ritter and Lettl (2018) have connected their BM definitions with the generation of revenue, profit and money for the business, and the associated theme is thus considered as a revenue-based theme.

Teece (2010) stated that a strategy assures a competitive advantage for a business, whereas the BM helps create and deliver value to customers to ensure a competitive and sustainable business. According to Stefan and Branislav (2016), BM is strategically important to a company, being a fundamental and existential phenomenon on which a strategy grows. Therefore, most BM definitions incorporate a hidden strategy-based view. Therefore, the “strategy-based” theme is important in defining a BM. Likewise, the rest of the themes were identified based on their incorporation in the definitions.

Identifying resources in different business contexts is vital for the development and management of businesses (Rajala & Westerlund, 2007). Organisation resources are mainly tangible, intangible, and human. Tangible resources include buildings, plants, machinery, equipment, and cash reserves, whereas intangible resources include brands, reputation, patents, copyrights, and trade secrets. Human resources are the people who create value using tangible and intangible resources (Dubosson-Torbay et al., 2001). Therefore, some definitions reflect a resource-based view, making it another theme (E.g., Hedman & Kalling, 2003; Sabatier et al., 2010; Stefan & Branislav, 2016).

Today’s business environment is more dynamic and includes ongoing fast changes and severe stakeholders’ pressure resulting from managing modern businesses (Al-Debei & Avison, 2010). Thus, BM change is essential for the business’s success, ensuring its usage to be not only in a static sense but also in a dynamic sense (Beattie & Smith, 2013). Similarly, Demil and Lecocq (2010) identified the transformational view of BMs to deal with changes other than its static view. Closely allied to this, Cavalcante et al. (2011) posit that one of the most important purposes of BMs is providing

flexibility to allow changes. Hence, designing dynamic BM ensures capturing the process of change (Demil & Lecocq, 2010).

BM must be changed with the changes that affect only the core standard repeated processes of a BM without losing its model properties (Cavalcante et al., 2011). Accordingly, BMs must be well designed to be optimal for their chance to survive and succeed in a dynamic business environment full of internal changes and exogenous shocks, e.g., changes in technology and regulations (Martins et al., 2015). Hence, it could be argued that the “dynamicity-based” theme is essential to incorporate into BM definitions. Unfortunately, only eight studies, including Hedman and Kalling (2003), McGrath (2010), Demil and Lecocq (2010), and Arend (2013), have included the perspective of change in their BM definitions.

Achtenhagen, Melin, and Naldi (2013) emphasised that BM changes lead businesses towards success while providing new value creation opportunities together with sustained value creation over time. However, changing and developing the BMs of companies require direction towards experimenting with and exploiting new business opportunities (Achtenhagen et al., 2013). Being an opportunity facilitator is one of the BM characteristics where BM helps create opportunities (Bock & George, 2011; Amit & Zott, 2001) based on underlying dimensions of the resource, transactive, and value structures (Bock & George, 2011). New opportunities could be initiated by BM development and change (Bock & George, 2011). Thus, the opportunity-based theme is embedded in their definitions by some authors (e.g., Amit & Zott, 2009; Rajala & Westerlund, 2007; Bock & George, 2011; Casadesus-Masanell & Heilbron, 2015).

When analysing BM definitions, Wirtz et al. (2015) identified the content-related aspect of BM definitions that focus on BMs’ general structure and their various elements or partial models. Similarly, as per the analysis of BM definitions in Table 2.7, nine BM definitions portray the perception of BM elements (e.g., Hedman & Kalling, 2003; Osterwalder, 2004; Stefan & Branislav, 2016), leading to the elemental-based theme. Alternatively, Baden-Fuller and Mangematin (2013) have stressed that embedding the cause-and-effect relationship into BM definition would provide a better understanding of the world of business. Consequently, Baden-Fuller and Mangematin (2013) have given two definitions to the BM with a cause-effect perspective: (i) *BM as a stripped-down characterization that captures the essence of the cause-effect relationships among customers, the organization, and money* (p. 419); and (ii) *BM as a ‘manipulable instrument’ which can be used to explore cause and effect and understand the world of business better* (p. 424), prominent to the causality-based theme.

As per Shafer et al. (2005), BM definitions are discharged from many different perspectives. Through various viewpoints, authors include different aspects to their BM definitions. Therefore, identifying fundamental themes is essential for developing a definition for BM for a particular field because researchers only consider one or a few sections of the whole (Al-Debei & Avison, 2010).

Hence, it is required to select and describe underlying themes related to the nature of the construction business for picking “most essential” themes for CBM definition, named “fundamental themes”. Selection of ‘fundamental themes’ is imperative to avoid a lengthy definition and ambiguousness of the definition (Al-Debei et al., 2008).

2.9.2.3. Step 3 - Selection of fundamental themes for the “Construction Business Model” (CBM) definition

Precisely, Pekuri et al. (2014) understood the requirement to consider value creation for construction clients by construction companies to survive within the industry’s highly sensitive economic cycles. Further, design and construction companies must understand their customers’ needs and expectations to win new businesses and keep existing customers (Othman, 2015). Therefore, the construction industry’s performance could be increased by making it more customer-oriented and competing for more based on added value rather than cost efficiency (Pekuri et al., 2014). Hence, CBMs should describe the company’s value proposition and way of creating that value, which are the key functions of BMs. Hence, the value-based theme had to be considered for a comprehensive definition of the CBM.

Construction projects can be considered multi-actor projects due to the involvement of a broad range of actors with different competencies and specialities (Eriksson, 2013). Even simple construction projects have many individual suppliers, subcontractors, designers, and supervisors (Aho, 2013). The contractors must co-develop the project with the client and other actors in the project network (Crespin-Mazet & Ghauri, 2007). Accordingly, the relationship with trust, commitment, and shared goals must be applied between the contractor and the customer and other key actors involved in the project network who contribute to its development (Crespin-Mazet & Ghauri, 2007). The value network created by the actors should include precise performance requirements and goods or services to be delivered against specified requirements (Aho, 2013). Hence, construction businesses must recognize their stakeholders and manage them (Chinyio & Olomolaiye, 2010). In this context, a stakeholder-based theme is also necessary for CBM definition.

In general financial characteristics, construction companies have more creditors than debtors, longer cash cycles, and longer days’ of inventory (Balatbat et al., 2011). The construction companies must be more liquid for facing unexpected weather, defaults in client payments, longer cash-flow cycles, interest rate fluctuations, and industry contractions caused by economic recessions (Balatbat et al., 2011). Profitability and turnover can be used as indicators of the financial strength of construction companies (Isik et al., 2010). Hence, the revenue-based theme is influential for CBM definition.

Though each construction project is unique, the managerial process is usually uniform across company projects (Isik et al., 2010); contractors must have good management skills to improve site operation effectiveness (Keung & Shen, 2017). Generally, the construction process is complex, and it is difficult to gain the benefits of regular-line activities (Karna et al., 2009). However, it is essential to focus on service quality to satisfy clients and continue winning new orders (Sunindijo et al., 2014; Jonas et al.,

2017). Profoundly, Wirtz et al. (2015) emphasised that the depiction of specific company processes should not be neglected from BM definitions. Hence it is vital to consider critical processes of construction businesses under the CBM definition.

Construction contractors always have to work with limited resources, e.g., money, workforce, time, and management efforts, and the possession of adequate resources are essential for improving competitiveness (Lu et al., 2008). Further, the construction company's performance is affected by its resources and capabilities, which should be efficient, cost-effective, rare, and sufficiently sophisticated to avoid imitation by competitors (Isik et al., 2010). Therefore, a resource-based theme is identified as a fundamental theme for CBM definition.

According to Hafeez et al. (2016), an effective business strategy would improve the project managers' abilities to face future project challenges. For example, construction companies adopt good bidding strategies to win more contracts, which in turn help them to have competitive advantages (Lu et al., 2008). Also, contractors could be flexible to the changing construction markets and operate within a more significant market area by successfully implementing the differentiation strategy (Ho, 2015).

Furthermore, when implementing an innovation strategy, contractors must adopt strategic decision-making in their businesses through innovations that clients are willing to pay for, which reduce contractors' construction costs and provide contractors with a sustainable competitive advantage (Lim & Ofori, 2007). Moreover, contractors can develop project management strategies to achieve project goals by setting those strategies to planning, cost control, quality control, risk management, and safety management (Isik et al., 2010). Likewise, construction companies develop different strategies to win construction projects, keep client satisfaction at the highest level, and achieve project and company goals. Thereby strategy-based theme is recognised valuable as strategies that set companies apart from their rivals.

Today the construction industry is undergoing significant changes due to the issues such as the ageing of the construction workforce, globalisation, growth of the organisation, and "better" client solutions (Chinowsky et al., 2007). Also, construction projects are in a dynamic working environment where variability is essential within the processes because there is stress on delivering projects with minimal buffers of time, resources, and space and with a minimal negative impact on the surrounding environment (Dave et al., 2008). Consequently, organisations that can constantly change and adapt to meet new regulations, new problem areas, and new client challenges will sustain the construction industry and succeed (Chinowsky et al., 2007).

On the other hand, to reduce risks in the construction business, business development and innovation through change management and business transformation need to be improved to seek more innovative approaches and opportunities (Cunningham & Odeyinka, 2016). Accordingly, both dynamicity-based and opportunity-based themes are considered fundamental.

Timmers (1998) defined BM by including the identified BM elements, i.e., product architecture, business actors and their roles, benefits for business actors, and sources

of revenue. Similarly, Hedman and Kalling (2003), Onetti et al. (2012), and Fielt (2013) used elements of BMs in defining BMs (refer Annexure 2.3). Hence, the elemental-based theme is a different perspective of defining BM and is not considered as a fundamental theme for CBM. However, those definitions are also fallen into one or more other themes. In contrast, the causality-based theme emphasises the BM definition towards exploring cause and effect relationships, which is another different way of defining BM. Hence, this study does not define CBM based on those perspectives.

However, BM elements related to the construction business are analysed and discussed separately in this chapter under Sections 2.10 and 2.11.

2.9.2.4. Step 4 - Selection of ‘wordings’ from the BM definitions to represent the fundamental themes of the Construction Business Model (CBM)

Al-Debei et al. (2008) urged that a BM definition for a particular field should be created by referring to different perspectives presented in studies of other fields. Hence, the quotations from existing BM definitions against “fundamental themes” related to construction business are used to phrase the CBM definition. Table 2.8 presents the wordings the researcher extracted from the existing BM definitions under the eight identified fundamental themes.

Table 2.8

'Wordings' extracted from the BM definitions for fundamental themes

Fundamental theme	Wording for consideration	References consisting ‘wordings’ close to the selected ‘wordings’
Value-based	" <i>that performs value creation</i> " (Chesbrough 2007a)	Petrovic et al.(2001); Kallio et al. (2006); Rajala and Westerlund (2007); Johnson et al. (2008); Amit and Zott (2009); Teece (2010); Casadesus-Masanell and Ricart (2011); Arend (2013); Fielt (2011); Mutka and Aaltonen (2013); Martins et al. (2015)
Stakeholder-based	" <i>various business actors and their roles</i> " (Timmers 1998)	Andersson et al. (2005); Kallio et al. (2006); Rajala and Westerlund (2007); Boons and Lüdeke-Freund (2013)
Process-based	" <i>arranged in a process</i> " (Stefan and Branislav 2016)	Hedman and Kalling (2003); Chesbrough (2007a); Rajala and Westerlund (2007); Al-Debei et al. (2008); and Wirtz et al. (2015)
Resource-based	" <i>picture of company resources</i> " (Stefan and Branislav 2016)	Hedman and Kalling (2003); Sabatier et al. (2010); Onetti et al. (2012)
Revenue-based	" <i>revenue and profit generation</i> " (Kujala et al. 2010)	Timmers (1998); Rajala and Westerlund (2007); Teece (2010); Boons and Lüdeke-Freund (2013)
Strategy-based	" <i>firm’s strategic choices</i> " (Shafer et al. 2005)	Al-Debei et al. (2008); McGrath (2010); Mutka and Aaltonen (2013); Martins et al. (2015); Ritter and Lettl (2018)
Dynamicity-based	" <i>awareness of opportunities and necessary changes</i> " (Kindstrom and Kowalkowski 2015)	Rajala and Westerlund (2007); Amit and Zott (2009); Bock and George (2011);
Opportunity-based		

Table 2.8 presents the article reference from which the selected ‘wordings’ for each theme and the other references that give phrases close to the selected. Each ‘wordings’ was used initially to develop a comprehensive CBM definition, as explained in the next section.

2.9.2.5. Step 5 - Defining the Construction Business Model (CBM)

BM is identified as a “model” under various definitions (e.g., Andersson et al., 2005; Chesbrough, 2007; Johnson et al., 2008; Kujala et al., 2010; McGrath, 2010; Stefan & Branislav, 2016; Ritter & Lettl, 2018). Seddon and Lewis (2003), Al-Debei et al. (2008), Arend (2013), and Wirtz et al. (2015) stated it is a “representation” (refer Table 2.7). As per Osterwalder (2004), a model is generally created to help understand, describe, or predict how things work in the real world by exploring a particular entity or phenomenon. Therefore, a ‘model’ is a representation of something. Al-Debei et al. (2008) stated that the BM definition could be systematically deduced to arrive at a comprehensive definition. Thus, the phrasing of the CBM definition can be initiated.

“A CBM is a simplified representation of a construction business”

Most past researchers have considered the BM a concept, whereas Osterwalder (2004) and Osterwalder et al. (2005) considered it a ‘conceptual tool’. BM is a conceptual representation showing how an organization functions (Massa et al., 2017). Thus, the term ‘conceptual’ is added to the BM definition as indicated below.

“A CBM is a simplified conceptual representation of a construction business.....”

After considering the wordings related to ‘value-based’, ‘stakeholder-based’, ‘process-based’, and ‘revenue-based’ themes (refer Table 2.8), the CBM definition is expanded to read as,

“A CBM is a simplified conceptual representation of a construction business that performs value creation by identifying the various business actors and their roles in different processes and the status of the company resources.....”

Most construction clients can define high-performance targets, which drive the industry to challenge its structures, working methods, and established business practices (Aho, 2013). Therefore, understanding the clients’ needs and expectations is essential to winning new businesses and retaining existing clients (Othman, 2015). Accordingly, the phrase “**according to client requirements**” is incorporated into the CBM definition. The words “**various business actors**” are replaced with the word “**stakeholders**” because of the familiarity of the construction industry with the latter. The amended BM definition is as follows:

“A CBM is a simplified conceptual representation of a construction business that performs value creation according to client requirements by identifying the stakeholders and their roles in different processes and the status of the company resources”

Al-Debei et al. (2008) emphasised that the BM cannot represent all aspects and details related to the organisation, but it can represent the business hallmarks being a simplified representation. Therefore, the term ‘key’ is added to the definition to exclude all the processes and resources of construction businesses. Furthermore, only ‘relevant’ stakeholders are considered to prevent the BM from becoming complex. According to Bizon-Gorecka and Gorecki (2017), these stakeholders have different levels of responsibility and power, influencing the achievement of the business objectives. Hence, the level of involvement required from each stakeholder must be identified. The resulting definition is as follows:

***“A CBM is a simplified conceptual representation of a construction business that performs value creation according to client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key processes and the status of the key company resources*”**

Construction contractors require good management skills to improve the effectiveness of their site operations (Keung & Shen 2017), where they must use both operational and managerial processes to deliver value to their customers (Johnson et al., 2008). Hence the key processes are described using “**managerial and operational**” as given below.

***“A CBM is a simplified conceptual representation of a construction business that performs value creation according to client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes and the status of the key company resources*”**

The focus of a business is revenue and profit generation. According to Isik et al. (2010), they should be the leading financial strength indicators. Accordingly, the definition was amended to read as,

***“A CBM is a simplified conceptual representation of a construction business that performs value creation according to client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes and the status of the key company resources towards revenue and profit generation*”**

Construction businesses that successfully implement strategies, e.g., differentiation, business development, competitiveness, and adaptability, can adopt flexible approaches to make changes (Li & Ling, 2012; Smyth et al., 2016). Accordingly, the final CBM definition includes strategy-, dynamicity-, and opportunity-based themes as follows:

***“A CBM is a simplified conceptual representation of a construction business that performs value creation according to client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes and the status of the key company resources towards*”**

revenue and profit generation while expressing the company's strategic choices with the awareness of the changes required and opportunities available”.

The above definition must be validated empirically, complying with the sixth step of developing the CBM definition (refer Chapters 4 and 5). Next, the BM development process moves to Stage 2, listing BM elements.

2.10. Stage 2 - List business model elements

The basic idea of contents in a BM can be understood by developing a CBM definition. This section further discusses the contents of BMs by listing BM elements for the fulfilment of Stage 2 of the BM development process. Accordingly, the BM elements identified in the literature were analysed and listed.

2.10.1. Different business model elements in the literature

While defining BM, some authors have further specified identifying BM elements within definitions (Itami & Nishino, 2010; Sabatier et al., 2010; Fielit, 2013; Wirtz et al., 2015). As per Osterwalder (2004), BM elements are essential parts of a BM that enable managers to understand and describe the firm's business logic while using BM as a tool for business planning. BM elements are also referred to as “components”, “building blocks”, “functions”, or “attributes” (Osterwalder, 2004).

Wirtz et al. (2015) highlight that a component-oriented view of a concept is apparent for understanding a terminology. The contents of a BM are usually expressed by its subordinate components. Therefore, the extraction of BM elements from literature is significant to developing a clear understanding of the BM concept, besides clarifying BM definitions. Listing BM elements by authors also have a long BM literature tradition. According to Wirtz et al. (2015), the fundamental component-oriented view of BMs breaks down the BM concept into partial models and components.

The BM elements provided in 51 studies ranging from 1998 to 2020 were extracted as per Table 2.9 and comprehensively analysed to identify different elements of BM.

Consequently, as depicted in Table 2.9, homogeneity in BM elements could not be observed even in the same business field/domain. For instance, Mokhlesian and Holmen (2012) and Abuzeinab and Arif (2014) focused on green construction even though their BM elements differed. On the other hand, in some studies, e.g., Mokhlesian and Holmen (2012), Van den Brink (2016), Ling and Li (2016), Zhao et al. (2018), and Das et al. (2019) used the BM elements identified from previous literature and made modifications following their research domain and focus.

Table 2.9*Business Model Elements in different studies*

No	Reference	BM elements used	No of BM elements
1	Timmers (1998)	Product Architecture, Business Actors and Roles, Benefits For Business Actors and Sources of Revenues	4
2	Hamel (2000)	Core Strategy, Strategic Resources, Customer Interface and Value Network	4
3	Cheng et al. (2001)	A Cooperative Virtual Network Structure, A Supply Chain Infrastructure, Change Management and Organizational Adaptation	4
4	Rainer and Hans-Dieter (2001)	Mission, Structure, Processes, Revenues, Technology and Legal Issues	6
5	Petrovic et al. (2001)	Value Model, Resource Model, Production Model, Customer Relations Model, Revenue Model, Capital Model and Market Model	7
6	Dubosson-Torbay et al. (2001)	Targeted Customer Segments, Value Proposition, Capabilities, Getting A Feel for the Customer, Serving the Customer, Branding, Resources/Assets, Activity & Processes, Partner Network, Revenue, Costs and Profit	12
7	Magretta (2002)	Identifying Customer, Value Proposition For Customers And Revenue Generation	3
8	Hedman and Kalling (2003)	Customers, Competitors, Offering, Activities & Organization, Resources, Supply of Factors & Production Inputs and Longitudinal Dimension	7
9	Osterwalder (2004)	Value Proposition, Target Customer, Distribution Channels, Relationship Management, Value Configuration, Capabilities, Partnerships, Cost Structure and Revenue Model	9
10	Morris et al. (2005)	Factors Related to the Offering, Market Factors, Internal Capability Factors, Competitive Strategy Factors, Economic Factors and Personal/Investor Factors	6
11	Osterwalder et al. (2005)	Value Proposition, Target Customer, Distribution Channel, Relationship, Value Configuration, Capability, Partnership, Cost Model and Revenue Model	9
12	Shafer et al. (2005)	Strategic Choices, Creating Value, Capturing Value, and Value Network	4
13	Kallio et al. (2006)	Product Development Strategy, Sales and Marketing Strategy, Servicing and Implementation Strategy, Value Creation Strategy, Existing Customer Base, Government Policy & Regulation, Technological Advancements & Constraints, and Value Chain Dynamics between Network Operators & Suppliers	8
14	Rajala and Westerlund (2007)	Value Propositions or Offerings, Assets & Capabilities and The Revenue Logic	3
15	Chesbrough (2007a)	Value Proposition, Target Market, Value Chain, Revenue Mechanism(S), Value Network, and Competitive Strategy	6
16	Al-Debei et al. (2008)	Value Architecture, Value Proposition, Value Network and Value Finance	4

No	Reference	BM elements used	No of BM elements
17	Johnson et al. (2008)	Customer Value Proposition (CVP), Profit Formula, Key Resources and Key Processes	4
18	Kujala et al. (2010)	Customer, Value Proposition for Customers, Competitive Strategy, Position in the Value Network, Supplier's Internal Organization & its Capabilities and Logic of Revenue Generation	6
19	McGrath (2010)	Unit of Business and Process or Operational Advantages	2
20	Teece (2010)	Create Value for Customers, Entice Payments and Convert Payment to Profit	3
21	Demil and Lecocq (2010)	Resources & Competencies, Organizational Structure and Value Propositions A Company Delivers to Customers.	3
22	Sabatier et al. (2010)	Recipe, the List of Ingredients and Required Quantities, the Stages of the Recipe, Picture of the Dish and Complementary Elements	5
23	Bock and George (2011)	Organizational Design, Resource Structure, Transactive Structure, and Value Structure	4
24	Casadesus-Masanell and Ricart (2011)	Choices and Consequences	2
25	Mason and Spring (2011)	Technology, Market Offering and Network Architecture	3
26	Mokhlesian and Holmen (2012)	Value Proposition, Target Customer, Distribution Channel, Customer Interfaces/Relationship, Value Configuration, Capability/Core Competency, Partner Network, Cost Structure and Revenue Model	9
27	Onetti et al. (2012)	The "Focus", The "Locus", and The "Modus"	3
28	Baden-Fuller and Mangematin (2013)	Identifying Customers, Customer Engagement, Monetization and Value Chain And Linkages	4
29	Boons and Lüdeke-Freund (2013)	Value Proposition, Organization of Supply Chain, Customer Interface and Financial Model	4
30	Beattie and Smith (2013)	Resources, Competencies, Value Creation & Value Delivery and Strategy & Competitive Advantage	4
31	Fielt (2013)	Customer, Value Proposition, Organizational Architecture and Economics	4
32	Frankenberger et al. (2013)	The Who, The What, The How, and The Why	4
33	Mutka and Aaltonen (2013)	Offering, Resources & Capabilities, Internal Organization & Activities, Revenue Creation Logic, Customers, Value Proposition, Partner Network and Competitive Strategy.	8
34	Abuzeinab and Arif (2014)	Green Value Proposition (GVP), Target Groups (TG), Key Activities (KA), Key Resources (KR) and Financial Logic (FL)	5
35	Bocken et al. (2014)	Value Proposition, Value Creation & Delivery and Value Capture	3
36	Brege et al. (2014)	Prefabrication Mode, Role in the Building Process, End-User Segments, System Augmentation and Complementary Resources	5
37	Kindström and Kowalkowski (2014)	Strategy, Structure, Offering, Revenue Mechanism, Development Process, Sales Process, Delivery Process, Customer Relationships, Value Network, and Culture.	10
38	Pekuri et al. (2014)	Offering, Value Creation System and Revenue Model	3

No	Reference	BM elements used	No of BM elements
39	Bertels, Koen and Elsum (2015)	Value Propositions, Offering, Customer/Consumer Segments, Customer/Consumer Relations, Channels, Key Partners, Key Activities, Key Resources, Cost Structure, Margins, Velocity/Clock Speed and Revenue Streams & Volume	12
40	Heikkila et al. (2015)	Customer, Service, Technology, Organization, Finance, Value Exchange, Information Exchange and Process Alignment	8
41	Wirtz et al. (2015)	Strategy Model, Resources Model, Network Model, Customer Model, Market Offer Model, Revenue Model, Manufacturing Model, Procurement Model and Financial Model	9
42	Van den Brink (2016)	Product/Service, Customer Segments and Relationships, Value for Customer, Society, and Environment, Activities, Resources, Distribution Channels, Partners and Suppliers, Technology and Product Features, Cost Structure and Revenue Streams, Value Capture for Key Actors including Society and Environment and Growth Strategy/Ethos	11
43	Jablonski and Jablonski (2016)	The Customer, Value Proposition for the Customer, Logic of Generating Income, Organization of Internal Suppliers & their Key Capabilities, Competitive Strategy and Position in the Value Network.	6
44	Ling and Li (2016)	Factors Related to the Offering, Market Factors, Internal Capability Factors, Competitive Strategy Factors, Economic Factors and Personal/Investor Factors	6
45	Taran et al. (2016)	Value Proposition, Value Segment, Value Configuration, Value Network and Value Capture	5
46	Fjeldstad and Snow (2018)	Value Proposition, Role of Customers, Value Creation Mechanisms And Value Appropriation Mechanisms	4
47	Lessing and Brege (2018)	Offering, Market Position and Operational Platform	3
48	Zhao, Hwang and Lu (2018)	Product/Service, Value Proposition, Target Customer, Resources & Capabilities, Internal Organization & Activities, Competitive Strategy, Value Network and Revenue Generation Logic	8
49	Berg et al. (2019)	Value Proposition, Resources, Profit Formula and Processes.	4
50	Das et al. (2019)	Supply Chain, Key Partners, Value Proposition, Client Relationships, Potential Competition, Key Resources, Cost Structure, Revenue Streams and Key Activities	9
51	Todaria et al. (2020)	Transparency, Beneficiary, Social Business Value Proposition, Value Proposition, Starting Situation, Strands Of Action, Intended Outputs, Intended Outcomes, Steps of Change, Negative Influence, Negative Impact, and Ecological Footprint	12

Listing BM elements by various authors in the literature shows a heterogeneous number of elements. As depicted in Table 2.9, some studies consider only a few elements and extensively focus their understanding on minimum aspects. In contrast, some studies establish a more comprehensive point of view with more elements. The maximum number of BM elements, that is, twelve numbers, are identified in three studies: Dubosson-Torbay et al. (2001), Bertels et al. (2015), and Todaria et al. (2020). On the other hand, two studies, McGrath (2010) and Casadesus-Masanell and Ricart (2011), present the minimum number of BM elements, i.e., two. Moreover, most studies (14 out of 51) utilise four BM elements. This proves that there is no agreement for a standard number of elements for a BM; it can be any number depending on the business domain, preferably within two to twelve.

Besides BM elements, some authors used major components of BM under which the BM elements belong (refer Annexure 2.4). For instance, Dubosson-Torbay et al. (2001) identified four principal components: (i) Product innovation, (ii) Customer relationship, (iii) Infrastructure management, and (iv) Financial aspects and allocated twelve BM elements among them. Osterwalder (2004) categorised his nine BM elements into four pillars, i.e. (i) Product, (ii) Customer Interface, (iii) Infrastructure Management, and (iv) Financial Aspects. Similarly, Kallio et al. (2006) distributed their eight BM elements among two main factors, i.e. (i) Operator-specific or Internal Factors and (ii) External Factors. Three BM blocks, (i) Market position, (ii) Offering, and (iii) Operational platform, were used by Brege et al. (2014). Van den Brink (2016) chose three building blocks, i.e. (i) Value proposition, (ii) Value creation and delivery, and (iii) Value capture.

On the other hand, some studies further categorised some of their BM elements into a different number of BM sub-elements (refer Annexure 2.4). For example, Petrovic et al. (2001) identified three BM sub-elements, whereas Heikkila et al. (2015) divided their BM elements into thirty (30) BM sub-elements. Hence, in the literature, sub-elements were not limited to lesser numbers, allowing appropriate numbers to form compressive BMs depending on the business domain.

Differently, Casadesus-Masanell and Ricart (2011) named two BM elements as (i) choices and (ii) consequences. This is because executives make the choices of organisation operations, and consequences result from those choices. Similarly, Onetti et al. (2012) and Frankenberger et al. (2013) adopted differential views of naming BM element lists. Generally, many studies have acknowledged some BM elements, e.g., Value Proposition and Customers (e.g., Osterwalder, 2004; Kujala et al., 2010; Mokhlesian & Holmen, 2012; Fielt, 2013; Bertels et al., 2015; Zhao et al., 2018). Also, BM studies tried to list BM elements in general or specific fields or domains.

Some authors differentiated their list of BM elements according to the field or domain of concern. For instance, Brege et al. (2014) specified BM elements concerning the area of industrialised prefabricated buildings. Similarly, Todaria et al. (2020) identified twelve BM elements related to social business, as given in Table 2.9. Todaria

et al. (2020) selected some elements, prioritising the business area. For example, the element ‘Transparency’ is described as “the accountability provided to the public in a comprehensible, accessible, and timely manner”, which can be considered an essential element for social businesses, even though other businesses expect transparency. Besides, some studies attempted to use the most appropriate terms for their BM elements concerning the field or business domain. For example, Das et al. (2019) used the construction industry's familiar term ‘Client relationships’ rather than ‘Customer relationships’, and Todaria et al. (2020) considered ‘Customer’ as ‘Beneficiary’ in the social business.

However, similar meanings and terms could be detected in the listed elements in different studies. Therefore, 291 BM elements taken from 51 studies were deducted into 17 different BM elements by mapping each element (refer Annexure 2.5). The explanations given for each element under the relevant study were considered when mapping each element. Table 2.10 shows the 17 deducted BM elements and similar BM elements with different terms identified in the literature. Table 2.10 also presents the grouping of 17 BM elements under fundamental themes used for defining CBM.

Table 2.10

Deducted BM elements and different terms used in literature

Fundamental Theme	BM element	Different terms used in literature
Value-based	Value proposition	Offering, Product, Product architecture, Product development strategy, Service, Branding, Level of the promise (recipe), System augmentation, The “focus”, Value for customer, society, & environment, Green value proposition, The what, Unit of a business, Social Business Value Proposition
	Value Network	Channels, Distribution Channel, Network Architecture, Information exchange, A cooperative virtual network structure, A supply chain infrastructure, Organizational Structure, Relationship, Relationship Management, Supply chain, The “modus”, Value chain & linkages, Value exchange
	Value creation	Serving the customer, Operational platform, Value Architecture, Value Configuration
	Value Capture	Benefits for business actors, Value capture for key actors including society and environment, Value appropriation mechanisms, The why, Intended Outcomes
Revenue-based	Revenue	Revenue generation, Revenue streams, Logic of revenue generation, Revenue mechanism, Revenue creation logic, Revenue model, Revenue streams & volume, Sources of revenues, Financial aspects, Financial model, Financial perspective, Financial logic, Monetization, Transactive structure, Value economics, Value finance Economic factors
	Profit	Profit formula, Margins, Convert payment to profit
	Costs	Cost structure, Entice payments, Cost model

Fundamental Theme	BM element	Different terms used in literature
Resource-based	Resources and capabilities	Key resources, Resources/Assets, Resource structure, Resource Model, Strategic resources, Resources and Competencies, Complementary resources, Capability/core competency, Assets and capabilities, Internal capability factors, Capital Model, The list of ingredients and their required quantities, The ‘Locus’
Process-based	Processes & Activities	Key processes, Process or operational advantages, Activities and organization, Delivery process, Key activities, Process alignment, Production model, Infrastructure management, Servicing and implementation strategy, The stages of the recipe, Organization of the supply chain, The how, Prefabrication mode, Sales process, Internal organization & activities, Service provisions
Stakeholder-based	Partnerships	Key partners, Personal/investor factors, Partner Network, Partners and suppliers, Business actors and roles
	Customers	Customer interface, Customer Relations, Customer Segments, Client relationships, Customer engagement, Customer perspective, End-user segments, Existing customer base, Identifying Customer, Target Customer, Customer segments and relationships, Target Group, Role of customers, The Who, Beneficiary
	Government policy and regulation	Legal issues
Strategy-based	Strategic choices	Core strategy, Competitive strategy, Competitive strategy factors, Potential competition, Competitors, Market factors, Market model, Market position, Picture of the dish, Sales and marketing strategy, Growth strategy/ethos, Strategy, Strategy and competitive advantage, Target market
	Mission	
Dynamicity-based & Opportunity-based	Change management	Longitudinal dimension, Value chain dynamics, Development process, Velocity/Clock Speed, Organizational adaptation, Steps of Change
	Technology	Technological advancements and constraints, Technology and product features
	Culture	

Table 2.10 demonstrates that Value Proposition is the most common BM element, and Value Network, Revenue, Resources and Capabilities, and Processes are also used in a considerable number of studies. A strong consensus was noted about the importance of those elements to a BM. The element, Strategic Choices, is also important in terms of competition and marketing. Technology, Government Policy and Regulations, Mission, and Culture are rarely used in research studies as BM elements depending on their priority.

This study does not consider the elements ‘Choices’ and ‘Consequences’ proposed by Casadesus-Masanell and Ricart (2011), as they are in a different perspective and hence challenging to explain with other elements. As per Casadesus-Masanell and Ricart

(2011), executives choose how the organisation should operate, and those Choices have Consequences. However, the element Choices can be considered under several elements, e.g., Processes and Activities, Resources, Capabilities and Strategic Choices, which create Consequences.

The 17 BM elements in Table 2.10 are used as a literature outcome to discover BM elements appropriate for the construction business. The next section discusses each BM element's use and importance as Stage 3 of the BM development process.

2.11. Stage 3 - Describe business model elements

Under the third stage of the BM development process (Figure 2.7), some authors (e.g., Kallio et al., 2006; Chesbrough, 2007; Johnson et al., 2008; McGrath, 2010; Mason & Spring, 2011; Fielt, 2013; Kindström, & Kowalkowski, 2014; Heikkilä et al., 2015) have described their listed BM elements. Hence, it is worthy of providing a brief understanding of BM elements listed in Table 2.10.

2.11.1. Brief descriptions of business model elements

The following subsections provide brief explanations of each of the 17 BM elements identified in Table 2.10.

2.11.1.1. Value Proposition

Value Proposition provides an overall picture of a company's products and services, which offer value to the Customers (Osterwalder, 2004; Osterwalder et al., 2005). Firms may deliver Value Propositions to various kinds of 'Customers', i.e., end consumers, suppliers, complementors, or sponsors (Demil & Lecocq, 2010). It also gives judgment regarding what core product(s)/ service(s)/ experience(s) are delivered to the Customer, including other value-added services provided by the firms (Petrovic et al., 2001). Thus, the Value Proposition is what a company delivers to Customers in the form of products and services (Demil & Lecocq, 2010; Richardson, 2011). Accordingly, BM literature contains the 'meaning' of the Value Proposition as a parameter for describing purposes.

As Fielt (2013) states, business enterprises attempt to solve their Customers' problems. Thus, Value Proposition addresses such solutions offered by the business firms. Furthermore, due to the project-based nature of the construction industry (Eriksson, 2013), construction firms can be considered project suppliers where BMs can be used for delivering solutions (Kujala et al., 2010). Therefore, concerning the construction business, the Value Proposition could be described as the method which helps Customers to get a job done, i.e., help to find a solution for a fundamental problem in a given situation where the offering is designed after identifying the job (Johnson et al., 2008). Thus, 'purpose' can also be used for describing Value Proposition.

Value Propositions are the underlying reasons customers value the products or services (Richardson, 2011). Companies provide value for Customers in different 'ways'. Franca et al. (2017) listed a few examples of the Value Proposition: newness,

performance, customisation, brand, cost reduction, convenience, accessibility, and usability. As per Dubosson-Torbay et al. (2001), customisation is one of the typical Value Propositions concerning ICT business through which the business firms can propose a tailored value to every single Customer. Similarly, customer-oriented thinking and competing based on added value are required to increase the construction industry's performance (Pekuri et al., 2014). While core competence is identified as helpful in providing Value Propositions (Petrovic et al., 2001), in the sustainability concept, focusing on society and the environment is also required (Van den Brink, 2016).

As per literature, Value Model (Petrovic et al., 2001), Offering (Hedman & Kalling, 2003), The "Focus" (Onetti et al., 2012), Unit of Business (McGrath, 2010), The "What" (Frankenberger et al., 2013), and System Augmentation (Brege et al., 2014) are some of the different terms given by different authors for the Value Proposition.

2.11.1.2. Value Network

Initially, when describing 'Value Network', its meaning was considered by several authors. For instance, the 'Value Network' links suppliers and Customers by identifying potential complementors and competitors (Chesbrough, 2007). As per Al-Debei et al. (2008), it represents the external arrangements that communicate and collaborate the organisation's needs and conduct with other businesses in its Value Chain or Value Network to offer its products/or services.

Many members work together on construction projects creating highly interactive project teams where inter-firm networks are developed (Keung & Shen, 2017). As per Isik et al. (2010), the strength of the construction companies' relationships with the parties involved in construction projects is vital for their bettered performance. Furthermore, construction companies could gain benefits by maintaining good networks among stakeholders, e.g., help to build a good business environment, encourage potential job opportunities, mitigate risks existing in the long and complex project process, and ensure the timely completion of the construction project within the cost and with the required quality (Lu et al., 2008).

Osterwalder (2004), Osterwalder et al. (2005), and Bertels et al. (2015) identified Distribution Channels/Channels as one of the BM elements which explain the networks of the company to get in touch with its customers (Osterwalder, 2004). However, considering the nature of the construction business, Das et al. (2019) modified it as the "Supply Chain", representing an interconnected hierarchy of supply contracts consisting of products, services and logistics.

Likewise, Value Network was also termed a "Value Chain" by Hedman and Kalling (2003), Kallio et al. (2006), and Baden-Fuller and Mangematin (2013), while the elements 'The Relationship Management' by Osterwalder (2004) and 'Relationships' by Osterwalder et al. (2010) also belong to the Value Network as it describes the kind of link a company establishes between itself and the Customer (Osterwalder, 2004).

2.11.1.3. Value creation

Providing a meaning is noted when describing Value Creation. For example, Taran et al. (2016) presented a detailed explanation of Value Creation as “the efficient mix of Key Resources (e.g., tangible, financial, human, intellectual), Key Activities (e.g., production, service delivery, logistics), and Distribution Channels needed to create and deliver the Value Proposition to the selected Value Segment in a cost-effective manner and the Cost Structure needed to make the BM work” (p.501). Value Creation is also called *Value Configuration*, which describes the arrangement of activities and resources required to create value for the Customer (Osterwalder, 2004).

When creating value for customers, it is required to ensure service quality to make their satisfaction and behavioural intention (Sunindijo et al., 2014). Hence it contributes to the success and survivability of construction organisations in the current fierce business environment (Sunindijo et al., 2014).

2.11.1.4. Value Capture

Value Capture describes how and how much the Customers pay for the delivered products/services offered by the firm (Taran et al., 2016). Simply, it represents potential benefits for the various business actors (Timmers, 1998). Fjeldstad and Snow (2018) named Value Capture as *Value Appropriation* by stating that firms’ appropriate values by performing their activities efficiently and effectively towards Customer satisfaction. Hence, the companies can capture value from Customers by ensuring Customer satisfaction. In addition, Value Capture can differ with the area of concern. For example, within the sustainability criteria, the Value Capture for key actors must also include both society and the environment (Van den Brink, 2016).

Frankenberger et al. (2013) named the element Value Capture as ‘The Why’, which includes Revenue, while Todaria et al. (2020) mentioned ‘Intended Outcomes and Outputs’ as benefits received for the social businesses.

2.11.1.5. Revenue

Revenue Model (Petrovic et al., 2001; Osterwalder, 2004; Wirtz et al., 2015; A. Pekuri et al., 2014), Revenue Mechanism (Kindström & Kowalkowski, 2014), Monetisation (Baden-Fuller & Mangematin, 2013), and ‘The Why’ (Frankenberger et al., 2013) are substituted terms for Revenue used by various authors. Revenue answers why the BM is financially viable (Frankenberger et al., 2013) and describes how a company makes money through various revenue flows (Osterwalder et al., 2005). It includes pricing, systems, determination of timings of payments, and methods of collecting Revenues (Baden-Fuller & Mangematin, 2013).

2.11.1.6. Costs

The Cost Structure represents the money of all the means employed in the BM (Osterwalder et al., 2010). It includes the Costs required to get the infrastructure used to create value (Dubosson-Torbay et al., 2001). In addition, as per Boons and Lüdeke-

Freund (2013), it includes the Costs of all other BM elements and their distribution among BM stakeholders. Cost is one of the leading project management areas in construction project management, which also critically affects contractors' competitiveness. Therefore, managing cash flows is vital in the construction business (Das et al., 2019).

2.11.1.7. Profit

Profit is the difference between Revenues and Costs (Dubosson-Torbay et al., 2001). According to Boons and Ludeke-Freund (2013), Profit is created from other BM elements and distribution across BM stakeholders. Johnson et al. (2008) recognised the BM element 'Profit Formula', which enables planning of how the companies make value for themselves while providing value to the Customers. Profit is a monetary value that answers how much money can be made (Johnson et al., 2008).

2.11.1.8. Resources and Capabilities

Key Resources include the people, products, equipment, technology, facilities, channels, and brand required to deliver the Value Proposition to Customers (Johnson et al., 2008).

“Capability is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the Customer” (Osterwalder, 2004, p.43). Capabilities are also termed *Competencies* by Demil and Lecocq (2010), referring to the managers' abilities and knowledge. Managers can develop their Competencies individually and collectively to improve, recombine, or change the services they offer (Demil & Lecocq, 2010). For example, construction contractors provide their service in delivering projects, requiring their inherent knowledge of efficiently performing construction activities (Van den Brink, 2016).

As per Isik et al. (2010), both tangible and intangible assets of a company could be considered as its Resources and Capabilities, including equipment, workforce, technical and managerial know-how, financial resources, experience and image in the industry, leadership characteristics, research and development capabilities, and innovation tendencies. Moreover, Isik et al. (2010) emphasised that construction companies' Resources and Capabilities should be cost-effective, efficient, rare, and adequately sophisticated to compete with their rivals without imitation. The Resources can be generated internally or obtained from external markets (Demil & Lecocq, 2010). Companies can also own, lease, or acquire key Resources (Franca et al., 2017). Accordingly, the companies must consider the required Resources and Capabilities and methods of obtaining them and using them effectively and efficiently.

2.11.1.9. Processes

'Processes and Activities' are differently known by different authors: Process Alignment (Heikkila et al., 2015), The How (Frankenberger et al., 2013), and The Modus (Onetti et al., 2012). Processes show the elements of the Value Creation process

(Rainer & Hans-Dieter, 2001). Fjeldstad and Snow (2018) termed a Process that transforms inputs into products as a value chain. Further, it represents the business methods needed to design the internal organisation and the network (Onetti et al., 2012).

The Processes are sets of activities employed to sell business units (McGrath, 2010). Rainer and Hans-Dieter (2001) differently mentioned that a company's Processes provide a more detailed view of the company's Mission. Also, the organisational structure includes various discrete Processes and relationships with suppliers, customers, competitors, and regulators (Demil & Lecocq, 2010).

A firm must direct several Processes and Activities to develop and distribute a Value Proposition (Frankenberger et al., 2013). As per Heikkila et al. (2015), Process Alignment focuses on the operational-level business activities, processes, and systems shared between organisations. Usually, construction contractors' activities range from demolishing and manufacturing, across traditional core activities in construction, to knowledge-intensive business services (Brochner, 2010). Keung and Shen (2017) identified the requirement of good management skills to improve contractors' effectiveness in site operation because construction firms are progressively involved with financing, structuring, planning, and designing construction projects (Brochner, 2010). Eventually, McGrath (2010) identified that the assessment of 'key metrics' is necessary for operating company Processes towards better performance.

2.11.1.10. Partnerships

"Partnerships portray the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value" (Osterwalder et al., 2010, p.18). The Partners make the BM of the company work, help obtain Resources and Capabilities, reduce risks and uncertainties, and make the economy of scale (Franca et al., 2017). Hence, the companies consider the benefits affirming from their Partners.

In the construction industry, Partners can be the clients, external suppliers, and/or financiers. For example, Van den Brink (2016) argued that the client is the key Partner in housing construction because the housing is completely tailored to the client's needs. Franca et al. (2017) stated the main types of Partnerships: joint ventures, strategic Partnerships between competitors, strategic alliances between non-competitors, and buyer-supplier relationships. Therefore, construction firms should carefully address the conflicting interests with Partnerships to execute construction projects successfully (Berge et al., 2019).

2.11.1.11. Customers

Several authors differently identified matters related to Customers. For example, the Customer interface tells how to reach Customers (Hamel, 2000), and the Customer Relations Model addresses how to reach, serve, and maintain Customers (Petrovic et al., 2001).

Franca et al. (2017) emphasise the importance of exploring, understanding, and delineating specific Customer needs. Therefore, Customer relationships can be made by acquiring a feeling for the Customer's desires, serving him, and developing a continuing relationship (Dubosson-Torbay et al., 2001).

Baden-Fuller and Mangematin (2013) highlighted that the stability of Customer interaction on both firm and personal levels is required to develop strong customer relationships. Heikkila et al. (2015), on the other hand, considered that the Customer perspective is helpful in creating value with the fulfilment of the relevant need(s) of customers to denote the expected relationships established with customers and quantify the intended value to be created for Customers.

Finally, the BM elements, Target Customer (Osterwalder et al., 2010), Target Market (Chesbrough, 2007), The Who (Frankenberger et al., 2013), Customer Segments (Bertels et al., 2015), and Value Segment (Taran et al., 2016), are all related to the Customers to whom the company needs to offer value.

2.11.1.12. Government

Government involvement in the industry is vital as the construction industry constitutes a large portion of a country's economy. Government contributes to the construction industry by making laws and policies and implementing regulatory agencies (Isik et al., 2010). As per Kallio et al. (2006), markets with Government support have taken off quickly through infrastructure investment, regulatory policy, subsidies, and/or the education of its citizens.

2.11.1.13. Strategic Choices

BMs should provide a high-level understanding of the overall vision and strategic goals (Rainer & Hans-Dieter, 2001). Also, firms must maintain a long-term focus and create internal awareness and a "sense of urgency" strategically (Kindström & Kowalkowski, 2014). Therefore, the Strategy is an essential element that describes how firms choose to compete or hold an advantage over their rivals (Hamel, 2000; Chesbrough, 2007).

Contractors use Strategies as mechanisms to link their competitive industrial environments (Ho, 2015). However, other than competitive strategy, construction firms take different strategic decisions, e.g., project management strategies, Investment strategies, differentiation strategies, organisational management strategies, market, project, client, and partner selection strategies (Isik et al., 2010), and cost leadership strategy, adaptability strategy, market intelligence strategy, and networking strategy (Li & Ling, 2012).

2.11.1.14. Mission

The study of Rainer and Hans-Dieter (2001) is the only study that took "Mission" as a BM element, considering it as one of the most critical elements of the BM. Therefore, the "Mission" develops a high-level understanding of the company's overall vision,

strategic goals, and Value Proposition. In addition, the Mission is vital for strategic preparedness before launching businesses (Rainer & Hans-Dieter, 2001).

2.11.1.15. Change Management

Change Management requires the implementation of human, organisational, and cultural enablers, helping the organisation's employees adapt to business changes (Cheng et al., 2001). Furthermore, Osterwalder (2004) emphasise the requirement of finding new ways of keeping up with faster industry "Clockspeed" in today's world of rapid change, where "Clockspeed" means the different paces that different industries own in the changing life cycles of their products and processes. Therefore, BM adaptation to change is necessary due to threats and opportunities in the business environment (Saebi, Lien, & Foss, 2017). Hence, the managers and employees should be capable of learning and responding to changes in the external environment, known as organisational adaptation (Cheng et al., 2001). Hence, innovations and improvements to the firm's services cannot be achieved without an appropriate structure (Kindström & Kowalkowski, 2014).

2.11.1.16. Technology

Mason and Spring (2011) stated that Technology could be recognised as using and knowing tools, techniques, systems, methods of organisations, or material products. As per Berge et al. (2019), the BMs must elaborate on how firms collaborate and implement technological trends. However, suitable technological choices influence a firm's ability to sustain and grow its market share (Kallio et al., 2006).

2.11.1.17. Culture

Culture is an intangible and "softer" element of a BM, with which many companies struggle (Kindström & Kowalkowski, 2014). However, only Kindström and Kowalkowski (2014) have considered Culture as a BM element. Nevertheless, it can be a key to successful change and innovation, even though large-scale Cultural change needs time (Kindström & Kowalkowski, 2014).

The above sub-sections briefly explain the identified BM elements from the literature, referring to Stage 3 of the BM development process. In addition, the literature provides evidence that BM elements could be described in terms of their meaning, purpose, benefits, and other concerns, e.g., methods of obtaining. Thus, different parameters used for describing BM elements are described in the next section.

2.11.2. Parameters for describing business model elements

The describing parameters explain BM elements that are varied with the business domain or field. Accordingly, Table 2.11 presents the describing parameters adapted in the literature in different studies.

Table 2.11*Describing parameters of BM elements*

Reference	Describing parameters			
	List of factors to select	Characteristics of elements	Questions that underlie a BM/ Benchmark Questions	Guiding Principles for each BM element
Hamel (2000)			✓	
Osterwalder(2004)		✓		
Morris et al. (2005)	✓		✓	✓
Johnson et al. (2008)			✓	
Onetti et al. (2012)			✓	
Fielt (2013)			✓	
Ling and Li (2016)			✓	
Taran et al. (2016)			✓	
Das et al. (2019)			✓	

Morris et al. (2005) listed factors related to each BM element, enabling relevant factors to be selected for a particular business case. In addition, Morris et al. (2005) proposed three specific decision-making levels, reflecting the different managerial purposes: (i) ‘foundation’, (ii) ‘proprietary,’ and (iii) ‘rules’ levels. At the foundation level, fundamental decisions of what the business is/is not being made while ensuring internal consistency. At the proprietary level, individual decisions are taken for marketplace advantage. Finally, the rules level outlines guiding principles leading to the decisions made at the foundation and propriety levels that direct the firm and employees.

Managers themselves can ask questions/benchmark questions that underlie a BM when developing a BM, which is raised in the literature, e.g., Hamel (2000), Magretta (2002), Johnson et al., (2008), Morris et al. (2005), Onetti et al. (2012), Fielt (2013), Ling and Li (2016), Taran et al. (2016), and Das et al. (2019). Conversely, Osterwalder (2004) noted the characteristics of each BM element, e.g., name, definition, pillar belongs to, sub-elements, and relevant attributes, allow BMs to be described with required details and according to specific needs.

After explaining BM elements and identifying parameters to describe them, BM frameworks/ontologies are created during Stage 4 of the BM development process. Hence, the next section discusses what ontology is, its applications, and its development.

2.12. Stage 4 –Model BM elements as a business model ontology

Business Model ontologies are developed at Stage 4 of the BM development process as a prerequisite for properly applying the BM concept in a field or a business domain. Therefore, the next sub-sections initially explain the “ontology” and “ontology creation” leading to the development of a BM ontology for the construction business.

2.12.1. What is an “ontology”?

The term “ontology” is referred to as “an agreement within a community of interest or practice over the description (i.e., conceptualisation) of the domain” (Akkermans, & Gordijn, 2006, p.112). While attempting to make terminological clarification to “ontology”, Guarino and Giaretta (1995) defined it as a “logical theory which gives an explicit, partial account of a conceptualization” (p.7). Guarino and Giaretta (1995) identified the term “ontology” as a synonym of “conceptualisation”. On the other hand, “Ontology” also represents a branch of philosophy that deals with the nature and the organisation of reality (Guarino & Giaretta, 1995).

Osterwalder (2004) used Guarino and Giaretta (1995)’s interpretation of the term “ontology” while developing a BM ontology concerning Information Systems (IS) and Information and Communication Technology (ICT) businesses. Correspondingly, this study used “Ontology” to explain the philosophical stance under Research Methodology and “ontology” as a conceptualisation when developing a BM ontology for the construction business. Guarino and Giaretta (1995) further defined conceptualisation as “an intentional semantic structure which encodes the implicit rules constraining the structure of a piece of reality” (p.6).

Ushold and Gruninger (1996) highlighted that ontology displays a shared understanding of a particular field, giving the stakeholders accurate and effective communication means. On the other hand, authors found several consequences due to lack of a shared understanding, e.g., poor communication within and between people and their organisation, difficulties in identifying the requirements, lack of interoperability, and poor use of potential re-use and sharing. Also, Akkermans and Gordijn (2006) mentioned that ontologies provide methods to model phenomena of interest in a conceptual framework. Ultimately, ontology can be considered a conceptualisation used for various domains and disciplines as a modelling method. Hence, the BM concept can also be modelled as ontologies, as discussed in the next section.

2.12.2. Business model frameworks/ ontologies

A BM framework allows visualisation and communication among the practitioners while working as a more precise conceptualisation of the BM concept (Bengtsson & Hansen, 2018). According to Fielt (2013), BM frameworks can be used as a shared language to describe, visualise, assess, and change BMs. Hence, such frameworks have to be reasonably straightforward, logical, measurable, comprehensive, and operationally meaningful (Morris et al., 2005). In addition, Verstraete et al. (2017) stated that the BM itself needs modelling to serve the project’s development and the exercise of conviction among stakeholders.

On the other hand, BM frameworks represent the elements of BMs and the relationships between these elements (Bengtsson & Hansen, 2018; Fielt, 2013). Therefore, Fielt (2013) emphasised the importance of defining the relationships between the elements and creating interactions between the elements helps to have robust BMs.

The thinking of BM design inspires the development of BM frameworks. BM ontologies are also the languages used to design BMs (D'Souza et al., 2015) and can be identified as BM frameworks. These ontologies then provide tools to help firms' stakeholders imagine the business idea, understand its nature, and fill it with its content (Verstraete et al., 2017). Hence, BM ontologies are generally developed for different and specific purposes and allow describing a firm's BM accurately and in detail (Taran et al., 2016).

Gordijn et al. (2005) identified that the motivation to use ontologies in the BM domain could be increased by explaining the purpose of BM ontologies. For example, some of the purposes can be, improving communication, achieving reliability, acquiring knowledge, providing a basis for scientific research on BMs, and providing the fundamentals for enabling support tools.

BM ontologies are made up of a set of BM elements. However, literature findings evidenced that scholars have no agreement on a common set of BM elements. Furthermore, as per Taran et al. (2016), there is a heterogeneity of terminologies regarding the appropriate number of elements that constitute a BM ontology. However, as Gordijn et al. (2005) stated, BM ontology content includes the actual concepts, relationships, and rules/axioms. Hence, the authors categorised how the main actors interact with the ontology.

For example, business developers involve in designing a BM for a company; business managers use ontologies in aligning business and strategy; stakeholders then execute or implement BMs using BM ontologies, and scientists/researchers can concern with understanding BM and developing new theories based on BMs (Gordijn et al., 2005).

The Business Model Ontology (BMO) by Osterwalder (2004), the Four-Box Business Model framework by Johnson (2010), an integrative framework for Entrepreneur's Business Model by Morris et al. (2005), A Health Information Technology (HIT)-specific BM Ontology by Gand and Esswein (2018), and the Ontology for Social Business value proposition by Todaria et al. (2020) were some attempts in modelling BM elements as frameworks/ontologies. However, these ontologies/frameworks found different features depending on the purpose (refer Annexure 2.6). Further, the last two BM ontologies considered the uniqueness of their business domains while developing ontologies.

Ultimately, the trend is choosing, defining, and analysing BM elements on the aspects that the researcher wants to highlight and develop corresponding BM ontologies that best serve their needs (D'Souza et al., 2015). Hence this research aims to develop a best-suited BM ontology for the construction business by understanding how to create an ontology.

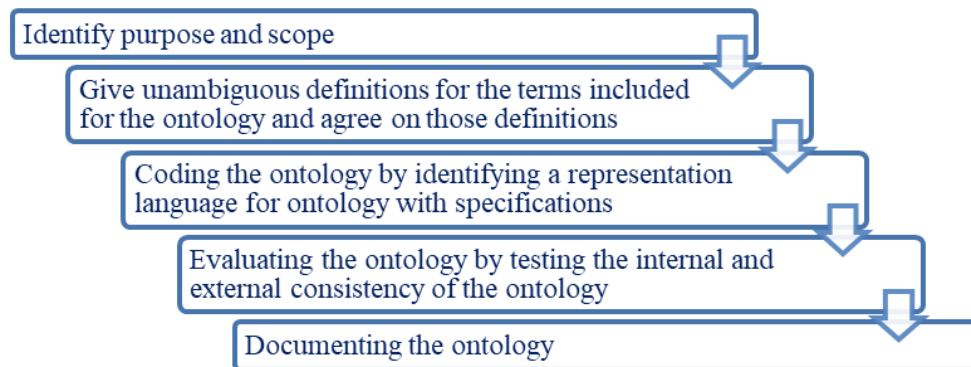
2.12.3. Method of creating an ontology

The development of ontologies for new fields helps expand the application of ontologies (Ushold & Gruninger, 1996). Thus, Guarino and Giarretta (1995) and

Osterwalder (2004) identified some steps of an informal approach for creating ontologies, as shown in Figure 2.9.

Figure 2.9

Informal process of creating an ontology



Source: Adapted from Osterwalder (2004)

Dudycz and Korczak (2016) proposed a more comprehensive way of creating an ontology by analysing previous methodologies. This process consists of five stages, as illustrated in Table 2.12.

Table 2.12

Stages of creating an ontology

Stage	Requirements	Result
Definition of the goals, scope, and constraints	Provide Assumptions by answering the question: what will the created ontology be used for?	A definition of the scope and required detail level
Conceptualisation	Identify all concepts, the definition of classes and their hierarchic structures, modelling relations, instances, specification of axioms, and rules of reasoning	The ontology's model of the defined area
Verification	Verify the correctness through experts in two steps; Formal verification and Content verification	The verified ontology
Encoding	Encode using a formal language or an editor of ontology. Two basic stages; (i) enter all topics and create a taxonomy, (ii) enter all other types of relations between topics	The encoded ontology
Validation and evaluation	Check against the needs of the managers. Three areas; (i) validation of usefulness by managers and its correctness, (ii) evaluation of the application, and (iii) validation of predefined use cases	The validated ontology

Source: Dudycz and Korczak (2016)

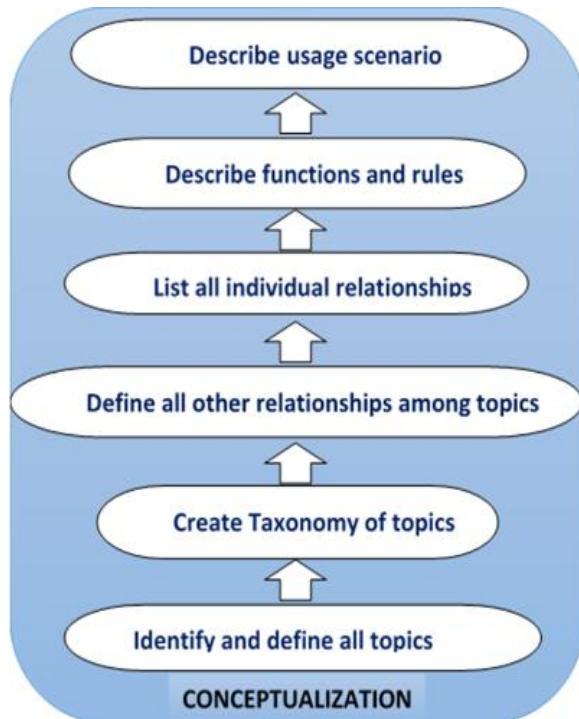
As per Table 2.12, Dudycz and Korczak (2016) stated the activity requirements and outcome at each stage. Thus, the ontology's goal, scope, and required constraints need to be defined with assumptions by considering its use at the first stage. Then, during

the Conceptualisation stage, the ontology is developed as a model to be verified, encoded, and validated at the subsequent three stages.

The Conceptualisation stage consists of a significant part of the ontology creation process, which is to be done in collaboration with experts in the field (Dudycz & Korczak, 2016). This stage includes six sub-stages, as illustrated in Figure 2.10.

Figure 2.10

Sub-stages of Conceptualisation stage in ontology creation



Source: Adapted from Dudycz and Korczak (2016)

As per Figure 2.10, the first sub-stage must identify and define all the topics representing the particular concept, highlighting their names, synonyms, and descriptions. The second sub-stage specifies taxonomic relations between topics with their classes and subclasses. Basic and additional relationships between topics are defined in the third sub-stage, and all the existing individual relationships in the ontology are listed in the fourth sub-stage. In the fifth sub-stage, functions and rules are described, including inputs, outputs, conditions, and definitions of operations. Finally, the usage scenario is applied through a demonstration.

After identifying the way to create an ontology, it is necessary to consider how to apply it for developing BM ontology for the construction business. Accordingly, the next section discusses the compatibility of the ontology creation process with the BM development process (refer Figure 2.7).

2.12.4. The process of developing a business model ontology for the construction business

Osterwalder (2004) stated that ontology modelling requires a careful and accurate description of BM terms, concepts, components, and their relationships. Section 2.12.3 discussed the method of creating an ontology with five stages. The development of BM ontology also emerged stage-by-stage through the BM development process established in Section 2.7 and described in Sections 2.9, 2.10, 2.11 and 2.12. Developing a Construction Business Model Ontology (CBMO) is clarified by mapping the BM development process (Figure 2.7) with the ontology creation process of Dudycz and Korczak (2016), as shown in Table 2.13. This table illustrates the research focus of this study achievable under each stage.

Table 2.13

Mapping of BM development process with stages of ontology creation

Stages of the ontology creation		Stages of BM development Process	The research focus of this study
Definition of the goals, scope, and constraints		Defining BM	Defining CBM
Conceptualization	Identify and define all topics	Listing BM elements Describing BM elements	Investigate and describe relevant elements for CBMO
	Create a taxonomy of topics	Developing a BM ontology	Establish relationships among CBMO elements & develop CBMO
	Define all other types of relations between topics		
	List all the existing individual relationships		
	Describe functions & rules		
	Describe usage scenarios		
Verification			Describe a sample scenario using CBMO Validate CBMO
Encoding		Apply BM Concept using BM ontology	Not in the scope of this research
Validation and evaluation			

Based on the first stage of ontology creation and BM development, this study focuses on developing a definition for construction BMs, achieved under Section 2.9. The Conceptualisation stage of the ontology creation process covers the second, third, and fourth stages of the BM development process, which guides this study in developing CBMO. Sections 2.10 and 2.11 covered the step ‘identify and define all topics’ in ontology creation by listing BM elements and describing listed BM elements, for which empirical data is required concerning the construction business. Subsequently, as depicted in Table 2.13, when creating BM ontology for the construction business, it is required to create taxonomies for BM elements, define and list all other types of relationships between BM elements, describe functions and rules, and describe BM ontology with usage scenarios. Finally, the verification of CBMO is achieved through

validation. However, the last two stages of ontology creation are not considered under the scope of this study due to time constraints.

Before creating taxonomies of BM elements, the composition of BM ontologies must be identified for deciding different taxonomy levels. Hence, the next section explores the compositions of several BM ontologies/frameworks in the literature.

2.12.5. Composition and relationships of business model ontology

The complexity of BMs depends on the numbers and types of their constituent elements and their interrelationships (Rumble & Mangematin, 2015). However, a comprehensive list of BM configurations is necessary (Rumble & Mangematin, 2015; Taran et al., 2016). Systematically and architecturally organising the comprehensive list of BM elements and grouping these configurations into a concrete classification framework are the main challenges in developing BM ontologies (Taran et al., 2016). Table 2.9 in Section 2.10.1 indicates that different BM studies identified different BM elements in different numbers. However, various kinds of BM elements were proposed in some studies, i.e., BM Elements, Main Factors/ Pillars/ Principal Components/ Building Blocks, BM Sub-elements, Decomposed elements, Bridge elements, and Common elements.

Accordingly, Table 2.14 illustrates the composition of BM frameworks/BM ontologies in different studies.

Table 2.14

Composition of BM ontologies/ BM frameworks

Reference	Composition of BM ontologies/ BM Frameworks						
	Main Factors/ Pillars/ Principal Components/ Building Blocks	BM Elements	BM Sub-elements	Decomposed Elements	Bridge Elements	Common elements span over other elements/ affect to each other element	Additional high-level elements and their low-level elements
Hamel (2000)		✓			✓		
Cheng et al. (2001)		✓	✓				
Rainer and Hans-Dieter (2001)		✓	✓			✓	
Petrovic et al. (2001)		✓	✓				
Dubosson-Torbay et al. (2001)	✓	✓					
Hedman and Kalling (2003)		✓	✓			✓	
Osterwalder (2004)	✓	✓		✓			
Shafer et al. (2005)		✓	✓				
Kallio et al. (2006)	✓	✓					
Johnson et al. (2008)		✓	✓				
Osterwalder et al. (2010)	✓	✓					
Casadesus-Masanell and Ricart (2011)		✓	✓				
Mason and Spring (2011)		✓	✓				

Reference	Composition of BM ontologies/ BM Frameworks						
	Main Factors/ Pillars/ Principal Components/ Building Blocks	BM Elements	BM Sub-elements	Decomposed Elements	Bridge Elements	Common elements span over other elements/ affect to each other element	Additional high-level elements and their low- level elements
Fielt (2013)		✓					✓
Mutka and Aaltonen (2013)	✓	✓					
Bocken et al. (2014)		✓	✓				
Brege et al. (2014)	✓	✓					
Kindström and Kowalkowski (2014)		✓				✓	
Bertels et al. (2015)	✓	✓					
Heikkila et al. (2015)		✓	✓				
Wirtz et al. (2015)		✓	✓				
Van den Brink (2016)	✓	✓					
Todaria et al. (2020)		✓	✓				

BM Elements are further divided into different (numbers of) BM Sub-elements in 12 studies (refer Annexure 2.4). Eight (08) studies have identified the main areas of rough categorisation for which the related BM Elements are fallen and given different names. For instance, “Main Factors” by Kallio et al. (2006) and Bertels et al. (2015); “Principal Components” by Dubosson-Torbay et al. (2001); “Pillars” by Osterwalder (2004); and “Blocks” by Brege et al. (2014) and Van den Brink (2016). In addition, Osterwalder (2004) identified that some elements in the Business Model Ontology (BMO) are inherited from “Decomposed elements” that are not shown in the BMO but are used to identify additional relationships of BMO elements. Hamel (2000) introduced “Bridge elements”, which connect other BM framework/ontology elements and act as connections to build relationships among other BM framework/ontology elements. Accordingly, three primary taxonomy levels of a BM ontology can be identified as BM Pillars (taxonomy level 1), BM Elements (taxonomy level 2), and BM Sub-elements (taxonomy level 3).

On the other hand, few studies have identified that some elements are to be concerned with all the other elements of BM. For instance,

- As per Rainer and Hans-Dieter (2001), legal issues and technology influence decisions on other BM elements. Thus, “Legal and Technological requirements and constraints” are Common elements that span over other elements.
- According to Kindström and Kowalkowski (2014), “Strategy” and “Structure” are two elements that span over other BM elements, and each element is linked to different underlying “Resources and Capabilities”.
- Hedman and Kalling (2003) identified a “Longitudinal Dimension” to cover the dynamics of the BM over time, including constraints on actors, cognitive and cultural limitations that managers must cope with.

Furthermore, Fielt (2013) considered some elements as ‘High-level core elements’ and introduced ‘Additional High-level elements’ (e.g., technology, competitive strategy) to the BM framework. Therefore, the framework included Additional High-level elements identified based on the purpose and context. Furthermore, these High-level core elements were further provided with ‘Minimal Low-level elements’ (e.g., revenues and costs for economics) (Fielt, 2013). Consequently, together with the composition of BM ontologies/BM frameworks, the relationships among the BM framework/ontology elements could be identified as described above, e.g., taxonomies, bridging BM elements and spanning over BM framework/ontology elements.

Besides the above relationships, Osterwalder (2004) and Dudycz and Korczak (2016) employed different relationship indicators to describe relationships between and among BM Elements, BM Sub-elements and other BM framework/ontology elements, e.g., Decomposed elements. For instance, Osterwalder (2004) used relationship indicators ‘Set of’, ‘Is A’, ‘Value for’, ‘Based on’, ‘Built on’, ‘Delivers’, ‘Provides’, ‘Fits to’ and ‘Flows to’. These relationship indicators describe the qualitative relationships among BM framework/ontology elements; for instance, the ‘Value for’ relationship indicator can be used between Value Proposition and Target Customer(s) to describe “a Value Proposition represents *Value for* one or several Target Customer(s)” (Osterwalder, 2004, p.50).

Gand and Esswein (2018) and Todaria et al. (2020) used different qualitative relationship indicators in their ontologies to display relationships among BM framework/ontology elements. Furthermore, Peter et al. (2020) developed an ontology-based visualisation tool for BMs incorporating qualitative relationship indicators. Accordingly, different and similar qualitative relationship indicators could be found in the literature, depending on the study and the field.

By establishing relationships among BM framework/ontology elements, including taxonomies and other relationships, a BM ontology can be created, needing demonstration with usage scenarios (Dudycz & Korczak, 2016). Afterwards, the developed BM ontology can be used for different purposes, as discussed in the next section.

2.13. Stage 5 - Apply the business model concept using a business model ontology

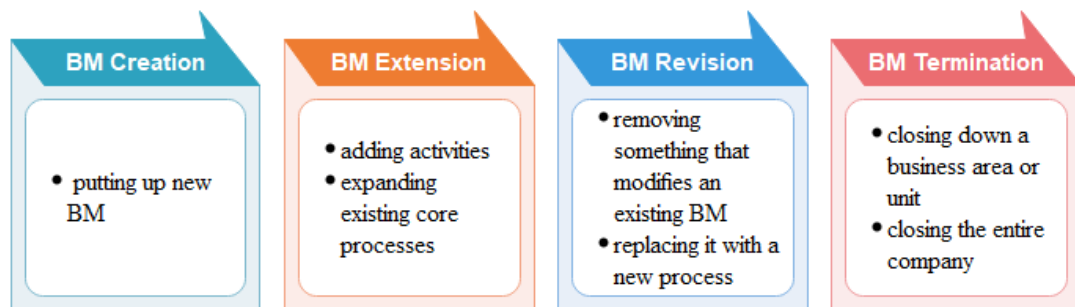
Stage 5 of the BM development process indicates the application of BM ontologies in a particular business area, mainly for designing, describing, visualising, assessing, and changing BMs (Fielt, 2013). Designing new BMs is closer to an art than science (Casadesus-Masanell & Ricart, 2011). Thus, some researchers have addressed the issue of “how to design BM” (Teece, 2010; Zott & Amit, 2010; Amit & Zott, 2015). BMs should be designed with improved value creation covering a high degree of internal and external configurations and an increased share of the co-created value (Nenonen & Storbacka, 2009). Hence, Nenonen and Storbacka (2009) argued that identifying and analysing suitable BM design elements and modifying the potentially

incompatible design elements are important. Therefore, BM ontologies are primarily used for designing BMs while conceptualising and evaluating BMs (D'Souza et al., 2015).

BM ontologies provide fundamentals for supporting, changing, and innovating BMs (Osterwalder & Pigneur, 2005). In addition, Chesbrough (2007a) highlighted the requirement of BM advancement for improving a specific BM by sequencing BMs from very basic models to far more advanced models. Thus, BM changes lead businesses towards success while providing new value creation opportunities together with sustained value creation over time (Achtenhagen et al., 2013). Accordingly, Cavalcante et al. (2011) suggested four different ways of changing BMs, as shown in Figure 2.11.

Figure 2.11

Change of BMs



Source: Adapted from Cavalcante et al. (2011)

To succeed in the dynamic business environment, companies must recognise new technologies and ideas and develop the right strategy to achieve them to get a competitive advantage (Bullinger et al., 2016). However, the extensive efforts of discovering new products, technologies, ideas, and processes remain worthless until those are commercialised through a proper BM (Chesbrough, 2010). Thus, innovating BMs together with products and processes is vital to achieving revenue growth and improving profit margins.

Furthermore, BM innovations represent a firm's reaction to change (Verhoeven & Johnson, 2017) and help firms identify and adopt novel opportunities (Teece, 2010). Therefore, BM ontologies are more supportive in changing and innovating BMs (Bengtsson & Hansen, 2018).

On the other hand, Bengtsson and Hansen (2018) highlighted that BM ontologies allow practitioners to visualise and communicate their BM ideas. In addition, BM ontologies can also describe, visualise and assess the current state of the existing BM (Fielt, 2013). After developing an ontology, it could be applied for the purposes listed by Gordijn et al. (2005).

- Tool support – BM ontologies can be used to develop tools for designing, analysing, evaluating, or manipulating BMs.

- Visualisation – BM ontologies can be used to represent the BM of a company graphically, textually, or both.
- Evaluation method for BM instances – BM ontologies can evaluate a company’s BM.
- Change methodology – BM ontologies can contain guidelines, steps, and actions to transform a current BM into the desired BM.
- Classification – BM ontologies can be used to classify BM instances.

The application of the BM concept in a particular field can be improved through the development of BM ontology. For instance, the famous and widely used tool, “Business Model Canvas (BMC),” created by Osterwalder and Pigneur (2010), is a follow-up of the Business Model Ontology (BMO) developed by Osterwalder in 2004. BMs can be designed and innovated with BMC using visual thinking because it stimulates BMs in a holistic approach to storytelling (Fielt, 2013). Thus, in the first place, BM ontology helps design different BMs for different business ideas and options, leading to BM concept adaptation in a business domain. In the words of Osterwalder (2004):

“Specifying a set of business model elements and building blocks, as well as their relationships to each other, is like giving a business model designer a box of Lego stones. He can play around with these stones and create completely new business models, limited only by his imagination and the pieces supplied.” (p.22)

Given that the necessary theories were comprehended, a conceptual framework needs to be developed before commencing empirical data collection, based on coherent findings obtained by critically reviewing the literature. Thus, the next section discusses the development of the conceptual framework of this study.

2.14. Development of Conceptual Framework

A *conceptual framework* is defined as a network, or a “plane,” of linked concepts that together provide a comprehensive understanding of a phenomenon (Jabareen, 2009, p.51). Conceptual frameworks can be found in many scholarly works to connect all aspects of the research, from the early research stage with reviewing the literature. Clarifying the research concepts and proposing relationships among those concepts is one of the primary purposes of a conceptual framework (Jabareen, 2009). As per Vaughan (2008), a conceptual framework is a reference point for discussing literature and methodology while providing boundaries of the work. Similarly, according to Yin (2009), the conceptual framework shows the concepts of a study, how they are interrelated, and the boundaries where those concepts and interrelationships are applicable.

As discussed in Section 2.4, it is apparent that the deployment of appropriate BM provides many rewards to an organisation’s business. However, literature identified the lack of BM concept application in the construction industry, which leads the researcher to pose the research problem of **“How to contextualise BM concept to**

construction contractors’ business via developing a BM ontology in the construction context?”

Accordingly, literature was reviewed to realise the evolution of BM research and found the phase-wise development in BM research as discussed in Section 2.6. Consequently, a process of BM development was derived in Section 2.7 with five stages. That reveals that the step before proper and improved application of the BM concept in a particular business domain is the development of a BM framework like BM ontology, i.e., the development of a BM ontology is a prerequisite for the proper and improved application of the BM concept in any field. Hence, the study aimed to **propose a developed and validated Business Model ontology for the construction context to facilitate contractors in designing Business Models (BMs).**

The following objectives were formulated considering the BM development process (Figure 2.7) and to accomplish the aim of the study:

1. Critically review the literature on the BM concept to interpret the gaps, particularly on construction industry application **(OB1)**
2. Define BM corresponding to the construction business to scope BM ontology development particular to the contractors’ business **(OB2)**
3. Investigate BM elements essential for a BM ontology applicable to construction contractors’ business **(OB3)**
4. Analyse the BM elements identified above (OB3) for establishing parameters to describe BM elements **(OB4)**
5. Establish relationships among BM elements for developing a BM ontology applicable to construction contractors’ business **(OB5)**
6. Propose a developed and validated BM ontology for construction contractors’ business, facilitating BM design for different construction business ideas/ options **(OB6)**

Research Questions (RQs) were formulated from literature along with the objectives and literature outcomes (LOs) of each objective, as depicted in Table 2.15.

Table 2.15

Literature outcomes and research questions for achieving objectives

		Literature Outcome (LO)	Research Questions (RQs) from Literature review	
OB1	LO1	BM ontology is a prerequisite for the proper BM application in any field which needs to follow the BM development process.	RQ1	What is the requirement of proper BM application in a field?
		No phase-wise development of BMs in Construction Business (CB) literature	RQ2	What is the situation in the construction industry regarding BM application requirements?

		Literature Outcome (LO)	Research Questions (RQs) from Literature review	
OB2	LO2	Proposed process for developing a Construction Business Model (CBM) definition	RQ3	What is the suitable process for developing a CBM definition?
		A definition for CBM	RQ4	What is the definition for CBM?
OB3	LO3	17 possible BM elements with substituted terms	RQ5	What suitable BM elements can be used for developing a BM ontology for construction contractors' business?
OB4	LO4	Different describing parameters for BM elements	RQ6	How to describe each of the above BM elements using suitable parameters?
OB5	LO5	Compositions of different BM frameworks/ontologies Relationships among BM elements	RQ7	What is the composition of the BM ontology for construction contractors' business?
			RQ8	What are the relationships among BM elements of the BM ontology for construction contractors' business?
OB6			RQ9	What is the proposed BM ontology for construction contractors' business?
			RQ10	How to use the proposed BM ontology for designing CBM for a sample scenario related to construction contractors' business?

By critically reviewing the literature, the OB1 was achieved by identifying the gap in the literature related to the BM concept in the construction business, that is, the requirement of developing BM ontology, particularly for the construction business (refer Sections 2.7 and 2.8). Therefore, the BM development process, which complies with the stages of ontology creation (refer Section 2.12.4), must be followed to develop a BM ontology related to construction contractors' business which is named Construction Business Model Ontology (CBMO) while achieving OB2, OB3, OB4, OB5, and OB6 gradually by answering RQs 3 to 10.

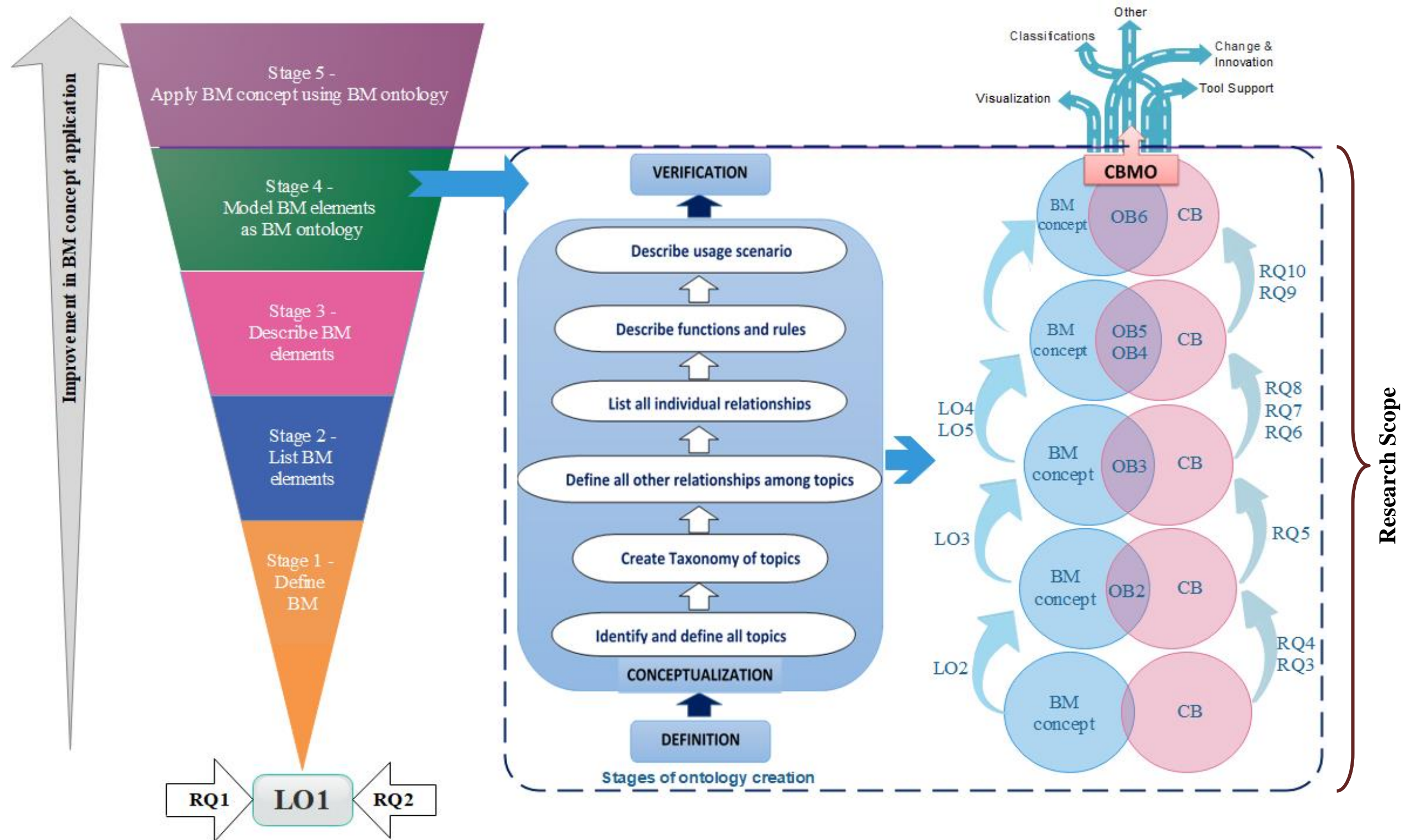
The present study does not consider the last two stages of ontology creation: (i) the Encoding stage and (ii) the Validation and Evaluation stage. However, this study has taken "apply BM concept using BM ontology" as Stage 5 of the BM development process to show that the CBMO development is the stage before BM concept application in the construction contractors' business.

Accordingly, considering the coherent set of literature findings described in several sections in this chapter, a conceptual framework was developed, illustrating the most relevant factors extracted from the literature review within research boundaries, as shown in Figure 2.12.

The conceptual framework comprises the two main concepts: the BM concept and Construction Business (CB). As per Figure 2.12, the research objectives must be achieved by answering Research Questions (RQs) to merge the BM concept and Construction Business (CB). In addition, relevant literature outcomes were employed under each objective (Table 2.15).

Figure 2.12

Conceptual Framework



As per the conceptual framework (Figure 2.12), the BM concept application in the CB can be improved eventually for developing CBMO. Furthermore, the developed CBMO can then be applied for several purposes, e.g., developing tools to support BM design, BM changes, and BM innovations. Hence, the conceptual framework in Figure 2.12 guided the empirical stage of the study for answering RQs.

2.15. Chapter summary

Chapter 2 further synthesised the current knowledge gaps of the research area to the background discussed in Chapter 1. This chapter established the significance and role of BMs, highlighting the helpfulness of its usage in the construction business where BM application is lacking. Reviewing the existing BM literature revealed that BM application in a particular field can be improved through BM ontology development. The BM development and the ontology creation processes provide a road map for developing a BM ontology.

Initially, a definition for CBM was developed following a systematic process created by the researcher to achieve OB2 of the study. Likewise, literature outcomes for each stage of the BM development process were used to establish RQs. Ultimately, the conceptual framework was developed to summarise the overall discussion in the chapter and illustrate how to achieve the research aim and improve BM application in the construction business. The next chapter presents the research design after devising the conceptual framework.

3. RESEARCH METHODOLOGY

3.1. Introduction

Chapter 2 presented a detailed review of literature emphasising the BM concept and its significance for a business. Nevertheless, the extant construction literature has identified wide research gaps in the BM concept's application and established RQs towards achieving the research aim and objectives. Thus, Chapter 3 elucidates the researcher's approach with respect to the methodological framework of the research. The research philosophy, research design, and research process have been broadly discussed here, along with explanations of the data collection techniques and data analysis.

3.2. Reviewing literature

According to Webster and Watson (2002), a literature review is a foundation for advancing knowledge that facilitates theory development and discloses areas with research needs. Generally, a literature review is conducted through two main steps (Tranfield et al., 2003): (i) a Preliminary literature search helps to form a broader view of research ideas as the first step, and (ii) A critical literature review sharpens research ideas to a workable research problem towards achievable research objectives.

A thorough knowledge about a topic can be acquired by reviewing the literature, enabling conducting of the research (Hart, 2018). The author further identified other purposes of reviewing relevant literature, such as differentiating what has been done from what needs to be done, discovering important variables relevant to the topic, identifying relationships between ideas and practice, establishing the context of the topic or problem, justifying the significance of the problem, enhancing and acquiring the subject vocabulary, and identifying the main methodologies and research techniques used. Reviewing literature through different sources, e.g., journal articles, books, conference publications, websites, and institutional reports, could reach almost all these purposes.

Saunders et al. (2019) identified the requirement of searching literature throughout the entire research project duration, from research questions and objectives to writing the final draft of the critical literature review. Thus, the process of defining parameters (i.e., generating and refining keywords, searching, obtaining literature, evaluating, recording and drafting, and redefining parameters) repeats as a spiral (Saunders et al., 2019).

A Business Model (BM) concept map (refer Annexure 3.1) was created to visualise and organise the BM concept knowledge and thereby define the parameters and refined keywords. This redefined and narrowed the research area to find gaps in the BM literature related to the construction industry. Further, a specific literature review helped detect the significance of BMs, roles of a BM, the evolution of BM research, and stages of the BM research development process towards enhancing the application

of the BM concept in the construction business. The Auxiliary (Annexure 3.2) gives the vocabulary and their meanings related to the BM concept acquired from the literature.

Through a critical review of the literature, the researcher established the research problem, the aim, and objectives while identifying the Literature Outcomes (LOs) concerning the objectives OB1, OB2, OB3, OB4, and OB5 (Table 2.15). Subsequently, the conceptual framework was developed (Figure 2.12). Finally, the researcher formulated several research questions to attain more focus, as stated in Section 2.14 and summarised in the next section.

3.3. Research Questions (RQs)

Research questions guide investigating narrow areas and every aspect of the research study with the organisation of topics under study. This research comprises ten (10) RQs, presented as follows:

- RQ1 What is the requirement of proper BM application in a field?
- RQ2 What is the situation in the construction industry regarding BM application requirements?
- RQ3 What is the suitable process for developing a CBM definition?
- RQ4 What is the definition of CBM?
- RQ5 What suitable BM elements can be used for developing a BM ontology for construction contractors' business?
- RQ6 How to describe each of the above BM elements using suitable parameters?
- RQ7 What is the composition of the BM ontology for construction contractors' business?
- RQ8 What are the relationships among BM elements of the BM ontology for construction contractors' business?
- RQ9 What is the proposed BM ontology for construction contractors' business?
- RQ10 How to use the proposed BM ontology for designing CBM for a sample scenario related to construction contractors' business?

The way of asking RQs inevitably leads to different purposes of research, which may change over time (Saunders et al., 2019). Therefore, the following section discusses the purpose of this research based on its nature.

3.4. Purpose of the research

The research design and its achievement of any research study depend on the research purpose (Kothari, 2004). Saunders, Lewis, and Thornhill (2016) highlighted that a

research design fulfils five purposes: (i) exploratory, (ii) descriptive, (iii) explanatory, (iv) evaluative, and (v) combined.

An exploratory study is a valuable means of finding out ‘what is happening; seeking new insights; asking questions; assessing phenomena in a new light’ (Robson 2002, p.59). Such studies help ensure the precise nature of an issue, problem, or phenomenon by clarifying the understanding (Saunders et al., 2016). The descriptive studies may be an extension or a piece of exploratory research. The purpose is to gain a clear picture or accurate profile of the phenomena on which the data are collected (Saunders et al., 2016).

Furthermore, if a research project utilises description, it is likely to be a precursor to explanation, and such studies are known as ‘descripto-explanatory studies’. Besides, studies that establish causal relationships between variables may be termed ‘explanatory research’ where a situation or a problem is studied to explain the relationships between variables (Saunders et al., 2016). Finally, evaluative studies are conducted to determine how well something works, emphasising the understanding of ‘how effective’ something is and ‘why’ (Saunders et al., 2016).

However, research studies can have multiple purposes—such studies can be considered ‘combined studies’ (Saunders et al., 2019). Also, as pointed by Robson (2002), the purpose of the research may change over time.

This research was developed for the exploratory purpose of clarifying the understanding of the BM concept to assure the precise nature before applying it to the construction business. Exploratory research also involves finding out what is happening regarding BM development in the construction business, developing BM ontology considering the practical context of the construction business, and assessing the BM concept in different set up (construction business). Therefore, this study also searched the literature, conducted case studies and interviewed ‘experts’ of the construction business as ways of conducting exploratory research identified by Saunders et al. (2016).

Next, a descriptive study is required to define the research aspects based on RQs, such as defining CBM and describing and identifying describing parameters of elements of CBMO for the construction business. Hence, the study can be considered a ‘descripto-explanatory’ study, being a precursor to an explanation. Finally, the research was developed into a stage with an explanatory purpose by establishing and explaining relationships among elements for CBMO in the construction business context.

3.5. Research design

“Research design logically links the research questions to the research conclusions through the steps undertaken during data collection and data analysis” (Baskarada, 2014, p. 5). It is a conceptual structure that facilitates the researcher to efficiently yield maximum information relevant to the research (Kothari, 2004). On the other hand, a defective research design may cause misleading findings (Kumar, 2011). Hence,

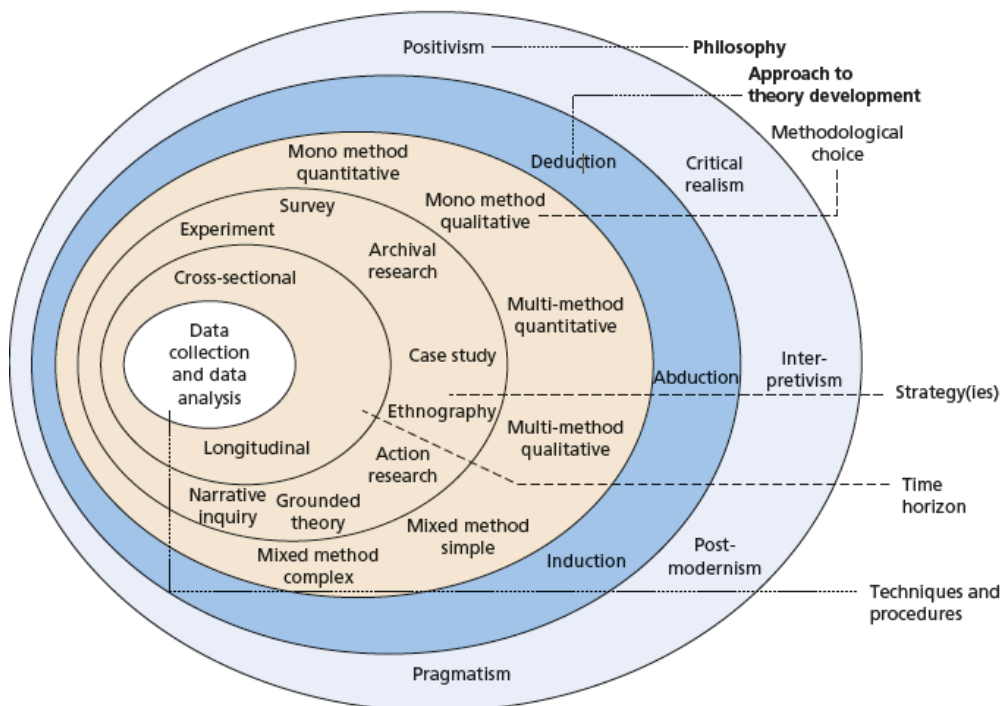
selecting an appropriate research design ensuring validity, workability, and manageability is essential (Kumar, 2011), and the choice of research design also depends on the nature of the research problems and RQs (Walliman, 2011).

Some considerations have to be made when preparing a research design fitting for a particular research problem and RQs: (i) the means of obtaining the information; (ii) the skills of the researcher; (iii) the reasons for selecting the means of obtaining information and ways of organising selected means; (iv) the time available for research; and (v) the availability of finance for the research (Kothari, 2004).

Two popular hierarchical models are available for formulating the research methodology of a research project: (i) the Nested Model with three steps; research philosophy, research approach, and research techniques by Kagioglou et al. (1998), and (ii) the Research Onion with six steps: philosophy, approach, methodological choice, strategies, time horizon, and techniques and procedures by Saunders et al. (2016 and 2019). Both models contain the main steps required to conduct effective research. However, the Research Onion is comparatively advantageous to the ‘nested approach’ of Kagioglou et al. (1998) due to the increased number of layers and availability of different options. Figure 3.1 illustrates the Research Onion adopted from Saunders et al. (2019).

Figure 3.1

The Research Onion



Source: Saunders et al. (2019)

The added layers of the Research Onion provide more information and different choices required to decide on an appropriate methodology and illustrate the steps to design and effectively describe a methodological study of research. The research onion

is adaptable for almost any type of research methodology and applicable to various contexts (Bryman, 2012).

Therefore, Research Onion was chosen as the most suitable research methodological guidance model for this study. The Research Onion contains six layers that describe the steps of a methodological study.

Understanding the research philosophy is the first step, which is the point of departure for the appropriate research approach. The subsequent layers are research choices, strategies, time horizons, and techniques and procedures. The following sections describe the layers of the research onion while peeling off layer by layer to achieve the aim and objectives of this study.

3.6. Research Philosophy

Researchers should understand what knowledge is and how to make sense of the surroundings from the philosophical position since research is about acquiring knowledge and developing understanding, collecting facts, and interpreting them to build a picture of the world around and within us (Walliman, 2011).

Research methodology literature includes many different terms and categorisations for research philosophies with overlapping emphasis and meanings. The term ‘research philosophy’ is broadly related to the development of knowledge and the nature of that knowledge (Saunders et al., 2019). According to Bryman (2012), it is a set of beliefs regarding the nature of the reality investigated through a research study. As per Walliman (2011), all the philosophical positions and associated methodologies, explicitly or implicitly, hold a view about the reality that determines what can be the appropriate knowledge.

Many studies (e.g., Saunders et al., 2019; Bryman, 2012; Creswell, 2014) have presented different research paradigms and philosophies. For example, Creswell (2014) presented four philosophical worldviews: (i) post-positivism, (ii) constructivism, (iii) transformative, and (iv) pragmatism. The outer layer of the Research Onion of Saunders et al. (2019) shows five philosophical positions: (i) positivism, (ii) critical realism, (iii) interpretivism, (iv) postmodernism, and (v) pragmatism. Since this investigation follows the Research Onion of Saunders et al. (2019), it takes five philosophical stances for understanding the philosophy of this research.

Positivism relates to natural science dealing with an observable social reality to produce law-like generalisations where knowledge is shaped by data, evidence, and rational considerations (Saunders et al., 2019). Laws and theories are tested, verified, and refined to understand the world with a positivist view (Creswell, 2014). In contrast, interpretivism (constructivism) refers to a study of meanings created by humans, highlighting those humans are different from physical phenomena (Saunders et al., 2019). Hence, interpretivism creates interactions among individuals concerning specific contexts (Creswell, 2014) and produces knowledge by exploring and

understanding the people’s social world, focusing on their meanings and interpretations (Ormston, Spencer, Barnard, & Snape, 2014).

Other than the two end philosophies, i.e., positivism and interpretivism, Saunders et al. (2019) identified three other philosophies: critical realism, postmodernism, and pragmatism. Critical realism explains what is seen and experienced in terms of the underlying structures of reality that shape the observable events (Saunders et al., 2016, p. 138), while postmodernism emphasises the role of language and power relations, seeking to question accepted ways of thinking and give voice to marginalised alternative views (Saunders et al., 2019, p. 149). Finally, the pragmatism worldview arises from actions, situations, and consequences rather than antecedent conditions (Creswell, 2014).

Different research philosophies are created with assumptions about how researchers view the world (Saunders et al., 2016). As per Saunders et al. (2019), the three (03) basic assumptions are (i) ontology (nature of reality), (ii) epistemology (what constitutes acceptable, valid, and legitimate knowledge and how that knowledge is communicated to others), and (iii) axiology (the role of values). The philosophical assumptions are further spread between two extremes: (i) Objectivism and (ii) Subjectivism, as illustrated in Table 3.1.

Table 3.1 *Characteristics of Philosophical assumptions at two extremes*

Philosophical Assumption	Objectivism extreme	Subjectivism extreme
Ontology	Real	Nominal/decided by convention
	External	Socially constructed
	One true reality	Multiple realities
	Granular (things)	Flowing (processes)
Epistemology	Adopt assumptions of the natural scientist	Adopt the assumptions of the arts and humanities
	Facts	Opinions
	Numbers	Written, spoken, and visual accounts
	Observable phenomena	Attributed meanings Individuals and contexts, specifics
	Law-like generalizations	
Axiology	Value-free	Value-bound
	Detachment	Integral and reflexive

Source: Adapted from Saunders et al. (2019)

Objectivism portrays that reality is external to the social actors, and it is made up of solid, granular, and relatively unchanging ‘things’ where a law-like generalisation can be drawn using observable and measurable facts. Subjectivism emphasises that reality is made from social actors' perceptions and consequent actions. As summarised in Table 3.1, the characteristics of three philosophical assumptions are differed under objectivism and subjectivism.

On the other hand, the characteristics of the main philosophical positions are also differed based on the three philosophical assumptions. Table 3.2 summarises the characteristics of the main philosophical positions by understanding the differences in

beliefs, views, and values of each philosophical position based on philosophical assumptions.

Table 3.2

Comparison of Philosophical positions

	Ontology	Epistemology	Axiology
Positivism	Real, external, independent, One true reality (universalism) Granular, Ordered	Scientific method, Observable & measurable facts, Law-like generalizations, Numbers, Causal explanation & prediction as a contribution	Value-free research, Researcher is detached, neutral and independent of what is researched, researcher maintains an objective stance
Critical realism	Stratified/layered (the empirical, the actual & the real), External, independent, Intransient Objective structures Causal mechanisms	Epistemological relativism Knowledge historically situated and transient Facts are social constructions Historical causal explanation as a contribution	Value-laden research, researcher acknowledges bias by world views, cultural experience & upbringing, researcher tries to minimise bias & errors and is as objective as possible
Interpretivism	Complex, rich, Socially constructed through culture & language, Multiple meanings, interpretations, realities A flux of processes, experiences, practices	Theories and concepts too simplistic Focus on narratives, stories, perceptions and interpretations New understandings and worldviews as contribution	Value-bound research Researchers are part of what is researched subjective Researcher interpretations key to the contribution Researcher reflexive
Postmodernism	Nominal, Complex, rich Socially constructed through power relations, Some meanings, interpretations, realities are dominated & silenced by others A flux of processes, experiences, practices	What counts as ‘truth’ & ‘knowledge’ is decided by dominant ideologies, Focus on absences, silences & oppressed/repressed meanings, interpretations and voices, Exposure of power relations and challenge of dominant views as a contribution	Value-constituted research Researcher and research embedded in power relations Some research narratives are repressed and silenced at the expense of others Researcher radically reflexive
Pragmatism	Complex, rich, external ‘Reality’ is the practical consequences of ideas A flux of processes, experiences and practices	Practical meaning of knowledge in specific contexts, ‘True’ theories and knowledge are those that enable successful action, Focus on problems, practices and relevance Problem-solving and informed future practice as contribution	Value-driven research Research initiated and sustained by the researcher’s doubts and beliefs Researcher reflexive

Source: Saunders et al. (2019)

The discussion on the commonly available research philosophies in the literature is followed by the next section that presents the philosophical positions specifically adapted for this research.

3.7. The philosophical position of the research

The research philosophy is the central parameter to “Why research?” decided based on the researcher’s assumptions about the inter-related concepts (Holden & Lynch, 2004). Accordingly, Table 3.3 justifies the philosophical assumptions of this research adapted for each objective concerning the three research assumptions identified by Saunders et al. (2019): (i) ontology, (ii) epistemology, and (iii) axiology.

Table 3.3

Philosophical assumptions adopted for this research

	Ontology	Epistemology	Axiology
OB 1	Critically reviewing literature found multiple realities and socially constructed world about BM concept due to different definitions, BM compositions, and BM elements. Hence mostly subjectivism .	Literature found both facts and opinions related to the BM concept in different business domains. Also, a typical BM development process, different BM frameworks with different and common elements could be found in different contexts. Hence both objectivism and subjectivism is applied	Reviewing literature and identifying the gap mostly value-free and also value-bound to some extent
OB 2	When defining BM definition for Construction Business (CB), both objectivism and subjectivism is adopted because some aspects of BM are common to all the business domains and some aspects to be considered based on CB and decided by the convention of CB	Since the CBM definition is developed using literature and verified or modified with experts' opinions, different social realities of different social actors are accounted. Also, as a definition, it is required to be commonly accepted and generalized within the CB context. Hence both objectivism and subjectivism is adopted	This objective is both value-free and value-bound because the researcher's experience was included for developing CBM definition for some aspects and not for all.
OB 3	Similar to the first objective, there can be common BM elements to all business domains and specifics for CBM. Hence, both objectivism and subjectivism are taken into consideration	When deciding BM elements for CB, both facts and opinions to be considered and need a common agreement among CB experts. Thus both objectivism and subjectivism is applied	This is both value-free and value-bound because the researcher's experience was included when selecting BM elements in the CB context for some aspects and not all.
OB 4	When analysing and describing BM elements and establishing parameters for that, most of the knowledge exists within the social phenomenon, and some are external. Therefore it is little objectivism and mostly subjectivism .	Mostly resolved with the use of opinions of CB experts and attributed meanings of CB context and specifics. However, some facts from outside the social phenomenon also be considered when deciding parameters. Hence mostly subjectivism	This is mostly value-bound as it is opinion and context-based except for selecting some parameters
OB 5	Objectivism and subjectivism are required because knowledge of relationships among BM elements was gathered externally as well as from the social phenomenon (Construction industry)	Relationships can be identified from the facts in the business milieu considering objectivism while establishing them using opinions and attributed meanings related to CB context and specifics considering subjectivism .	The researcher would need to add the experience as value-bound for the aspect of gathering opinions , but it is also a little value-free in deciding some relationships
OB 6	Objectivism applies considerably because the BM ontology development involves knowledge from outside the social phenomenon	Facts from outside the phenomenon for developing an ontology and some generalization is required to be adopted with validation. Hence considerably objectivism	This objective is value-free because the detachment is required for the creation of the framework/ontology

Table 3.3 explains the philosophical stance of the research objectives considering common characteristics of philosophical assumptions illustrated in Table 3.1 under two extremes: (i) objectivism and (ii) subjectivism. Ontologically, the research objectives of this research are assumed to be partly objectivism and partly subjectivism, where the knowledge of developing a BM ontology for construction business would be both external and socially constructed.

As per Table 3.3, epistemologically, the nature of the objectives of this research tends to decide the acceptable knowledge is related to both objectivism and subjectivism, with more weight to subjectivism. This research constitutes mainly practices of construction companies (cases), the opinions of construction business managers and experts, and attributed meanings of specific contexts with a few facts. Therefore, this study adopts a combination of value-laden and value-free based on the nature of the objectives axiologically. Moreover, as a professional member of the construction industry, the researcher is openly acknowledged and reflexive on values incorporated in the research. Hence, this research cannot be totally detached from the researcher's values and beliefs.

According to Creswell (2014), the philosophical pragmatism position opens the door to different worldviews, different assumptions, multiple methods, and various methods of data collection and analysis. It aims to accommodate both objectivism and subjectivism, facts and values, accurate and rigorous knowledge, and different contextualised experiences (Saunders et al., 2019). Further, Holden and Lynch (2004) pointed out that the intermediate philosophical position allows the researcher to match philosophical perspective, methodology, and problem. Saunders et al. (2019) stated that the pragmatism view is perfectly possible to work with different knowledge and methods. Hence, pragmatism is the most appropriate philosophical position of this research since the researcher wishes to consider research questions without prior conditions and answer research questions based on freely selected methods.

It is also believed that a single point-of-view cannot produce the entire picture of this research area; there can be many ways to interpret the research area and methods to collect credible, reliable, and relevant data to improve the research. Therefore, it is the perfect philosophy to proceed with this study where the research questions are not suggested to accept one type of knowledge. Thus, with the understanding of research philosophy, the next layer to be peeled off is research approaches.

3.8. Research Approaches

Deduction, *induction*, and *abduction* are the three terms the second layer of the research onion includes as per Figure 3.1. The objective of the deductive approach is to test or verify a theory rather than develop a theory. However, the inductive approach builds from the data to broad themes to generalised models or theories (Creswell, 2014), whereas the research starts with a theory, and a research strategy is designed to test the theory in the deductive approach (Saunders et al., 2019).

In contrast, research starts by collecting data to explore a phenomenon and then generating or building theory in an inductive approach. Considering the combination of both the above approaches, where data is collected to explore a phenomenon, identify themes and explain patterns, and generate a new or modify an existing theory which is subsequently tested through additional data collection, it is an abductive approach (Saunders et al., 2019).

Due to the tendency of constructing a rigid methodology and highly structured research design, the deductive approach does not allow for alternative explanations of what is going on (Saunders et al., 2019). On the other hand, the inductive approach is used in research where reasoning is likely to be particularly concerned with the context of events where a large sample is not required (Saunders et al., 2019). In addition, the deductive approach is associated with a quantitative research approach, and the inductive approach is typically linked with a qualitative research approach as a tradition (Bryman, 2012; Creswell, 2014). However, Saunders et al. (2019) identified that most management research tends to use at least some elements of abduction due to difficulty in adapting pure deduction or pure induction approaches. As such, a well-developed abductive approach is most likely to be supported by pragmatism.

Furthermore, when the research topic owns a wealth of information in one context, but the researching context has far less information, an abductive approach tends to be used, enabling modifying an existing theory (Saunders et al., 2019). Table 3.4 presents general characteristics of the abductive approach concerning its logic, generalisability, use of data and theory, which can be matched with this research.

Table 3.4

Characteristics of the abductive approach

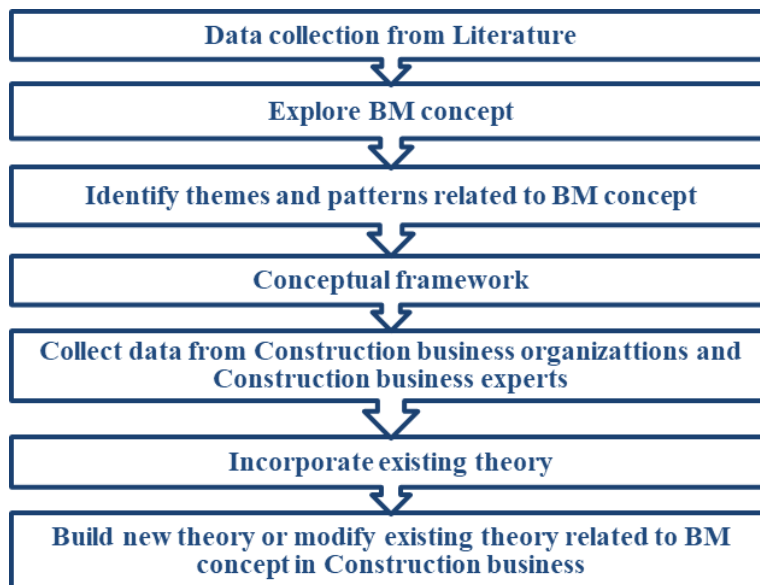
Area	Characteristic of abductive approach
Logic	In an abductive inference, known premises are used to generate testable conclusions
Generalisability	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory generation or modification; incorporate existing theory where appropriate, build new theory or modify existing theory

Source: Adapted from Saunders et al. (2019)

Ultimately, this research applies an abductive approach by considering the abovementioned facts. In the beginning, the research is a ‘deduction’, which then moves into ‘induction’ under the pragmatism philosophical view. Figure 3.2 illustrates the abduction process followed in this research.

Figure 3.2

The abduction process followed in this study



First, the literature on the BM concept, including its elements, definitions, perspectives, and categories, is sufficiently detailed and rich, allowing exploring the phenomenon and identifying and explaining themes and patterns related to the BM concept. Then, a conceptual framework was developed by incorporating the information gathered from literature, highlighting the gap in the existing literature within the construction business context and illustrating what to find through the research. Next, the data would be collected from the highest-graded construction business organisations and construction business experts, where a large sample could not be collected to explore specific information for the construction business. Finally, a new or modified theory could be built up for the BM concept related to the construction business by incorporating collected data.

After understanding the two outer layers of the research onion, the following section uncovers the third layer, i.e., methodological choices.

3.9. Methodological Choices

Saunders et al. (2019) divided the methodological choices of research designs mainly into three categories: (i) quantitative, (ii) qualitative, and (iii) mixed. Qualitative and quantitative research designs are further divided into ‘mono method’ and ‘multi-method’, while the mixed method ranges from simple concurrent forms to more complex and sequential forms (Saunders et al., 2019).

Table 3.5 illustrates the characteristics of each methodological choice where mono methods follow a single data collection technique and corresponding analysis procedure, and multi-methods use more than one data collection technique and corresponding analysis procedures to answer RQs. On the other hand, the mixed-methods study combined quantitative and qualitative techniques in various ways

ranging from simple concurrent forms to more complex and sequential forms (Saunders et al., 2019).

Table 3.5 *Use of different research choices*

Research Choice		Use
Quantitative	Mono method quantitative studies	A single quantitative data collection technique and corresponding quantitative analytical procedure
	Multi-method quantitative studies	More than one quantitative data collection technique and corresponding quantitative analytical procedure
Qualitative	Mono method qualitative studies	A single qualitative data collection technique and corresponding qualitative analytical procedure
	Multi-method qualitative studies	More than one qualitative data collection technique and corresponding qualitative analytical procedure
Mixed methods	Mixed-methods study (simple) - Concurrent	Use quantitative and qualitative methods separately within a single phase of data collection and analysis.
	Mixed-methods study (complex) - Sequential	Use quantitative and qualitative methods within more than one phase of data collection and analysis where one method follows the another.

Source: Adapted from Saunders et al. (2019)

The research design is necessary to distinguish between quantitative and qualitative studies. Generally, quantitative studies use numeric data (numbers) employing data collection techniques, e.g., questionnaires, whereas qualitative studies employ data collection techniques, e.g., interviews generating non-numerical data (words). Table 3.6 distinguishes the characteristics of quantitative and qualitative studies listed by Saunders et al. (2019).

Table 3.6

Characteristics of quantitative and qualitative research designs

Characteristics of quantitative research designs	Characteristics of qualitative research designs
The researcher is generally independent of those being researched	The researcher is generally not being independent from those researched
Designed to examine relationships between variables	Designed to study participants' attributed meanings and associated relationships
Often use probability sampling techniques	Generally use non-probability sampling techniques
Data collection methods are rigorously defined and highly structured	Data collection methods are unstructured or semi-structured
Data collection is numerical and standardised	Data collection is non-standardised, like categorization
Data analysis uses statistics and diagrams	Data analysis use conceptualisation
Resulting meanings derived from numbers	Resulting meanings derived from words and images

Source: Adapted from Saunders et al. (2019)

The characteristics of quantitative research design cannot be matched when considering the nature of this research, research objectives, and RQs. For example, choosing a large sample under the probability sampling technique to gather quantitative data is difficult and unreliable in this research because the BM concept and BM ontology are unfamiliar concepts to the construction industry, and construction business managers have minimal knowledge of those concepts. Therefore, the researcher cannot be independent of those researched, requiring clarification of the concept while interviewing. Henceforth, mixing quantitative and qualitative data to follow mixed methods is also impossible, though there are many valuable reasons to use mixed methods in research, e.g., triangulation, facilitation, complementarities, generality, aid interpretation, study of different aspects, solving a puzzle, and diversity (Tashakkori & Teddlie, 2003; Saunders et al., 2019).

Qualitative studies try to understand multiple dimensions, e.g., the types of people in a group, how they think, how they interact, what kinds of agreements or norms are present, and how these dimensions amalgamate holistically to describe the group, which can be used when little is known about a topic or phenomenon requiring more information (Antwi & Kasim, 2015). Hence, this study adopts a qualitative research design conforming to the research requirements and thereby explore the business practice and attributes of the highest-graded contracting organisations in Sri Lanka and express the perspectives of construction business experts in developing a BM ontology for the construction business.

Tashakkori and Teddlie (2003) argue that multiple methods are helpful if those methods provide better opportunities for answering RQs and evaluating findings. Hence, it is vital to ensure that the selected methods meet the study's RQs and objectives (Saunders et al., 2016).

Even though it is challenging to collect data from two or more independent sources due to less accessibility of business documents of organisations, the published websites acted as a source of data collection, as the interviews provided only qualitative data. Hence, this research involved two sources of data collection: interviews with top-level construction managers and official websites of the contracting organisations.

In addition, a qualitative research design can be undertaken within the pragmatism philosophical stance to add up socially constructed meanings about the phenomenon and use with the abductive approach to theory development (Saunders et al., 2019). Ultimately, this research used a multi-method qualitative research design where more than one qualitative data collection technique is used to collect qualitative data.

Research strategy is the next layer of the research onion to be adopted, which is another fundamental decision-making point.

3.10. Research Strategies

Selecting a research strategy is directed by the RQs, research objectives, the extent of existing knowledge, available time, and other resources and philosophical

underpinnings (Saunders et al., 2009). Research strategies mainly identified in the literature are the experiment, survey, case study, action research, grounded theory, ethnography, and archival research (Creswell, 2014; Yin, 2009; Saunders et al., 2019). As per Yin (2009), each research strategy can be used for exploratory, descriptive, and explanatory purposes.

Table 3.7 presents the main characteristics of the above research strategies. In addition, Table 3.7 indicates the inappropriate characteristics of those strategies in relation to this research by putting “x” in front of the characteristic.

Table 3.7

Characteristics of research strategies

Research Strategy	Characteristics		Ref.
Experiments	The purpose is to study causal links		[3]
	Costly and complex	X	
	Undertaken within controlled situations	X	[2] [4]
	Answer ‘how’ and ‘why’ questions		[1]
	Not be feasible for many business & management research questions	X	
	More relates to natural sciences	X	[4]
	Unlikely to be related to the real world of organizations	X	[4]
Surveys (Quantitative)	Answer ‘who’, ‘what’, ‘where’, ‘how much’ and ‘how many’ questions	X	[1] [4]
	Associated with the deductive approach	X	
	Allow the collection of a large amount of data from a sizeable population in a highly economical way	X	
	Suggest possible reasons for particular relationships between variables and produce models of these relationships		
	Data are standardized and allow easy comparison	X	
	Generate findings that are representative of the whole population	X	
	Used for explanatory and descriptive research		
	A popular strategy in business and management research		
	Collect quantitative data	X	
	Need to ensure that the sample is representative	X	
Qualitative Survey	A study of diversity (not distribution) in a population		[5]
	determining the diversity of some topic of interest within a given population		
	Use in different contexts		
	Establishes the meaningful variation (relevant dimensions and values) within that population		
	It can be used casually in various fields of empirical research		[6]
	Researcher’s characteristics & reflexivity influence the research		
	It is both logical and more efficient to purposively select a diversity sample to cover all existing relevant varieties of the phenomenon		[5]
	Sample sizes are much smaller than is required for a quantitative survey		[7]
Case studies	Can gain a rich understanding of the context of the research and the processes being enacted		[1]
	Use in exploratory, descriptive and explanatory research		[9]
	Use to investigate a particular contemporary phenomenon within its real-life context, using multiple sources of evidence		[8]
	Answers to the question ‘why?’ ‘what?’ and ‘how?’ questions		
	Multiple case studies can be chosen to allow replication		[4]

Research Strategy	Characteristics		Ref.
Action research	Concerned with the resolution of organizational issues	X	[1] [4]
	To be a collaborative, democratic partnership between practitioners and researchers	X	
	The researcher is part of the organization	X	
	Iterative nature of the process		
	Explicitly focus on action	X	
	'How' questions		
	Focus on change		
	Involvement of employees (practitioners) throughout the process.	X	
Archival Research	Availability and accessibility of documents are essential. Getting access to documents that may not be commercially sensible	X	[4]
	As secondary sources use, the quality of the original data needs to be assessed	X	
	Makes use of administrative records and documents as the principal source of data	X	[1]
	RQs focus upon the past and change over time	X	
Grounded theory	The best example of the inductive approach	X	[1]
	Helpful for research to predict and explain behaviour		
	It can be used to explore a wide range of business and management issues		
	Data collection starts without the formation of an initial theoretical framework	X	[4]
	Data collection starts as soon as the research idea has been developed	X	[2]
	Develop theory that is grounded in data systematically gathered and analysed		[4]
	Time-consuming, intensive and reflective	X	
Ethnography	A form of qualitative research focused on discovering and describing the culture of a group of people	X	[2]
	Rooted firmly in the inductive approach	X	[1] [4]
	Time-consuming and takes place over an extended time period	X	
	Appropriate for researches need to gain insights about a particular context and better understand and interpret it from the perspectives of those involved		
	Participants observations need to be done over an extended period of time	X	
References - [1] Saunders et al.(2009); [2] Christensen, Johnson & Turner (2014); [3] Hakim (2000); [4] Saunders et al. (2019), [5] Jansen (2010), [6] O'Brien, Harris, Beckman, Reed, and Cook (2014), [7] Twining et al. (2017), [8] Yin (2009); [9] Yin (2018)			

Considering the nature, research objectives, and RQs of this research, the following reasons caused the inappropriateness of some of the above strategies;

- Unfamiliarity and inadequacy of knowledge on the BM concept and BM ontologies among participants in the construction industry.
- Need for explanations and clarifications of the concept for the participants while collecting data due to unfamiliar terms in BM and BM ontology concepts.
- Difficulty in taking a large representative sample with both business knowledge and construction expertise for collecting data.

- Difficulty in accessing some data sources due to business nature and confidentiality reasons.

Accordingly, the strategies; experiment, quantitative survey, action research, archival research, grounded theory, and ethnography possess many inappropriate characteristics, confirming their unsuitability for this research. On the other hand, when appropriate characteristics are concerned, qualitative survey and case study strategies fit this study in answering RQs with the pragmatism philosophical view, where selecting the best strategy to answer RQs is the primary focus.

As per Section 3.9, this research is proved to be a qualitative study. The “case study strategy” is suitable for this study to collect qualitative data, as it is an empirical inquiry for investigating a contemporary phenomenon in its real-life context where controlling behavioural happenings or variables is not required (Yin, 2009). Further, the case study investigates the particular unit intensively under consideration and purposes to find the factors that represent the behaviour patterns of the given unit as an integrated totality (Kothari, 2004). Therefore, to investigate and understand the highest-graded construction contractors’ business practices and the business attributes they use in business planning and decision-making to develop a BM ontology, this study initially followed the case study strategy with multiple cases. Then, as the other strategy suitable for this research study, a qualitative survey describes the diversity of specific cognitions or behaviours in a population through semi-structured interviews with a small sample of population members followed by qualitative studies (Jansen, 2010). Further, the pragmatism philosophical view accepted working with both case studies and a qualitative survey.

3.11. Time horizon

Peeling of this layer allows one to reach the research onion’s core, emphasising the time horizon of the research commenced. As per Saunders et al. (2019), the research design can be of two types: (i) longitudinal and (ii) cross-sectional.

In cross-sectional research, data are collected at a single point or during a single relatively brief period from the participants. On the other hand, the longitudinal research data are collected from the participants at multiple time points, making comparisons across time (Christensen et al., 2014). Although cross-sectional research has the shortcoming of its confinement to a particular point in time, this study adopted cross-sectional research that identifies a snapshot of a sample population at a particular point of time as academic research. The study was conducted between November 2017 to July 2022. The following section discusses the techniques and procedures to collect and analyse data within the identified time horizon.

3.12. Techniques and procedures

Finally, the research design moved towards the core of the research onion or final layer: techniques and procedures that explain the data collection and analysis

techniques and the research procedures. The previous selections provided the basic idea about data collection and analysis procedures, which help answer the RQs; this section discusses them in detail.

3.12.1. Techniques and procedures for data collection

The empirical data collecting process regarding the RQs consists of two (02) phases. The two phases were divided based on the data requirement of the research and RQs to be answered. Phase I focuses on collecting qualitative data from multiple case studies to find the current practice and business attributes considered by the highest-graded contractors in Sri Lanka and BMs in the context of the Sri Lankan construction industry with the following purposes:

- To identify the availability of specific company BMs in the highest-graded contracting organisations in Sri Lanka
- To identify and understand the BM concepts among construction business managers of highest-graded contracting organisations.
- To find the opinions of construction business managers of the highest-graded contracting organisations regarding developing a definition for CBM.
- To identify the business attributes considered by the highest-graded contracting organisations in their business decisions and underlying reasons for using such attributes.

Phase I findings helped develop basic taxonomies of identified BM elements in the construction business, which were then incorporated into Phase II data collection. The basic taxonomies developed through Phase I data analysis were presented to the Phase II construction business experts under qualitative survey strategy.

The purpose of conducting a qualitative survey in Phase II is to investigate further information and improve precision. Finally, both Phase I and Phase II data contributed to establishing relationships among identified BM elements and developing CBMO.

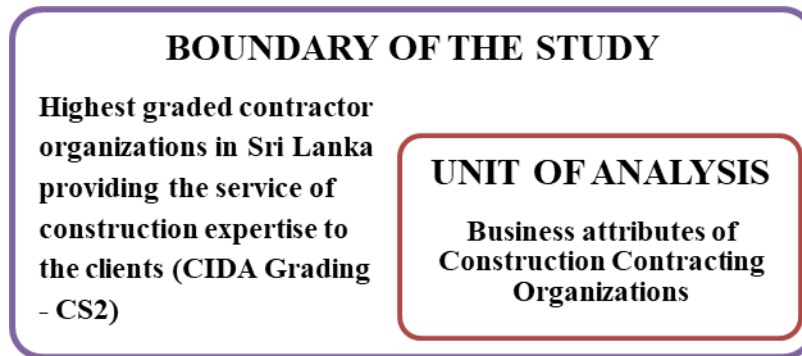
3.12.2. Phase I – Selection of cases for qualitative data collection

The case study strategy can generate answers to the question ‘why?’ and the ‘what?’ and ‘how?’ questions (Saunders et al., 2019). Therefore, the most suitable cases should be selected before formal data collection, where identifying the study’s unit of analysis is vital (Yin, 2009). The research gap of this study was found as a global issue. However, the data collection was conducted in the Sri Lankan context.

Defining the boundary of the study enables researchers to identify the scope of the study (Yin, 2018). The unit of analysis for Phase I data collection is defined as “business attributes of construction contracting organisations”. The boundary of the study is “the highest-graded contracting organisations providing the service of construction expertise to the clients”, as illustrated in Figure 3.3.

Figure 3.3

The unit of analysis and boundary of the research

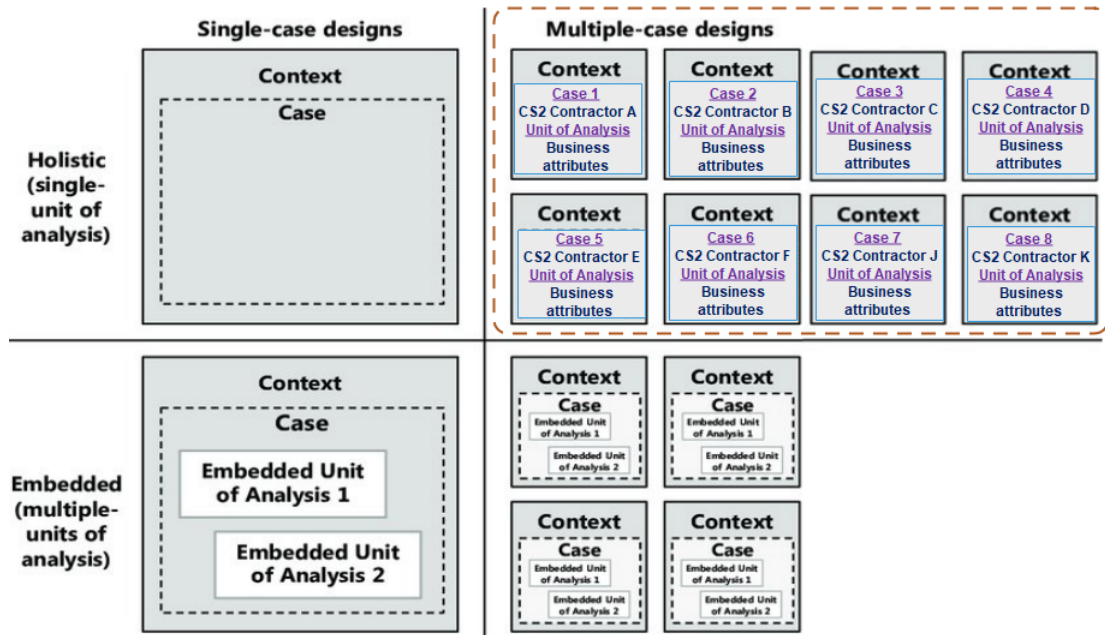


Yin (2018) identified four (04) types of case study design strategies: single-case holistic design, single-case embedded design, multiple-case holistic design, and multiple-case embedded design. The rationale of these case study designs is the attention on the number of cases and the unit of analysis. The design is holistic when there is one (1) unit of analysis, whereas more than one unit of analysis leads to an embedded design.

A single case study is most suitable when the study is focused on a critical case, an extreme or a unique case, a representative or typical case, a revelatory case, or a longitudinal case (Yin, 2009). However, this study does not represent any of such cases. Hence, by considering the nature of RQs and objectives to be achieved, this study incorporates multiple cases focusing on replication across cases. Furthermore, in this study, the cases were chosen based on the prediction that each case would have similar results considering literal replication. Therefore, this study collected data from more than one highest-graded contracting organisation (eight organisations) using one unit of analysis (refer Figure 3.3) to produce more evidence. Accordingly, this study used a multiple-case holistic case study design, as highlighted in Figure 3.4.

Figure 3.4

Case study design



(Source: Adapted from Yin, 2009)

Figure 3.4 was adapted from Yin (2009), indicating the four case study design types. The selected design type was adjusted in Figure 3.4 based on the unit of analysis and the number of cases in this study.

Different sampling techniques were considered when selecting cases. There are two groups of sampling techniques, i.e. (i) probability sampling and (ii) non-probability sampling (Saunders et al., 2016). In probability sampling, the chance of each case being selected from the population is known, confirming an equal chance for all cases being selected. Conversely, in non-probability sampling, the chance of being selected is unknown. Therefore, it is impossible to give statistical interpretations of the characteristics of the population using non-probability sampling (Saunders et al., 2016).

The research population is “a collective term used to describe the total quantity of cases of the type which are the subject of the study. It can consist of objects, people, and even events” (Walliman, 2011, p. 175). The choice of a sampling technique or techniques depends on the RQs and objectives of the study (Saunders et al., 2009). As mentioned earlier, Phase I of this research aims to collect data from the highest-graded contracting organisations in the Sri Lankan construction industry to identify the business attributes of those organisations.

Registration and grading offered by the Construction Industry Development Authority (CIDA), Sri Lanka, were considered in identifying the highest-graded contracting organisations. CIDA grading ‘CS2’ is the highest grade of contractors where the annual financial capability of the contractor is more than Rs. 3000 million. ‘CS1’ is

the second-highest grade, with an annual financial capability between Rs. 3000 million and Rs. 1500 million. Accordingly, fourteen (14) cases of CS2 contracting organisations in the Sri Lankan construction industry are the population of this study (refer Table 3.8).

This research used the purposive or judgmental sampling technique under non-probability sampling to select the sample of cases that enable to answer the research question(s) and meet research objectives, as stated by Saunders et al. (2019). Here, the researcher's judgment is required to select the sample. Table 3.8 shows the highest-graded contracting organisations in Sri Lanka with overall CS2 grade (population) with their grading for main construction fields.

Table 3.8

The population of Phase I and selection of cases

Case	Main Field of Construction									
	Buildings	Highways	Bridges	Water Supply and Sewerage	Irrigation and Drainage Canals	Dredging and Reclamation	Storm Water disposal and Land Drainage	Maritime	Heavy Construction	
A	CS2	CS2		CS2						
B	CS2	CS2		CS1	CS1					
C	CS2	CS2							CS2	
D	CS2									
E	CS2	CS2	CS1	CS2						
F	CS2	CS2								
G	CS2	CS2		CS2						
H	CS2		CS1	CS1						
J		CS2	CS2	CS2	CS1					
K		CS2								
L		CS2								
M		CS2		CS1						
N		CS2								
P		CS2								

The sample was selected based on a heterogeneous or maximum variation sampling strategy using the researcher's judgment. Heterogeneous or maximum variation purposive sampling strategy supports collecting data to describe and explain the key themes observed, ensuring the maximum variation within the sample (Saunders et al., 2019). To judge the maximum variation among cases, the fields in which the contracting organizations possess the second-highest grade were also taken into account to identify the 14 contractors' involvement in other types of fields. Eight cases with sufficiently diverse involvement in different construction fields were selected for the sample by carefully observing Table 3.8. Accordingly, Cases A, B, C, D, E, F, J, and K were nominated as the sample by further considering accessibility, availability of information, and time limitation of the research.

Using and triangulating multiple data sources is preferable under the case study strategy (Saunders et al., 2019). Data triangulation can be obtained by using data from different participants, in different settings, or at different times (Santiago-Delefosse et al., 2016), enhancing research credibility and trustworthiness (Twining et al., 2017).

Hence, two members from each case in the sample, who belong to the top management, were interviewed to collect qualitative data in Phase I. The involvement in the business decisions of the contracting organisations leads to taking top-level construction managers as interviewees.

As per Saunders et al. (2019), access to organisational documentation allows for data triangulation. Therefore, published websites of the above eight cases were chosen as another source of evidence in data collection in Phase I. However, the researcher could not access organisations' other business documents due to confidentiality.

3.12.3. Phase II – Sample selection for qualitative survey with experts

Kothari (2004) stated that in judgemental sampling, the researcher's judgment is used to select the sample that the researcher considers representative of the population. Therefore, selecting the correct sample of experts is considered the most critical factor in Phase II. The sample selected in this phase purposely depends on the researcher's judgment corresponding to the research aim. Therefore, the interviewees in Phase II were considered well-versed and experienced experts in the research area.

Since a qualitative survey establishes the meaningful variation within the population (Jansen, 2010), an explicit guidance/criteria for qualifying individuals as experts in the Phase II data collection was employed. It was ensured that the sample was knowledgeable about the studied issues as per objectives and RQs. Table 3.9 presents the criteria for defining expertise for the research area, i.e., construction business.

Table 3.9

Details of experts in Phase II data collection

Coding for Panel Expert	Criteria										
	Compulsory qualification		Additional qualifications (Experts must satisfy at least four of the following criteria)								Accessibility
	At least 5 years of experience as a Top-Level Manager in Contracting organization/s.	More than 10 years of professional experience in the construction	Graduate in construction related discipline	Top-level manager in Grade CS 2 Contractor/ foreign contracting organization	Senior Lecturer/ visiting lecturer in reputed university related to construction management	Speaker in construction management and construction business	A postgraduate degree related to construction management or business administration	Member of a construction-related reputed professional institution	Member of Board of directors of a construction organization		
PE 1	✓	✓	✓	✓		✓	✓	✓		✓	
PE 2	✓	✓	✓	✓			✓	✓		✓	
PE 3	✓	✓	✓	✓				✓		✓	
PE 4	✓	✓	✓		✓	✓	✓	✓		✓	
PE 5	✓	✓	✓		✓	✓		✓	✓	✓	
PE 6	✓	✓	✓		✓	✓	✓	✓		✓	
PE 7	✓	✓	✓		✓	✓		✓		✓	
PE 8	✓	✓	✓	✓		✓	✓	✓		✓	
PE 9	✓	✓	✓			✓	✓	✓		✓	
PE 10	✓	✓	✓		✓	✓	✓	✓		✓	

Coding for Panel Expert	Criteria										
	Compulsory qualification		Additional qualifications (Experts must satisfy at least four of the following criteria)								Accessibility
	At least 5 years of experience as a Top-Level Manager in Contracting organization/s.	More than 10 years of professional experience in the construction	Graduate in construction related discipline	Top-level manager in Grade CS 2 Contractor/ foreign contracting organization	Senior Lecturer/ visiting lecturer in reputed university related to construction management	Speaker in construction management and construction business	A postgraduate degree related to construction management or business administration	Member of a construction-related reputed professional institution	Member of Board of directors of a construction organization		
PE 11	✓	✓	✓		✓	✓	✓	✓		✓	
PE 12	✓	✓	✓				✓	✓	✓	✓	
PE 13	✓	✓	✓	✓	✓		✓	✓		✓	
PE 14	✓	✓	✓	✓	✓		✓	✓		✓	
PE 15	✓	✓	✓	✓		✓	✓	✓		✓	
PE 16	✓	✓	✓			✓	✓	✓		✓	
PE 17	✓	✓	✓		✓	✓	✓	✓		✓	
PE 18	✓	✓	✓			✓	✓	✓		✓	
PE 19	✓	✓		✓	✓	✓		✓		✓	
PE 20	✓	✓	✓		✓	✓	✓	✓		✓	

The qualitative data collection should address the research questions (Twining et al., 2017). Hence, many research books recommend collecting qualitative data until reaching data saturation (Saunders et al., 2019). Data collection is to be continued until reaching the point at which further data collection no longer reveals new patterns, themes, or insights (Twining et al., 2017; Saunders et al., 2019). Accordingly, Phase II qualitative data collection was focused on addressing the research objectives and RQs of the research using summarised results of Phase I data until reaching saturation.

Data saturation was considered during interviews even though 20 experts were selected for Phase II data collection. Data saturation was carefully considered and evaluated after every expert interview until no additional data were collected to enrich the thickness of descriptions. Thus, data saturation minimises the challenge in qualitative research, in collecting excessive data and difficulty in analysing them adequately (Twining et al., 2017).

3.12.4. Data collection techniques

As previously discussed, this study is proven to adapt the multi-method qualitative research choice where more than one qualitative data collection technique with corresponding qualitative data analysis procedures are used. The commonly used methods for collecting qualitative data are interviews, focus groups, observations, and documentary analysis. Focus groups allow having a free and open discussion between members of a group and the researcher in finding attitudes, opinions, or perceptions towards an issue, product, service, or programme where a researcher can raise issues or ask questions that stimulate discussion among group members (Kumar, 2011).

However, the focus groups are not suitable for collecting data on sensitive topics and where people are not willing to express their opinions in front of others (Harding, 2019). Under this study, focus groups were not used for data collection due to the study's business nature and difficulty in arranging groups of top-level construction managers and construction business experts.

Saunders et al. (2019) pointed out that observation is a time-consuming process, including systematic observation, recording, description, analysis, and interpretation of people's behaviour. However, data collection relating to construction businesses is impossible through observations, and access to organisations' management meetings from which such data could be obtained, is impossible. Hence, the observation technique is unsuited for this study.

Therefore, this study used interviews and documentary analysis to collect qualitative data to answer RQs.

Collecting primary data using interviews

The interviews help determine how people make decisions and examine people's perspectives (Harding, 2019). According to Saunders et al. (2009), interviews collect in-depth information related to a social phenomenon of concern and help gather valid and reliable data relevant to research questions. Based on standardisation, interviews are classified into two types: (i) standardised and (ii) non-standardised (Saunders et al., 2019).

Interviewer-administered questionnaires are used in standardised or structured interviews to collect quantifiable data, hence referred to as 'quantitative research interviews' (Saunders et al., 2019). Hence, structured interviews could not be employed in this study as it is a qualitative study where attributes related to construction businesses must be found.

Non-standardised interviews include unstructured and semi-structured interviews, where unstructured interviews or 'in-depth interviews' allow the interviewee to talk freely to explore in-depth information about the area of interest with no pre-determined list of questions (Saunders et al., 2019). However, unstructured interviews are not manageable in this study due to top-level construction managers' and construction business experts' busy schedules and unfamiliarity with the BM concept.

Semi-structured interviews contain structured and unstructured sections with standardised and open-type questions (Walliman, 2011). In the qualitative survey, semi-structured interviews can be used as a data collection technique by translating every research question into a question about diversity in the participants' meanings or practices (Jansen, 2010). Accordingly, the researcher can have a list or interview guidelines of themes and questions covered under semi-structured interviews (Saunders et al., 2019). The interview guideline ensures the desired coverage of the areas of inquiry and comparability of information across interviewees (Kumar, 2011).

In Phase I, the research envisages interviews with top management in selected sample cases of CS2 contractors in Sri Lanka. Different themes were identified in BM

definitions and BM elements by critically reviewing BM literature, mainly of other disciplines. The data collection related to the construction discipline must be aligned with them due to a lack of awareness of the BM concept among construction business managers. Hence, semi-structured interviews were held for data collection (refer Annexure 3.3).

The semi-structured interview guideline for Phase II (refer Annexure 3.5) was prepared based on the Phase I data results. As per Saunders et al. (2009), raising semi-structured questions together with appropriately worded probing questions will support exploring the topic and producing a fuller account. Therefore, in Phase I and Phase II, the semi-structured interview guideline was followed up with probing questions to explore more details to explain BM elements concerning the construction business while identifying their relationships.

The semi-structured interviews were held on a one-to-one basis in both phases. In Phase I, face-to-face meetings with sixteen top-level construction managers of eight cases lasted about 30 to 90 minutes. However, the COVID-19 pandemic compelled conducting Phase II interviews electronically via the Zoom platform for about 60 to 120 minutes.

Collecting primary data using documentary analysis

As per Saunders et al. (2009), documentary data are available in written form (organisational documents, reports, emails, and newspapers) and non-written forms (audio and video recordings). Unfortunately, a proper documentary analysis could not be adapted in this research due to the very low accessibility of business-related documents of organisations. However, in Phase I case studies, data from official websites of the highest-graded contacting organisations (CS2) in the sample were considered other than interviewing two top-level construction managers. Accordingly, only qualitative data were obtained from these websites that explain some of the business and marketing aspects of the organisations.

Table 3.10 summarises the data collection techniques used in Phase I and Phase II in answering RQs and achieving objectives.

Table 3.10

Summary of data collection techniques of the study

	Research Strategy	Data Collection Technique	Research questions concern	Ultimate Purpose
Phase I	Case studies	Semi-structured interviews Documentary analysis	RQ2, RQ5, RQ6, RQ7, RQ8	To get initial inputs in answering RQs and achieving OB1, OB2, OB3, OB4, and OB5
Phase II	Qualitative Survey	Semi-structured interviews	RQ2, RQ3, RQ4, RQ5, RQ6, RQ7, RQ8, RQ9, RQ10	To agree with any modifications and additional inputs in answering RQs and achieving OB2, OB3, OB4, OB5, and OB6.

Since the related concept of this study is less familiar to the construction business managers, and the study gathered business-related attributes, determining the feasibility of interviews through a pilot study seems essential, as described in the next section.

3.13. Pilot study

A pilot study can test interview guidelines to minimise the likelihood of respondents having problems answering the questions. Pilot studies further allow some assessment of the questions' validity and the reliability of the collected data (Saunders et al., 2009). Moreover, pilot studies improve the practicability of the interview protocol by modifying interview questions with the help of participant feedback (Kim, 2010). Finally, as per Kim (2010), pilot studies promote the rigour and trustworthiness of qualitative research.

This study required identifying the business attributes used by construction contractors in Sri Lanka through case studies of the highest-graded contractors (CS2). However, the BM concept is less familiar in the construction context, and the data to be collected in this study belongs to the business nature. Moreover, two top-level construction managers, who could allocate minimal time for the interviews due to their busy schedules, were to be interviewed under each case of Phase I. Hence, the pilot study was considered essential to testing the appropriateness and robustness of interview questions to obtain maximum relevant data within a short time. Thereby, unnecessary effort from the researchers and participants could be minimized.

The researcher expected to interview two top-level managers from each case involved in the organisation's business decision-making. For the pilot study, two construction managers from two highest-graded contracting organisations in the sample whom the interviewer could easily access were interviewed with the semi-structured interview guideline developed by the researcher. As a result, the instrument could be modified to be appropriate for the research environment, as discussed in Section 4.2.2 of Chapter 4. Further, the ability to extract data was understood, and the research design was improved, informing a substantive study. Such modifications and understanding made the main case study data collection process effective.

3.14. Data analysis

This research is associated with qualitative data collected through semi-structured interviews. Due to the non-standardised and complex nature of the qualitative data, they are required to be condensed (summarised), grouped (categorised), or restructured as a narrative to support meaningful analysis (Saunders et al., 2009).

Data were collected in two phases for this research: (i) Phase I and (ii) Phase II. Qualitative data from the sample of eight cases, CS2 contractors in Sri Lanka, were collected via semi-structured interviews and official websites in Phase I. A qualitative survey was conducted in Phase II with construction business experts.

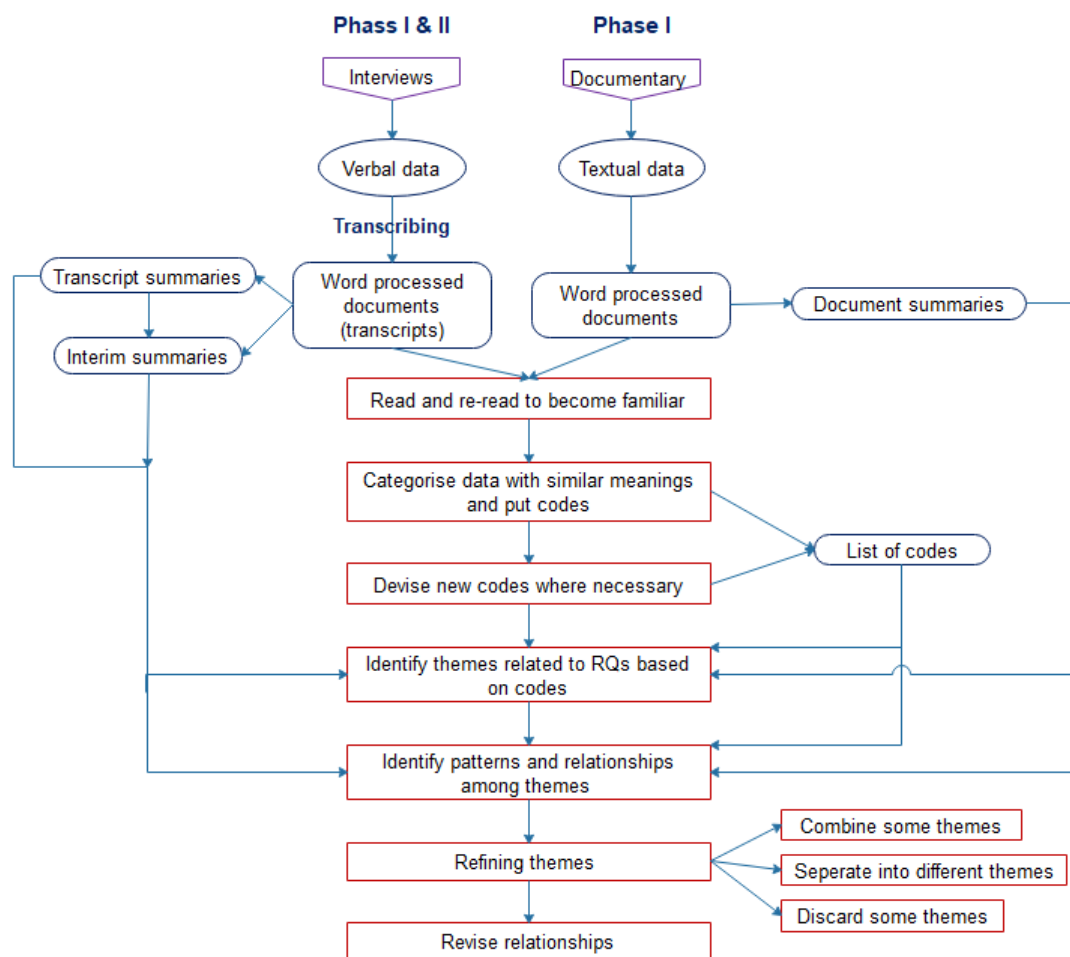
Verbal data from interviews were audio-recorded and subsequently transcribed to produce word-processed documents (transcripts). Parallely, transcript summaries were prepared to compress lengthy statements while producing interim summaries after completing two interviews with each company. In addition, textual data were collected from official websites of the contracting organisations in the sample with document summaries to condense key points in the websites for the research.

The qualitative data gathered in this study were analysed using the ‘Thematic Analysis’ method, which provides an orderly and logical way to systematically analyse qualitative data (Saunders et al., 2019).

Figure 3.5 demonstrates the thematic analysis process followed in this research to analyse qualitative data, referring to Saunders et al. (2019).

Figure 3.5

The thematic analysis process followed in this research



As Saunders et al. (2019) stated, the thematic analysis pursues themes or patterns from a data set for further exploration of RQs and helps produce thematic descriptions, develop explanations based on apparent thematic patterns or relationships, and draw conclusions.

The process depicted in Figure 3.5 was adopted to analyse verbal data from interviews in Phase I (case studies) and Phase II (qualitative survey) and textual data from websites in Phase I (case studies).

Categories were developed after data familiarisation, and similar meanings of data were identified and coded. The categories in this research are primarily derived from the existing BM literature. Some were altered or added based on the terms used by the interview participants, relating those categories to the construction industry. Both data-driven and theory-driven codes were used in this research.

As per Saunders et al. (2019), data-driven codes are from actual terms used by interviewees and developed by the researcher from data, whereas theory-driven codes are derived from the literature. The codes used in Phase II data analysis are mainly acquired from the Phase I list of codes. After assigning codes to units of data under the categories of the whole data set, the themes were searched, indicating ideas important to the RQs. The themes are broad categories incorporating several codes possibly related to one another (Saunders et al., 2019). Subsequently, the patterns and relationships among categories are recognised and developed.

Some other qualitative data analysis methods are template analysis, data display and analysis, and narrative analysis. Saunders et al. (2009) explained the template analysis used to combine deductive and inductive approaches in analysing qualitative pre-determined and then amended or added to data collected and analysed. Data display and analysis include data summarising, displaying data using summary diagrammatic or visual displays, drawing conclusions, and verifying relationships and patterns recognised through data displays (Saunders et al., 2009). Finally, narrative analysis is a collection of analytical approaches to analyse different aspects of narratives (a story with a beginning, middle, and an end), where following a perceptible structure is required (Saunders et al., 2019).

The manual method and the Computer-Aided Qualitative Data Analysis Software (CAQDAS), “NVivo”, are used in this research for analysing qualitative data, which allows for collecting, organising, analysing, and visualising unstructured or semi-structured data. NVivo software assists researchers in managing many data efficiently, finding themes easily, and creating relationships among generated themes by saving time and energy for researchers (Dollah et al., 2017). This technique is used for analysing the data collected in Phase I (case studies).

Other than CAQDAS, NVivo, this study used two software for data display, namely EdrawMax and Edraw MindMaster. ‘EdrawMax’ is a diagramming tool that serves many purposes, including creating flowcharts, organisational charts, mind maps, network diagrams, workflow diagrams, business charts, and engineering diagrams. ‘Edraw MindMaster’ allows the creation of mind maps easily.

These software packages make the diagrams more dynamic by linking real-time graphics to the data and exporting them to various formats.

In summary, this research generates qualitative data and utilises qualitative data analysis techniques to gain necessary information manually and using various software packages.

3.15. Research ethics and quality of the research

Research ethics refers to the behaviour standards that guide a researcher's behaviour in relation to the rights of those who become the subject of the research study or are affected by it (Saunders et al., 2019, p.252-253). Research ethics must be concerned when designing and planning the research, seeking access to people and organisations, and collecting, analysing, and managing data. Saunders et al. (2019) discussed some ethical principles to recognise ethical issues during the research process.

Some of the ethical concerns considered in this research are as follows:

- Integrity, fairness, and open-mindedness to act openly, being truthful, and promote accuracy
- Respect others (those who participate in or are affected by the research)
- Assuring confidentiality and anonymity
- Informed consent of those taking part which provides sufficient information and assurances about taking part
- Reporting findings fully and accurately

The researcher must think from an ethical perspective about each aspect of the research during the research process (Saunders et al., 2019). Accordingly, this research assured the research ethics in different stages in several ways.

When formulating RQs and objectives, the researcher is concerned about the purpose of RQs, data required to answer RQs, and methods of collecting such data. Before collecting data, informed consent from participants was obtained by sending a mail including the nature of the research, type of data, time required for the interview, assurance of confidentiality and anonymity, and the use of collected data. Pilot interviews with two construction business managers were conducted to ensure the suitability and practicability of interview questions of Phase I. The face-to-face interviews were scheduled, keeping the time arrangement convenient for the interviewee and protecting the interviewees' rights for declining to respond to any question. In addition, this research contains inputs from construction business experts who are professionals in the industry. This was not an ethically sensitive study; data were not collected from children or any vulnerable social groups. The participants' confidentiality and anonymity were assured, and subjectivity in selecting data was avoided when analysing and reporting data.

The research quality depends on the researcher's ethical perspective and ethical concerns related to the reliability and validity of the research study. Therefore, the following section discusses the validity and reliability of the research.

3.16. Reliability and validity of the research

Reliability is the extent to which the data collection techniques or analysis procedures will produce consistent findings (Easterby-Smith et al., 2007). In contrast, validity denotes the suitability of the measures used, the accuracy of the analysis of the results, and the generalisability of the findings (Saunders et al., 2019).

This research ensures its reliability by avoiding reliability threats identified by Saunders et al. (2019). Accordingly, participant error and bias were avoided by always conducting interviews at times and locations convenient for interviewees. Moreover, the findings were correctly interpreted through audio recordings without being subjective to avoid researcher error and bias.

Verification through validation is required to establish the credibility and validity of research data and analysis interpretation (Saunders et al., 2019). Therefore, attention was paid with scrutiny to logical leaps and false assumptions in the research design. The triangulation is adopted in Phase I, where data were collected through two interviews of top management and official websites of each contracting organisation in the sample.

Lincoln et al. (2013) identified validity as determining the fidelity of the findings from the standpoint of the researcher, the participants, and/or the consumers of the research. Accordingly, the final model was validated using a sample scenario in front of two groups. One group was an external group representing the population but not the sample, including three top- and middle-level managers (Company G). The other group is the internal group representing the Phase I case study sample, including three top and middle-level managers (Company A). Table 3.11 provides the background information of the top-level and middle-level who contributed to validating CBMO.

Table 3.11

Background information of validation group members

	Coding	Position	Qualifications	Experience in the company
Internal Group for Validation (Company A)	VA-1	General Manager	BSc, MSc, MBA Member of a construction-related reputed professional institution	25
	VA-2	Deputy General Manager	BSc, MSc Member of a construction-related reputed professional institution	13
	VA-3	Middle Manager	BSc Member of a construction-related reputed professional institution	6
External Group for Validation (Company G)	VG-1	Deputy General Manager	BSc, MBA, Member of a construction-related reputed professional institution	18
	VG-2	Contracts Manager	BSc, MSc Member of a construction-related reputed professional institution	10
	VG-3	Middle Manager	BSc	5

3.17. Chapter summary

Initially, the chapter presented research objectives and RQs integrating the research purpose. Next, the philosophical stance of the research, the research approach, together with the methodological decisions made by the researcher based on the RQs, were discussed. Accordingly, this chapter justified the research design in terms of research choice, research strategies, sampling, data collection, and data analysis. Finally, Chapter 3 revealed the measures taken to ensure the quality of the research through validity and reliability by concerning ethical principles.

4. RESEARCH FINDINGS AND ANALYSIS: PHASE I

4.1. Introduction

Data collection in this study was conducted in two (02) phases, i.e., (i) case studies and (ii) qualitative surveys. This chapter presents the case study findings and data analysis results of Phase I.

First, the chapter presents the findings from the pilot study, explaining how those findings modified the interview guidelines and the interview process. Next, the case study findings are discussed, initially with the top-level construction managers' perceptions about the nature of the construction business and business model concept. Next, the attributes of business decision-making are explored to identify elements appropriate for developing the business model ontology in the construction context, highlighting primary relationships and parameters for describing the BM elements. Finally, Chapter 4 presents the initial business model ontology for construction contractors with the taxonomies of the BM element.

4.2. Analysing case studies

The case study strategy facilitated the exploration and analysis of findings under Phase I. Section 3.12.2 discussed the selection of eight (08) highest-graded contracting organisations in Sri Lanka as the sample of cases based on the possession of the highest grading for different construction fields. Accordingly, the case backgrounds were briefly described in the following sub-section.

4.2.1. Backgrounds of cases

The backgrounds of eight (08) cases are presented individually under the following headings, highlighting the company's establishment and experience in the Sri Lankan construction industry, fields with the highest CIDA grading, accreditations and certifications, and diversification with subsidiaries.

Construction Industry Development Authority (CIDA) provides grades for contractors in Sri Lanka by evaluating their financial capability, technical ability with staff and plant & machinery, and the experience gained in relevant fields. CIDA is expected to motivate contractors to upgrade through self-development and ensure the contractors complete projects within the set times, cost and quality targets. 'CS2' is the highest grade of the contractors where the annual financial capability of the contractor is more than Rs. 3000 million under the particular field. 'CS1' is the second-highest grade, with an annual financial capability between Rs. 3000 million and Rs. 1500 million under the particular field. (<https://www.cida.gov.lk>)

Case A – Company A

Company A, concerned as Case A, was incorporated as a public limited liability company in 2001. Initially, it was established in 1994. The company was assigned to the highest classification of contractors in Sri Lanka by CIDA, i.e., CS2. While

involved in most of the leading construction fields classified by CIDA, this organization possesses the highest grading (CS2) for building construction, highway construction, and water supply and sewerage works. The company is compliant with ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 accreditations for its quality, environmental, health, and safety management systems. The company has wholly-owned and partly-owned subsidiaries in construction and other industries.

Case B – Company B

Case B - Company B was established in 1980 and has become one of the largest civil engineering organisations in Sri Lanka. The company holds the highest CIDA Grading (CS2) for the leading areas in local construction, i.e., buildings and highways, and the second-highest grading (CS1) for water supply and sewerage and irrigation and drainage canals construction. In addition, the company received the International Organisation for Standardisation (ISO) 9001, 18001, and 14001 certifications. Focusing on diversification, the company established many fully-owned subsidiary companies in relation to construction material production and property development.

Case C – Company C

Case C - Company C has been a prominent player in the Sri Lankan construction industry for over 68 years. The company possesses the highest grading (CS2) of CIDA for building construction, highway construction, and heavy construction. The company strongly emphasises fulfilling environmental, health, and safety standards while maintaining quality control measures. It is accredited with the ISO 9001:2015, ISO 14001:2015, and OHSAS 18001:2007. The company has started manufacturing asphalt, ready-mix concrete, and aggregates as subsidiaries of the company.

Case D – Company D

Case D - Company D started their journey in the construction industry around 1978 and was established as a leading construction company in 2001. Company D is mainly involved in building construction and obtained the highest grading, CS2, for building construction from CIDA. Company D implemented the ISO systems, being the recipient of many constructions excellence awards, and is currently accredited with ISO 9001, ISO 14001, and the BS OHSAS 18001 certifications. The company has its subsidiaries to supply ready-mix concrete, construction materials and equipment, and real estate investment and development.

Case E - Company E

The organisation concerned under Case E was established in 1981 and has been an active participant in the construction industry of Sri Lanka. to become one of the best-known enterprises. The company holds the highest CIDA grading (CS2) for the main construction fields in the country: building construction, highway construction, and water supply and sewerage works. It also possesses the second-highest grading (CS1) for bridge construction. They are an ISO-accredited organisation with ISO 9001 and

ISO 14001 certifications. Company E has a few subsidiary companies related to the construction industry and further diversified its services internationally by establishing subsidiaries for overseas operations in some countries.

Case Study 06 – Company F

Case F- Company F was established in 1947; it is one of Sri Lanka's most well-reputed and longstanding construction companies. While involved in different construction fields, the company obtained the highest grading, CS2, of CIDA for Building Construction and Highway Construction. The company currently holds the prestigious ISO 9001:2015 certification for their quality management system. Company F has its subsidiaries related to construction, including MEP services and supply construction machinery and equipment, to support and complement the work accomplished.

Case Study 07 – Company J

Case J - Company J, a specialist in roads, highways, bridges, water supply, and irrigation construction, was established in 1991. The company holds the highest grading, CS2, for highway construction, bridge construction, water supply, and sewerage works and obtained the second-highest grading, CS1, for irrigation and drainage canal construction. Company J is an ISO-certified company, compliant with ISO 9001–Quality Management Systems (QMS), ISO 14001 Environmental Management Systems (EMS), and ISO 18001 Occupational Health and Safety Management Systems (OHSAS). The subsidiaries of Company J include the supply of asphalt, quarry products, aggregates, concrete and concrete products, and hiring heavy machinery.

Case Study 08 - Company K

Case K - Company K, established in 1979, is a leading construction company in Sri Lanka. Company K was awarded the CIDA registration with the highest grade, CS2, for highway construction. It was rewarded with ISO 9001:2015, ISO 14001:2015, and ISO 18001:2015 certifications for its efforts and unwavering quality standards, environmental and health and safety management systems. The company also registered a few subsidiary companies, including supplying ready-mixed concrete and construction machinery and equipment.

As per Section 3.9, this research must collect qualitative data by employing a multi-method qualitative choice. Hence, each case study consisted of two semi-structured interviews with the company's top-level construction managers involved in company decision-making and a documentary analysis of the company website. Table 4.1 presents the codings representing the interviewees from each case and the websites of the cases used within texts to maintain confidentiality and clarity.

Table 4.1*Codings of interviewees and websites of the cases*

Case	Interviewee Position	Interviewee Coding	Website coding
A	General Manager (GM) - Development & Planning	CA-1	WEB-A
	General Manager (GM)	CA-2	
B	Contracts Manager (CM)	CB-1	WEB-B
	Deputy General Manager (DGM)	CB-2	
C	Deputy General Manager (DGM)	CC-1	WEB-C
	Senior Manager (SM) – Planning & monitoring	CC-2	
D	Chairperson	CD-1	WEB-D
	General Manager (GM)	CD-2	
E	Deputy General Manager (DGM)	CE-1	WEB-E
	Senior Manager (SM) – Contracts	CE-2	
F	Chairperson	CF-1	WEB-F
	Deputy General Manager (DGM)	CF-2	
J	Senior Manager (SM)	CJ-1	WEB-J
	Senior Manager (SM)	CJ-2	
K	Senior Manager (SM)	CK-1	WEB-K
	Senior Manager (SM)	CK-2	

As per Table 4.1, top management includes Chairpersons, Managing Directors, General Managers, Deputy General Managers, Contracts Managers, and Senior Managers. However, the positions/designations of the interviewees differed among cases due to accessibility issues. In addition, the top-level construction managers' busy schedules caused difficulty in securing time for interviews, requiring practical interview guidelines. Hence a pilot study was conducted to improve the interview guideline and interview process of case studies. Accordingly, the following section discusses the identified issues and modifications after the pilot study.

4.2.2. Pilot study

The pilot study was guided by questions on concerns related to the construction business, including Construction Business Model (CBM) definition and BM elements related to the construction business. Initially, the interview guideline was devised based on literature findings since the researcher found rich literature related to BMs in other industries.

The pilot study helped the researcher improve the interview guideline with changes, including removing some questions, rephrasing some questions, and aligning them sequentially. Consequently, the interview guideline was revisited and modified to allow data quality and effective responses from the participants. Accordingly, two (2) top-level managers from two (2) CS2 contracting organisations were interviewed in the pilot study to identify the effectiveness of conducting interviews and check the appropriateness and robustness of interview questions. Both pilot interviewees are senior managers who have not contributed to the case study data collection.

The first issue was identified with the opening questions “*what is your idea about the Business Model concept?*” and “*does your company have a Business Model?*” Because of these opening questions, respondents tended to answer subsequent questions with their ideas on the BM concept, which usually differs from what is typical in other sectors and within the literature. Hence, the interviewer decided to ask those two questions during the latter part of the interview.

The second issue was the insertion of questions related to CBM definition into the interview guideline. There were three questions; the first one is to identify the necessity of a specific BM definition in the construction context, the second is to obtain opinions about the themes to be included in such definition, and the third is to identify the appropriateness of the created process for developing such definition.

Surprisingly, both pilot interviewees did not even want to answer those questions and just said, “*It is OK to have a definition*”. Given that, the researcher decided to remove the questions related to CBM definition from the interview guideline, except “*what is your opinion regarding specifically defining BM in the context of construction business?*” This question was moved to the end of the interview guideline to be asked with the previous paragraph’s questions.

The third issue evolved with asking about the business elements considered in their company’s business in relation to the list of BM elements found in the literature review and the suitable terms for such elements related to the construction business. Both pilot interviewees were confused and raised the question, “*what do you mean by the ‘elements’?*”. Hence, top managers of cases were asked about the “business attributes” instead of “elements” while conducting interviews, as suggested by one of the pilot interviewees, which seemed more understandable to the construction business managers. Moreover, the interviewer had to explain some elements in the list with examples, as the interviewees were unfamiliar with those terms and lacked a precise idea about them. As a result, the interviewer added another column to the elements list, explaining each element briefly (refer Annexure 3.3). In addition, the interviewer was prepared with real-life examples to explain those elements.

It was pointless asking interviewees to select the suitable terms for the BM elements in relation to the construction business from the list of alternative terms. Instead, the interviewees described those attributes/elements using the terms they knew and were familiar with. However, the list of alternative terms (Annexure 3.4) was attached to the element list of the interview guideline. An additional question, “*Any other attribute you think that is essential for construction business?*” was added to the interview guideline. Further, the question “*What is your idea about the nature of construction business?*” was added as the first question to get the idea of construction business managers about the nature of construction business.

Table 4.2 provides the Phase I case study semi-structured interview guideline questions before and after the pilot study with the sequence change. The questions removed from the interview guideline based on the pilot study results are shown with

‘~~strikethrough~~’, while newly added questions after the pilot study are shown in ‘**bold**’. Sequence change of questions can be identified with colours.

Table 4.2

Semi-structured interview questions before and after the Pilot study

Questions & Sequence before Pilot interviews	Questions & Sequence after Pilot interviews	
What is your idea about the Business Model concept?	Q1	What is your idea about the nature of the construction business?
Does your company have a Business Model?		Which of these themes are most appropriate for inclusion in the Construction BM definition?
What is your opinion regarding specifically defining BM in the context of the construction business?		Please make comments on this process for developing a definition for Construction Business Model regarding its suitability?
Which of these themes are most appropriate for inclusion in the Construction BM definition?	Q2	What are the business attributes that your company considered especially when making business judgments in relation to these BM elements?
Please make comments on this process for developing a definition for Construction Business Model regarding its suitability?	Q3	Can you please mention the the appropriate terms which can be used for each attribute in relation to your company business?
What are the business elements your company considered when making business decisions in relation to these 17 BM elements?	Q4	Any other attribute that you use and think as essential for the construction business as a contractor company?
	Q5	Does your company have a Business Model?
As per your opinion, what are the suitable terms for these 18 elements in relation to the construction business?	Q6	What is your idea about the Business Model concept?
	Q7	What is your opinion regarding specifically defining BM in the context of the construction business?

Eventually, the Phase I interview guideline for semi-structured interviews was developed with the above modifications, as shown in Annexure 3.3. Thus, the pilot study helped the researcher improve the effectiveness of the research instrument and adjust the way of conducting interviews appropriate for the research environment.

4.2.3. Reflection on within-case analysis

This study is not reported within-case analysis in detail as there were no contradictory statements from data sources within a case while checking triangulation. Therefore, the abstract findings from the within-case analysis were used in the cross-case analysis discussion.

4.2.4. Cross case Analysis

Phase I multiple case study was conducted to identify the current BM practice and the attributes considered by the highest-graded construction organizations in their business decision-making. Cases were selected purposively, considering maximum variation under literal replication. Table 4.3 analyses the general considerations of each case regarding fields of involvement and availability of company BMs.

Table 4.3*Fields of involvement and availability of company BMs of Cases*

		Case							
		A	B	C	D	E	F	J	K
Main fields involved in the capacities of the highest and second-highest grades	Buildings	✓	✓	✓	✓	✓	✓		
	Highways	✓	✓	✓		✓	✓	✓	✓
	Water Supply and Sewerage	✓	✓			✓		✓	
	Bridges					✓		✓	
	Irrigation and Drainage Canals		✓					✓	
	Heavy Construction			✓					
Availability of Subsidiaries		✓	✓	✓	✓	✓	✓	✓	✓
Availability of BM in the company	No idea about a specific BM for the company	✓	✓	✓	✓	✓	✓	✓	✓
	Consider business attributes for annual business planning		✓	✓	✓	✓	✓	✓	✓
	Use a business framework for business planning	✓							

The cases were selected considering their involvement in main construction fields. Accordingly, Case A, Case B, Case C, Case D, Case E and Case F are mainly involved in building construction, and Case J and Case K are primarily involved in highway construction at their highest capacity level as per the CIDA grading system. All the cases have diversified their businesses with different subsidiaries.

Top managers of all the cases did not know about a separate company BM, underlining the unavailability of a specific company BM. However, Case B, Case C, Case D, Case E, Case F, Case J and Case K accepted that they use different attributes in business planning. In the meantime, Case A uses a business framework for decision-making and business planning.

The business attributes of each case were identified concerning 17 BM elements found in the literature, as given in Table 4.4.

Table 4.4*Business attributes of cases identified against the BM elements of literature findings*

BM elements (Literature Findings)		Case							
		A	B	C	D	E	F	J	K
1	Value proposition	✓	✓	✓	✓	✓	✓	✓	✓
2	Value Network	✓	✓	✓	✓	✓	✓	✓	✓
3	Customers	✓	✓	✓	✓	✓	✓	✓	✓
4	Government policy & regulation	✓	✓	✓	✓	✓	✓	✓	✓
5	Partnerships	✓	✓	✓	✓	✓	✓	✓	✓
6	Value creation	✓	✓	✓	✓	✓	✓	✓	✓
7	Processes & Activities	✓	✓	✓	✓	✓	✓	✓	✓
8	Resources and capabilities	✓	✓	✓	✓	✓	✓	✓	✓
9	Technology	✓	✓	✓	✓	✓	✓	✓	✓
10	Value Capture	✓	✓	✓	✓	✓	✓	✓	✓
11	Revenue	✓	✓	✓	✓	✓	✓	✓	✓

BM elements (Literature Findings)		Case							
		A	B	C	D	E	F	J	K
12	Profit	✓	✓	✓	✓	✓	✓	✓	✓
13	Costs	✓	✓	✓	✓	✓	✓	✓	✓
14	Strategic choices	✓	✓	✓	✓	✓	✓	✓	✓
15	Change management	✓	✓	✓	✓	✓	✓	✓	✓
16	Culture	✓	✓	✓	✓	✓	✓	✓	✓
17	Mission	X	X	X	X	X	X	X	X

All the cases are concerned with BM elements identified from the literature as their business attributes except ‘Mission’. No case identified the element ‘Mission’ as a business attribute. However, while explaining the above BM elements, cases disclosed some additional business attributes they consider in their organization in relation to some BM elements, as depicted in Table 4.5.

Table 4.5

Additional BM elements (business attributes) considered in cases

Other business attributes (BM elements) of cases			Case							
			A	B	C	D	E	F	J	K
1	Value Proposition	Time	✓	✓	✓	✓	✓	✓	✓	✓
2		Cost	✓	✓	✓	✓	✓	✓	✓	✓
3		Quality	✓	✓	✓	✓	✓	✓	✓	✓
4		Other methods of value addition	✓	✓	✓	✓	✓	✓	✓	✓
5	Value Network	Subsidiaries	✓	✓	✓	✓	✓	✓	✓	✓
6		Suppliers & Subcontractors	✓	✓	✓	✓	✓	✓	✓	✓
7		Financial Institutions	✓			✓				
8		Industry peers & Competitors	✓				✓		✓	✓
9		Society							✓	✓
10		Management			✓	✓		✓		
11		Professional staff	✓	✓	✓	✓	✓	✓	✓	✓
12		Other employees	✓	✓	✓		✓	✓		
13	Processes	Supply chain management	✓	✓	✓	✓	✓	✓	✓	✓
14		Procurement	✓							
15		Arranging Finance	✓	✓	✓	✓	✓	✓	✓	✓
16		Risk management	✓	✓	✓	✓	✓	✓	✓	✓
17	Resources and Capabilities	Plant & Equipment	✓	✓	✓	✓	✓	✓	✓	✓
18		Workforce	✓	✓	✓	✓	✓	✓	✓	✓
19		Technical knowhow				✓	✓			
20		Managerial knowhow				✓	✓			
21	Revenue	Overheads	✓				✓			
22	Value Capture	Good recommendations	✓	✓	✓	✓	✓	✓	✓	✓
23		Entering new sectors	✓							
24		Goodwill & Prestige			✓			✓		
25		Creating Network	✓	✓	✓	✓	✓	✓	✓	✓
26	Company vision		✓		✓		✓			

As depicted in Table 4.5, additional 14 business attributes are considered in all the cases related to some of the BM elements in Table 4.4. Cases considered a few different parties under Value Network; financial institutions [Case A and D], industry

peers and competitors [Cases A, E, J and K], society [Case J and K], management [Cases C, D and F], and other employees [Cases A, B, C, E and F]. Procurement as a process is only considered by Case A, while Case D and E consider technical know-how and managerial know-how as business attributes.

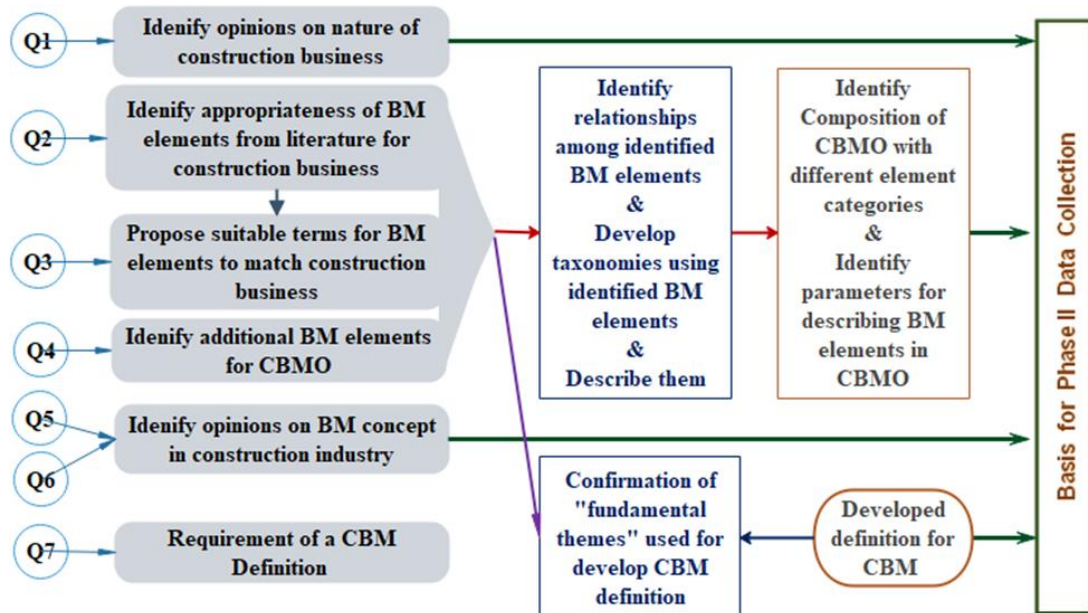
Case A and E view ‘overheads’ separately as a business attribute, whereas other cases put it under ‘costs’. Cases identified four non-monetary ways of capturing value as; good recommendations [all cases], entering new sectors [Case A], goodwill and prestige [Cases C and F] and creating a network [all cases]. Cases B, D and F try to align their business decisions with the company vision, while top managers of other cases identified the requirement of mindfulness of the Company Vision.

In summary, the cross-case analysis emphasised that there is no major deviation of findings among cases, and most business attributes of cases are similar. Therefore, case study findings were analysed and presented in the following sections. Moreover, these business attributes are considered BM elements for construction contractors when analysing Phase I data.

Figure 4.1 summarises the process followed in analysing Phase I case study data. The contribution of answers to the questions in the semi-structured interview guideline (refer Table 4.2) to the data analysis was also presented in Figure 4.1. The data from websites of cases are also used for justifications and explanations.

Figure 4.1

Process of analysing data from case studies in Phase I



The analysed case study data of Phase I have contributed to the Phase II qualitative survey data collection. Initially, responses from top-level managers of all the eight cases to Q1, Q5, and Q6 of the interview guideline were discussed in the following sections, providing general implications about the nature of the construction business and BMs in the construction business/construction industry. Then, the answers to Q7

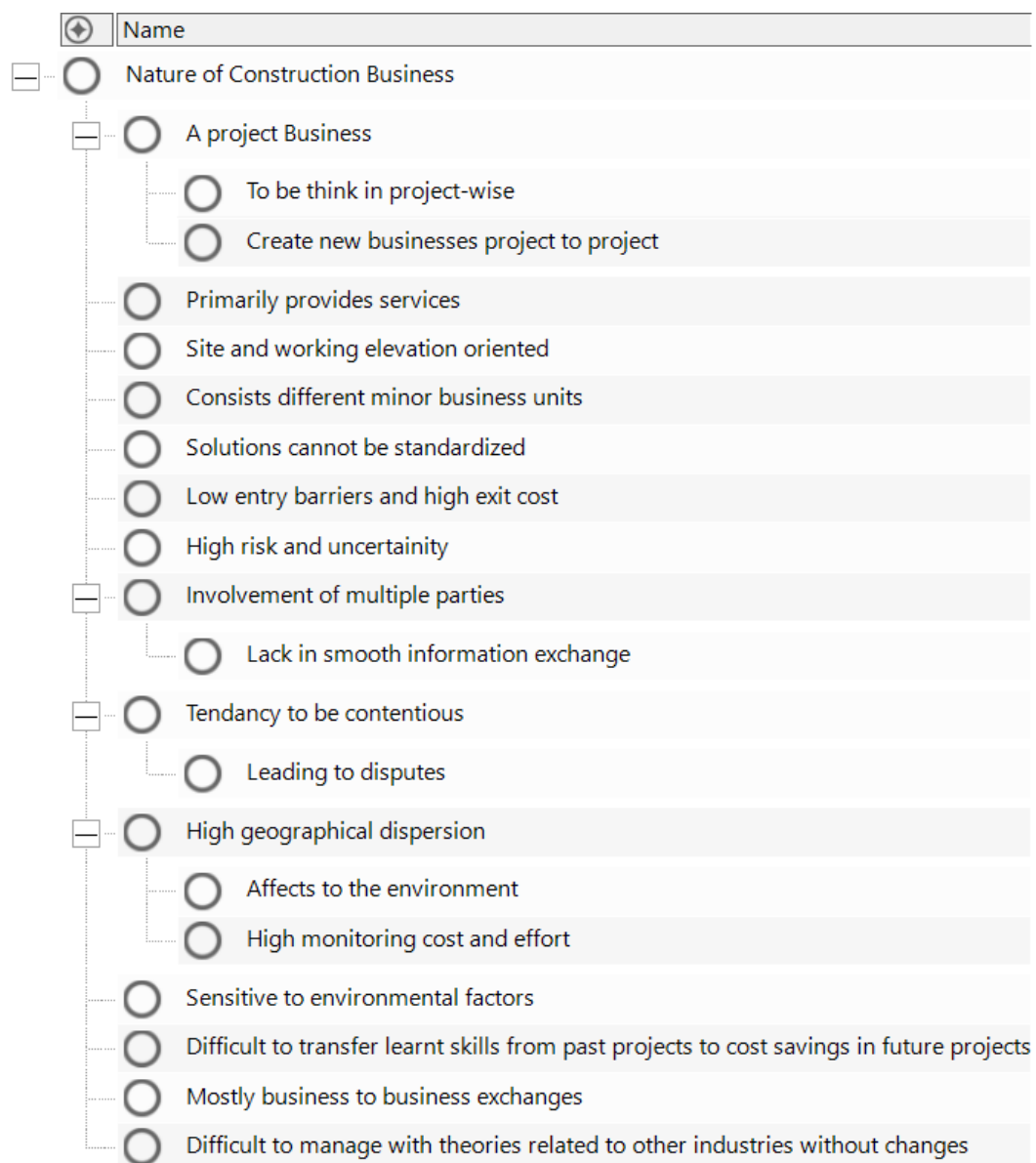
were analysed to identify the top-level construction manager’s opinion on defining BM, specifically for the construction business. Finally, the responses for Q2, Q3, and Q4 contributed to identifying and describing BM elements for the BM ontology for construction business while confirming the “fundamental themes” of CBM definition.

4.3. Nature of the construction business

As an opening approach to the interview, the interviewees of each case were asked about their perspectives on the nature of the construction business compared to other businesses. The results are based on the interviews with top-level managers of the eight highest-graded contracting organisations. Figure 4.2 summarises the findings related to the nature of the construction business as a coding structure, discussed below.

Figure 4.2

Coding Structure for perceptions of nature of the construction business



The case studies made it apparent that the construction business is considered a project business. For instance, CF-1 of Case F stated, *“As construction business is a project business, it has to think in project-wise. So, project-to-project new business is creating”*. Aligned with the project-based nature of the construction business, CE-1 of Case E further mentioned, *“together with its project nature, the construction business is site oriented, and working elevation oriented”*.

CE-2 of Case E gave another perspective on the construction business, *“in a construction project business, there are several minor business units like bar bending, concreting...so on”*. CE-2 further explained that the profit percentage loading to each business unit differs, and therefore, the return from each business unit also varied. Therefore, CE-2 emphasised, *“it is important to think about how to increase profit from each unit separately and how to eliminate losses from units which occurred previously.”* Moreover, CC-2 mentioned, *“the clients select the procurement route, and we, as contractors, have to rely upon working in such procurement routes where our business units need to be formed.”*

“Many solutions are found to be standardised in other businesses and were successful, but it is not working in construction business due to its project-based nature”, stated CB-2, a DGM in Case B, highlighting the uniqueness of construction products and business. Correspondingly, a DGM from Case E, CE-1, elaborated on the difficulty of a piece-rate model for calculating cost, revenue, and profit in the construction business due to the work norms’ unstandardised nature. However, though the construction projects are unique, making the construction business unstandardised, CK-1 of Case K, involving only highway construction, argued that *“the service to be provided for the same project is relatively the same no matter the contractor”*. He further mentioned that *“it is required to make each contractor unique through mixes of skills, capabilities, and technical specialities”*. Accordingly, contractors must differentiate their services from their rivals like other businesses. Moreover, CD-1, the chairman of Company D, reminded the industry conviction, *“the construction industry has low barriers to entry”* while cautioning about the high exit cost, giving the reason as *“because there are obligations under existing contracts and invested capital”*.

The possession of high uncertainty and high risk in the construction business has been pointed out by the interviewees from Case A, Case B, Case C, Case F, Case J, and Case K: *“As construction business deals with high risks and uncertainty, it is difficult to forecast all future contingencies and the exact outcome of the business.”* [CC-1]. Moreover, CK-1 claimed that *“the uncertainty, complexity, and involvement of multiple parties create numerous issues in the construction business”*. CA-2 disclosed the same point as *“there is a tendency to be contentious”*. CA-2 further mentioned, *“As main contractors, there can be disputes with employers, with our supply chain, with consultants and with nominated subcontractors & suppliers.”* CC-1 added, *“it is difficult to ensure a smooth exchange of information among parties in the construction business, which can lead the business litigious”*.

Top management of Case F, Case J, and Case K underlined the importance of concerning the environment by construction businesses because of its impact on the environment throughout the life cycle of a development project. For instance, CJ-2 of Case J, which only involves infrastructure development projects, stated, “*Construction industry closely deals with the environment*”, and CK-2 of Case K detailed, “*Construction industry consumes a higher amount of natural materials and higher amount of fuel and energy per product than other industries.*” Moreover, CJ-1 acknowledged that the high geographical dispersion of construction projects, especially infrastructure projects, causes environmental impact and affects monitoring costs. As a result, some company websites show their compliance with environmental standards. For example, WEB-A stated that Case A contributes “*to sustain the environment and its natural resources for future generations by ensuring business operations comply with environmental regulations...*”.

Concerning the above characteristics of the construction business, CB-2 of Case B uncovered another issue of the construction business: “*In the construction business, though we could learn new skills from project to project, it is difficult to translate learned skills into cost savings of the company due to project-based unique nature.*”

Interviewees of Case E stressed that viewing construction businesses through the lenses of other businesses like product manufacturing is not effective. “*Involvement of managers from disciplines not related to construction like pure management and accountancy for business planning and other business functions of construction organizations is ineffective because their thinking pattern is related to manufacturing sector*” [CE-2]. Furthermore, CE-1 mentioned, “*Today most construction businesses try to use systems like ERP since those systems are created for the manufacturing industry, it is difficult to use in our business without considerable modifications. That is because of the variations and difficulty in defining the exact scope in construction projects.*” Hence, it is difficult to manage construction businesses directly using theories related to other industries.

CD-1 of Case D, which is only involved in building construction, mentioned, “*Construction business mostly deals with the business-to-business exchange because construction businesses are basically fulfilling Clients’ business requirements rather than their consumption requirements*” as a prominent feature of the construction business. Thus, construction businesses have to deal with typically fewer clients.

After identifying different unique features of the construction business disclosed by top-level managers of construction companies, the next section focuses on top-level managers’ perceptions of the BM concept in the construction industry.

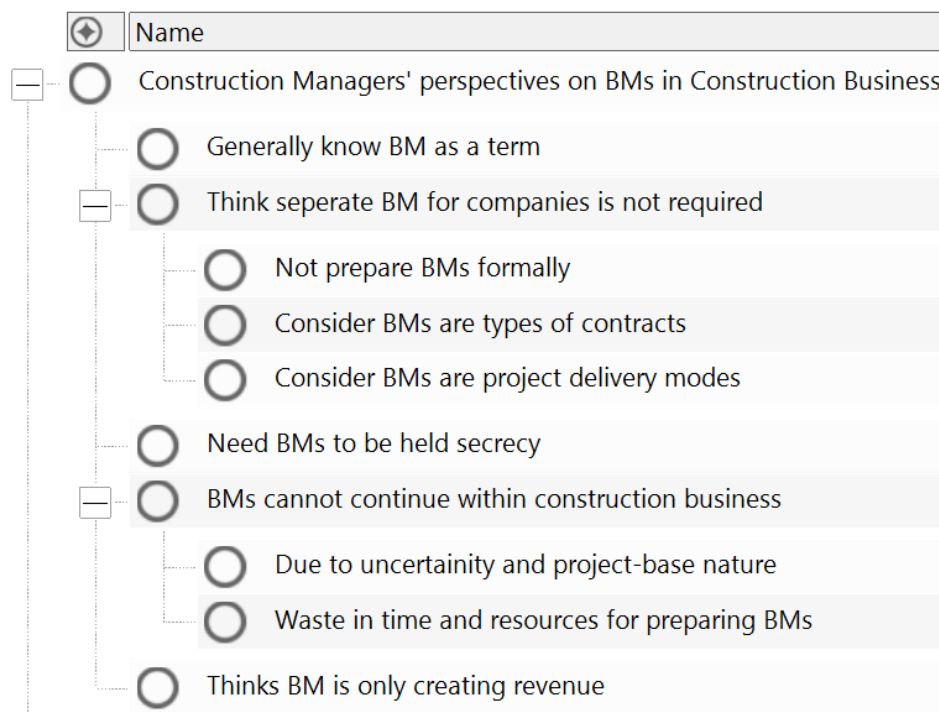
4.4. The business model concept in the construction industry

This section explores how top management of the eight highest-graded construction organisations understand the BM concept in the construction industry context. The interviewees were further queried about the existence of BMs in the cases.

Accordingly, the findings presented here are based on the coding structure given in Figure 4.3 derived from NVivo.

Figure 4.3

Coding structure of perceptions of the BM concept in the construction industry



From interviews, it became apparent that top-level managers of all cases believe that they know BM generally as a term. However, interviewees have different views about BMs than what the literature of other sectors explains. In reality, some were unable to explain their personal perspectives about BMs. Further, interviewees were unaware of the benefits of having designed BM and multiple roles of BM properly, as discussed in Section 2.4.

Surprisingly, the perception of the top-level managers of Case B, Case C, Case E, Case J, and Case K was that they do not require a separate BM. As mentioned by CC-2, “we followed the procurement methods specified by the Clients, and hence we do not need separate BM for the company”. The wordings of CK-2 echoed the same view: “a procurement strategy was selected for a project, and the parties follow that procurement strategy with specific forms of contract. So that is the BM”. Similarly, CC-2 of Case C stated, “PPP (Public-Private Partnerships) and EPCC (Engineering, procurement, construction, and commissioning) are some BMs used in the construction industry, and if Clients required, we go with such models”. Hence, as per

findings, the BM was confused with different types of contracts and project delivery modes used in the construction industry.

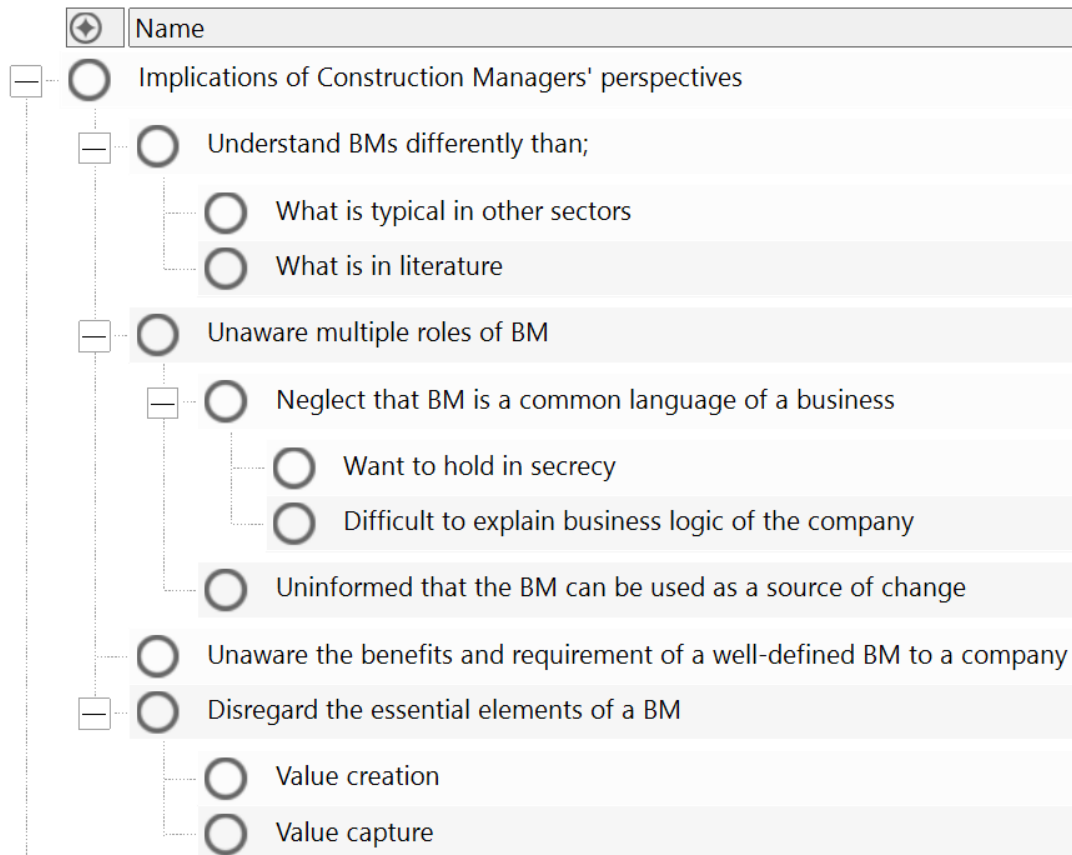
Negatively, CE-2 stated, *“Due to the nature of construction business that is uncertainty and uniqueness, it is wasting time and resources to prepare company BM, because we cannot continue it,”* without knowing that BM could be used as a source of change. However, the statement by CA-1 provided a clue that Case A has some form of BM, *“We are not preparing BMs formally, but we have our framework. If the business ideas or projects fit our framework, we do them; and if not, we are not going to do them.”* This statement further reflects the usefulness of having a BM framework for decision-making.

Interestingly, CD-1, the chairman of Case D, mentioned, *“Business decision-making is something that we want to hold in secretly, so, such models only discussed within our director board.”* Similarly, CB-1, a contracts manager of Case B, stated, *“Company’s BM idea maybe with the minds of our directors’, and we are not aware of such BM, but we refer to our annual business plan.”* These statements confirm that top-level managers of construction organisations are unaware of the primary purpose of having a BM, i.e., providing managers with a common language to discuss and visualise their business ideas/options and communicate them to employees and other vital stakeholders (Pekuri, 2015). As a result, the top-level managers failed to describe the business logic of their company briefly. Furthermore, CF-2 of Case F stated, *“Construction of Expressways is a BM because it makes revenue”*, disregarding the BMs’ multivalent functions, including value creation and value capture other than revenue generation.

Though BMs can be used to visualise, understand, study, and develop a company’s business as a whole, the above findings revealed different implications regarding the role and use of BMs in the construction industry, mainly among construction contractors. Those implications can be summarised as a coding structure, as shown in Figure 4.4.

Figure 4.4

Coding structure for implications on the BM concept in the construction industry



Defining a BM related to the construction business is undoubtedly required because top-level managers of construction organisations have different perspectives regarding the BM concept. Therefore, the next section discusses the contribution of Phase I case study data in confirming ‘fundamental themes’ used to develop a CBM definition within Stage 1 of the BM development process.

4.5. Stage 1 – BM development process: Definition for Construction Business Model (CBM)

As described in Section 2.9, a definition for BM related to the construction business was developed following a systematic process for developing a CBM definition. In addition, Phase I case study interviewees were asked their opinions on precisely defining BM for the construction businesses and the requirement of such definition, as described in the next section.

4.5.1. Requirement of a definition for Construction Business Model (CBM)

All interviewees of eight cases agreed with the idea of developing a definition specifically for the Construction Business Model (CBM). CE-1 disclosed his assent by stating, “Definitions are useful in our industry. We used to work with definitions in

conditions of contracts, and we always tried to comply with them. So, if there is a definition for BM in the construction context, we can go with that.” Further, CF-1 of Case F highlighted the required features of CBM definition in his statement, *“Definitely, a definition for construction business model is required. However, it is to be with construction-related words familiar to us.”* CA-1 of Case A further emphasised that since different fields may have their own sub-languages, such as ‘construction’, defining BM with that sub-language is important for better understanding. More profoundly, findings necessitated the specifically defined BM for the construction industry context, i.e., a CBM definition.

As the top-level managers of cases expressed, introducing a definition will be an impetus to improve the BM concept’s applicability in the construction industry. CC-2 positively stated, *“Definition of construction business model will be much helpful to improve the familiarity of BM concept among construction managers.”* CB-2 added that familiarity with a concept would increase its applicability in any field.

4.5.2. Confirmation of derived “fundamental themes” for defining CBM

Five steps of the CBM definition development process (Figure 2.8) were accomplished under the literature review in Chapter 2. First, the existing definitions were analysed, and keywords were extracted to identify underlying themes in Steps 1 and 2. Eight themes among them that were suitable for the construction industry were chosen as ‘fundamental themes’ in the third step. Next, ‘wordings’ were extracted from the existing BM definitions for each fundamental theme (Step 4). Finally, the CBM definition was systematically developed using those wordings.

The developed CBM definition is,

A CBM is a simplified conceptual representation of a construction business that performs value creation according to Client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes and the status of the key company resources towards revenue and profit generation while expressing the company’s strategic choices with the awareness of the changes required and opportunities available.

This section incorporates evidence from Phase I case study findings to confirm the appropriateness of ‘fundamental themes’ of CBM definition and give empirical value to the developed definition. The explanations and clarifications provided by the top-level managers throughout the case study interviews, and the information derived from the websites of cases, helped verify the appropriateness and the importance of each ‘fundamental theme’.

Followings are the “fundamental themes” selected by reviewing literature for CBM definition.

- Value-based theme
- Stakeholder-based theme
- Process-based theme
- Resources-based theme
- Revenue-based theme
- Strategy-based theme
- Dynamicity-based theme
- Opportunity-based theme

CC-1 of Case C explained how adding value to Clients' investments is helpful in the construction industry: *"Actually, a particular construction project can be the only project that one Client may have in his lifetime. Therefore, it may be his lifetime investment, not like products or other types of services. So, they cannot ignore if something goes wrong. Hence it is our duty to add value to the Client's lifetime investment."* CB-2 added, *"As a top-level contracting company, why we exist in the market is because we are delivering value to our clients through quality jobs."* The interviewees highlighted the difficulty of surviving in the construction industry as a contractor without creating value. Accordingly, the value-based theme is considered fundamental to the construction business; therefore, it needs to be incorporated into the CBM definition.

The CBM definition is incorporated with the strategy-based theme, which is vital in the construction business as per the literature review. In the case studies, all interviewees proved the importance of the strategy-based theme. For instance, CJ-1 mentioned, *"always we have to go with strategies as a business"*, while CE-2 stated, *"without strategies, we cannot compete with our competitors"*.

All top-level managers discussed the importance of having good relationships with their stakeholders, including clients, employees, partners, subcontractors, suppliers, government, and the public, while most construction company websites highlighted the stakeholder relationships. For instance, *"Our code of ethics has been devised with the objective of developing and maintaining long-term relationships with all stakeholders while satisfying the requirements of our valuable customers"* [WEB-A of Case A]. Hence, the stakeholder-based theme is proved to be essential for the CBM definition.

As per case study findings, revenue-based, resource-based, and process-based themes are also crucial for the construction business. The statements, *"Revenue is the most important attribute for any business including construction business"* [CA-2], *"Having good resource base for a company is important, and utilization and management of resources are more important"* [CB-1], and *"The processes of the company are the most important attribute for creating value which is needed to be efficient and effective"* [CE-1], respectively prove the importance of revenue-based, resource-based, and process-based themes.

The websites of cases promote their ability to work in dynamic environments and find opportunities. Examples: “*With a strong penchant for finding opportunities for expansion and diversification*” [WEB-B] and “*The dynamic work environment offers our employees with challenging and learning opportunities that help develop successful careers in constructions*” [WEB-J]. Moreover, all interviewees emphasised the importance of being flexible in responding to today’s dynamic construction business environment. Hence, the CBM definition must address the dynamicity-based and opportunity-based themes.

Eventually, the appropriateness of ‘fundamental themes’ selected and used to define CBM under the literature review was confirmed. Then, to accomplish the sixth step of developing a CBM definition (Figure 2.8) and achieving OB2, the above CBM definition was carried out for validation by construction business experts in the Phase II qualitative survey.

Accordingly, the above discussion illustrated the contribution of Phase I case study findings to Stage 1 of the BM development process. However, the findings from case studies mainly contributed to selecting appropriate BM elements, establishing primary relationships among BM elements, explaining BM elements, and identifying describing parameters for developing Construction Business Model Ontology (CBMO) under Stages 2, 3, and 4 of the BM development process (Figure 2.7), as discussed in next sections.

4.6. Stage 2 – BM development process: Elements and composition of Construction Business Model Ontology (CBMO)

Initially, the composition of CBMO was identified based on Phase I case study findings. Therefore, the list of 17 different BM elements selected from the literature was presented to the interviewees with a brief explanation to identify appropriate BM elements for CBMO. Accordingly, Tables 4.6 and 4.7 lists the appropriate BM elements for developing a CBMO, highlighting changes and additions to the literature BM element list.

Table 4.6

Appropriate BM elements for developing CBMO – BM elements creating taxonomies

BM elements found in Literature	Appropriate BM elements constitute CBMO with changes and additions				
	Taxonomy Level 1	Taxonomy Level 2		Taxonomy Level 3	Taxonomy Level 4
Value proposition	Value Inputs	Time Cost	Quality Add-ons		
Value Network	Value Network	External Network		Client	<ul style="list-style-type: none"> • Financial Institutions/ • Industry peers & Competitors • Society
Customers				Partners & Subsidiaries	
Partnerships				Government	
				Suppliers & Subcontractors	
Government policy & regulation				Other Stakeholders	
	Internal Network	Management Professional staff Other employees			
Value creation	Value Creation		Processes	Supply chain management	
				Procurement	
Processes & Activities				Arranging Finance	
				Risk management	
Resources and capabilities	Resources and capabilities			Plant & Equipment	
				Workforce	
				Technical knowhow	
				Managerial knowhow	
Technology	Technology				
Value Capture	Value Capture			Profit	
				Costs	
Revenue				Overheads	
				Good recommendations	
Profit				Entering new sectors	
				Goodwill & Prestige	
Costs				Creating Network	

Table 4.7*Appropriate BM elements for developing CBMO*

BM elements found in Literature	Appropriate BM elements constitute CBMO with changes and additions
Strategic choices	Strategic choices
Change management	Change management
	Professionalism
Culture	Company Culture
	Company Vision
Mission	

As depicted in Tables 4.6 and 4.7, some BM elements were suitable for the construction business without changing the name (highlighted in pink). In addition, some BM elements were substituted with terms related to the construction business/industry (highlighted in green). Data also exposed some new BM elements (not highlighted with colours). The BM elements identified in Table 4.6 created taxonomies ranging from taxonomy levels 2 to 4.

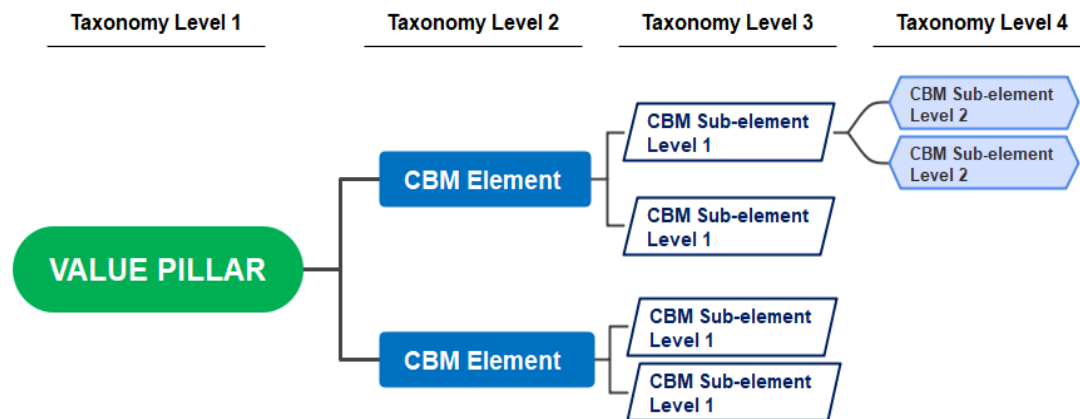
Considering the nature of the Value Proposition in the construction business, CA-1 of Case A highlighted, “*Construction businesses provide Value-Inputs that are convinced to their clients through previously completed projects.*” Similarly, CC-1 of Case C stated, “*Values we put into current projects will result in attracting future Clients and make the company profitable.*” Accordingly, CA-1 and CC-1 proposed that the most suitable term for element ‘Value Propositions’ is ‘Value Inputs’.

Osterwalder et al. (2010) suggested naming the primary areas of categorisation for which the related BM elements belong as ‘Pillars’. Similarly, within CBMO, four Pillars could be identified according to the Phase I findings: ‘Value Inputs’, ‘Value Network’, ‘Value Creation’, and ‘Value Capture’. Particularly, those four pillars were commonly identified as ‘Value Pillars’ due to the use of the term ‘Value’ with each pillar. The term ‘value’ denotes the importance and usefulness of those four pillars for the construction business. Consequently, the four ‘**Value Pillars**’ are considered the first taxonomy level of the CBMO, as shown in Table 4.6.

Four (04) BM elements were selected, and Seven (07) BM elements were introduced through case studies for the second taxonomy level as depicted in Table 4.6, which belong to four Value Pillars. The BM elements creating taxonomy level 2 are called ‘**CBM Elements**’ in this study. Based on findings from case studies, some CBM Elements could be categorised into sub-elements in the third taxonomy level called ‘**CBM Sub-elements**’. The CBM Sub-element, ‘Other Stakeholders’, contributes to the fourth taxonomy level introducing two levels for CBM Sub-elements. Accordingly, the CBMO comprises taxonomies of BM elements ranging from taxonomy levels 2 to 4, symbolised as shown in Figure 4.5.

Figure 4.5

Taxonomy levels of Value Pillars



The four Value Pillars with their CBM Elements and CBM Sub-elements are described in Sections 4.7.1, 4.7.2, 4.7.3, and 4.7.4 with findings from case studies.

On the other hand, all interviewees of the eight cases argued that strategies are essential to every business, including construction. Therefore, strategies must be used to survive and succeed in the industry when deciding on value additions to the Clients, handling Clients and Other Stakeholders, creating value, capturing value, and adapting to changes. Accordingly, the BM element ‘Strategic Choices’ must be shared with all BM elements. Furthermore, corresponding to Strategic Choices, interviewees from Case A, Case B, Case C, Case E, Case F, Case K, and CD-1 of Case D proposed that the ‘Change Management’ has to be applied to all the BM elements to survive in the dynamic business world.

Furthermore, the interviewees of Case A proposed and all the other interviewees confirmed ‘Professionalism’ as one of the essential BM elements to the CBMO. Accordingly, all the BM elements in CBMO are dominated by ‘Professionalism’ due to the involvement of multi-disciplinary professionals [CA-1]. Hence, professional ethics would be primarily applied in the construction business [CJ-1]. Subsequently, the BM elements Strategic Choices, Change Management, and Professionalism are named ‘**Shared Elements**’ in the CBMO. Sections 4.7.5, 4.7.6, and 4.7.7 discuss the three ‘Shared Elements’.

CB-1, CC-2, and CK-1 repudiated the BM element ‘Mission’, emphasising that the Mission is discussed with the Value Creation. As defined by CB-1, “*the mission describes what the company needs to do to achieve the vision*”—hence, a separate element is not necessary.

However, ‘Company Vision’ is included in the CBMO as proposed by CD-1 and CF-1. This must be considered and reflected when making business decisions, and the decisions under all the elements should be driven towards Company Vision, as discussed under Section 4.7.9. Accordingly, the BM element ‘Company Vision’ is

identified and named '**Reflective Element**' of the CBMO. Furthermore, 'Company Culture' affects every business decision as every organisation has its own culture [CA-1, CE-1, and CF-2]. Hence, the business decisions must align with the Company Culture, considering it as '**Incorporated Element**' of the CBMO, as discussed in Section 4.7.8.

To sum up, Phase I case studies found four Value Pillars with CBM Elements and CBM Sub-elements, three Shared Elements, one Reflective Element, and one Incorporated Element that constitute the CBMO. The following sections discuss these BM elements of CBMO in detail using findings from case studies.

4.7. Stage 3 – BM development process: Describing Construction Business Model Ontology (CBMO) elements

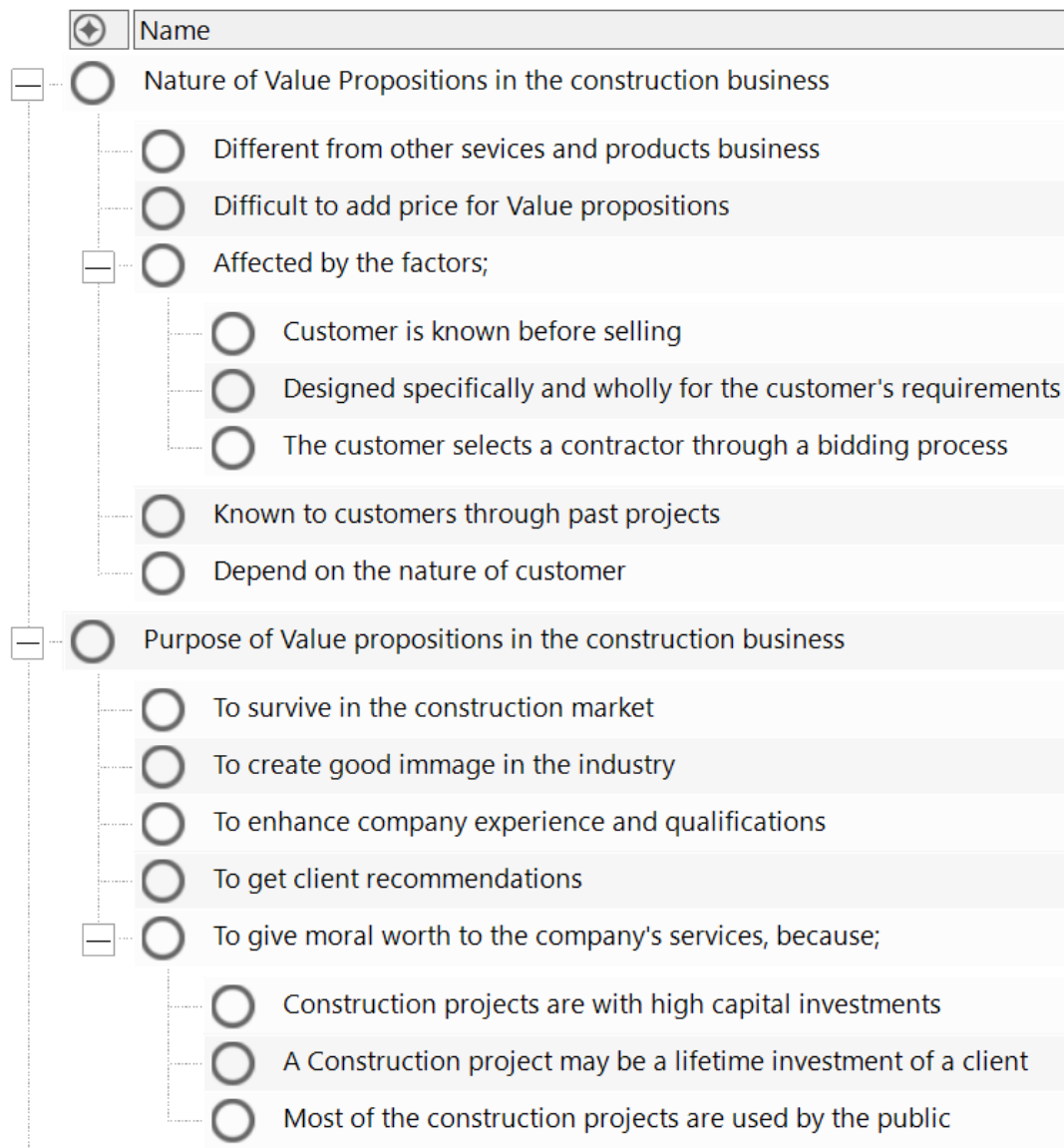
The case study findings related to each BM element selected for developing CBMO (Tables 4.6 and 4.7) are described in the following sections.

4.7.1. Value Inputs (Value Propositions)

'Value Inputs' is the term proposed by CA-1 and CC-1 to substitute 'Value Propositions'. The value proposition is "What do we offer to customers that they value?" (Yunus et al., 2010), or it is what makes a company attractive to customers. All the interviewed top-level managers emphasised that the purpose of Value Propositions in construction businesses is somewhat different from that of other product and service businesses since it is difficult to add a price for Value Propositions in construction businesses. Accordingly, Figure 4.6 shows the coding structure created by NVivo to present the nature and purpose of Value Propositions in the construction business, identified through case study findings.

Figure 4.6

Coding structure of the nature and purpose of Value Propositions in the construction business



The Value Propositions in the construction business are affected by various factors: E.g., the customer is known before selling the service [CB-1, CC-2, CF-2, and CJ-1], the product is designed specifically and wholly for the customer's requirements [CD-1, CE-2, and CF-2], and mainly the contractor's service is selling for customers through a bidding process [CJ-2 and CK-1]. As a result, interviewees highlighted that the construction businesses' Value Proposition is used "to survive in the construction market" [CF-1, CE-2, and CJ-1] "to create a good image in the industry" [CA-1, CB-1, CC-1, and CK-2], and "to enhance the company qualification and experience" [CB-2, CD-1, and CJ-2].

CF-1 detailed "the Value Proposition of our business to be displayed to construction Clients by setting examples through completed works", while CA-1 indicated "our

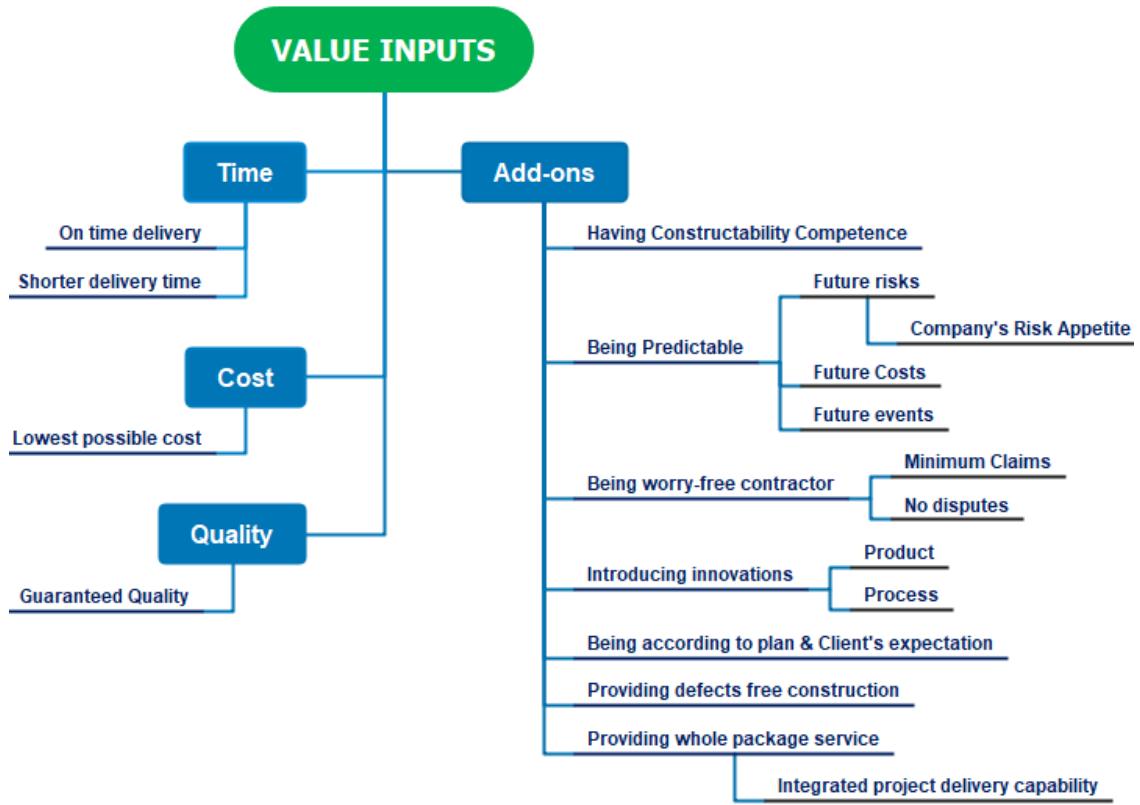
completed works, previous Clients' recommendations and consultants' recommendations are our Value Propositions". Auxiliary, *"like in other markets, we also have to go with innovations to survive in the construction market. The Value Propositions are important for innovations"* [CA-2]. CK-1 added, *"Value for Clients can be added through innovations."* CC-1 has come up with a different point identifying the Value Propositions for Clients as a moral duty of construction contractors to provide value for investments that can be the Clients' lifetime investment. As stated by CA-2, Value Propositions provided by the contractors depend on how the Clients consider those Value Propositions as a benefit for them. Hence, the Value Proposition is to be considered with the Client's requirements, type of Client, and type of the project: *"Value Proposition to be provided may differ from Client to Client and project to project"* [CA-2].

On the other hand, CE-2 pointed out the uselessness of defining construction businesses' Value Proposition on websites or via advertising as it comes from Client satisfaction through previously completed projects. However, the websites of all the cases try to promote their companies by highlighting Value Propositions. For instance, Case E's Mission consists of *"unparalleled value"* [WEB-E], and Case A highlighted *"...focus on expanding its portfolio of value-added engineering services"* [WEB-A].

The nature of the Value Propositions in the construction business helps identify Value Propositions in the construction businesses as 'Value Inputs' as proposed by CA-1 and CC-1 (refer Section 4.6). Figure 4.7 depicts the taxonomy developed for the 'Value Inputs' in relation to the construction business using Mind maps.

Figure 4.7

Taxonomy of Value Inputs



As illustrated in Figure 4.7, the first Value Pillar, ‘Value Inputs’, was primarily categorised into CBM Elements, ‘Time’, ‘Cost’, ‘Quality’, and ‘Add-ons’, discussed in the following sub-sections. Figure 4.7 further illustrates the details to be considered under each CBM Element.

4.7.1.1. Time, Cost and Quality

As all cases evidenced, the construction companies mainly provide value to the Clients concerning Time, Cost, and Quality. Completing projects on time or within a shorter period is the most common Value Input that Case A, Case B, Case D, and Case F believe in attracting future Clients based on time. As portrayed by all interviewees of all cases, Time is one of the significant determinants of project success. Further, Case B and Case D displayed the Time Value Input, on-time delivery of projects on their websites, stating “to ensure the timely completion of projects” [WEB-B] and “we are committed to complete our projects on time” [WEB-D].

However, Case J and Case K's interviewees stressed the difficulty in timely completion of projects, especially infrastructure projects, due to many reasons. As mentioned by CC-1 of Case C, “Since the quality of construction projects is in particularly defined standards that contractors must provide, it is better to add value through time to differentiate.” Yet, CA-2 remarked, “Saving time is the best value we can offer our clients, enabling them to get an early return from their investment.” All the interviewed top-level managers believed that delivering projects without deviating

from Clients' plans and schedules is a significant Value Input that benefits Clients and influences the construction company's survival in the industry.

'Guaranteed quality' is recognised as a Value Input by all the interviewed top-level managers since achieving the specified quality is vital to ensure Clients' expectations in construction projects. For example, while CF-1 of Case F believes that their company is the No.1 top-level contractor in the industry due to the quality of their works, CF-1 stated, "*We always try to give best quality work and use best quality materials to highlight and enhance our works' quality.*" Additionally, almost all company websites have exhibited 'Quality' related praises to make their companies attractive. For instance, "*Over the years, our construction performance has been continuously commended with awards won both locally and internationally for quality*" [WEB-J], and "*We are committed to complete our projects' superior quality matched with specifications*" [WEB-D]. It is noted that Case B came up with guaranteed quality rather than providing additional Quality as depicted by the statement of CB-2, "*The contractors are not going to add more quality than what is specified because of increase in cost.*" CA-2 added, "*Value engineering can be used to add quality to the project, but it is difficult to assess.*" Ultimately, all the interviewees highlighted that their companies' success in the industry depends on guaranteeing the projects' specified Quality without harming Client's expectations. Moreover, the websites of all eight cases promote their companies, highlighting the achievements of ISO certifications and guaranteeing their compliance with quality management systems.

"*Today, some Clients expect ideas and proposals from contractors other than consultants to achieve the lowest possible costs*" [CC-1 of Case C]. Hence, some contractors use it as a Value Input. CF-2 mentioned, "*We can achieve the lowest possible cost by increasing the efficiency of our work as a contractor.*" Case C and Case D websites also exhibit their commitment to completing projects with '*cost-effectiveness*' while WEB-F of Company F offers its services at a '*competitive cost*'. Hence, contractors could add value by completing the projects at the lowest possible cost.

Ultimately, the above-described methods provide value for Clients in terms of Time, Cost, and Quality being CBM Elements of Value Inputs.

4.7.1.2. Add-ons

Interviewed top-level managers of eight cases further declared different methods of providing additional values for their clients that ultimately affect Time, Cost, and Quality, named 'Add-ons'.

As listed in Figure 4.7, four top-level managers [CB-1, CD-1, CJ-2, and CK-1] believed that the company's **constructability competence** could attract Clients, which, in turn, affects the achievement of Time, Cost, and Quality targets of the projects. CB-1 of Case B identified constructability as a formalised process of construction that helps to construct a better-quality project on time within the expected budget. CD-2 pointed out, "*some procurement systems like design and build, enhance*

the constructability by integrating constructability into the design process because contractors can involve in the project from the early stages". Hence, it is believed that the construction companies' in-house construction abilities and practices lead to constructability, which helps achieve a successful project [CA-1].

CA-2, CB-1, and CJ-1 of Cases A, B, and J assume that their **ability to predict future risks, costs, and happenings** is beneficial to both the contractor and the Client in achieving project targets because construction projects have high risks and uncertainties. As stated by CB-1, *"If we can give more effort to predict future risks and uncertainties with our experience and knowledge, we can use it for successful completion of the projects, and future Clients could be attracted."* CA-2 enriched the statement by saying, *"The level of risk that company is willing to accept is important in business decision-making, which also benefits the Clients."* Case A identifies it as the **'company's risk appetite'**.

CC-1, CF-1, and CF-2 provided an interesting point: to be a **worry-free** contractor for the Client. CC-1 brought up, *"Having **minimum claims** in past projects is an additional value that some Clients consider."* For instance, CF-1 disclosed the experience of one of Case F's Clients as *"one of our Clients said that he was fed up with the previous project's contractor due to claims, disputes, adjudications...etc."*. Hence, being involved in fewer claims can reduce antagonism between the Client and the Contractor and provide value addition to the Client.

The website of Case A (WEB-A) expressed Company A's interest in innovation: *"We integrate an innovative mindset with cutting edge technology that strikes a balance between big ideas and the technical ability to bring them to life."* As per Case A, innovations make them different in the industry. Moreover, CF-1 pointed out, *"Today, it is important to think about innovations to achieve Time, Cost, and Quality targets and survive in the industry. As a contractor, process innovations are also important."* Accordingly, **introducing product/ process innovations** is an additional Value Input useful in achieving other Value Inputs.

All top-level managers of the eight cases expressed that Clients are interested in working with contractors who produce finished products with **less/no defects** and **according to plans and expectations**. Case A emphasised on its website, *"We live and breathe plans, blueprints, specifications..."* [WEB-A]. On the other hand, CA-1 revealed a different point as an Add-on: **"providing service for the Client's whole package"**, which could be used under integrated procurement methods. CA-1 described, *"Under the project delivery methods like D&B, PPP, and BOOT, the contractor's Value Inputs need to be included in every stage as a whole package. That could be provided for design, the construction method used, equipment used & their efficiency, the technology used, etc."*

Accordingly, the additional inputs provided for Clients are Add-ons, one of the CBM Elements of Value Inputs.

4.7.2. Value Network

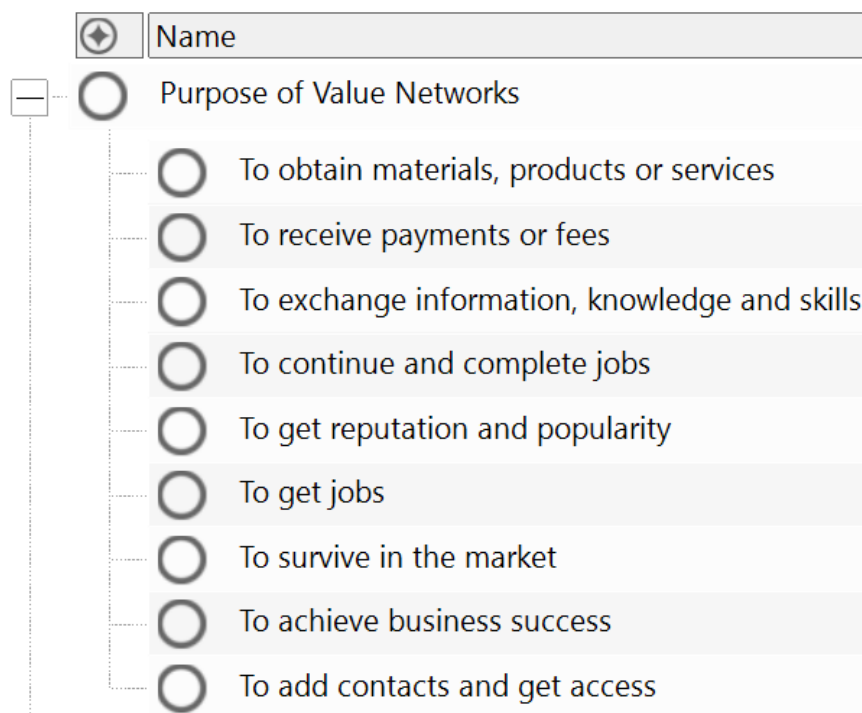
Perceptions of top-level managers of the eight contracting organisations (cases) regarding the ‘Value Network’ were gathered through interviews to explore the relations and the value exchange between construction businesses and different stakeholders. As per all interviewees, the Value Network is crucial for the construction business due to the involvement of various stakeholders in the construction industry. Interviewees further emphasised the importance of managing created Value Network [CA-1, CB-2, CD-1, and CF-1], keeping in touch with them [CA-1], and expanding to succeed [CD-1 and CF-1].

Moreover, interviewees from Case A, Case B, Case C, Case E, and Case J identified other benefits of creating and maintaining a strong Value Network: obtaining goods and services [CC-2, CE-1, and CE-2], exchanging information and knowledge [CA-2, CC-1, CJ-1, and CJ-2], getting jobs [CA-1, CB-2, CC-1, and CE-1] continuing jobs/projects [CJ-2], successfully completing jobs/projects [CE-2 and CJ-1], and business survival [CC-1 and CE-1].

The coding structure developed with NVivo to highlight the purpose of Value Network within the construction business is presented in Figure 4.8. These purposes ultimately benefitted the company, which can be enhanced by expanding Value Network.

Figure 4.8

Coding structure of purpose of Value Network



When deciding on a Value Network for a particular business option/ project, CE-2 of Case E urged the necessity of considering whether the parties in the network could fulfil the requirements of the business option/project and whether the party can comply with the given quality and standards. CB-1 of Case B confirms this: “*We have to think*

about who could provide us quality service for a particular project within our Value Network.” As per CD-1, it is vital to create strong relationships among parties where understanding and familiarity are useful. In creating a strong Value Network for a business, interviewees from Case A commended that ‘openness’ is essential. *“Openness is important in creating a strong network where we can get to know the appetite and sense of them and their society which is important to identify stakeholders and have relationships with them, especially Clients”* [CA-1].

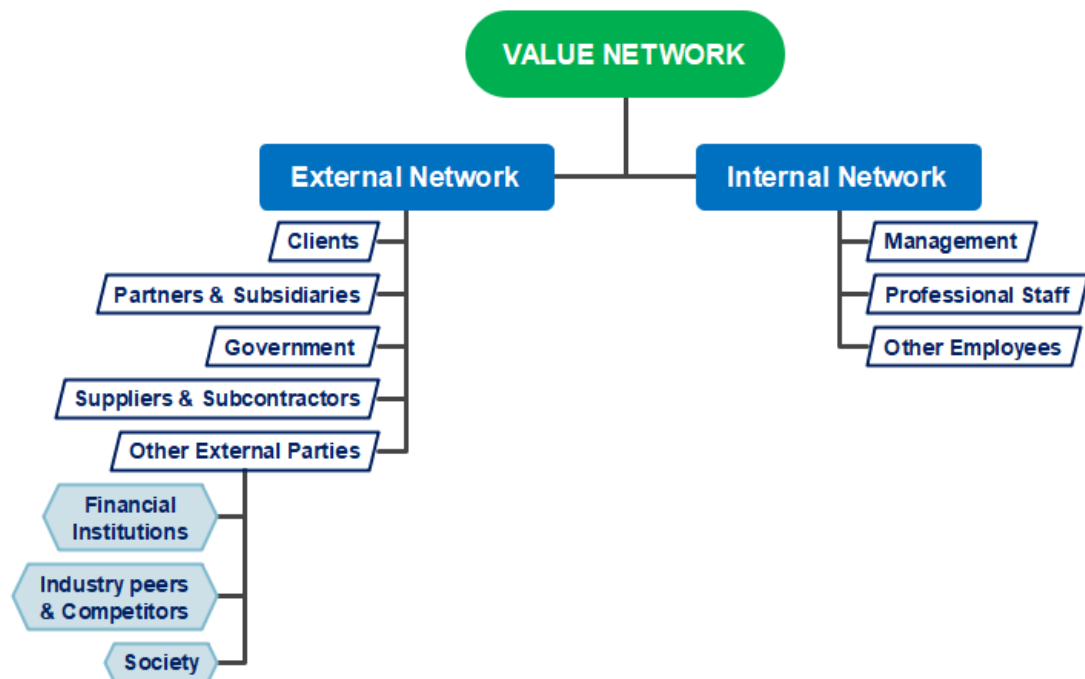
CA-2 explained the role of construction business managers in such networking: *“As construction business managers, we can talk with some of our stakeholders openly and unofficially to make connections and familiarity, which will be useful for our business later.”* Therefore, as displayed in WEB-A, developing long-term progressive relationships with all stakeholders is considered vital for Case A.

On the other hand, CE-1 of Case E stated, *“The Value Network has to be created among and within units of business of construction projects.”* Hence, four top-level managers of Case A, Case C, Case F, and Case K argued that Internal and External Networks are attached to the construction supply chain as it is a project business. For instance, CA-1 stressed, *“We need to identify who is in our supply chain internally and externally and how they are connected to our supply chain.”*

Accordingly, case studies categorised the Value Network of the construction business mainly into Internal and External Networks. Internal Network focuses on internal activities, processes, and relationships among company Management, Professional Staff, and Employees. In contrast, the External Network includes Clients, Partners, Subsidiaries, Subcontractors, Suppliers, Government, and Other External Parties, e.g., Financial Institutes, Society, Industry Peers, and Competitors. Ultimately, the primary taxonomy for the Value Network was created using ‘MindMaster’ as shown in Figure 4.9.

Figure 4.9

Taxonomy of Value Network



4.7.2.1. External Network

As per CF-2 of Case F, External Network is the connections and relationships with external parties essential for business success. CK-2 provided examples that Case K is experiencing where a corporation with the External Network is essential. *“If it is a road project, cooperating with authorities like Ceylon Electricity Board and Water Board is required, and if it is a pipe laying project, cooperating with Road Authorities is required.”* Therefore, as CA-1 advised, External Value Network should be handled strategically and tactfully to prevent possible ethical issues, especially when having open networking with Government authorities and Clients.

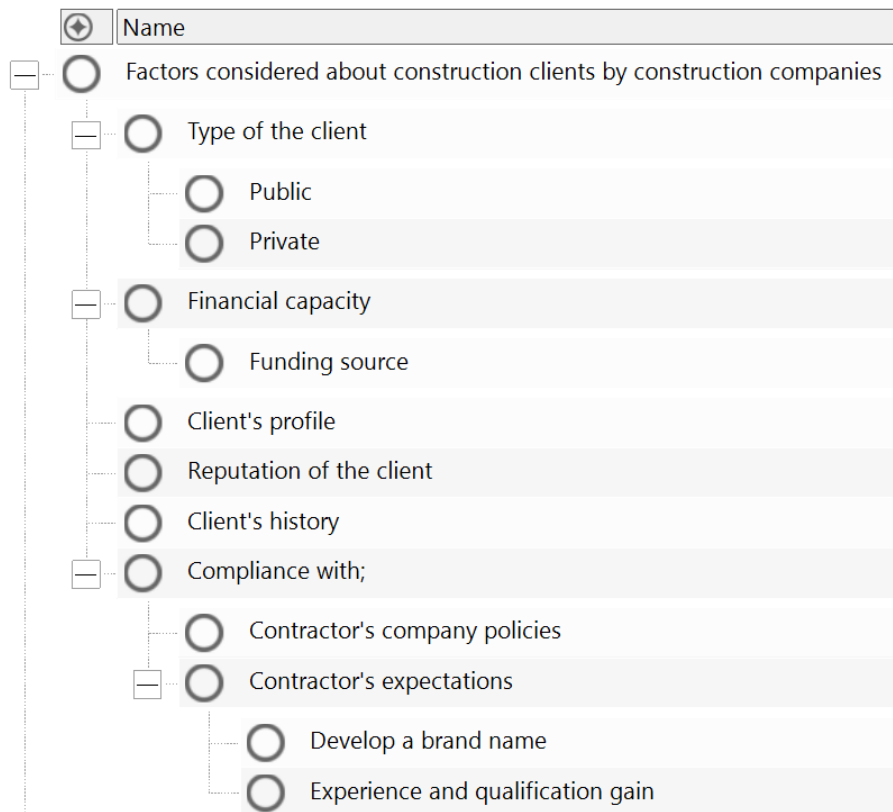
Client, Partners and Subsidiaries, Government, Suppliers and Subcontractors, and Other External Parties come under the External Network as CBM Sub-elements.

4.7.2.1.1. Client

Like other businesses, all the top-level managers of construction companies agreed that the Client was the most crucial attribute of the construction business. However, Cases A, B, C, E, and F consider several factors about Clients when selecting construction projects as their business options. Figure 4.10 illustrates the coding structure of factors that construction contractors consider about the Client in business decision-making.

Figure 4.10

Coding structure of the factors considered about Clients by the contractors



As depicted in Figure 4.10, all the interviewed top-level managers of cases accentuated the need to consider the type of construction client under the main categorisation of public and private. However, CA-2 of Case A further highlighted the uniqueness of each Client in the construction industry, saying, *“The construction Clients are unique because they are varied from public Clients to private Clients, from one public Client to another public Client, and from one private Client to another private Client.”*

Unlike other businesses, prior identification of customers would be possible in the construction business as customers are known before commencing projects. Accordingly, CC-2 of Case C stated, *“It is better to think about Client’s reputation while considering the nature of the project because we already completed and currently undertaking several high-profile projects of prominent Clients.”* The website of Case C gives the same idea: *“Company has undertaken several high-profile projects and completed several leading projects that set the benchmark in the country’s construction industry”* [WEB-C]. CB-2 of Case B added, *“We try to get projects of reputed Clients with discounts to develop a brand name for us and experience.”* Accordingly, it is evident that construction companies are targeting reputed Clients with high-profile projects even without expecting a high-profit margin.

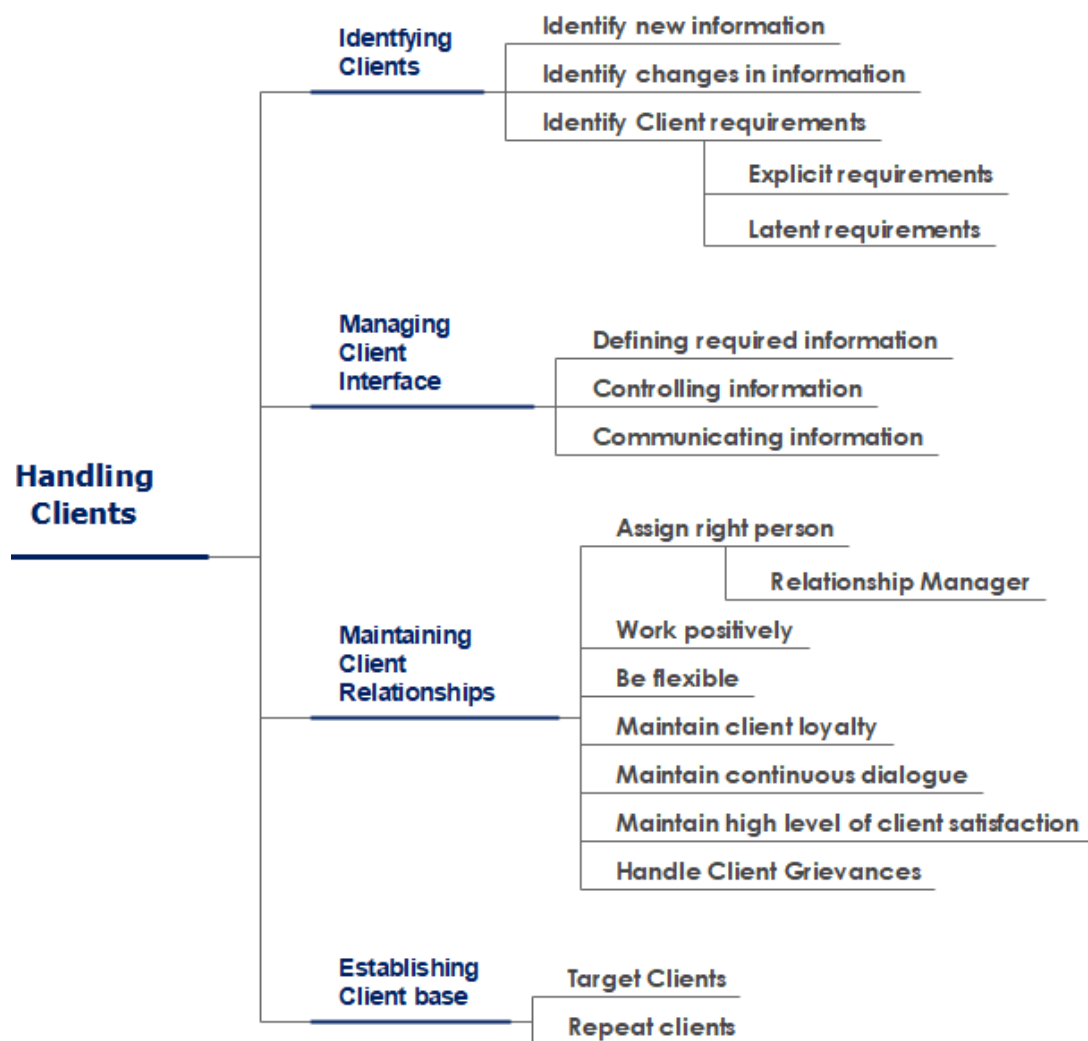
More importantly, *“It is beneficial to consider the Client’s history in previous projects and his financial capability.”* [CD-1]. CK-1 stressed, *“As we are mostly carrying out*

infrastructure projects, we primarily check the source of funding to predict future receipt of payments.” On the other hand, construction companies have their own policies when selecting projects and Clients. For instance, CA-1 declared a policy of Case A, “We mainly focus on doing foreign-funded projects, and we exclude government treasury funded projects.” Case B has the policy of not doing projects like school buildings and conventional buildings as per CB-2.

While the Client is one of the crucial elements of the construction business, all interviewees of eight cases stressed that handling Clients is the most challenging task for construction companies. Consequently, Figure 4.11 illustrates the necessary considerations and actions derived from data collection for handling Clients effectively.

Figure 4.11

Considerations and actions for effective handling of Clients



All interviewed top-level managers stated that initially identifying Clients is essential, especially when there is a new Client. As recognised by CB-1 of Case B, identifying a Client shall also include identifying the Client's requirements. Then, “after

identifying the Client, it is important to interact with the Client focusing on the Client's requirements within the Client's interface" [CA-2]. CJ-2 of Case J, which is only involved in infrastructure development projects, pointed out the importance of interface management to establishing and maintaining better relationships. "We have to identify clearly, control, and carefully communicate the required information within the Client interface. This is very important when handling public Clients" [CJ-2].

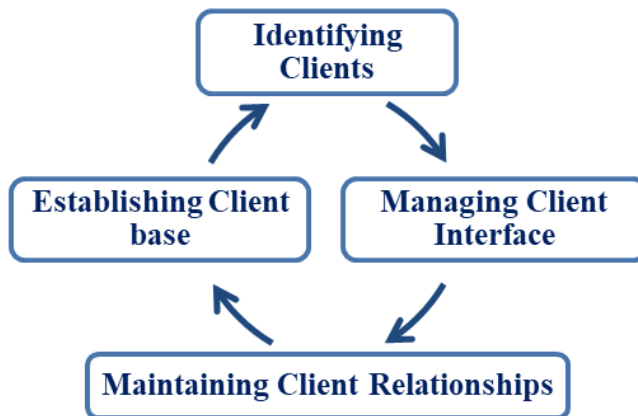
As per the interviewed top-level managers, all eight cases recognised the importance of maintaining cordial relationships with the Clients. For example, CB-1 claimed, *"The established relationships with Clients to be maintained are essential and difficult."* In addition, CC-1, CD-2 CF-2, and CK-2 disclosed the way of maintaining client relationships. *"Our staff always try to work with Clients positively and be flexible for their requirements" [CC-1], "we maintain a continuous dialogue with our Clients" [CD-2], "we assign right persons from our staff to handle different Clients separately" [CF-2], and "maintaining Client loyalty is important especially when dealing with government authorities" [CK-2].*

Similarly, interviewed top-level managers from Case A and Case B disclosed that their companies appoint Relationship managers for each significant Client. *"Our company expects to capture all Client requirements because there can be explicit and latent requirements of Clients. So, we use relationship managers at least for major reputed Clients" [CA-1].* Moreover, CE-2 acknowledged, *"Most of the repeat orders for us are based on our relationships with the Clients."* CA-2 added, *"In the construction industry, most of the time we have to work with the same Client for different projects and thus developing long-term progressive relationships with them is important."* CE-2 reminded that identifying changes in Client information and Client requirements for a particular project is essential when handling repeat Clients. CB-2, CE-1, CF-1, and CK-1 explored that Client satisfaction is affected by better relationships with Clients. CF-1 further mentioned the importance of Client satisfaction: *"Client satisfaction through effective project implementation helps us to secure our future business."* WEB-D also displayed, *"maintain a customer satisfaction level of over 95%",* stating Case D's grant for Client satisfaction.

On the other hand, Case A and Case F consider 'Client grievance handling' as essential in maintaining Client relationships. For example, CA-2 stated, *"We handle Client grievances and complaints and take corrective actions before they escalate into a big issue."* CF-2 added, *"The feedback from the Client grievance handling process can be used as lessons learned."* *"Finally, we can establish our existing Client base with repeat and target Clients" [CA-2].* However, CB-1 underlined, *"This process cannot be stopped, and we have to follow this process not only with our new Clients but also with repeat and target Clients."* Accordingly, Case A and Case B interviewees showed that handling Clients is to be done as a process. Consequently, Figure 4.12 demonstrates the process of handling Clients by the construction companies.

Figure 4.12

Process of handling Clients



To sum up, the Client is the most important party, and the construction companies must handle them carefully and consider a crucial CBM Sub-element that constitutes CBMO.

4.7.2.1.2. Partners and Subsidiaries

Interviewed top-level managers of Case A considered having partnerships as one of their Value Creation systems. CA-1 stated that his company has collaborated with Partners of significant and emerging economies like India and works with them to acquire experience, knowledge, and skill. CA-2 commented, *“Our partnerships are attractive to Clients, especially public sector infrastructure projects where we use our partnerships as our qualification and match them with the Client’s requirements.”* As highlighted by CF- 1, *“In JV projects, there is a synergy as the cost is sharing.”*

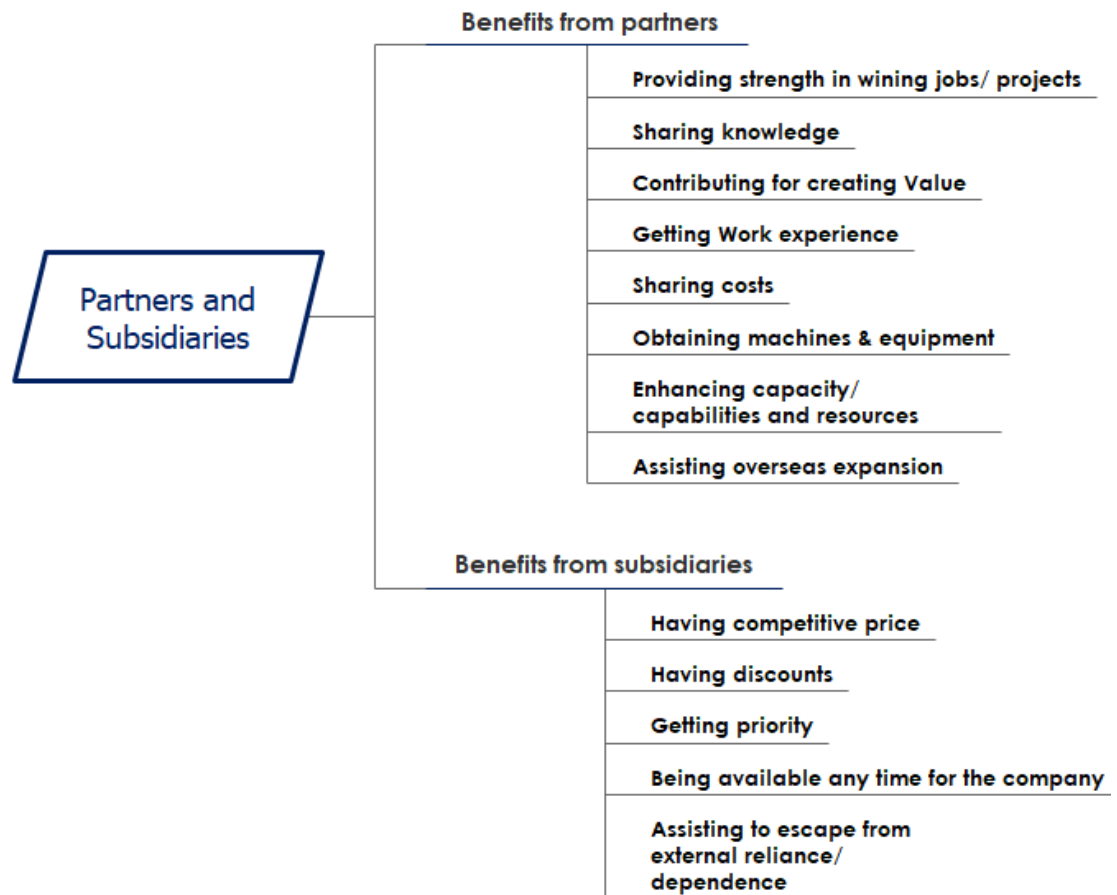
Above all, CA-2, CB-1, and CB-2 emphasised the importance of building and maintaining progressive, sustainable relationships with partners. As for handling Clients, Case A also has relationship managers for each major and foreign Partner, as stated by CA-2. CB-1 mentioned, *“Like Clients, our Partners also expect us to safeguard their interests by fulfilling the obligation on time”*. Case D openly invite like-minded entities and individuals to become partners of the company by stating, *“if you are willing to Partner or get into a joint venture with one of the most reputed businesses in Sri Lanka, drop an email...”* on their website (WEB-D).

All the cases in the sample have their subsidiaries listed on their official websites. Interviewed top-level managers disclosed the benefits they could gain by having subsidiaries. For example, *“due to subsidiaries, we can have competitive price from others as we have an option that is our subsidiary company”* [CE -1], *“we can have discounts from our subsidiaries”* [CC-2], and *“we can get priority for our projects from subsidiaries, and we can escape from external reliance/ dependence. Also, it is available any time for us”* [CE-2].

Accordingly, the Mind Map was created for CBM Sub-element – Partners and Subsidiaries as in Figure 4.13, which lists the benefits from Partners and Subsidiaries.

Figure 4.13

Benefits from Partners and Subsidiaries



4.7.2.1.3. Government

Interviewed top-level managers of all cases identified the vital role of the Government in the construction industry. The Government contributes to the construction industry as a client, a regulating authority, and a policy and standards maker. CE-1 explains how government actions affect the construction industry: *“The construction industry generally contributes 5-7% of any country’s GDP. So, the changes in fiscal policies, monetary policies, and other Government policies instantly affect the construction industry.”* In addition, all interviewees have agreed that maintaining cordial relationships and building confidence with the Government is paramount since the Government initiates most major projects (infrastructure). CA-1 added, *“...it also affected our business operations and continuity”*. CJ-1 pointed out another issue when working with the Government as the public Client, *“we have to negotiate some payment terms with the Government, for example, the grace period and interest rates which are directly affected to the construction contracts”*.

Findings reveal that adapting to Government policy changes is very important. CB-2 stated, *“As a construction company, we have to foresee Government policy changes and their impact to survive as a business.”* However, as mentioned by CK-1, frequent changes in Government policy decisions may affect construction industry development. CF-1 claimed, *“frequent changes in Government taxes affect our business performance and profitability”*. Nevertheless, top-level managers of construction companies accepted the requirement of adapting to policy changes as a business entity.

Construction companies sometimes have conflicts with some Government policies, rules, and regulations. For example, CF-2 indicated, *“environmental regulations, for example, banning some quarries, affected our business largely”* and *“construction business is depending on investments and investments are affected by Government policies, so due to some Government policies, investors are discouraged”* [CC-1]. However, some Government policies lead contractors towards modern and innovative methods and concepts as a positive point. For example, *“with environmental regulations, we will adapt for green concept automatically”* [CA-2].

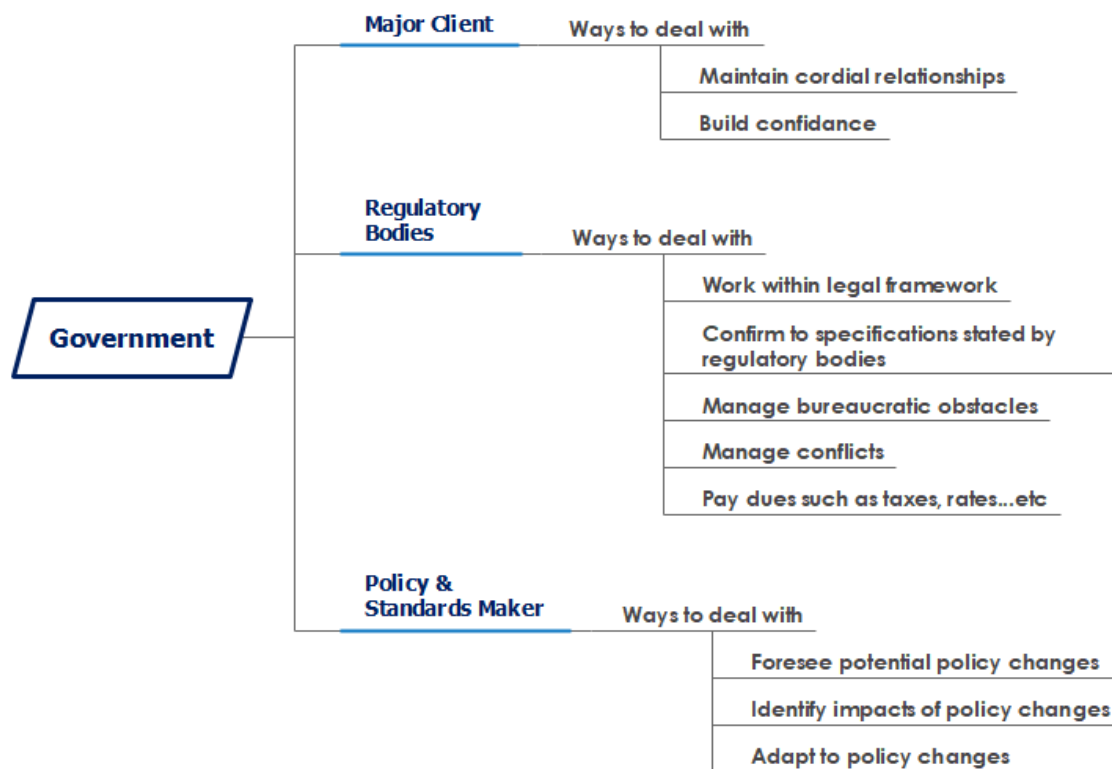
Interviewed top-level managers proved their compliance with laws and regulations of the country by providing examples: *“We continue and renew operating licences based on rules and regulations of Central Environmental Authority and Local Authorities”* [CJ-1], *“We renew CIDA grading complying with rules and regulations”*[CD-2], and *“We obey all the laws related to labour authority like working hours, minimum wage rates, and health and safety of employees”* [CD-1 and CF-1].

On the other hand, most interviewees claimed difficulty in dealing with Government authorities, especially when obtaining construction licences, approvals etc., such as *“long and delayed processes”* [CD-2], *“bureaucratic obstacles”* [CK-2], and *“lack of efficiency”* [CE-1].

Figure 4.14 shows the Mind Map prepared based on findings highlighting how to deal with the Government. Figure 4.14 illustrates the Government’s role in the construction business and the ways of dealing with the Government as a Client, as the regulatory body, and as a policy and standards maker.

Figure 4.14

Ways of Dealing with Government



4.7.2.1.4. Suppliers and Subcontractors

As per the findings from all the cases, Suppliers and Subcontractors play a vital role in achieving construction business objectives and timely and successful completion of projects. Furthermore, according to CC-1 of Case C, Suppliers and Subcontractors are also prominent in creating value for various Clients. Moreover, interviewees listed the potential they expect from their Subcontractors as follows.

- Capability in carrying out the works [CD-2, CE-2, and CK-2]
- Work uninterruptedly [CD-2, CE-1, CJ-2, and CK-1]
- Be trustworthy [CA-1, CB-2, and CF-1]
- Competitive in terms of prices [All interviewees]
- Quality in service [All interviewees]
- Flexibility [CE-1]
- Easy to communicate with [CF-2, CJ-1, and CJ-2]
- Possessing a good past track record [All interviewees]
- Adherence to ethical conduct [CA-1 and CB-1]

As stated by CA-1, the companies must establish long-term healthy relationships with Suppliers and Subcontractors. On the other hand, CA-2, CD-2, CE-1, and CF-2 disclosed that their companies continuously carry out Supplier and Subcontractor evaluations.

4.7.2.1.5. Other External Parties

The case study findings exposed that Financial Institutions, Industry Peers, Competitors, and Society can be considered ‘Other External Parties’ the construction companies deal with.

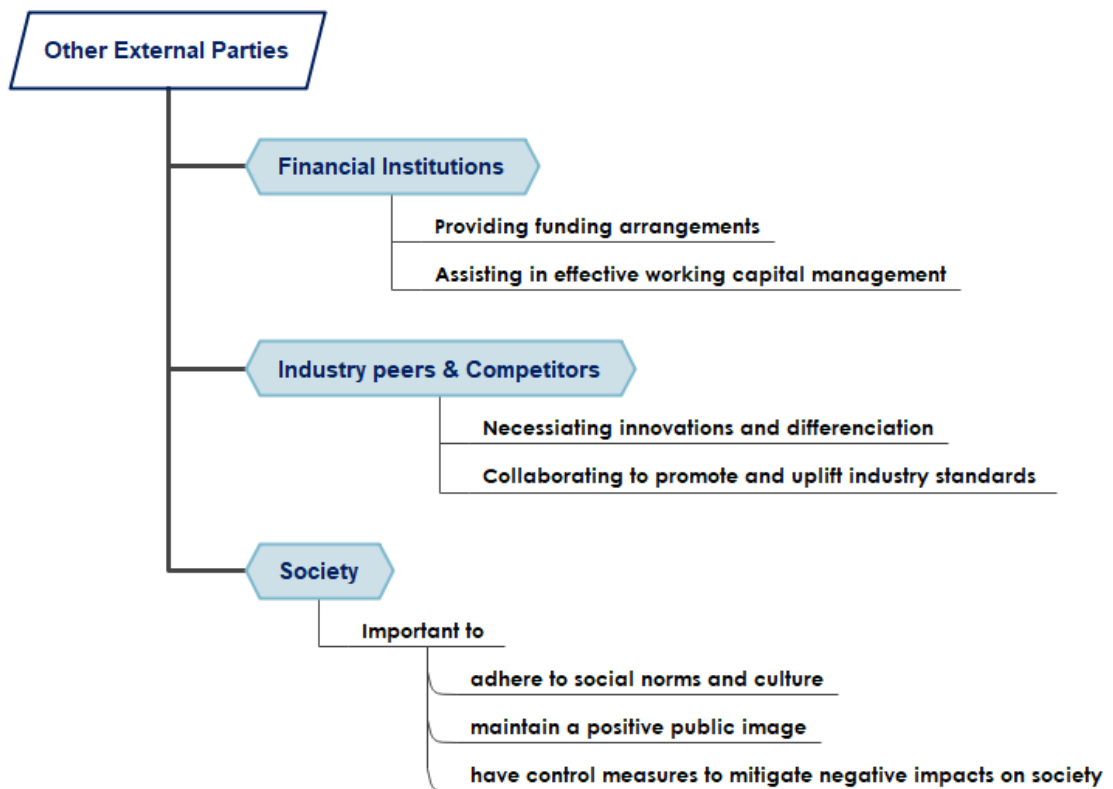
For example, “*Financial Institutes play a major role in any business*” [CA-1]; CD-1 provided an example for Financial Institutes’ involvement in the construction business as “*Financial Institutes provide us funding arrangements to enable effective working capital management*” [CD-1]; “*Competitors necessitate the innovations and differentiation of our company*” [CA-2]; CE-1, CJ-1, and CK-2 emphasised the requirement of work in collaboration with the industry peers, “*We jointly execute mega-scale infrastructure development with peers*” [CJ-1]; “*We actively promote and uplift the standards of the industry together with our peers*” [CE-1].

Interviewed top-level managers of Case J and Case K highlighted the importance of society as the end-user of most construction products. “*We always try to maintain a positive public image to succeed as a business in this industry, and therefore we have to adhere to the social norms and culture*” [CF-1]. In addition, CJ-2 and CK-1 pointed out the requirement of having control measures to mitigate actual and potential negative impacts on society during project execution, especially infrastructure projects. For example, “*due to the roads and bridges projects, communities are affected through hazards, inconvenience on travelling, dust generation, vibration, and so on*” [CJ-2].

Accordingly, the CBM Sub-element, Other External Parties, can be categorised into further Sub-elements as Financial Institutions, Industry Peers and Competitors, and Society, as shown in Figure 4.15.

Figure 4.15

Taxonomy of Other External Parties



4.7.2.2. Internal Network

When considering Internal Network, CC-1 highlighted the need for a strong cross-disciplinary approach among multi-disciplines because “... *the construction business is a project business with inputs from multi disciplines*” [CC-1]. As mentioned by all interviewees of case studies, professionals from multi-disciplines must be involved mainly in the top and middle-level management of the construction companies. Most importantly, they emphasised the requirement of Professionalism to survive in the industry as a construction company. Hence, ‘Professionalism’ is considered as a separate element for CBMO.

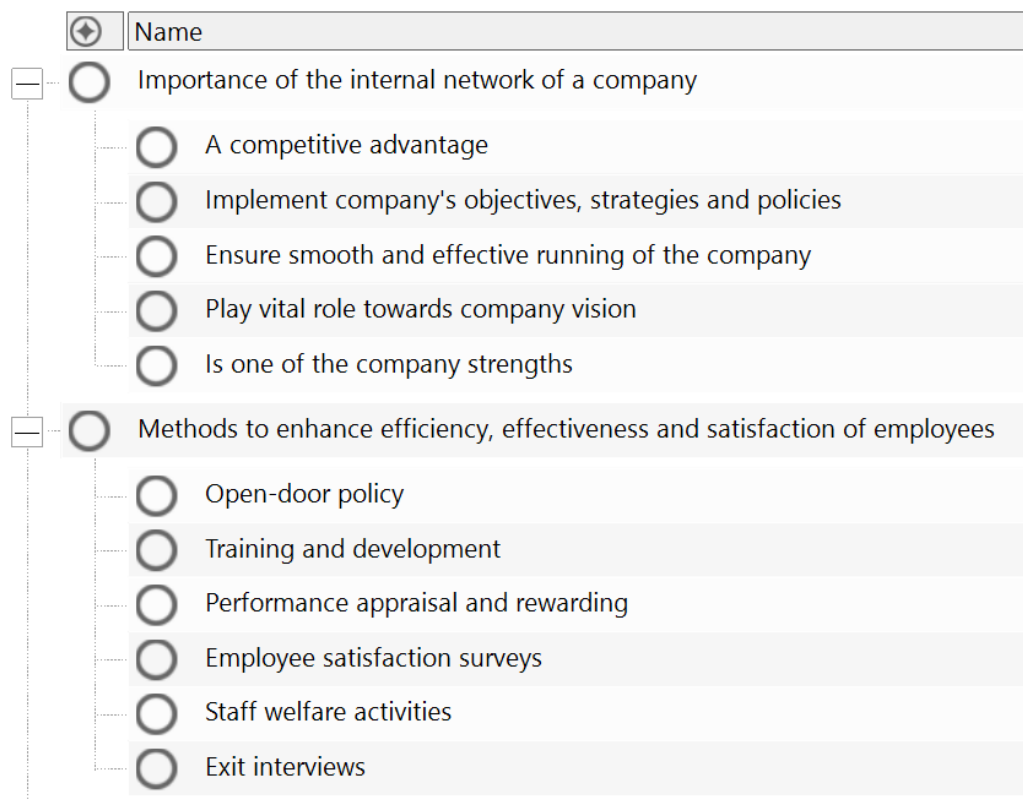
Case Study findings revealed that possessing talented human capital is a great strength of a construction company. CE-2 stated, “*A highly satisfied, fully engaged workforce will go the extra mile for the benefit of the company.*” Furthermore, CB-2 mentioned, “*We need to have the best-talented pool of employees to remain competitive in the market.*” CC-1 added, “*Employees play a vital role in driving towards our vision and achieving goals and objectives.*” Therefore, CF-2 accentuated, “*Employees have to be provided with the most up-to-date information to make valuable and informed contribution to the company.*” Additionally, CA-2 listed a few methods that Case A uses to enhance its employees' efficiency, effectiveness, and satisfaction: “*open-door policy, training and development, performance appraisal and rewarding, employee satisfaction survey, staff welfare activities, exit interviews...so on*”.

“Company’s management is responsible for implementing the company policies, objectives, plans and strategies” [CD-1]. Therefore, CF-1 stated, “Effective functioning of the company depends on our management team”. CC-2 added, “Visionary leadership of our top management is the main strength of our company.”

Figure 4.16 summarises the importance of Internal Networks, including Management, Professionals and Other Employees, and methods used in the cases to enhance efficiency, effectiveness, and satisfaction. Accordingly, Figure 4.16 is the coding structure related to the Internal Network.

Figure 4.16

Coding structure of the importance and methods used to enhance the efficiency of Internal Network



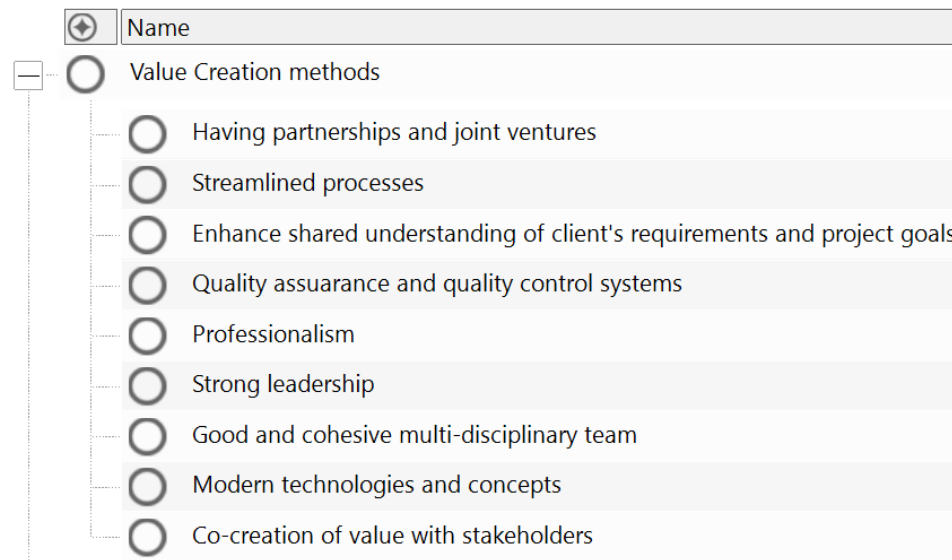
4.7.3. Value Creation

All the interviewed top-level managers recognised that no business could survive without creating value. As mentioned by CD-1, the value must be created in construction businesses to comply with the Client’s requirements. “Basically, construction contractors created value through their service to its stakeholders mainly to Clients as the most important stakeholder” [CC-1].

Interviewed top-level managers of cases initially disclosed different methods of creating value in the construction businesses, as shown in Figure 4.17 coding structure developed through NVivo.

Figure 4.17

Coding structure of methods of creating value



As depicted in Figure 4.17, **partnerships or joint ventures** create value [CA-1, CB-2, CC-2, CE-1, CJ-2, and CK-1]. Referring to Case E, CE-1 stated, “*We can collaborate with specialised reputed Partners having competency in that area to create value for that unit of business.*” At the same time, CB-2 pointed out the requirement of separate collaborative management units to minimise issues when having partnerships. As per all interviewees, **streamlined processes** create value. Accordingly, all the interviewed top-level managers agreed that Value Creation should undergo project and company processes related to project implementation. CA-1 added, “*By streamlining the company and project processes, we can remove unnecessary works and improve the efficiency.*”

Furthermore, as per findings, services to the Clients are provided through the construction company’s supply chain. Hence, CF-1 of Case F recognised the processes required to be carried out through the construction supply chain, mentioning, “*supply chain management is one of the main processes in creating value by construction contractors*”. Accordingly, “*the construction business consists of small units of businesses, and those business units create the value*” [CE 2]. CE-2 further described the usefulness of identifying each business unit’s ability and degree of Value Creation according to Clients’ requirements and project type.

By **enhancing shared understanding of Clients’ requirements and goals of each project**, value can be created [CB-2 and CF-2]. As per the case study findings, a clear understanding is necessary regarding the Client’s requirements by all project team members to provide an effective contribution to project implementation. “*At least key stakeholders to the project should have the understanding about Client’s requirements and project goals in creating value*” [CB-2]. CD-2 stated that proper quality control and quality assurance systems could enhance project value and Client satisfaction. Additionally, CC-1 explained, “*Through quality assurance, we can provide confidence*

about fulfilling the Client's quality requirements.” “*For assuring the quality, we have to control quality to fulfil quality requirements.*” Hence, **quality control and quality assurance systems** of the companies can create value.

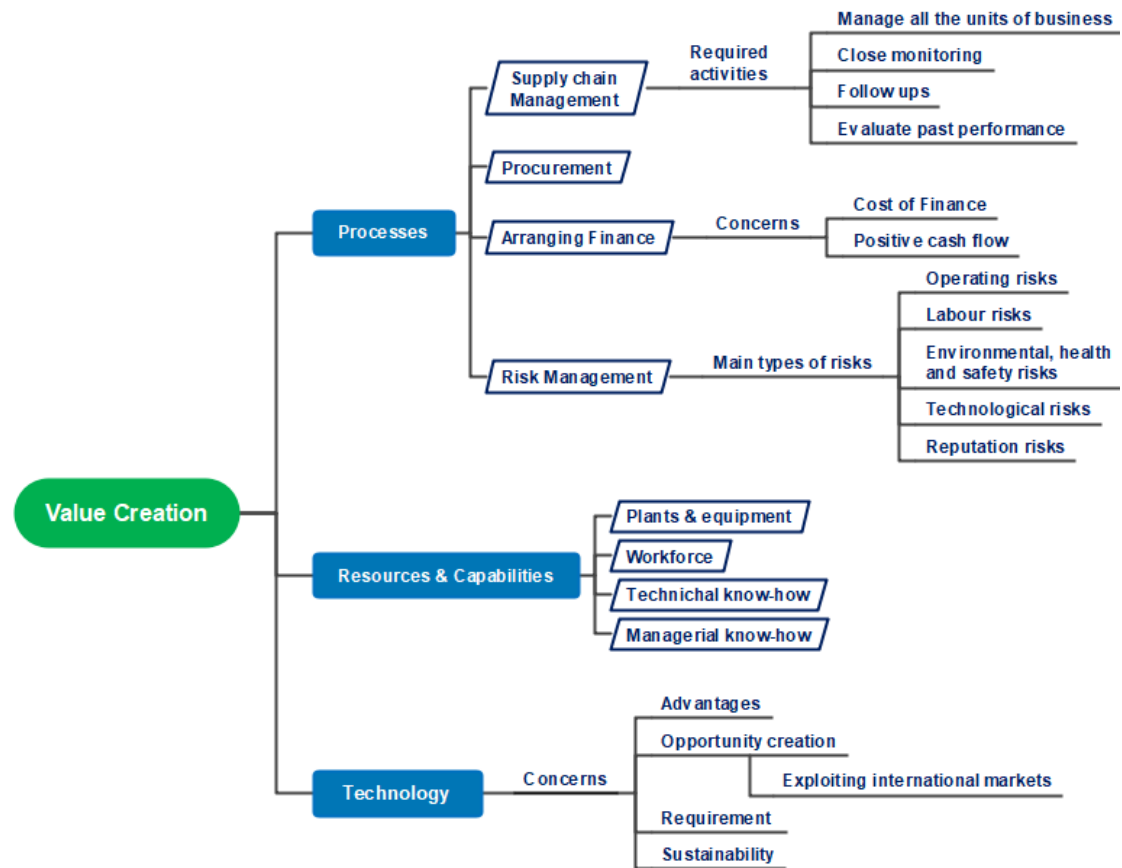
Professionalism is one of the most effective methods for creating value [All interviewees]. Remarkably, all the interviewed top-level managers commended the importance of professionalism for creating value in the construction industry. “*A construction company should have a good professional staff who can handle Clients professionally and deal with other stakeholders*” [CF-1]. Moreover, CA-1 proudly expressed that “*The core strength of our company is the passion and dedication of our professional team.*” In addition, a **good and cohesive multi-disciplinary team** is vital in creating value [CA-2, CB-1, and CC-1]. The findings revealed the necessity of identifying the construction business’s multi-disciplinary nature, which involves staff from different professional cultures. CC-1 claimed, “*Company leaders must be able to manage a multi-disciplinary team by identifying the value of all the members and keeping in mind that every role is important.*” This signifies the importance of **strong leadership** in maintaining an internal balance with a good multi-disciplinary team.

On the other hand, **modern technologies and concepts** can create value [CA-2, CE-1, CJ-2, and CK-2]. As per the findings, the value could be improved by implementing modern technologies and concepts to the projects and the company. “*We hope that better value could be created to all stakeholders with modern concepts like BIM (building information modelling), even though we do not still touch such methods*” [CE-1]. In addition, CB-1 mentioned, “*when creating value for stakeholders, it is important to innovate both technology and processes*”. The **co-creation of value with stakeholders** is considered a value creation method by CB-1 and CJ-1. It was discovered that Case B and Case J obtain assistance from stakeholders, including customers, to create the value jointly. “*We are not hesitating to utilise the opinions and ideas from our clients and other stakeholders and bring innovations to our business.*” [CB-1]. In addition, CJ-1 stated that “*...in infrastructure projects, there are significant risks and frequently require innovations, so the parties should closely work together to maximise project value*”.

The ‘Value Creation’ taxonomy was created using ‘Mind Master’ as shown in Figure 4.18, including the various factors to be considered under some elements.

Figure 4.18

Taxonomy of Value Creation



The interviewees of all cases emphasised that the elements Processes, Resources and Capabilities, and Technology are better discussed under Value Creation. Therefore, those elements are considered ‘CBM Elements’ under Value Creation, as depicted in Figure 4.18. Moreover, CBM Sub-elements were identified for the CBM Elements Processes and Resources & Capabilities as described in the following sub-sections.

4.7.3.1. Processes

Regarding Processes, CC-1 stated, *“It is important to identify the requirement of any additions or deviations to the normal Processes of carrying out projects when having new projects,”* whereas CE-1 mentioned coordination and efficiency development of the processes are crucial. Moreover, CA-2 pointed out, *“The selected procurement process is affected by all the other Processes involved in a construction project.”* CF-1 and CJ-1 further identified supply chain management as a key process in the construction business. Complementarily, CF-2 stated that effective supply chain management requires close monitoring and follow-ups and evaluation of past performance.

On the other hand, interviewees from all the cases disclosed that identifying and managing risks had become the most vital process in the construction businesses to ensure sustainable value creation for all stakeholders. Interviewees pointed out the

risks related to construction businesses with examples: Operating risks, e.g. cost overruns, project delays, unsatisfactory performance, and lack of quality [all interviewees]; Labour risks, e.g. skilled labour shortages and incompetent workforce [CB-2 and CF-2]; Technological risks, e.g. technological obsolescence, environmental, health and safety risks, e.g. accidents [CC-1, CE-2, and CD-2], and Reputation risks, e.g. diminishing qualifications [CA-1 and CF-1].

Findings also implied that all cases are trying to maintain positive cash flows throughout the project delivery, highlighting that arranging finance is another crucial process in the construction business. CK-1 described a reason for failure to maintain positive cash flow with examples: *“Depending on the nature of the project, we have to pump money during the execution of the project. For example, if it is a water project, it is possible to maintain positive cash flow because it does not require big finance during execution. However, it is difficult in highway projects due to the cost of major materials like asphalt.”* CA-1 of Case A specifically mentioned, *“In PPP projects, we are not financing company’s money, and our leverage is to borrow money. Therefore, in this case, cost of finance is an important factor to consider.”* Hence, *“The company’s financial arrangements are critical, especially as a top-level contractor”* [CC-2].

4.7.3.2. Resources and Capabilities

As per CD-1, CC-2, and CJ-2, the decisions related to physical resources such as machinery and equipment should be selected by considering geographical factors and the means of obtaining them, e.g., purchasing, hiring, or using their own resources. *“For human resources, it is required to decide whether outsourcing, consulting, utilising internal staff, newly recruiting, or subcontracting”* [CE-2]. As stated by CD-2, *“In identifying the Resources and Capability requirements, the decisions to be taken are based on availability, capacity, and suitability.”* On the other hand, the company websites promote their companies’ Resources and Capabilities, highlighting the availability of a fleet of plants and equipment and talented and experienced staff. For instance, WEB-D evidencing *“.... winning the hearts of Clients by employing competent, well trained, and motivated employees and efficiently deploying other necessary resources”*.

4.7.3.3. Technology

Today, continuous technological innovations are evident in the construction industry. As per case studies, energy consumption, sustainability, and value engineering concepts encourage innovative solutions. CB-1 argued that the IT department of a construction company could be involved in maximising the company's profit through project management, progress tracking, productivity measures, cost management, and communication improvements instead of simply fixing and installing computers and software. In addition, CF-1 convinced, *“We can have a CRM (Customer Relationship Management) system to track Client information.”* However, CA-2, CC-2, and CJ-1 pointed out the risk of accepting every technological innovation in the industry. Instead, interviewees suggested analysing advantages, opportunities, the requirement

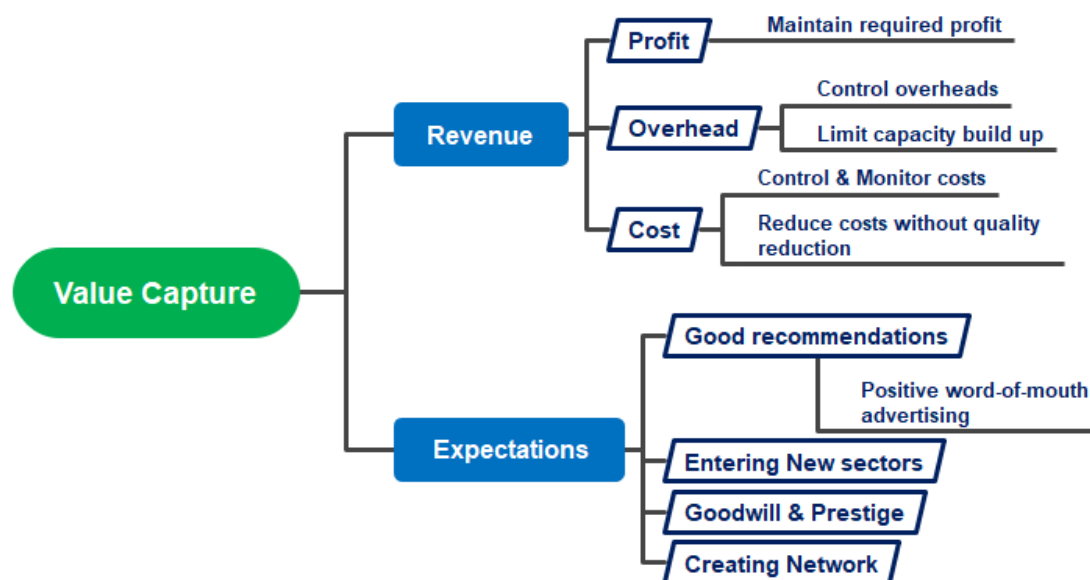
of the project or company, and the sustainability of the technology before implementation.

4.7.4. Value Capture

Value Capture in the construction business can be considered the value gained by offering services to construction Clients. The taxonomy for Value Capture was developed in Figure 4.19 based on the case studies. Accordingly, the Value Pillar, Value Capture, was categorised into two CBM Elements, *Revenue* and *Expectations*, as described in the following sub-sections.

Figure 4.19

Taxonomy of Value Capture



4.7.4.1. Revenue

Construction companies obtain Revenue from Clients, which includes Profit, Overhead, and Costs. Interviewed top-level managers from all the cases believed that generating Profit is the main idea behind the construction business. CD-2 mentioned, *“We can adjust and control Costs to earn more Profit or maintain required Profit.”* As per CE-1, costs can be minimised and controlled by eliminating waste, applying value engineering, and employing proper cost controlling methods throughout the project. Further, CC-2 of Case C stated, *“By establishing a separate division for Project Monitoring at head office, we would be able to successfully control the costs of all our projects which shows the whole picture of the company.”*

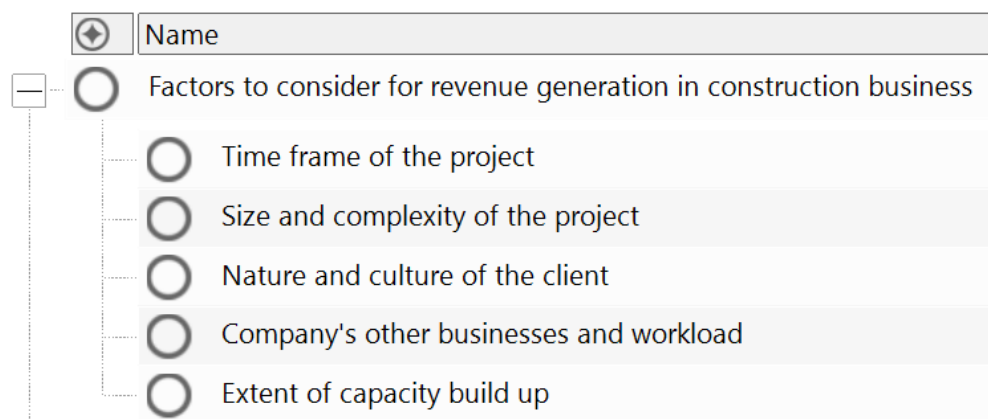
Unlike other industries, Revenue has a close relationship with time in the construction industry. As CA-1 stated, *“The Revenue in this business is linked with time frame. For example, if a project with a value less than Rs. 1 billion is going more than one year, it is not worth.”* Similarly, CB-1 mentioned, *“Revenue in construction projects is linked with time and size. Even though the size is big, time is not to be increased*

proportionately.” On the other hand, the website of Case D (WEB-D) highlights the ways to maximise profit: “*We plan to improve turnover and profitability by monitoring overall business, project costing, and monitoring.*”

Case studies also revealed that construction companies must own a discipline in revenue generation rather than just increasing revenue. Because, as CA-1 stated, “*We have to think about the extent of capacity built-up along with the increased revenue because we will be in trouble of maintaining built-up capacity including employees, machine, and equipment after the project is completed, which may sometimes lead to bankruptcy.*” Therefore, CE-1 emphasised that capacity building of the company through new options or projects for Revenue generation must be controlled by considering the workload and other businesses. In addition, CF-2 claimed, “*We have to think about Client’s financial status and payment risks along with Revenue generation through new projects.*” The case studies uncovered several concerns in generating Revenue in the construction businesses, as shown in the coding structure of Figure 4.20.

Figure 4.20

Concerns in Revenue Generation



4.7.4.2. Expectations

Besides the Revenue with Profit, construction companies expect other benefits for their created value to Clients as per case study findings. Specially, all interviewees expect recommendations from the Clients of completed projects. For instance, CF-1 stated that Case F is recommended by their clients through word-of-mouth advertising. Moreover, in all the cases, the interviewed top-level managers mentioned that they attempt to create networks/contacts through projects to obtain future orders and other benefits.

Goodwill and Prestige is another expectation of the contactors. CC-1 of Case C exemplified, “*We try to take landmark projects to increase our value without thinking profits. For example, the Custom’s building.*” Moreover, CA-2 illustrated, “*Sometimes we take projects to enter new sectors. For example, we took subcontract work of the*

Mattala Airport project to enter into the airport construction and get experience in international airport construction.”

4.7.5. Strategic Choices

All the interviewed top-level managers avowed that *Strategic Choices* are a must for construction businesses like other businesses. For example, CF-1 admired, “*Most of the best projects from which we got higher profits were due to our strategies*”. However, as per the findings, construction businesses have limited opportunities for differentiation, and thus, most think about bidding strategies. CJ-1 and CK-2 affirmed that as most infrastructure projects go with competitive bidding, Case J and Case K must use bidding strategies to win the projects. This idea is also disclosed in WEB-J, stating that Case J has won large-scale infrastructure projects via competitive bidding. Yet, as CF-2 stated, the usage of strategies depends on the importance of winning the particular project and the country’s economic situation. On the other hand, CE-1 stressed that all managers who deal with the project during pre- and post-contract stages must be aware of bidding strategies.

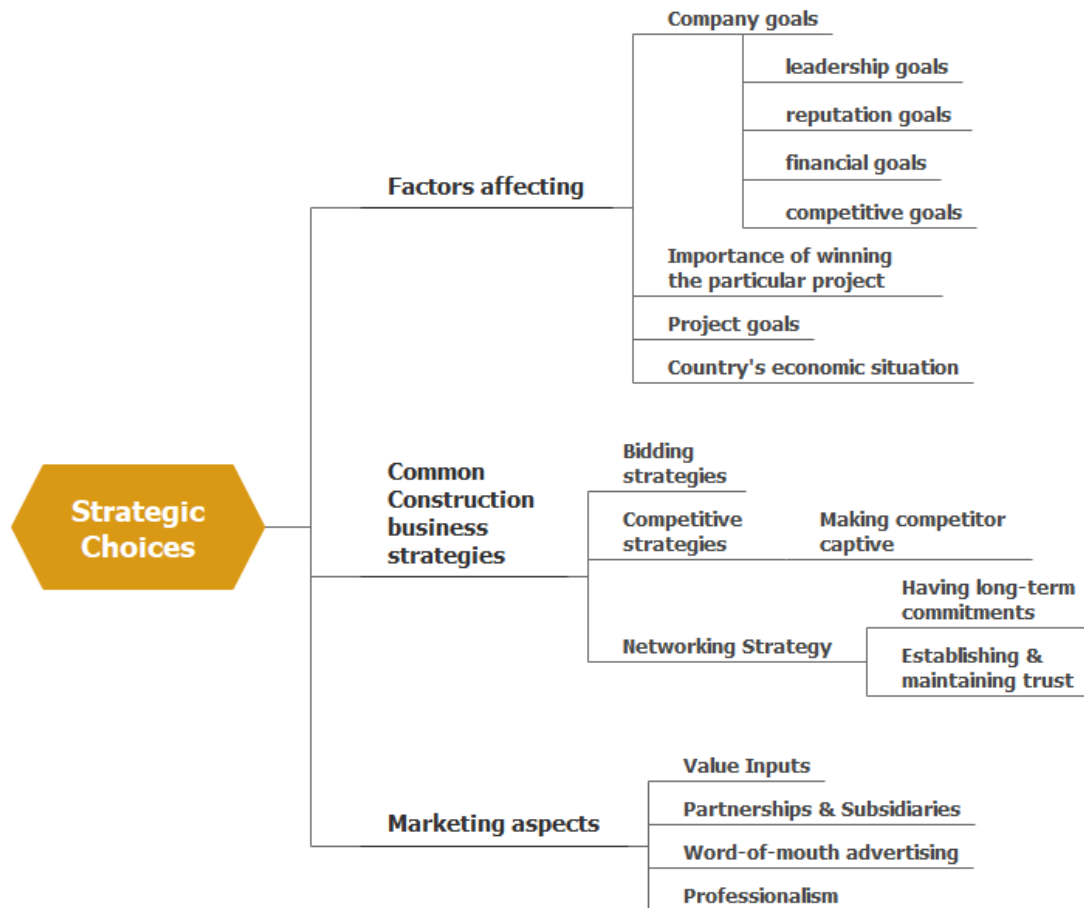
According to findings, all the cases must compete with the same few companies, most of the time. However, CB-2 stated, “*We try to understand the nature of our competitors and analyse them to decide strategies for future projects.*” Case A and F further elicited that making competitors captive is a strategy, e.g., having partnerships and JVs with competitors.

In addition, CC-1 highlighted the importance of networking strategy in the construction business: “*Through each and every project we are handling, we try to have a strong network by creating contacts and always try to keep in touch with them.*” CA-1 clarified how to decide on company strategies: “*Our company goals usually drive our strategies. So, we do a SWOT analysis to analyse our goals and identify strategies.*” CA-1 further explained, “*As a leading construction company, we have financial goals, leadership goals, reputation goals, as well as competitive goals.*”

Figure 4.21 shows the Mind Map for the Shared Element, Strategic Choices, considering the findings.

Figure 4.21

Details for Strategic Choices



As per Figure 4.21, interviewees identified marketing aspects of the construction companies under Strategic Choices. The findings further revealed that construction companies use different methods as their marketing aspects than other businesses. For example, CD-2 pointed out, “Value inputs for a particular project can be used as marketing aspect for future projects.” Similarly, CA-2 noted, “Client satisfaction and relationships create grounds for word-of-mouth advertising”; “We can market the professionalism in this industry” [CF-1]; “Having partnerships with reputed local and international companies is our marketing aspect” [CA-1].

4.7.6. Change Management

“We will be failed if we cannot change” [CF-1]. Thus, *Change Management* is vital for construction businesses to sustain themselves in the industry. Findings revealed that today’s construction business environment is dynamic due to rapid and dramatic changes in Clients’ tastes and requirements, technology, law and regulations, weather, political leaders, economic situation, and international factors [CB-1, CC-2, CE1, CE-2, CJ-2, and CK-1]. CA-1 claimed, “Today, we also have to face the influence from market lobbying groups and change accordingly,” and gave examples, “Market

lobbying groups influence us to protect human rights, prevent environmental damages, and sustainably utilise natural resources.” However, according to WEB-J of Case J, *“The dynamic work environment offers employees with challenging and learning opportunities that help develop successful careers in constructions.”*

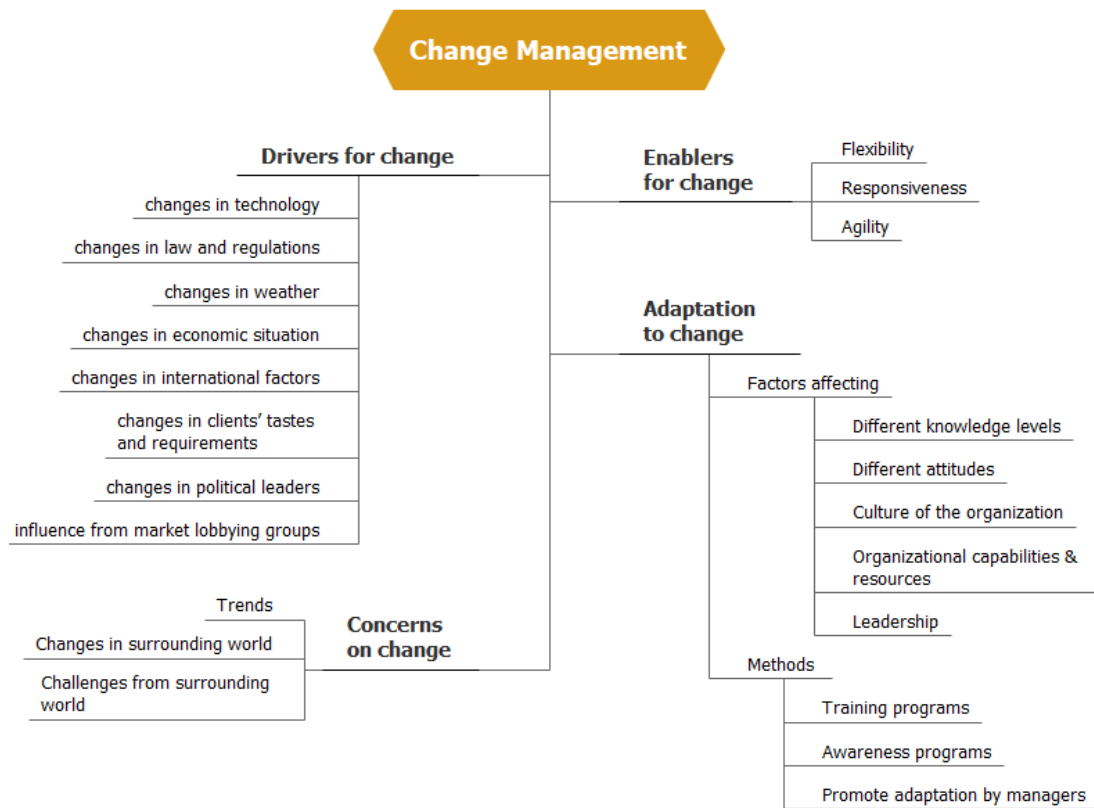
Further, CB-1, CE-1, and CJ-1 declared the importance of converting these dynamic factors into opportunities after their analysis. Hence, updating the construction business activities according to these factors is essential. According to WEB-B and WEB-C, the opportunities encourage construction companies to expand and diversify.

On the other hand, CB-2 stated, *“Change Management to be done based on trends.”* CD-2 raised that Change Management requires consideration of changes and challenges from the surrounding world. It was also identified that Change Management needs to be followed with adaptation, which takes time, especially in the construction business. Adaptation to change is affected by different factors: *“Different attitudes and different knowledge levels of staff and workers are affecting adaptation to changes”* [CA-2]; *“Adaptation to changes require cultural change for that within the organization”* [CB-2]; *“Leadership and capability of the organization are important in adapting to change”* [CD-1]; *“Staff training and awareness programmes can be used as adaptation methods”* [CK-1].

Furthermore, CF-2 pointed out, *“We have to change our work norms and practices with Change Management.”* For instance, CE-1 reminded, *“This year (2020), due to the Covid-19 pandemic, we have to change the practice of working in the offices to the work-from-home system using computerized and internet technology.”* Finally, it is necessitated to explore how flexible, responsive, and agile the company is when managing change and adapting to change [CA-2, CE-1, and CJ-2].

Figure 4.22 presents a summary of the Shared Element, Change Management as a Mind Map.

Figure 4.22 Details for Change Management



4.7.7. Professionalism

Case studies reveal that all areas of the construction business should be invaded with Professionalism. CD-1 appreciated, “*The lifeblood of our company is our highly-skilled professional team*”, and CA-2 added, “*Our performance as a construction business is mainly due to the passion and dedication of our professional team.*” Hence, it was emphasised that construction businesses expect Professionalism from professionals as a multi-disciplinary business involving professionals from different professional cultures. Interviewed top-level managers and websites of cases pointed out the importance and use of Professionalism in the construction business as follows.

- To attract Clients and maintain positive relationships [All interviewees]
- To build and maintain progressive, sustainable relationships with Partners [All interviewees]
- To maintain a cordial relationship with competitors and the external world [CA-1, CA-2, CB-1, CF-1, and CE-2]
- To win the trust of stakeholders [CC-1, CB-2, and CK-1]
- To deal with statutory authorities [CA-1, CD-1, CJ-1, and CK-2]
- To comply with laws, rules, and regulations [CC-1, CF-2, and CK-1]
- To ensure a strong market reputation [All interviewees]

- To drive towards innovative solutions [CA-2]

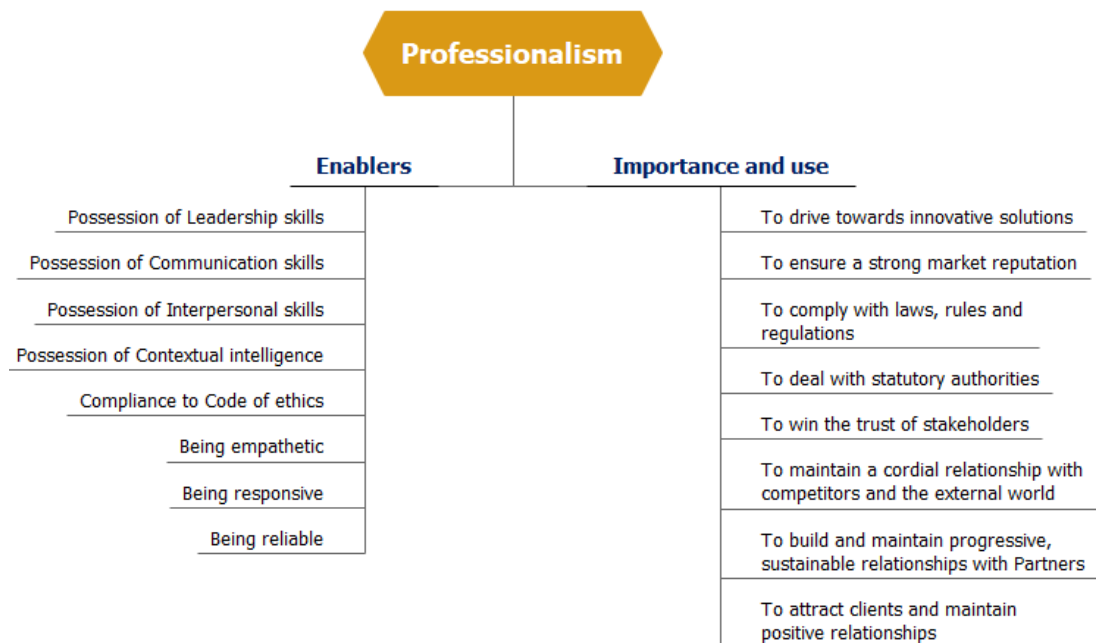
Case studies highlighted the examples where contractors show Professionalism. For instance, “When we first recognize a fault or poor work, we try to do required corrections without waiting for complaints from Clients.” [CD-2] and “We try to circle back the issues when solving them and when looking at the progress.” On the other hand, Professionalism is required to be concerned with ethics; e.g., CA-1 mentioned that the code of ethics of Case A had been devised to develop and maintain long-term relationships with all stakeholders.

In addition, Professionalism in the construction business is to be connected, especially with leadership skills, interpersonal skills, communication skills, responsiveness, and contextual intelligence [CB-1 and CE-1]. CB-1 clarified, “As the construction business involves different and dynamic contexts, contextual intelligence is important in identifying and managing such contexts.” CE-1 explained the nature of leadership in the construction business, “Leaders should be able to manage a multi-disciplinary team by identifying the value of all the members and think every role is important. Thereby they have to keep the internal balance.”

Figure 4.23 provides the Mind Map for the Shared Element, Professionalism, by considering the importance and enablers of Professionalism.

Figure 4.23

Details of Professionalism



4.7.8. Company Culture

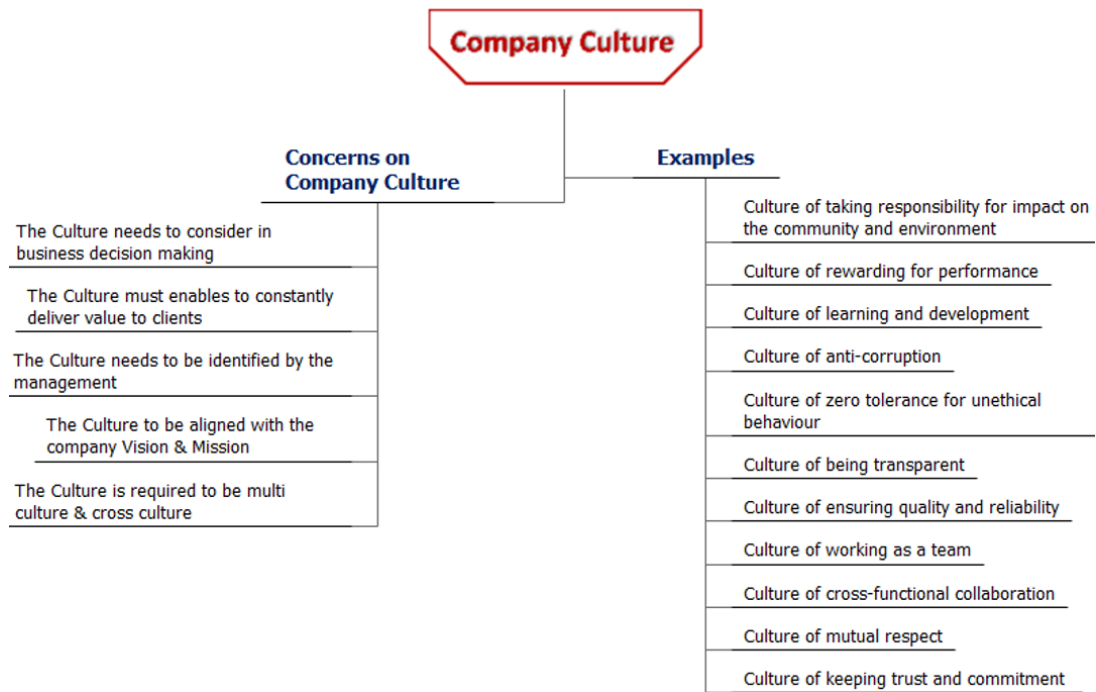
Company Culture is vital for any business, and it provides inputs to all the areas and processes of a business [CB-2]. Interviewed top-level managers believe that every organisation has their own culture. CA-1 added, “Our culture has developed since the establishment of our company, and our vision guides it.” Moreover, CB-1 elaborated

on the advantage of good Company Culture: *“Our culture contributes in delivering value to our clients constantly by employing efficient, effective and faster means.”* Hence, considering Company Culture is essential in business decisions.

A Mind Map was developed summarising details of Incorporated Element, Company Culture, as shown in Figure 4.24.

Figure 4.24

Details of Company Culture



Interview discussions revealed that the construction business’s Culture must be multi-culture and cross-culture due to involvement in multi-disciplinary staff. Eventually, different cultures of construction companies were disclosed. *“We are always responsible for the impacts on the environment and community due to our construction works”* [CK-1], *“We practising a culture of rewarding for performance using different methods”* [CA-2], *“We own a culture of learning and development”* [CB-2], *“Anti-corruption is an important part of our culture”* [CF-1], *“Our culture is to have zero tolerance for unethical behaviour”*[CE-1], and *“Transparency is the base of our culture”* [CJ-1]. In addition, company websites present the Cultures of Companies in the sample. For instance, WEB-F listed quality, reliability, teamwork, and cross-functional collaboration as the Culture of Company F. Similarly, WEB-C elaborates that teamwork and mutual respect are Company C’s culture. In contrast, trust and commitment are Company D’s Culture as per WEB-D.

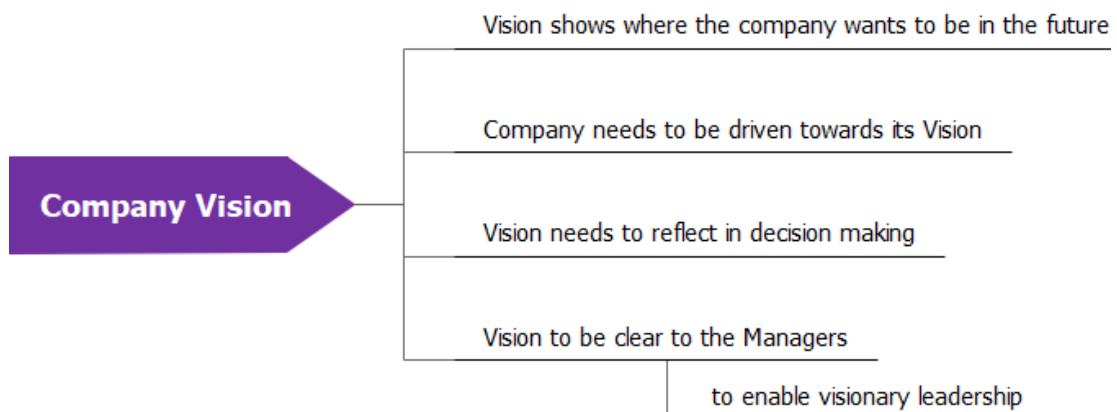
CD-1 stated, *“Top management should identify the Company’s Culture as a whole when making decisions”*, while CA-2 stated, *“Our Culture is introduced to all our new employees at the orientation programmes.”* However, *“Change in a Culture does not happen in revolutionary, and it happens gradually”* [CA-1].

4.7.9. Company Vision

Initially, top-level managers argued that mindfulness of the Vision of the company is important for construction business decision-making. CD-1 and CF-1 stressed that any company needs to be driven towards its Vision because it states where the company wants to be in the future. According to interviewed top-level managers, aligning business decisions with the Company Vision is beneficial. CB-1 argued that company managers must clearly understand the Vision, and they can reflect that in their decision-making actions and enhance visionary leadership. Accordingly, Figure 4.25 summarises the details related to the Reflective Element ‘Company Vision’.

Figure 4.25

Details of Company Vision



4.7.10. Describing parameters for the elements of CBMO

While describing Value Pillars, CBM Elements, CBM Sub-elements, Shared Elements, Incorporated Element and Reflective Element above, different parameters could be encountered for describing each element. As per case studies, these parameters must be considered under particular BM elements while making business decisions. Hence, those describing parameters should be highlighted when developing CBMs using the CBMO. CBMO elements were given ‘meaning’ to introduce them as one of the describing parameters. However, other describing parameters are not common to all the elements and vary from one element to another, highlighting the difference and uniqueness of the elements. Table 4.8 illustrates the related describing parameters for the CBMO elements under different element categories.

Table 4.8

Describing parameters for the elements of CBMO

Element of CBMO	Element category	Describing Parameter
Value Inputs	Value Pillar	Purpose of Value Inputs
Time	CBM Element	Methods of providing value through Time
Cost	CBM Element	Methods of providing value through Cost
Quality	CBM Element	Methods of providing value through Quality
Add-ons	CBM Element	Methods of providing additional value

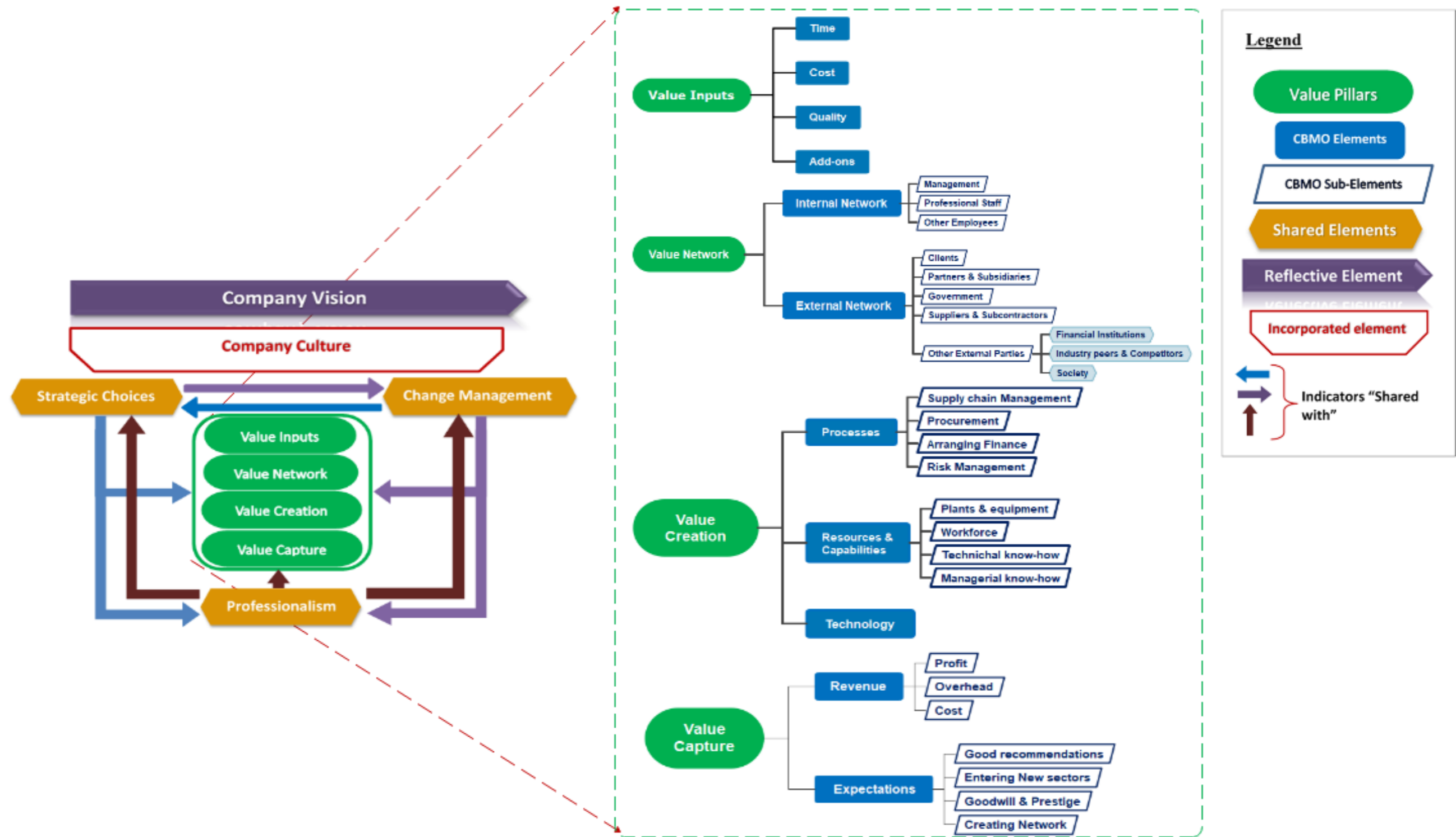
Element of CBMO	Element category	Describing Parameter
Value Network	Value Pillar	Purpose of Value Networks
Client	CBM Sub-element	Factors to be considered about Clients
		Process of Handling Clients
Partners and Subsidiaries	CBM Sub-element	Benefits
Government	CBM Sub-element	Roles of Government in the construction industry
		Ways to deal with Government
Suppliers and Subcontractors	CBM Sub-element	Expectations from Subcontractors
Value Creation	Value Pillar	Value Creation Methods
Supply Chain Management (SCM)	CBM Sub-element	Required activities in SCM
Arranging Finance	CBM Sub-element	Concerns in arranging finance
Risk Management	CBM Sub-element	Types of construction business risks
Resources & Capabilities	CBM Element	Concerns in identifying resources & capabilities
		Methods of obtaining
Technology	CBM Element	Concerns about acquiring technology
Revenue	CBM Element	Concerns in Revenue generation
Strategic Choices	Shared Element	Factors affecting
		Common Strategies in the Construction business
		Marketing Aspects
Change Management	Shared Element	Drivers for change
		Enablers for change
		Concerns on change
		Adaptation to change
Professionalism	Shared Element	Importance and use of Professionalism
		Enablers of Professionalism
Company Culture	Incorporated Element	Concerns about company culture
		Examples for Culture
		Different cultures in construction businesses

4.8. Stage 4 – BM development process: Developing initial Construction Business Model Ontology (CBMO) based on Phase I findings

In essence, the initial CBMO comprises four ‘Value Pillars’, three ‘Shared Elements’, one ‘Reflective Element’, and one ‘Incorporated Element’, as shown in Figure 4.26.

Figure 4.26

Initial CBMO with taxonomies of Value Pillars



As per Figure 4.26, the Shared Elements, namely, Strategic Choices, Change Management, and Professionalism, are placed in the initial CBMO showing the primary relationship ‘*shared with*’ among Shared Elements themselves and between Shared Elements and Value Pillars.

The Reflective Element ‘Company Vision’ and Incorporated Element ‘Company Culture’ are positioned in the CBMO as the shadow of all other elements of CBMO. Each Value Pillar is expanded to present their taxonomies with CBM Elements and CBM Sub-elements as discussed in Sections 4.7.1, 4.7.2, 4.7.3, and 4.7.4. Each category of elements in CBMO is presented with different symbolised indicators. Finally, the initial CBMO (Figure 4.26) has been developed, considering the discussed composition.

4.9. Chapter summary

This chapter analysed the findings of eight (08) case studies under data collection Phase I, where semi-structured interviews with top-level construction managers and company websites were used for data collection. Phase I findings were analysed to identify top-level construction managers’ perceptions of the nature of the construction business and the BM concept. Further, ‘fundamental themes’ used to define CBM were verified, and appropriate elements for CBMO were discovered with their primary relationships and details.

Coding structures using ‘NVivo’ and Mind Maps using ‘MindMaster’ were created when analysing data related to elements of CBMO. Accordingly, the CBMO comprises four (04) ‘Value Pillars’ with different numbers of ‘CBM Elements’ and ‘CBM Sub-elements’, three (03) ‘Shared Elements’, one (01) ‘Incorporated Element’ and one (01) ‘Reflective Element’. The elements of CBMO were described based on case study findings and identified describing parameters. Finally, the initial CBMO was developed based on composition and taxonomies identified under Phase I data analysis. The next chapter presents the findings of Phase II that sought further to develop the CBMO through the opinions of construction business experts.

5. RESEARCH FINDINGS AND ANALYSIS: PHASE II

5.1. Introduction

This chapter presents the qualitative survey results conducted with the construction business experts. The interviews aimed to further clarify the Phase I findings in the previous chapter. Initially, the chapter discusses the additional information on the nature of the construction business and BMs in the construction business context. This is followed by verifying the CBM definition for its compatibility and comprehensibility. After the modifications and changes to the taxonomies of Value Pillars, all the identified relationships among CBMO elements are displayed and discussed. Next, each CBMO element is discussed, with identified parameters described. Finally, the CBMO was developed, integrating findings gathered under the BM development process. The guiding questions were provided for each CBMO element enabling construction business managers to use the CBMO resourcefully.

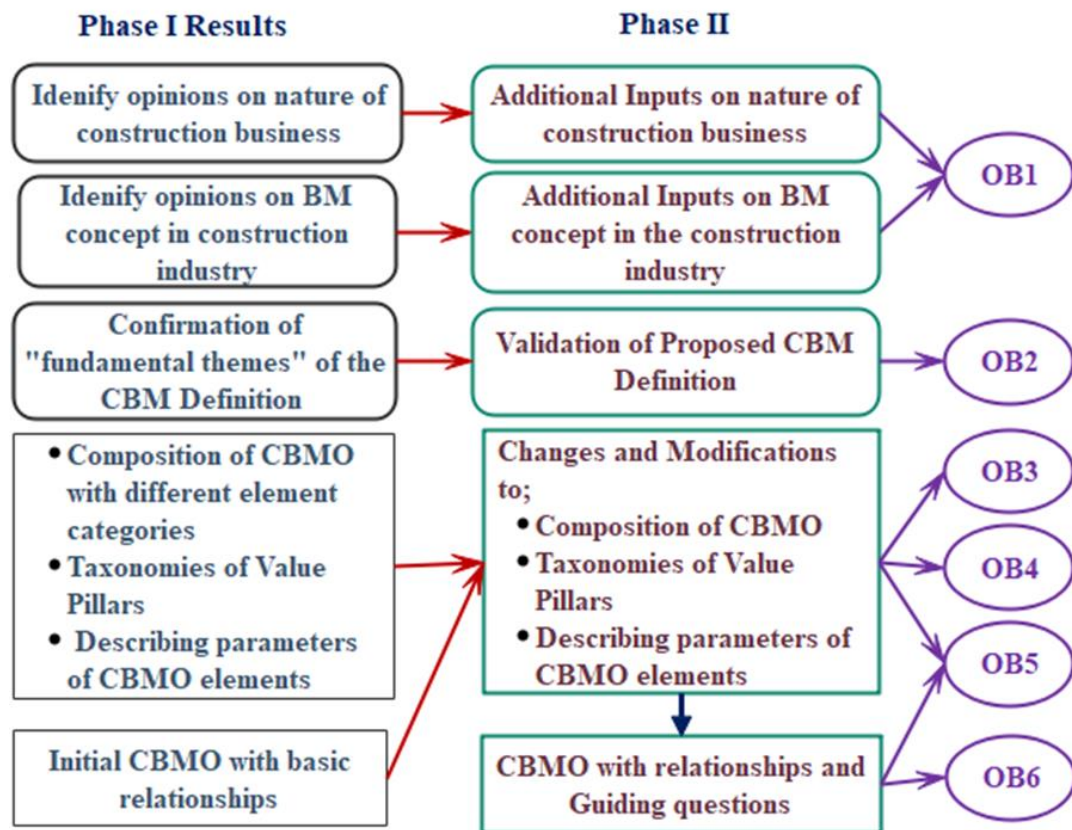
5.2. Analysing Phase II data: Qualitative survey

As explained in Section 3.12.3 of Chapter 3, semi-structured interviews were conducted with the construction business experts selected through pre-defined criteria as the sources of data collection at Phase II. The results of Phase I data formed the basis of questioning to get comments on those data and explore further details and relationships among CBMO elements (refer Annexure 3.5). However, considering the data saturation, the interviews were stopped after interviewing 15 experts though 20 experts were present in the pool of experts (Table 3.9).

Accordingly, the data were collected only from PE 1 to PE 15 (Table 3.9). Figure 5.1 summarises the process of analysing Phase II qualitative survey data and shows the contribution of Phase I results in collecting Phase II data. Ultimately, the results of Phase II contributed to achieving the research objectives.

Figure 5.1

Process of analysing data from the qualitative survey in Phase II



5.3. Nature of the construction business

At first, the construction business experts were asked about the nature of the construction business as it is distinguished from other businesses due to inherent characteristics. Then, by organising the quotations into the theme ‘nature of the construction business’, a quotation bank was created for the characteristics or nature of the construction business, identified additionally to the Phase I data collection (refer Figure 4.2). Accordingly, Figure 5.2 graphically displays the additional quotes about the nature of the construction business, which are added to the Phase I case study findings.

PE 4 argued, “*The construction businesses have a portfolio of projects with different sizes, different requirements, and different risks. So, **managing the complexity of the projects** is the main thing that they have to do.*” Phase II qualitative survey findings further revealed that the complexity of construction projects arises due to interconnected activities, design uniqueness, inadaptability of precedents, and uncontrollable external factors [PE 3, PE 9, and PE 13]. Hence, PE 7 and PE 10 declared the importance of careful decision-making in the construction business due to the **involvement of high risk together with high gain.**

Figure 5.2

Additional quotations about the nature of the construction business at Phase II



PE 14 emphasised the **requirement of a proper mechanism in construction business decision-making**. PE 1 also put forth a similar view and elaborated the **impossibility of implementing ad-hoc decisions** in construction businesses. Further, some argued that since the construction business and industry involve many specific standards, conditions, policies, frameworks, etc., it is difficult to manage with ad-hoc skills [PE1 and PE 11]. Therefore, professional involvement is essential for all management levels.

PE 2 elicited the argument that construction business **decisions need to be fed with inputs from all management levels**, including bottom-level managers. Because in construction companies, all management levels include professionals and face day-to-day business challenges. Moreover, PE 1 pointed out that *“The construction business is **not repetitive** due to unstandardized solutions. So, it is difficult to streamline the processes, and there are fewer control mechanisms.”* In addition, PE 5, PE 8, and PE 13 uncovered an important point: construction businesses must **deal with and be controlled by multiple regulatory bodies and agencies**. PE 8 provided a few examples for those authorities: Urban Development Authorities, Municipal Councils, Ministries, Ceylon Electricity Board, Road Development Authority, Labour Department, Police, Environmental Authorities, and Board of Investment. However, PE 13 claimed, *“as they are independent of others, dealing with them is very difficult”*.

In essence, the views of top-level construction managers in Phase I and construction business experts in Phase II about the nature of construction business emphasise its uniqueness and inherent complications requiring proper mechanisms for business decision-making like business model ontology. Hence, knowing the opinions of construction business experts about the BM concept and BMs in the construction business is vital.

5.4. The business model concept in the construction industry

All construction business experts at Phase II declared the importance of designing BMs for the business of construction contractors. However, like top-level construction managers in Phase I, Phase II experts highlighted the impossibility of applying the same BM for every business case as construction is a project business. Further, PE 2, PE 6, and PE 11 claimed the unavailability of a tool or a framework that supports construction business managers in designing BMs. More intimately, PE 8 stated, *“When applying different innovative concepts, solutions, and technologies like ERP and BIM, it is better we can go with a specific BM to make it a success.”* Otherwise, some of the opinions are similar to the top-level managers in Phase I. For instance, PE 12 believes the business can be managed with the annual business plan. On the other hand, PE 3 highlighted the availability of several business parameters in decision-making rather than BMs.

Accordingly, the findings confirm that it is crucial to make aware and understand the BM concept among the construction business managers, and the construction businesses must be backed with a BM design support tool or framework to properly implement the BM concept in the construction industry. Therefore, the developed definition for CBM is required to validate by construction business experts for the construction industry’s future use, which is Stage 1 of the BM development process.

5.5. Stage 1 – BM development process: Validated definition for Construction Business Model (CBM)

By critically reviewing the literature, ‘fundamental themes’ were selected to develop a specific definition for the Construction Business Model (CBM). Phase I data subsequently confirmed the appropriateness of those selected fundamental themes, as discussed in Section 4.5.2. Finally, the developed CBM definition was presented to the construction business experts in Phase II to check its compatibility and comprehensibility. Noticeably, all construction business experts appreciated developing a specific definition for CBM and identified the requirement of a proper method to disseminate the definition among construction business managers.

Further, all 15 experts interviewed in Phase II agreed with the ‘fundamental themes’ incorporated into the CBM definition, confirming their importance to the construction business. In addition, a few experts, namely PE 1, PE 4, PE 5, PE 6, PE 13, and PE 14, suggested changing the wording arrangement that represents ‘fundamental themes’ within the definition. Accordingly, PE 6 and PE 13 advised removing the term

‘company’ from the ‘company resources’ because, in the construction business, it is inevitable to obtain required resources and capabilities for projects also from outside the company. Therefore, the insertion of ‘company resources’ presents a wrong picture. PE 14 pointed out, “*It is not required to mention key processes with the adjective ‘managerial and operational’, because it is implied that all the processes in the construction business include both management and operational parts.*” Consequently, the proposed CBM definition was adjusted with suggested arrangement changes and modifications (refer Annexure 5.1). The validated CBM definition is,

A construction business model is a simplified conceptual representation of a construction business that performs value creation as per client requirements with key resources and capabilities, considering the appropriate level of involvement of relevant stakeholders in the key processes towards revenue and profit generation while expressing the firm’s strategic choices with awareness of necessary changes and opportunities.

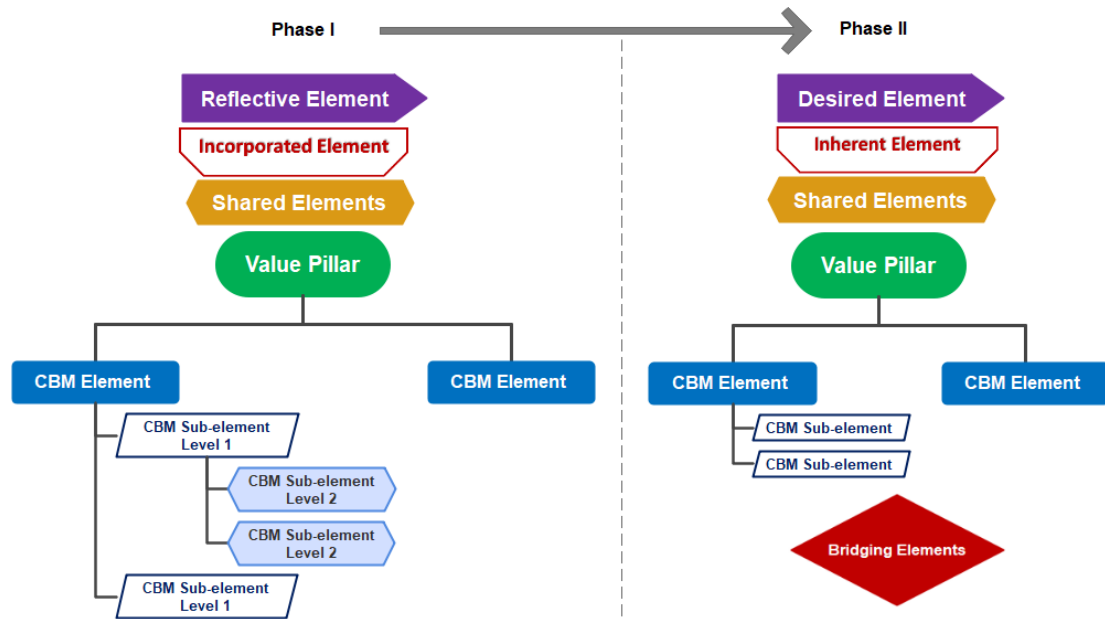
Having a validated CBM definition, the construction businesses require an ontology to design CBMs, as discussed previously. Accordingly, the initial CBMO proposed in Phase I was further improved with Phase II findings. Therefore, the next section identifies the final list of CBMO elements and the composition of CBMO with modifications to Phase I case study findings.

5.6. Stage 2 – BM development process: Elements and composition of Construction Business Model Ontology (CBMO)

Interviews with construction business experts at Phase II made a few stabilisations and modifications for the CBMO composition. Figure 5.3 illustrates the changes in the composition of CBMO from Phase I to Phase II.

Figure 5.3

Change in composition of CBMO from Phase I to Phase II



As per Figure 5.3, ‘Company Vision’ was regarded as the ‘Reflective Element’ of the CBMO in Phase I. However, Phase II findings explored that it is difficult to reflect the Company Vision through the CBMO elements. PE 2, PE 5, and PE 9 stated that the Vision of any company produces the desired future position of the company. Hence, “*Company Vision or Company Goals can be used as a drive mechanism to run the business that is what the company needs to be perceived*” [PE 9]. Ultimately, ‘Company Vision’ is branded as the ‘Desired Element’. Moreover, PE 1’s idea was to have a specific goal for a particular business case to drive towards success and thus the element named ‘Company Vision/Goal’.

After analysing Phase I data, the element ‘Company Culture’ was categorised as ‘Incorporated Element’ due to the construction business managers’ opinion of incorporating the Culture when making business decisions. All experts of Phase II also agreed to consider Culture when taking business decisions. However, PE 1, PE 2, PE 4, PE 7, and PE 8 doubted categorising it as ‘Incorporated Element’ because they felt it was challenging to incorporate Culture into decisions. PE 2 and PE 7 argued that every company has inherited its own Culture, and the Culture marks the company as what it is. As stated by PE 6, “*The company is guided by the Culture that shapes the attitude and behaviour of managers, which in turn affects decision making.*” Given that, the element related to Culture is named ‘Company Culture’ and categorised as the ‘Inherent Element’ of the CBMO.

All experts in Phase II appreciated the inclusion of ‘Strategic Choices’, ‘Change Management’, and ‘Professionalism’ in the CBMO as Shared Elements emphasising their importance to the construction business. For instance, PE 1 explained the

importance of Professionalism in every aspect of the construction business, saying, *“Construction businesses fulfil third party requirements. Therefore, the outputs of other industries may depend on the delivery and quality of output of the construction industry, and those should also be viable and safe. Hence, a professional approach is essential.”* PE 13 added, *“There are many standards, conditions, frameworks, quality assurance, and safety requirements in the Construction industry that are definitely needed to be practised by professionals.”*

Conversely, the Shared Element ‘Change Management’ created misunderstanding among some of the construction business experts because the term is already being used in the construction industry for another meaning. Hence, PE 8 requested to change the element’s name and proposed ‘Change’, which is confirmed suitable by the subsequently interviewed experts. In addition, two elements, ‘Revenue’ and ‘Costs’, were detached from the taxonomy of Value Capture (refer Section 5.6.4) and converted to ‘Bridging Elements’, which connects BM elements as per Hamel (2000).

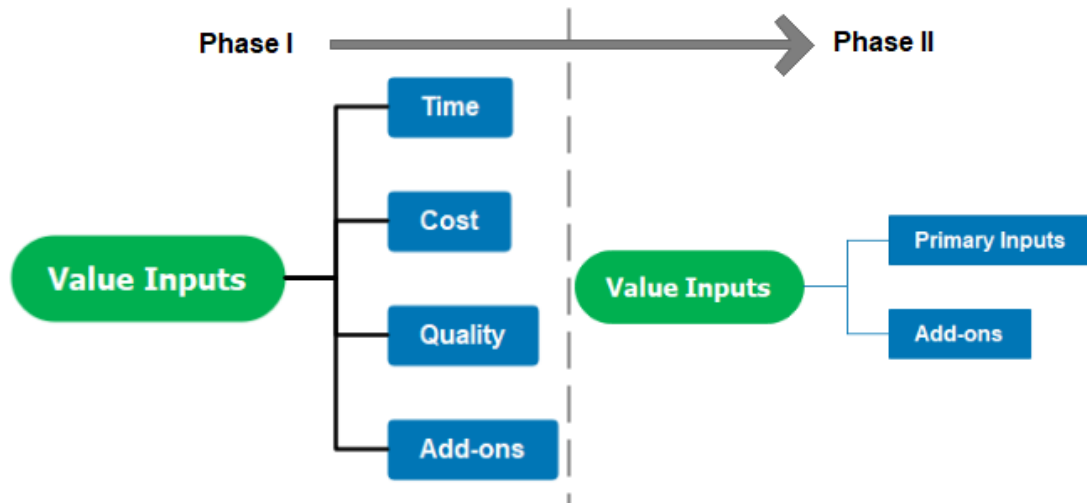
Noticeably, four ‘Value Pillars’ were identified in both phases, Phase I and Phase II. In addition, all the experts agreed for ‘CBM Elements’ as the taxonomy level 2 and ‘CBM Sub-elements’ as the taxonomy level 3 under ‘Value Pillars’. However, the different elements and number of elements under each ‘Value Pillar’ have been altered throughout the interview process of Phase II until data saturation. In Phase I, the four Value pillars were (i) Value Inputs, (ii) Value Network, (iii) Value Creation, and (iv) Value Capture. These four taxonomies were presented to Phase II construction business experts while conducting semi-structured interviews to gather comments and further information related to Value Pillars, CBM Elements, and CBM Sub-elements (refer Annexure 3.5). Accordingly, the construction business experts’ opinions led to some modifications to the taxonomies of Value Pillar, as discussed in the following sub-sections.

5.6.1. Changes and modifications to the taxonomy of ‘Value Inputs’

According to Phase I data analysis, the ‘Value Inputs’ taxonomy consisted of two taxonomy levels with four CBM Elements: (i) Time, (ii) Cost, (iii) Quality, and (iv) Add-ons. However, after Phase II data analysis, the ‘Value Inputs’ were categorised into only two CBM Elements: (i) Primary inputs and (ii) Add-ons. Figure 5.4 illustrates the change in the taxonomy of Value Inputs from Phase I to Phase II.

Figure 5.4

Changes and modifications to the taxonomy of Value Inputs at Phase II



All construction business experts emphasised that Time, Cost, and Quality are the basic requirements of a construction project. For instance, PE 2 explained, *“For them to be Value Inputs, contractors should provide benefits to the Clients within time, cost, and quality constraints of construction projects.”* However, PE 5, as a director of a contracting organisation, contradictorily mentioned, *“Shorter and on-time delivery are discouraged by the Contractor’s staff as they want to keep their job within that project.”* However, as per both Phase I and Phase II findings, the on-time/shorter delivery, cost advantage, and guaranteed quality are found to be the methods of providing value through Cost, Time, and Quality. Eventually, PE 3 and PE 14 proposed that within the taxonomy of ‘Value Inputs’, the CBM Elements, Time, Cost, and Quality identified in Phase I can be combined and named ‘Primary Inputs’.

5.6.2. Changes and modifications to the taxonomy of ‘Value Stakeholders’

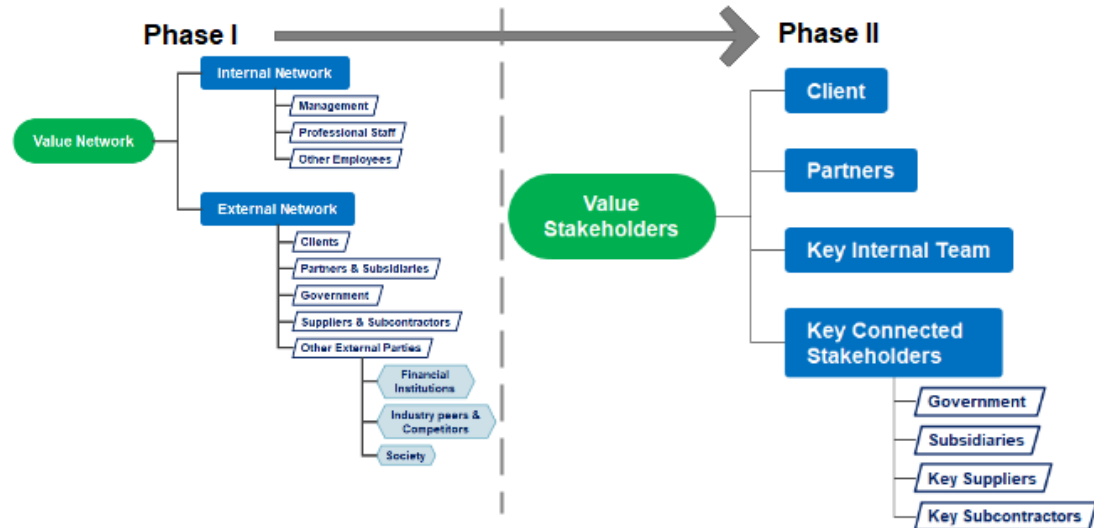
Two CBM Elements, i.e. (i) ‘Internal Network’ and (ii) ‘External Network’, belonged to the ‘Value Network’ as per Phase I findings. Management, Professional Staff, and other employees were CBM Sub-elements of the CBM Element ‘Internal Network’ while Client, Partners & Subsidiaries, Government, Suppliers & Subcontractors, and Other stakeholders were CBM Sub-elements’ ‘External Network’.

The term ‘Value Network’ caused misunderstanding among experts. At a glance, the experts understood Networks related to Information and Communication Technology (ICT) or means as contacts. However, here it depicts the main parties involved in the construction business. Therefore, all experts suggested changing the name as ‘Value Stakeholders’ by considering those who add value to the construction business. Figure

5.5 presents the adjustments to the taxonomy developed in Phase I after Phase II data analysis.

Figure 5.5

Changes and modifications to the taxonomy of Value Stakeholders at Phase II



As a corollary, CBM Elements are supposed to be the stakeholders in the construction business. However, it is challenging to consider all stakeholders when designing BMs. Thus, Phase II experts affirmed the importance of considering only the main stakeholders at the BM designing and decision-making level. As mentioned by all the construction business experts, Clients and Partners are the most important parties or stakeholders to the construction business. On the other hand, PE 5 and PE 12 advised taking only the Internal Team for a particular business case/project rather than considering all the Internal Stakeholders. PE 13 justified, “*Since the definition says BM is a simplified conceptual representation used for decision making, it is not required to consider all the internal staff; we can just use ‘Key Internal Team’ as one element.*”

However, as per Phase I findings, the Other External Parties were Financial Institutions, Industry Peers, Competitors, and Society. Contradictorily, construction business experts PE 4, PE 7, PE 8, and PE 10 argued that the BMs would become more complex by including all stakeholders in the construction business. Alternatively, the experts suggested places to consider such stakeholders within the CBMO. “*Industry peers and competitors can be considered under Strategic Choices as they are the rivals of construction companies*” [PE 4]. “*During financial management, construction businesses work with financial institutions. But they do not give specific attention to them in every business case*” [PE 8]. “*Society needs to be considered at a far broader level within the concepts like sustainability. The social responsibility of a company is an Add-on*” [PE 7]. Furthermore, PE 6 proposed including Government, Subsidiaries,

Suppliers, and Subcontractors under ‘Other External Parties’ as they are not given priority as Clients and Partners at the construction businesses’ decision-making level.

Closely allied to this point, the term ‘Other’ is removed from ‘Other External Parties’ due to the instability of the term ‘Other’ and was changed to ‘Connected Stakeholders’, implying their relationship with the construction business. Furthermore, as all the Connected Stakeholders are not considered, it was named ‘Key Connected Stakeholders’. Subsequently, ‘Value Stakeholders’ is divided into four CBM Elements, i.e. (i) Client, (ii) Partners, (iii) Key Internal Team, and (iv) Key Connected Stakeholders, and Key Connected Stakeholders are categorised into four CBM Sub-elements, i.e. (i) Government, (ii) Subsidiaries, (iii) Key Suppliers, and (iv) Key Subcontractors.

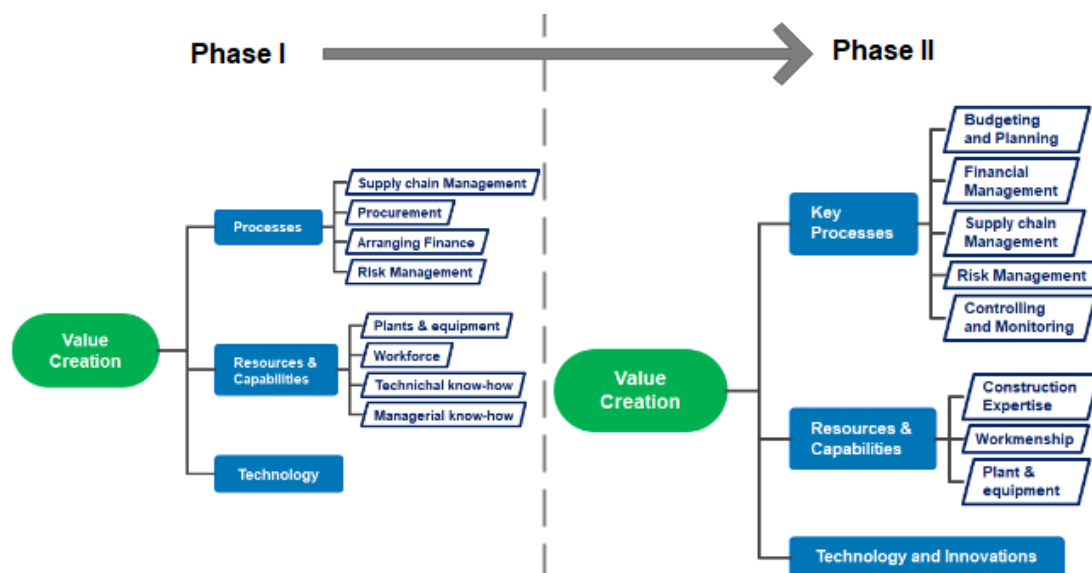
5.6.3. Changes and modifications to the taxonomy of ‘Value Creation’

The taxonomy for Value Creation after Phase I data analysis consisted of three CBM Elements, i.e., (i) Processes, (ii) Resources & Capabilities, and (iii) Technology; four CBM Sub-elements for Processes, i.e., (i) Supply Chain Management, (ii) Procurement, (iii) Arranging Finance, and (iv) Risk Management; and four CBM Sub-elements for Resources & Capabilities, i.e., (i) Plants & Equipment, (ii) Workforce, (iii) Managerial know-how, and (iv) Technical know-how. However, after Phase II data analysis, the taxonomy of ‘Value creation’ includes three CBM Elements, i.e., (i) Key Processes, (ii) Resources & Capabilities, and (iii) Technology & Innovations; five CBM Sub-elements for ‘Key Processes’, i.e., (i) Budgeting & Planning, (ii) Financial Management, (iii) Supply Chain Management, (iv) Risk Management, and (v) Controlling & Monitoring; and three CBM Sub-elements for ‘Resources & Capabilities’, i.e., (i) Construction Expertise, (ii) Workmanship, and (iii) Plant & Equipment.

Figure 5.6 shows the change in Value Creation taxonomy from Phase I to Phase II.

Figure 5.6

Changes and modifications to the taxonomy of Value Creation at Phase II



In Phase II, the construction business expert PE 8 suggested adding the term ‘Key’ to processes as all the processes cannot be considered at the BM designing level. Construction business experts further listed the Key Processes of the construction business. For instance, PE 4 stated, “*Financial Management is one of the Key Processes which includes arranging finance, cash flow management, and working capital management which are interconnected with each other.*” PE 1 and PE 4 mentioned that procurement is one of the most important steps in Supply Chain Management where the right suppliers and subcontractors are selected and negotiated. Hence, procurement is not considered as a separate Key Process under ‘Value Creation’. In addition, “*Budgeting and Planning is to be done at the management decision-making level as the whole business and each business case*” [PE 9]. Also, PE 8, PE 13, and PE 14 highlighted the importance of Controlling and Monitoring as a Key Process in the construction business. PE 13 reasoned, “*Size, complexity, risks, and large geographical dispersion have created the requirement of proper Controlling and Monitoring process for construction projects.*”

PE 3 stated that the most significant ‘Resources & Capabilities’ in the construction business is construction Expertise, which includes both management and technical know-how. PE 1 and PE 3 suggested using ‘Workmanship’ instead of ‘Workforce’, which is more familiar to the construction industry. PE 11 added, “*as we operate in a highly labour-intensive industry, Workmanship is essential.*”

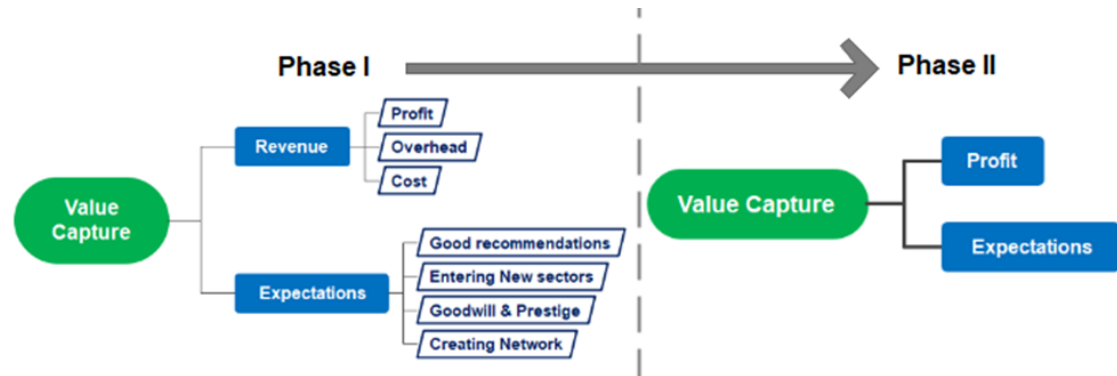
5.6.4. Changes and modifications to the taxonomy of ‘Value Capture’

Phase I data analysis resulted in creating the taxonomy of Value Capture with two CBM Elements, i.e. (i) Revenue and (ii) Expectations. Revenue consisted of CBM Sub-elements: Costs, Profit and Overheads, and Expectations had CBM Sub-elements: Good Recommendations, Entering into New Sectors, Creating Networks and Goodwill, and Prestige.

After Phase II data analysis, the taxonomy of Value Capture includes two CBM Elements, i.e. (i) Profit and (ii) Expectations, as shown in Figure 5.7.

Figure 5.7

Changes and modifications to the taxonomy of Value Capture Phase II



Construction business experts, PE 1, PE 4, and PE 6 at Phase II argued that the Revenue, including Costs, Overhead, and Profit, is not the real Value Capture of the construction business. Instead, only Profit is what the contractors benefitted from Revenue. PE 4 further explained, *“The return over inputs is different in the construction businesses because contractors do not spend their money as Costs, and they maintain their Overheads with Clients’ money.”* PE 6 added, *“Actually, the contractor’s Costs for a particular project is the cost of finance which is incurred for the finance used for running the project until receiving Client’s payments.”*

However, PE 12 contradictorily mentioned that the contractors’ correct decision for generating Revenue through jobs/projects is also important as a business. Furthermore, *“maximising profit by minimising costs and overheads have to be taken into consideration”* [PE 14]. Accordingly, the experts (PE 12, PE 14, and PE 15) accentuated the need for considering Revenue and Costs in the CBMO but not within the ‘Value Capture’ taxonomy. Additionally, PE 11 and PE 13 noted good recommendations, entering new sectors, creating networks and goodwill, and Prestige are the expected benefits from the Clients, which can include some more benefits. Hence, those are considered under describing parameters of Expectations.

After modifications, the CBMO consists of Desired Element, Inherent Element, Shared Elements, Bridging Elements, and Value Pillars with CBM Elements and CBM Sub-elements. The next section describes these elements under Stage 3 of the BM development process.

5.7. Stage 3 – BM development process: Describing Construction Business Model Ontology (CBMO) elements

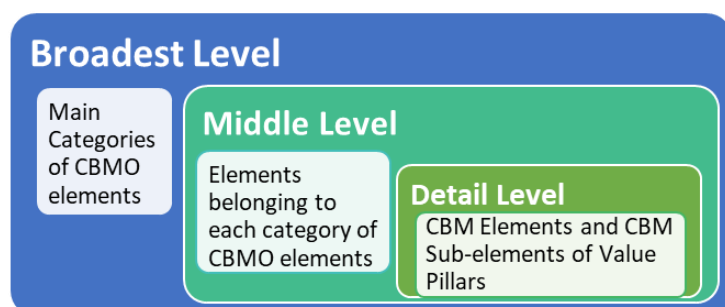
This section describes the CBMO elements based on the additional information gathered in Phase II qualitative survey. However, data from Phases I and II contributed to identifying describing parameters of each CBMO element.

Since the CBMO elements are placed in different levels of taxonomies, the descriptions are presented at multiple levels for better understanding. Hence, this study

adopted a level-wise presentation of analysed data for better understanding using the three levels identified by Azzam et al. (2013), i.e., (i) broadest level, (ii) middle level, and (iii) detail level. According to Azzam et al. (2013), the broadest level represents the overall activities and outcomes in simple terms, the middle level shows the additional details, and detail levels give measures and indicators related to a specific outcome. Therefore, this study uses these levels to embed data and information about the CBMO elements. The entire story of CBMO can be visualised as a result. Figure 5.8 illustrates the levels of describing CBMO elements adapted from Azzam et al. (2013).

Figure 5.8

Levels of describing CBMO elements



5.7.1. Describing CBMO elements at the broadest levels

At the outset, the main element categories of the CBMO were described in terms of their meanings, numbers, and names of belonging elements. Accordingly, ‘Inherent’, ‘Desired’, ‘Shared’, ‘Bridging’, and ‘Value Pillars’ element categories are described in Table 5.1 at the broadest level.

Table 5.1

Descriptions of main CBMO element categories at the broadest level

Category	Meaning	Elements belongs to	
		Numbers	Names
Desired Element	The element that shows the desired position of the company in the future	One	(i) Company Vision/Goal
Inherent Element	The element which inherits to a company and marks the company what it is.	One	(i) Company Culture
Shared Elements	The elements are to be concerned with all the Value Pillars, CBM Elements, CBM Sub-elements, Bridging elements, and themselves.	Three	(i) Strategic Choices (ii) Change (iii) Professionalism
Bridging Elements	The elements that connect and make relationships among Value Pillars, CBM Elements, CBM Sub-elements	Two	(i) Revenue (ii) Costs
Value Pillars	Main areas where CBM Elements are fallen into and the value of the construction business rests on the Value Pillars	Four	(i) Value Inputs (ii) Value Stakeholders (iii) Value Creation (iv) Value Capture

When providing the meanings, the findings from Phase I, Phase II and the literature review were used. After introducing the categories of the elements of the CBMO at the detail level, the next section describes the main elements of each category at the middle level.

5.7.2. Describing CBMO elements at middle levels

At the middle level, the Inherent Element: Company Culture, Desired Element: Company Vision/Goals, and each of the Shared Elements, Bridging Elements, and Value Pillars were described in terms of their names, meanings, and other describing parameters as illustrated in Table 5.2 and Table 5.3.

Initially, different describing parameters for CBMO elements were identified in Phase I, and presented to Phase II construction business experts to confirm appropriateness and gather further information. The modifications were made accordingly. As given in Tables 5.2 and 5.3, the meanings of the elements were derived from the explanations given by top-level managers in Phase I and construction business experts in Phase II.

As per Phase II findings, the Vision is significant for the success and survival of the companies if the construction companies use it as their drive mechanism. Therefore, PE 3 emphasised that visionary leadership and understanding the Vision by at least the company's management is essential. However, PE 7 blamed, *"Today, most construction companies use Vision and Mission to put in their websites and company walls."* Additionally, PE 5 noted that companies could have different goals and Visions that may change from project to project.

The construction business experts at Phase II also recognised the importance of Company Culture for construction businesses, highlighting the impact of culture on the business. Accordingly, PE 4 mentioned, *"Response to the same situation may differ according to the culture"*, while PE 7 said, *"Culture cannot be changed from project to project"*. Consequently, PE 10 emphasised, *"Better to consider culture when decision making because the Company Culture feeds more to the business than what business feed to the culture."*

Table 5.2

Descriptions of Inherent Element, Desired Element and Shared Elements at the middle level

Is a	Name	Meaning	Describing parameters			
DESIRED ELEMENT	Company Vision /Goal	Which can be used as the drive mechanism to run the business	Main Concern			
			Need to be understood by the management and leadership			
INHERENT ELEMENT	Company Culture	The condition within a company which guides the company and shapes the attitude of its employees.	Nature of Construction business culture	Main Concerns	Different Cultures (Examples)	
			<ul style="list-style-type: none"> • Difficult for directing to one point or place • Need to be multi-culture and cross-culture • Change in culture happens gradually <ul style="list-style-type: none"> ○ Take time ○ May cost more • Guided by the company Vision • Not differ project to project or case to case 	<ul style="list-style-type: none"> • To enable constant delivery of value • Need to identify company culture as a whole/ overall • To be considered in decision making • To be made align with Vision & Mission of the company 	<ul style="list-style-type: none"> • Rewarding for performance • Learning and development • Anti-corruption • Zero tolerance for unethical behaviour • Take responsibility (Eg, for community and environmental impacts) • Quality and reliability 	<ul style="list-style-type: none"> • Teamwork • Cross-functional collaboration • Mutual respect • Trust and commitment • Transparency • Aggressive • Rigid • Unprofessional • Money first
SHARED ELEMENTS	Strategic Choices	The decision to select a proposal/idea/mechanism to achieve something which contributes to business and project success	Factors affecting	Factors to consider	Examples for construction business strategies	Marketing Aspects
			<ul style="list-style-type: none"> • Company goals (Leadership goals/ Reputation goals/ Financial goals/ Competitive goals) • Country's economic situation • Project goals • Priority is given, and importance • Business and market environment and trends 	<ul style="list-style-type: none"> • Time constraints • Costs and benefits • Market dynamics and trends • Strengths and weaknesses • Information constraints • Impact of past strategies • Strategy implementation 	<ul style="list-style-type: none"> • Bidding Strategies • Competitive Strategies • Differentiation Strategies • Marketing Strategies • Networking Strategies • Change and Adaptability Strategies 	<ul style="list-style-type: none"> • Value Inputs • Professionalism • Visionary Leadership • Word-of-mouth advertising • Partnerships
			Reasons for change	Barriers for change	Drivers for change	
SHARED ELEMENTS	Change	The move of the company from the current position to a better position contributing to business and project success	<ul style="list-style-type: none"> • Change in technology • Change in law and regulations • Change in Clients' taste and requirements • Change in economic situation and policies • Change in international factors • Change in weather • Change in political leaders • Influence from market lobbying groups • Unexpected situations 	<ul style="list-style-type: none"> • Different knowledge levels • Different attitudes • Culture of the company • Organisational resources & capabilities • Leadership 	<ul style="list-style-type: none"> • Flexibility • Responsiveness • Agility • Adaptability • Change in the way of thinking 	
				Concern when changing	Examples for Change adaptation methods	
SHARED ELEMENTS	Professionalism	The demonstration of the behaviours of professionals in the company that takes the construction business towards success	Importance	Enablers	Main concerns	
			<ul style="list-style-type: none"> • To attract clients and maintain positive relationships • To build and maintain progressive, sustainable relationships with Partners • To maintain a cordial relationship with competitors and the external world • To win the trust of stakeholders • To deal with statutory authorities • To comply with laws, rules, and regulations • To ensure a strong market reputation • To drive towards innovative solutions 	<ul style="list-style-type: none"> • Interpersonal skills • Contingency Management skills • Contextual Intelligence • Leadership Skills • Reliability • Responsiveness • Higher visibility • Ethical background 	<ul style="list-style-type: none"> • Develop professional efficiency • Avoid Professional Obsolescence 	

Table 5.3

Descriptions of Bridging Elements and Value Pillars at the middle level

Is a	Name	Meaning	Describing parameters			
BRIDGING ELEMENTS	Revenue	The total income of the construction business that the company receives from a particular Client for the job/project.	<u>Nature of Construction business revenue</u>		<u>Factors to consider in Revenue generation</u>	
			<ul style="list-style-type: none"> • Irregular Revenue • Receives at Milestones/ interim valuations 		<ul style="list-style-type: none"> • Time frame • Project size • Nature of Client & consultant • Client’s financial status 	
BRIDGING ELEMENTS	Costs	All costs incurred for the job (project) concerning the design, construction, and equipping, including overheads	<u>Ways of incurring Cost</u>		<u>Ways of minimizing Cost</u>	
			<ul style="list-style-type: none"> • Payments • Fees • Charges • Salaries & wages 	<ul style="list-style-type: none"> • Profit-sharing • Rents & hires • Interests • Other 	<ul style="list-style-type: none"> • Identify the expensive resources & processes and their priority level • Consider alternatives • Effectively manage material usage and machine utilization • Use new technology/ innovations • Negotiations and renegotiations 	
VALUE PILLARS	Value Inputs	Value Inputs are company's services that are of value to the Client and are attract future Clients	<u>Purpose(s)</u>			<u>Set of CBM Elements</u>
			<ul style="list-style-type: none"> • To get Clients’ recommendations • To survive in the market • To enhance Company experience and qualifications 			<ol style="list-style-type: none"> 1. PRIMARY INPUTS 2. ADD-ONS
	Value Stakeholders	Value Stakeholders have an interest in company value creation or/and involved in creating values	<u>Purpose(s)</u>			<u>Set of CBM Elements</u>
			<ul style="list-style-type: none"> • To have payments or fees/Profit • To obtain materials, products, or services • To get jobs • To continue jobs • To complete jobs • To be competitive 			<ol style="list-style-type: none"> 1. CLIENT 2. KEY INTERNAL TEAM 3. PARTNERSHIPS 4. KEY CONNECTED STAKEHOLDERS
Value Creation	Value Creation describes the arrangement of key processes, resources and capabilities and technology required to create value	<u>Method(s) to use</u>			<u>Set of CBM Elements</u>	
		<ul style="list-style-type: none"> • Having partnerships or joint ventures • Streamlined processes • Enhance shared understanding of Clients’ requirements and goals of each project • Quality control and quality assurance systems • Professionalism 			<ol style="list-style-type: none"> 1. KEY PROCESSES 2. RESOURCES & CAPABILITIES 3. TECHNOLOGY & INNOVATIONS 	
Value Capture	Monetary and nonmonetary benefits received from the Client for the delivered service/ value	<u>Factors affecting</u>			<u>Set of CBM Elements</u>	
		<ul style="list-style-type: none"> • The current situation of the business and the industry • Cash flow management • Nature and type of Client 			<ol style="list-style-type: none"> 1. PROFIT 2. EXPECTATIONS 	

Interestingly, the construction business experts disclosed some possible bad cultures of construction companies. PE 11 stated that the aggressive culture creates more disputes and litigations while the rigid culture avoids changes and makes barriers for chasing opportunities and success as per PE 6. Further, PE 7 highlighted, *“Some companies still have money-first culture and unprofessional culture, but today it is difficult to survive with such cultures because clients are concerned more about that.”* Moreover, PE 15 emphasised that cultural changes need to be made and managed strategically. PE 14 reminded a recent cultural change that happened to most businesses in the world due to the Covid-19 pandemic: *“Recently, the offices have changed the Company Culture more towards the work-from-home culture using computerised and internet technology due to Covid-19.”*

Phase II findings also added some points to the Strategic Choices. For example, PE 1, PE 3, and PE 8 stated the requirement of careful analysis of time constraints, costs, and benefits in strategic decisions and implementation. Most prominently, PE 12 mentioned, *“Communicating the strategies internally among key internal team and management and externally among partners and subcontractors as per the requirement is very important.”* Accordingly, a good strategy must ensure that key stakeholders and team members work towards a common goal. On the other hand, PE 2 and PE 6 added differentiation strategies, marketing strategies, and change & adaptability strategies as other vital strategies for construction businesses. Finally, the construction business managers must reflect on the impacts of strategies on the company’s business [PE 15].

Moreover, PE 11 explained, *“Marketing and differentiation are essential for construction businesses also. The competition is very high in this business. Even as a higher graded contractor, we had to compete with more than ten companies.”* PE 10 added, *“Companies trying to increase their list of add-ons to be differentiated.”* Likewise, *“In marketing, we have to consider market dynamics and trends in the construction industry. For example, the industry is talking about sustainability, Green, carbon footprint, zero waste, etc.”* [PE 7]. Also, *“We need to define our strengths and weaknesses in deciding Strategic Choices”* [PE 5].

Like Phase I findings, Phase II experts have identified Professionalism as the most vital element in the construction business in all aspects. Therefore, all construction business experts stated that the construction business depends on its power of Professionalism and ethical background. In addition, the development of professional efficiency [PE 6] and avoiding professional obsolescence [PE 1] are the main concerns to be given under Professionalism, achievable via CPDs, seminars, workshops, etc.

Regarding Change, PE 1 pointed out that construction companies cannot survive in the industry and compete with rivals without change. PE 14 added, *“Construction companies will miss opportunities like the international market if they do not change.”* Moreover, PE 11, PE 7 and PE 3 explained the importance of change, illustrating the Covid-19 pandemic. *“During this pandemic situation, some construction companies have adjusted quickly than others and used it as an Add-on”* [PE 11]; *“Contractors*

have turned to technology for monitoring and screening workers on sites and communicating with stakeholders” [PE 7]; *“This pandemic encourages the construction industry to use Building Information Modelling (BIM) and virtual reality”* [PE 3]. Ultimately, the construction companies had to change themselves, responding to the Covid-19 pandemic.

After analysing Phase II data, Revenue and Costs were identified as Bridging Elements in the CBMO. Table 5.3 summarises Phase I and Phase II findings of the two Bridging Elements. PE 1, PE 4, PE 9, and PE 11 underlined that the nature of construction business Revenue is irregular because it comes in varying amounts at milestones or with interim valuations. Phase II findings also revealed the decision of increasing Revenue generation by construction companies to be taken wisely. PE 2 stated, *“Clients’ financial status also needs to be considered to ensure continuous Revenue flow”*, and *“Nature of the consultants also affect Revenue flow as they are the ones who are checking and certifying payments”* [PE 5]. Accordingly, Revenue is one of the significant concerns in the construction businesses that contribute to change in the company’s profitability.

The other Bridging Element is Costs, which is also one of the most significant concerns in the construction businesses. Phase II findings list a few methods of incurring Costs by construction businesses; payments, fees, charges, interests, salaries, wages, rents, hires, and profit-sharing with partners [PE 7, PE 9, and PE 14]. However, as per PE 1 and PE 4, the construction companies must find ways to minimise Costs without reducing the service and product quality, to maximise Profit. Accordingly, different methods used and the methods the construction companies can use to minimise costs were identified; e.g. considering alternatives [PE 4], using new technology/innovations [PE 8], negotiations and renegotiations [PE 5 and PE 15], building good relationships with Suppliers and Subcontractors to get discounts [All experts], tax-free purchases [PE 5], limit capacity building [PE 3], and cost controlling & monitoring [All experts]. PE 3 added that it is essential to identify the company’s most expensive resources and processes and their priority level. Further, PE 3 emphasised the importance of controlling overheads due to difficulty in recovery.

Table 5.3 summarises the details for describing Value Inputs: Value Stakeholders, Value Creation, and Value Capture. Consideration of their purpose is important when describing Value Inputs and Value Stakeholders. As findings revealed, there could be one or many underlying purposes providing Value Inputs and having relationships with Value Stakeholders. Additionally, in Phase II, PE 3 said, *“Value Inputs are important to create a positive attitude about the company among Clients and consultants.”* PE 5 stated, *“Our Partners, Suppliers, and Subcontractors help us to be competitive in the construction market”*, while PE 12 mentioned, *“We can acquire overseas market through our Partners and by using Client network.”* Furthermore, as depicted in Table 5.3 and according to PE 5’s statement, value capturing needs proper cash flow management in the company, which is affected by the business’s and the industry’s current situation.

Accordingly, each Value Pillar owns different describing parameters in a broader view, and their CBM Elements are required to be described at the detail level to give a more comprehensive understanding of Value Pillars as in the next section.

5.7.3. Describing CBMO elements at the detail level

Tables 5.4 and 5.5 present the summarised details and describing parameters found from Phase I and Phase II data related to CBM Elements and CBM Sub-elements of each Value Pillar. Additions and modifications in Phase II data analysis are discussed in the following sub-section for each Value Pillar.

5.7.3.1. Descriptions of CBM Elements: Value Inputs

Primary Inputs and Add-ons are the CBM Elements of Value Inputs which gives the values primarily and additionally expected by the Clients from construction companies. Table 5.4 provides the summary of descriptions for CBM Elements of Value Inputs.

As stated by PE 9, *“If a client is attracted by delivering the project in a shorter time, the contractor can seek innovative ways to do it, but it will cost more.”* Further, PE 1 suggested that saying ‘cost advantage’ is more appropriate than the ‘lowest possible Cost’. The expert further explained, *“Both Contractor and Client can get advantage by reducing Cost without reducing quality. So that project can be completed within budget.”* PE 4 added, *“Construction companies can analyse cost drivers of their activities and find opportunities to reduce cost within required quality.”*

Moreover, Phase II findings prove that today, contractors can provide primary value through designing due to the popularity of Design and Build projects. Thus, making designs to the Client’s requirements and specifications is a Primary Value Input. Also, *“Optimising the design considering cost constraints along with Client requirements and objectives is possible, especially structural designs”* [PE 10]. On the other hand, construction business experts further listed Add-ons considering the perspectives of today’s Clients and consultants. For instance, *“High health, safety, and environmental concerns are essential where Clients look at standard certifications like ISO and OSHA”* [PE 7], *“Having good working relationship or connectivity with consultants as well as with statutory authorities can be taken as Add-on because that reduces the extra burden to the Client”* [PE 11].

Table 5.4

Descriptions of CBM Elements and CBM Sub-Elements of Value Inputs and Value Stakeholders

Part of	Name	Meaning	Describing parameters				
VALUE INPUTS	PRIMARY INPUTS	Company's services that are of primary value to the Client and are primarily needed by the Client	Methods of providing Primary Inputs <ul style="list-style-type: none"> On-time delivery Shorter time delivery Cost advantage Guaranteed Quality On spec/ optimal design 				
	ADD-ONS	Company's services that are of additional value to the Client and are additionally expected by the Client.	Methods of giving additional value (Examples for Add-ons) <ul style="list-style-type: none"> Constructability competence Predictability Worry-free/ Hassel free Innovative processes & products According to the plan and the Client's expectations Be less adversarial Updated knowledge of the industry No defects Service for the whole package Smooth Post contract dealing Good working relationship (Connectivity) Less/no contribution to litigation history Confidentiality maintenance Health/ safety & environmental concerns and records Sustainability policy & practices Vigilance on disinfection 				
VALUE STAKEHOLDERS	CLIENT	For whom the construction company creates value and delivers Value Inputs to capture value	Process of Handling Client				
			Identifying Client	Type	Category	Nature	Other Factors
				<ul style="list-style-type: none"> Private Public Other 	<ul style="list-style-type: none"> New Repeat Target 	<ul style="list-style-type: none"> Highly professional Technically rich Politically powerful Layman 	<ul style="list-style-type: none"> Client's profile Financial Capability Reliability Compliance with company's policies & expectations
			Client Interface Management	<ul style="list-style-type: none"> Appropriate information to be communicated with Client <ul style="list-style-type: none"> Defining required information Controlling information 		<ul style="list-style-type: none"> The appropriate person to deal within client-side The appropriate time to communicate The appropriate place to meet 	
			Maintain Client Relationship	Appropriate approaches <ul style="list-style-type: none"> Assign the right person to deal with Maintain a high level of client satisfaction Open communication/ be available Maintain continuous dialogue 		<ul style="list-style-type: none"> Maintain Confidentiality Be flexible Work positively Not being too official and contractual 	<ul style="list-style-type: none"> Professionalism Maintain client loyalty Handling Client grievances
	Create Client Base	<ul style="list-style-type: none"> Target Clients Repeat Clients 					
PARTNERS	With whom the construction company has partnerships to create value for the Client	Purpose / expected benefits		Factors to consider in selecting Partners	Main Concerns when creating partnerships		
		<ul style="list-style-type: none"> Strength in wining jobs Sharing knowledge Getting work experience Cost-sharing Sharing obligations 	<ul style="list-style-type: none"> Expedite works Enhance capacity & capability Obtain machines and equipment Overseas expansion 	<ul style="list-style-type: none"> Nature of the proposed Partner Reliability Cultural compatibility Partner's relationship with the Client Experience with the proposed Partner 	<ul style="list-style-type: none"> Determine the lead Partner Determine the roles and responsibilities Determine cost and profit-sharing mechanisms Decide method of exit Mitigation of Potential issues 		

Part of	Name	Meaning	Describing parameters					
VALUE STAKEHOLDERS	KEY INTERNAL TEAM	The team of the company's internal staff who involve in creating value for the Client	Factors to consider in the selection		Method to enhance efficiency and effectiveness			
			<ul style="list-style-type: none"> Type and nature of the project/business case Type and nature of the Client Priority is given for the Client and Project Teams' past dealings with the Client Goal/targets to be achieved 	<ul style="list-style-type: none"> Key tasks and roles of the team Required skills & capabilities Capabilities of the team Leader of the team Key members of the team – Professional & technical 	<ul style="list-style-type: none"> Set targets Provide most up-to-date information Best suit leadership Training and development 	<ul style="list-style-type: none"> Open-door policy Performance appraisal and rewarding Welfare activities 		
	KEY CONNECTED STAKEHOLDERS	The other vital external stakeholders of the company who are connected in creating value for the Client	Set of CBM Sub-elements					
			GOVERNMENT	Meaning - Government of the country as a regulatory authority and policy and standards maker				
				Ways to deal with as a Regulatory body		Ways to deal with as a Policymaker		
				<ul style="list-style-type: none"> Identify the culture of regulators Update with requirements Work within the legal framework Confirm to specifications stated by regulatory bodies 	<ul style="list-style-type: none"> Follow up prompt requests Manage bureaucratic obstacles Manage potential conflicts Decide on the time to be allocated for the process Timely payment of dues 	<ul style="list-style-type: none"> Identify impacts of current policy changes Adapt for policy changes Foresee potential policy changes Prepare for policy changes 		
			SUBSIDIARIES	Meaning - Secondary companies that control by the company and used for value creation				
				Expected benefits				
			<ul style="list-style-type: none"> To have discounts Getting priority Any time availability 			<ul style="list-style-type: none"> Escape from external dependence Get competitive price 		
			KEY SUBCONTRACTORS	Meaning - Those whom the company appoints to perform a particular task related to creating value				
Expected characteristics		Main factors to consider in selecting						
<ul style="list-style-type: none"> Capability in carrying out the works Adherence to ethical conduct Work uninterruptedly Be trustworthy Competitive in terms of prices 	<ul style="list-style-type: none"> Quality in service Flexibility Easy to communicate with Possessing a good past track record Commitment to teamwork 	<ul style="list-style-type: none"> Potential lists of subcontractors Feedback from Periodical reviews Possible risks Price Strategic and high performing subcontractors 						
KEY SUPPLIERS	Meaning - Those who provide materials/products to the company to create value							
	Main factors to consider in selecting							
<ul style="list-style-type: none"> Potential lists of Suppliers Quality of materials/products Discounts 			<ul style="list-style-type: none"> Feedback from Periodical reviews Possible risks – Eg. Non-conformities, late deliveries, and non-deliveries Availability and constructability 					

“Today, many Clients worry about incorporating novel concepts into their projects and seek contractors with BIM capability, sustainability practices, and digitalisation” [PE 3]. Alternatively, focusing on the Covid-19 pandemic situation, PE 14 pointed out, *“With the pandemic, Clients may expect different Add-ons like vigilance on disinfection.”* In addition, PE 15 gave an exciting idea by stating, *“In future, Clients may ask for a “Menu” of values that the Contractor can offer for a particular project. Clients can select the contractors based on the most comprehensive menu with compared to price.”* Finally, PE 10 stated that the Value Inputs could be decided whether need-to-provide or nice-to-provide.

Table 5.4 includes the describing parameters of Primary Inputs and Add-ons, incorporating modifications to Phase I findings as mentioned above.

5.7.3.2. Descriptions of CBM Elements and Sub-Elements: Value Stakeholders

Value Stakeholders consist of four CBM Elements: (i) Client, (ii) Key Internal Team, (iii) Partners, and (iv) Other Connected Stakeholders. Table 5.4 portrays the summary of details related to these CBM Elements.

According to Phase I findings, the first step of handling Clients is identifying the Client. The Phase II findings added that first, it is necessary to consider whether the Client is private or public, and then whether new, repeat, or target. Further, according to PE 10, *“There can be Clients with high professional knowledge, with rich technical knowledge, with political power, and also there are laymen.”* PE 11 provided an example, explaining how the Clients become technically rich, i.e., *“when clients repeat the same project chain continuously, they become technically rich in that area”*. Also, PE 13 added, *“RDA, Water Board, and Electricity Board can be considered technically rich and professionally high Clients.”* Finally, PE 6 stated, *“If we go with Layman, it is required to see whether there is an independent consultant.”*

Table 5.4 also provides factors to be considered in identifying Clients. As mentioned by PE 1, the Client’s profile with financial capability and what the company expected from the Client aligned to company policies are important factors when identifying Clients. Additionally, looking at previous experience with the Client and deviations to previous profile and financial abilities is helpful if the Client is repeating [PE 8]. PE 13 stated the main point about target Clients is why the company is targeting that Client. Under Client interface management, PE 8 underlined, *“Within Client interface, it is required to consider with whom, where, and when to communicate and meet, especially with public Clients.”*

According to the findings, construction companies use different approaches to maintain relationships with Clients. For example, besides those identified in Phase I, PE 8 mentioned, *“being too much official and contractual is not creating better relationships with Clients”*. However, communicating openly [PE 3], being available when required [PE 5], and maintaining confidentiality [PE 5] create cordial

relationships with Clients. Finally, all the construction business experts identified that Professionalism is key to better relationships with Clients.

The construction companies create partnerships for different purposes, as given in Table 5.4. However, more importantly, Phase II findings revealed the factors to be considered when creating partnerships. Accordingly, the nature of the proposed Partner, e.g., reliability and cultural compatibility [PE 5 and PE 9], Partner's relationship with the Client, and experience [PE 3, PE 4, and PE 9], have to be considered. Furthermore, when creating partnerships, construction companies must pay attention to determining the roles and responsibilities [PE 6], cost and profit-sharing mechanisms [PE 12], method of exit [PE 2], and mitigation methods of potential issues [PE 1, PE 7, and PE 10]. Prominently, PE 12 stressed, *"Deciding on a lead partner is essential to drive the partnership."*

The Key Internal Team involves creating value under the BM of a particular business case/project. As per Table 5.4, several factors were identified from Phase II findings that need to be considered when selecting an internal team. As PE 14 stated, *"Based on the priority given for the Client and project/business case, we can assign a better team from the internal staff with the best leader."* In addition, PE 8 indicated that a valuable and informed contribution could be acquired from the internal team by providing them with clear goals, targets, tasks, roles, and up-to-date information. Contrarily, PE 5 pointed out, *"there should be a method to retain knowledge within the company after completing the project, which is a challenging task in the construction business"*. Therefore, methods to improve the efficiency and effectiveness of the Key Internal Team found from Phase I case studies can be applied to achieve the task's success and retain the team members and the knowledge within the company.

Key Connected Stakeholders are further categorised into four CBM Sub-elements: (i) Government, (ii) Subsidiaries, (iii) Key Suppliers, and (iv) Key Subcontractors. All experts in Phase II confirmed the significant role of the Government in the construction industry, highlighting that careful dealing is essential. For example, PE 7 stated that the cultures of different regulatory authorities must be identified when dealing with them. PE 3 added, *"We, as construction companies, have to obtain approvals from regulatory authorities in the forms of licenses, permits, registrations, and authorisations under several circumstances, which take time. So, we have to make allowances in planning for the expected timeline for those processes."*

Further, PE 8 noted that updating the approval requirements and following up on the promptly requested information by authorities is essential. Under the CBM Sub-element Subsidiaries, no additional data could be found in Phase II data collection, and Table 5.4 summarises findings from Phase I.

Key Subcontractors and Key Suppliers are considered as two separate CBM Sub-elements in Phase II. PE 6 mentioned, *"The lists of Subcontractors and Suppliers are*

maintained and updated by the contractors considering feedback from periodical reviews which are then used for selection.” For example, as PE 5 highlighted, the list of Subcontractors shall include strategic and high-performing Subcontractors. PE 3, on the other hand, highlighted that since both Suppliers and Subcontractors contribute to the risks of the construction companies, the possible risks need to be predicted. PE 4 disclosed, *“We have to face non-conformities, late deliveries, and non-deliveries with the Suppliers”*, and PE 1 stated, *“Material and product quality, discounts, the availability and contact ability of Suppliers are the basic things we are looking at.”* Accordingly, the CBM Elements under Value Stakeholders could be finalised with the describing parameters and relevant details from Phase I and Phase II findings, as shown in Table 5.4.

5.7.3.3. Descriptions of CBM Elements and Sub-Elements: Value Creation

‘Key Processes’ is one of the CBM Elements of Value Creation, the most crucial part with the highest impact in creating value towards the company’s success [All construction business experts]. PE 9 questioned, *“How can we survive as a business without the processes?”*

PE 12 mentioned that the concentration on the effect of new business cases on the company’s annual budget is important under the Budgeting and Planning process, where cash flow forecasting is helpful. As evident in both Phase I and Phase II, Supply Chain Management is the most important process of creating value. However, as per PE 8, the supply chain of construction companies is not always effective and efficient. *“There can be processes in the supply chain which are not added value for the company. For example, having an in-house design division may not add value to construction companies like consultants. Therefore, the contractors tend to out-source design teams whenever they require designing like for D & B projects.”*

Furthermore, there could be supply chains contributing to recurring mistakes and errors [PE 11], unresponsive and delayed processes [PE 13], and expensive but ineffective processes [PE 10]. Therefore, identifying waste in the supply chains through periodic reviews and follow-ups and taking precautions for them is important. Consequently, the company’s supply chain deviations can occur while considering additions [PE 6, PE 8, and PE 10]. Prominently, Risk Management is to be considered under Key Processes though it is a vast area [All experts in Phase II]. Therefore, at the business decision-making level, it is to be mainly concerned with risk appraisal by identifying potential internal and external risks of business cases and proposing methods to minimise them [PE 4], looking for strategies to transfer risks, e.g., partnerships and considering how to allow for risks [PE 7].

In parallel, PE 8, PE 13, and PE 14 stated that Controlling and Monitoring should be a compulsory process in a construction company. PE 13 further pointed out that assessing the current Controlling and Monitoring system is necessary to encounter

deficiencies and problems and make possible solutions. *“For example, we have established a separate division for controlling and monitoring due to the problems with monitoring several projects”* [PE 13]. PE 14 stated the extent of Controlling and Monitoring requirements to be considered for each business case with the available systems.

Besides, Key Processes, Resources and Capabilities, and Technology and Innovations help create value. However, as PE 6 stated, in selecting and deciding on required Resources & Capabilities for a business case or project, the companies must first check the availability and capacity of such Resources and Capabilities and decide on their suitability for the requirements. PE 12 further pointed out, *“We decide on the allocation of our Resources and Capabilities based on the priority given for the project and client relationship.”* Consequently, other than utilising their own Resources & Capabilities, construction companies use different methods for obtaining them externally, e.g., subcontracting and hiring [PE 1], out-sourcing and consulting [PE 4 and PE 15], and purchasing and recruiting [PE 11 and PE 14]. PE 9 underlined, *“Many construction companies try to go with partnerships or joint ventures to acquire unavailable Resources and Capabilities.”* All the experts in Phase II identified the importance of Technology and Innovations to the construction businesses. However, PE 5, PE 8, and PE 11 warned the need for careful and informed acquisition. Accordingly, PE 8 mentioned, *“Before implementing new technologies and innovations, we have to think why we require them and their use.”* Furthermore, *“We have to look at the company’s and its employee’s adaptability for the new technologies and innovations and whether those can be sustained within the company”* [PE 11]. Differently, PE 8 stated that instead of looking at the benefits itself, it is required to concern net benefits with any opportunity creation.

Ultimately Table 5.5 was updated with describing parameters of CBM Elements and CBM Sub-Elements of Value Creation.

Table 5.5

Descriptions of CBM Elements and CBM Sub-Elements of Value Creation and Value Capture

Part of	Name	Meaning	Describing parameters			
VALUE CREATION	KEY PROCESSES	Processes are the company's primary value-adding activities that have maximum impact on the success and survival of the company	Set of CBM Sub-elements			
			BUDGETING & PLANNING	Main Concerns		
				• Impact on the company's annual budget	• Cash flow forecasting (Cash flow management)	
			FINANCIAL MANAGEMENT	Main Concerns		
				• Methods for arranging financial requirements • Cost of finance	• Cash flow management	
			SUPPLY CHAIN MANAGEMENT	Main Concerns		
	• Maintain relationships • Acquire quality inputs • Periodical reviews and follow-ups	• Identify waste in the supply chain • Identifying deviations/additions				
	RISK MANAGEMENT	Main Concerns				
		• Identify potential internal/external risks • Types of risks • Minimize risks	• Transferring risks • Allowances for risks • Improve risk appetite			
	CONTROLLING & MONITORING	Main Concerns				
• The extent of controlling and monitoring requirement • Adequacy of current controlling and monitoring system		• Problems in current controlling and monitoring system and possible solutions • Maintain positive cash flow (Cash flow management)				
RESOURCES & CAPABILITIES	The sources that create values and allow a company to do the business and face competition.	Set of CBM Sub-elements				
		CONSTRUCTION EXPERTISE	Factors to Consider	Methods of obtaining		
		WORKMANSHIP				
		PLANT & EQUIPMENT				
• Allocation • Availability • Capacity • Suitability	• Use own resources & capabilities • Sub-contracting • Hiring • Purchasing	• Out-sourcing • Consulting • Recruiting • Having Partnerships/ Joint Ventures				
TECHNOLOGY & INNOVATIONS	New or improved products or processes used for creating values	Main Concerns				
		• Requirement/ Use • Net benefit • Opportunity creation	• Adaptability • Sustainability			
VALUE CAPTURE	PROFIT	Difference between revenue and costs	Main Concerns			
	• Profitability goals • Maintain required Profit • Revenue generation	• Understand and define associated costs • Consider productivity improvements				
VALUE CAPTURE	EXPECTATIONS	Benefits expected from the Client other than Profit and that explore opportunities to the company	Examples for Expectations			
			• Maintain overheads • Have good recommendations • Have positive word-of-mouth advertising • Enter new sectors	• Receive Goodwill & Prestige • Create network • Maintain track records		

5.7.3.4. Descriptions of CBM elements: Value Capture

As the ultimate purpose of any business, Profit is the main CBM Element of Value Capture. According to all Phase II experts, Revenue generation through projects mainly creates Profit, even though many factors have to be considered in Revenue generation in the construction businesses, as given in Table 5.5. PE 3 advised having profitability goals for the construction companies and working towards them. PE 6 added, “*Construction companies always try to maintain their required profit.*” Hence, “*minimising Costs as much as possible is vital for maximising Profit, so we need to understand and predict Costs associated with projects*” [PE 5]. PE 10 suggested that construction companies can use different strategies to improve the productivity of their processes and thereby increase Profit.

On the other hand, PE 1 added ‘maintain overheads’ to the CBM Element, *Expectations*, stating, “*Many contractors maintain their overheads using Clients’ money. So that it is one of their primary Expectations.*” However, PE 4 mentioned that contractors should manage overheads carefully. PE 2 underlined, “*Contractors expect to add every project that they carry out to their track records. So that they can win future jobs.*” Importantly, PE 8 pointed out that contractors can use their *Expectations* to seek opportunities. Finally, this information was added to the descriptions of Value Capture in Table 5.5.

After exploring describing parameters of CBMO elements (refer Annexure 5.2) under Stage 3 of the BM development process, the next stage is to develop CBMO as explained in the next section.

5.8. Stage 4 – BM development process: Developing Construction Business Model Ontology (CBMO)

This section discusses the development of the CBMO based on findings from case studies in Phase I and findings from the qualitative survey in Phase II. Besides the taxonomies of Value Pillars, the qualitative relationships among finalised elements constituting the CBMO were established using relationship indicators, as discussed in the next sub-section.








5.8.1. Establishing relationships among CBMO elements

Qualitative relationship indicators in literature are used to display relationships among BM elements as described in Section 2.12.5. This study also derived different qualitative relationship indicators from the findings and used them to indicate the relationships among CBMO elements. However, the relationship indicators ‘Set of’ and ‘Part of’ were obtained from Osterwalder (2004)’s study to establish the Value Pillar’s primary relationship with its CBM Elements and the CBM Element’s primary relationship with its CBM Sub-elements. For instance, it can be described as “*Value Inputs are the set of Primary Inputs and Add-ons, whereas Primary Inputs and Add-ons are parts of Value Inputs.*”

Table 5.6 illustrates the connotations of a few relationship indicators used to present relationships among CBMO elements.

Table 5.6

Connotations of sample relationship indicators

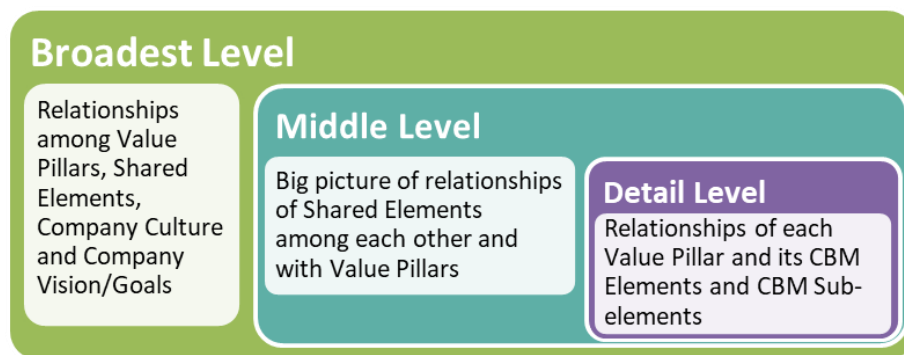
Element 1		Element 2	Relationship Indicator	Relationship explanation
X ₁		X ₂	“Drive towards”	X ₁ to be driven towards X ₂
X ₁		X ₂	“Fit to”	X ₁ to be fitted with X ₂
X ₁		X ₂	“Shared with”	Elements of X ₁ to be shared with elements of X ₂
X ₁		X ₂	“Consider with”	X ₁ to be considered with X ₂
X ₁		X ₂	“Set with”	X ₁ to be set with X ₂
X ₁		X ₂	“Build on”	X ₁ can be built on X ₂
X ₁		X ₂	“Use as”	X ₁ can be used as X ₂

The relationship indicators were placed between two CBMO elements with different coloured arrows. Consequently, the particular relationship can be explained as illustrated in Table 5.6.

Like descriptions of CBMO elements, multiple levels were used for better understanding when presenting relationships. Accordingly, three levels, i.e. (i) broadest level, (ii) middle level, and (iii) detail level, were adapted from Azzam et al. (2013), as shown in Figure 5.9.

Figure 5.9

Levels of presenting relationships among the CBMO elements



The next sub-sections discuss the relationships among CBMO elements at three levels

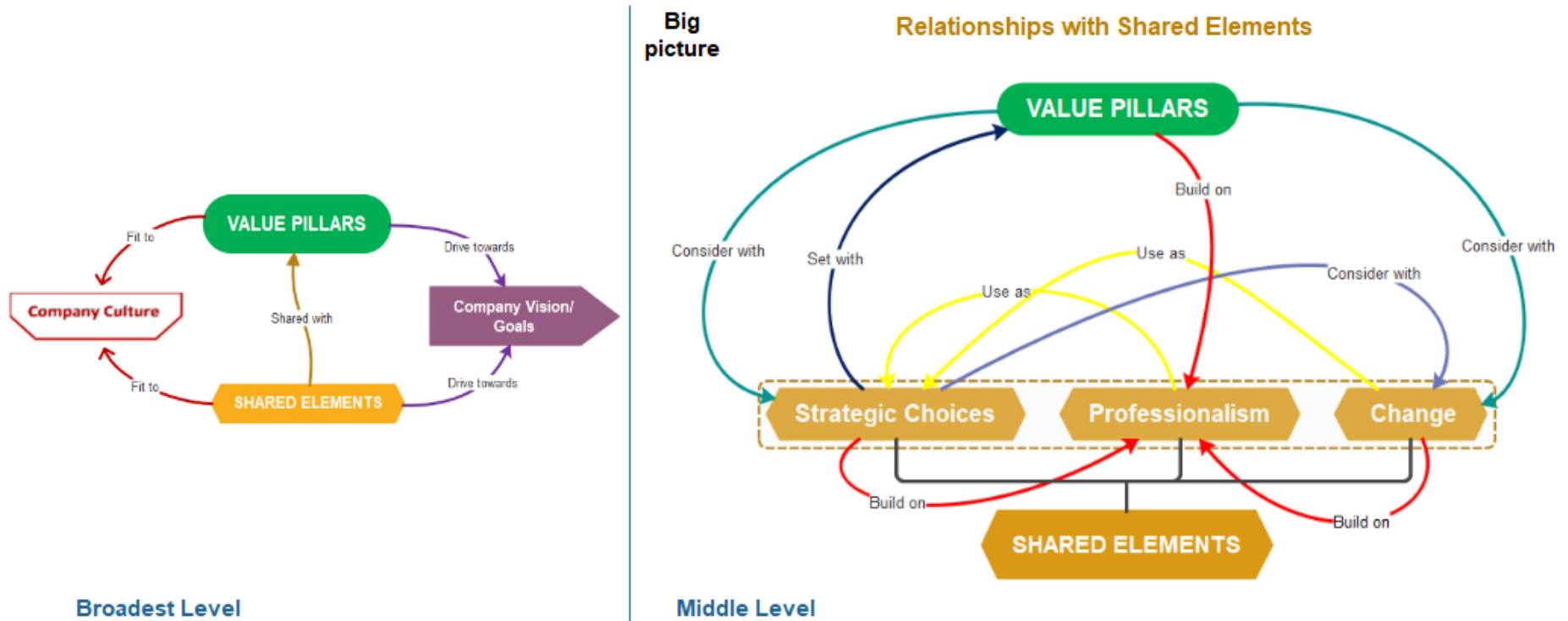
5.8.1.1. Broadest level and middle level relationships among CBMO elements

At the Broadest level, the relationships among Value Pillars, Shared Elements, Company Culture, and Company Vision/Goal are established. On the other hand, the middle level shows the big picture of relationships of three Shared Elements, i.e. (i)

Strategic Choices, (ii) Change, and (iii) Professionalism among each other and with Value Pillars. Accordingly, Figure 5.10 illustrates the broadest and middle levels of CBMO relationships indicating all the identified relationships from the Phase I and Phase II findings.

As depicted in Figure 5.10, at the broadest level, all the Shared Elements and Value Pillars drive towards Company Vision/Goal, as discussed in Section 5.7.2. Moreover, all the Value Pillars and Shared Elements must be fitted to the inherited culture of the company. In addition, the Shared Elements must be shared with all the elements under Value Pillars.

Figure 5.10 *Broadest-level and middle-level relationships among CBMO elements*



As per all the top-level managers in Phase I and the construction business experts in Phase II, all the elements under Value Pillars need to be considered with Strategic Choices. PE 1 pointed out, *“Under each element, the company has to set strategies, and such strategies must assure the efficient delivery of the whole project.”* Hence, Strategic Choices need to be set with all the Value Pillars as per Figure 5.10 at the middle level.

On the other hand, PE 4 stated that Change is a strategy that construction companies can use, while PE 11 identified Professionalism as a strategy. PE 6 added, *“It is necessary to consider the requirements and possibilities of changes with Value Pillars and Strategic choices.”* However, *“all these elements need to be built on Professionalism that is the major strength of construction companies”*. Ultimately, all these relationships are indicated as middle-level relationships in Figure 5.10. The next section discusses the detail-level relationships by expanding ‘Value Pillars’ one by one.

5.8.1.2. The detailed level of relationships among CBMO elements

The relationships of each Value Pillar and its CBM Elements and Sub-elements with other Value Pillars have been established at the detail level. All the relationships with indicators were found and derived based on collected data.

As per PE 9 and PE 13, the construction companies deliver values to the Clients through Value Creation. PE 13 stated, *“All the Value Inputs are delivered to the Client due to methods and efforts used under Value Creation for which the Partners, Key internal team, and Key Connected stakeholders have contributed.”* Accordingly, the Client will benefit from Value Inputs. As per PE 6 and PE 8, Value Inputs connect with the Value Capture because it helps achieve the Contractor’s expectations and generate profit in the future through more jobs. However, all Phase II experts mentioned that different Clients expect different Value Inputs and depend on the nature, type, and relationships with the Clients.

In addition, PE 2 emphasised that the availability of Resources and Capabilities and effective use of Technology and Innovations will affect the delivery of Value Inputs. Consequently, these identified qualitative relationships of Value Inputs and its CBM Elements with other Value Pillars are indicated in Figure 5.11.

Figure 5.11

Detail-level relationships of Value Inputs

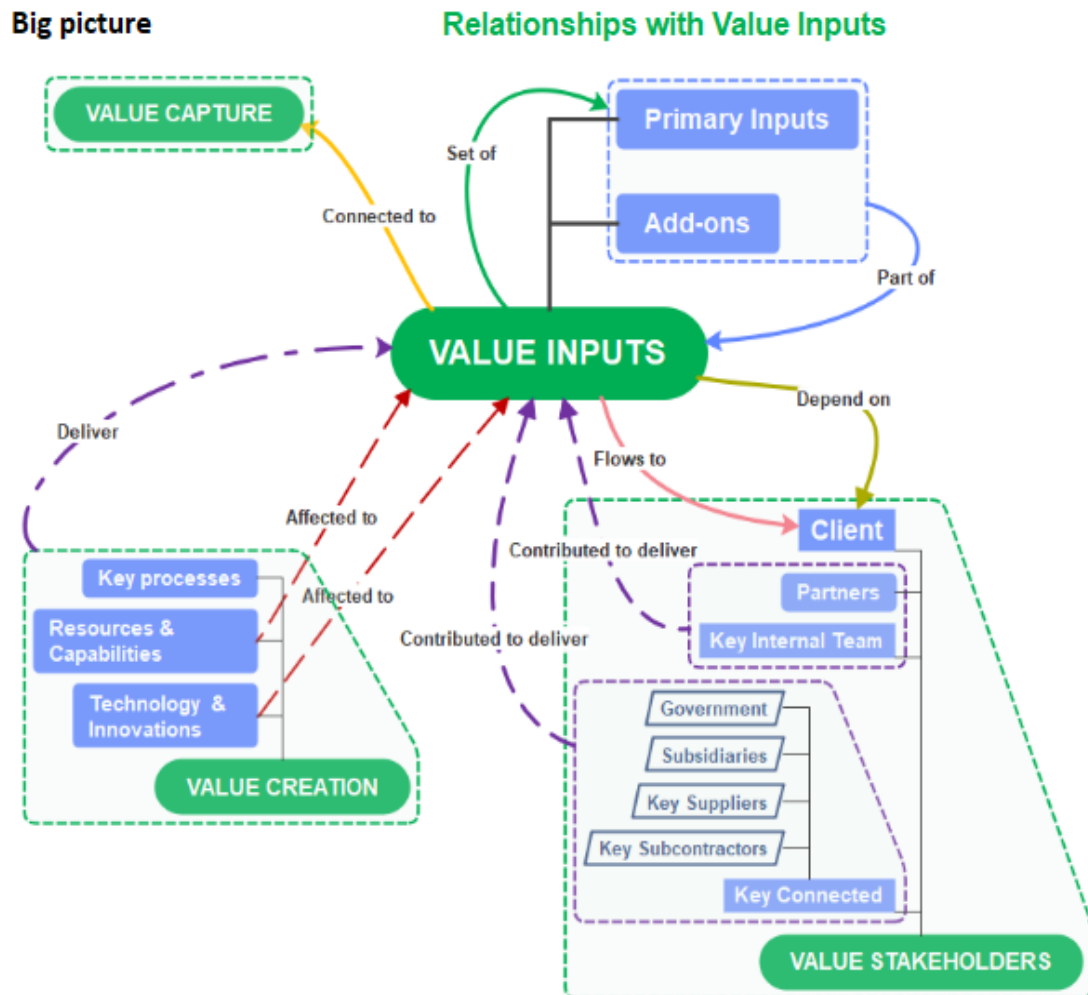


Figure 5.12 displays the relationships of Value Stakeholders and its CBM Elements and CBM Sub-elements with the rest of the Value Pillars at the detail level. To avoid being complicated, the primary relationship indicators, ‘Set of’ and ‘Part of’, are not displayed in Figure 5.12. In brief, Value Stakeholders are the **set of** Client, Partners, Key Internal Team, and Key Connected Stakeholders, whereas the Client, Partners, Key Internal Team, and Key Connected Stakeholders are becoming **part of** Value Stakeholders. Further, Key Connected Stakeholders include the **set of** Government, Subsidiaries, Key Suppliers and Key Subcontractors, while Government, Subsidiaries, Key Suppliers and Key Subcontractors are **part of** the Key Connected Stakeholders.

All experts in Phase II confirmed that the Key Internal Team should deal with the Client, Partners, and Key Connected Stakeholders on behalf of the construction company. As described above, Partners, Key Internal Team, and Key Connected Stakeholders involve in Value Creation and contribute to delivering Value Inputs from which the Client benefits. Besides, a construction business expert PE 2 disclosed that partnerships also could be formed with Key Subcontractors and Key suppliers. Further, as per the findings in Phase I and construction business experts PE 1 and PE 2, the company expects to share Profit and Costs with Partners. As affirmed by all the construction business experts, the Client provides Revenue to the construction company. PE 3 explained that construction companies gain Profit through Revenue, where Profit is calculated based on Cost, and companies can maximise Profit by minimising costs.

Phase I findings reveal the construction companies expect benefits other than Profit from the Client, e.g., good recommendations, creating networks, goodwill, and prestige. However, as underlined by PE 5, Key Internal Team and Key Connected Stakeholders incur Costs to the company via salaries, wages, payments, fees, etc., while gaining benefits from Value Capture. These relationships of Value Stakeholders are graphically presented in Figure 5.12.

Figure 5.13 presents a detailed qualitative relationship between Value Creation and its CBM Elements and CBM Sub-elements. As discussed above, construction companies create value for Clients with Value Inputs. PE 2 highlighted that construction companies give these Value Inputs primarily based on the Client's requirements and giving due consideration to what the construction companies expect from the Client in return. However, as all the construction experts identified, the entire Value Creation process, including Resources and Capabilities, Technology and Innovations, and Key Processes, incur Costs to the company, affecting Profit. Therefore, companies should create value efficiently and effectively.

Figure 5.13

Detail-level relationships of Value Creation

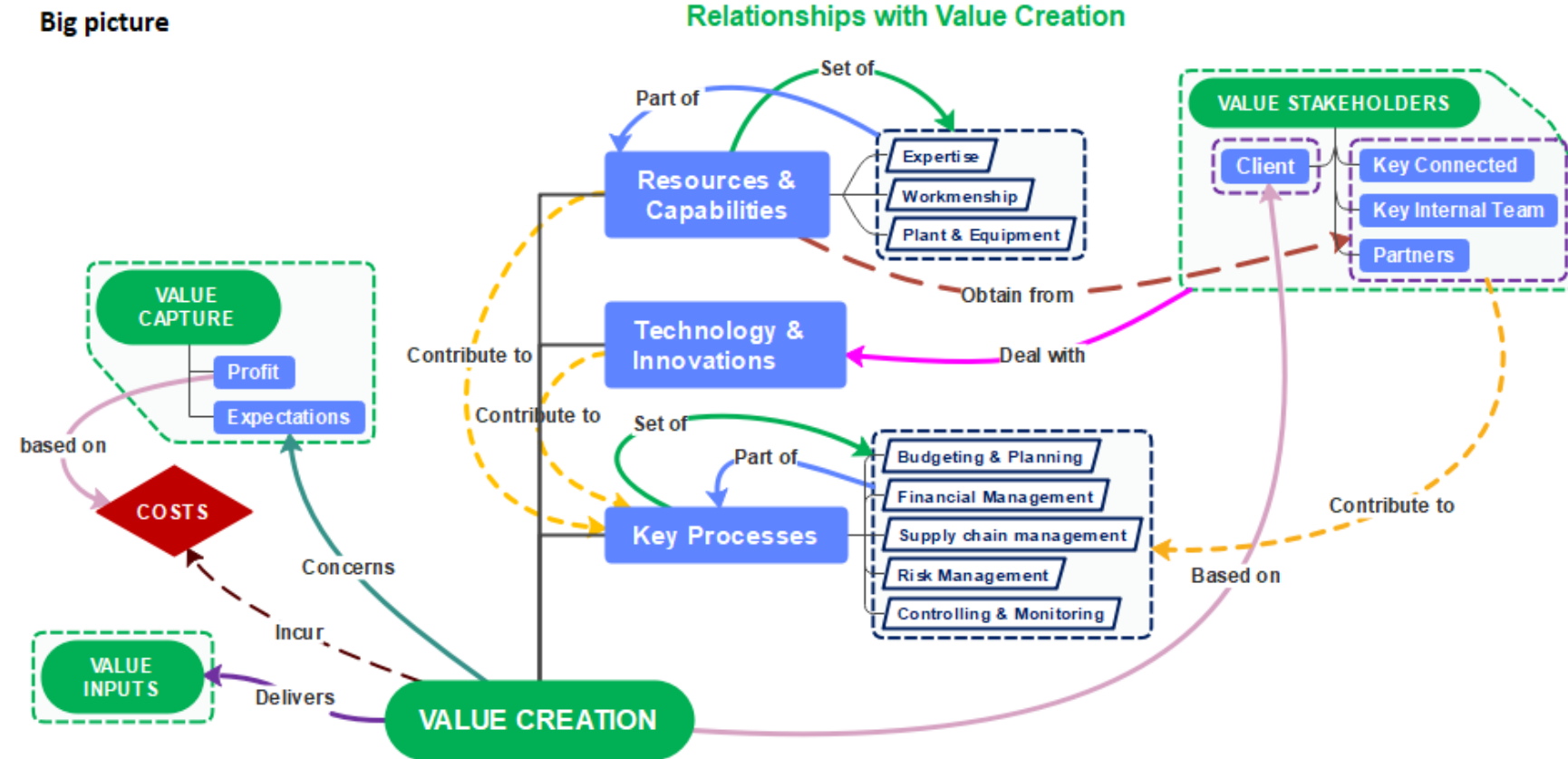
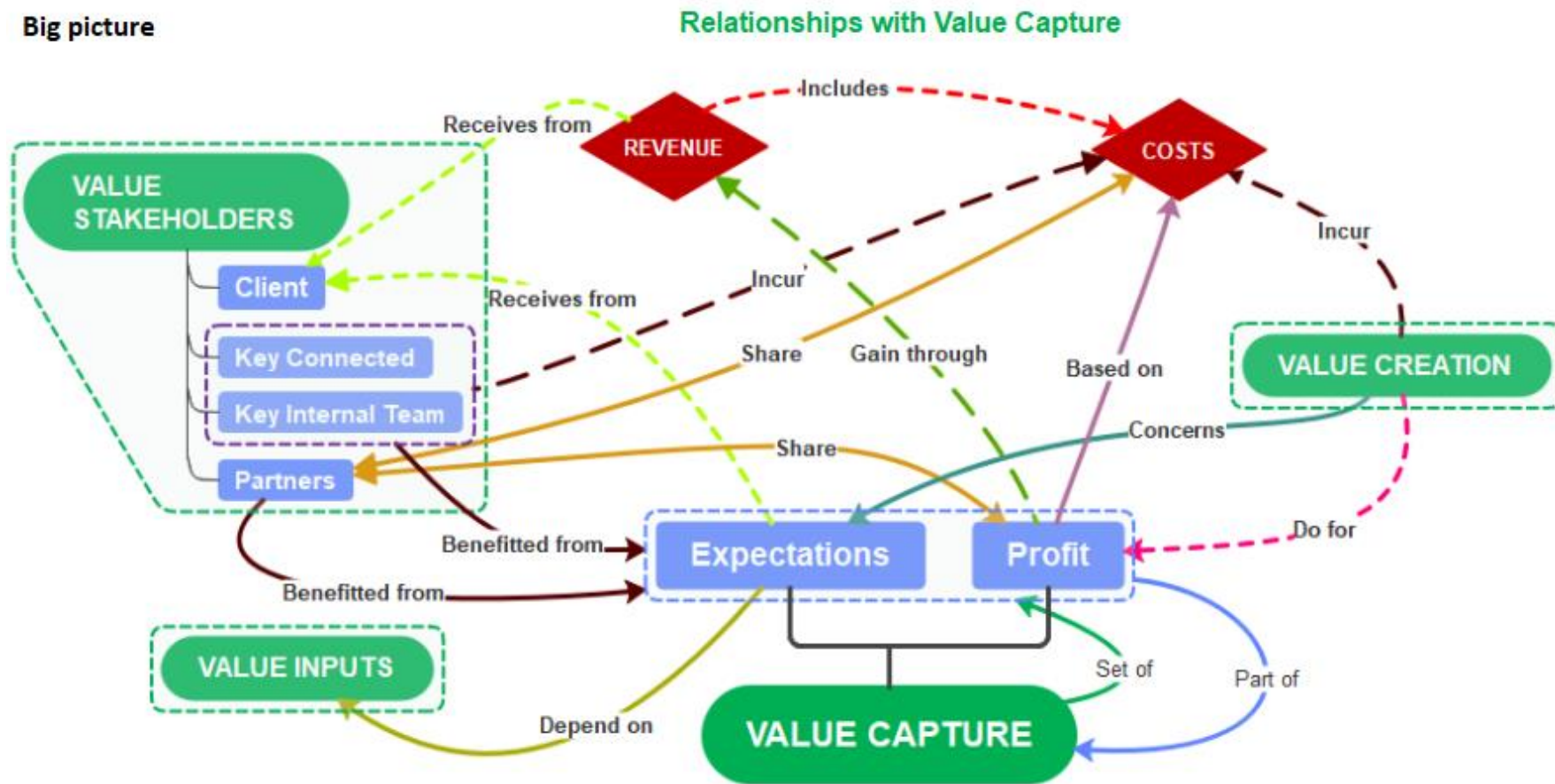


Figure 5.14

Detail-level relationships of Value Capture

Big picture



Further, as noted by PE 3, the construction companies obtain required Resources and Capabilities from Partners, Key Internal Teams, and Key Connected Stakeholders accompanied by the use of the company's Plant and Equipment, which contribute to creating value. As per Phase II experts, Technology and Innovations play another vital role in value creation by contributing to efficiency and effectiveness. All the Value Stakeholders, including the Client, deal with Technology and Innovations from which they all get benefitted.

Figure 5.14 displays the relationships of Value Capture with other Value Pillars and Bridging Elements. As discussed, the company, its Partners, Key internal team, and Key Connected Stakeholders are benefitted from the Value Capture, including Profit and Expectations. According to PE 4, *"The construction companies are supposed to receive Expectations from Clients, but it depends on the value provided by the company to the Clients."* For example, *"Clients are not going to recommend the adversarial contractors with many disputes to their colleagues"* [PE 4]. As discussed above, the companies gain Profit from Revenue from the Client, which includes Costs where the Profit can be maximised by reducing costs. Hence, the Profit needs to be calculated based on Costs. In addition, the companies share Profit and Costs with their Partners. Accordingly, as per PE 12, the construction companies create value mainly for Profit, and they are also concerned about the Expectations for future benefits and ultimate Profit.

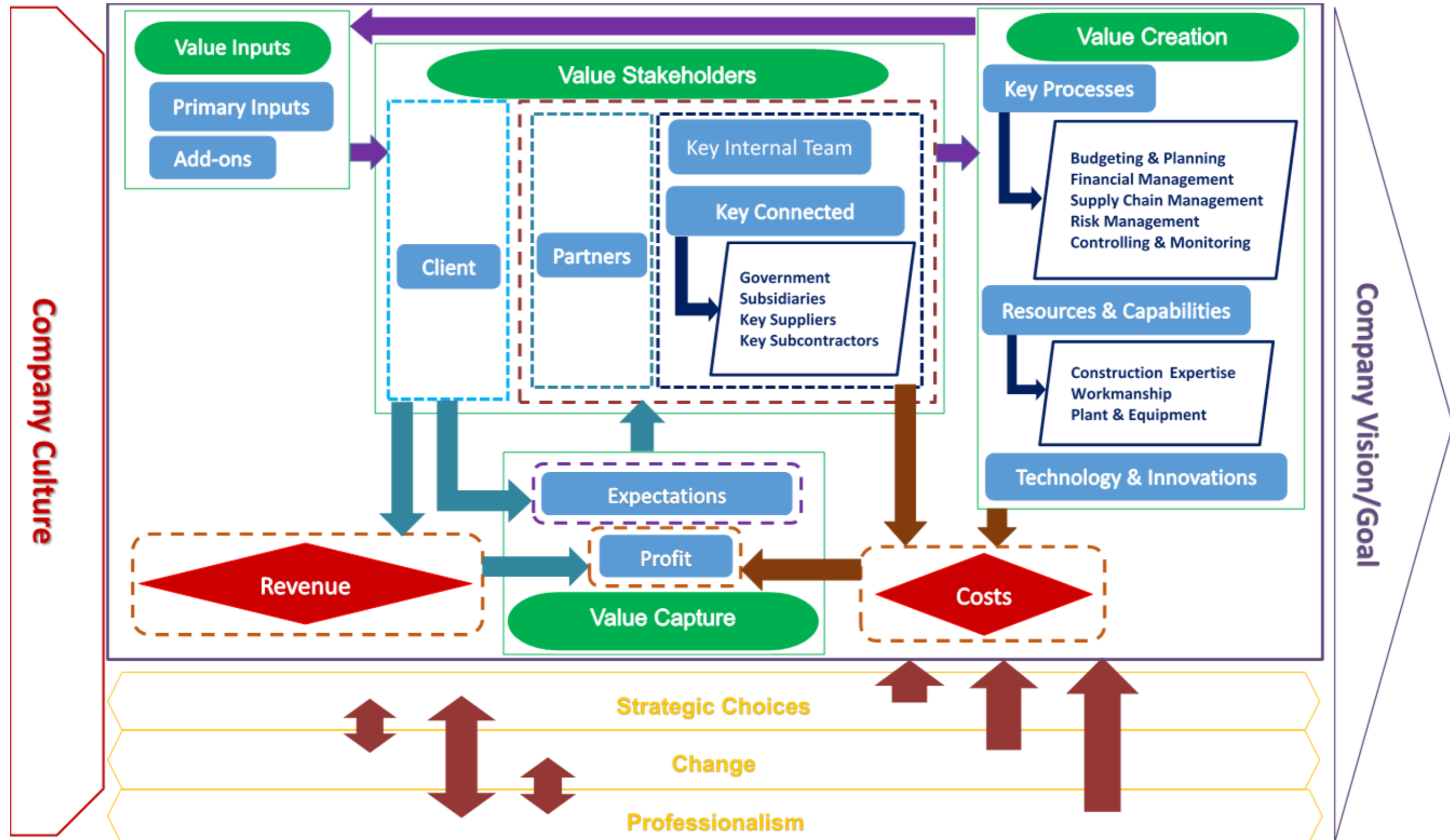
Finally, the above relationships, identified from Phase I and II findings, describe how the CBMO elements connect each other at three levels: broadest, middle, and detail. Also, Section 5.7 provides a detailed understanding of the CBMO elements with descriptions. Eventually, the next step is to develop the proposed CBMO.

5.8.2. Development of the Construction Business Model Ontology (CBMO)

The Construction Business Model Ontology (CBMO) attempts to present a common language for construction contractors and initially support them in designing BMs for their projects/jobs/business ideas/options. Figure 5.15 shows the proposed CBMO based on Phase I and Phase II findings.

Figure 5.15

The Construction Business Model Ontology (CBMO)



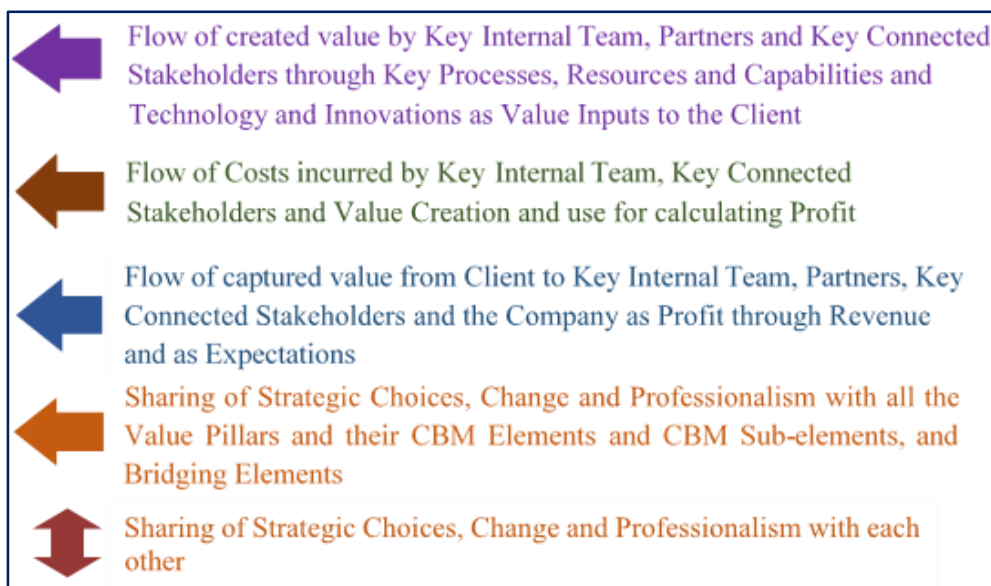
CBMO was developed by displaying and positioning the identified CBMO elements in Section 5.6. The four Value Pillars with their CBM Elements and CBM Sub-elements, three Shared Elements, two Bridging Elements, the Inherent Element, and the Desired Element are incorporated in the CBMO, as depicted in Figure 5.15.

As the Inherent Element, Company Culture guides and shapes CBMO's all other elements, while 'Company Vision/ Goals' as the Desired Element drives them to the company's desired position. The three Shared Elements, i.e. (i) Strategic Choices, (ii) Change, and (iii) Professionalism, span over Value Pillars and their CBM Elements and Bridging Elements.

As shown in Figure 5.16, the CBMO also consists of different coloured arrows, indicating primary flows of value and costs. Figure 5.16 illustrates the indications of the different arrows in CBMO.

Figure 5.16

Indications of the arrows in the CBMO



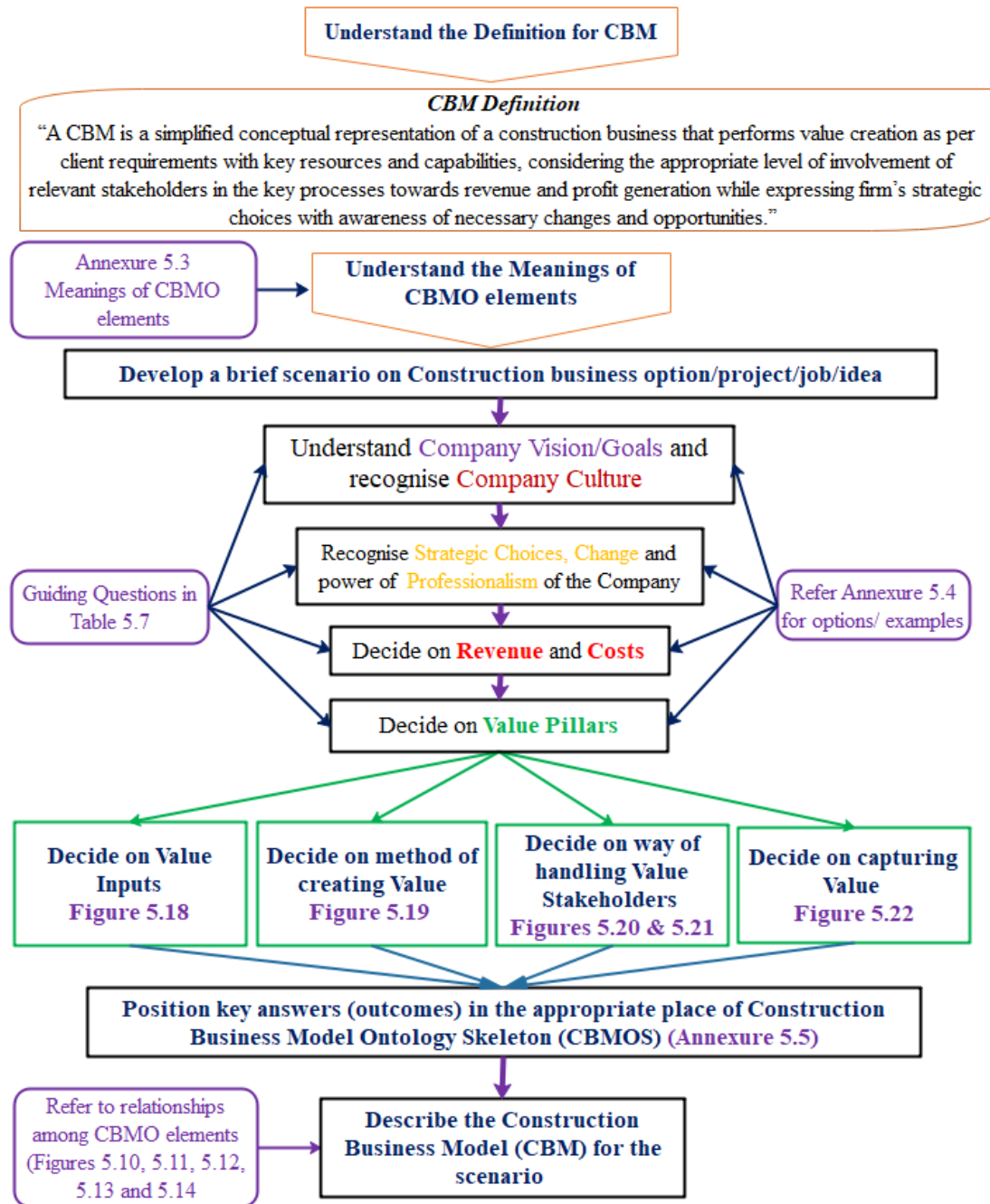
Developing questions under each CBMO element as guidance for construction business managers is helpful [PE 13 and PE 15] and can be referred to while using the CBMO. Accordingly, the next section develops the guiding questions directed to developing CBMs using the CBMO.

5.9. Guide to use Construction Business Model Ontology (CBMO)

Figure 5.17 provides the Guide to using the CBMO for designing BMs related to construction business cases/projects.

Figure 5.17

Guide to using CBMO



Construction contractors are recommended to use CBMO with their management team to ensure the development of a shared understanding of the designed CBM. However, before commencing the use of CBMO, the understanding of “what is Construction Business Model (CBM)?” and “What is meant by each CBMO element?” are important by referring to the CBM definition and meanings of CBMO elements, as shown in Figure 5.17. Next, the scenario of construction contractors' business option/project/job/idea for which the CBM is designed, is prepared.

The guiding questions for BMs are also evident in literature that provides questions to be asked in BMs, for instance, Johnson et al. (2008), Morris et al. (2005), Onetti et al.

(2012), Fielt (2013), Ling and Li (2016) and Taran et al. (2016), the studies from other fields and Das et al. (2019), a study from the construction field. In this research study, the guiding questions were developed considering the different describing parameters given in Tables 5.2, 5.3, 5.4, and 5.5 and the ideas disclosed by the interviewees in both phases, i.e., Phase I and Phase II. By paying attention to each guiding question, construction contractors can focus on what they must think about under each element and the possible solutions when developing CBMs.

Accordingly, Table 5.7 gives the possible primary questions for the main CBMO elements.

Table 5.7

Primary guiding questions for CBMO elements



Primary guiding questions	
<p>Company Vision /Goals What is our Vision? Do we have specific goals to achieve?</p>	
<p>Company Culture What is our Company Culture?</p>	
<p>Revenue Do we need to increase the Revenue? What factors do we have to consider when increasing Revenue?</p>	
<p>Costs How can we minimize costs?</p>	
<p>Value Inputs What makes us survive in the market? Why do we need to provide this Client with Value Inputs?</p>	
<p>Value Creation What are the ways of creating value?</p>	
<p>Value Stakeholders Why do we need Value Stakeholders?</p>	
<p>Value Capture What factors affect capturing value?</p>	
<p>Strategic Choices What are the factors to be considered in Strategic Choices? What strategies can be used for the situation/project? What are our Marketing aspects?</p>	<p>Through which element are the strategies to be used? (refer detail guiding questions under each Value Pillar)</p>
<p>Change Does this case urge us to change? Are our industry and competitors changing? What are the reasons for the change? What are the drivers and barriers to our company's change?</p>	<p>What is to be changed in the company? (refer detail guiding questions under each Value Pillar)</p>

Primary guiding questions	
<p>Professionalism</p> <p>Why do we need the Power of Professionalism as a Construction Company?</p> <p>What are the enablers for our power of Professionalism?</p> <p>How can we avoid Professional Obsolescence?</p> <p>How can we develop professional efficiency?</p>	<p>How does Professionalism influence here? (refer detail guiding questions under each Value Pillar)</p>



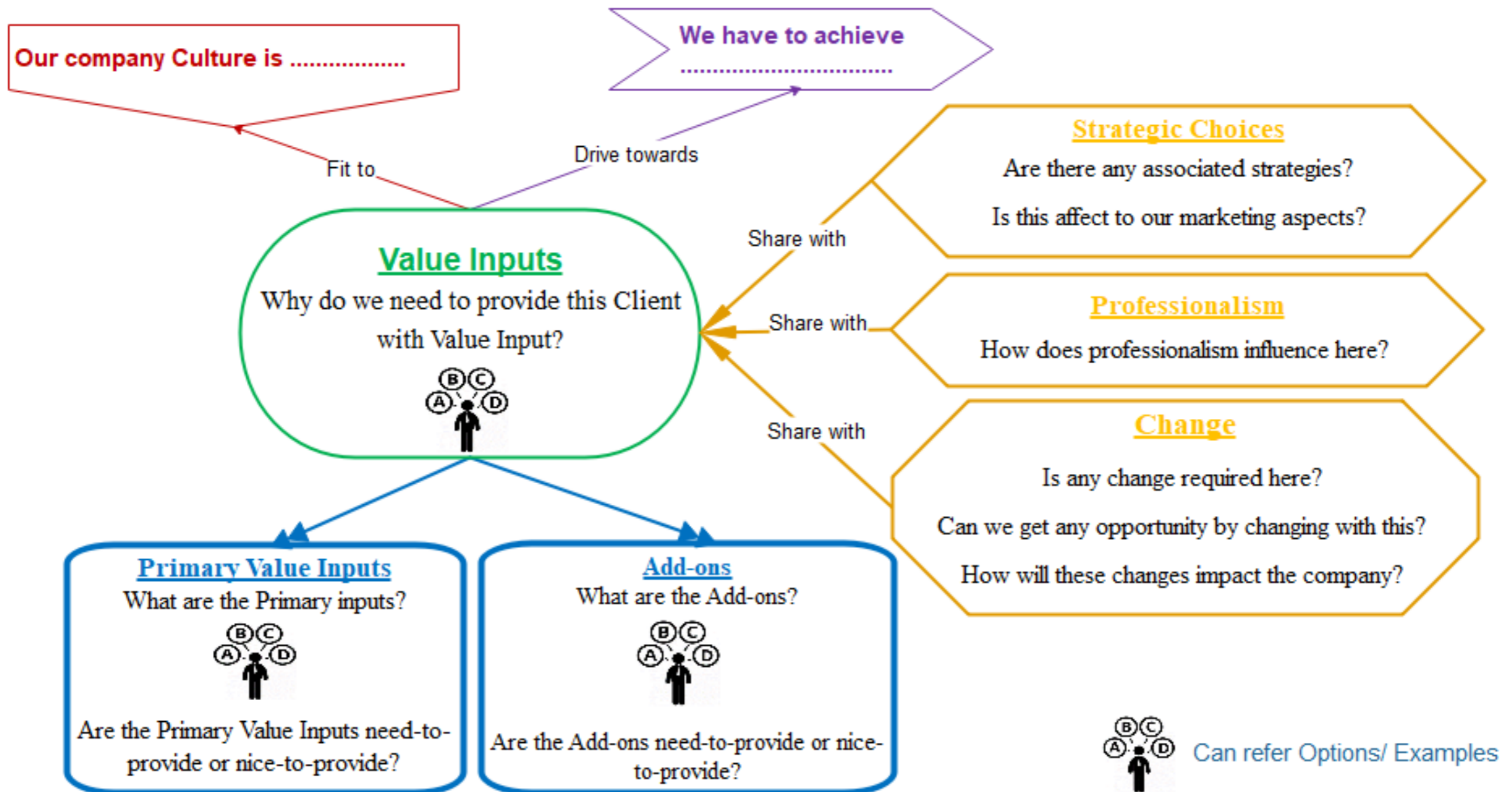
Under each Value Pillar, further questions can be asked about CBM Elements and CBM Sub-elements for detailing the CBM to be designed. Accordingly, Figures 5.18, 5.19, 5.20, 5.21, and 5.22 provide the guiding questions for each Value Pillar, including CBM Elements and CBM Sub-elements. Moreover, common guiding questions related to Strategic Choices, Change and Professionalism as Shared Elements were established to ask under each Value Pillar. Accordingly, the details can be clarified and decided for the CBM Elements and CBM Sub-elements of the Value Pillars.

On the other hand, some guiding questions are directed to options/examples which were explored from descriptions of CBMO elements. These options/examples were given in Annexure 5.4 as supplementary.

GUIDING QUESTIONS DIRECTING TO DECIDE VALUE INPUTS

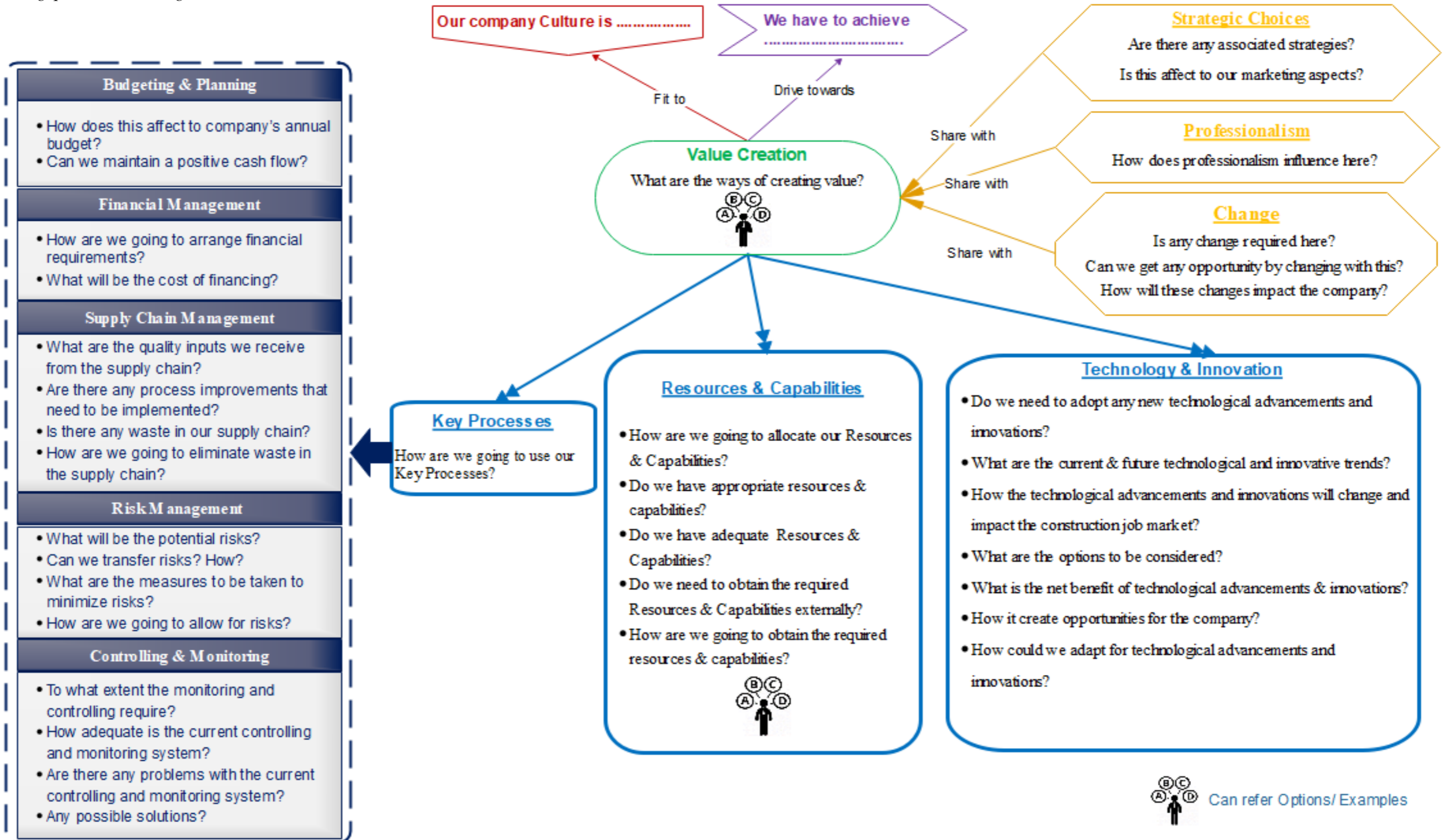
Figure 5.18

Guiding questions directing to decide Value Inputs



GUIDING QUESTIONS DIRECTING TO CREATE VALUE

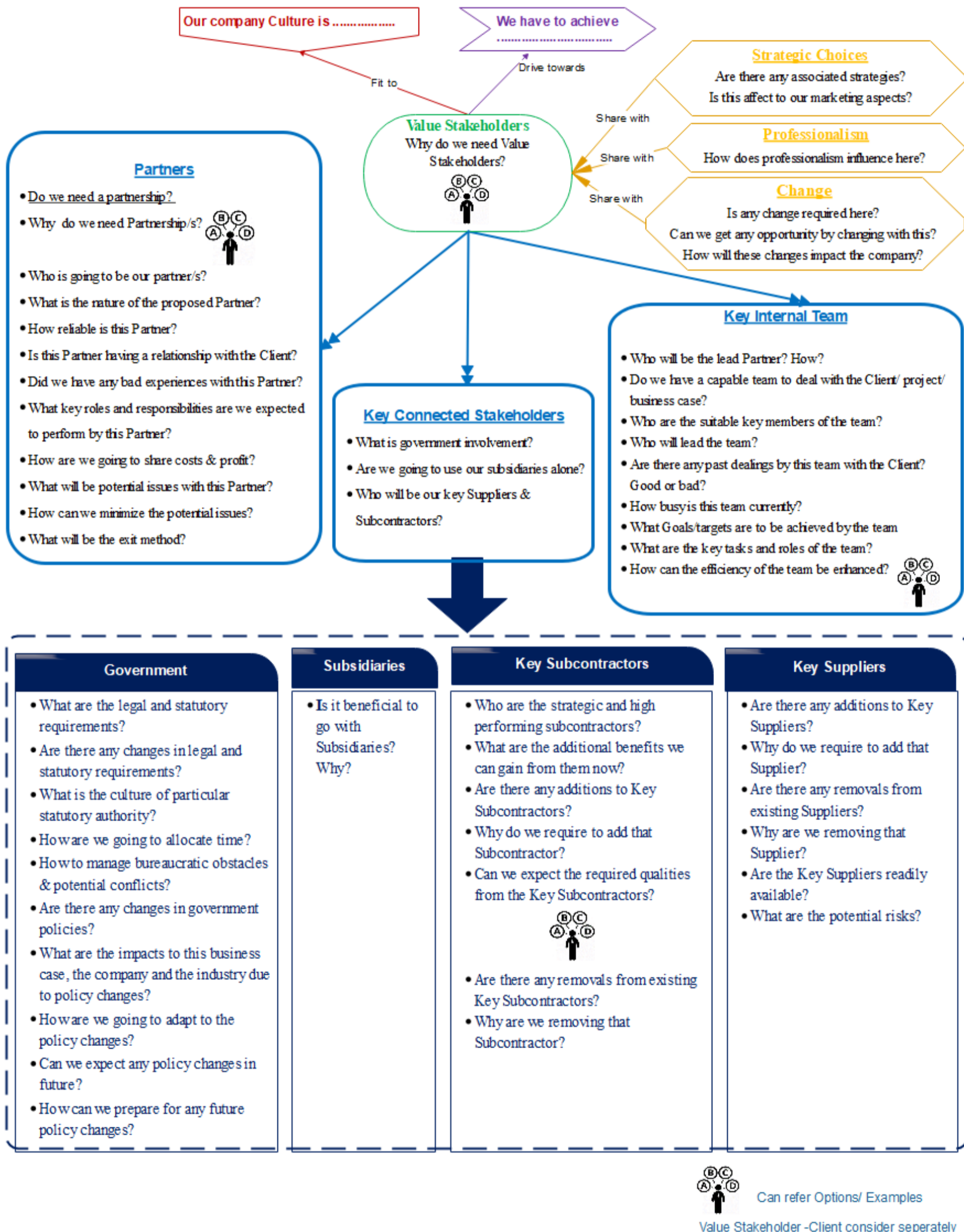
Figure 5.19
Guiding questions directing to create value under Value Creation



GUIDING QUESTIONS DIRECTING TO HANDLE VALUE STAKEHOLDERS

Figure 5.20

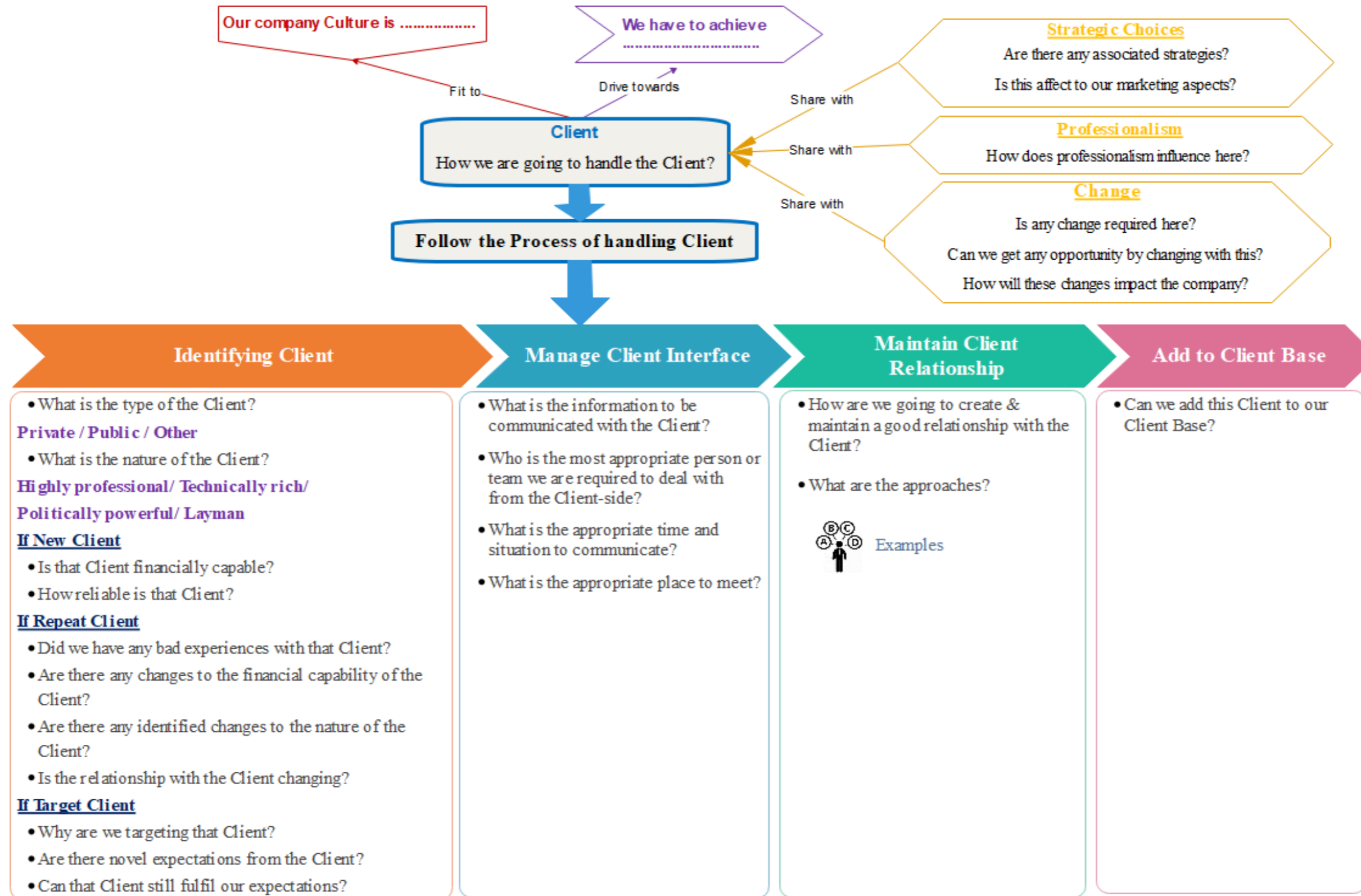
Guiding questions directing to handle Partners, Key Internal Team and Key Connected Stakeholders under Value Stakeholders



GUIDING QUESTIONS DIRECTING TO HANDLE THE CLIENT

Figure 5.21

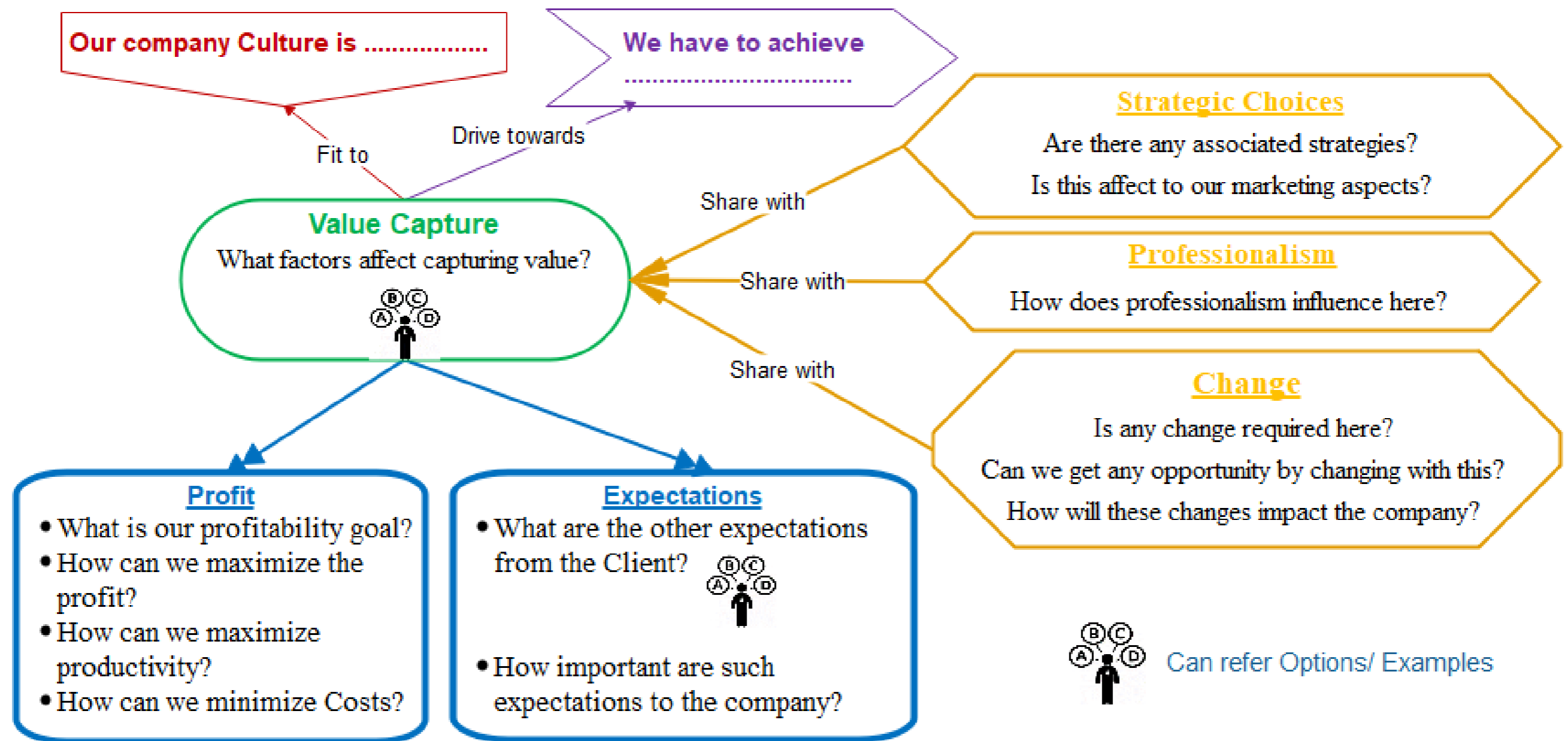
Guiding questions directing to handle the Client under Value Stakeholders



GUIDING QUESTIONS DIRECTING TO CAPTURE VALUE

Figure 5.22

Guiding questions directing to capture value under Value Capture



Then, the construction contractors will be directed to identify the Value Inputs to be provided for the Client (Figure 5.18), the method of creating value (Figure 5.19), handling Value Stakeholders, including the Client (Figures 5.20 and 5.21), and capturing value (Figure 5.22). The decided outcomes for each elements could then be positioned on the concise format of the CBMO for describing CBM which was named Construction Business Model Ontology Skeleton (CBMOS) (refer Annexure 5.5). Finally, the CBM related to the particular business option/project/job can be designed and described as a story. In addition, the relationships among CBMO elements can be referred to as indicated in Figures 5.10, 5.11, 5.12, 5.13, and 5.14 to build connections between each CBMO element.

Finally, a brief step-by-step guide was prepared to direct construction contractors in using CBMO (Annexure 5.6) to design CBMs for different options/ideas/projects/jobs by formalising related information. The next section tests the validity of the CBMO to improve its applicability.

5.10. Validation of the Construction Business Model Ontology (CBMO)

The purpose of validating the CBMO is to check whether it fulfils the intended purpose, i.e., to effectively and easily design CBMs and provide shared understanding among relevant stakeholders and meet all the business attributes related to the construction business while ensuring its clarity and level of understanding. The CBMO was validated with two companies, i.e. (i) Company A and (ii) Company G. Company A contributed to the findings as one of the cases in the sample of case studies in Phase I. Hence, the group of Company A was taken as the internal group for validation, and its background was described in Section 4.2.1. On the other hand, Company G was newly selected for validation as the external group, which has no contribution to the findings, but includes in the population. The background of Company G is as follows,

Company G

Since its establishment in 1984, Company G has been an active participant in the construction industry in Sri Lanka. The Company holds the highest CIDA Grading, CS2, for the major areas in local construction; buildings, highways, and water supply and sewerage, and the second-highest grading, CS1, for bridges. In addition, the company successfully obtained ISO 9001:2015, 14001:2015, 45001:2018 and Superbrands certifications. Furthermore, the company established many fully owned subsidiary companies for construction material production and supply.

A group of three top and middle-level managers from each company participated in the validation (refer Table 3.11 in Chapter 3).

Then, the brief step-by-step guide for the CBMO was presented to the two groups with the sample scenario formed by the researcher. The sample scenario was derived from a practical case and developed with the purpose of validating the usability of the CBMO in practical business cases (refer Annexure 5.7). The sample scenario enables

the groups to smoothly follow the step-by-step guide. Each group was allowed to answer the guiding questions to make decisions and understandings related to each CBMO element with reference to the sample scenario. While processing, the researcher kept continuous attention to how the group members understood the CBMO. All feedback from the group members was captured accordingly.

All members of the two groups agreed that the elements shown in the CBMO covered all attributes of the construction business at the stage of designing business models and when taking business decisions. A validation group member of Company G, VG 1, appreciated the inclusion of *Professionalism* as an element to consider for construction business modelling by emphasising the usefulness of professionalism. VG 1 further mentioned, “*We never specifically thought of Professionalism in our business decisions.*” All members of the two groups identified the usefulness of guiding questions, and VA 1 said, “*These guiding questions play a major role in this CBMO.*” While going through the process of designing CBMs using the step-by-step guide, the researcher realised that group members tend to ask some probing questions subsequent to some guiding questions. Some of these probing questions varied with the company. In relation to this, VA 2 suggested inserting a note in the CBMO guide stating, “*The guiding questions could be followed with probing questions as required.*”

The CBMO attempted to cover different possible examples and options for some of the guiding questions that arose from the study. The validation process also added a few points for some examples and options. For example, VA 3 pointed out ‘value engineering proposals’ as a method of creating value. At the same time, VG 2 emphasised that the current economic situation of the country and the world affected the Strategic Choices. Further, VG 1 mentioned, “*We have to provide Value Inputs as a social responsibility.*” Referring to the sample scenario, VG 1 explained that on-time or shorter delivery of this project is our social responsibility in this Covid-19 pandemic where internet facilities have become essential. On the other hand, VA 2 purported, “*...actually guaranteed quality is not considered by contractors in their business*”. However, since the extensive lists of all the options or examples could not be covered, the step-by-step guide for CBMO already included ‘other’ to allow any additional information that may vary between companies.

During the validation process, managers did not disclose options for some guiding questions due to business matters; detailed answers for some guiding questions were also avoided due to time constraints. The selected key answers (outcomes) for guiding questions in designing CBM for the sample scenario (Annexure 5.7) were positioned on CBMOS for describing the CBM (refer Annexure 5.8).

At the end of each group interview, a few questions were asked from group members as follows.

- What is your idea about the clarity and understanding of CBMO?
- How useful would CBMO be for easily designing Construction Business Models (CBM)?

All members of the validation groups appreciated the clarity and understanding of the CBMO and its information. VG 3 suggested, *“If you can include a summary of steps into the guide on one page, it will be helpful for easy reference.”* Moreover, all the members accepted the usefulness of the CBMO for designing CBMs and determining information related to business cases. As a member of external group for validation, VG 1 positively mentioned, *“putting a business case into one page is a great work”*, and VG 2 added, *“yes, this is very good for explaining our business cases to our stakeholders”*. During validation of the internal group, VA 2 stated that the CBMs prepared with the CBMO could be easily improved for annual business plans reducing our time and effort. Besides designing CBMs, VA 1 noted another use of the CBMO: *“I think we can use this to recognise required changes to existing business scenarios.”*

Finally, VG 2 of the external group raised a question: *“Can we use this at the project level?”* Since this study was considered business decision-making at the company level, this issue would be taken for future research directions to modify the CBMO for the project level.

Eventually, the use of the sample scenario helped in validating the CBMO in front of two validation groups, i.e. (i) external group from Company G, and (ii) internal group A from Company A. As a result, it showed that the CBMO represented the construction contractor’s business assuring CBMO’s applicability.

5.11. Chapter Summary

This chapter analysed the data from the qualitative survey with 15 construction business experts. The additional information related to the nature of the construction business and BMs in the construction business were discussed. Next, the chapter presents validation of the CBM definition for its compatibility and comprehensibility. Further, the Composition of CBMO resulting from Phase I was modified with changes based on Phase II findings. Then, addressing further details from Phase II findings, a comprehensive explanation for each CBMO element was given while identifying and describing parameters for the elements.

Next, the chapter established the relationships among CBMO elements using qualitative relationship indicators derived from Phase I and II findings. Later, the CBMO was developed to achieve the aim by following the BM development process. The CBMO is guided with guiding questions built up for each CBMO element. Finally, the CBMO was validated with two groups, i.e. (i) external group from Company G and (ii) internal group A from Company A, using a sample scenario applied to the step-by-step CBMO guide.

The next chapter discusses the research findings of Phase I and Phase II compared with the findings from the literature review.

6. DISCUSSION ON RESEARCH FINDINGS

6.1. Introduction to the chapter

This chapter discusses the overall findings of the research. It reviews the literature findings from Chapter 2 and the empirical findings in Chapter 4 and Chapter 5 while comparing each other. This chapter begins by making an inference regarding the BM concept and its development in the construction industry. The discussion then follows the five stages of the BM development process towards developing CBMO.

6.2. The business model concept in the construction industry

In literature, Magretta (2002) identified and many other scholars (e.g., Casadesus-Masanell & Ricart, 2010; Teece, 2010; Baden-Fuller & Morgan, 2010; Al-Debei & Avison, 2010; and Stefan & Branislav 2016) confirmed that a good BM is fundamental to any successful business, highlighting the significance of BMs (refer Section 2.4). Al-Debei and Avison (2010) emphasised the requirement of explicit BMs for unique and complex businesses like construction. However, this study disclosed that most of the top-level managers of construction organisations know the BM as a term but understand it differently than in the literature and other sectors. Correspondently, the study of Pekuri et al. (2013) revealed that the construction managers in Finland also carried the same opinion, even as a developed country.

On the other hand, this study revealed that a proper mechanism for decision-making is essential in the construction business as it involves high risks and is not repetitive. Also, this study recognises the impossibility of applying the same BM for every business case as the construction is a project business. Hence, the top-level construction managers and construction business experts affirmed the requirement of a framework/ ontology to support in designing BMs.

Ultimately, the BM concept application gap in the construction industry was identified, requiring a method to improve awareness and application of BMs in the construction business.

6.3. The business model development process

The evolution of the BM concept was explored to identify a method to improve its awareness and application. Unfortunately, few attempts have been made on the evolutionary phases/ areas/ domains of BMs: Pateli and Giaglis (2003); Gordijn et al. (2005); Osterwalder et al. (2005); Lambert (2006); Zott et al. (2011), and Wirtz (2016).

These studies explored BM development since 1957, analysing published BM-related articles, but no clear insight could be identified regarding BM development since 2006. However, through the analysis of published articles from 2006 to 2020, the present study found seven BM development areas: (i) BM change and innovations, (ii) sustainability in BMs, (iii) different types of BMs, (iv) combining different theories

with the BM concept, (v) BM design development, (vi) BM management and implementation, and (vii) BM concept clarifications.

Referring to Table 2.4, which shows the contribution of BM articles to the above areas, BM change and innovations have received almost equal importance throughout the period (from 2006 to 2020), indicating its necessity in this dynamic business environment where technological advancements and product, process and system innovations are inevitable. On the other hand, BM clarifications and studying different types of BMs can be seen in a clear decline since 2006, highlighting the adequacy of BM clarifications in the literature. Instead, there has been clear progress in BM design developments since 2006, when the trend was to modify the Business Model Canvas of Osterwalder and Pigneur (2010) to design BMs for different areas. However, from 2016 to 2020, there was a concern on developing specific ontologies for some unique business areas, e.g. BM ontology for social business by Todaria et al. (2020) and Health Information Technology by Gand and Esswin (2018). Furthermore, there was a development in the use of the BM concept with novel concepts, e.g. circular economy, green, blockchain technology and digitalization.

However, from 2006 to 2020, BM-related research studies considered different aspects of the BM concept. Therefore, this period was identified as the ‘Differentiation Phase’ of the BM concept, similar to Wirtz (2016).

In 2021, researchers tended to discover decision support systems for BMs, e.g., Mboli et al. (2021) developed an Internet of Things (IoT)-enabled Decision Support System for Circular Economy BM, and Hamrouni et al. (2021) proposed an Explainable Intelligent Decision Support Systems for BM (EIDSS BM) of digital technologies. Similarly, CBMO provides support for decision-making in construction contracting organizations.

The BM development process with five stages (Figure 2.7) created for improving BM application reflects the commonly identified phases of BM development by Pateli and Giaglis (2003); Gordijn et al. (2005); Osterwalder et al. (2005); Lambert (2006); Zott et al. (2011), and Wirtz (2016). The five stages are (i) defining BM, (ii) listing BM elements, (iii) describing BM elements, (iv) modelling BM elements as a BM ontology, and (v) applying BM concept using the BM ontology.

Consequently, this study recognised that the prerequisite for proper BM application is modelling BM elements as BM ontologies. Hence, the BM development process provides a path to adopting the BM concept in any industry with a proper mechanism. However, this study encountered the non-existence of stage-wise development in BM literature related to the construction industry (refer Section 2.8). Only a few studies have so far experimented on the BM concept.

6.4. Business model development in the construction industry

The BM research studies related to the construction industry could be allotted among different areas within the Differentiation Phase. For instance,

- i. Cheng et al. (2001), Duyshart et al. (2003), Liu et al. (2017), and Das et al. (2020) focused on BM change and innovations,
- ii. Mokhlesian and Holmen (2012), Aho (2013), Abuzeinab and Arif (2014), and Abuzeinab et al. (2017) focused on sustainability in BMs,
- iii. Brady et al. (2005), Grimscheid and Rinas (2012), Ling and Li (2016), Lessing and Brege (2018), Thuesen and Hvam (2013), and Christian and Lars (2013) studied different types of BMs,
- iv. Pekuri et al. (2015), Zhao et al. (2017), Berg et al. (2019), and Van den Brink (2016) combined different theories of the construction industry with the BM concept,
- v. Brege et al. (2014) assessed prefabrication to implement BM, and
- vi. Pekuri (2015) clarified the BM concept concerning the construction industry.

Accordingly, several studies focused their BM studies specifically on the areas of off-site construction, industrialised buildings and modular prefabrication, similar to manufacturing business (e.g., Grimscheid & Rinas, 2012; Pan & Goodier, 2012; Christian & Lars, 2013; Goulding et al., 2014; Liu et al., 2017; and Lessing & Brege, 2018). Hence, the focus on offering construction expert services to erect construction products was ignored in construction-related BM literature.

Furthermore, the BM design development attempts with BM ontologies could not be identified in the construction industry literature, and stage-wise BM development with BM ontologies as the prerequisites for proper BM application could not be observed. Therefore, the application and awareness of BMs in the construction business are limited.

This study revealed a few dilemmas among the construction contractors in relation to the BM concept. E.g., “Construction companies do not require separate BM”, and “same BM cannot be implemented in the construction business due to uncertainty and project-based nature”. However, findings further emphasised the requirement of a BM design support tool or framework for the construction business to improve the BM concept application. Accordingly, this study followed the BM development process (Figure 2.7) and developed CBMO as a support for designing Construction Business Models (CBMs).

6.5. Stage 1 - Define ‘Business Model’ in relation to Construction Industry

Top-level construction managers and construction business experts identified the requirement of a BM definition exclusively for the construction business. However, no attempt has been made to define BM in relation to the construction business, even though Abuzeinab et al. (2014) specifically provided a generic definition for green BMs. Instead, Abuzeinab et al. (2014) combined the definitions given by managers having green construction experience with the theory to develop the green BM

definition without presenting a systematic process for its development. However, this study used a systematic process (Figure 2.8) to define BM in relation to the construction contractors' business (refer Section 2.9.2).

Even though the literature discloses several BM definitions, no systematic process could be identified except the procedure followed by Al-Debei et al. (2008). Hence, the process followed in this study to develop the CBM definition and the process followed by Al-Debei et al. (2008) are mapped in Table 6.1.

Table 6.1

Process of developing a BM definition

Process followed in this study	Process followed by Al-Debei et al. (2008)
Concerned Construction Business of Contractors	Concerned Information Systems (IS) business
Extracted BM definitions from Literature irrespective of the domain of concern	Extracted BM definitions from IS-related Literature
Analysed extracted BM definitions to identify underlying themes based on keywords and took out emphasised BM character of each BM definition.	Analysed extracted BM definitions to identify the basis of each BM definition and proposed reasons for establishing a BM emphasising different characters of BMs
Selected fundamental themes to match the construction industry with the justification of their appropriateness for the construction business.	
Selected the 'wordings' from the BM definitions to represent the "Fundamental themes."	
Established five principles to follow when defining BM	Established four principles to follow when defining BM
Systematically developed the BM definition using the selected "wordings" from previous definitions	Deduced a definition for the BM with the different points of view presented in the literature
Added and replaced with the terms to match the construction business	
Validated the CBM definition	
Proved the compliance of the final validated definition with the five principles	Proved the compliance of the final definition with the four principles

As per Table 6.1, Al-Debei et al. (2008) selected 17 definitions from IS-related literature. However, this study extracted 49 definitions without considering the business domain since only one definition could be found in relation to the construction industry. Those 49 definitions were then analysed to identify different themes that the definitions concerned. Al-Debei et al. (2008) directly identified the basis of the selected 17 definitions and proposed ten reasons for establishing a BM using previous IS-related literature. However, this study followed a new step to choose appropriate themes to define CBM, considering their usefulness to the construction business, because this study used BM definitions from different business domains.

Accordingly, eight ‘fundamental themes’ were selected to incorporate into the CBM definition, and top-level construction managers and construction business experts confirmed their appropriateness to the construction business.

After realising that it is not sufficient to define BM only in terms of its elements, Al-Debei et al. (2008) synthesised the different perspectives presented in earlier research works and developed the BM definition. Therefore, the doubt is about the place where the identified basis of each BM definition and reasons for establishing a BM, were used when developing the BM definition by Al-Debei et al. (2008).

Conversely, in this study, relevant “wordings” were extracted from the existing BM definitions for each fundamental theme and used while developing the CBM definition systematically. Thus, it ensures consistency with the other BM definitions. In addition, the terms appropriate to the construction business were added and replaced to the definition and incorporated the revisions suggested by the experts during validation. However, the definition developed by Al-Debei et al. (2008) was not empirically validated.

As a final point, Al-Debei et al. (2008) proved the compliance of the final definition with four principles: (i) BM definition is comprehensive and general, (ii) demonstrates the flexibility of the BM representation, (iii) identifies the location of the BM within the digital business organisation, and (iv) represents the importance and the reasons behind designing and developing the BM. Similarly, the validated CBM definition (refer Section 5.5) could check the compliance of five principles established in Section 2.9.2.

Since a BM is required to perform two essential functions, namely, value creation and value capture (Chesbrough, 2007a), “*value creation according to client requirements*” and “*towards revenue and profit generation*” were included in the CBM definition. Hence, the CBM definition indicates the importance and reasons for designing a BM (principle 1). The definition is comprehensive (principle 2) because it includes all the fundamental themes necessary for the construction business. The conciseness (principle 2) was retained in the CBM definition by adding the terms ‘key’ and ‘relevant’ to avoid considering all the processes, resources, capabilities, and stakeholders. Room for performing better than the rivals (principle 3) is provided in the CBM definition by phrasing “*while expressing the firm’s strategic choices*”. Validation of CBM definition under Section 5.5 proved its unambiguity (principle 4). Finally, the CBM definition shows its relevance to the complex, uncertain, and rapidly changing construction industry (principle 5) by adding the words “*with the awareness of the changes required and opportunities available*”. Thus, construction firms can identify the required changes and seek opportunities in the dynamic business environment. The proposed CBM definition, therefore, fulfils the principles stated in Section 2.9.2.

6.6. Stage 2 – List BM elements constituting the Construction Business Model Ontology (CBMO)

This study developed a business model ontology related to the construction contractor's business named the 'Construction Business Model Ontology' (CBMO). As per the findings of this study, the CBMO comprises one 'Desired Element', one 'Inherent Element', three 'Shared Elements', two 'Bridging Elements', four 'Value Pillars', eleven 'CBM Elements', and twelve 'CBM Sub-elements' (refer Section 5.6 of Chapter 5).

In literature, all studies are concerned with the BM elements while developing ontologies, frameworks, or models related to BMs. Therefore, most of them added BM sub-elements by dividing some BM elements (Annexure 2.4). Further, eight studies grouped their BM elements into Main factors/ Principal components /Pillars/ Blocks (e.g., Kallio et al., 2006; Bertels et al., 2015; Dubosson-Torbay et al., 2001; Osterwalder, 2004; Brege et al., 2014; and Van den Brink, 2016). Similarly, this study grouped CBM Elements into four Value Pillars following the famous research of Osterwalder (2004).

On the other hand, Hamel (2000) introduced 'Bridge Elements' to his BM framework where 'Customer Benefits' bridges 'Customer Interface' and 'Core Strategy', 'Configuration' bridges 'Core Strategy' and 'Strategic Resources', and 'Company Boundaries' bridges 'Strategic Resources' and 'Value Network'. Correspondingly, this study introduced two 'Bridging Elements': Revenue and Costs. However, the Revenue and Costs bridge several CBMO elements, as shown in Figures 5.12, 5.13 and 5.14. E.g., Revenue bridges CBM Elements Profit and Client.

Rainer and Hans-Dieter (2001), Hedman and Kalling (2003), and Kindstrom and Kowalkowski (2014) recognised some BM elements span over other BM elements of the framework/ontology as described in Section 2.12.5. These studies were not identified such elements as a separate category and were considered BM elements. However, this study identified that there are three elements that need to be concerned with all the Value Pillars, CBM Elements, and CBM Sub-elements of the CBMO and named them 'Shared Elements'.

Two new BM elements categories were recognised differently for CBMO: (i) 'Desired Element' – Company Vision/Goal, and (ii) 'Inherent Element' – Company Culture. However, in literature, only Rainer and Hans-Dieter (2001) considered Goals and Vision, but as BM Sub-element, giving less priority to Company Vision/Goal under BMs. The culture was one of the BM elements only in the study of Kindstrom and Kowalkowski (2014). However, as per this study's findings, culture and Vision/goals affect the overall business decisions of all the other CBMO elements.

The literature comprises BM elements; some have similar terms with the same meaning, and some have different terms with the same meaning compared to the CBMO elements. Table 6.2 presents the number of studies out of analysed 51 studies

(refer Annexure 2.5) that recognise the elements of their BM frameworks/ ontologies compared to the CBMO elements.

Table 6.2

Number of Studies that use BM elements similar to the elements of the CBMO

Elements of the CBMO (this study)	Number of studies			
	As BM element		As BM sub-element	
	with the same term	with different terms	with the same term	with different terms
Company Culture	1			
Company Vision /Goals			1	
Strategic Choices	1	18		
Change		6		
Professionalism				
Revenue	3	26		
Costs	1	8		
Value Inputs		42		
Primary Inputs				
Add-Ons				
Value Stakeholders		27		
Client		27		
Partners	8	4		
Key Internal Team				
Key Connected Stakeholders				
Government	1	1		
Subsidiaries				
Key Subcontractors				
Key Suppliers		1		
Value Creation	3	11		
Key Processes	25			
Budgeting & Planning				
Financial Management		4		
Supply Chain Management				
Risk Management			1	
Controlling & Monitoring				
Resources & Capabilities	24	4		
Construction Expertise				
Workmanship				
Plant & Equipment			1	
Technology & Innovations	5		2	
Value Capture	4	4		
Profit	5			
Expectations				

As depicted in Table 6.2, Revenue, Value Inputs, Value Stakeholders, Client, Key Processes, and Resources & Capabilities are the elements the literature frequently uses (by more than 25 studies) as BM elements. Some studies applied different terms to

identify them (refer Annexure 2.5), e.g., Revenue is identified as Revenue logic (Rajala & Westerlund, 2007), Revenue Model (Osterwalder, 2004; Osterwalder et al., 2005; Pekuri et al., 2014), Revenue Streams (Bertels et al., 2015; Das et al., 2020), and Revenue mechanism (Kindstrom & Kowalkowski, 2014).

Value Inputs and Value Stakeholders are not found in the literature in similar terms since the interviewees of this study suggested using the terms to match the construction business. However, BM elements with similar meanings could be identified in the literature (refer Annexure 2.5). 'Client' is termed in all other studies as Customers and customer-related aspects like Customer interface (Hamel, 2000; Boons & Lüdeke-Freund, 2013), Customer Relations Model (Petrovic et al., 2001), and Identifying Customer (Magretta, 2002). However, a study by Das et al. (2020) which is related to BM innovation in the construction industry, listed 'Client relationships' as a BM element. On the other hand, Key Processes and Resources & Capabilities are similarly identified by most studies, even though the processes, resources, and capabilities differ from business to business.

The strategy-related elements took as a BM element by considerable studies (19 studies). Most studies used the term 'Strategy', considering different strategies. E.g., Competitive Strategy (Zhao et al., 2018; Jabłonski & Jabłonski, 2016; Mutka & Aaltonen, 2013; Kujala et al., 2010; Chesbrough, 2007; Morris et al., 2005), Sales and marketing strategy (Kallio et al., 2006), and Growth Strategy (Van den Brink, 2016).

Similar to this study, Kindstrom and Kowalkowski (2014) recognised that Strategy spans over other BM elements. Moreover, the dynamic nature of BMs is considered by six studies, selecting change-related BM elements. E.g., Change management (Cheng et al., 2001), Longitudinal dimension (Hedman & Kalling, 2003), and Steps of Change (Todaria et al., 2020). In addition, as per Hedman and Kalling (2003), a Longitudinal Dimension covers the BM's dynamics over time.

Professionalism was not selected when developing BMs in literature or other business domains. Hence, priority was not given to Professionalism under BMs, even though professionals are involved in every business. However, this research revealed and justified the essentiality of Professionalism for the construction business (see Section 4.7.7). A project business, Key Internal Team, is found as one of the CBM Elements in the construction business. However, it is not considered for BMs in the literature. Likewise, CBMO consists of elements which are not considered as BM elements in the literature. E.g., Add-Ons, Expectations, Subsidiaries, Key Subcontractors, Construction Expertise, and Workmanship.

Budgeting and Planning, Financial Management, Supply Chain Management, Risk Management, and Controlling & Monitoring are the CBM Sub-elements of Key Processes as per the findings of this study. In literature, Heikkila et al. (2015) took 'Risks' as a sub-element of the Financial Perspective concerning BMs of networked enterprises, e.g., mobile and internet access providers and online advertising companies. However, Risk Management was not considered a process as in the CBMO. Similarly, Supply Chain Management and Financial Management are not

considered as processes in literature, even though they are differently taken as BM elements. For instance, Abuzeinab and Arif (2014) identified ‘Financial logic’ as a BM element while ‘Supply Chain’ is considered a BM element by Das et al. (2020).

Accordingly, elements constituting CBMO for the construction contractors’ business were found through case studies and qualitative surveys with construction business experts. However, some are neither considered nor given priority in the literature as BM elements (e.g., Professionalism, Key Internal Team, Subsidiaries, Key Subcontractors, Construction Expertise, and Workmanship). Some elements are frequently used in BM literature (e.g., Revenue, Value Inputs as Value Propositions, Value Stakeholders as Value Network, Client as Customers, Key Processes, and Resources and Capabilities). Moreover, less number of studies identified the element category, BM sub-elements in the literature (refer Annexure 2.4). However, with a detailed investigation of the construction business, this study identified seven BM element categories, including CBM Sub-elements, allowing CBMO to interpret CBMs in a detail and comprehensive manner.

In addition, all the identified CBMO elements could be related to the eight (8) fundamental themes identified in the CBM definition (refer Annexure 6.1).

6.7. Stage 3 – Describe BM elements constituting Construction Business Model Ontology (CBMO)

Stage 3 of the BM development process is critical for describing the BM elements that constitute a particular business domain. However, in literature, as described in Table 2.6, most BM research related to the construction industry has not considered describing BM elements in detail. Moreover, few studies briefly described their listed BM elements to convince their meanings (e.g., Cheng et al., 2001; Mokhlesian & Holmén, 2012; Brege et al., 2014; Pekuri et al., 2014, Van den Brink, 2016; Ling & Li, 2016; Zhao et al., 2018; Berg et al., 2019; and Das et al., 2020).

This study recognised that Stage 3 of the BM development process is essential when designing BMs for a specific business domain. While validating CBMO using a sample scenario, the importance and usefulness of CBMO element descriptions based on describing parameters, guiding questions, and options/examples were emphasised.

The descriptions of the CBMO elements were provided based on the findings of this study (refer Section 5.7). In literature, other than the meanings of BM elements, only a few studies have identified other parameters for describing BM elements (Table 2.11). E.g., a list of factors to select under each BM element by Morris et al. (2005), and characteristics of BM elements by Osterwalder (2004). As described in Section 5.7, this study explored different describing parameters to describe each CBMO element (refer Annexure 5.2) specifically related to the construction business.

Further, the literature highlighted questions to be asked under BM elements while making decisions (E.g., Morris et al., 2005; Johnson et al., 2008; Onetti et al., 2012; Fielt, 2013; Ling & Li, 2016; Taran et al., 2016; and Das et al., 2019).

Correspondingly, this study raised ‘guiding questions’ under each CBMO element based on their describing parameters, explanations given by interviewees and relationships identified. Further, this study provides options or examples for some guiding questions that could be selected while answering them to make decisions (refer Annexure 5.4).

Accordingly, this study goes beyond the other BM studies related to the construction industry and allows construction contractors to realise the elements related to their business case/project/job/idea in detail. As a result, relationships among CBMO elements could be identified for developing the CBMO.

6.8. Stage 4 – Model BM elements as a Construction Business Model Ontology (CBMO)

BM literature contains different BM frameworks/ ontologies developed for designing and accurately describing a firm's BMs. Some of the famous BM frameworks/ ontologies are the Business Model Ontology (BMO) by Osterwalder (2004), the Four-Box Business Model framework by Johnson (2010), an integrative framework for Entrepreneur’s Business Model by Morris et al. (2005), A Health Information Technology (HIT)-specific BM Ontology by Gand and Esswein (2018), and the Ontology for Social Business value proposition by Todaria et al. (2020).

BMO of Osterwalder (2004) originated from Information Systems (IS) business and has nine BM elements grouped into four pillars: (i) customer interface, (ii) product, (iii) infrastructure management, and (iv) financial aspects. BMO was developed by presenting individual taxonomies for each BM element and describing them in terms of name, definition, pillar belongs to, sub-elements, and relevant attributes.

Correspondingly, CBMO in this study was developed by identifying appropriate BM elements for the construction business, developing taxonomies, and describing each CBMO element. Furthermore, CBMO was developed by following the stages of ontology creation process which was proposed by Dudycz and Korczak (2016) based on the informal ontology creation process of Guarino and Giaretta (1995).

Johnson (2010) presented the Four-Box Business Model, consisting of Customer Value Proposition, Profit Formula, Key Resources, and Key Processes. However, this BM framework does not consist of a box for customers and other business stakeholders, e.g., partners. Hence the comprehensiveness of the designed BMs using the Four-Box Business Model is doubtful. On the other hand, Morris et al. (2005) developed an integrative framework for Entrepreneur’s Business Model by introducing three levels for different managerial purposes: (i) foundation level to make generic decisions, (ii) proprietary level to gain marketplace advantages, and (iii) rules level to guide business operations. Further, that BM framework presents key questions with lists of factors to select under each question while designing BMs. Correspondingly, most of the describing parameters identified for CBMO elements are

provided options/examples to select and guided with guiding questions when designing CBMs.

Todaria et al. (2020) built a framework for modelling a social business using an ontology-based approach. By realising the nature of social business (e.g., changing and self-purpose nature), Todaria et al. (2020) extended the BMO of Osterwalder (2004) to social business, encompassing multiple concepts and viewpoints in social business literature. According to Todaria et al. (2020), many BM elements related to social business were not usually considered in traditional businesses, e.g., Impact, Positive Externalities, Beneficiary and Transparency. Similarly, in CBMO, some elements could not be found in the literature as BM elements, e.g., Professionalism, Construction Expertise, and Subcontractors, since the CBMO was developed incorporating the practice of highest-graded contractors in Sri Lanka, viewpoints of top-level construction managers of highest-graded contracting organisations and viewpoints of construction business experts. On the other hand, instead of creating taxonomies for BM elements as like in CBMO, Todaria et al. (2020) formed three sub-ontologies as further extensions to the BMO of Osterwalder (2004) related to social businesses.

Without developing a totally new ontology, Gand and Esswein (2018) outlined a HIT-specific BM ontology based on the BMO of Osterwalder (2004). Furthermore, Gand and Esswein (2018) extended the Actor element by giving more profound insights into the HIT-specific factors while considering the views and changes of product, customer interface, key resources, key activities, and financial aspects.

Recently, Explainable Intelligent Decision Support Systems for BM (EIDSS BM) was proposed by Hamrouni et al. (2021) for Digital technologies. This model uses an ontology-based Case-Based Reasoning (CBR) approach where a historic BM is represented as an ontology built on the BMO of Osterwalder (2004), and knowledge of experts on past BM is capitalised. However, this is a different approach that uses relevant past BMs to interpret and design new BMs. Hence, its applicability for the construction business is doubted due to its project-based nature and the impossibility of finding and using similar past BMs for construction project businesses.

Osterwalder and Pigneur (2010) presented the popular visualisation template Business Model Canvas (BMC), prepared based on the BMO of Osterwalder (2004). As a result, several attempts in the literature tried modifying BMC concerning different business domains. Among them, in a study related to the construction business, Das et al. (2020) developed a construction BM Transformation Canvas (BMTC) to map the transformation of construction enterprises in Industry 4.0. However, the BMC does not consider the BM elements that considerably affect the construction business, e.g., Professionalism, Change, and Strategic Choices.

Further, it was noticed that when modifying BMC for another business, the relationships among BM elements are often less discussed. Hence, this study is not concerned with modifying BMC and realised the requirement of starting from the beginning, i.e., developing a business model ontology for the construction business.

The detailed relationships among the CBMO elements could be identified, including taxonomy levels and qualitative relationship indicators as described in Section 5.8.1.

This study disclosed some specific characteristics of the construction business, e.g., a project business, decisions involve high risk and uncertainty, high monitoring costs and effort, solutions are unstandardised, tendency to be contentious, involvement of multiple parties, control by multiple regulatory bodies, and requirement of complexity management. Unfortunately, the BM frameworks and ontologies in the literature do not investigate the specific characteristics of the construction business. Hence, CBMO was developed as a novel BM ontology that portrays the construction business by identifying appropriate BM elements for the construction business. Therefore, the BM concept application in the construction business is expected to be improved using CBMO.

6.9. Stage 5 – Apply BM concept using Construction Business Model Ontology (CBMO)

As per D'Souza et al. (2015), BM ontologies are primarily used for designing BMs. Accordingly, the CBMO was developed, enabling construction contractors to easily design BMs for construction business cases/projects/jobs/ideas. In addition, the BM literature highlighted that BM ontologies could be used as support for changing and innovating BMs. Therefore, during validation, it was identified that the required changes could be identified by incorporating existing business scenarios into the CBMO.

The literature further highlighted the multivalent characters of BMs (refer Section 2.4). As per Doganova and Eyquem-Renault (2009), BM is a narrative device that describes the selection of appropriate entities. This study identified an inclusive set of appropriate BM elements for the construction business and incorporated them into the CBMO, supporting designing CBMs characterising a narrative device. The CBMO supports designing CBMs that can show how the construction companies organise their project business and increase the understanding of that business by all stakeholders. As a result, CBMs could cover the characters: a generic level descriptor (Baden-Fuller & Morgan, 2010) and a common language (Arend, 2013). This study further revealed the requirement of involving all management levels for construction business decision-making where the CBMO is useful.

The Shared Element, Change, and its describing parameters (Table 5.2) in CBMO address the BM role source of change highlighted by Martins et al. (2015). Moreover, the BM roles, source of competitive advantage (Zott & Amit, 2008), and strategic-oriented knowledge capital (Al-Debei & Avison, 2010) are addressed under the Shares Element, Strategic Choices of the CBMO. By inserting Professionalism into the CBMO, this study added a new character specifically for CBMs, i.e., 'reflection of Professionalism', which demonstrates and reflects the company's professional behaviours.

As proved through validation, the step-by-step guide for CBMO (Annexure 5.6) will provide clear, detailed, and comprehensive directions for designing CBMs using CBMO. As a result, the following strengths of CBMO came out from findings and through validation;

- It creates a big picture of a business option/case/project and expresses relationships among CBMO elements
- It enables communicating a business option/case/project among stakeholders
- Its use with the step-by-step guide stimulates identifying and understanding the fundamental problems of a business option/case/project
- It supports as a planning tool grasping the whole picture of a business option/case/project and avoiding missing parts
- It recognises and facilitates changes to existing business scenarios due to internal organisational changes and external shocks.
- It enables seeking opportunities
- It enables choosing appropriate strategies and gaining competitive advantages
- It enables effective management of company processes, e.g. supply chain management, risk management and monitoring and controlling

The above strengths of CBMO emphasised the importance of CBMO and its use in designing BMs to avoid and mitigate adverse effects to the construction contractors due to business challenges, e.g. business failures, pandemics and economic crises.

It is expected that the world, including the construction industry, will face many challenges and new dynamics. As per Jang et al. (2020), economic globalization makes construction contractors vulnerable to business failures due to the complex and turbulent nature of the construction industry, high competition, and high uncertainty and risk. Accordingly, Assaad and El-adaway (2020) identified incompetent planning and business decisions, fierce competition, limited experience in the business, poor financial performance, poor marketing skills, overtrading and rapid expansion and poor relationships with customers and stakeholders are the common business failure factors of the construction contractors.

External market factors, fragmented and complex industry dynamics, vulnerability to high risks and uncertainty caused accelerating difficulty, disruption and delay in the construction industry due to the Covid 19 pandemic (Ribeirinho et al., 2020). Ranasinghe and Pathirana (2021) recommended that construction companies have to manage their supply chain efficiently, maintain the supply chain network more effectively, manage their financial and legal capacity effectively, and make informed decisions to emerge through the crisis. Pathirana (2020) also emphasised the importance of avoiding ad-hoc decisions limiting inward policies, and focusing on value-adding activities while navigating the pandemic crisis.

Accordingly, the recommended strategies for facing the Covid-19 pandemic are achievable with the use of CBMO and factors affecting construction business failures also can be avoided with CBMO.

6.10. Chapter Summary

This chapter discussed the findings from case studies, qualitative surveys, and literature review. Accordingly, the chapter provided the triangulated discussion on this research study. The literature findings under each stage of the BM development process were compared with the findings of this study on developing CBMO. Accordingly, CBM definition development, the composition of CBMO elements, and describing parameters of CBMO elements were matched with the related literature findings. Further, few BM frameworks/ontologies in the literature were compared with the CBMO. The next chapter presents the conclusion of the study's contribution to the knowledge, the recommendations and future research directions.

7. CONCLUSIONS

7.1. Introduction

This chapter presents the conclusions and recommendations of the study. The chapter initially summarises how the study's aim and objectives were achieved. Then it discusses the contribution to the existing body of knowledge by this study, followed by limitations of the study—finally, the discussion shifts to recommendations for the industry and future potential research.

7.2. Conclusions of the research

The study was set out to develop a business model ontology for the construction context to facilitate contractors in designing Business Models (BMs) to answer the key research question “*How to contextualise BM concept to construction contractors' business via developing a BM ontology for the construction context?*” The aim was achieved by following six objectives and answering ten (10) RQs. The research conclusions were presented in the following sub-sections with summarised answers for RQs in achieving each research objective.

7.2.1. Critically review the literature on the BM concept to interpret the gaps, particularly in construction industry application (OB1)

The literature reported that BM has multiple characters as a model, other than the two key functions: *value creation* and *value capture*. Hence, a sound BM is fundamental to a company's success by supporting high-quality business decisions. Therefore, the objective was to interpret the BM literature gaps, particularly in the construction industry, that require a change in business thinking to proper BM adaptation since construction firms face many survival challenges.

The critical literature review explored the evolution and reinterpretation of the BM concept through eight stages leading to roadmap for BM application improvement (Figure 2.6). Among the eight stages, the first stage, BM indication, is present in almost all disciplines, including construction. On the other hand, Stages 7 and 8, i.e., BM issues and clarifications and BM design improvements, occur either with or after adopting the BM concept to any industry. The rest of the stages contributed to creating a BM development process (Figure 2.7) that facilitate effective BM adaptation and improvement in BM application in the construction industry, where the BM concept has not been sufficiently studied.

The BM development process consists of five stages: (i) define BM, (ii) list BM elements, (iii) describe BM elements, (iv) develop BM ontology, and (v) apply BM concept using BM ontology. Although the BM concept is being widely used and investigated in many other disciplines, e.g., information systems, e-business and e-commerce, telecommunications industry, and software industry, only a few works researched the BM concept application in the construction industry. Therefore, the mapping of construction industry-related BM studies with the BM development

process found the gap in the literature related to the BM concept in the construction industry.

A few frameworks could be found regarding the BM concept in the construction industry for different purposes (e.g., a transmission and communication model for an e-business infrastructure by Cheng et al., 2001; an evaluation model for innovative BMs for sustainable buildings by Zhao et al., 2017; and Business Model Transformation Canvas for Industry 4.0 by Das et al., 2019). However, a BM ontology enabling construction contractors to design, compare, analyse, and communicate their BMs was absent. Further, some studies only listed and described BM elements derived from another study, e.g., Van den Brink (2016) used Bocken and Short (2016)'s BM elements relating them to the circular construction industry. However, most studies could not be placed with any stage of the BM development process.

Accordingly, mapping the construction-related BM studies confirms the absence of stage-wise proper development of the BM concept in the construction industry. Hence, the construction industry must follow the BM development process to adopt the BM concept with a proper mechanism. Each stage of the BM development process gradually contributes to enhancing the BM concept application, and the need for a BM ontology was found to be the pre-requisite for proper BM adaptation in any business domain.

After identifying the gap, the conceptual framework (Figure 2.12) was developed to accomplish the pre-requisite, which requires following the BM development process, compiled with the stages of ontology creation while achieving OB2, OB3, OB4, OB5, and OB6.

7.2.2. Define BM corresponding to the construction business to scope BM ontology development, in particular to the contractors' business (OB2)

The findings reported that the construction business managers in the industry do not adequately understand the BM concept, where a BM definition in relation to the construction industry is absent. The empirical findings further confirmed the requirement of introducing a definition for CBM to enhance the familiarity with the BM concept. Even though the literature consists of several definitional views for BMs, no generally accepted definition has developed using a systematic process. Hence, this study created a systematic process with six stages to develop a CBM definition (Figure 2.8).

Different 49 BM definitions were extracted from the literature in the first step, and keywords were selected from them to identify their underlying themes in the second step. It revealed that the extracted BM definitions focus around ten notions, among which eight (8) fundamental themes, i.e., (i) Value-based, (ii) Stakeholder-based, (iii) Revenue-based, (iv) Process-based, (v) Resource-based, (vi) Strategy-based, (vii) Dynamicity-based, and (viii) Opportunity-based, appropriate for the construction business were identified. Finally, the literature review enabled the systematic development of the CBM definition using the phrases extracted from the existing BM definitions for each fundamental theme while replacing some of the terms to enhance

the compatibility with the construction business. The empirical findings confirmed the fundamental themes and incorporated a few modifications to improve its compatibility and comprehensibility.

The validated Construction Business Model Definition is,

“A construction business model is a simplified conceptual representation of a construction business that performs value creation as per Client requirements with key resources and capabilities, considering the appropriate level of involvement of relevant stakeholders in the key processes towards revenue and profit generation while expressing the firm’s strategic choices with awareness of necessary changes and opportunities.”

The definition characterises the eight selected fundamental themes being comprehensive. It also represents the two basic functions of the BM, i.e., value creation and value capture, while highlighting construction companies’ ability to identify their competitive advantages through strategic choices. The definition further indicates that CBM could apply to a complex, uncertain, and rapidly changing construction industry by knowing the available opportunities and required changes.

Ultimately, the CBM definition helps understand the construction business with its essential features, being an impetus to improve the BM concept’s applicability in the construction industry. Accordingly, the CBM definition provides a basic idea about the content of a CBM. It directed identifying a list of BM elements essential for developing a BM ontology applicable to construction contractors’ business by achieving the next objective.

7.2.3. Investigate BM elements essential for a BM ontology applicable to construction contractors’ business (OB3)

An extensive literature review enables us to gain an insight into the listing of BM elements in the literature which shows the heterogeneity in the use of elements, their names, and numbers, even in the studies of the same business fields/domains. Further, while some studies select BM elements that are prioritised in their business domains, other studies sought to use the most appropriate terms concerning their field or business domain. Accordingly, 291 BM elements from 51 studies were deduced into 17 different BM elements as literature outcomes to guide finding appropriate BM elements for the construction business through case studies.

Phase I case studies set up a list of BM elements related to the construction business after modifying and removing some of the above BM elements and introducing new BM elements. Later, the qualitative survey in Phase II with construction business experts made some changes and modifications to finalise the list of elements for the CBMO. Accordingly, some of the listed elements for the CBMO could be frequently found in BM literature, e.g., Revenue, Value Inputs as Value Propositions, Value Stakeholders as Value Network, Client as Customers, Key Processes, and Resources & Capabilities, while some are rarely found, e.g. Company Culture, Company Vision/Goal, Government, Risk Management, and Plant & Equipment. On the other

hand, some newly identified elements are not considered in other business domains as BM elements, e.g., Professionalism, Add-Ons, Expectations, Subsidiaries, Key Subcontractors, Construction Expertise, and Workmanship.

The listed elements of the CBMO were divided into seven (07) categories by observing their relationships, roles, and position in the business. As a result, the elements for the CBMO were concluded with the following element categories and respective elements:

- One Desired Element, i.e. (i) Company Vision, which is the desired position of the company
- One Inherent Element, i.e. (i) Company Culture, which is inherited in every company and affects business decisions
- Three Shared Elements, i.e. (i) Strategic Choices, (ii) Change, and (iii) Professionalism, need to be considered with all the other elements and with each other
- Two Bridging Elements, i.e. (i) Revenue and (ii) Costs, which link some of the Value Pillars, CBM Elements, and CBM Sub-elements
- Four Value Pillars, i.e. (i) Value Inputs, (ii) Value Stakeholders, (iii) Value Creation, and (iv) Value Capture consisting of 3 taxonomy levels; (i) Value Pillars (taxonomy level 1), (ii) CBM Elements (taxonomy level 2), and (iii) CBM Sub-elements (taxonomy level 3)

Hence, this study's attempt to specifically identify the appropriate BM elements for CBMO applicable to construction contractors' business was a success. Accordingly, the second stage of the BM development process was completed by achieving OB3.

7.2.4. Analyse the BM elements identified above (OB3) for establishing parameters to describe BM elements (OB4)

The fourth objective was achieved under the third stage of the BM development process, identified as an essential stage when developing BM ontology for a specific business domain. The analysed data through the thematic analysis process provided data for describing the CBMO elements listed above. These BM element descriptions varied in their depth and importance, ranging from meanings in simple to detailed descriptions. Meanings were provided for every CBMO element category and element based on findings to provide a basic understanding of the elements. Other than meanings, different describing parameters were identified through findings from case studies and qualitative surveys. There were similar and different describing parameters, including related information of each element.

The descriptions were presented in three levels, i.e. (i) broadest level, (ii) middle level, and (iii) detail level. The main categories of CBMO elements, i.e., Desired Element, Inherent Element, Shared Elements, Bridging Elements, and Value Pillars, were described at the broadest level in terms of their meaning and relevance. At the middle level, the elements of the above main categories were described in terms of their

names, meanings, and other different describing parameters (Table 5.2 and Table 5.3)—for instance, the describing parameters of the Shared Element, Change included meaning, reasons for Change, barriers for Change, drivers for Change, a concern when changing, and examples for Change adaptation methods.

CBM Elements and CBM Sub-elements of each Value Pillar are described at a detailed level with their describing parameters (Tables 5.4 and 5.5). For example, the describing parameters for Clients are its meaning and process of handling, while meaning, purpose/expected benefits, factors to consider in the selection, and main concerns when creating partnerships are describing parameters for Partners.

This study identified the importance of focusing construction business more on providing value rather than merely lowering costs and promoting value-based competition. Therefore, findings suggested introducing a ‘Contractor’s Menu of Value Inputs’ where contractors can list their methods of providing values under Value Inputs.

Accordingly, the descriptions of CBMO elements with describing parameters allow construction contractors to exactly realise the CBM elements related to their business case/project/job/idea. Subsequently, the relationships among CBMO elements could be identified for developing the CBMO.

7.2.5. Establish relationships among BM elements for developing a BM ontology applicable to construction contractors’ business (OB5)

The relationships were identified through findings to model CBMO elements to develop the CBMO. Accordingly, different qualitative relationship indicators were derived from findings to establish relationships among CBMO elements and presented at three levels.

The relationships among the main CBMO element categories, i.e., Desired Element, Inherent Element, Shared Elements, and Value Pillars, were established at the broadest level. Accordingly, all the other CBMO elements had to be fitted with the Company Culture while driving toward the Company Vision /Goal. Since Strategic Choices, Change, and Professionalism have affected all Value Pillars, the relationship ‘shared with’ is identified for the Shared Elements towards Value Pillars. The findings provided a broad picture of the relationships of Shared elements at the middle-level presentation to express further relationships among Strategic Choices, Change, Professionalism, and Value Pillars. As a result, the qualitative relationships could be identified in Shared Element among each other and with Value Pillars (Figure 5.10). For instance, the success of decisions related to Strategic Choices, Change, and all Value Pillars are built on Professionalism, while decision-making with all the Value Pillars needs to be considered with the requirement of Strategic Choices and Changes.

The primary relationships of Value Pillars with their CBM Elements and the CBM Elements with their CBM Sub-elements were established, creating taxonomies. For example, Value Stakeholders are the *set of* Client, Partners, Key Internal Team, and Key Connected Stakeholders, while Client, Partners, Key Internal Team and Key

Connected Stakeholders are being *parts of* Value Stakeholders. In addition, the other qualitative relationships of each Value Pillar and its CBM Elements and Sub-elements with other Value Pillars and Bridging Elements were established and presented at the detail level (Figures 5.11, 5.12, 5.13, and 5.14).

Overall, this study emphasised the relationships among CBMO elements in detail and covered a less-discussed area in the literature. These relationships were considered when developing the CBMO.

7.2.6. Propose a developed and validated BM ontology for construction contractors' business, facilitating BM design for different construction business ideas/ options (OB6)

To complete Stage 4 of the BM development process and achieve the 6th objective, the identified CBMO elements were modelled to develop **Construction Business Model Ontology (CBMO)** by considering the established relationships and formalising related information. The four Value Pillars with their CBM Elements and CBM Sub-elements, three Shared Elements, two Bridging Elements, the Inherent Element, and the Desired Element are placed in the CBMO, highlighting the primary flows of values and costs among CBMO elements (Figure 5.15).

Describing parameters were used to create guiding questions for each CBMO element, which directs construction contractors in decision-making while designing CBMs. The effectiveness of answering some guiding questions was enhanced by providing options or examples obtained from the findings. Most importantly, a step-by-step guide for CBMO was developed to facilitate a user-friendly guide for construction contractors to design CBMs using the CBMO. The CBMO was validated by two groups of construction business managers of two construction companies and verified its contents, clarity, and level of understanding. Using the sample scenario created by the researcher and its instantiation in the validation process signified that the CBMO represents the business of construction contractors correctly and satisfactorily.

Initially, the CBMO attempts to support construction contractors in designing CBMs for their projects/jobs/ideas/options and provide shared understanding among relevant stakeholders. The CBMs developed with the CBMO characterise different roles, e.g., a narrative device, a common language, a source of competitive advantage, a source of change, and a strategic-oriented knowledge capital. In addition, the CBMO supports CBMs act as a reflection of Professionalism, which mostly benefited construction businesses as the findings. Accordingly, this study recognised that the CBMO elements could contribute to different BM characters.

In a nutshell, the construction contractors can use the step-by-step guide for CBMO and play with the CBMO elements to efficiently design their CBMs.

7.3. Contribution to Knowledge - Theoretical Implications

The knowledge created through this research mainly contributes to the existing knowledge domain of construction business management from the business models' perspective. However, in the construction context, the literature contains limited research from the BM viewpoint, which is mostly related to specific circumstances or technologies, e.g., green constructions and off-site construction. Accordingly, this study developed the BM development process (Figure 2.7) with five (5) stages towards proper BM adaptation/application, highlighting the modelling BM elements as BM ontologies for particular business domains as a pre-requisite.

Thus, this research provides good supplements to the business model literature by following the BM development process. At the first stage of defining BM, this study presented a comprehensive, concise, and empirically validated definition for CBM, which was developed following a systematic process. This process (Figure 2.8) is also appropriate for defining BMs for any business domain where the selection of fundamental themes can be differed according to the business domain.

Under the second stage of the BM development process, this study explored a list of elements that form CBMs, including newly identified BM elements for the construction business, e.g., Professionalism, Key Internal Team, Subsidiaries, Key Subcontractors, Construction Expertise, and Workmanship, concerning their importance for the construction business. On the other hand, this study introduced new BM element categories, i.e., Desired Element, Inherent Element, and Shared Elements, which could help decide the categories and functions of BM elements related to different business domains.

This study contributed to the BM knowledge by establishing different parameters for describing each CBMO element at the third stage of the BM development process. These parameters are essential for understanding BM elements in relation to the construction business.

Furthermore, these parameters provide the base for creating questions to guide in CBM designing. The major contribution to the theory from this study is the **Construction Business Model Ontology (CBMO)** (refer Figure 5.15). The CBMO was developed by combining the BM development process and the stages of ontology creation (refer Figure 2.12) and establishing the detailed relationships among the CBMO elements, including taxonomy levels and qualitative relationship indicators. The CBMO supports designing CBMs for construction business cases/projects/ jobs/ideas while supporting change and innovative CBMs. These CBMs could act as multiple characters, as mentioned in the literature, and this study added a new character, i.e., a reflection of Professionalism.

Overall, the present investigation enhanced the knowledge by developing the CBMO from the beginning, rather than modifying or extending existing BM ontologies of other business domains.

7.4. Contribution to Knowledge - Practical Implications

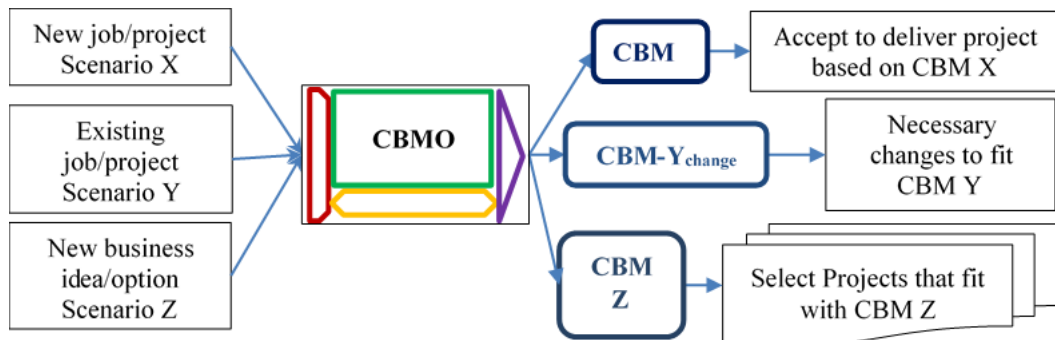
The research findings will assist in improving the BM concept application in the construction industry and thereby gain the benefits of its multiple user roles. Initially, this study contributed to practice by explicitly defining the CBM, which helps understand the construction business and its features and emphasises the basic requirements of CBMs for business decision-making.

Most prominently, this study directly contributes to construction business practice by developing the CBMO and presenting a user-friendly step-by-step guide for directing construction contractors for its use. Furthermore, the findings revealed the impossibility of implementing ad-hoc decisions in construction businesses. Therefore, it is believed that designing CBMs using CBMO will reduce the adhocacy in construction business decision-making.

CBMO supports construction contractors in designing CBMs for their projects/jobs/business ideas/options. Further, the CBMO facilitates changes to existing business scenarios. Accordingly, Figure 7.1 shows the primary uses of the CBMO in the business management of construction contractors and their ultimate results, exploring business opportunities and innovations.

Figure 7.1

Use of the CBMO in the construction business management



Moreover, the CBMO creates a big picture of a business option/case/project for communicating with stakeholders. It will also assist construction contractors in business planning by showing the whole picture of a business and avoiding missing parts.

CBMO also enables client identification and handling, using specified processes and company procedures, setting acceptable risks and financial objectives, choosing appropriate strategies, gaining competitive advantages and utilising resources and capabilities. Therefore, by creating a better fit with the designed CBMs, the likelihood of unsuccessful projects or business cases will be reduced. Also, the use of the Contractor's menu of value inputs which was introduced by this study, will be contributed to avoiding unhealthy competition among contractors by promoting value-based competition.

Consequently, construction contractors can easily manage their businesses on a project-by-project basis, focusing on their growth and survival, ultimately determining the construction industry's performance. It also explores opportunities by grasping new ways of doing project businesses.

7.5. Scope and Limitations of the study

The study has identified a global issue related to the business model concept in the construction business: the absence of BM ontology for construction contractors' business. However, the study was conducted in a developing country setting, considering the Sri Lankan construction industry by collecting data from the highest-graded construction contracting organisations and individual construction business experts. Accordingly, the study made certain limitations that need to be considered.

- Recognising the contracting organisations as the key business entity in the construction industry, this study focused on the construction contracting organisations' perspective. However, the qualitative survey with construction business experts was not limited to a particular segment and was conducted considering contractor organisations' business perspectives. Further, the highest-graded contractor organisations were only selected due to their highest level of business vision, and only their core business was considered, i.e., providing the service of construction expertise. Therefore, the terms 'construction business' and 'construction contractors' business' mean the core business of construction contractors.
- Although the researcher attempted to collect documentary data, only companies' official websites could be accessed due to the unavailability of disclosed business documents of the companies.
- In collecting Phase II data, face-to-face interviews could not be conducted with construction business experts due to the Covid-19 pandemic.
- This study may not be completely generalisable due to its qualitative nature. However, findings can be applied to a similar context and can be used as a base study for other contexts and studies of other countries.
- This study has mainly elaborated on the company-level business decision-making regarding construction project businesses, assuming that top-level construction managers make business decisions.
- The CBMO was developed with the combined use of the BM development process and the stages of ontology creation. However, the last two stages, i.e., encoding and evaluation of ontology creation, were not considered under the scope of this study due to the limited time and resources.
- The study is limited to a specific time, being a cross-sectional study.
- The study was limited to validate using a sample scenario and was not tested with a real-life example due to difficulty in getting details of usage scenarios. However,

the validation was done with two highest-graded construction organisations in Sri Lanka

- Even though the CBMO can be transformed into computer-based tool/software, only a brief step-by-step guide was prepared for directing construction contractors due to limited time and resources.

7.6. Recommendations

Construction contractors should ensure their sustainability in the industry as a business with enhanced competition while facing rapid environmental changes. Due to the peculiar characteristics of project business and the volatility of construction markets, the construction business requires a proper mechanism for making business decisions. Therefore, this study recommends adopting the BM concept to the construction business and improving its application to gain benefits through its multiple roles. The following actions are being recommended accordingly:

- BMs provide a common language among the company members and align the efforts of all the members toward business success. Hence, firstly, the top-level managers of construction companies are advised to avoid the dilemma of keeping BMs secret.
- All the construction business stakeholders are recommended to be familiarised with the CBM definition to develop a fundamental understanding of what constitutes a CBM and its importance to the construction business and the industry.
- Construction contractors are advised to use the CBMO with its step-by-step guide as support to design, change, and innovate their business models easily. Since construction business decisions require feed from all management levels, the CBM design team must consist of relevant persons from all management levels. It is recommended to work through the guiding questions with the team to ensure the development of a shared understanding of the key features of the designed CBM.
- Construction contractors are recommended to design CBMs for their projects/business cases/jobs before planning the construction process to keep in mind the whole picture of the project/business case/job and avoid missing parts.
- Contractors are requested to maintain a menu of Value Inputs and discuss with the Clients to promote value-based competition.

7.7. Recommendations for future research

The following recommendations can be suggested for consideration in future research further to improve the BM concept adaptation in the construction industry.

- More in-depth case studies for the CBMO application are required to paint a more comprehensive picture of how CBMO can be used in the construction business management and for further improvements in the step-by-step guide for CBMO.

- The CBMO can be tested or modified to make project-level business decisions.
- The CBMO was developed focusing on the construction contractors. Hence, future studies extending to conduct the use of CBMO for other businesses in the construction industry is recommended, e.g., consultants, suppliers, and subcontractors with required modifications or revisions.
- Future research must develop strategies to promote the use of CBM definition among construction business managers, since it will enhance the understanding of the BM concept.
- The literature review revealed many avenues to follow upon developing a BM ontology, e.g., BM changes, BM innovations, and BM classifications. Hence, another potential arena for future research lies in exploring these areas with the CBMO.
- The CBMO can be transformed into software or computer-based tool for its better implementation in future while concerning its diffusion and commercialisation.
- The CBMO can be considered to develop CBMs related to specific areas, e.g., sustainable construction, Industry 4.0 transformation, and green construction with required modifications and changes.

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ANNEXURES

Annexure 2.1: Allocation of literature articles from 2006 to 2020 for areas of BM development

Areas of BM development	No of articles	References
<u>2006 to 2010</u>		
Initiating solutions for BM renewal/change/reinventing and innovations; BM innovation frameworks and tools Barriers to business model innovation Accelerating BM renewal	10	Chesbrough (2007a); Chesbrough (2007b); Johnson et al. (2008); Lindgren et al. (2010); Fritscher and Pigneur (2010); Doz and Kosonen (2010); Amit and Zott (2009); Chesbrough (2010); Gambardella and McGahan (2010); and Teece (2010)
Concerns on different types of BMs E.g. complex BMs, Operator driven BMs and Hybrid BMs	6	Kallio et al. (2006); Rajala and Westerlund (2007); Kshetri (2007); Martnez-olvera (2009); Smith et al. (2010); and Wikström et al. (2010)
Combine and compare BM concept with different theories and views E.g. Penrosian view & theories of the firms	5	Rasmussen (2007); Zott and Amit (2008); Sabatier et al. (2010); Zott and Amit (2010); and Demil and Lecocq (2010)
Clarify BM concept and issues with BMs E.g. Multivalent character of BM Criticisms of the BM Concept	5	Al-Debei et al. (2008); Doganova and Eyquem-Renault (2009); Al-Debei and Avison (2010); Baden-Fuller and Morgan (2010); and Perkmann and Spicer (2010)
BM management and experimentation	3	Mcgrath (2010); Nenonen and Storbacka (2009) and Osterwalder et al. (2010)
Attempts to develop a generic approach E.g. Reference ontology/ Representation/ BM Canvas	3	Andersson et al. (2005); Casadesus-Masanell and Ricart (2010); and Osterwalder and Pigneur (2010)
Sustainability of BMs	2	Stubbs and Cocklin (2008); and Birkin, Cashman, Koh and Liu (2009)

Areas of BM development	No of articles	References
2011 to 2015		
Increasing solutions for BM change and innovations E.g. BM innovations of different types of BMs (sponsor-based BMs), Tools for BM innovation, Role of BM innovation Prerequisites for BM innovations, and modifying BM Canvas for innovations	25	Zott et al. (2011); Rohrbeck et al. (2013); Cavalcante et al. (2011); Bock et al. (2012); Schaltegger et al. (2012); Huang et al. (2012); Onetti et al. (2012); Abraham (2013); Bocken et al. (2013); Berglund and Sandström (2013); Casadesus-Masanell and Zhu (2013); Schneider and Spieth (2013); Richter (2013); Achtenhagen et al. (2013); Frankenberger et al. (2013); Velu (2014); Breuer and Lüdeke-Freund (2014); Spieth et al. (2014); Visnjic et al. (2014); Bocken et al. (2014); Kindström and Kowalkowski (2014); Sniukas (2015); Joyce et al. (2015); Bertels et al. (2015); and Martins et al. (2015)
Concern on Sustainable BMs E.g. Categories of sustainable BMs Performance Metrics for Sustainable BM	12	Jonker (2012); Bocken et al. (2013); Boons and Lüdeke-Freund (2013); Boons et al. (2013); Girotra and Netessine (2013); Osborne et al. (2014); Abdelkafi and Täuscher (2016); Schaltegger et al. (2016); Bocken and Short (2016); Abdelkafi and Täuscher (2015)
Combine and compare BM concept with different theories and views E.g. Resource-based view, Integrated reporting, Contingency perspective	10	Casadesus-Masanell and Ricart (2011); Hacklin and Wallnöfer (2012); Morris et al. (2013); Baden-Fuller and Mangematin (2013); Beattie and Smith (2013); Cocchi (2013); DaSilva and Trkman (2014); Mezger (2014); Friis et al. (2015) and Yun et al. (2015)
Concerns on different types of BMs E.g. Solution, Digital & Green BMs	6	Mutka and Aaltonen (2013); Frankenberger et al. (2013); Storbacka et al. (2013); Veit et al. (2014); Caro and Martinez-de-Albeniz (2014); and Al-Saleh and Mahroum (2014)
BM design development E.g. Computer-Aided BM Design, Antecedents of BM Design, use of BM Canvas for different aspects	4	Osterwalder and Pigneur (2013); Dalby et al. (2014); Amit and Zott (2015); and Dudin, et al. (2015)
BM management and implementation E.g. Product Service Systems (PSS), Management of multiple BMs	3	Mason and Spring (2011); Rein et al. (2015); and Höök, Stehn and Brege (2015)
Clarify BM concept & Seeking issues related to BM concept E.g. BM Classifications, Present & future of BM, BM dilemma, BM disruptions	7	Arend (2013); Fielt (2013); Tongur and Engwall (2014); Khanagha et al. (2014); Klang et al. (2014); Lambert (2015); and Wirtz et al (2015)

Areas of BM development	No of articles	References
<u>2016 to 2020</u>		
Increasing solutions for BM change and innovations E.g. BM innovations of different types of BMs (Zero-carbon buildings), definition for BM innovation, BM innovation process, and modifying BM Canvas for BM innovations	10	Franca et al. (2017); Geissdoerfer et al. (2016); Saebi et al. (2017); Verhoeven and Johnson (2017); Hacklin et al. (2017); Cosenz and Noto (2018); Hossain (2017); Martina et al. (2017); Zhao et al. (2018); and Anwar (2018)
Combine and compare BM concept with different theories and views E.g. Circular economy, Blockchain technology, activity system, Demand-side strategy	8	Štefan and Branislav (2016); Türko (2016); Lewandowski (2016); Priem et al. (2017); Ritter and Lettl (2017); Snihur and Tarzijan (2018); Morkunas et al. (2019); and Mboli et al. (2020)
Concern on Sustainable BMs E.g. Public Procurement (PP) and Sustainable BM, Sustainable BM archetypes	5	Dentchev et al. (2016); Witjes and Lozano (2016); Rauter et al. (2017); Yip and Bocken (2018); Piscicelli et al. (2018); and Breuer et al. (2018)
Attempts for BM design development with ontologies for different disciplines E.g. Health Information Technology, Social businesses	5	Joyce and Paquin (2016); Gand and Esswein (2018); Bouwman et al. (2020); Peter et al. (2020); and Todaria et al. (2020)
Clarify BM concept with classifications and patterns	2	Rosca et al. (2017); and Weking et al. (2018)
Concerns on different types of BMs E.g. Inclusive BM	1	Shyam (2017)
BM management	1	Bullinger et al. (2016)

Annexure 2.2: Mapping of BM studies related to construction industry with stages of BM development process

Source of Reference	BM Research Development Process					Area of consideration related to Construction Industry
	1st Stage	2nd Stage	3rd Stage	4th Stage	5th Stage	
	Defining BM	Listing BM elements	Describing BM elements	Developing BM ontology/ Framework	Apply BM Concept	
Cheng et al. (2001)	-	BM components identified for e-BM	BM components described for e-BM	Developed transmission and communication model	BM for Specific area	e-business infrastructure
Duyshart et al. (2003)	-	-	-	-	BM change - Change methodology	ICT adaptation for construction
Grimscheid and Rinas (2012)	-	-	-	-	BM concept combine with other theories	Use of systems theory Swiss precast concrete (SPC) industry
Mokhlesian and Holmén (2012)	-	Nine BM components of Osterwalder et al. (2005) were listed	Nine BM elements described	-	Different type of BM	Green construction
Abuzeinaba et al. (2014)	Defined Green BM	-	-	-	Different type of BM	Green Business Models in the UK Construction Sector
Abuzeinaba and Arif (2014)	-	Five elements were identified specifically for GBM	-	-	Different type of BM	Stakeholder engagement of Green Business Model (GBM)
Brege et al. (2014)	-	3 BM blocks & 5 BM elements were identified	BM blocks & elements were described	-	BM for Specific area	Industrialised multi-storey buildings
Pekuri et al. (2014)	-	3 components listed- For value creation logic	3 components were described	Framework developed	BM for Specific area	Value creation of a construction company.

Source of Reference	BM Research Development Process					Area of consideration related to Construction Industry
	1st Stage	2nd Stage	3rd Stage	4th Stage	5th Stage	
	Defining BM	Listing BM elements	Describing BM elements	Developing BM ontology/ Framework	Apply BM Concept	
Brink (2016)	-	3 Building blocks were listed following Bocken and Short (2015)	Building blocks were described	-	BM concept combine with other theories	Circular construction service provider
Ling and Li (2016)	-	6 BM components were listed as Morris, et al. (2005)	6 BM components were described	Framework developed	BMs for Specific area	Foreign firms offering construction-related consultancy services
Zhao et al. (2017)	-	-	-	-	BM innovation	Model developed for evaluating Performance of Innovative BMs for Sustainable Buildings Use the AHP and ANP approaches
Lessing and Brege (2018)	-	3 BM blocks were taken from Brege et al. (2014)	-	-	BMs for Specific area	Industrialised building companies
Zhao et al. (2018)	-	Eight BM elements identified	Descriptions for eight elements were give based on case studies	-	BM innovation	BM innovations for Zero Carbon Buildings (ZCBs)
Berg et al. (2019)	-	Four BM elements/ archetypes identified	Discussed the BM elements in relation to four parties of construction value chain	-	Issues related to BM in construction industry	Archetypical characteristics of BMs of construction value chain: Architect, Engineer, Supplier and Contractor

Source of Reference	BM Research Development Process					Area of consideration related to Construction Industry
	1st Stage	2nd Stage	3rd Stage	4th Stage	5th Stage	
	Defining BM	Listing BM elements	Describing BM elements	Developing BM ontology/ Framework	Apply BM Concept	
Das et al. (2019)	-	Nine BM blocks listed with some modifications	Nine BM blocks described with some modifications	-	Business Model Transformation Canvas based on BMC use as a Change methodology	Transformation of construction businesses due to Industry 4.0 scenarios of globalisation, industrialization and digitalization.
Das et al. (2020)						
Brady et al. (2005)	-	-	-	-	Different type of BM	Integrated solutions BM
Pan and Goodier (2012)	-	-	-	-	BMs for Specific area	Off-site construction
Aho (2013)	-	-	-	-	BMs for Specific area/ BM Change	Sustainable construction
Christian and Lars (2013)	-	-	-	-	BMs for Specific area/ BM innovation	Off-site manufacturing practices
Pekuri et al. (2013)	-	-	-	-	Issues related to BM in construction industry	Managers' awareness
Thuesen and Hvam (2013)	-	-	-	-	BMs for Specific area	Off-site system deliverances
Goulding et al. (2014)	-	-	-	-	BMs for Specific area	BMs concerning offsite construction & their impact on design, manufacturing and construction
Pekuri (2015)	-	-	-	-	Issues related to BM in construction industry	Role of BMs in construction business management.

Source of Reference	BM Research Development Process					Area of consideration related to Construction Industry
	1st Stage	2nd Stage	3rd Stage	4th Stage	5th Stage	
	Defining BM	Listing BM elements	Describing BM elements	Developing BM ontology/ Framework	Apply BM Concept	
Pekuri et al. (2015)	-	-	-	-	BMs for Specific area	Project selection
Abuzeinab et al. (2017)	-	-	-	-	Different type of BM	Barriers to Green BMs for the construction sector - Multinational enterprises (MNEs)
Liu et al. (2017)	-	-	-	-	BMs for Specific area/ BM innovation	Modular prefabrication and construction
Brunoro et al. (2018)	-	-	-	-	BMs for Specific area	Energy Efficiency in Collective Self-Organized Housing
	1		9	3	28	

Annexure 2.3: Selected business model definitional views

Reference	Description/definition given to BM
Timmers (1998, p.2)	An architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various actors; and description of the sources of revenue.
Petrovic et al. (2001, p.2)	Organisation's core logic for creating value.
Magretta (2002,p.4)	A story that explains how enterprises work and answers the questions: Who is the customer and what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?
Hedman and Kalling (2003, p.49)	A term used to describe the key components of a given business; customers, competitors, offers, activities and organisation, resources, supply of factors and production inputs as well as longitudinal process components to cover the dynamics of the business model overtime.
Seddon and Lewis (2003, p.246)	A business model is an abstract representation of some aspect of a firm's strategy; it outlines the essential details one needs to know to understand how a firm can successfully deliver value to its customers.
Osterwalder (2004, p.15)	A conceptual tool that contains a set of elements and their relationships and which allow for expressing a company's logic of earning money.
Osterwalder et al. (2005, p.5)	A conceptual tool containing a set of objects, concepts and their relationships with the objective of expressing the business logic of a specific firm.
Shafer et al. (2005, p.203)	A model that facilitates analysis, testing, and validation of a firm's strategic choices.
Andersson et al (2006, p.1)	A model created to identify the main actors in a business and the values transferred among them.
Brousseau and Penard (2006, p.82)	A pattern of organizing exchanges and allocating various costs and revenue streams so that the production and exchange of goods and services become viable, in the sense of being self-sustainable on the basis of the income it generates
Kallio et al. (2006, p.282-283)	Means by which a firm is able to create value by coordinating the flow of information, goods and services among the various industry participants including customers, partners within the value chain, competitors and the government, with whom it comes into contact.
Chesbrough (2007, p.12)	A model that performs value creation and value capture while identifying and capturing value from a series of activities, from procuring raw materials to satisfying the final consumer.
Rajala and Westerlund (2007, p.118)	A way of creating value for customers through which a business turns market opportunities into profit through a set of actors, activities and collaboration.
Al-Debei et al. (2008, p.8-9)	A BM is an abstract representation of an organisation, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organisation presently and in the future, as well as all core products and/or services the organisation offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives.

Reference	Description/definition given to BM
Johnson et al. (2008, p.60)	A model consisting of four interlocking elements that taken together create and deliver value .
Zott and Amit (2008, p.3)	A structural template of how a focal firm transacts with customers, partners, and vendors : that is, how it chooses to connect with factor and product markets.
Amit and Zott (2010, p.4)	A BM depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities.
Demil and lecocq (2010, p.231)	A blueprint for the coherence between core BM components and a tool to address change and innovation.
Doz and Kosonen (2010, p.371)	BMs stand as cognitive structures providing a theory of how to set boundaries to the firm, of how to create value, and how to organise its internal structure and governance
Gambardella and McGahan, (2010, p.263)	A business model is an organisation's approach to generating revenue at a reasonable cost, and incorporates assumptions about how it will both create and capture value.
Itami and Nishino (2010, p.364)	A BM is composed of two elements, a business system and a profit model
Kujala et al. (2010, p.98)	A model used for describing the underlying logic for supplier's revenue and profit generation.
McGrath (2010, p.248)	A model that suggests a change to the way that strategies are conceived created and executed.
Sabatier et al. (2010, p.433)	A recipe in which BM elements characterize ingredients, and then 'match' these elements to the business model portfolio concept which highlights the specific combination of resources required to deliver value propositions.
Teece (2010, p.173)	Architecture of revenues, costs and profits connected with the business creating and delivering value to customers.
Bock and George (2011, p.24)	A BM is the design of organizational structures to enact a commercial opportunity.
Casadesus-Masanell and Ricart (2011, p.9)	A Logic of the company as to how it operates, creates and captures value for stakeholders in a competitive marketplace.
Mason and Spring (2011, p.1033)	A frame for action which allows front-line workers to translate, adapt and act in contextually appropriate ways and practices
Onetti et al. (2012, p.24)	Way a company structures its own activities in determining the focus, locus and modus of its business.
Aho (2013, p.113)	A BM defines the architecture, principles, logic and capabilities that an enterprise applies for creating, delivering and capturing value
Arend (2013, p.2)	A useful representation of how the organization creates value through transforming and transferring matter, and by drawing on available factors, fuelled by an identifiable economic engine.
Baden-Fuller and Mangematin (2013, p.419 and p.424)	A stripped-down characterization that captures the essence of the cause-effect relationships among customers, the organization and money A 'manipulable instrument' which can be used to explore cause and effect and understand the world of business better.

Reference	Description/definition given to BM
Beattie and Smith (2013, p.15)	A system-wide description of how companies do business
Boons and Lüdeke-Freund (2013, p.10)	A plan which specifies how a new venture can become profitable and a reference point for communication among different actors.
Fielt (2013, p.92)	A BM describes the value logic of an organization in terms of how it creates and captures customer value and can be concisely represented by an interrelated set of elements that address the customer, value proposition, organizational architecture and economics dimensions.
Frankenberger et al. (2013)	A unit of analysis to describe how the business of a firm works.
Mutka and Aaltonen (2013, p.168)	A model that conceptualizes the way in which a firm creates and captures values and comprises of the strategic choices, the organizational architecture and the economics of the firm.
Nielsen and Lund (2014,p.2)	A BM is a concept which spells out the unique value proposition of the firm and how such a value proposition ought to be implemented.
Kindstrom and Kowalkowski (2014)	A collection of decisions enforced by the authority of the firm on its employees
Casadesus-Masanell and Heilbron (2015)	A tool to visualize changes, which should increase internal transparency, understanding, and awareness of service opportunities and necessary changes.
Martins et al. (2015, p.17)	A distinct and strategic construct that explains the logic for a firm's value creation and capture.
Reim et al. (2015, p.65)	BMs describe the design or architecture of the value creation, delivery and capture mechanisms
Upward and Jones (2015, p.11)	A description of the logic for an organization's existence: who it does it for, to and with; what it does now and in the future; how, where and with what does it do it; and how it defines and measures its success.
Wirtz et al. (2015, p.41)	A simplified and aggregated representation of the relevant activities of a company which show marketable information, products and/or services generated by means of a company's value-added components.
Stefan and Branislav (2016, p.72)	A model that portrays and displays the picture of company resources, which are grouped and arranged in a process to produce values to customers and earnings for firm and thus solves an elementary sense of company existence.
Anwar (2018, p.6)	A BM tells which activities should be executed, by whom and how the players can be connected together.
Ritter and Lettl (2018, p.1)	A business model explains how an actor is positioned within a value network or supply chain and how a business turns inputs into outputs while fulfilling its goals.
Zhao et al. (2018, p.2)	A BM is a mediating construct between technological artefacts and the fulfilment of business strategic goals including the creation of economic value.

Annexure 2.4: BM Main Elements and BM Sub-elements identified in selected articles with their numbers

Reference	No of BM Elements	Number of Main Elements/ Pillars	Number of Sub-Elements	Total	Pillars/ Main elements	Sub-elements of BM Elements
Timmers (1998)	4			4		
Hamel (2000)	4			4		
Cheng et al (2001)	4		8	12		
Rainer and Hans-Dieter (2001)	6		8	14		Goals & Vision, Value Proposition, Actors and governance, Focus, Customer-orientation, Coordination mechanism, Source of revenues, Business logic
Petrovic et al. (2001)	7		3	10		Distribution Model, Marketing Model and Service Model
Dubosson-Torbay et al. (2001)	12	4		16	Product innovation, Customer relationship, Infrastructure management and Financial aspects	
Magretta (2002)	3			3		
Hedman and Kalling (2003)	7		8	15		Physical component, Price/Cost, Service component, Human, Physical, Organisational, Factor Markets, Production Inputs
Ostenwalder (2004)	9	4	9	22	Product, Customer Interface, Infrastructure Management, and Financial Aspects	Offering, Criterion, link, Mechanism, Resources, Activity, Agreement, Revenue stream and pricing, Account
Morris et al. (2005)	6			6		
Shafer et al. (2005)	4		20	24		
Ostenwalder et al. (2005)	9	4		13		
Kallio et al. (2006)	8	2		10	Operator-specific or Internal Factor External Factors	
Rajala and Westerlund (2007)	3			3		

Reference	No of BM Elements	Number of Main Elements/ Pillars	Number of Sub-Elements	Total	Pillars/ Main elements	Sub-elements of BM Elements
Chesbrough (2007a)	6			6		
Al-Debei et al. (2008)	4			4		
Johnson et al. (2008)	4		17	21		Target customer, Job to be done, Offering, Revenue model, Cost structure , Margin model , Resource velocity, People, Technology, products, Equipment, Information, Channels, Partnerships or alliances, Brand, Processes, Rules and metrics, Norms
Kujala et al (2010)	6			6		
McGrath (2010)	2			2		
Teece (2010)	3			3		
Demil and lecocq (2010)	3			3		
Sabatier et al. (2010)	5			5		
Bock and George (2011)	4			4		
Casadesus-Masanell and Ricart (2011)	2		5	7		Policies, assets, governance Flexible, rigid
Mason and Spring (2011)	3		12	15		product, process, core and infrastructure Market and standards, capabilities, transactions, relationships Artifacts, Access, Activities and value
Mokhlesian and Holmen (2012)	9			9		
Onetti et al (2012)	3			3		
Baden-Fuller and Mangematin (2013)	4			4		
Boons and Lüdeke-Freund (2013)	4			4		

Reference	No of BM Elements	Number of Main Elements/ Pillars	Number of Sub-Elements	Total	Pillars/ Main elements	Sub-elements of BM Elements
Beattie and Smith (2013)	4			4		
Fielt (2013)	4			4		
Frankenberger et al. (2013)	4			4		
Mutka and Aaltonen (2013)	8	2		10	Internal elements External elements	
Abuzeinab and Arif (2014)	5			5		
Bocken et al (2014)	3		10	13		Product/service, Customer Segment, Relationships Key activities, Resources, Channels, Partners, Technology Cost structure, Revenue streams
Brege et al. (2014)	5	3		8	Market position, offering and operational platform	
Kindström and Kowalkowski (2014)	10			10		
Pekuri et al (2014)	3			3		
Bertels et al. (2015)	12	3		15	PESTEL factors (Political, Economical, Sociocultural, Technological, Ecological, Legal) Internal dynamics Adaptation Dynamics	
Heikkila et al. (2015)	8		30	38		Created Customer Value, Share/Coverage of The Market Segment, and Website Usage. Service Development, Quality, Customer Satisfaction, And Sustainability. Complexity in The Architecture, Complexity in Databases, Interoperability Requirements, and/or Accessibility and Up-Time Requirements.

Reference	No of BM Elements	Number of Main Elements/ Pillars	Number of Sub-Elements	Total	Pillars/ Main elements	Sub-elements of BM Elements
						Complexity/Variety of Internal Partners, Access to Partners, Complexity/Variety of External Partners, And Characteristics of Network. Value of and to The Network, Profitability, Cost, Including Costs for Investments in Technology and Marketing, And Risks. Size of The Partner Network, Contracts, Importance, And Value Conflicts. Size of The Partner Network, Flow and Volume of Data and Information Between Actors, Information Accessibility, And Knowledge Development. Number of Processes, Throughput, And Variety
Wirtz et al. (2015)	9	3	20	32		
Brink (2016)	11	3		14	Building Blocks: Value proposition, Value creation and delivery and Value capture	
Jabłonski and Jabłonski (2016)	6			6		
Ling and Li (2016)	6			6		
Taran et al. (2016)	5			5		
Fjeldstad and Snow (2018)	4			4		
Lessing and Brege (2018)	3			3		
Zhao et al. (2018)	8			8		
Berg et al. (2019)	4			4		
Das et al. (2019)	9			9		
Todaria et al. (2020)	12		23	35		

Annexure 2.5: Mapping of BM elements in the literature

Theme	Element	Timmers (1998)	Hamel (2000)	Cheng et al. (2001)		Rainer and Hans-Dieter (2001)
V-b	Value proposition	Product architecture				
	Value Network		Value Network	A cooperative virtual network structure	A supply chain infrastructure	Structure
	Value creation					
	Value Capture	Benefits for business actors				
Rv-b	Revenue	Sources of revenues				Revenues
	Profit					
	Costs					
Rs-b	Resources & capabilities		Strategic resources			
Pr-b	Processes & Activities					Processes
Sh-b	Partnerships	Business actors & roles				
	Customers		Customer interface			
	Government policy & regulation					Legal issues
Str-b	Strategic choices		Core Strategy			
	Mission					Mission
Dy-b Op-b	Change management			Organizational adaptation	Change management	
	Technology					Technology
	Culture					
O T H E R	Choices					
	Consequences					
	Negative influence					
	Negative Impact					
	Ecological Footprint					

Theme	Element	Petrovic et al. (2001)		Torbay et al. (2001)		Magretta (2002)
V-b	Value proposition	Value Model		Value proposition	Branding	Value proposition
	Value Network					
	Value creation			Serving the customer		
	Value Capture					
Rv-b	Revenue	Revenue Model		Revenue		Revenue generation
	Profit			Profit		
	Costs			Costs		
Rs-b	Resources & capabilities	Resource Model	Capital Model	Resources/ Assets	Capabilities	
Pr-b	Processes & Activities	Production Model		Activity and Processes		
Sh-b	Partnerships			Partner Network		
	Customers	Customer Relations Model		Getting a feel for the customer	Targeted customer segments	Identifying Customer
	Government policy & regulation					
Str-b	Strategic choices	Market Model				
	Mission					
Dy-b Op-b	Change management					
	Technology					
	Culture					
O T H E R	Choices					
	Consequences					
	Negative influence					
	Negative Impact					
	Ecological Footprint					

Theme	Element	Hedman and Kalling (2003)		Osterwalder (2004)		Morris et al. (2005)	
V-b	Value proposition	Offering		Value Proposition		Factors related to the offering	
	Value Network			Distribution Channels	Relationship Management		
	Value creation			Value Configuration			
	Value Capture						
Rv-b	Revenue			Revenue Model		Economic factors	
	Profit						
	Costs			Cost Structure			
Rs-b	Resources & capabilities	Resources		Capabilities		Internal capability factors	
Pr-b	Processes & Activities	Supply of factors & production inputs	Activities and organization				
Sh-b	Partnerships			Partnerships		Personal/investor factors	
	Customers	Customers		Target Customer			
	Government policy & regulation						
Str-b	Strategic choices	Competitors				Market factors	Competitive strategy factors
	Mission						
Dy-b Op-b	Change management	Longitudinal dimension					
	Technology						
	Culture						
O T H E R	Choices						
	Consequences						
	Negative influence						
	Negative Impact						
	Ecological Footprint						

Theme	Element	Shafer et al. (2005)	Kallio et al. (2006)	Rajala and Westerlund (2007)	Chesbrough (2007)		Al-Debei et al. (2008)
V-b	Value proposition		Product Development Strategy	Value propositions or offerings	Value proposition		Value proposition
	Value Network	Value network	Value chain dynamics		Value network	Value chain	Value Network
	Value creation	Creating value	Value creation strategy				Value Architecture
	Value Capture	Capturing value					
Rv-b	Revenue			Revenue logic	Revenue mechanism(s)		Value Finance
	Profit						
	Costs						
Rs-b	Resources & capabilities			Assets and capabilities			
Pr-b	Processes & Activities		Servicing and Implementation Strategy				
Sh-b	Partnerships						
	Customers		Existing customer base				
	Government policy & regulation		Government policy and regulation				
Str-b	Strategic choices	Strategic choices	Sales and marketing strategy		Target market	Competitive strategy	
	Mission						
Dy-b Op-b	Change management						
	Technology		Technological advancements and constraints				
	Culture						
O T H E R	Choices						
	Consequences						
	Negative influence						
	Negative Impact						
	Ecological Footprint						

Theme	Element	Johnson et al. (2008)	Kujala et al (2010)	McGrath (2010)	Teece (2010)	Demil and lecocq (2010)	Sabatier et al. (2010)
V-b	Value proposition	Customer value proposition (CVP)	Value proposition	Unit of business		Value propositions	Level of the promise (Recipe)
	Value Network		Position in the value network			Organizational Structure	
	Value creation				Create value for customers		
	Value Capture						
Rv-b	Revenue		Logic of revenue generation				
	Profit	Profit formula			Convert payment to profit		
	Costs				Entice payments		
Rs-b	Resources & capabilities	Key resources	Supplier's internal organization and its capabilities			Resources and Competences	The list of ingredients and their required quantities
Pr-b	Processes & Activities	Key processes		Process or operational advantages			The stages of the recipe
Sh-b	Partnerships						
	Customers		Customer				
	Government policy & regulation						
Str-b	Strategic choices		Competitive strategy				Picture of the dish
	Mission						
Dy-b Op-b	Change management						Complementary elements
	Technology						
	Culture						
O T H E R	Choices						
	Consequences						
	Negative influence						
	Negative Impact						
	Ecological Footprint						

Theme	Element	Osterwalder et al. (2010)		Bock and George (2011)	Casadesus-Masanell and Ricart (2011)	Mason and Spring (2011)	Mokhlesian and Holmen (2012)	
		Value Proposition				Market Offering	Value proposition	
V-b	Value proposition	Value Proposition				Market Offering	Value proposition	
	Value Network	Relationship	Distribution Channel	Organizational Design		Network Architecture	distribution channel	
	Value creation		Value Configuration	Value Structure			Value configuration	
	Value Capture							
Rv-b	Revenue		Revenue Model	transactive structure,			Revenue model	
	Profit							
	Costs		Cost Model				Cost structure	
Rs-b	Resources & capabilities		Capability	Resource structure			Capability/core competency	
Pr-b	Processes & Activities							
Sh-b	Partnerships		Partnership				Partner network	
	Customers		Target Customer				Customer interfaces/relationship	Target customer
	Government policy & regulation							
Str-b	Strategic choices							
	Mission							
Dy-b Op-b	Change management							
	Technology					Technology		
	Culture							
O T H E R	Choices				Choices			
	Consequences				Consequences			
	Negative influence							
	Negative Impact							
	Ecological Footprint							

Theme	Element	Onetti et al. (2012)	Boons and Lüdeke-Freund (2013)	Beattie and Smith (2013)		Fielt (2013)	Frankenberger et al. (2013)
V-b	Value proposition	The “focus”	Value Proposition			Value proposition	The What
	Value Network	The “modus”				organizational Architecture	
	Value creation			Value creation and value delivery			
	Value Capture						
Rv-b	Revenue		Financial but Financial aspects/ Value Finance			Value Economics	The Why
	Profit						
	Costs						
Rs-b	Resources & capabilities	The “locus”		Resources	Competencies		
Pr-b	Processes & Activities		Organization of Supply chain				The How
Sh-b	Partnerships						
	Customers		Customer interface			Customer	The Who
	Government policy & regulation						
Str-b	Strategic choices			Strategy and competitive advantage			
	Mission						
Dy-b Op-b	Change management						
	Technology						
	Culture						
O T H E R	Choices						
	Consequences						
	Negative influence						
	Negative Impact						
	Ecological Footprint						

Theme	Element	Mutka and Aaltonen (2013)		Abuzeinab and Arif (2014)	Baden-Fuller and Mangematin (2013)		Bocken et al. (2014)	Brege et al. (2014)
V-b	Value proposition	Offering	Value proposition	Green value proposition (GVP)			Value Proposition	System augmentation (offering)
	Value Network				Value chain and linkages			Role in the building process (market position)
	Value creation						Value Creation and delivery	
	Value Capture						Value Capture	
Rv-b	Revenue	Revenue creation logic		Financial logic (FL)	Monetization			
	Profit							
	Costs							
Rs-b	Resources & capabilities	Resources and capabilities		Key resources (KR)				Complementary resources (operational platform).
Pr-b	Processes & Activities	Internal Organization and Activities		Key activities (KA)				Prefabrication mode (operational platform)
Sh-b	Partnerships	Partner network						
	Customers	Customers		Target groups (TG)	Identifying the customers	Customer engagement		End-user segments (market position)
	Government policy & regulation							
Str-b	Strategic choices	Competitive strategy						
	Mission							
Dy-b Op-b	Change management							
	Technology							
	Culture							
O T H E R	Choices							
	Consequences							
	Negative influence							
	Negative Impact							
	Ecological Footprint							

Theme	Element	Kindström, and Kowalkowski (2014)		Pekuri et al (2014)	Bertels et al. (2015)		Heikkila et al. 2015	Wirtz et al. (2015)	
V-b	Value proposition	Offering		Offering	Value Propositions	Offering	Service	Market offering	
	Value Network	Value network	Structure		Channels		Information exchange	Network	Information exchange
	Value creation			Value Creation System					
	Value Capture						Value exchange		
Rv-b	Revenue	Revenue mechanism		Revenue Model	Revenue streams & Volume		Financial perspective	Revenues	
	Profit					Margins			
	Costs				Cost Structure			Procurement and Finances	
Rs-b	Resources & capabilities				Key Resources		Organizational perspective	Resources	
Pr-b	Processes & Activities	Sales process	Delivery process		Key Activities		Process alignment	Service provisions	
Sh-b	Partnerships				Key partners				
	Customers	Customer relationships			Customer Relations	Customer Segments	Customer perspective	Customers	
	Government policy & regulation								
Str-b	Strategic choices	Strategy						Strategy	
	Mission								
Dy-b Op-b	Change management	Development process			Velocity/ Clock Speed				
	Technology						Technology		
	Culture	Culture							
O T H E R	Choices								
	Consequences								
	Negative influence								
	Negative Impact								
	Ecological Footprint								

Theme	Element	Brink (2016)		Jablonski and Jablonski (2016)		Ling and Li (2016)		Taran et al. (2016)
V-b	Value proposition	Product / service	Value for customer, society, and environment	Value proposition for the customer		Factors related to the offering		Value Proposition
	Value Network	Distribution channels		Organization of internal suppliers & their key capabilities	Position in the value network.			Value Network
	Value creation							Value Configuration
	Value Capture	Value capture for key actors including society						Value Capture
Rv-b	Revenue			Logic of generating income		Economic factors		
	Profit							
	Costs	Cost structure and revenue streams						
Rs-b	Resources & capabilities	Resources				Internal capability factors		
Pr-b	Processes & Activities	Activities						
Sh-b	Partnerships	Partners and suppliers				Personal/ investor factors		Value Segment
	Customers	Customer segments and relationships		The customer				
	Government policy & regulation							
Str-b	Strategic choices	Growth strategy / ethos		Competitive strategy		Market factors	Competitive strategy factors	
	Mission							
Dy-b Op-b	Change management							
	Technology	Technology and product features						
	Culture							
O T H E R	Choices							
	Consequences							
	Negative influence							
	Negative Impact							
	Ecological Footprint							

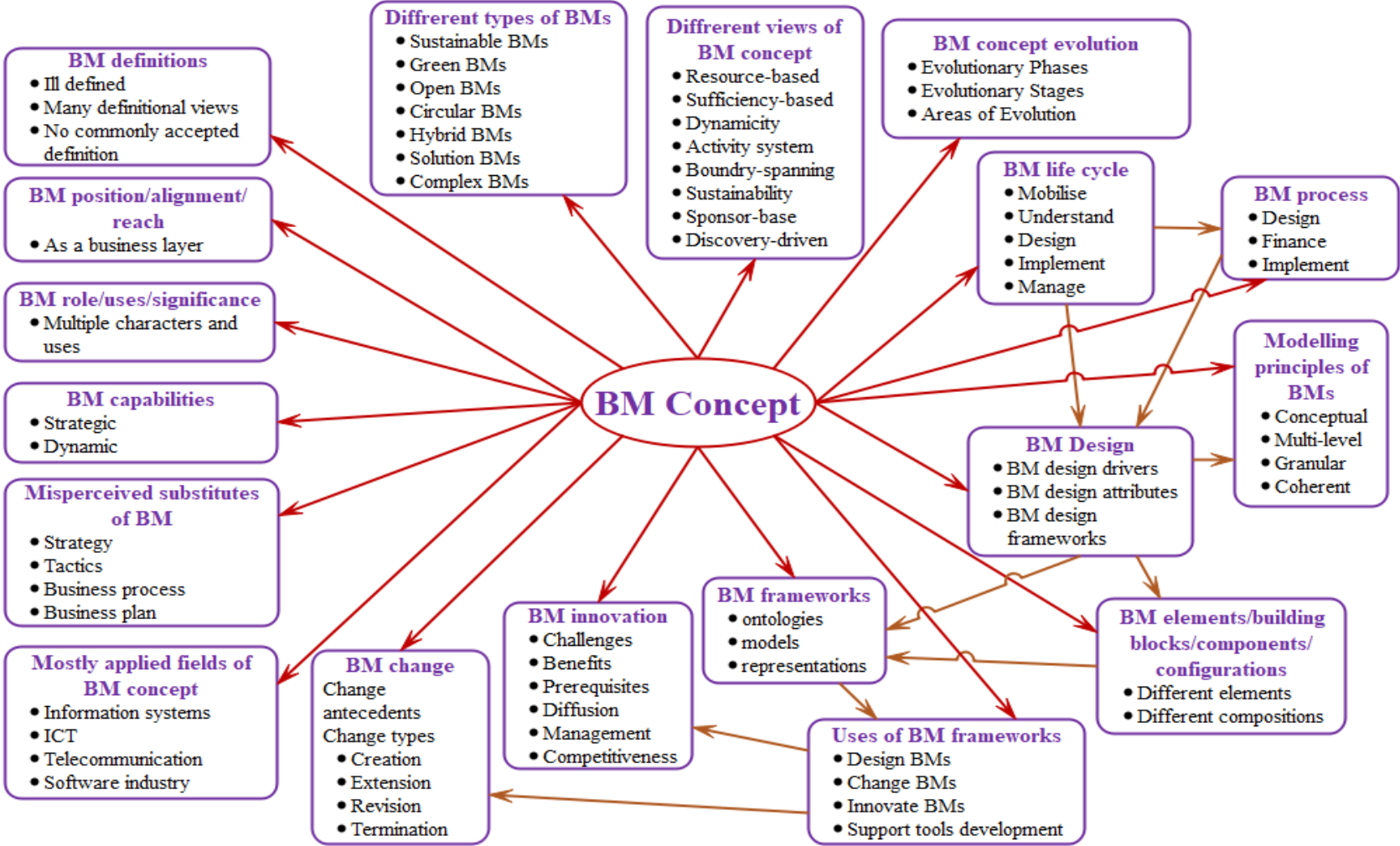
Theme	Element	Fjeldstad and Snow (2018)	Lessing and Brege (2018)	Zhao et al. (2018)		Berg et al. (2019)
V-b	Value proposition	Value proposition	Offering	Product/service	Value proposition	Value proposition
	Value Network			Value network		
	Value creation	Value creation mechanisms				
	Value Capture	Value appropriation mechanisms				
Rv-b	Revenue			Revenue generation logic		
	Profit					profit formula
	Costs					
Rs-b	Resources & capabilities			Resources & capabilities,		resources
Pr-b	Processes & Activities		Operational platform	Internal organization & activities		processes.
Sh-b	Partnerships					
	Customers	Role of customers		Target customer		
	Government policy & regulation					
Str-b	Strategic choices		Market position	Competitive strategy		
	Mission					
Dy-b Op-b	Change management					
	Technology					
	Culture					
O T H E R	Choices					
	Consequences					
	Negative influence					
	Negative Impact					
	Ecological Footprint					

Theme	Element	Das et al. (2020)	Todaria, Azevedo and Ferreira (2020)		
V-b	Value proposition	Value proposition	Transparency	Value Proposition	Social Business Value Proposition
	Value Network	Supply chain			
	Value creation				
	Value Capture		Intended Outputs	Intneded Outcomes	
Rv-b	Revenue	Revenue Streams			
	Profit				
	Costs	Cost structure			
Rs-b	Resources & capabilities	Key resources			
Pr-b	Processes & Activities	Key activities	Starting Situation	Strands of Action	
Sh-b	Partnerships	Key partners			
	Customers	Client relationships	Beneficiary		
	Government policy & regulation				
Str-b	Strategic choices	Potential competition			
	Mission				
Dy-b Op-b	Change management		Steps of Change		
	Technology				
	Culture				
O T H E R	Choices				
	Consequences				
	Negative influence		Negative influence		
	Negative Impact		Negative Impact		
	Ecological Footprint		Ecological Footprint		

Annexure 2.6: Features of different BM ontologies/ frameworks selected from the literature

BM Framework/ ontology	BM Elements		Features
The Business Model Ontology (BMO) by Osterwalder (2004)	Customer Segments Customer Relationships Distribution Channels Value Propositions Key Resources	Key Activities Key Partnerships Revenue Streams Cost Structure	BM Elements grouped into Pillars Include BM Sub-elements Each element described including relationships with other elements Created famous visualisation template BMC
An integrative framework for Entrepreneur’s Business Model by Morris, Scheindehutte and Allen (2005)	How do we create value? (factors related to the offering) Who do we create value for? (market factors) What is our source of competence? (internal capability factors) How do we competitively position ourselves? (strategy factors) How we make money? (economic factors) What are our time, scope, and size ambitions? (personal/investor factors)		Focuses on BM development from an entrepreneurship perspective Include factors to be selected Introduced 3 levels considering different managerial purposes Questions used as BM Elements and no relationship indications No visualisation template
The Four-Box Business Model framework by Johnson (2010)	Customer Value Proposition Profit Formula Key Resources Key Processes		Focuses on BM innovation for companies entering the ‘white space’ Include BM Sub-elements Identified interdependencies between boxes No visualisation template
A Health Information Technology (HIT)-specific BM Ontology by Gand and Esswein (2018)	Actor Customer Relationships Distribution Channel Target Customer Value Propositions Key Partners	Capability Value Configuration Revenue Model Cost Structure Profit	focus on BMs for HIT solutions Took the BMO and add the HIT-specifics Extended the Actor element of the BMO with relationships With the extension, the elements being special within healthcare systems were discussed separately with relationships.
The Ontology for Social Business value proposition by Todaria, Azevedo and Ferreira (2020)	Transparency Beneficiary Social Business Value Proposition Value Proposition Starting Situation Strands Of Action	Intended Outputs Intended Outcomes Steps of Change Negative Influence Negative Impact Ecological Footprint	Extend the BMO to social business covering multiple concepts and viewpoints Social business specific elements were incorporated to the ontology Three sub-ontologies were developed Applied the proposed ontology to the exploratory case study for validation

Annexure 3.1: Business Model Concept map



Annexure 3.2: BM Vocabulary from literature (Sample)

Term	Meaning	Article referred
Activity System	A set of interdependent organizational activities centred on a focal firm and encompasses activities that are either conducted by the focal firm or by partners, customers or vendors	Zott and Amit (2010)
Actor	An actor is an economically independent entity. An actor is often, but not necessarily, a legal entity, such as enterprises and end-consumers	Andersson et al. (2006)
Aggregation	A ‘zooming out’ and looking at the (real) business model from a distance, ‘bunching together’ detailed choices and consequences into larger constructs	Casadesus-Masanell and Ricart (2010)
Assets	Tangible resources deploy	Casadesus-Masanell and Ricart (2010)
BM-Blueprint	In which the individual BM-structural elements of the ideas are embodied.	Bullinger et al. (2016)
Business agility	The capability of organizations to rapidly adapt the organization to a changing environment and changing requirements	Jonkers, Quartel, Berg, and Franken (2011)
Business analysis tools	Business analysis tools might help to extend the analysis of value opportunities by considering potential changes in technology, legislation, social change, environmental pressures and competition that affect the business environment.	Bocken et al. (2013)
Business concept	Business concept is any conceptualization of business reality, such as the business itself along with a company’s strategy and business model. Term “business concept” will progressively disappear from the academic literature	DaSilva and Trkman (2014)
Business model creation	Refers to the transition from “business ideas” to and the materialization of a business idea into a new venture, i.e. Getting a new business model up and running	Cavalcante et al. (2011)
Business model erosion	The declining competitiveness of established business models	McGrath (2010)
Business model extension	Adding activities and/or expanding existing core processes to an existing business model.	Cavalcante et al. (2011)
Business model learning	An established firm modifies its business model in face of competition from a new business model	Teece (2010)
Business model revision	Removing something that modifies an existing business model and replacing it with a new process	Cavalcante et al. (2011)
Business model termination	To abandoning/removing processes	Cavalcante et al. (2011)
Business Modelling Starter Kit	Used to support the establishment of a common ground with respect to the goals and normative orientations of workshop participants	Breuer and Lüdeke-Freund (2014)
Business models function as the recipe	Draw the elements (ingredients) together and ‘cook’ them - arrange and combine them in ways (old and new) through which firms may be successful or not.	Baden-Fuller and Morgan (2010)
Choices	Made by management about how the organization must operate.	Casadesus-Masanell and Ricart (2010)
Closed business models	Focus primarily on internal value creation and rarely collaborate with partners; they only maintain simple buyer-seller relationships with the outside world	Frankenberger et al. (2013)
Collaborative business modelling (CBM)	Collaborative business modelling as an activity where multiple organizations that might differ in type (industry, public research and non-profit), their position in the value chain (manufacturing, service, etc.) and industry (energy,	Rohrbeck et al. (2013)

Term	Meaning	Article referred
	ICT, etc.) Work together to create a value creation system. CBM approach can support the joint development of BMs	
Complementarities	Complementarities are present whenever having a bundle of goods together provides more value than the total value of having each of the goods separately.	Amit and Zott (2001)
Conflicting values	Values which one stakeholder benefit creates a negative for another stakeholder	Bocken et al. (2013)
Conflicting values	Where one stakeholder benefit creates a negative for another stakeholder	Bocken et al. (2013)
Consequences	Consequences of the choices	Casadesus-Masanell and Ricart (2010)
Conventional strategic planning	In conventional strategic planning, the measure of a plan's success is how close your projections came to what happened later on.	McGrath (2010)
Corporate culture	Concerned with the behaviour of the members of organisations.	Dalby et al. (2014)
Cost leadership	Cost leadership means a firm can earn a healthy margin by protecting itself from competitive forces, as compared to its less efficient rivals whose profits have been eroded away by the competition	Ling and Li (2016)
Creative culture	Creative culture facilitates innovative solutions to competitive threats especially as environmental turbulence increases. Represents an important prerequisite capability to innovate	Bock et al. (2012)
Critical capabilities	Dynamic capabilities which enable a company to shape, adapt and renew business models to create value in a sustainable way.	Achtenhagen et al. (2013)
Customer centricity	Customer centricity as a defining characteristic of open business models where the customer should be at the centre of the business model and its primary goal is to create value for the customer	Frankenberger et al. (2013)
Customer engagement	Emphasize the need for identifying the value proposition from each of the customer's perspective, and this process involves a degree of creativity and sensing	Baden-Fuller and Mangematin (2013)
Customer interface	How are downstream relationships with customers structured and managed	Boons and Lüdeke-Freund (2013)
Customer value	Customer benefits such as functionality, convenience, and well-being, which are often intangible	Bocken et al. (2013)
Customer-driven	Based on analysis of the Customer Segments – what different customers and markets, anywhere, would suggest changes in other building blocks and hence a new business model worth pursuing?	Osterwalder and Pigneur (2010)
Decomposition	Some business models are decomposable, in the sense that different groups of choices and consequences do not interact with one another and thus can be analysed in isolation	Casadesus-Masanell and Ricart (2010)
Design	Extending the business model: alternatives can be identified until a best one emerges.	Fritscher and Pigneur (2010)
Discovery driven planning processes	The goal of a discovery-driven plan is to learn as much as possible at the lowest possible cost, bringing us back to the theme of experimentation. Discovery driven planning processes demand that business model assumptions are both articulated and tested.	McGrath (2010)
Dynamic business model	A dynamic business model can and should be capable of exercising both static properties (to ensure the smooth running of existing activities) and flexible characteristics	Cavalcante et al. (2011)

Term	Meaning	Article referred
Dynamic capabilities	The capacity to anticipate, shape, seize opportunities and avoid threats while maintaining competitiveness by improving, combining, protecting and, when deemed necessary, rearranging the company's intangible and tangible assets.	Teece (2010)
Dynamic consistency	The capability that allows a firm to change its BM while at the same time building and maintaining sustainable performance	Demil and lecocq (2010)
Elements of BM	What constitutes BMs, or what aspects need examining when designing, evaluating, and managing BMs	Al-Debei and Avison (2010)
Empiricism	Empiricism is based on Adansonian principles whereby polythetic groups of objects are formed. Polythetic groups of objects '...have the greatest number of shared character states, and no single state is either essential to group membership or sufficient to make an [object] a member of the group'. Classifications that are the product of empiricist philosophy are called taxonomies	Lambert (2015)
Essentialism	Essentialism stems from the Aristotelian view that there exist a few essential characteristics, which define the essence of an organism and that, by identifying these characteristics, classes of organisms can be created. Classifications that are the product of essentialist philosophy are called typologies	Lambert (2015)
Finance-driven.	Based on analysis of the Cost Structure and Revenue Streams – what new revenue streams, pricing structures, or cost savings would suggest changes in other building blocks and hence a new business model worth pursuing?	Osterwalder and Pigneur (2010)
Financial model	Costs and benefits and their distribution across business model stakeholders.	Boons and Lüdeke-Freund (2013)
Flexible	One that respond quickly when underline choice changes	Casadesus-Masanell and Ricart (2010)
Frugal innovation	Frugal innovation is an inclusive approach to innovation that maximizes value for customers, shareholders, and society – while significantly reducing the use of financial and natural resources in developing countries.	Rosca et al. (2017)
Function sematic approach	Used to excerpt possible functions and applications	Bullinger et al 2016
Governance	Arrange decision making rights	Casadesus-Masanell and Ricart (2010)
Horizontal coherence	A horizontal coherence, or an integrated approach to exploring an organization's economic, environmental or social impact, by highlighting key actions and relationships within the nine components of each layer	Joyce and Paquin (2016)
Hybrid business models	The integration of features of two different business models	Martnez-olvera (2009)
Customer sensing	Identifies the firm's targeted user and customer groups	Baden-Fuller and Mangematin (2013)
Implement	The chosen business model: help share the vision and therefore facilitated the implementation	Fritscher and Pigneur (2010)
Infopreneurship	The development and sale of information goods	Andersson et al. (2006)

Term	Meaning	Article referred
Intellectual capital,	A form of capital of growing importance, refers to intangible resources which create company value by giving the company a competitive edge	Beattie and Smith (2013)
Leadership unity	The ability of the top team to make bold, fast decisions, without being bogged down in top-level ‘win-lose’ politics. To build leadership unity, dialoguing, revealing motives, integrating roles, aligning aspirations and interests and caring are needed	Doz and Kosonen (2010)
Lock-in	Prevents the migration of customers and strategic partners to competitors	Amit and Zott (2001)
Manage	The current business model: help to monitor the current situation	Fritscher and Pigneur (2010)
Manipulable instrument	Which can be used to explore the cause and effect and understand the world of business better.	Baden-Fuller and Mangematin (2013)
Mobilize	Generate new business opportunities and set a simple common language	Fritscher and Pigneur (2010)
Model	A schematic description of a system, theory, or phenomenon; A small object, usually built to scale, that represents in detail another, often larger object; or something or someone “serving as an example to be imitated or compared”	Doganova and Eyquem-Renault (2009)
Monetization	Is a key part of value capture and involves more than just pricing, but includes systems determining timings of payments and methods of collecting revenues.	Baden-Fuller and Mangematin (2013)
Multiple-epicentre-driven.	Based on analysis of the Key Partnership, Value Proposition, and Customer Segments – what innovations involving multiple epicentres would suggest changes in other building blocks and hence a new business model worth pursuing?	Osterwalder and Pigneur (2010)
National culture	Concerned with distinguishing between people of different national contexts	Dalby et al. (2014)
Novelty	Being the first to market with a novel business method	Amit and Zott (2001)
Offer-driven.	Based on analysis of the Value Proposition – what different value propositions would suggest changes in other building blocks and hence a new business model worth pursuing?	Osterwalder and Pigneur (2010)
Open business models	An open business model explains value creation and value capture of a focal firm, whereby externally sourced activities contribute significantly to value creation	Frankenberger et al. (2013)
Open system	Open system can be defined as a system that allows interactions between the focal subject or organization and its surrounding environment	Berglund and Sandström (2013)
Open systems theory	Posits that organizations are influenced by their environment	Berglund and Sandström (2013)
Operational platform	Operational platform consists of resources & competences of the company, together with complementary external resources from suppliers & partners, & the manner in which these are organized & used.	Brege et al. (2014)
Organizational structure	Encompasses the organization’s activities and the relations it establishes with other organizations to combine and exploit its resources.	Demil and lecocq (2010)
Outside the core	Beyond the familiar markets and competencies on which the company has built its existing business	Bertels et al. (2015)

Term	Meaning	Article referred
Paradox	A paradox denotes contradictory yet interrelated elements that seem logical in isolation, but absurd and irrational when appearing simultaneously	Klang et al. (2014)
Penrosian approach	Penrosian approach underlines the ongoing dimension of change as a permanent state.	Demil and lecocq (2010)
Policy	Which determine actions take across all operations	Casadesus-Masanell and Ricart (2010)
Power distance	Represents the degree to which the inequality between people is accepted.	Dalby et al. (2014)
Resource fluidity	Resource fluidity: the internal capability to reconfigure capabilities and redeploy resources rapidly.	Doz and Kosonen (2010)
Resource-based view (RBV)	The RBV states that marshalling and uniquely combining a set of complementary and specialized resources and capabilities may lead to value creation	Amit and Zott (2001)
Resource-driven.	Based on analysis of the Key Partnerships – what different resources (including acquisitions) would suggest changes in other building blocks and hence a new business model worth pursuing?	Osterwalder and Pigneur (2010)
Resources and competences	The resources may come from external markets or be developed internally, while the competences refer to the abilities and knowledge managers develop, individually and collectively, to improve, recombine or change the services their resources can offer.	Demil and lecocq (2010)
Revenue model	The specific mode in which a business model enables the generation of revenue, a revenue model describes the revenue sources, their volume and distribution.	Amit and Zott (2001)
Reverse innovation	Reverse innovations are frugal products and services successful in developing markets that make their way back to industrialized countries by creating new market segments.	Rosca et al. (2017)
Rigid	Companies need time to build and are difficult to imitate	Casadesus-Masanell and Ricart (2010)
Role models	Role models are models to be copied	Baden-Fuller and Morgan (2010)
Scale models	Scale models are copies of things	Baden-Fuller and Morgan (2010)
Smart Scouting	A software-based analytical tool to make fast and relevant statements about technologies, markets and competitors.	Bullinger et al 2016
Solution provider	A solution provider is responsible for delivery of the actual solution. Customer closeness and customer focus as important factors for solution success	Frankenberger et al. (2013)
Sponsor-based business model innovations	Where a firm monetizes its product through sponsors rather than setting prices to its customer base	Casadesus-Masanell and Zhu (2013)
Stakeholder approach	A theory of organizational management that seeks the maximization of the interests of all its stakeholders as its highest objective.	Joyce et al. (2015)
Static approach	Allows us to build typologies and study [its] relationship with performance	Demil and lecocq (2010)
Strategic concealment	Strategic concealment refers to a situation where the entrant prefers to not compete through the new business model when it would choose to do so if the incumbent was expected to continue competing through the traditional model.	Casadesus-Masanell and Zhu (2013)

Term	Meaning	Article referred
Strategic effectiveness	Can be measured in terms of market share, brand equity, customer satisfaction & profit margins from premium prices	Brege et al. (2014)
Strategic flexibility	Strategic flexibility involves firm responsiveness to pressures and a proactive rather than reactive attitude	Bock et al. (2012)
Strategic interaction	Organizations affecting each other through strategy - that is, by changing their business models	Casadesus-Masanell and Ricart (2010)
Strategic management	Strategic management aims to identify, achieve, and exploit a position of strategic advantage	Breuer and Lüdeke-Freund 2014
Strategic networks	Strategic networks are 'stable inter-organizational ties which are strategically important to participating firms	Amit and Zott (2001)
Strategic revelation	Strategic revelation refers to a situation where the entrant prefers to compete through the new business model when it would choose not to do so if the incumbent was expected to continue competing through the traditional model.	Casadesus-Masanell and Zhu (2013)
Strategic sensitivity	The sharpness of perception of, and the intensity of awareness and attention to, strategic developments. Anticipating, experimenting, distancing, abstracting and reframing can sharpen strategic sensitivity	Doz and Kosonen (2010)
Strategy	Strategy refers to the choice of business model through which the firm will compete in the marketplace	Casadesus-Masanell and Ricart (2010)
Strategy	Strategy entails devising dynamic capabilities able to respond to contingencies through the organization's business model.	DaSilva and Trkman (2014)
Sufficiency-based approach	Takes an alternative direction to doing business – directly seeking to reduce or moderate consumption	Bocken et al.(2014) ; Bocken and Short (2015)
Sufficiency-driven business models	Focus on influencing consumption behaviour, which involves for example, a fundamental shift in promotion and sales tactics (e.g. No aggressive or manipulative 'over-selling'), eschewing fast fashion trends, providing consumer education and 'choice editing' to reduce access to sustainably undesirable products, and product design changes to enhance durability, reparability and longevity	Bocken et al. (2014) ; Bocken and Short (2015)
Sustainable business models	Sustainable business models seek to go beyond delivering economic value and include a consideration of other forms of value for a broader range of stakeholders. Defined as business models that create competitive advantage through superior customer value while contributing to sustainable development of the company and society	Ludeke-Freund (2010)
Systemic instruments	Aim to define new ways to maximize the impact of public policies on complex systems	Cocchi (2013)
Tactical interaction	Where organizations affect each other when acting within the bounds set by their business models; has well-defined rules of play because business models constrain the tactical sets and game theory can easily be applied to predict competitive dynamics and outcomes	Casadesus-Masanell and Ricart (2010)
Tactics	Tactics refers to the residual choices open to a firm by virtue of the business model it chooses to employ	Casadesus-Masanell and Ricart (2010)

Term	Meaning	Article referred
The Decision Model (TDM)	The Decision Model (TDM) is a platform- and technology-independent intellectual template for perceiving, organizing, and managing the business logic behind a business decision.	Jonkers et al. (2013)
The evolutionary view	The evolutionary approach to understanding business models is based on a view that strategists engage in local search 'in response to specific problems or opportunities	Martins et al. (2015)
The market position	Defines and distinguishes the roles taken in the marketplace and is closely connected to strategic effectiveness	Brege et al. (2014)
The modelling principles of BMs,	That is, what guidelines organizations need to draw upon when modelling their BMs, what is characteristic in BMs, and what features are included.	Al-Debei and Avison (2010)
The reach of the BM concept	That is, the positioning of the BM concept within organizations, and what sort of relations exist between the BM concept and other related notions such as strategy, business process, and IS.	Al-Debei and Avison (2010)
Transaction content	Refers to the goods or information that are being exchanged, and to the resources and capabilities that are required to enable the exchange.	Amit and Zott (2001)
Transaction cost economics	Transaction cost economics identifies transaction efficiency as a major source of value, as enhanced efficiency reduces costs.	Amit and Zott (2001)
Transaction governance	Refers to the ways in which flows of information, resources, and goods are controlled by the relevant parties. It also refers to the legal form of organization, and to the incentives for the participants in transactions.	Amit and Zott (2001)
Transaction structure	Refers to the parties that participate in the exchange and the ways in which these parties are linked. Transaction structure also includes the order in which exchanges take place (i.e., their sequencing), and the adopted exchange mechanism for enabling transactions. The choice of transaction structure influences the flexibility, adaptability, and scalability of the actual transactions	Amit and Zott (2001)
Transaction value	Economic or exchange value, paid by the buyer to the producer; generally defined financially, although it may also include intangible benefits such as market access	Bocken et al. (2013)
Transformational approach	Deals with the major managerial question of 'how to change it'	Demil and lecocq (2010)
Trend Arena	An innovative tool to identify, describe and evaluate future trends systematically.	Bullinger et al 2016
Understand	The current situation: regroup the collected information and hints at missing information.	Fritscher and Pigneur (2010)
Value architecture	The value architecture component revolves around organizational resources and capabilities as well as their configurations	Al-Debei et al. (2008)
Value arena	Objective is to offer customers the greatest possible technical and social utility in every area, thereby attaining maximum value added.	Bullinger et al 2016
Value chain	A value chain transforms inputs into products, as in a manufacturing firm. Value chains form sequentially linked value system of suppliers, partners, and customers.	Fjeldstad and Snow (2018)
Value chain analysis	Identifies activities of the firm and studies their economic implications	Amit and Zott (2001)
Value chain and linkages	The mechanisms the firm uses to deliver its product or service to the customer	Baden-Fuller and Mangematin (2013)

Term	Meaning	Article referred
Value configuration	Refers to the arrangement of activities and resources, which means it stands in close relation to many of the other business model elements.	Mokhlesian and Holmen (2012)
Value Constellation	That is, the answer to the question: ‘How do we deliver this offer to our customers?’ This involves not only the company’s own value chain but also its value network with its suppliers and partners	Yunus et al. (2010)
Value destroyed	Negative value outcomes	Bocken et al. (2013)
Value finance	The value finance component revolves around the financial arrangements the business organization conducts for its value proposition and value architecture.	Al-Debei et al. (2008)
Value innovation	Creating new forms of customer value, focusing on use value and how the firm captures value through transaction value	Bocken et al. (2013)
Value interface	A value interface consists of in and out ports that belong to the same actor. Value interfaces are used to model economic reciprocity.	Andersson et al. (2006)
Value mapping tool	A “value mapping tool” is conceived to help companies create value propositions to support business modelling	Bocken et al. (2013)
Value migration	Value migration can be understood as the shifting of value-creating forces that over time determine the profit level of firms.	Jacobides and macduffie (2013)
Value missed	Value squandered, wasted or inadequately captured	Bocken et al. (2013)
Value network	A value network links nodes e customers, things, and places e and provides services that allow various kinds of exchanges among them.	Fjeldstad and Snow (2018)
Value object	A value object is something that is of economic value for at least one actor	Andersson et al. (2006)
Value opportunities	New opportunities for additional value creation and capture	Bocken et al. (2013)
Value port	A value port is used by an actor to provide or receive value objects to or from other actors	Andersson et al. (2006)
Value proposition	Refers to the benefit of an offer from the perspective of the customer.	Mokhlesian and Holmen (2012)
Value proposition	That is, the answer to the question: ‘Who are our customers and what do we offer to them that they value?’	Yunus et al. (2010)
Value proposition	Value proposition: what value is embedded in the product/service offered by the firm;	Boons and Lüdeke-Freund (2013)
Value propositions	A company delivers to customers, in the form of its products and services	Demil and lecocq (2010)
Value shop	A value shop resolves customer problems on a case-by-case basis. Value shops form reciprocally linked value systems of referring, sub-contracting, and collaborating firms that together harness the knowledge required to develop the desired solutions.	Fjeldstad and Snow (2018)
Vertical coherence	Connecting the components of each layer to their analogs in the other layers, further elucidating key actions and connections and their impacts across layers.	Joyce and Paquin (2016)
Virtual markets	Virtual markets refer to settings in which business transactions are conducted via open networks based on the fixed and wireless Internet infrastructure.	Amit and Zott (2001)
Virtuous Cycles	Company make choices resulting consequences, consequences enable further choices, and so on. This process generates Virtuous Cycles.	Casadesus-Masanell and Ricart (2010)

Annexure 3.3

SEMI - STRUCTURED INTERVIEW GUIDELINE – PHASE I

Dear Sir /Madam,

Thank you for agreeing to partake in interviews conduct for this research project. Your participation will be completely confidential, and you will remain completely anonymous throughout this process. The data gathered within this survey will not be subjected to any public disclosure and is for use only as part of a PhD research project. The PhD project aims to *develop a Business Model ontology in the construction context to facilitate contractors in designing Business Models (BMs)*.

Your honest and true comments during the interview would add much value to this research's outcome.

Company Name:.....

Name(optional):.....

Designation:.....

Date:.....

How long have you been with the company?

1. What is your idea about the nature of the construction business?

Table 1 gives a brief explanation of each attribute.

2. What are the business attributes that your company considered when making business judgments in relation to this list of BM elements?
3. Can you please mention the the appropriate terms which can be used for each attribute in relation to your company business?
4. Any other attribute that you use and think as essential for the construction business as a contractor company?
5. Does your company have a Business Model?
6. What is your idea about the Business Model concept?
7. What is your opinion regarding specifically defining BM in the context of the construction business?

*Thank you for your assistance
Dilani Abeynayake*

Table 1 -Explanations of attributes – Attachment for Semi-structured interview guideline - Phase I

No	Attribute	Explanation
1	Value proposition	A promise of value to be delivered Service or feature intended to make a company attractive to customers
2	Value Network	Value network represents the arrangements which communicate and collaborate the organization's needs. (External & internal value networks)
3	Value creation	Value creation is a firm's primary value-adding activities which describe the arrangement of activities and resources required to create value for the customers, employees and investors
4	Value Capture	Value capture describes how and how much the customers pay for the delivered products/services offered by the firm. (not only money)
5	Revenue	Revenue is the income that a business has from its normal business activities like services to customers
6	Profit	Profit is the difference between revenues and costs
7	Costs	Cost is the monetary value that a company has spent in order to create value
8	Resources	Resources mainly include the people, technology, products, facilities, equipment, channels, and brand which are required to deliver the value proposition to the customers
	Capabilities	Capabilities are abilities and knowledge the managers develop, individually and collectively, to improve, recombine or change the services that they offer
9	Processes & activities	Processes show the elements of the value creation process. Business process refers to a wide range of structured, chained activities or tasks conducted by people or equipment to produce a specific service or product for a particular user or consumer.
10	Partnerships/ Subsidiaries	A Partnership is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer Subsidiaries are owned and controlled by the parent company
11	Customers	A person who purchases goods or services from another
12	Government policies and regulations	
13	Strategic choices	The strategy describes the way that firms choose to compete or hold an advantage over their competitors
14	Mission	
15	Change management	The implementation of human, organizational, and cultural enablers which helps the organization's employees to adapt to the changes in business
16	Technology	The usage and knowledge of tools, techniques, systems, methods of organizations or material products.
17	Culture	Culture of the organization

Annexure 3.4 - Alternative terms for elements of a business model

No	Element	Alternative terms
1	Value proposition	Value proposition Unit of business The “focus” The What Value Model Service provisions Service perspective Product Product architecture Level of the promise (Recipe) Market Offering
2	Value Network	Value Network Network Position in the value network Network Architecture Information exchange Relationship Management Channels Distribution Channels Organizational Structure
3	Value creation	Value creation Value Configuration Value creation strategy Value Architecture Value Creation and delivery Product Development Strategy
4	Value Capture	Value Capture Benefits for business actors The Why Value appropriation
5	Customers	Customers Identifying Customer Customer relationship Customer interface Customer Relations Model Existing customer base

No	Element	Alternative terms
		Customer engagement Customer perspective Target Customer Targeted customer segments The Who Value Segment
6	Revenue	Revenue Revenue Streams & Volume Sources of revenues Revenue mechanism(s) Revenue Model Revenue generation Logic of revenue generation Revenue logic Revenue creation logic The Why Financial Aspects Monetization Financial Model Capital Model Value Finance Financial perspective
7	Costs	Costs Cost Structure Cost Model
8	Profit	Profit Profit formula Convert payment to profit Margin
9	Resources and Capabilities	Resources Resources & Assets Resource Model Strategic resources Assets Ingredients Capabilities Competences Internal capability factors
10	Processes and activities	Processes Activities and Processes Key processes Servicing and Implementation strategy Delivery process

No	Element	Alternative terms
		Process or operational advantages
		Key Activities
		Organization of Supply chain
		Value chain & linkages
		Value chain dynamics
		Production Model
		The How
		The “modus”
11	Partnerships	Partnerships & Subsidiaries
		Business actors and roles
		Partner Network
		Investor factors
		Key partners
12	Strategic choices	Strategic choices
		Strategy and Competitive advantage
		Core Strategy
		Competitors
		Competitive Strategy
		Market Model
		Target market
		Sales and marketing strategy
		Market factors
13	Mission	
14	Change management	Change management
		Organizational adaptation
		Longitudinal dimension
15	Technology	Technology
		Technological advancements and constraints
		Technical perspective
16	Government policy and regulation	Government policy and regulation
		Legal issues
17	Culture	Culture

Annexure 3.5

SEMI - STRUCTURED INTERVIEW GUIDELINE – PHASE II

Dear Sir /Madam,

Thank you for agreeing to partake in interviews conduct for this research project. Your participation will be completely confidential, and you will remain completely anonymous throughout this process. The data gathered within this survey will not be subjected to any public disclosure and is for use only as part of a PhD research project. The PhD project aims to *develop a Business Model ontology in the construction context to facilitate contractors in designing Business Models (BMs)*.

Your honest and true comments during the interview would add much value to this research's outcome.

Name

(optional):.....

Designation:.....

Date:.....

1. What is your idea about the nature of the construction business?
2. What is your idea about the Business Models application in the contractor firms?
3. What is your opinion regarding specifically defining BM in the context of the construction business?
4. Could you comment on the following definition of the Construction Business Model (CBM)?

A CBM is a simplified conceptual representation of a construction business that performs value creation according to Client requirements by identifying the appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes and the status of the key company resources towards revenue and profit generation while expressing the company's strategic choices with the awareness of the changes required and opportunities available.

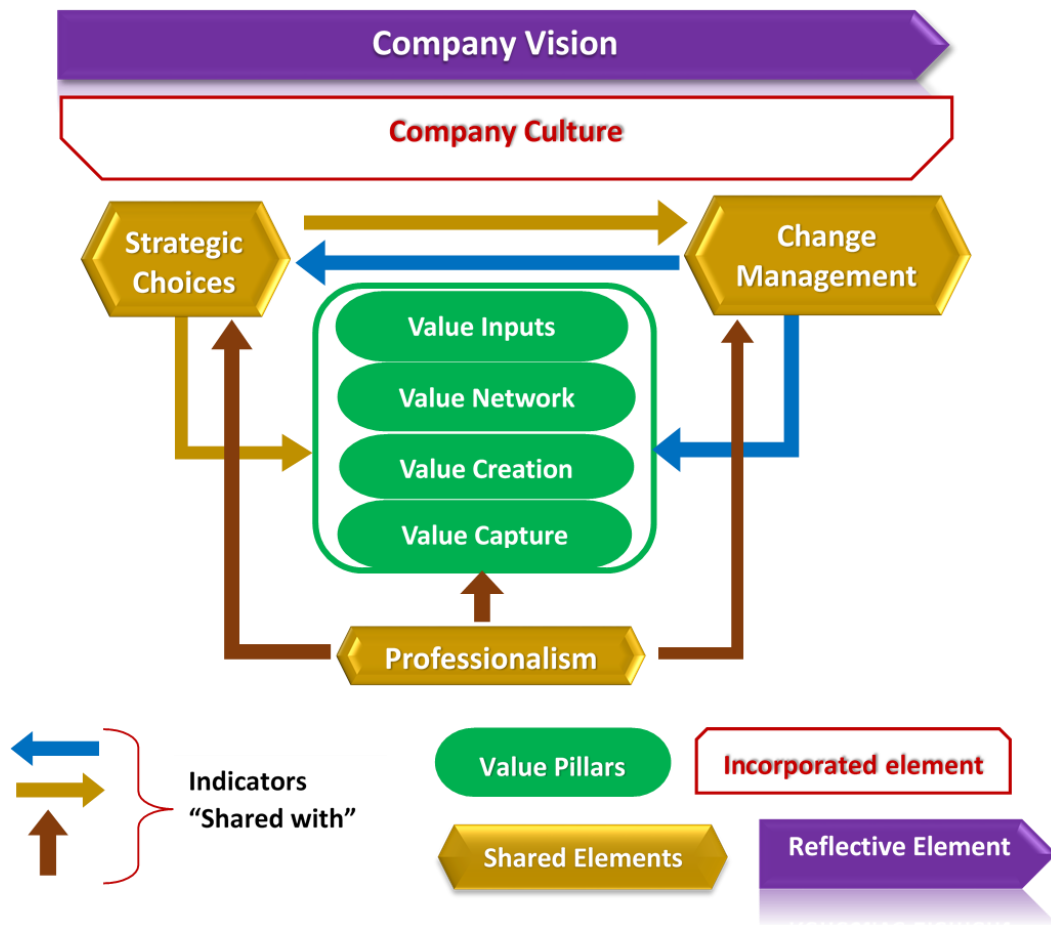
Attachments 1, 2 and 3 show the selected elements and their taxonomies to develop a BM ontology/framework from Phase I findings.

5. Do you agree with the identified BM elements (please refer Attachments 1, 2 and 3) concerning the construction contracting business, especially when making business judgements?
6. Do you agree about considering ‘Value Inputs’, ‘Value Networks’, ‘Value Creation’ and ‘Value Capture’ as main elements (***Value Pillars***) of the framework?
7. Please comment on the taxonomy levels given for four (04) ***Value Pillars*** in Attachments 2 and 3?
8. Do you agree to consider ‘Strategic Choices’, ‘Change Management’ and ‘Professionalism’ as ***Shared elements*** which are common to all the other elements (refer Attachment 1)?
9. Would you consider ‘Company Vision’ as a ***Reflective element*** (because Vision & Mission is the image of a company, requiring representation/ embodied in all the company’s business actions) and ‘Company Culture’ as an ***Incorporated element*** (because every organization have their own culture)? (refer Attachment 1)
10. Please comment on the other relationships among the elements?

Thank you for your assistance
Dilani Abeynayake

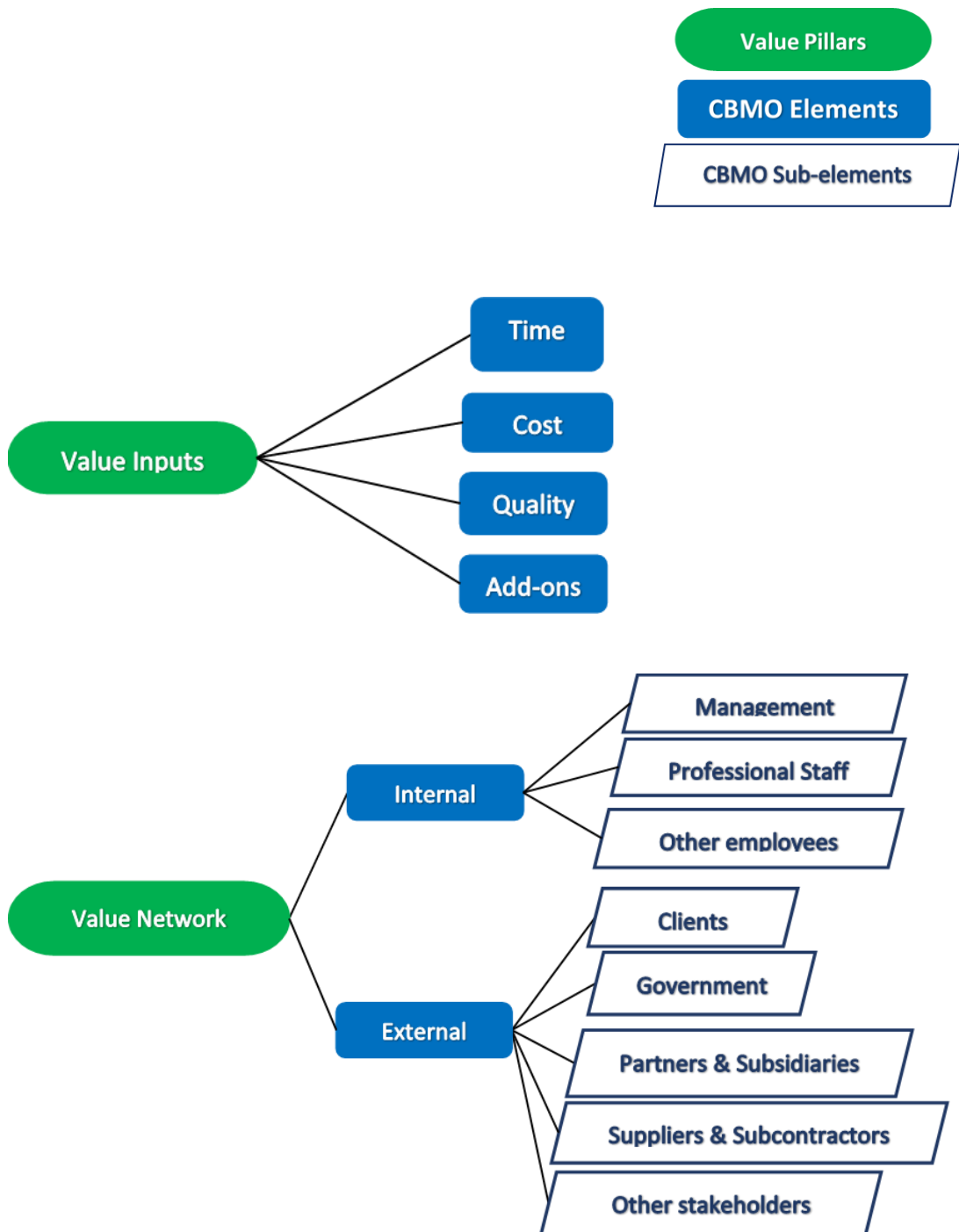
Attachment 1 for Semi-structured interview guideline- Phase II

The framework developed based on Phase I findings



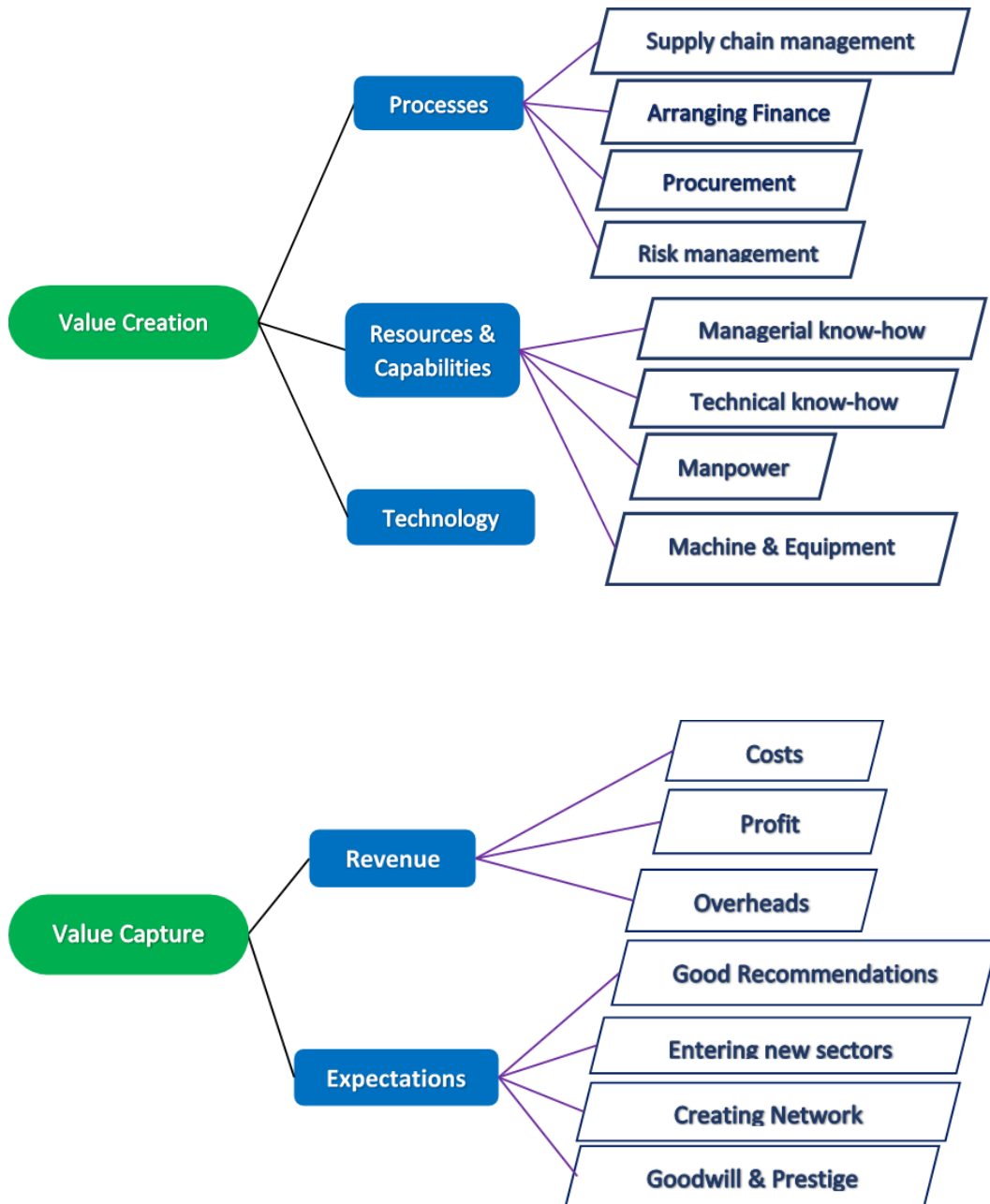
Attachment 2 for Semi-structured interview guideline- Phase II

Individual taxonomies of Value Inputs and Value Network



Attachment 3 for Semi-structured interview guideline- Phase II

Individual taxonomies of Value Creation and Value Capture



Annexure 5.1: Changes in Proposed CBM definition after Validation at

Phase II

Proposed CBM Definition	Validated CBM Definition
<p><i>“A CBM is a simplified conceptual representation of construction business that performs value creation according to Client requirements by identifying the <u>appropriate level of involvement of the relevant stakeholders in the key managerial and operational processes</u> and <u>the status of the key company resources</u> towards revenue and profit generation while expressing the company’s strategic choices with the awareness of the changes required and opportunities available”.</i></p>	<p><i>“A CBM is a simplified conceptual representation of construction business that performs value creation as per Client requirements with key resources and capabilities, considering <u>the appropriate level of involvement of relevant stakeholders in the key processes</u> towards revenue and profit generation while expressing firm’s strategic choices with awareness of necessary changes and opportunities.”</i></p>

Note :

- Coloured words (purple, blue and red) – show changes in words
- Underlined sentences – show sequence changes
- Highlighted in light blue – shows the added word

Annexure 5.2 : Summary of describing parameters of CBMO elements after Phase II


CBMO element	Describing parameters	
Company Vision /Goals	Meaning Main Concerns	
Company Culture	Meaning Main Concerns	Nature of Construction business culture Different Cultures (Examples)
Strategic Choices	Meaning Factors affecting Factors to consider	Examples for construction business strategies Marketing Aspects
Change	Meaning Reasons for Change Barriers for Change	Drivers for Change Concerns when changing Examples for Change adaptation methods
Professionalism	Meaning Importance	Enablers Main Concerns
Revenue	Meaning Nature of Construction business revenue Factors to consider in Revenue generation	
Costs	Meaning Ways of incurring Cost Ways of minimising Cost	
Value Inputs	Meaning Purpose(s) Set of CBM Elements	
Primary Inputs	Meaning Methods of providing Primary Inputs	
Add-Ons	Meaning Examples for Add-ons	
Value Stakeholders	Meaning Purpose(s) Set of CBM Elements	
Client	Meaning Process of Handling Client	
Partners	Meaning Purpose / expected benefits	Factors to consider in selecting Partners Main Concerns when creating partnerships
Key Internal Team	Meaning Factors to consider in the selection Method to enhance efficiency and effectiveness	
Key Connected Stakeholders	Meaning Set of CBM Sub-elements	
Government	Meaning Ways to deal with as a Regulatory body	Ways to deal with as a Policymaker
Subsidiaries	Meaning Expected benefits	
Key Subcontractors	Meaning Expected characteristics Main factors to consider in selecting	


CBMO element	Describing parameters
Key Suppliers	Meaning Main factors to consider in selecting
Value Creation	Meaning Method(s) to use Set of CBM Elements
Key Processes	Meaning Set of CBM Sub-elements
Budgeting & Planning	Main Concerns
Financial Management	Main Concerns
Supply Chain Management	Main Concerns
Risk Management	Main Concerns
Controlling & Monitoring	Main Concerns
Resources & Capabilities	Meaning Set of CBM Sub-elements
Construction Expertise	Factors to Consider Methods of obtaining
Workmanship	Factors to Consider Methods of obtaining
Plant & Equipment	Factors to Consider Methods of obtaining
Technology & Innovations	Meaning Main Concerns
Value Capture	Meaning Factors affecting Set of CBM Elements
Profit	Meaning Main Concerns
Expectations	Meaning Examples for Expectations

Annexure 5.3: Meanings of CBMO elements


CBMO element	Meaning
Company Vision /Goals	Which can be used as the drive mechanism to run the business
Company Culture	The condition within an organisation that guides the organisation and shapes the attitude of its employees.
Strategic Choices	The decision to select a proposal/idea/mechanism to achieve something which contributes to business and project success
Change	The move of the company from the current position to a better position contributes to business and project success
Professionalism	The demonstration of the behaviours of professionals in the company that takes the construction business toward success
Revenue	The total income of the construction business that the company receives from a particular Client for the job/project.
Costs	All costs incurred for the job (project) with respect to the design, construction and equipping, including overheads
Value Inputs	Value Inputs are a company's services that are of value to the Client and are attract future Clients
Primary Inputs	Company's services that are of primary value to the Client and are primarily needed by the Client
Add-Ons	Company's services that are of additional value to the Client and are additionally expected by the Client.
Value Stakeholders	Value Stakeholders have an interest in company value creation or/and are involved in creating values
Client	For whom the construction company creates value and delivers Value Inputs to capture value
Partners	With whom the construction company has partnerships to create value for the Client
Key Internal Team	The team of the company's internal staff who involve in creating value for the Client
Key Connected Stakeholders	The other vital external stakeholders of the company who are connected in creating value for the Client
Value Creation	Value Creation describes the arrangement of key processes, resources and capabilities and technology required to create value
Key Processes	Processes are the company's primary value-adding activities that have maximum impact on the success and survival of the company
Resources & Capabilities	The sources that create values and allow a company to do the business and face competition
Technology & Innovations	New or improved products or processes used for creating values
Value Capture	Monetary and nonmonetary benefits received from the Client for the delivered service/ value
Profit	Difference between revenue and costs
Expectations	Benefits expected from the Client other than Profit and that explore opportunities for the company


Annexure 5.4 –A: Options/ Examples available for guiding questions of Inherent Element, Shared Elements, Bridging Elements and Value Pillars

	Guiding question	Options/ examples 	
Company Culture	What is our Company Culture?	<ul style="list-style-type: none"> Rewarding for performance Learning and development Anti-corruption Zero tolerance for unethical behaviour Take responsibility (E.g. for community and environmental impacts) Quality and reliability Teamwork Cross-functional collaboration 	<ul style="list-style-type: none"> Mutual respect Trust and commitment Transparency Aggressive Rigid Unprofessional Money first
Strategic Choices	What are the factors to be considered in Strategic Choices?	<ul style="list-style-type: none"> Time constraints Costs and benefits Market dynamics and trends 	<ul style="list-style-type: none"> Information constraints Impact of past strategies Strategy implementation
	What strategies can be used for the situation/project?	<ul style="list-style-type: none"> Bidding Strategies Competitive Strategies Differentiation Strategies 	<ul style="list-style-type: none"> Marketing Strategies Networking Strategies Change and Adaptability Strategies
	What are our Marketing aspects?	<ul style="list-style-type: none"> Value Inputs Professionalism Visionary Leadership 	<ul style="list-style-type: none"> Word-of-mouth advertising Partnerships
Change	What are the reasons for the change?	<ul style="list-style-type: none"> Change in technology Change in law and regulations Change in Clients' taste and requirements Change in economic situation and policies Change in weather 	<ul style="list-style-type: none"> Change in political leaders Influence from market lobbying groups Unexpected situations Change in international factors
	What are the barriers to our company's change?	<ul style="list-style-type: none"> Different knowledge levels Different attitudes Culture of the company 	<ul style="list-style-type: none"> Organizational resources & capabilities Leadership
	What are the drivers to our company's change?	<ul style="list-style-type: none"> Flexibility Responsiveness Agility 	<ul style="list-style-type: none"> Adaptability Change in the way of thinking
Professionalism	Why do we need the Power of Professionalism as a Construction Company?	<ul style="list-style-type: none"> To attract clients and maintain positive relationships To build and maintain progressive, sustainable relationships with Partners To maintain a cordial relationship with competitors and the external world To win the trust of stakeholders 	<ul style="list-style-type: none"> To deal with statutory authorities To comply with laws, rules and regulations To ensure a strong market reputation To drive towards innovative solutions
	What are the enablers for our power of Professionalism?	<ul style="list-style-type: none"> Interpersonal skills Contingency Management skills Contextual Intelligence Leadership Skills 	<ul style="list-style-type: none"> Reliability Responsiveness Higher visibility Ethical background

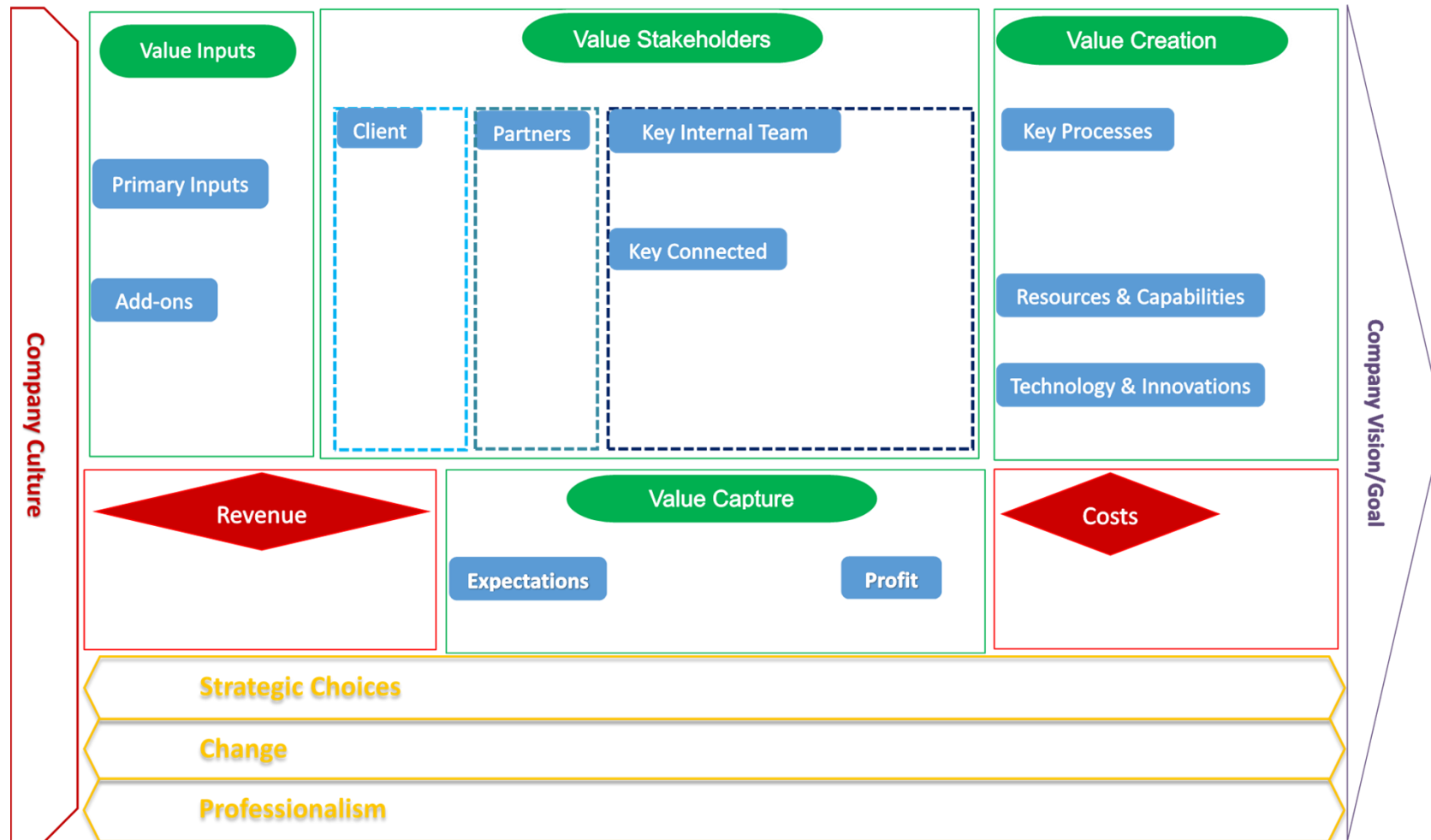
	Guiding question	Options/ examples 	
Revenue	What factors do we have to consider when increasing Revenue?	<ul style="list-style-type: none"> • Time frame • Project size • Nature of Client & consultant • Client's financial status 	<ul style="list-style-type: none"> • Workload • The extent of capacity build-up • Project nature
Costs	How can we minimize costs?	<ul style="list-style-type: none"> • Identify the expensive resources & processes and their priority level • Consider alternatives • Effectively manage material usage and machine utilization • Use new technology/ innovations • Negotiations and renegotiations 	<ul style="list-style-type: none"> • Productivity improvements • Tax-free purchases • Limit capacity building • Control overheads • Cost controlling and monitoring • Build Good Relationships with suppliers and subcontractors to get discounts
Value Inputs	Why do we need to provide this Client with Value Inputs?	<ul style="list-style-type: none"> • To get Clients' recommendations • To survive in the market • To enhance Company experience and qualifications • To create a good image • To give moral worth to the company's service • To create a positive attitude about the company among Clients and Consultants 	
Value Stakeholders	Why do we need Value Stakeholders?	<ul style="list-style-type: none"> • To have payments or fees/Profit • To obtain materials, products, or services • To get jobs • To continue jobs • To complete jobs • To be competitive • To get access through contacts • To exchange information, knowledge, and skills • To get reputation & popularity • To survive in the market • To achieve business success • To acquire overseas market 	
Value Creation	What are the ways of creating value?	<ul style="list-style-type: none"> • Having partnerships or joint ventures • Streamlined processes • Enhance shared understanding of Clients' requirements and goals of each project • Quality control and quality assurance systems • Professionalism • Strong Leadership • A good and cohesive multi-disciplinary team • Co-creation of value with stakeholders • Modern technologies and concepts 	
Value Capture	What are the other expectations from the Client?	<ul style="list-style-type: none"> • The current situation of the business and the industry are affected • Need proper Cash flow management • Nature and type of Client 	

Annexure 5.4 –B: Options/ Examples available for guiding questions of CBM Elements of Value Pillars

		Guiding question	Options/ examples 	
Value Inputs	Primary Inputs	What are Primary Value Inputs expected by the Client?	<ul style="list-style-type: none"> On-time delivery Shorter time delivery Cost advantage 	<ul style="list-style-type: none"> Guaranteed Quality On spec/ optimal design
	Add-Ons	What Add-ons may the Client expect?	<ul style="list-style-type: none"> Constructability competence Predictability Worry-free/ Hassel free Innovative processes and products According to the plan and the Client's expectations No defects Service for the whole package 	<ul style="list-style-type: none"> Smooth Post contract dealing Connectivity Less/no contribution to litigation history Confidentiality maintenance Health/ safety & environmental concerns and records Sustainability policy & practices
Value Stakeholders	Client	What are the approaches of maintaining relationships with Client?	<ul style="list-style-type: none"> Assign the right person to deal with Maintain a high level of client satisfaction Open communication/ be available Maintain continuous dialogue Maintain Confidentiality Be flexible 	<ul style="list-style-type: none"> Work positively Not being too official and contractual Professionalism Maintain client loyalty Handling Client grievances
	Partners	Why do we need Partnership/s?	<ul style="list-style-type: none"> Strength in wining jobs Sharing knowledge Getting work experience Cost-sharing Sharing obligations 	<ul style="list-style-type: none"> Expedite works Enhance capacity & capability Obtain machines and equipment Overseas expansion
	Key Internal Team	How can the efficiency of the team be enhanced?	<ul style="list-style-type: none"> Set targets Provide most up-to-date information Best suit leadership Training and development 	<ul style="list-style-type: none"> Open-door policy Performance appraisal & rewarding Welfare activities
	Key Connected Stakeholders	Can we expect the required qualities from the Key Subcontractors ?	<ul style="list-style-type: none"> Capability in carrying out the works Adherence to ethical conduct Work uninterruptedly Be trustworthy Competitive in terms of prices 	<ul style="list-style-type: none"> Quality in service Flexibility Easy to communicate with Possessing a good past track record Commitment to teamwork

		Guiding question	Options/ examples 	
Value Creation	Resources & Capabilities	How are we going to allocate our Resources & Capabilities?	<ul style="list-style-type: none"> • Use own resources & capabilities • Sub-contracting • Hiring • Purchasing 	<ul style="list-style-type: none"> • Out-sourcing • Consulting • Recruiting • Having Partnerships/ Joint Ventures
Value Capture	Expectations	What are the other expectations from the Client?	<ul style="list-style-type: none"> • Maintain overheads • Have good recommendations • Have positive word-of-mouth advertising • Enter new sectors 	<ul style="list-style-type: none"> • Receive Goodwill & Prestige • Create network • Maintain track records

Annexure 5.5: Construction Business Model Ontology Skeleton (CBMOS)



Annexure 5.6: Step-by-Step Guide for CBMO

STEP-BY-STEP GUIDE

CONSTRUCTION BUSINESS MODEL

ONTOLOGY

FOR

CONSTRUCTION CONTRACTORS

CONTENTS OF STEP-BY-STEP GUIDE FOR CBMO

1	PURPOSE OF THE STEP-BY-STEP GUIDE FOR CONSTRUCTION BUSINESS MODEL ONTOLOGY (CBMO)
2	WHAT IS CBM?
3	WHAT IS CBMO?
4	WHAT CONSTITUTES CBMO?.....
5	CONSTRUCTION BUSINESS MODEL ONTOLOGY (CBMO)
6	STEP-BY-STEP GUIDE.....
6.1	STEP 1: Develop a brief scenario of the construction business option/project/job/idea
6.2	STEP 2: Understand company Vision/Goals and recognise Company Culture
6.3	STEP 3: Recognise Strategic Choices, Changes and power of Professionalism of the company
6.4	STEP 4: Decide on Revenue and Costs
6.5	STEP 5: Recognise Value Inputs
6.6	STEP 6: Recognise Value Stakeholders
6.7	STEP 7: Decide on methods of creating value.....
6.8	STEP 8: Decide on capturing value.....
6.9	STEP 9: Position outcomes on Construction Business Model Ontology Skeleton (CBMOS).....
6.10	STEP 10: Describe the Construction Business Model (CBM) of the option/project/job/ idea
7	SUMMARY OF THE STEP-BY-STEP GUIDE FOR CBMO.....

1. PURPOSE OF THE STEP-BY-STEP GUIDE FOR CONSTRUCTION BUSINESS MODEL ONTOLOGY (CBMO)

The step-by-step guide for Construction Business Model Ontology (CBMO) provides clear, detailed, and comprehensive directions for designing Construction Business Models (CBMs) using CBMO. This guide outlines the required steps to complete the designing of CBM for a business option/project/job /idea.

2. WHAT IS CBM?

Refer to the below Definition for Construction Business Model;

“A construction business model is a simplified conceptual representation of a construction business that performs value creation as per client requirements with key resources and capabilities, considering the appropriate level of involvement of relevant stakeholders in the key processes towards revenue and profit generation while expressing firm’s strategic choices with awareness of necessary changes and opportunities.”

3. WHAT IS CBMO?

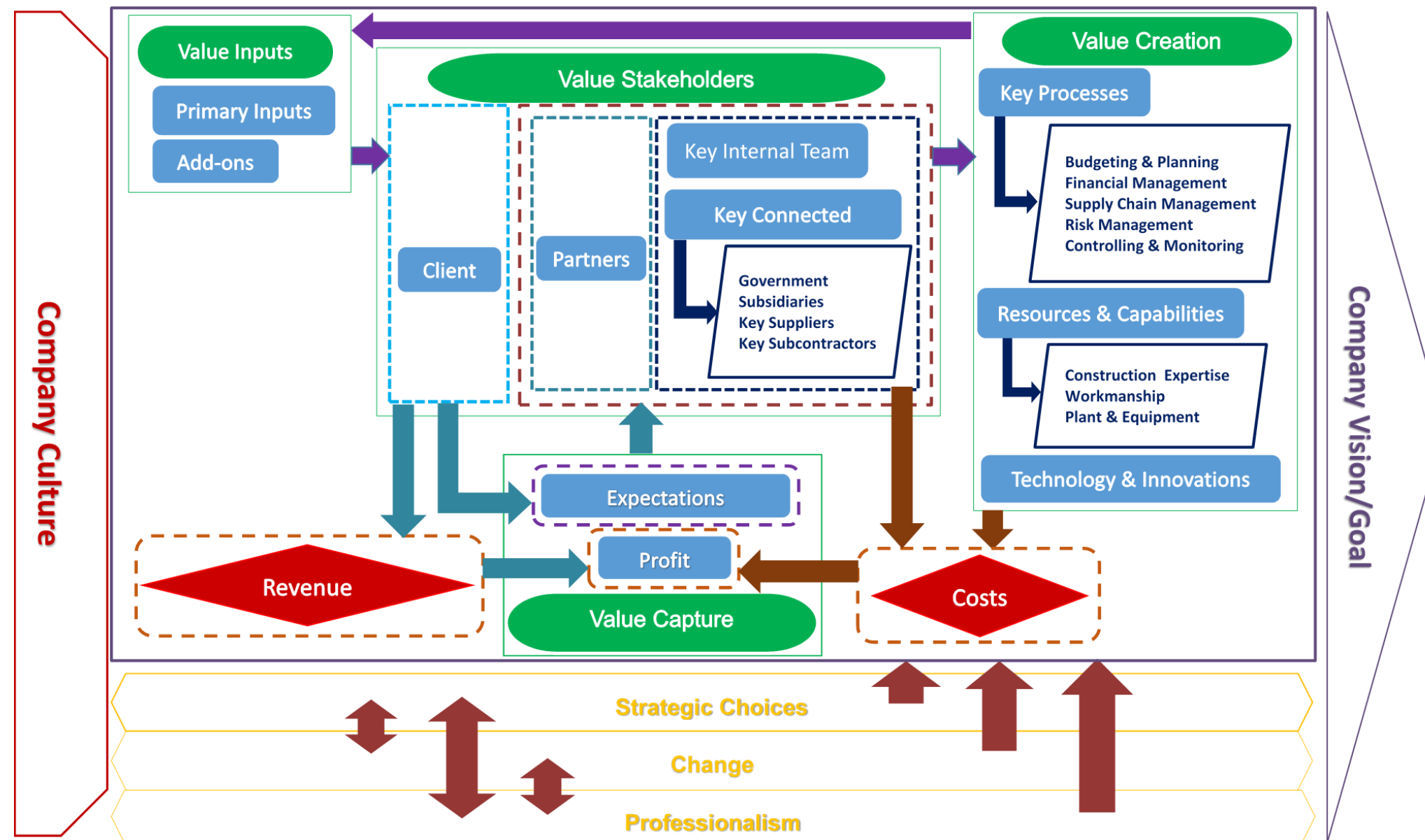
The Construction Business Model Ontology (CBMO) was developed through comprehensive research after recognising the requirement of developing a BM ontology as a framework for assisting construction contractors in successfully and effortlessly designing, visualizing, and changing their Construction Business Models (CBMs). It also gives easy reference to the team with a shared understanding and facilitates ongoing discussions among relevant stakeholders.

4. WHAT CONSTITUTES CBMO?


CBMO consists following elements, which are the main drivers of the construction business.

CBMO elements		
<p>Company Vision /Goals</p> <p>Company Culture</p> <p>Strategic Choices</p> <p>Change</p> <p>Professionalism</p> <p>Revenue</p> <p>Costs</p>	<ul style="list-style-type: none"> • Value Inputs <ul style="list-style-type: none"> ○ Primary Inputs ○ Add-Ons • Value Stakeholders <ul style="list-style-type: none"> ○ Client ○ Partners ○ Key Internal Team ○ Key Connected Stakeholders <ul style="list-style-type: none"> • Government • Subsidiaries • Key Suppliers • Key Subcontractors 	<ul style="list-style-type: none"> • Value Creation <ul style="list-style-type: none"> ○ Key Processes <ul style="list-style-type: none"> • Budgeting & Planning • Financial Management • Supply Chain Management • Risk Management • Controlling & Monitoring ○ Resources & Capabilities <ul style="list-style-type: none"> • Construction Expertise • Workmanship • Plant & Equipment ○ Technology & Innovations • Value Capture <ul style="list-style-type: none"> ○ Profit ○ Expectations

5. CONSTRUCTION BUSINESS MODEL ONTOLOGY (CBMO)



Indications of Arrows in the CBMO

-  Flow of created value by Key Internal Team, Partners and Key Connected Stakeholders through Key Processes, Resources and Capabilities and Technology and Innovations as Value Inputs to the Client
-  Flow of Costs incurred by Key Internal Team, Key Connected Stakeholders and Value Creation and use for calculating Profit
-  Flow of captured value from Client to Key Internal Team, Partners, Key Connected Stakeholders and the Company as Profit through Revenue and as Expectations
-  Sharing of Strategic Choices, Change and Professionalism with all the Value Pillars and their CBM Elements and CBM Sub-elements, and Bridging Elements
-  Sharing of Strategic Choices, Change and Professionalism with each other

6. STEP-BY-STEP GUIDE

By following the ten steps below a CBM, can be designed with the use of CBMO. At each step, ask the given **guiding questions** to make decisions. You can also ask any probing questions in relation to guiding questions (if any).

6.1 STEP 1: Develop a brief scenario of the construction business option/project/job/idea

The Construction Business Model (CBM) development team has to first recognise and note down the scenario of construction business option/project/job/idea for which the CBM is required to be designed.


6.2 STEP 2: Understand company Vision/Goals and recognise Company Culture

Company Vision /Goals can be used as the drive mechanism to run the business that shows the company's desired position in the future, hence categorised as **DESIRED ELEMENT**.

Guiding questions

- What is our Vision?
- Do we have specific goals to achieve?

Company Culture is inherited and marks the company as what it is. Hence it is categorised as **INHERENT ELEMENT**. It guides the company and shapes the attitude of its employees. Therefore, recognising **Company Culture** is important.


	Guiding Question	 Options/ Examples		
Company Culture	What is our Company Culture?	<ul style="list-style-type: none"> • Rewarding for performance • Learning and development • Anti-corruption • Zero tolerance for unethical behaviour • Take responsibility (E.g. for community and environmental impacts) 	<ul style="list-style-type: none"> • Quality and reliability • Teamwork • Cross-functional collaboration • Mutual respect • Trust and commitment • Transparency 	<ul style="list-style-type: none"> • Aggressive • Rigid • Unprofessional • Money first • Other

Outcome 1

By completing this step, you could remind the company Vision and/or establish any specific goal(s). Further, the Culture of the company could be clearly recognised. When deciding on every other element, you should take into account the outcome of this initial step.

6.3 STEP 3: Recognise Strategic Choices, Changes and power of Professionalism of the company


You can decide on **Strategic Choices** in order to achieve something that contributes to business and project success.

	Guiding Question	 Options/ Examples			
Strategic Choices	What are the factors to be considered in Strategic Choices?	<ul style="list-style-type: none"> • Time constraints • Costs and benefits 	<ul style="list-style-type: none"> • Market dynamics and trends • Information constraints 	<ul style="list-style-type: none"> • Impact of past strategies • Strategy implementation 	<ul style="list-style-type: none"> • Other
	What strategies can be used for the situation/project?	<ul style="list-style-type: none"> • Bidding Strategies • Competitive Strategies 	<ul style="list-style-type: none"> • Differentiation Strategies • Marketing Strategies 	<ul style="list-style-type: none"> • Networking Strategies • Change and Adaptability Strategies 	<ul style="list-style-type: none"> • Other
	What are our Marketing aspects?	<ul style="list-style-type: none"> • Value Inputs • Professionalism 	<ul style="list-style-type: none"> • Visionary Leadership • Word-of-mouth advertising 	<ul style="list-style-type: none"> • Partnerships • Other 	
	Through which element are the strategies to be used?	(refer to detail Guiding questions under each Value Pillar)			

Outcome 2

Here, you could understand overall construction business strategies and your marketing aspects related to this option/project/job/idea including issues associated with them.


Change is the company's move from the current position to a better position contributing to business and project success.

	Guiding Question	 Options/ Examples			
Change	Does this case urge us to change?				
	Are our industry and competitors changing?				
	What are the reasons for the change?	<ul style="list-style-type: none"> • Change in technology • Change in law and regulations • Change in Clients' taste and requirements 	<ul style="list-style-type: none"> • Change in economic situation and policies • Change in weather • Change in political leaders 	<ul style="list-style-type: none"> • Influence from market lobbying groups • Unexpected situations • Change in international factors 	<ul style="list-style-type: none"> • Other
	What are the barriers to our company's change?	<ul style="list-style-type: none"> • Different knowledge levels • Different attitudes 	<ul style="list-style-type: none"> • Culture of the organization • Leadership 	<ul style="list-style-type: none"> • Organizational resources & capabilities 	<ul style="list-style-type: none"> • Other
	What are the drivers to our company's change?	<ul style="list-style-type: none"> • Flexibility • Responsiveness 	<ul style="list-style-type: none"> • Agility • Adaptability 	<ul style="list-style-type: none"> • Change in the way of thinking 	<ul style="list-style-type: none"> • Other
	What is to be changed in the company?				

Outcome 3

You could get understanding on current changes in the industry and the requirement of change in relation to this option/project/job/idea including issues associated with them.

Professionalism demonstrates the behaviours of professionals in the company that takes the construction business towards success.

	Guiding Question	 Options/ Examples			
Professionalism	Why do we need the Power of Professionalism as a Construction Company?	<ul style="list-style-type: none"> To attract clients and maintain positive relationships To build and maintain progressive, sustainable relationships with Partners 	<ul style="list-style-type: none"> To maintain a cordial relationship with competitors and the external world To win the trust of stakeholders 	<ul style="list-style-type: none"> To deal with statutory authorities To comply with laws, rules and regulations To ensure a strong market reputation 	<ul style="list-style-type: none"> To drive towards innovative solutions Other
	What are the enablers for our power of Professionalism?	<ul style="list-style-type: none"> Interpersonal skills Contingency Management skills 	<ul style="list-style-type: none"> Contextual Intelligence Leadership Skills 	<ul style="list-style-type: none"> Reliability Responsiveness Higher visibility 	<ul style="list-style-type: none"> Ethical background Other
	How can we avoid Professional Obsolescence?				
	How can we develop professional efficiency?				

Outcome 4

You could understand your company’s power of Professionalism and its requirement in relation to this option/project/job/idea including issues associated with them.

Note:

Strategic Choices, Change and Professionalism are concerned with other CBMO elements and hence categorised as **SHARED ELEMENTS**. Therefore it would be best to consider them with other CBMO elements asking common guiding questions to decide on associated strategies, use of Professionalism and requirement of Changes, given under each element.


6.4 STEP 4: Decide on Revenue and Costs

Revenue is the total income of the construction business that the company receives from a particular Client for the option/project/job/idea.

Costs are incurred for the option/project/job/idea for the design, construction and equipping, including overheads

Revenue and **Costs** connect and make relationships among some of the other elements, hence categorised as **BRIDGING ELEMENTS**.

Guiding Questions directing to decide on Revenue and Costs

	Guiding Question	 Options/ Examples			Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes
Revenue	Do we need to increase the Revenue?				<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects?
	What factors do we have to consider when increasing Revenue?	<ul style="list-style-type: none"> • Time frame • Project size • Nature of Client & consultant 	<ul style="list-style-type: none"> • Client’s financial status • Workload • Project nature 	<ul style="list-style-type: none"> • The extent of capacity build-up • Other • 	
Costs	How can we minimize costs?	<ul style="list-style-type: none"> • Identify the expensive resources & processes and their priority level • Effectively manage material usage and machine utilization • Control overheads • Tax-free purchases 	<ul style="list-style-type: none"> • Productivity improvements • Use new technology/ innovations • Consider alternatives • Limit capacity building • Cost controlling and monitoring 	<ul style="list-style-type: none"> • Build Good Relationships with suppliers and subcontractors to get discounts • Negotiations and renegotiations • Other • 	<p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company?

Outcome 5
 You could identify the issues in generating Revenue through this option/project/job/idea and suitable ways of minimizing costs.


- ❖ The value of the construction business rests on four **VALUE PILLARS**, namely; (i) **Value Inputs**, (ii) **Value Stakeholders**, (iii) **Value Creation** and (iv) **Value Capture**.
- ❖ These **VALUE PILLARS** are divided into **CBM ELEMENTS**, and some of the **CBM ELEMENTS** are further divided into **CBM SUB-ELEMENTS** which are decided under Steps 5, 6, 7 and 8 below.

6.5 STEP 5: Recognise Value Inputs

Value Inputs are the company's services that are of value to the Client and attract future Clients and make the company survive in the market.

- **Primary Inputs** are company's services that are of primary value to the Client and are primarily needed by the Client
- **Add-Ons** are the company's services that are of additional value to the Client and are also expected by the Client.

Guiding Questions directing to decide Value Inputs

	Guiding Question	 Options/ Examples		Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes	
Value Inputs	Why do we need to provide this Client with Value Inputs?	<ul style="list-style-type: none"> To get Clients' recommendations To survive in the market To create a good image 	<ul style="list-style-type: none"> To enhance Company experience and qualifications To give moral worth to the company's service 	<ul style="list-style-type: none"> To create a positive attitude about the company among Clients and Consultants Other 	
			need-to-provide	nice-to-provide	
	PRIMARY INPUTS	<ul style="list-style-type: none"> What are Primary Value Inputs expected by the Client? Are the Primary Value Inputs need-to-have or nice-to-have? 	On-time delivery		
			Shorter time delivery		
			Cost advantage		
			Guaranteed Quality		
			On spec/ optimal design		
			Other		
	ADD-ONS	<ul style="list-style-type: none"> What Add-ons may the Client expect? Are the Add-ons need-to-have or nice-to-have? 	Constructability competence		
			Predictability		
			Worry-free/ Hassel free		
			Innovative processes and products		
			According to the plan and the Client's expectations		
			No defects		
			Service for the whole package		
Smooth Post contract dealing					
Connectivity					
Less/no contribution to litigation history					
Confidentiality maintenance					
Health/ safety & environmental concerns and records					
Sustainability policy & practices					
Other					

Strategic Choices

- Are there any associated strategies?
- Is this affect our marketing aspects?

Professionalism

- How does Professionalism influence here?

Change

- Is any change required here?
- Can we get any opportunity by changing with this?
- How will these changes impact the company?

Outcome 6


You could now have a clear idea about the link between Value Inputs and the Client. You can prepare a list/menu of Value Inputs for this Client and promote value based competition.

6.6 STEP 6: Recognise Value Stakeholders

Value Stakeholders are interested in company Value Creation or/and are involved in creating values. CBMO considers key Value Stakeholders to the construction business.

Guiding Questions directing to handle the Client

The construction company creates value and delivers value inputs to the **Client** in order to capture value.

Guiding Question		 Options/ Examples				Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes					
Value Stakeholders	CLIENT	Why do we need Value Stakeholders?		<ul style="list-style-type: none"> To have payments or fees/Profit To obtain materials, products, or services To get jobs To continue and complete jobs 	<ul style="list-style-type: none"> To be competitive To get access through contacts To exchange information, knowledge, and skills To get reputation & popularity 	<ul style="list-style-type: none"> To survive in the market To achieve business success To acquire overseas market Other..... 					
		What is the type of the Client?		Private		Public		Other			
		What is the nature of the Client?		Highly professional		Technically rich		Politically powerful		Layman	
		Which category does the Client belong to?		New		Repeat		Target			
		Identifying Client	New	Is that Client financially capable?							
				How reliable is that Client?							
			Repeat	Did we have any bad experiences with that Client?							
				Are there any changes to the financial capability of the Client?							
				Are there any identified changes to the nature of the Client?							
			Target	Is the relationship with the Client changing?							
		Why are we targeting that Client?									
		Are there novel expectations from the Client?									
		Manage Client interface	Can that Client still fulfil our expectations?								
			What is the information to be communicated with the Client?								
			Who is the most appropriate person or team we are required to deal with from the Client-side?								
What is the appropriate time and situation to communicate?											
Maintain Client relationship	What is the appropriate place to meet?										
	How are we going to create & maintain a good relationship with the Client?		<ul style="list-style-type: none"> Assign the right person to deal with Work positively Maintain a high level of client satisfaction Not being too official and contractual 		<ul style="list-style-type: none"> Open communication/ be available Professionalism Maintain continuous dialogue Maintain Client loyalty 		<ul style="list-style-type: none"> Be flexible Maintain Confidentiality Handling Client grievances Other 				
Add to Company Client base	What is the approach?										
	Can we add to our Client base?										

Strategic Choices

- Are there any associated strategies?
- Is this affect our marketing aspects?

Professionalism

- How does Professionalism influence here?

Change

- Is any change required here?
- Can we get any opportunity by changing with this?
- How will these changes impact the company?


Outcome 7

You could now have a description of the Client and way of handling particular Client.

Guiding Questions directing to handle Partners and Key Internal Team.

The construction company may have partnerships with **Partners** to create value for the Client.

Key Internal Team of the company's internal staff is directly involved in creating value for the Client.

Guiding Questions		 Options/ Examples				Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes
Value Stakeholders	PARTNERS	Why do we need Partnership/s?	<ul style="list-style-type: none"> • Strength in wining jobs • Expedite works • Sharing knowledge 	<ul style="list-style-type: none"> • Enhance capacity & capability • Getting work experience 	<ul style="list-style-type: none"> • Obtain machines and equipment • Cost-sharing 	<ul style="list-style-type: none"> • Overseas expansion • Sharing obligations • Other
		What is the nature of the proposed Partner?				
		How reliable is this Partner?				
		Is this Partner having a relationship with the Client?				
		Did we have any bad experiences with this Partner?				
		What key roles and responsibilities are we expected to perform by this Partner?				
		How are we going to share costs & profit?				
		What will be potential issues with this Partner?				
		How can we minimize the potential issues?				
	What will be the exit method?					
	Who will be the lead Partner? How?					
	KEY INTERNAL TEAM	Do we have a capable team to deal with the Client/ project/ business case?				
		Who are the suitable key members of the team?				
		Who will lead the team?				
		Are there any past dealings by this team with the Client? Good or bad?				
		How busy is this team currently?				
		What Goals/targets are to be achieved by the team?				
		What are the key tasks and roles of the team?				
How can the efficiency of the team be enhanced?		<ul style="list-style-type: none"> • Set targets • Provide most up-to-date information • Best suit leadership 	<ul style="list-style-type: none"> • Training and development • Open-door policy • Performance appraisal & rewarding 	<ul style="list-style-type: none"> • Welfare activities • Other 		
<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects? <p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company? 						

Outcome 8

You could now decide who will be the Partner (s) for this business case.


Outcome 9

You could also have a capable appropriate team to deal with the Client/ project/ business case.

Guiding Questions directing to handle Key Connected Stakeholders

Key Connected Stakeholders are the other vital external stakeholders of the company connected to creating value for the Client.

Government of the country as a regulatory authority and policy and standards maker, **Subsidiaries** as secondary companies controlled by the company, **Key Suppliers** as providers of materials/products to the company, and **Key Subcontractors** appointed by the company to perform a particular task related to creating value, are **Key Connected Stakeholders**.

Guiding Questions		 Options/ Examples			Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes			
Value Stakeholders	KEY CONNECTED STAKEHOLDERS	Government	What are the legal and statutory requirements?			<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects? <p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company? 		
			Are there any changes in legal and statutory requirements?					
			What is the Culture of the statutory authority					
			How are we going to allocate time?					
			How to manage bureaucratic obstacles & potential conflicts?					
			Are there any changes in government policies?		What are the impacts to the company and industry due to policy changes?			
			How are we going to adapt to the policy changes?					
		Can we expect any policy changes in future?		How can we prepare for any future policy changes?				
		Subsidiaries	Is it beneficial to go with Subsidiaries?					
			Why?					
		Key Subcontractors	Who are the strategic and high performing subcontractors?		What are the additional benefits we can gain from them now?			
			Are there any additions to Key Subcontractors?		Why do we require to add that Subcontractor?			
			Can we expect the required qualities from the Key Subcontractors?		<ul style="list-style-type: none"> • Capability in carrying out the works • Adherence to ethical conduct • Work uninterruptedly • Be trustworthy 		<ul style="list-style-type: none"> • Competitive in terms of prices • Quality in service • Flexibility • Easy to communicate with 	<ul style="list-style-type: none"> • Possessing a good past track record • Commitment to teamwork • Other.....
			Are there any removals from existing Key Subcontractors?		Why are we removing that Subcontractor?			
			What are the potential risks?					
			Key Suppliers	Are there any additions to Key Suppliers?			Why do we require to add that Supplier or Subcontractor?	
		Are there any removals from existing Suppliers?		Why are we removing that Supplier?				
		Are the Key Suppliers readily available?						
What are the potential risks?								

Outcome 10
You could now have the way of handling Key Connected Stakeholders who support creating value

6.7 STEP 7: Decide on methods of creating value

Value Creation describes the arrangement of **Key Processes, Resources and Capabilities**, and **Technology** required to create value.

Common methods to Create Value

Guiding Questions		Options/ Examples			
Value Creation	What are the ways of creating value?	<ul style="list-style-type: none"> • Having partnerships or joint ventures • Enhance shared understanding of Clients' requirements and goals of each project 	<ul style="list-style-type: none"> • Quality control and quality assurance systems • Streamlined processes 	<ul style="list-style-type: none"> • Strong Leadership • Modern technologies and concepts • Professionalism 	<ul style="list-style-type: none"> • A good and cohesive multi-disciplinary team • Co-creation of value with stakeholders • Other.....

Outcome 11
The outcome is appropriate method(s) of creating value for the Client and the job/project.

Guiding Questions directing to create value through Key Processes

Key Processes are the company's primary value-adding activities that have maximum impact on the success and survival of the company with business cases. **Key Processes** are; **Budgeting & Planning, Financial Management, Supply Chain Management, Risk Management** and **Controlling & Monitoring**


		Guiding Questions	Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes	
Value Creation	KEY PROCESSES	Budgeting & Planning	<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects? <p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company? 	
				How does this affect to company's annual budget?
				Can we maintain a positive cash flow?
		Financial Management		How are we going to arrange financial requirements?
				What will be the cost of financing?
		Supply Chain Management		What are the feedbacks from periodical reviews?
				What are the quality inputs we receive from the supply chain?
				Are there any process improvements that need to be implemented?
				Is there any waste in our supply chain?
				How are we going to eliminate waste in the supply chain?
		Risk Management		What will be the potential risks?
				Can we transfer risks? How?
				What are the measures to be taken to minimize risks?
				How are we going to allow for risks?
		Controlling & Monitoring		How are we going to control material and machine usage?
	How are we going to control overhead?			
	To what extent is monitoring and controlling required?			
	How adequate is the current controlling and monitoring system?			
	Are there any problems with the current controlling and monitoring system? Any possible solutions?			

Outcome 12
The outcome is a list of activities and issues related to Key Processes linked to Value Creation for the Client and the job/project.

Guiding Questions directing to create value through Resources and Capabilities and Technology and Innovations

Resources & Capabilities are the sources that create values and allow a company to do the business and face competition. **Resources & Capabilities** include; **Construction Expertise, Workmanship, Plant & Equipment**

Technology & Innovations are used for creating values as new or improved products or processes.

Guiding Questions		 Options/ Examples				Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes	
Value Creation	RESOURCES & CAPABILITIES	<ul style="list-style-type: none"> • Construction Expertise • Workmanship • Plant & Equipment 	How are we going to allocate our Resources & Capabilities?				<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects? <p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company?
			Do we have adequate Resources & Capabilities?				
			Do we have appropriate Resources & Capabilities?				
			Do we need to obtain the required Resources & Capabilities externally?				
			How are we going to obtain the required resources & capabilities?	<ul style="list-style-type: none"> ▪ Use own resources & capabilities ▪ Sub-contracting 	<ul style="list-style-type: none"> ▪ Hiring ▪ Purchasing 	<ul style="list-style-type: none"> ▪ Out-sourcing ▪ Consulting 	
	TECHNOLOGY & INNOVATION	What are the current & future technological and innovative trends?					
		How will technological advancements and innovations change and impact the construction job market?					
		What are the options to be considered?					
		What is the net benefit of technological advancements & innovations?					
		How does it create opportunities for the company?					
		How could we adapt to technological advancements and innovations?					

Outcome 13

The outcome is a list of essential Resources and Capabilities and appropriate ways of obtaining them in order to create value for the Client and the job/project.

Outcome 14


The outcome is Technology and Innovation requirements linked to create value for the Client and the job/project and their impact on the company.

6.8 STEP 8: Decide on capturing value

Value Capture includes monetary and nonmonetary benefits received from the Client for the delivered service/ value

- **Profit** is basically the difference between revenue and costs
- **Expectations** are the benefits expected from the Client other than Profit. Your **Expectations** will help you to seek opportunities.

Guiding Questions directing to capturing value

Guiding Questions		 Options/ Examples	Guiding Questions to decide on associated strategies, use of Professionalism and requirement of Changes
Value Capture			
	PROFIT	<ul style="list-style-type: none"> ▪ The current situation of the business and the industry are affected ▪ Cash flow management ▪ Nature and type of Client 	<p>Strategic Choices</p> <ul style="list-style-type: none"> • Are there any associated strategies? • Is this affect our marketing aspects?
	EXPECTATIONS	<ul style="list-style-type: none"> ▪ Maintain overheads ▪ Have good recommendations ▪ Have positive word-of-mouth advertising ▪ Enter new sectors ▪ Receive Goodwill & Prestige ▪ Create network ▪ Maintain track records 	<p>Professionalism</p> <ul style="list-style-type: none"> • How does Professionalism influence here? <p>Change</p> <ul style="list-style-type: none"> • Is any change required here? • Can we get any opportunity by changing with this? • How will these changes impact the company?

Outcome 15

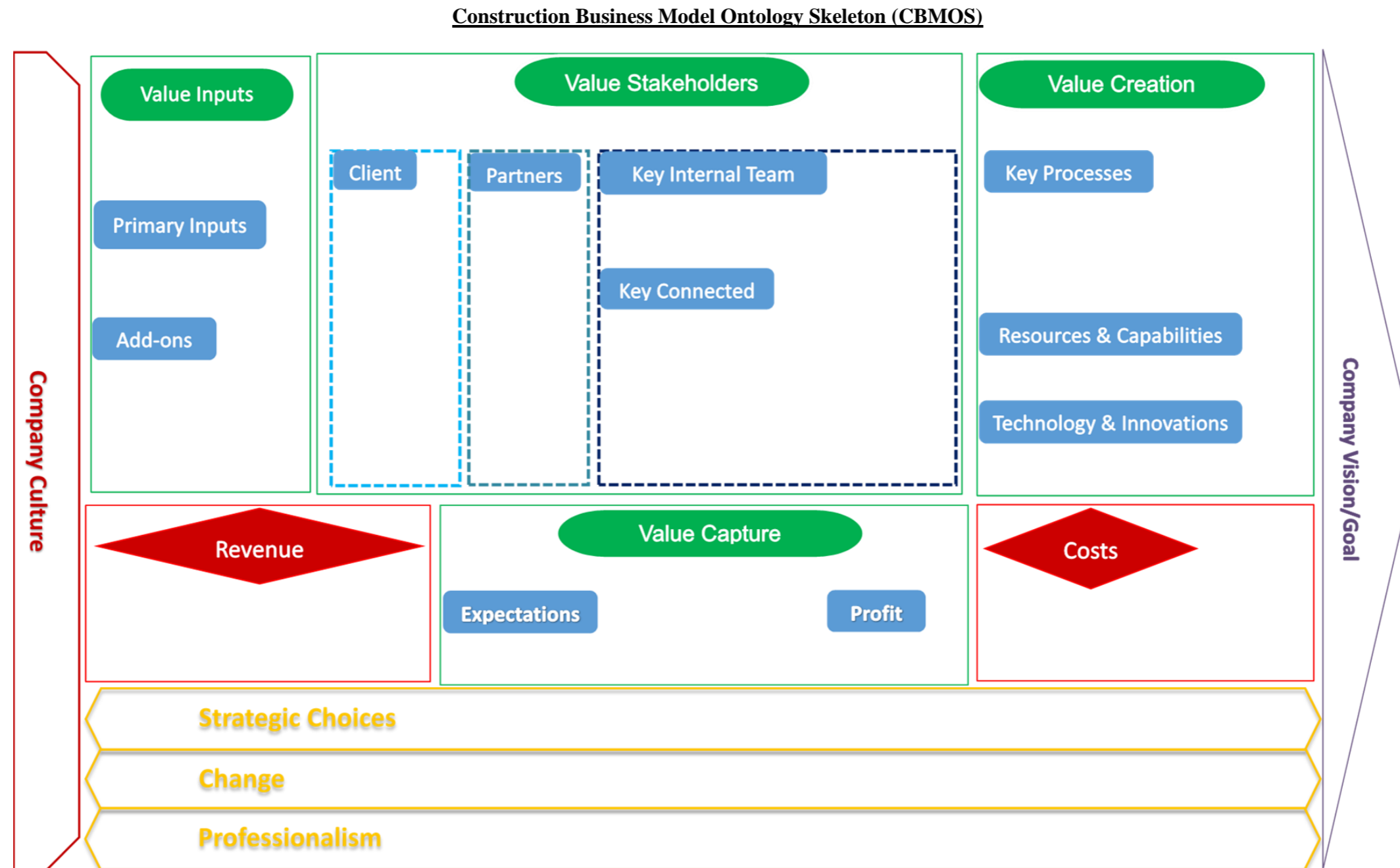
You can get an idea about the profitability of the option/project/job/idea.

Outcome 16

You can come up with a priority list of benefits that could be received from the Client. You also can explore opportunities referring to expected benefits.

6.9 STEP 9: Position outcomes on Construction Business Model Ontology Skeleton (CBMOS)

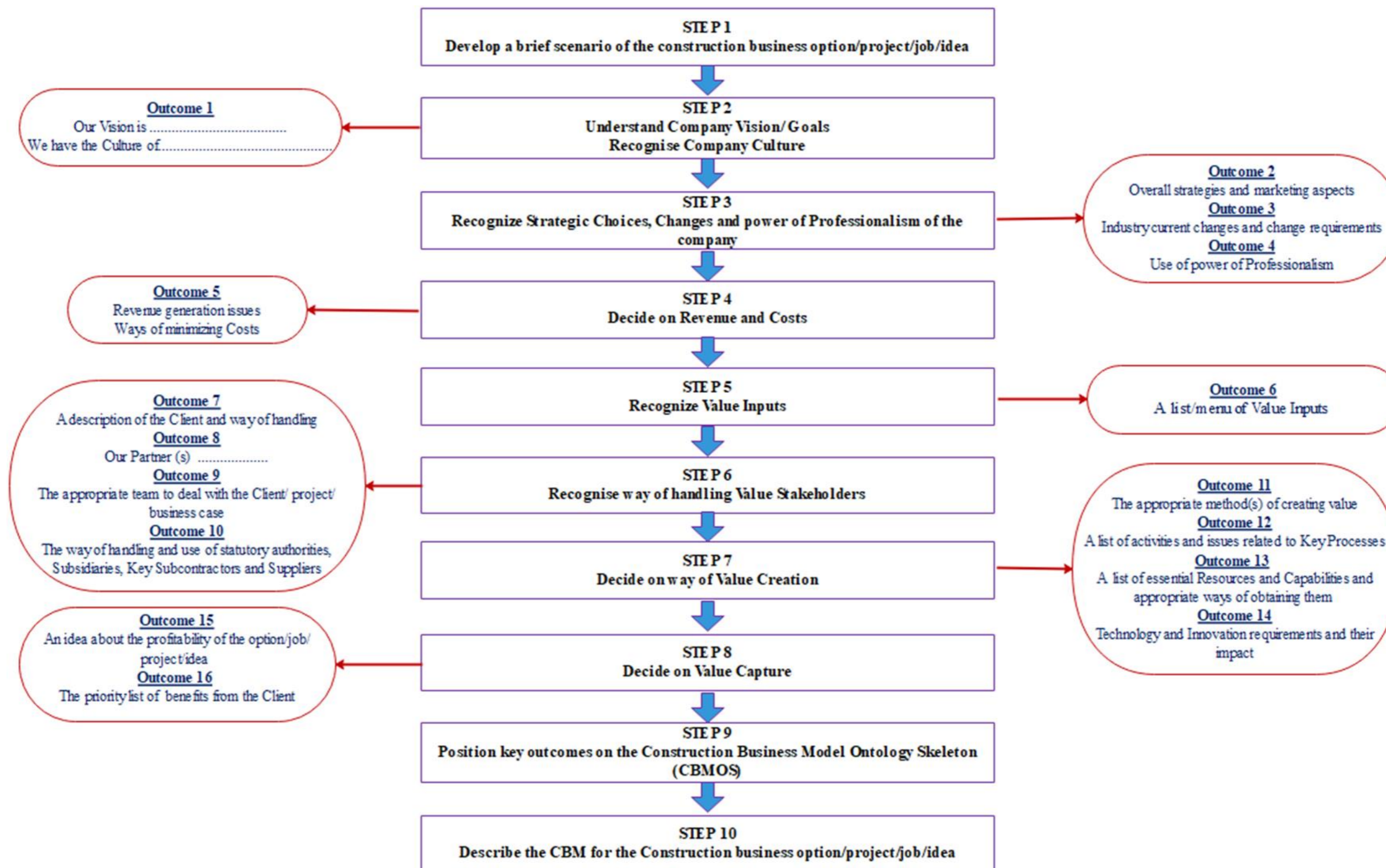
The outcomes could be positioned (e.g. using sticky notes) on the relevant positions of Construction Business Model Ontology Skeleton (CBMOS).



6.10 STEP 10: Describe the Construction Business Model (CBM) of the option/project/job/ idea

Now you can describe your CBM for the particular option/project/job/idea briefed in the scenario at Step 1, referring to the CBMOS. Then, you can check whether this CBM could be understood by all the team members and get more ideas. As you go through the process, you may encounter the problem areas, and also, you may explore new opportunities.

7. SUMMARY OF THE STEP-BY-STEP GUIDE FOR CBMO



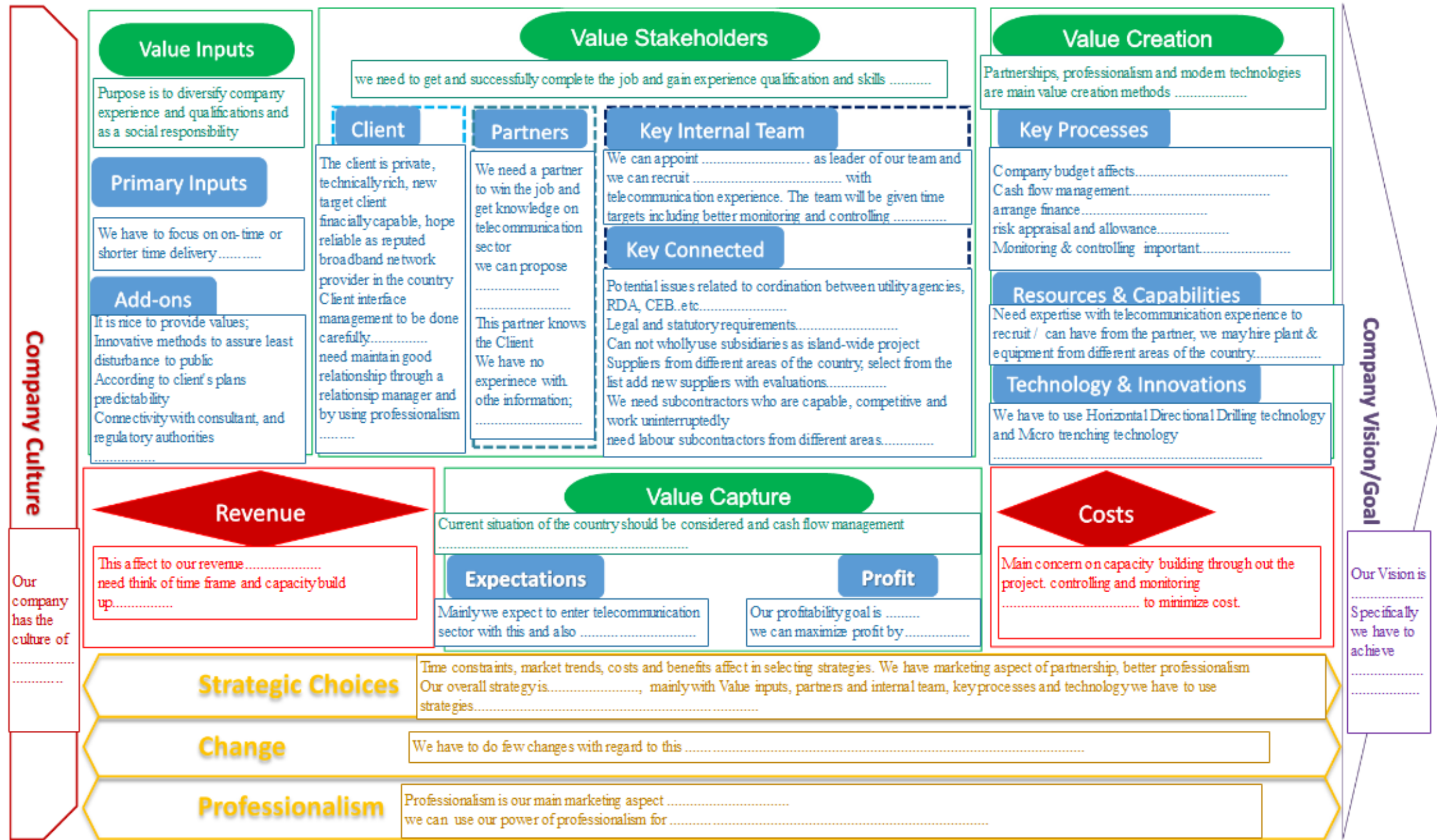
Annexure 5.7: Sample Scenario for designing CBM using CBMO

A company is supposed to expand their construction business to the telecommunication infrastructure development sector. Accordingly, they need to be involved in the project of developing the Optical Fibre Network and Sprouts Connectivity project for ABC Broadband Networks (Pvt) Ltd. This project is proposed in order to enhance the current internet penetration through wireless technology and is required to be completed within a minimum duration due to the current urgency of internet requirements. The project consists of several phases and is to be carried out across the island, including in urban areas. It requires coordination with road authorities, utility agencies and the general public.

Information about the project

Location	Multiple locations island wide
Client	ABC Broadband Networks (Pvt) Ltd
Project value	Approximately LKR 96 Mn
Funded by	ABC Broadband Networks (Pvt) Ltd

Annexure 5.8: Construction Business Model Ontology Skeleton (CBMOS) filled with key selected outcomes in relation to given sample scenario obtained from the validation process



Note: Dotted lines denote the information that is not disclosed due to business matters and skipped due to time constraints during the validation process.

Annexure 6.1: Related Fundamental theme of CBMO elements

CBMO elements	Related Fundamental Theme
Company Vision /Goals	Opportunity-based
Company Culture	Opportunity-based
Strategic Choices	Strategy-based
Change	Dynamicity-based
Professionalism	Opportunity-based
Revenue	Revenue-based
Costs	Revenue-based
Value Inputs	Value-based
Primary Inputs	Opportunity-based
Add-Ons	Opportunity-based
Value Stakeholders	Value-based
Client	Stakeholder-based
Partners	Stakeholder-based
Key Internal Team	Stakeholder-based
Key Connected Stakeholders	Stakeholder-based
Government	Stakeholder-based
Subsidiaries	Stakeholder-based
Key Subcontractors	Stakeholder-based
Key Suppliers	Stakeholder-based
Value Creation	Value-based
Key Processes	Process-based
Budgeting & Planning	Process-based
Financial Management	Process-based
Supply Chain Management	Process-based
Risk Management	Process-based
Controlling & Monitoring	Process-based
Resources & Capabilities	Resource-based
Construction Expertise	Resource-based
Workmanship	Resource-based
Plant & Equipment	Resource-based
Technology & Innovations	Dynamicity-based
Value Capture	Value-based
Profit	Revenue-based
Expectations	Opportunity-based

List of Publications

Referred Index-Journal Publications

Abeynayake, D.N., Perera, B.A.K.S., & Chandanie, H. (2021). A Roadmap for Business Model Adaptation in the Construction Industry: A Structured Review of Business Model Research. *Construction Innovation*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/CI-05-2020-0077> (**Scopus indexed Q1 journal**)

Abeynayake, D.N., Perera, B.A.K.S., & Chandanie, H. (2021). Defining a ‘business model’ in the construction context. *Intelligent Buildings International*, Vol. ahead-of-print No. ahead-of-print. doi: 10.1080/17508975.2021.1927660 (**Scopus indexed Q2 journal**)

Conference Publications

Abeynayake, D.N., Perera, B.A.K.S., & Chandanie, H. (2018). Business Model Concept for Construction Businesses: A Literature Synthesis. In *Proceedings of the 7th World Construction Symposium 2018: Built Asset Sustainability: Rethinking Design, Construction and Operations*, (pp.126-135). https://uom.lk/sites/default/files/becon/files/WCS2018-Proceeding_0.pdf