Adopting sustainable business models in small island developing states (SIDS): buildings and construction sector

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This dissertation is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Awarded by

De Montfort University

March 2022

Abstract

Sustainable business models can be used as tools to facilitate the understanding and implementation of sustainable solutions; however, the sustainable business model research field is not yet mature and studies specific to the buildings and construction sector are limited. There is also a clear lack of research in developing and emerging countries.

This doctoral research identifies sustainable business models in the buildings and construction sector and develops a conceptual framework for analysing business models in the buildings and construction sector. The developed conceptual framework is applied to case studies in vulnerable small island developing states (SIDS) to identify 'sustainability gaps' and provide high-level recommendations for reducing those gaps. Overall, the aim of this research is to contribute to theory and practice on adopting sustainable business models in SIDS.

The research process starts with a high-level literature review of business models and sustainability that quickly narrows to the emerging field of sustainable business models. Sustainable business models are then investigated more thoroughly to build an understanding of the literature, define the theoretical framework for this research and identify research gaps. The following sustainable business model research gaps are addressed: systems-based, boundary-spanning approach underpinned by natural and social science; emphasis on the social element of sustainability; clearer guidance on benefits for both companies and customers; sector specific empirical data (contextual implications); and, analysis from developing and emerging economies (contextual implications).

The framework for strategic sustainable development (FSSD) is embedded in this research to place emphasis on systems thinking and scientific principles for understanding sustainability challenges and how they may be turned into business opportunities. The approach is through systematically exploring how the FSSD has been

used to enhance sustainability in business and management research. Results are then conceptually integrated by identifying potential sustainable business model characteristics. A systematic literature review of business models for sustainable buildings is then conducted to find and analyse peer-reviewed empirical case study data. Results are used to develop the initial conceptual sustainable business model framework for buildings and construction and explore a single case study, which is an organisation based in in Sweden. This is followed by a multiple case study on organisations based in SIDS in the Caribbean region for comparative analysis.

The geographical context for the single case study is mainly based on Sweden's vision for and progress with sustainability in the buildings and construction sector. The selected organisation is based on alignment with the existing sustainable business model archetypes to fit with the emerging theoretical profile. The multiple case study comprises 12 organisations in the Caribbean region that are either market leaders in their subsectors or have sustainable value propositions. There is specific focus on the small island of Barbados, which is the common country of operation for all cases. Case study data collection includes interviews with senior management, company documents, and publicly available data. The overall process is constantly comparative where emerging information is used to guide to the following steps. Codes and themes are used to structure data extraction and analysis. Initial codes are derived from literature and then themes and new codes emerge from the data.

The comparative analysis of results identifies various 'sustainability gaps' in business models in the Caribbean region that could be further explored to create/enhance sustainable business models such as: shared sustainable visions; sustainability champions both top-down and bottom-up; sustainability training and education, especially around embodied carbon and circularity; comprehensive environmental management approaches; the incorporation of sustainable certifications and standards; formalised construction and demolition waste management; longer-term revenue approaches, facilitated by triple bottom line and whole lifecycle thinking; and, wider

distribution of economic costs and benefits. Development is needed on circular economy business models and the incorporation of modern methods of construction.

Overall, this doctoral research comprehensively consolidates empirical data on sustainable business models in the buildings and construction sector, adds empirical knowledge to the sustainable business model research field, and provides useful insights and recommendations for sustainable buildings and construction research and practice.

Keywords: sustainable business models; sustainable building; sustainable construction; buildings and construction; strategic sustainable development; business models; sustainable development; systematic review; case study

Is being less bad being good?

Acknowledgements

Thank you to the Leicester School of Architecture and the overall Faculty of Art, Design and Humanities, De Montfort University (DMU) for my supervisory team and research funding. I want to particularly thank my first supervisor, Dr. Amal Abuzeinab, for strong support and encouragement.

Thank you to DMU Global and the Department of Strategic Sustainable Development at Blekinge Institute of Technology (BTH) in Sweden for the opportunity to participate in a professionally and personally inspiring and rewarding research placement - also to the wider BTH and Karlskrona staff and community for great hospitality.

Thank you to everyone who took time out of their schedules to contribute to my research journey from informal research experience conversations at various academic and social events to formal interviews for my data collection. To the organisations in Sweden and the Caribbean region that I reached out to for data, I am especially grateful for the willingness to participate and the high level of engagement.

Thank you to my wonderful colleagues, both in academia and industry, who have been instrumental in keeping me motivated throughout this doctoral research process and have always been open to providing support.

Most of all, thank you to my family and friends for unwavering love, support, motivation and understanding.

All of you have made this possible. Thank you.

Declaration

I declare that all work presented in this thesis is entirely my own and has not been submitted in whole or in part of any previous professional qualification; except where stated by reference or acknowledgment.

Signature: Kaie Small-Warner

Date: 28/03/22

Publications and Conferences

Small-Warner, K., Abuzeinab, A., & Taki, A. (2018). A Review of Sustainable Business Models and Strategic Sustainable Development. *Journal of Business Models*, 6(2), 84-89.

Small-Warner, K (2020). Societal and behavioural dimensions of business models for sustainable buildings. Conference paper for the 5th International Online Conference on New Business Models. Nijmegen, OCF 2.0, Doetinchem (NL).

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1 Introduction

1.1 Chapter outline

This chapter summarises the background of the overall research field – where business model research intersects with sustainable development and sustainability science. Challenges in academia and industry are highlighted to identify research gaps and outline the research objectives for this doctoral thesis. The chapter concludes with an overview of the research process and outline of how the thesis is structured.

1.2 Business models and sustainable development

In 1987, Brundtland and World Commission on Environment and Development defined sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (p.43). Elkington (1997) embraced the concept of sustainable development within business strategy and coined the term 'triple bottom line' (TBL) which became a standard framework in management theory. It created a major shift in modern accounting by highlighting the inadequacy of the financially focused bottom line and recommending a broader approach that encompassed social and environmental impacts. Elkington understood that in the dynamic business environment, planning for long-term viability was critical. Sustainability required more focus on the customer's changing needs and the complete life cycle of products (Elkington, 1994; Elkington, 1997; Elkington, 2013). Fast forward to 2017, thirty years since the Brundtland definition and twenty years since the TBL was introduced, and there is still a lack of understanding that business opportunities can be created by embracing a sustainable strategy. Global research from 2009 to 2016 on how businesses adopt and integrate sustainability into strategies and practices concluded that sustainable business practices are not yet widespread and progress needs to be accelerated (Kiron et al., 2017). There is a lack of proactive action and innovation from the private sector (Bini et al., 2018; Kiron et al., 2017; Schaltegger et al., 2016). Some business leaders implement strategies aligned with sustainable development goals but out of sync with their core businesses (Kiron et al., 2017). Some

are solely motivated by the need for compliance with regulations (Bini, Bellucci and Giunta, 2018). Large corporations are adapting quicker than small and medium sized corporations but collectively, progress still needs to be accelerated. Businesses have a major role to play as sustainability issues will not be resolved by the government alone. Business leaders, therefore, need assistance with understanding and embedding sustainability within their organisations (Kiron et al., 2017).

The need to adapt and create new business opportunities spurred researchers to use the business model concept to help drive sustainable development but this is still a new research focus (Schaltegger et al., 2016). The business model is being used more frequently to investigate how organisational strategies are addressing sustainability challenges (Boons & Lüdeke-Freund, 2012). The business model concept emerged through using a combination of theoretical positions, mainly strategic management and entrepreneurship, to explain empirical patterns of value creation in and in between internet-based businesses (Amit & Zott, 2001). "*A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities*" (Amit and Zott, 2001, p.511). Transactions are the link between activities but the term is regularly used interchangeably with activities. An activity is "*the engagement of human, physical and/or capital resources of any party to the business model (e.g., the focal firm, end customers, vendors) to serve a specific purpose toward the fulfilment of the overall objective*" (Zott & Amit, 2010, p.217). Content refers to goods, services, or information along with resources and capabilities. Structure refers to the actors involved, the relationship between these actors, the sequence in which they are connected for transactions to occur, and how (mechanisms) they exchange the 'content' amongst themselves (Amit & Zott, 2001). This evolved to conceptualising the business model as an activity system where content represents activities, structure represents how activities are linked, and governance represents who performs activities (Afuah & Tucci, 2001; Amit & Zott, 2001).

Johnson et al. (2008) reiterated that the purpose of the business model is value creation and delivery and described it as an interconnected model of customer value proposition, profit formula, key resources, and key processes (Johnson et al., 2008). Richardson (2008) further explained that the business model provides a clear picture of how strategy is embodied in business activities. The business model can be articulated around the concept of value to reflect strategic execution (business activities) towards competitive advantage. This includes three key components -the value proposition, the value creation and delivery system, and value capture (Richardson, 2008). Overall, business models therefore explain the logic of companies and how they operate. As a conceptual tool it can be used in various contexts and applications, enabling business and management research analysis and experimentation (Osterwalder & Pigneur, 2010; Richardson, 2008; Teece, 2010). The investigation of models and how they work aids with understanding and replication and helps determine the effect of changes (Baden-Fuller & Morgan, 2010).

One of the most frequently referenced analysis tools in this field is the business model canvas (BMC) (Osterwalder & Pigneur, 2010) and it provides further breakdown of the three key business model components (Figure 1:1). The value proposition is the benefit/satisfaction to a customer from a product or service being offered, including how it is delivered. Customer relationships and channels are the chosen methods of interaction and product/service delivery between the business and customer. Customers refers to specific attributes of customers suited for the value proposition. Key activities (business operations), partners (suppliers and other entities), and resources (assets) are within value creation. These are the areas critical to successfully delivering the value proposition. Value capture is how the business meets stakeholder requirements/profits and therefore considers the costs of value creation and the revenue that can be generated (Osterwalder & Pigneur, 2010).

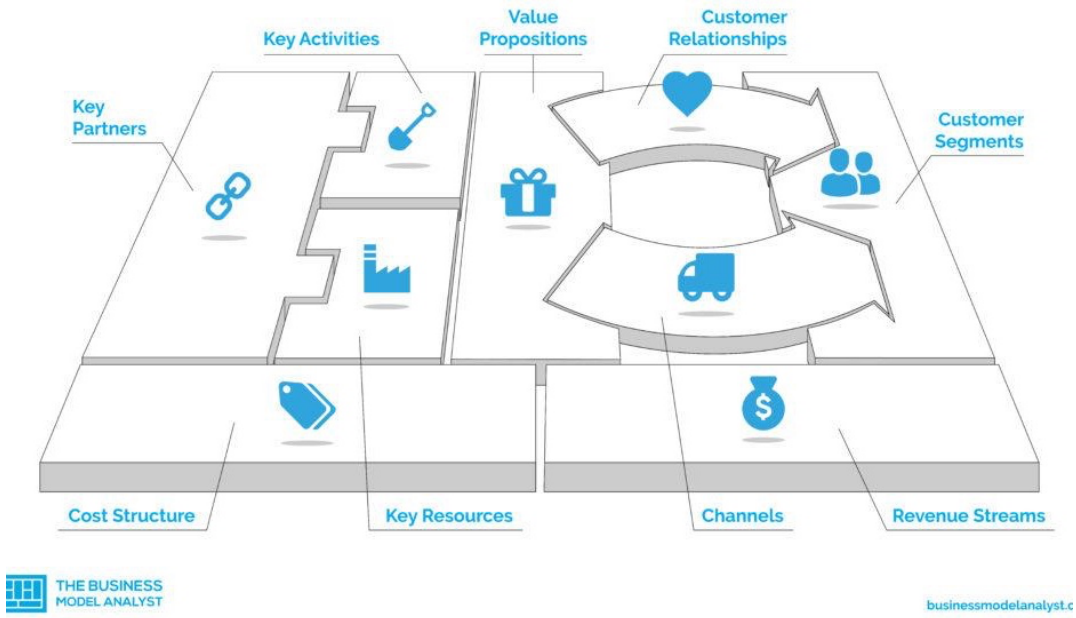

Figure 1:1 - The nine building blocks of the Business Model Canvas (Osterwalder & Pigneur, 2010) illustrated by The Business Model Analyst (Business Model Analyst, 2021)

By applying these theoretical developments to sustainable development, the green business model emerged. Moving towards 'competitive' environmental sustainability, Sommer (2012) defined a green business model from two value perspectives, value creation and value capture. Schaltegger, Hansen & Lüdeke-Freund (2016) more holistically embedded sustainability in business model research and proposed that:

> *"A business model for sustainability helps describing, analyzing, managing and communicating:*
>
> *i) A company's sustainable value proposition to its customers, and all other stakeholders*
>
> *ii) How it creates and delivers this value*
>
> *iii) And how it captures economic value while maintaining or regenerating natural, social and economic capital beyond its organizational boundaries"* (p.6).

The increase in sustainable business model research activity over the last decade has highlighted strong cases that the sustainable business model concept facilitates the understanding and implementation of sustainable solutions. Research is ongoing to unify concepts, test frameworks and archetypes and investigate the ways to achieve

sustainable business models in practice (Dentchev et al., 2016; Evans et al., 2017). This is especially the case for developing and emerging countries where there is a clear research gap (Lüdeke-Freund et al., 2019; Silvia & Truzzi, 2020). The majority of literature covers organisations from the UK, USA and Europe and the remaining literature covers Australia, Canada, Brazil and China (Silvia & Truzzi, 2020, Table 6). A systems-based approach underpinned by natural and social science is also critical to sustainable business model research and practice (Broman & Robert, 2017; Upward & Jones, 2016).

Based on reviewing the sustainable business model literature (Chapter 2), the following needs arise:

1. Systems-based, boundary-spanning approach underpinned by natural and social science
2. Emphasis on the social element of sustainability
3. Clearer guidance on benefits for both companies and customers
4. Sector specific empirical data (contextual implications)
5. Analysis from developing and emerging economies (contextual implications)
6. Analysis of partnerships (NGOs, government, etc.) that are relied on for success
7. Real world applications and how to understand or measure their success
8. Attention to the importance of customer heterogeneity through better definition and analysis of target groups
9. Empirical data on the lesser found archetypes 'repurpose the business for society/environment' which requires changing the business vision and aims to positively contribute sustainable development and 'encourage sufficiency' which requires slowing consumption patterns (examples include Vitscoe and Patagonia)
10. Capacity building approaches/tools for the use of specialized methods and tools or simplified versions of the tools and frameworks to guide individuals and corporations

11. Analysis of the contribution of online communities and tools (linked to above point).

The terms sustainable innovation, sustainability-oriented innovation and sustainable business model innovation can also be found in the sustainable business model literature (Boons et al., 2013; Evans et al., 2017; Morioka et al., 2016). Whilst these concepts similarly aim to embed sustainability at the core of organisations, they investigate the development and implementation processes towards sustainable business models. This research focuses on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders (environmental, social and financial). It does not include the investigation of sustainable business model innovation but the research outcomes are still relevant for innovation studies as there is unavoidable content overlap.

1.3 The importance of systems thinking and strategy in sustainable development

To help demonstrate the importance of systems thinking, whether as a perspective, language or tool, an iceberg analogy was produced. Events are at the top of the iceberg because these are easy to observe in daily life. Below this are patterns, which can be developed from the analysis of these easily observable events. Systemic structures form the base of the iceberg, which are core beliefs and assumptions that are more difficult to identify but form the basis of patterns and events. There is a tendency to allow events to drive decision-making as the events are obvious but this approach does not address the fundamental systemic structures (Kim, 1999). Systems level thinking does not diminish the need to address events and patterns; it moreso emphasises that understanding all levels is required to truly understand the world.

The framework for strategic sustainable development (FSSD) originated as the natural step (TNS) framework in 1989 by a Swedish medical doctor, Karl-Henrik Robert. The goal was to translate sustainable development into a practical framework for transitioning resource usage from a linear to circular model. The FSSD embodies systems thinking

with the rationale that to achieve the required rate of sustainability, there is a need for a thorough understanding of the enormity and urgency of sustainability challenges along with the benefits of proactively transitioning. This thoroughness requires identifying root causes, which are often overlooked or underestimated, to create possibilities for root solutions and eliminate fundamental unsustainable practices (systemic structures level) (Broman and Robert, 2017). Researchers and practitioners already agree that for a change in culture along with successful results, the business model cannot be changed in isolation. It requires a proper strategy and effective leadership (Kiron et al., 2017). The FSSD aims to be an overarching multidisciplinary structure that is complimentary to other supportive tools and frameworks for sustainable development. It has been (and continues to be) developed over 30 years through a systematic and iterative process of peer and practitioner reviewing and testing (Broman & Robert, 2017; Missimer, 2015). Best summarized by Missimer (2015), "*…the FSSD has been designed to give guidance on strategically moving any region, organization, project or planning endeavor towards social and ecological sustainability in an economically viable way*" (p.2-3).

Sustainable business models require a systems-based, boundary-spanning approach underpinned by natural and social science. Exploring the interrelationship between sustainable business models and strategic sustainable development could help improve the understanding of sustainability challenges and how they may be turned into business opportunities (Small-Warner et al., 2018).

1.4 Industrial problem: buildings and construction

Buildings and construction (including building materials' manufacturing) together account for just over one third of the world's final energy use and almost 40% of carbon dioxide emissions from energy-related sources (Figure 1:2). The global buildings sector is projected to double its floor area in 40 years (by 2060) and the use of fossil fuels in buildings has been relatively constant since 2010. These projections and trends counteract with global climate change goals. To meet the Paris Agreement, the global average building energy intensity needs a 30% improvement by 2030. The buildings and construction sector therefore needs to rapidly scale up actions. This requires, but is not

limited to, regulatory support, financing mechanisms, capacity and awareness building and the implementation of successful business models (UN Environment and International Energy Agency, 2017).

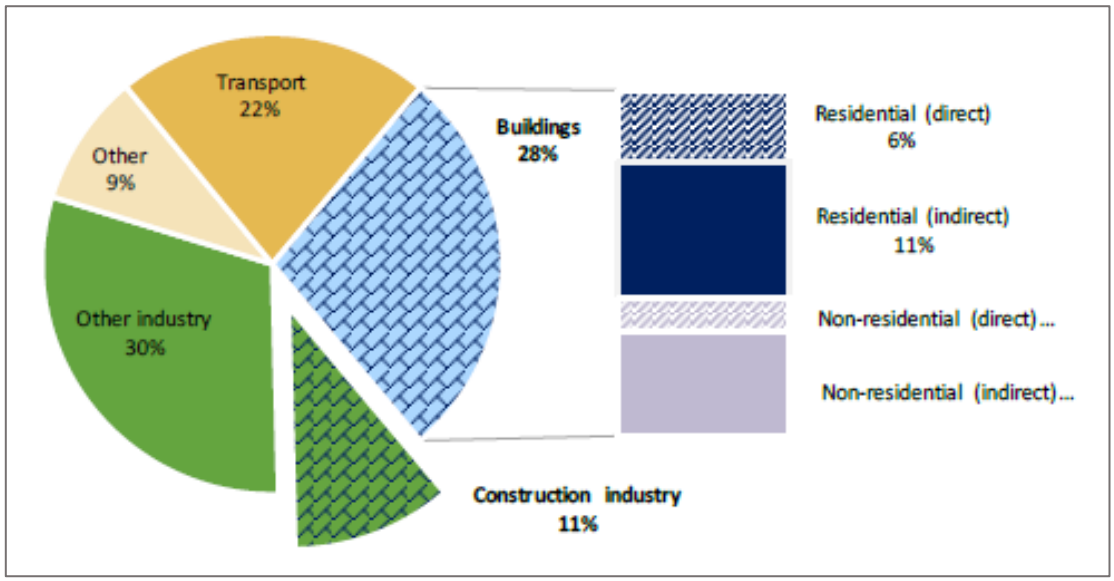

Figure 1:2 - 2015 Global share of carbon dioxide emissions from energy-related sources (UN Environment and International Energy Agency, 2017, p.14)

Energy performance is a major building performance criterion to assess sustainability but it is increasingly being acknowledged that a sustainable building expands beyond the physical building boundaries (Berardi, 2013; GhaffarianHoseini et al., 2013). Consolidating the literature on sustainability in the built environment, Berardi (2013) defined a sustainable building as "*a healthy facility designed and built in a cradle-to-grave resource-efficient manner, using ecological principles, social equity, and life-cycle quality value, and which promotes a sense of sustainable community*" (p. 76). Resource efficiency ranges from material production to construction to operation and end of life. There is operational impact through the energy generated to use buildings and there is embodied impact from the processes used to produce, supply and deconstruct building materials (Kibert, 2016). Buildings can easily exist longer than our lifecycle projections and these evaluations are based on what we know at the time. Flexibility, adaptability and resilience over time and through unpredictable changes are therefore fundamental considerations. It is also important to understand that there is a dynamic relationship

between a building and its surrounding environment and community, requiring considerations for infrastructure interconnectivity, social impact and cultural/traditional preservation (Berardi, 2013; Kibert, 2016).

The behavioral and societal dimensions within sustainable buildings have not been widely researched due to varying concepts and challenges with practical implementation (Berardi, 2013; Dempsey et al., 2011; Merli et al., 2018; Nußholz et al., 2019; Pomponi & Moncaster, 2017). The behavioural dimension considers cognitive elements of material and technology usage and management such as decision-making, peer/stakeholder influence, leadership impact, etc. The societal dimension fundamentally refers to strong communities and collaborations. This requires partnership and wider stakeholder engagement to rethink the way that buildings are designed and share knowledge on various approaches (Pomponi & Moncaster, 2017). Governmental and regulatory factors such as the lack of incentives, supportive policy, codes and regulations have also been highlighted as major barriers to the adoption of sustainability in the built environment (Abuzeinab et al., 2017; Darko & Chan, 2017; Davies & Osmani, 2011; Hagbert et al., 2013; Osmani & O'Reilly, 2009; Rizos et al., 2016).

Alwan, Jones and Holgate (2017) explored how to help overcome some of the barriers to sustainable development in the UK construction industry and found that the construction industry lacked a unified and structured framework for sustainability. The FSSD was incorporated with building information modelling (BIM) using a team of skilled BIM researchers. There was particular focus on material substitution and dematerialisation with conclusions that the combination of the FSSD and BIM can help drive change in the construction industry. The FSSD expanded considerations to wider impacts on the global system and emphasised the importance of manufacturers and suppliers to effect change. Alwan, Holgate and Jones (2017) propose the continuation of exemplary l9ocalised case studies that can be used as change agents for development and acceptance.

1.5 Geographical contexts

Business model transformation is a key element for sustainable development in organisations, enabling firms to quickly identify alternative ways of doing business in alignment with all stakeholders and global sustainability targets (Kiron et al., 2017; Schaltegger et al., 2012). However, business models are not widely understood in the buildings and construction sector (Abuzeinab et al., 2017; Adams et al., 2017; Aho, 2013) and there is limited research on developing and emerging economies (Lüdeke-Freund et al., 2019; Silvia & Truzzi, 2020). This doctoral research develops and uses a sector specific sustainable business model framework as a tool to describe and communicate sustainable value to all stakeholders. The framework is based on peer-reviewed empirical case studies collated from a systematic literature review along with conceptual sustainability enhancements from the framework of strategic sustainable development (FSSD). The framework is then used to explore a single case study from Sweden and make comparisons with a multiple case study from the Caribbean region, addressing the following sustainable business model research gaps:

1. Systems-based, boundary-spanning approach underpinned by natural and social science
2. Emphasis on the social element of sustainability
3. Clearer guidance on benefits for both companies and customers
4. Sector specific empirical data (contextual implications)
5. Analysis from developing and emerging economies (contextual implications)

1.5.1 Sweden's vision for construction

"All construction takes place with the focus on people's needs for quality of life, good health and economising with resources. In the latter case, energy use during production, transportation and building use has been reduced. New buildings are now adaptable for people's changing needs and for different purposes. Materials are very often recycled. The architectonic, aesthetic and cultural-historical values are self-evident features for all building construction."

Vision for Sweden 2025 (Swedish National Board of Housing Building and Planning, 2014, p.21)

Real estate organisations from countries in Western Europe, with Sweden being a leader, have been found to the most active in integrating sustainable development goals (SDGs) into corporate reporting (non-financial reporting) based on the Global Reporting Initiative (GRI) database (Ionașcu et al., 2020). In the Swedish construction industry (construction, real estate, building engineering, architects, design consultants) the results of a longitudinal analysis of surveys from 1998-2010 on the perception of environmental development indicated a structured increase of environmental activities due to various factors such as: increasing stakeholder environmental demands; adopting environmental management systems and policies; incorporating life-cycle assessments in projects; and including environmental personnel in senior managerial positions and higher. Unfortunately, environmental activities were still perceived as costly and though there was a general willingness to cooperate within the industry, suppliers were seen as an obstacle (Gluch et al., 2014). Overall, greater emphasis is still needed on long-term costs and benefits which requires a greater understanding of user value (Isaksson & Linderoth, 2018). Behavioural and ethical changes are also fundamental to achieving long-term results (Al-Saleh & Mahroum, 2015).

A case study attempts to describe what is happening in reality. As a method of data collection, it involves gathering data from a practice setting and can provide very useful and detailed information due to capturing various perspectives. It is an ideal method for exploratory research and pre-testing hypotheses. For industry, it is a very useful way of disseminating knowledge on practical solutions (Yin, 2014). Cases should further develop our theoretical knowledge through replication, expansion or the identification and investigation of outliers/polar types (Eisenhardt, 1989). Patton (2015) refers to the approach as ‘theory-based sampling’ or ‘operational construct sampling’ where sampling is based on the potential for representing the theoretical construct(s) of interest. Given Sweden’s vision for their construction industry and progress so far (despite systemic challenges), the object of study for this single case study is an organisation that provides insight and learning on the construct and context of interest – sustainable business models for sustainable buildings (Chapter 7).

1.5.2 Vulnerability of the built environment in small island developing states (SIDS) in Latin America and the Caribbean

Small Island Developing States (SIDS) are a group of countries that encounter distinct social, economic and environmental obstacles to sustainable development. SIDS typically collaborate through regional Secretariats, such as the Caribbean Community (CARICOM) and the Secretariat for the Pacific Regional Environment Programme (SPREP), to help overcome some of these challenges. This research focuses on the CARICOM. Across Latin America and the Caribbean (LAC), around 83% of the population are considered to be living in urban areas and this is expected to increase due to population and economic growth. Researchers have found that building contractors tend to focus on maximising earnings and thus adopt the most cost-effective solutions available to them. Contractors may not have appropriate training at all or have not undertaken any professional training over a long period (Chmutina & Bosher, 2014). Modular construction appears to be less dominant due to production limitations but it has been suggested that even with access to modern methods of construction, the informal sector would still likely use more traditional materials and methods (Moreno, 2020). Only around 10% of waste is reused/recycled/recovered, even less than 10% for construction and demolition waste (Moreno, 2020; UN Environment, 2018). In some cases, there is an informal recycling market (estimated to be 25-50% of all recycled municipal waste) that has potential value such as plastic bottles, iron scrap, glass, and ceramics. Specifically for the Caribbean region (Figure 1:3), climate change adaptation planning in SIDS has been predominantly at the national level with minimal translation to specific sectors, which is critical for the practical implementation of actions. Sectors that have received focus have typically been agriculture, water and coastal zones (Thomas et al., 2019). While these sectors will be significantly impacted, all sectors need to be engaged to benefit from cross-sector synergies and maximise adaptation efforts. The adoption of more sustainable building practices has been impeded by a lack of national building codes, weak policies, general unawareness of sustainable building benefits, perception of more sustainable approaches being too costly and significant reliance on energy subsidies (Chadee & Stoute, 2017). Densely populated areas are near

to coastlines and prone to flooding; some areas are prone to landslides. Housing is predominantly constructed by the informal building sector, which are small businesses with limited knowledge of sustainable building requirements. In many cases, housing is regularly severely impacted by natural disasters such as hurricanes and earthquakes (Caribbean Development Bank, 2018). There is a need to understand, scale-up and accelerate sustainable environmental and societal transitions and reliable data is needed to help improve-decision making. Transition studies have already acknowledged that technology is not enough for systemic shifts; non-technological action, focusing on changing production and consumption behaviour is critical (Hansen et al., 2018).

In 2021, ministers across LAC agreed to work together on the central integration of environmental issues in coronavirus pandemic recovery and regional action plans. More specifically, the signed 'Bridgetown Declaration' requires social inclusion, low carbon and resilient economies and the conservation and sustainable use of natural resources. United Nations Environment Programme (UNEP) will coordinate a 'Circular Economy Coalition' for LAC that will create a common regional vision for sustainable production and consumption, encouraging governmental collaboration and knowledge sharing and exploring new business opportunities (UNEP, 2021). Based on these challenges and needs, a multiple case study is conducted on SIDS in the Caribbean region to provide insight and learning on the current state of play and identify key areas for organisations in the buildings and construction sector to address in their sustainable business models (Chapter 8).

Figure 1:3 - The Caribbean region

1.6 Research aim and objectives

The increase in sustainable business model research activity over the last decade has highlighted strong cases that the sustainable business model concept facilitates the understanding and implementation of sustainable solutions. The research field is not yet mature and studies specific to the buildings and construction sector are limited. There is also a lack of research on the role, relevance, and features of sustainable business models in developing and emerging countries. This qualitative research uses the sustainable business model perspective to explore the characteristics of sustainable business models in the buildings and construction sector. These characteristics are then used to explore sustainability in buildings and construction in the Latin American and Caribbean region, specifically focusing on vulnerable small island developing states (SIDS) that are under researched. Overall, the aim of this research is to contribute to theory and practice on adopting sustainable business models in SIDS by completing the following objectives:

- identify sustainable business models in buildings and construction (first in general and then more specifically to address the research gap on sustainable business models in developing countries);
- develop a conceptual sustainable business model framework for analysing business models in buildings and construction (contributing to sustainable business model research for buildings and construction); and
- identify sustainability gaps (and provide high-level recommendations for reducing the gap) in organisations in the Caribbean region using the conceptual sustainable business model framework.

Secondary objectives include highlighting how the FSSD has been used in academic research and identifying approaches that could be useful to further academic research.

1.7 Research methodology

This interdisciplinary research focusses on sustainable business models, which are still theoretically being defined and developed. The research falls into the larger fields of sustainability and business and management research. The sustainability aspect of

sustainable business model research is mostly built on objective theories from natural science but also incorporates more subjective thinking from social science to address 'wicked problems' such as climate change and social inequities. Wicked problems are complex global challenges that have significant social and institutional uncertainty. There is no 'right' approach or solution. It is more critical to quickly identify/recognise whether approaches will have negative or positive impacts and adapt accordingly (Levin et al., 2012; Mertens, 2015; Upward & Jones, 2016). This research design pragmatically embraces a whole world view when thinking about and framing problems. The pragmatist view is that philosophies and methods can be mixed based on what is required to understand and solve research problems (Creswell, 2014; Morgan, 2007; Patton, 2015). A qualitative stance is predominantly adopted but both qualitative and quantitative methods are incorporated to adequately complete the research objectives. The research philosophy and design are further explained in Chapter 4.

This research focuses on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders. The research started with a high-level literature review of business models and sustainability that quickly narrowed to the emerging field of sustainable business models. Sustainable business models were then investigated more thoroughly to build an understanding of the literature, define the theoretical framework for this research and identify research gaps. This led to exploring how the framework for strategic sustainable development (FSSD) has been used to enhance sustainability in business and management research to gather insights for enhancing sustainable business models. The overall process highlighted multiple needs within the literature to be addressed (Chapters 2 and 5). Given the lack of sustainable business model knowledge for the buildings and construction sector, a systematic literature review was conducted to find and analyse existing empirical case study data towards the creation of a conceptual framework. A single case study (from Sweden) was then selected that fitted with the emerging theoretical profile. Semi-structured interviews were conducted to gather data on the sustainable business model and determine if any new ideas emerged. The overall process was constantly

comparative where emerging information would be added to the next stage of analysis and also guide further analysis. On reaching the point where no new data was emerging (saturation), the findings were synthesised with the empirical literature and used as a tool for analysis in an under researched geographical region – the Caribbean. The region was explored using a multiple case study approach comprising regional organisations based on the small island of Barbados. The aim is to highlight sustainability gaps and inspire the creation/expansion of sustainable business models. An overview of the research process is shown in Figure 1:4 and in Chapter 4 Figure 4:1.

1.8 Structure of the thesis

The thesis contains nine chapters as illustrated in Figure 1:4. Chapter 1 introduces the research background, topic and approach. Chapter 2 reviews the sustainable business model literature to address definitions, frameworks, components and tools. Chapter 3 provides an overview of existing research in the context of sustainability and business models in buildings and construction to highlight the need for further research. The chapter then describes the motivation for focusing on the sustainable building landscape in the Caribbean region. Chapter 4 reviews the research philosophy, design and methods including justifications for the methodological choices and potential limitations. This is followed by Chapter 5 which explores the interrelationship between sustainable business models and strategic sustainable development towards improving the understanding of sustainability challenges and how they may be turned into business opportunities. The chapter is based on findings from systematic reviews and informal observational data during the first two years of doctoral research. Chapter 6 presents the findings of a systematic literature review of empirical business model case studies for sustainable buildings to highlight key themes and develop a conceptual and sector specific sustainable business model framework. Chapter 7 presents empirical data from an organisation focused on achieving higher levels of sustainability within their business and community (single case study). A brief overview of the company is followed by a detailed description of the sustainable business model based on publicly available data, company documents and semi-structured interviews. The results are discussed within the context of current sustainable business model literature towards

extracting key learnings, understanding contextual implications and enhancing the conceptual sustainable business model framework. Chapter 8 presents the results of the multiple case study with 12 organisations across the construction value chain that operate in the Caribbean region. There is specific focus on the island of Barbados, which is the common country of operation for all cases. Qualitative content analysis is used to narratively present the findings, which are compared with the findings from the Swedish case study (Chapter 7) and the sustainable business model conceptual framework (Chapter 6) to highlight commonalities and potential areas for expansion and improvement (sustainability gaps). Overall theoretical implications, conclusions to the research objectives, limitations and future research pathways are presented in Chapter 9.

Each chapter begins with an overview of the chapter's sub-sections and concludes with a summary. Some of the research that underpins this thesis has been published or presented at conferences and have been included/referenced in this report where needed.

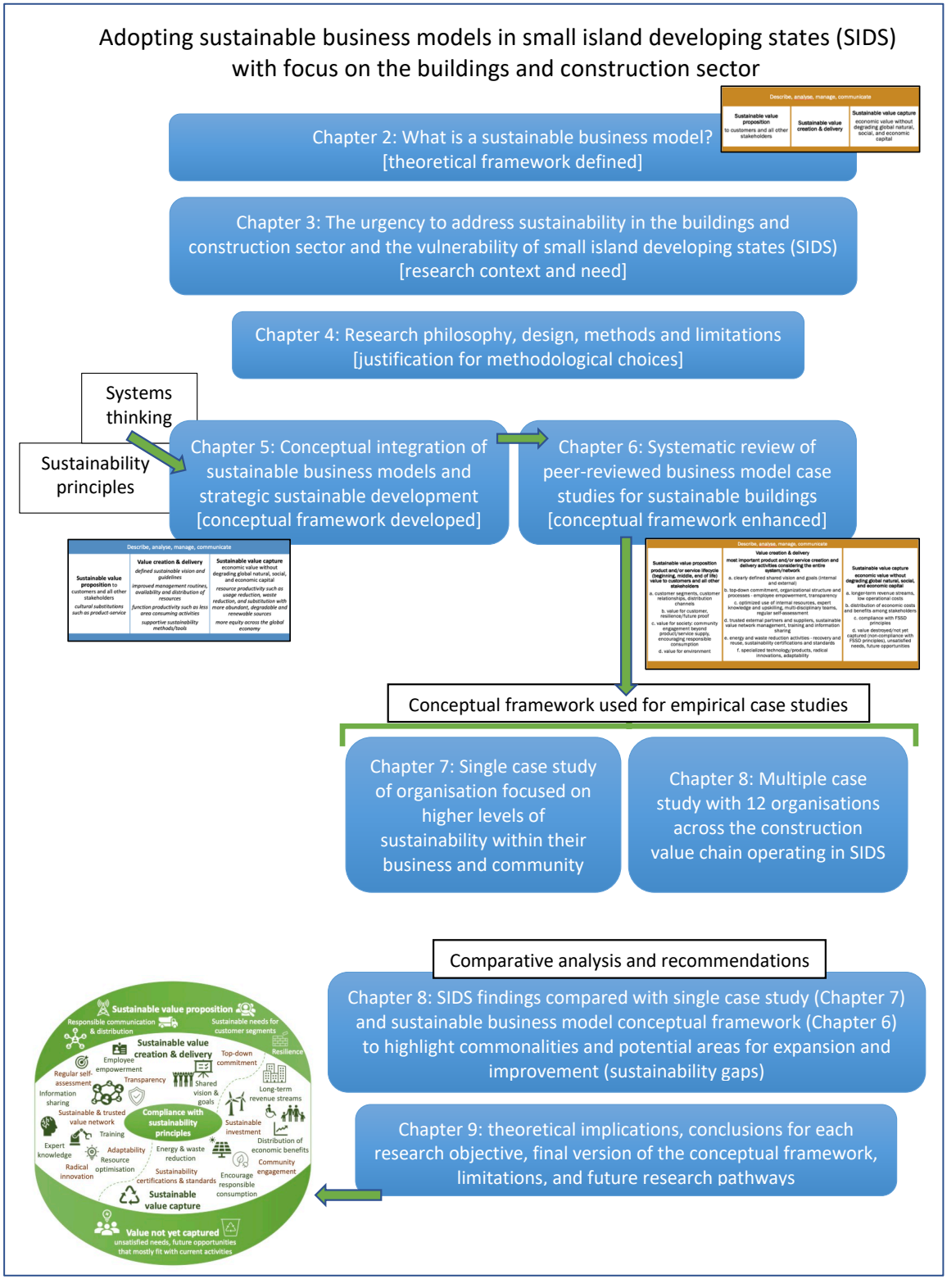

Figure 1:4 - Overview of the structure of the thesis and the research process

2 Literature Review: Sustainable Business Models

2.1 Chapter outline

This chapter describes sustainable business model definitions, archetypes, components, frameworks and tools. Since the theoretical development of sustainable business models is still at a very early stage, the aim is to identify and synthesize key themes and theoretical concepts, required components, functions and interrelationships along with key research gaps. The outcome is a sustainable business model theoretical framework that will be used as the unit of analysis for this research and will be enhanced throughout the research process.

2.2 Definitions

Stubbs and Cocklin (2008) seminal study was one of the earliest articles on sustainable business models (Schaltegger, Hansen and Lüdeke-Freund, 2016). Stubbs and Cocklin (2008) took an ecological modernization approach and proposed that "*an organization adopting a sustainability business model develops internal structural and cultural capabilities to achieve firm-level sustainability and collaborates with key stakeholders to achieve sustainability for the system that the organization is part of*" (p.123). Subsequently, Lüdeke-Freund (2010) highlighted that there was a subset of literature addressing sustainability issues using the business model as a unit of analysis. The summary of literature reviewed by Lüdeke-Freund (2010) is shown in Table 2:1. Lüdeke-Freund (2010) theoretically examined the interrelations between ecological sustainability, business activities and business model components from a strategy and sustainability management perspective to conclude that a sustainable business model is "*a business model that creates competitive advantage through superior customer value and contributes to the sustainable development of the company and society*" (p.23).

Table 2:1 - Examples of business model literature addressing sustainability issues (Lüdeke-Freund, 2010, pp. 5-6)

Article and Topic	Theoretical Perspective	Empirical Perspective	Article Type
Tukker & Tischner 2006 Product-service (PS) as specific value proposition of business models	Combining PS and business perspectives; referring to (sustainable) PS as value proposition and (sustainable) PS system as business model; latter consists of value network, value proposition, revenue model, technological infrastructure	Discussion of potential for product-services in different need areas: base materials, information and communication technology, offices, food, households; over 40 participants from industry, research and others contributed to the development of new PS	Deductive theoretical and conceptual work (also descriptive country, industry or company cases AND case-based inductive theory building)
Halme et al. 2008 Business models for material efficiency services	Three generic models for material efficiency services; focus on financial aspects; business model concept includes competitive advantage, customer benefit, resources and capabilities, financing arrangement	Opportunities for material efficiency services in paper, food and different service industries; also focusing financial and regulatory mechanisms; based on a large sample of interviews with Finnish companies, data triangulation	Descriptive country, industry or company cases (also deductive theoretical and conceptual work)
Stubbs & Cocklin 2008 Conceptualization of a sustainability business model	Business model ideal type is built on numerous structural and cultural attributes that either belong to socioeconomic environment or internal organizational capabilities	Ideal type development based on two in-depth case studies (carpet producer, bank); based on secondary data analyses and interviews	Case-based inductive theory building)
Wells 2008 Alternative business models for the automotive industry	Problem of business change is located in an industrial transformation context; strategic perspective on combinations of business structure, product-service offering, added value for customers; business model = value creation framework	Disruptive technologies in the automotive industry, innovative vs. traditional business models; four case studies of entrepreneurial and management approaches, focus on business model and technology combinations	Descriptive country, industry or company cases
Wüstenhagen & Boehnke 2008 Business models for sustainable energy	Barriers to sustainable energy technologies can be overcome by innovative business models; business model concept includes value proposition, value creation configuration and revenue model	Reference to sustainable energy technologies such as solar cells, solar thermal collectors, micro-cogeneration plants, Stirling engines or heat pumps	Deductive theoretical and conceptual work
Birkin et al. 2009a	Process of integrating corporate sustainability into business model:	Exploratory study on Chinese manufacturing companies (survey,	Descriptive country, industry

Identification of new sustainable business models in China	investigating, internalizing, integrating and innovating capabilities, commitments and partnerships; business model concept is missing	interviews); focus: environmental awareness and performance, community matters, performance drivers and barriers, sustainability issues	or company cases
Birkin et al. 2009b Identification of a new business model for sustainable development Nordic countries	Four classes of information related to sustainable development necessary to represent and assess sustainable organizations: mass balances, life-cycle impacts, stakeholders, ecological resilience; business model concept is missing	Exploratory study on diverse Nordic firms using the management method of the 'theory of constraints' as analytical frame; focus on operations related to four information classes (see above)	Descriptive country, industry or company cases
Johnson & Suskewicz 2009 Innovative business models for a clean tech economy	Innovative and customized business models are crucial to clean tech success; business models consist of value proposition, profit formula, key resources and processes	Better Place (electric vehicles) and Masdar City (planned carbon- neutral city in the Abu Dhabi desert) as examples of radical business model innovation	Descriptive country, industry or company cases
Schoettl & Lehmann- Ortega 2010 Generic types of photovoltaic business models for utilities	Business model based on value proposition and value constellation, translated into profit equation; business models result from value chain deconstruction	Qualitative approach to photovoltaic business models' fit with utilities' core competencies; based on secondary data analyses and interviews	Deductive theoretical and conceptual work (also case-based inductive theory building)

Since these developments up to 2010, there has been a significant increase in sustainable business model research. Figure 2:1 shows the annual breakdown of 558 results found in a Web of science topic search conducted on April 25th 2020 for "sustainab* business model$" OR "business model$ for sustainab*".

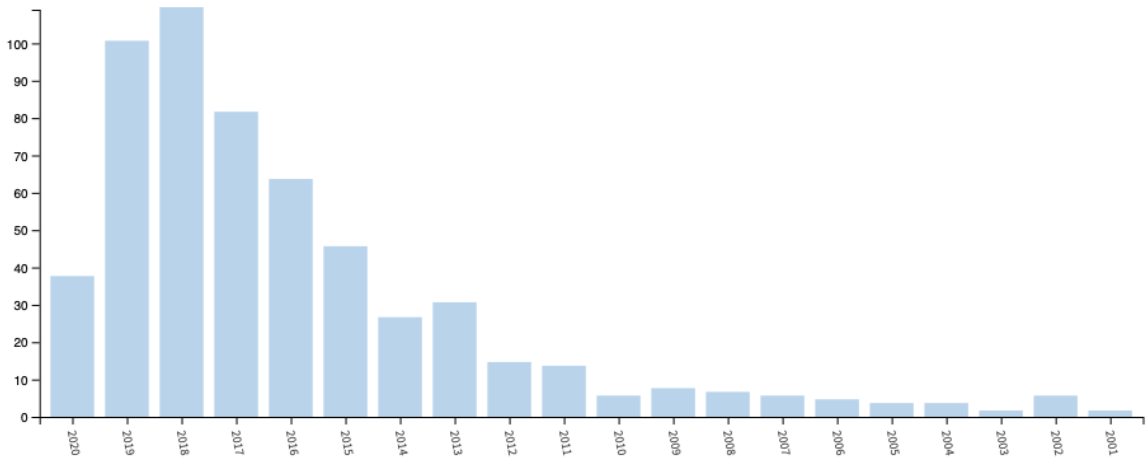

Figure 2:1 - Web of science results by publication year for "sustainab business model$" OR "business model$ for sustainab*"*

As activity increased, there was a special journal issue on business models for sustainability in Organisation & Environment where Schaltegger, Hansen and Lüdeke-Freund (2016) summarized what was learnt from the literature and proposed the following definition:

"A business model for sustainability helps describing, analyzing, managing and communicating:

i) a company's sustainable value proposition to its customers, and all other stakeholders
ii) how it creates and delivers this value
iii) and how it captures economic value while maintaining or regenerating natural, social and economic capital beyond its organizational boundaries" (p.6).

The special issue included new theoretical and conceptual approaches, new ontologies, and in-depth empirical cases. The conclusion was that business model transformation is a critical element for sustainable development in organisations but the use of business models to help drive this development is still a new focus (Schaltegger, Hansen and Lüdeke-Freund, 2016).

Across the definitions, there is a clear link to sustainability science, including a push to embrace the cradle to cradle concept. Back in the 1980's, Stahel (1982) and McDonough & Braungart (2002) highlighted that waste came at a cost but produced no value to

customers when it could actually be utilised. The core idea was to avoid waste where possible by reusing it in production. For industrial/commercial processes, materials should maintain a closed loop cycle where possible, also ideally maintaining their highest value for as long as possible. The concepts are biologically inspired as nature is already viewed as a closed loop system. Cradle to cradle goes further from reducing harmful environmental impact to encouraging prosperous regenerative activity. It emphasises the simple question – is being less bad being good? (McDonough & Braungart, 2002; Stahel, 1982).

There is therefore more specific research into 'cradle to cradle business models', 'circular business models', 'resource efficiency business models' and similar approaches that are fundamentally built on this avoidance of waste and circular production systems. These circular business models are essentially sustainable business models that primarily focus on closing and slowing material loops and require coordinated interconnectivity within complex stakeholder networks (Antikainen & Valkokari, 2016; Bakker et al., 2020; Bocken et al., 2018). These are discussed in more detail in the following sections.

The terms 'sustainable innovation', 'sustainability-oriented innovation' and 'sustainable business model innovation' can also be found in the sustainable business model literature. Boons et al. (2013) define sustainable innovation as a "*process where sustainability considerations (environmental, social and financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialization. This applies to products, services and technologies, as well as to new business and organizational models*" (p.3). They proposed that core business model concepts -value proposition, supply chain, customer interface, and financial model- are critical for successful sustainable innovations and basically view the business model as a marketing tool that can enable these innovations to be successful (Boons et al., 2013). Sustainable business model innovation requires the development and implementation of new solutions for a firm to contribute to sustainable development. Similar to

sustainable innovation, these solutions apply to processes, products, marketing, organisation, etc. (Morioka, Evans and Carvalho, 2016; Evans et al., 2017). Sustainability-oriented innovation surrounds organizations making changes beyond products, processes or practices to intentionally transforming philosophy and values that expand to encompass the economy, society and environment (Adams et al., 2016). Whilst these concepts similarly aim to embed sustainability at the core of organizations, they investigate the development and implementation processes towards sustainable business models. This research focuses on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders (environmental, social and financial). It does not include the investigation of sustainable business model innovation but the research outcomes will still be very useful for innovation studies as there will be unavoidable content overlap.

2.3 Archetypes and components

Greenwood and Hinings (1993) proposed that an archetype is "*a set of structures and systems that consistently embodies a single interpretive scheme*" (p.1055). To help expand research on organizational theory and typologies, identifying and classifying design archetypes begins with identifying the core beliefs and values embodied in the structure and system (Greenwood and Hinings, 1993).

Stubbs and Cocklin (2008) analysed sustainable organisations using abductive reasoning and grounded theory to generate characteristics and components of an ideal sustainable business model. Fifteen structural attributes and nine cultural attributes were placed into four groups of characteristics: economic, environmental, social and multidimensional/holistic. They concluded with six characteristics of sustainable business model:

- *"draws on economic, environmental and social aspects of sustainability in defining an organization's purpose*
- *uses a TBL approach in measuring performance*
- *considers the needs of all stakeholders rather than giving priority to shareholder's expectations*
- *treats nature as a stakeholder and promotes environmental stewardship*

- *sustainability leaders, or champions, drive the cultural and structural changes necessary to implement sustainability*
- *encompasses the systems perspective as well as the firm-level perspective"* (Stubbs and Cocklin, 2008, p.121-122).

Despite the limitation that only two organizations were used for the study, these parameters provide ideal types that could be improved upon with further empirical research into how firms incorporate sustainability (Stubbs and Cocklin, 2008; Schaltegger, Hansen and Lüdeke-Freund, 2016).

The product-service systems (PSS) concept embodies a value proposition that aligns with sustainable business model thinking and therefore sparked significant interest in sustainability literature (Tukker, 2004; Tukker and Tischner, 2006; Reim et al., 2015; Evans et al., 2017; Franca et al., 2017). The customer's usage and satisfaction are the focus for business and product development. The integration of service with products minimizes customer effort and offers more customizable solutions through enhanced customer relationships. The concept can enable more efficient product usage and sustainable practices; however, it requires radical changes in the value proposition and business-consumer interactions thus making it difficult to implement. The major challenges have been with the business to consumer market as these consumers highly value product ownership (Tukker, 2004; Tukker and Tischner, 2006; Reim et al., 2015).

Bocken et al. (2014) developed eight sustainable business model archetypes, subsequently nine (Bocken, Weissbrod and Tennant, 2016; Lüdeke-Freund, F. et al., 2016), by systematically identifying themes in the literature, considering alternatives for categorization (existing conceptual frameworks), and analysing examples from practice (using secondary literature such as existing case studies, corporate websites, and sustainability reports). Since novel business models were being explored in practice (grey literature) that were not yet explored within academia, these were included for analysis. Various approaches applicable to integrating sustainability in organizations were also considered by reviewing major frameworks and concepts in the sustainability literature. The goal was to provide a variety of mechanisms for the creation or

innovation of business models for sustainability. The entire value network was considered along with the creation of new systems as opposed to only focusing on existing firms and technologies. Three business model components, adapted from Osterwalder and Pigneur's (2010) nine building blocks and Richardson's (2008) business model framework, were used to explain each archetype: value proposition, value creation & delivery, and value capture. The value proposition identifies the product and/or service being offered. Value creation and delivery involves the activities and resources needed to seize new opportunities and markets. Value capture lays out how to generate measurable value from the product and/or service. These components are aligned with Schaltegger, Hansen & Ludeke-Freund (2016) sustainable business model definition.

The nine sustainable business model archetypes, examples and potential impacts are shown in Figure 2:2. The archetypes are grouped based on the dominant component. Since the archetypes were developed using historical information, they need to be revisited to keep up with practice. There are or will be new and perhaps radical approaches that were not considered. Social findings were not as frequently encountered or developed as the environmental innovations, highlighting the weakness of social development in this area (Bocken et al., 2014; Ritala et al., 2018). An analysis of the Swedish agri-food sector that surveyed 204 companies found that only half of the companies completely aligned with an archetype. Given that Sweden is considered as one of the most sustainable countries in the world, this led to the question of if the archetypes were suitable for this sector or required much more consideration. One thought is that research may be taking a generalized approach and lack industry specific tools to help with novel business model development (Ulvenblad et al., 2019).

	ENVIRONMENTAL			SOCIAL			ECONOMICAL		
	1. Maximizing material and energy efficiency	2. Closing resource loops	3. Substituting with renewables and natural processes	4. Delivering functionality, not ownership	5. Adopting a stewardship role	6. Encouraging sufficiency	7. Repurposing for society/ environment	8. Inclusive value creation	9. Developing sustainable scale-up solutions
Short definition	Do more with fewer resources. Generate less waste, emissions, and pollution.	Reuse materials and products. Turn waste into feedstocks for other products/ processes.	Use of non-finite materials and energy sources.	Provide services that satisfy users' needs without their having to own physical products.	Proactively engage with all stakeholders to ensure their long-term health and well-being.	Solutions that actively seek to reduce end-user consumption.	Seek to create positive value for all stakeholders, in particular society and environment.	Sharing resources, knowledge, ownership, and wealth creation. Inclusive value generation.	Delivering sustainable solutions at a large scale to maximize benefits for society and the environment.
Innovations within this archetype	Lean manufacturing. Dematerialization. Increased functionality.	Cradle-to-cradle. Industrial symbiosis. Extended producer responsibility.	Cleantech. Renewable energy (e.g. solar, wind). Biomimicry.	Rental/lease. Pay per use. Product-service combinations.	Community development. Biodiversity protection. Choice editing.	Consumer education. Demand management. Slow fashion. Frugal businesses.	Social enterprises and benefit-corporations. Non-profits. Hybrid models. Net positive initiatives.	Collaborative platforms. Collaborative consumption. Peer-to-peer and sharing models.	Open innovation platforms. Incubators. Slow/patient capital.
Typical positive impacts	Enhance efficiency and improve resource use. Save costs.	Reduce waste. Turn waste into value/new business lines. Generate new revenue streams.	Reduces use of finite resources, waste, and pollution. Supports long-term energy supply. Contributes to "green economy."	Can encourage the right behaviours with manufacturers and users. Can reduce the need for physical good.	Ensure long-term well-being of planet (e.g. forests) and society (e.g. health). Ensure long-term viability of the value network.	Actively reduce consumption. Encourage community sufficiency, sustainable living. Build long-term customer loyalty, and new repair and service markets.	Deliver positive societal (e.g. community development) value. Deliver positive environmental (e.g. afforestation) value. Prepare for a resource capacity for long-term business sustainability.	Share resources, skills, and knowledge, and distribute wealth. Leverage resources and talents. Create new business opportunities.	Achieve scale from small sustainability pilot or start-up to large-scale project or business. Create industry-wide change for sustainability. Create breakthrough innovation.
Possible negative side effects	May generate incremental change only. May lead to rebound effects. May lead to job losses.	May lead to quicker sales cycles and more material use. May sustain waste streams because waste = value.	"Carbon lock-in" and NIMBY prevent uptake. Embedded footprint of production (e.g. solar panels). Lack of recyclability consideration of (solar-based) products.	More product/ service usage. If not combined with efficiency improvements, it may have negligible environmental impact improvement.	More product/ service usage. If not combined with efficiency improvements, it may have negligible environmental impact improvement.	Potential price premium for consumers. Remaining niche because it goes against "growth" principles.	Potential to remain niche without policy changes. Potential to remain niche within current capitalist framework.	If not combined with efficiency improvements, it may lead to limited environmental improvement. May induce more product/service use due to wider accessibility.	Focus on scale might detract from sustainability purposes. Risk of unproven radical innovation.

Figure 2:2 - Nine SBM archetypes adapted from Bocken et al. (2014) (Lüdeke-Freund et al., 2016)

Ulvenblad et al. (2019) research also highlighted 'value intention' as a critical element for the agri-food industry due to its inherent nature of aiming to conduct business in a sustainable way. Many agricultural companies are family businesses with strong connections to the community, appreciation of the ancestral history of the land and accepted responsibility for future generations (Barth et al., 2017; Ulvenblad et al., 2019). All eight archetypes used in the study were found across the 102 companies that matched with an archetype(s). The highest matched archetypes were 'maximize material and energy efficiency' and 'adopt a stewardship role' and the least were 'repurpose the business for society/environment' and 'encourage sufficiency'. Bocken and Short (2016) also found a lack of sufficiency driven business models and highlighted the need for further research on sufficiency as a business strategy.

To create a more holistic sustainable business model categorization approach, Ludeke-Freund et al. (2018) consolidated the literature (both academic and practice-oriented to be as current and rigorous as possible given the youth of the field) on sustainable business model ideal types and developed 45 sustainable business model patterns (Figure 2:3) based on Alexandrian pattern theory -originally conceptualised to articulate built environment design and planning (Alexander et al., 1977). The patterns are not specific to one tool or framework and therefore should be applicable to various ideologies/disciplines:

> "*A sustainable business model pattern describes an ecological, social, and/or economic problem that arises when an organisation aims to create value, and it describes the core of a solution to this problem that can be repeatedly applied in a multitude of ways, situations, contexts, and domains. A sustainable business model pattern also describes the design principles, value creating activities, and their arrangements that are required to provide a useful problem–solution combination*" (Ludeke-Fruend et al., 2018, p.148).

This consolidation was proposed to help unify existing research and build a stronger theoretical base for advancing the sustainable business model field (Lüdeke-Freund et al., 2018). Circular economy business models, considered to fall within sustainable business models, use circular economy principles to guide value creation and delivery

(Bocken et al., 2014; Ghisellini et al., 2016; Lüdeke-Freund et al., 2019). Similar to the unification aims of business model patterns, early stage development of circular economy business model (CEBM) patterns from academic and practitioner literature concluded with six patterns: repair and maintenance; reuse and redistribution; refurbishment and remanufacturing; recycling; cascading and repurposing; and organic feedstock business models (Lüdeke-Freund et al., 2019). Diaz Lopez et al. (2019) also investigated 143 cases of resource efficient and circular business models (including non-scientific literature).

Incorporating circular economy principles requires companies to rethink supply chains so that cycles can be reversed but it also requires the consideration of behavioural aspects, such as promoting sufficient lifestyles. If target groups are not well defined, it is also challenging to investigate user heterogeneity. More research is required on benefits for both companies and customers from these types of models and the details of very successful partnerships (NGOs, government, etc.). Furthermore, "*there is a clear gap with regard to the role, relevance, and features of CEBMs that operate in developing and emerging countries*" (Ludeke-Fruend et al., 2019, p.56). Overall, sustainable business model research still requires deeper insights from statistical analyses of larger groups of case studies. The lack of empirical data equates to a lack of research on addressing implementation barriers, in practice. More emphasis also needs to be placed consistent usage of terms so that research processes can be followed and built on (Bocken & Short, 2016; Diaz Lopez et al., 2019; Lüdeke-Freund et al., 2019).

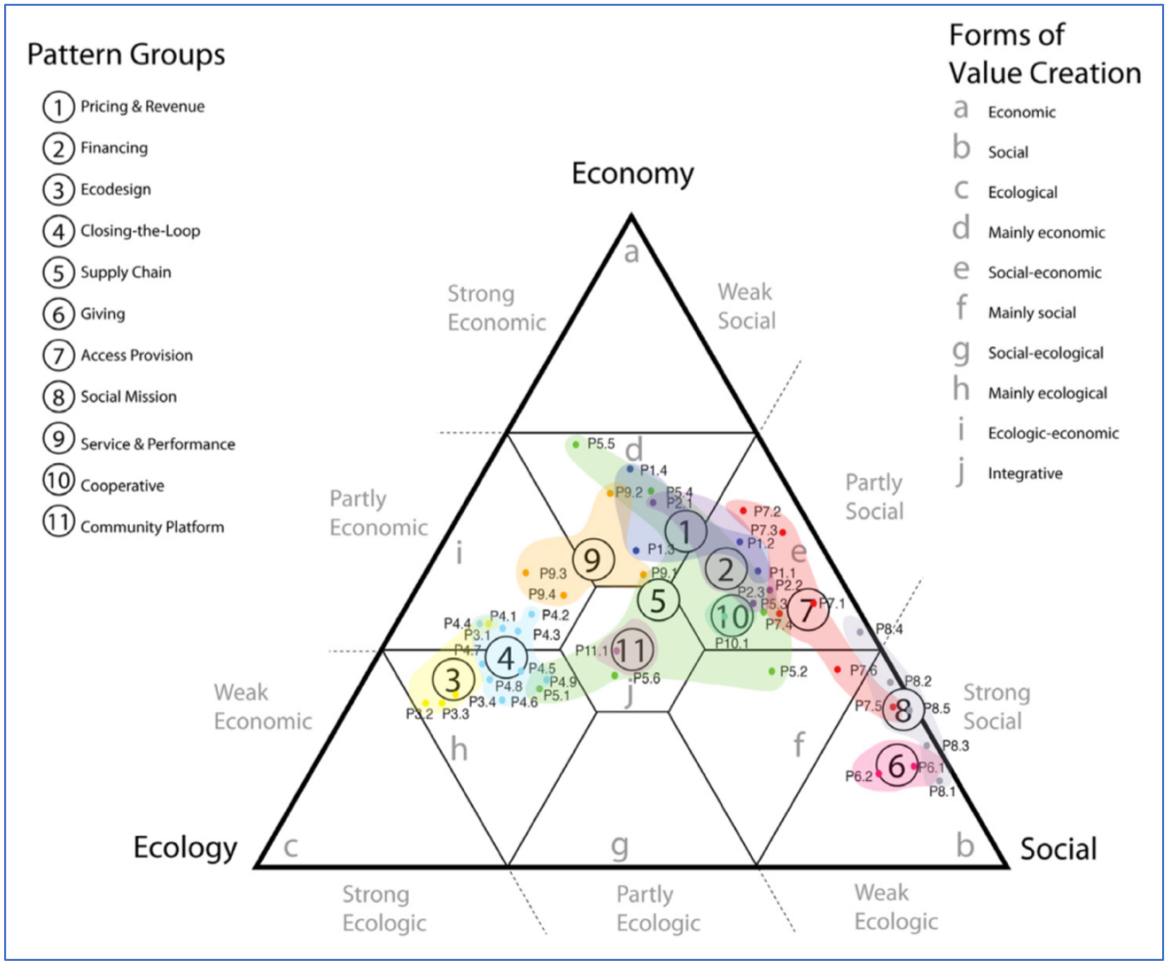

Figure 2:3 - A triangular view of the SBM pattern taxonomy developed by Ludeke-Freund et al. (2019, p.156)

2.4 Frameworks and tools

Further to identifying ideal types, research on sustainable business models has also focused on assisting firms to incorporate sustainability in practice. Bocken et al. (2013) found that existing tools mostly focused on one sustainable development element - environment, economy, or society- in comparison to the entire system. Through six industry case studies, a 'value mapping tool' was created and tested to improve awareness of the positive and negative value of various business activities to all stakeholders. Geissdoerfer et al. (2016) further proposed a sustainable business model value mapping solution by integrating existing value mapping approaches with design thinking. Continuing the focus on value, Yang et al. (2017) proposed the consideration of 'value uncaptured' as a new way to thoroughly evaluate value perspectives for SBMs. The theoretical framework considers four forms of uncaptured value -value surplus,

value absence, value missed, and value destroyed- and uses six empirical studies with product-service system (PSS) firms for validation. The results indicated that the framework increases the understanding of the negative impact of unsustainable business activities in a structured way, leading to the discovery of new sustainable opportunities and sustainable business models (Yang, M. et al., 2017). Yang, Vladimirova & Evans (2017) sustainable value analysis tool analyses this concept of uncaptured value throughout the entire product life cycle assessment (LCA). It uses a step-by-step approach to systematically identify value uncaptured and how it translates to value opportunity. Overall, the tool is focused on ideation and not implementation. An expert facilitator is critical to guiding the process (Yang, Miying et al., 2017).

Morioka et al. (2018) created a visual sustainable business model framework for both academia and industry called the 'sustainable value exchange matrix' (SVEM) shown in Figure 2:4. The SVEM was developed from a systematic literature review on sustainable business models to strengthen the conceptual foundation and practitioner interviews to validate practical application and enhance usability (Morioka et al., 2018). Tauscher & Abdelkafi (2018) selected an innovative company with high societal impact, formed hypotheses, created a conceptual sustainable business model and used a quantitative stock-and-flow simulation model to simulate sustainability and financial performance towards assessing robustness and scalability. The results indicated that the strongest element of scalability was societal value creation and robustness was directly linked to withstanding changes in the market/environment. The research used a private company and relied on third party sources for the simulation data but the researchers suggest using the model as a cheap business model experimentation tool that can be further developed using formal sustainability indices (Tauscher & Abdelkafi, 2018).

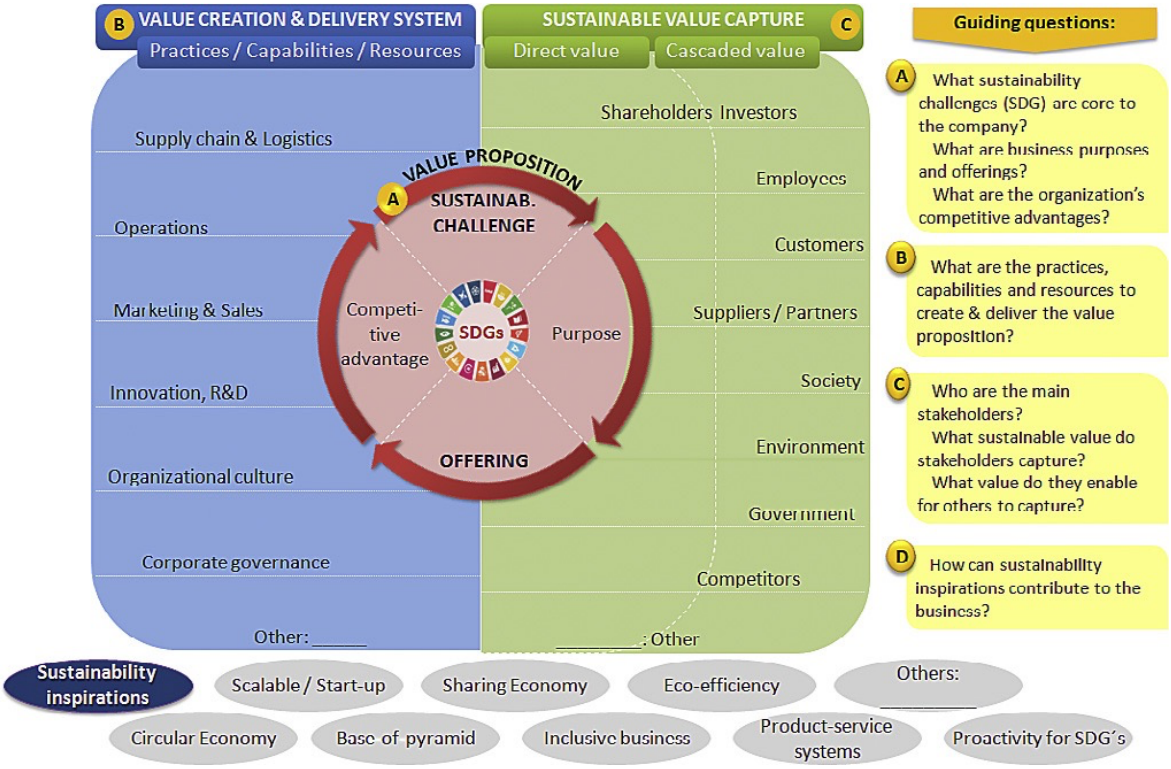

Figure 2:4 - Sustainable value exchange matrix (Morioka, Bolis & Monteiro de Carvalho, 2018, p.85)

The very popular framework in business management literature is Osterwalder & Pigneur's (2010) business model canvas (BMC) which is used to support the development of business models. Multiple researchers have built on the BMC for sustainable business model research. For example, Bocken and Short (2016) used the framework shown in Figure 2:5 to investigate sufficiency-driven business models.

Value proposition	Value creation & delivery	Value capture
1. Product/ service, 2. Customer segments and relationships, 3. Value for customer, society, and environment *What value is provided and to whom?*	4. Activities, 5. Resources, 6. Distribution channels, 7. Partners and suppliers, 8. Technology and product features *How is value provided?*	9. Cost structure & revenue streams, 10. Value capture for key actors incl. environment & society 11. Growth strategy/ ethos *How does the company make money and capture other forms of value?*

Figure 2:5 - Sustainable business model framework used by Bocken and Short (2016, p.44)

Joyce and Paquin (2016) expanded the BMC to integrate the three sustainability elements with an inside-out approach based on the view that a business model is often implicitly understood. The tool is called the 'triple layered BMC' where the environmental layer adds a life-cycle perspective and the social layer focuses on stakeholder engagement and management. It is a simple tool for guiding the development of sustainable business models and driving change but is only a starting point with a high-level viewpoint (Joyce & Paquin, 2016). The framework for strongly sustainable business models (SSBM), known as the strongly sustainable business model ontology (SSBMO), also expands on Osterwalder & Pigneur's (2004; 2010) theoretical contributions. The approach is from organizational management, built on scientific knowledge and derived from the initial question of what is a successful sustainable business. Interlinked with cradle to cradle thinking, a key aspect is to move beyond sustainable development to 'flourishing by design' (Upward and Jones, 2016). This is based on Laszlo et al. (2014) definition:

> "*Flourishing individuals and organizations go beyond the limited paradigms of incentives, and beyond the usual attempts at employee engagement and positive cultures. They are able to tap into something much more profound, powerful and ever ineffable. They unleash the human spirit. And the challenge of doing exactly that will need to be met by increasing numbers of businesses in the years ahead"* (Laszlo et al., 2014, p.10).

Upward and Jones (2016) view is that a truly systems-based approach underpinned by natural and social science is critical to sustainable business model research and practice. Small-Warner et al. (2018) similarly identified that exploring the interrelationship between sustainable business models and the framework for strategic sustainable development (FSSD) could lead to a systemic, scientific and strategically robust sustainable business model concept. The FSSD has proven that science can help business leaders with sustainability transitions. The framework facilitates multilevel and cross-sectoral understanding and collaboration (Broman & Robert, 2017). In an effort to enhance strategic sustainable development from a business perspective, Franca et al. (2017) combined the BMC with the FSSD to create business model design for strategic sustainable development. The FSSD strengthened the BMC through the integration of

sustainability-driven thinking towards longer-term market requirements. The FSSD was enhanced with a thorough integration of a business perspective. The most notable business impacts from the combination were business model scalability to global level, risk identification and avoidance, investment strategy, and enhanced partnerships and social integration (Franca et al., 2017). Further researching this combination could improve the understanding of sustainability challenges and how they may be turned into business opportunities. The FSSD can also be used to highlight whether or not current actions are indeed sustainable and enhance the integration of social sustainability in sustainable business models (Small-Warner et al., 2018).

One noticeable caveat is that the success of most of these tools requires expert facilitators and more skill and analysis than the tools provide (Bocken et al., 2013; Geissdoerfer, Bocken and Hultink, 2016; Yang, Vladimirova and Evans, 2017; Morioka, Bolis and Carvalho, 2018). De Padua Pieroni, Pigosso and McAloone (2018) also concluded this in their research on sustainable qualifying criteria for the design of sustainable and circular business models. It was found that the existing approaches for the design of sustainable business models were experimental, complex and not holistically sustainable. A sustainable qualifying criteria framework was proposed which has five categories. Four of the categories –proposition, creation, delivery, and capture- are similar to the business model components used by Bocken et al. (2014) to develop the sustainable business model archetypes. The categories were created based on work from Teece (2010), Osterwalder and Pigneur (2010), Boons and Ludeke-Freund (2013), and Yang et al. (2017). Value transformation, the fifth category, accounts for elements that may not fit into the previous categories and incorporate a transformational and long-term perspective (de Pádua Pieroni et al., 2018). However, this transformational element appears to be more aligned with strategy or sustainable business model innovation.

In extension and addition to the literature, online tools and communities have been created to circulate and build sustainable business model knowledge (Table 2:2). They

are similar to Lave and Wagner's (1991) definition of communities of practice: "*an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communit*y" (p.98). Less experienced members learn from experts or more experienced members through social interaction and activities or tasks (Lave & Wenger, 1991).

Table 2:2 - Sustainable business model online tools and communities

Online platform or community	Connection to research	Structure
Sustainable Business Model.Org https://blog.ssbmg.com	Started by F. Ludeke-Freund	▪ Discussion curated by research experts ▪ Free learning resources
BM Innovation Grid http://www.plan-c.eu/bmix/	Bocken et al (2014) SBM archetypes	▪ Database of ideal types (100 cases) ▪ Free learning resources
Flourishing Enterprise Innovation www.flourishingbusiness.org	Upward & Jones (2016) Ontology for strongly SBMs, flourishing business canvas	▪ Linked to Sustainable Business Model.Org blog ▪ Free learning resources ▪ Niche – Strongly SBM/Flourishing BM
GreenEcoNet http://greeneconet.eu (last update 2016)	EU Research & Innovation funding programme (2013-2016)	▪ Open discussion community ▪ Free learning resources ▪ Niche – SMEs & green solutions
Empowering European SME BMI (Envision) www.businessmakeover.eu	EU Research & Innovation funding programme (2015-2018)	▪ Database of ideal types (11 cases) ▪ Open discussion community ▪ Free learning resources ▪ Niche – Social SMEs
PV Financing Project http://www.pv-financing.eu	EU Research & Innovation funding programme (2015-2017)	▪ Free learning resources ▪ Niche – Solar PV technology
FUSIONS EU co-funded project https://www.eu-fusions.org	EU Research & Innovation funding programme	

2.5 Performance

B Corp Certified companies are for-profit companies certified by the nonprofit B Lab to meet social and environmental performance, accountability, and transparency standards. There is a growing community of more than 2,500 Certified B Corps from over 50 countries and a variety of industries working to redefine business success (B Corporation, 2018). Piscicelli, Ludden and Cooper (2018) compared two companies with sharing-based business models that are considered intrinsically sustainable and found

that despite having the B Corp Certification, the ecological and social elements of the business needed to be better reported (Piscicelli, Ludden and Cooper, 2018). Overall, there is a lack of research on sustainable business model functionality and real-world applications along with how to understand or measure their success (Dentchev et al., 2016). Kendall (2019) highlighted multiple reasons why sustainability performance metrics need to be critically evaluated. Firstly, some companies receive high sustainability scores/ratings due to better performance than peers but still have fundamentally unsustainable business models. Secondly, there is a focus on previous performance without as much consideration of the credibility of and commitment to longer term goals. Thirdly, methods used for measurement sometimes provide minimal useful feedback to companies on improvement. To overcome some of these challenges, the open source 'Future-Fit Business Benchmark' was proposed, which is a self-assessment tool. The goal is to help with clearly defining long term goals and the pathway to achieving them. The FSSD is one the frameworks that underpins the benchmark (Future-Fit Foundation, 2016; Kendall, 2019)

Brehmer, Podoynitsyna and Langerak (2018) used the business model as a unit of analysis to conduct a study on 64 sustainable organizations. The results showed that sustainable business models rely on the entire network/system and that a boundary-spanning systems perspective of the business model is likely to give more valuable insight than a component-based focus such as using the elements of the BMC. They proposed that Zott and Amit's (2010) business model properties -content, structure, governance- could be used to create sustainability indices and assess performance (Brehmer, Podoynitsyna and Langerak, 2018). Similarly, Ritala et al. (2018) used Zott and Amit's (2010) activity systems perspective combined with the logic that practice provides fundamental evidence of transitions in society and business. Sustainable practices/activities, assumed to be a part of or the outcome of sustainable business models, indicate sustainable efforts. A longitudinal study of sustainable business activities from 101 S&P 500 firms was conducted to therefore identify sustainable business model transformation trends. Neumeyer and Santos (2018) also assessed

sustainable entrepreneurial activities but used a social constructivist approach along with network theory and entrepreneurial ecosystems to evaluate social connections between the sustainable business models and its ecosystem. Performance and certifications are seemingly linked to sustainable business activities, which are considered to be the product of the business having sustainable business model(s).

2.6 Conclusion to the literature review and research implications

In the theoretical and practical development of sustainable business models, scholars aim to embed sustainable development (encompassing the environment, society, and economy) into all business processes and expand beyond organisational boundaries. There is regular reference made to re-conceptualising value and embracing wider stakeholder collaboration. This has been presented through definitions, archetypes, frameworks and tools but research has not yet matured. The discourse shows a general alignment on systems thinking as a necessary approach for this topic along with the expected business research approaches such as innovation, organizational, and strategic management. Other approaches also emerged such as ecological modernization (Stubbs and Cocklin, 2008), network theory (Bocken et al., 2014; Neumeyer and Santos; 2018), design thinking (Geissdoerfer, Bocken and Hultink, 2016), lifecycle thinking (Joyce and Paquin, 2016; Yang, Vladimirova and Evans, 2017), flourishing enterprise, sociology (Upward and Jones, 2016), relational leadership (Rauter, Jonker and Baumgartner, 2017), system dynamics (Tauscher and Abdelkafi, 2018), and natural science and strategic sustainable development (Upward and Jones, 2016; Future-Fit Foundation, 2016; Franca et al., 2017; Rauter, Jonker and Baumgartner, 2017; Kurucz et al., 2017). Scholars also report a lack of focus or suitable inclusion of the social element of sustainability (Bocken et al., 2014; Upward and Jones, 2016; Ritala et al., 2018).

The majority of methods utilized in the sustainable business model literature appear to be literature reviews and exploratory empirical case studies with questionnaires, interviews and workshops, using firms already engaging in sustainable business practices. Sustainable business practices are used as an indicator of the presence of sustainable business models. There is also the creation of conceptual models or

descriptive frameworks, with some using abductive reasoning and grounded theory. Overall the majority have restrictive sample sizes that limit further generalization. Longitudinal studies and big data analyses (Brehmer et al., 2018; Diaz Lopez et al., 2019; Lüdeke-Freund et al., 2018; Ritala et al., 2018) now seem to be emerging in an attempt to include quantitative methods towards better understanding sustainable business model patterns, progress and performance. However, caution must be used when analyzing the frequency of terms/keywords as a comparative sustainability indicator (Ritala et al, 2018). These findings are still in alignment with the recent sustainable business model systematic literature review (up to September 2016) by Morioka, Bolis and Carvalho (2018), which analysed 79 peer-reviewed publications. The two main research methods were found to be exploratory case studies and literature reviews. Others included*: "Delphi method, interviews, secondary data analysis, workshops, longitudinal study, engaged scholarship, grounded theory, ethnographic study, etc."* (p. 78).

Archetypes are configured structures expressing underlying value. In business model literature, archetypes are typically derived from well-known firms, through in-depth case studies, thus adding the practical element to the concept (Fielt, 2013). Bocken at al. (2014) developed sustainable business model archetypes mainly from academic and grey literature; therefore, whilst the archetypes are very useful for advancing research and innovation in a more structured and unified manner, more empirical data is needed. Researchers have so far identified that two of the archetypes are rarely found - 'repurpose the business for society/environment' and 'encourage sufficiency' - and that the archetypes have research limitations in some sectors. Industry specific tools are needed to help with novel business model development and further research is needed on sufficiency as a business strategy (Bocken & Short, 2016; Ulvenblad et al., 2019). To create a more holistic categorisation approach, Ludeke-Freund et al. (2018) developed 45 sustainable business model patterns that should be applicable to various ideologies/disciplines. The patterns aim to help unify existing research and build a stronger theoretical base for advancing the sustainable business model field. Circular

economy business model patterns have also been proposed to focus on sustainable business models that are built on circular economy principles (Lüdeke-Freund et al., 2019).

Overall, there are strong cases that the sustainable business model concept facilitates the articulation and implementation of sustainable solutions. Despite increased sustainable business model research activity over the last decade, there are still ongoing attempts to unify concepts, empirical explorations and testing of frameworks and archetypes, and investigations into the ways to achieve sustainable business models in practice (Dentchev et al., 2016; Evans et al., 2017). Target groups have been found to be weakly defined which makes it challenging to investigate user heterogeneity. Clearer guidance is required on benefits for both companies and customers along with the details of partnerships (NGOs, government, etc.) that have been found to be heavily relied on for success (Bocken & Short, 2016; Lüdeke-Freund et al., 2019). Integrative research is recommended to continue development for a sustainable economy and society and emphasis is needed on methodological rigour and consistent usage of terms so that research processes can be followed and built on (Ludeke-Freund & Dembek, 2017; Schaltegger et al., 2016). This is especially the case for developing and emerging countries where there is a clear research gap (Lüdeke-Freund et al., 2019; Silvia & Truzzi, 2020). The majority of literature covers businesses from the UK, USA and Europe and the remaining literature covers Australia, Canada, Brazil and China (Silvia & Truzzi, 2020, Table 6).

A systems-based approach underpinned by natural and social science is also critical to sustainable business model research and practice (Upward and Jones, 2016; Small-Warner et al., 2018). The FSSD has proven that science can help business leaders with sustainability transitions (Broman and Robert, 2017). Exploring the interrelationship between sustainable business models and the FSSD could improve the understanding of sustainability challenges and how they may be turned into business opportunities. The FSSD can also be used to highlight whether or not current actions are indeed sustainable

and enhance the integration of social sustainability in sustainable business models (Small-Warner et al. 2018). This is important given that some companies are acknowledged as sustainable due to better performance than peers but still have fundamentally unsustainable business models (Kendall, 2019).

Based on the sustainable business model literature, the following needs arise (research gaps):

1. Systems-based, boundary-spanning approach underpinned by natural and social science
2. Emphasis on the social element of sustainability
3. Clearer guidance on benefits for both companies and customers
4. Sector specific empirical data (contextual implications)
5. Analysis from developing and emerging economies (contextual implications)
6. Analysis of partnerships (NGOs, government, etc.) that are relied on for success
7. Real world applications and how to understand or measure their success
8. Attention to the importance of customer heterogeneity through better definition and analysis of target groups
9. Empirical data on the lesser found archetypes 'repurpose the business for society/environment' which requires changing the business vision and aims to positively contribute sustainable development and 'encourage sufficiency' which requires slowing consumption patterns (examples include Vitscoe and Patagonia)
10. Capacity building approaches/tools for the use of specialized methods and tools or simplified versions of the tools and frameworks to guide individuals and corporations
11. Analysis of the contribution of online communities and tools (linked to above point).

This research focuses on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders. The research begins by

further exploring how the FSSD has been used to enhance sustainability in business and management research to gather insights for enhancing sustainable business models. The aim is to build on the integration of systemic and scientific approaches to contribute to the first five areas of research needs – guided by the following research objectives:

- identify sustainable business models in buildings and construction (first in general and then more specifically to address the research gap on sustainable business models in developing countries);
- develop a conceptual sustainable business model framework for analysing business models in buildings and construction (contributing to sustainable business model research for buildings and construction); and
- identify sustainability gaps (and provide high-level recommendations for reducing the gap) in organisations in the Caribbean region using the conceptual sustainable business model framework.

2.7 Theoretical framework for this research

Eisenhart (1991) defines a theoretical framework as "*a structure that guides research by relying on a formal theory; that is, the framework is constructed by using an established, coherent explanation of certain phenomena and relationships*" (p.205). It outlines the underlying principles, definitions and concepts that the researcher will follow. This enables clearer communication amongst scholars and encourages researchers to be more systematic (Eisenhart, 1991; Grant and Osanloo, 2014). The sustainable business model theoretical framework will be used to frame this research (Figure 2:6).

Describe, analyse, manage, communicate		
Sustainable value proposition to customers and all other stakeholders	**Sustainable value creation & delivery**	**Sustainable value capture** economic value without degrading global natural, social, and economic capital

Figure 2:6 - Theoretical sustainable business model framework adapted from Bocken et al. (2014) and Schaltegger, Hansen and Ludeke-Freund (2016)

3 Research context: sustainability in the built environment and in small island developing states (SIDS)

3.1 Chapter outline

This chapter first introduces the sector that is being researched, buildings and construction, by describing sustainable buildings and the incorporation of circular economy principles. This is followed by an overview of general barriers to scaling up sustainability in the sector, which highlights the important role of sustainable business models and the need for further research. The chapter then describes the motivation for focusing on small island developing states (SIDS) - a group of countries that encounter distinct social, economic and environmental obstacles to sustainable development – by providing an overview of the vulnerability of SIDS and the built environment in Latin America and the Caribbean (LAC).

3.2 Sustainable buildings

"*Too many structures diminish humanity because primary design criteria focus on building taller, faster, and cheaper instead of building better*"

(Fedrizzi, 2010 in (Tisak, 2015, p.11)

Buildings and construction (including building materials' manufacturing) together account for just over one third of the world's final energy use and carbon dioxide emissions from energy-related sources. The global buildings sector is projected to double its floor area in 40 years (by 2060) and the use of fossil fuels in buildings has been relatively constant since 2010. These projections and trends counteract with global climate change goals. To meet the Paris Agreement, the global average building energy intensity needs a 30% improvement by 2030. The buildings and construction sector therefore needs to rapidly scale up actions. This requires, but is not limited to, regulatory support, financing mechanisms, capacity and awareness building and the implementation of successful business models (UN Environment and International Energy Agency, 2017).

Energy performance is a major building performance criterion to assess sustainability (Berardi, 2013; GhaffarianHoseini et al., 2013). In some cases, the terms energy efficient building, green building and sustainable building are used interchangeably (Darko & Chan, 2017). However, considerations for a sustainable building expand beyond physical building boundaries. Consolidating the literature on sustainability in the built environment, Berardi (2013) defined a sustainable building as "*a healthy facility designed and built in a cradle-to-grave resource-efficient manner, using ecological principles, social equity, and life-cycle quality value, and which promotes a sense of sustainable community*" (p. 76). Resource efficiency ranges from material production to construction to operation and end of life. There is operational impact through the energy generated to use buildings and there is embodied impact from the processes used to produce, supply and deconstruct building materials (Kibert, 2016). Buildings can exist longer than our lifecycle projections. Flexibility, adaptability and resilience over time and through unpredictable changes are therefore fundamental considerations. It is also important to understand that there is a dynamic relationship between a building and its surrounding environment and community, requiring considerations for infrastructure interconnectivity, social impact and cultural/traditional preservation (Berardi, 2013; Kibert, 2016).

Pomponi & Moncaster (2017) found that research into sustainable buildings and construction mostly focused on individual products that create the building in comparison to the final complex structure as a whole. To address this, they proposed a 'six pillar' framework (Figure 3:1) for research on 'circular buildings', which they define as "*a building that is designed, planned, built, operated, maintained and deconstructed in a manner consistent with circular economy principles*" (Pomponi & Moncaster, 2017, p.711).

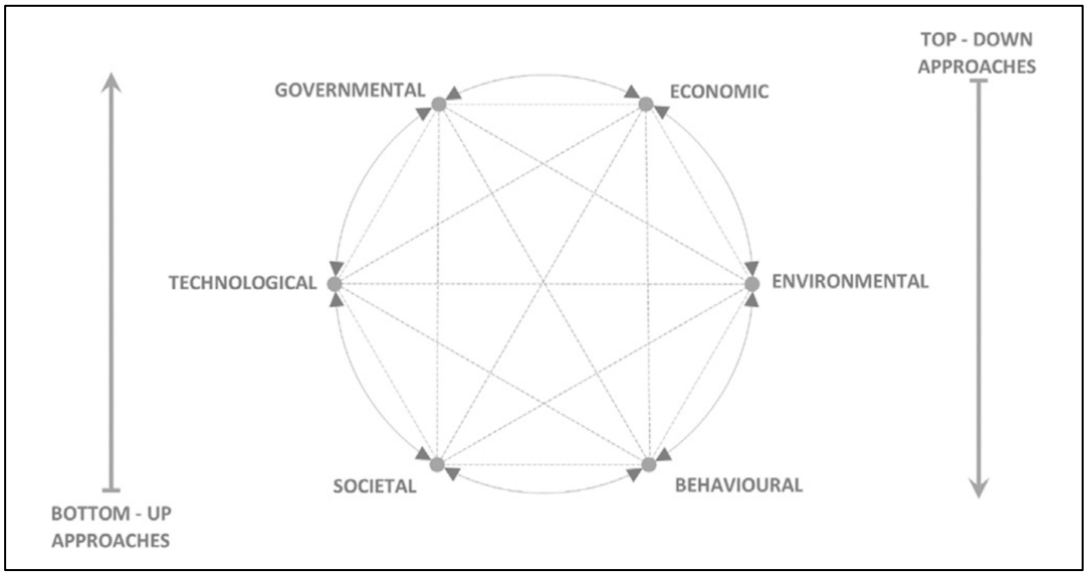

Figure 3:1 - Six dimensions for circular economy research for buildings (Pomponi and Moncaster, 2017, p.715)

Leising at al. (2018) expanded on the definition of circular buildings to state that circular economy thinking for building is:

> "*a lifecycle approach that optimizes buildings' useful lifetime, integrating the end-of-life phase in the design and uses new ownership models where materials are only temporarily stored in the building that acts as a material bank*" (p. 977).

'Buildings as Material Banks' (BAMB) was an EU Horizon 2020 Framework Programme project with the goal of creating circularity in the building sector through establishing the value of materials that are usually allocated as waste (BAMB, 2019; Leising et al., 2018). A key aspect included the consideration of material health. When incorporating circularity, it is important to ensure that the ultimate goal of sustainability is still achieved. Some circular loops may not align with sustainability principles and result in being counter-productive. For example, some materials are harmful (such as CFCs) and should be substituted instead of reused/recycled until there is capability for safe recycling.

In a systematic review of how circular economy, sometimes referred to as 'sharing economy', has been used in research, 565 articles from 2004 to 2017 were analysed and revealed that whilst there was significant focus on environmental and economic aspects,

social and institutional implications were marginally considered (Merli et al., 2018). Research mainly focuses on waste management (Adams et al., 2017; Cheshire, 2016; Pomponi & Moncaster, 2017) due to the potentially high value for reuse and recycling (European Commission, 2018). Specifically for buildings and construction, a recent analysis of the evolution of scientific literature (7,005 publications from 2005-2020) on incorporating the circular economy concept highlighted three main thematic clusters: energy and energy efficiency in buildings; recycling, waste management and alternative construction materials; and sustainable development. It was found that current research (within the last five years) is placing emphasis on interconnecting the following aspects with circular economy:

i) "the development and use of alternative construction materials;
ii) the development of circular business models;
iii) smart cities, Industry 4.0" (Norouzi et al., 2021).

3.3 Barriers to scaling up sustainability in buildings and construction

Some building owners think that benefits from sustainability improvements primarily go to tenants and this is especially a challenge with commercial property retrofit (Ma et al., 2012; Pardo-Bosch et al., 2019). Some building owners rely on policy to pass on all or some of their sustainable investment cost through rental increases or split incentives (where savings are shared between tenant and landlord); however, relying on policy changes can take a long time. Some organisations voluntarily adopt green certifications and building codes in hopes of selling or renting at a premium but this is risky since increases in valuation based on sustainability are not standardized. 'Sermon-induced business models' such as the fairtrade concept and ethical businesses emerged from shifting value systems and created a market segment that is willing to pay more for these 'premium' products and services. However, there is still a need for increased awareness of the benefits of sustainable buildings to the owner, occupants and surrounding communities (Al-Saleh & Mahroum, 2015).

The behavioural and societal dimensions within sustainable buildings have not been widely researched as there are varying concepts and challenges with practical

implementation (Berardi, 2013; Dempsey et al., 2011; Merli et al., 2018; Nußholz et al., 2019; Pomponi & Moncaster, 2017). The behavioural dimension considers cognitive elements of material and technology usage and management such as decision-making, peer/stakeholder influence, leadership impact, etc. In various carbon and waste reduction programmes, human behaviour was identified as either a major threat or the key to success. The societal dimension fundamentally refers to strong communities and collaborations. This requires partnership and wider stakeholder engagement to rethink the way that buildings are designed and share knowledge on various approaches (Pomponi & Moncaster, 2017). A key challenge is the ability to demonstrate the value of new approaches such as whole lifecycle costing (Ellen Macarthur Foundation, 2016). Clients focus on initial costs instead of the whole lifecycle, thus associating sustainable construction with high costs (Abuzeinab et al., 2017; Darko & Chan, 2017; Davies & Osmani, 2011; Hagbert et al., 2013; Opoku & Ahmed, 2014; Rizos et al., 2016).

Alwan, Jones and Holgate (2017) explored how to help overcome some of the barriers to sustainable development in the UK construction industry and found that the construction industry lacked a unified and structured framework for sustainability. The FSSD was incorporated with building information modelling (BIM) using a team of skilled BIM researchers. There was particular focus on material substitution and dematerialization with conclusions that the combination of the FSSD and BIM could help drive change in the construction industry. The FSSD expanded considerations to wider impacts on the global system and emphasized the importance of manufacturers and suppliers in regards to effecting change. The continuation of exemplary localized case studies was proposed for use as change agents for development and acceptance. Adams et al (2017) conducted a survey with various construction sector stakeholders (contractors, researchers, consultant, building owners, manufacturers, designers) to assess awareness levels, technological and organizational challenges with circular economy concepts. It was concluded that while individuals may be aware of circular economy concepts, that does not translate to industry level awareness. There were a lack of incentives and clearly defined business cases. In regards to technical elements,

the complexity of building design and lack of waste recovery routes posed the greatest challenges. Due to the fragmented supply chain within construction, there was also a major challenge with unification – lack of systems thinking and long-term approaches. Ultimately, all agreed that a clear business case and articulation of value is critical. Cost and profit are major considerations in the decision-making process.

Overall, many scholars agree that the construction industry needs a more holistic sustainability approach along with increased research, development and training (Alwan et al., 2017; Davies & Osmani, 2011; Hagbert et al., 2013; Häkkinen & Belloni, 2011; Ma et al., 2012; Opoku & Ahmed, 2014; Pardo-Bosch et al., 2019). Business model transformation could contribute as it is considered a key element for sustainable development in organizations, enabling firms to quickly identify alternative ways of doing business in alignment with all stakeholders and global sustainability targets (Kiron et al., 2017; Schaltegger et al., 2016). However, business models are not widely understood in the buildings and construction sector (Abuzeinab et al., 2016; Adams et al., 2017; Aho, 2013).

3.4 Green business models and the need for further research

A systematic review of green construction literature, 1995-2010, found that previous empirical research explained changes in business practices without making explicit connections to theoretical or conceptual business model frameworks or components. The review used the business model canvas to identify where and how business models change when transitioning to environmentally conscious construction processes. The findings highlighted value configuration (activities and resources) and cost structure as the most referenced and problematic areas. These were followed by partner network and capability (core competencies) (Mokhlesian & Holmén, 2012). The review explicitly excluded final building structures and focused on construction processes. There were also no explicit references to behavioural and societal dimensions. Pan and Goodier (2012) similarly conducted a review on business models in the construction industry using the terms “business model” and “construction” to search for articles from 1990-2010. The articles found also did not explicitly define the business model but implicitly

could be mapped to some components (refer to (Pan & Goodier, 2012), Table 1 – Selected (Implicit) Descriptions of Business Models in Building and Construction). The review focused on housebuilding business models in the UK and cross-analysed those models with offsite construction materials and processes (also referred to as modern methods of construction (MMC) or prefabrication). Whereas Mohklesian & Holmén (2012) made explicit reference to green practices, Pan and Goodier (2012) only referred to sustainable practices in regards to risk avoidance due to increasing sustainable policy and regulation, such as the Code for Sustainable Homes. The findings showed land development to be the major focus for value creation and capture instead of opportunities from building innovations. The business models focused on the profit gained from land acquisition through applying strategic land-use planning, such as keeping land until market prices increase and then developing it (land banking).

Other researchers have also focused on offsite construction to consider how new business models could shift the construction industry's business approach from predominantly margin-centric models to value-centric models, considering market factors and strategic alliances in the value chain. Offsite manufacturing was identified as a practice that already facilitates this shift in thinking, incorporating mass customisation strategies (system deliveries theory) to highlight how value can be created for the customer, business, and society (Thuesen & Hvam, 2013). Instead of the mass production of standardised goods, mass customisation involves high volume delivery of individually customised products or services at relatively low costs (Pine, 1993). The concept of mass customisation in housing developed partly due to the monotony of the mass production model and quality issues. Over time, homeowners demanded more variety and higher quality. Advancements in digital technologies and computer-based design enabled rapid expansion of mass customisation in housing. Complex architectural design can be efficiently and effectively managed and customers can be involved in the design process using interactive programs (Friedman et al., 2013).

In this journey towards more 'competitive' environmental sustainability, (Sommer, 2012) proposed green business models from two value perspectives - value creation and value capture. Further applying green business models to the construction sector, Abuzeinab et al. (2018) used five components derived from Sommer (2012) -key resources, green value proposition, financial logic, target group, and key activities- to investigate potential benefits. The exploratory study analysed 19 interviews from senior practitioners and academics in the construction sector to find that green business models can improve reputation/creditability as it is important to be seen as an environmental leader/expert in your subsector. This is also critical to remaining relevant given the global sustainability targets and interconnects with the next benefit of long-term viability, internally and externally. Another benefit is reducing lifecycle costs for the building owner/occupier. Some of these intangible benefits could evolve into tangible outcomes such as increasing demand and new opportunities (winning green projects) and attracting/retaining talented human resources. The findings also highlighted key resources as the most important element in regards to the benefits (Abuzeinab et al., 2018).

Moschetti & Brattebo (2016) explored quantitative sustainability indicators for business models for deep energy retrofitting projects. This was developed from finding value propositions that were financially focused on increasing asset value and lowering operating costs. Also because business models were market-oriented, neglecting to express value for all stakeholders. Four 'state-of-the-art' business models for energy retrofitting were first highlighted from the literature and articulated using the business model canvas. These were: traditional individualized solutions; one stop shops such as energy service companies (ESCOs); new revenue models such as government incentives and sustainable certifications; and new financing schemes. A list of the most significant sustainability measures for energy retrofits in buildings was then compiled from the literature to create indicators that could be used with the business model to assess the level of sustainability integration. The suggested methodology was tested on selected case studies representative of sustainable projects (Moschetti et al., 2018) and is not

limited to energy retrofits but could potentially expand to other types of construction projects (Moschetti & Brattebø, 2016). Brown (2018) similarly explored the usefulness of incorporating business model thinking in the buildings and construction sector. Five business model archetypes were derived after reviewing both academic and grey literature on residential retrofits in Europe followed by expert interviews for validation (and standardized interviews with example cases). It was concluded that, quite contrary to the predominantly market-oriented approach in the UK, successful business models for comprehensive residential retrofits include the following elements:

- *"A value proposition focussed primarily upon aesthetics, comfort, health and well-being and includes guaranteed rather than estimated energy performance savings*
- *An integrated and industrialised supply chain providing a comprehensive whole-house approach*
- *A simplified customer interface with a single expert point of contact*
- *A financial model that includes a low-cost financing mechanism integral to the offering*
- *Coordinated governance of these four components through an integrated BM"* (Brown, 2018, p.1512).

Other recent energy retrofit studies include Pardo-Bosch et al. (2019) using a 'City Model Canvas' (derived from the business model canvas) to describe cases studies of municipalities facilitating energy efficient and renewable energy retrofits through 'Urban Platforms' in residential dwellings (Pardo-Bosch et al., 2019). Kivimaa and Martiskainen (2018) systematically reviewed peer-reviewed academic literature on low energy building innovation from 2005-2015, including both renovations and new builds. Building on sustainability transitions theories, the research focused on actors referred to as 'innovation intermediaries', with the logic that defined goals/outcomes, network expansion, and knowledge sharing are fundamental to success. The findings highlighted a lack of research on innovation processes in comparison to technical, economic, and politically oriented approaches. There was specifically a significant lack of empirical data for low energy housing retrofit (Kivimaa & Martiskainen, 2018).

Research has shown that all stakeholders in the buildings and construction sector agree that cost and profit are major considerations in decision-making processes and, therefore, a clear articulation of sustainable value is critical (Abuzeinab et al., 2016; Adams et al., 2017; Aho, 2013). Sustainable business models facilitate this articulation of value; however, business model concepts for sustainable development are not widely understood. This creates a challenge for firms to quickly identify alternative ways of doing business in alignment with all stakeholders and global sustainability targets. Due to the fragmented value chains, there is also a major challenge for firms to work together towards achieving long-term goals or long-term collaboration over multiple projects and various clients (Abuzeinab et al., 2016; Aho, 2013; Mokhlesian & Holmén, 2012; Pan & Goodier, 2012; Selberherr, 2015; Zhao et al., 2017). The lack of adequately referencing business model theoretical developments or explicitly making a connection to sustainable buildings, or components thereof, makes it even more difficult to develop the field in a coherent and holistic way. Overall, further business model research is needed to overcome these barriers. Peer-reviewed academic analyses of projects are needed to complement industry (grey/non-peer reviewed) literature.

3.5 Sustainable development in small island developing states (SIDS)

"*Small island developing States (SIDS) are a "special case" for sustainable development: this was recognized in 1992 at the UN Conference on Environment and Development in Rio, and reaffirmed in Barbados in 1994 at the first UN Global Conference on SIDS and again in Mauritius in 2005 at the second SIDS Conference. During the Rio + 20 Conference in 2012, the "special case" was re-emphasized, and this formed the basis of the call for a Third International Conference on SIDS, to be held in Samoa in 2014*."

United Nations Trends in Sustainable Development (United Nations, 2014, p.1)

Small Island Developing States (SIDS) consists of around 65 million people (less than 1% of the global population) from 58 developing countries across the Caribbean; the Pacific; and the Atlantic, Indian Ocean, Mediterranean and South China Seas (AIMS). Despite their heterogeneity in governance, geography, etc., they are a group of countries that encounter distinct social, economic and environmental obstacles to sustainable development such as (Table 3:1):

- limited resources, which hinders the benefits that can be gained from economies of scale;
- small domestic markets with heavy reliance on external markets that may be long distances away or providing short term relief;
- high costs for energy, infrastructure, transportation, communication and servicing;
- limited data and resources for risk assessment, disaster planning, project development - minimal resilience to natural disasters (with frequent disasters creating a worsening loop as capacity is diminished with each extreme event);
- volatile economic growth with increasing populations;
- unsustainable natural resource planning and management

Most governments simply have insufficient resources for planning, developing, implementing, managing, reporting, etc. to address climate change. There is significant economic reliance on the public sector and limited opportunities for the private sector (Nunn & Kumar, 2018; Robinson, S. & Dornan, 2017; United Nations, 2014). The Samoa Conference in 2014 led to the adoption of the SIDS Accelerated Modalities of Action – commonly referred to as the SAMOA Pathway, which highlighted priority areas and urgent actions required to support the sustainable development of SIDS (United Nations, 2014).

Table 3:1 - Typical barriers to climate change adaptation in small island developing states (SIDS) (Thomas et al., 2020, p6.14)

Adaptation option	Risks addressed	Barriers	Limits
Ecosystem-based approaches: coral reef restoration, mangrove replanting	Coastal erosion, loss of biodiversity, coastal flooding from storm surges	Competing land uses (e.g., tourism versus mangroves) Non-climate stressors on ecosystems, reducing effectiveness (87)	Biophysical limitations relating to ocean acidification, ocean temperature, sea-level rise, and species adaptation are likely to arise during the twenty-first century (41, 88). Economic and social barriers arise well before the end of the century (41). Space and competing land uses (89). Increases in extreme events (e.g., marine heatwaves) leading to catastrophic events (e.g., mass mangrove die-off) (90).
Strengthened building codes, retrofitting of infrastructure	Damages from tropical storms	Costs Governance (including compliance) Political and public acceptability Trade-offs with short-term development priorities (91)	Increases in extreme and unprecedented events (11).
Sea walls, groins	Coastal flooding	Costs/cost effectiveness Potential displacement of impacts Political and public acceptability Adverse impacts on biodiversity and natural systems (91)	Prohibitive costs (including maintenance) linked to economic, financial, and social barriers. Technical limits to hard protection are expected to be reached under high emission scenarios (RCP8.5) beyond 2100 (41).
Climate resilient agriculture	Declines in agricultural production (reduced yields) Increased food insecurity Exposure to food price spikes	Social and cultural acceptance of new techniques and crops Increasing reliance on imported food products (links to cultural change and social preferences) Small population size reduces commercial viability of adaptation options (92).	Multiple interacting impacts reduce adaptation options (e.g., drought, extreme heat, and soil salinization). Loss of agricultural land. Climate-related migration leads to demographic change/changes in the capacities of agricultural labor force (38).
Rainwater harvesting	Freshwater stress	Predominately household level	Does not overcome related freshwater issues, e.g., salinization of freshwater lens in low-lying atolls.
Ridge-to-reef and whole-island approaches	Multiple impacts and interconnected stressors	Complexity Public and political acceptance Requires high level of commitment Trade-offs will be exposed (93).	Less likely to face limits than isolated adaptation options due to holistic approach (e.g., changes in agricultural practices can reduce impacts of run-off on reef systems).

SIDS typically collaborate through regional Secretariats, such as Caribbean Community (CARICOM) and the Secretariat for the Pacific Regional Environment Programme (SPREP), in an effort to overcome some of these challenges. Despite collaboration on their goals for mitigation and adaptation and some progress made within nations, future concerns lie with increasing hazards and vulnerabilities (especially linked to sea-level

rise and tropical cyclones) and being able to scale up responses. There may be a need for more radical and transformational measures (Thomas et al., 2020).

Studies show that some SIDS have a high level of awareness regarding the impacts of climate change but awareness is generally affected due to various factors such as educational level, financial/social status, and age (with increased awareness found among younger people) (Altschuler & Brownlee, 2016; Chandra & Gaganis, 2016; Petzold et al., 2018; Stancioff et al., 2018; Thomas & Baptiste, 2018; Thomas et al., 2020). There is generally limited understanding of the scientific fundamentals of climate change (Vignola et al., 2013) and immediate concerns of daily life tend to be the predominant focus instead of perceived climate change impacts (Stancioff et al., 2018). There is a tendency to attribute problems to broader social and environmental issues instead of making the connection to local action/behaviour (Altschuler & Brownlee, 2016). Some researchers have also found that the private sector's general view is that government is responsible for climate change (Petzold et al., 2018; Robinson, S., 2018).

Within the Caribbean region, adaptation planning in SIDS has been predominantly at the national level with minimal translation to specific sectors, which is critical for the practical implementation of actions. Sectors that have received focus have typically been agriculture, water and coastal zones (Thomas et al., 2019). While these sectors will be significantly impacted, all sectors need to be engaged to benefit from cross-sector synergies and maximize adaptation efforts. National Action Plans have been found to poorly articulate implementation and monitoring measures, which could be hindering the transition from national plans to practical implementation (Woodruff & Regan, 2019). In February 2021, ministers across Latin America and the Caribbean agreed to work together on the central integration of environmental issues in coronavirus pandemic recovery and regional action plans. More specifically, the signed 'Bridgetown Declaration' requires social inclusion, low carbon and resilient economies and the conservation and sustainable use of natural resources. United Nations Environment Programme (UNEP) will coordinate a 'Circular Economy Coalition' for Latin America and

the Caribbean that will create a common regional vision for sustainable production and consumption, encouraging governmental collaboration and knowledge sharing and exploring new business opportunities. There are also ambitions to implement sustainable procurement practices, a regional environmental information system, and accelerators (UNEP, 2021).

"One of the great challenges for the region is the ability to maintain sustainable and inclusive growth in the coming years. This is no small challenge considering the already low growth in the region prior to the crisis: in 2014–2019, growth averaged 0.3%, one of the weakest six-year runs since records began, comparable only to those that spanned World War I and the Great Depression. Furthermore, the underlying structural problems that have hindered growth over the last four decades persist."

Economic Survey of Latin America and the Caribbean (ECLAC, 2021, p.17)

3.6 Vulnerability of the built environment in Latin America and the Caribbean

Construction has accounted for around 12% of GDP on average (1993-2016) across Latin America and the Caribbean (LAC) with an almost equal split between residential and non-residential investment (ECLAC, 2018). Around 83% of the population are considered to be living in urban areas and this is expected to increase due to population and economic growth. Researchers have found that building contractors tend to focus on maximising earnings and thus adopt the most cost-effective solutions available to them. Contractors may not have appropriate training at all or have not undertaken any professional training over a long period (Chmutina & Bosher, 2014). Modular construction appears to be less dominant due to production limitations but it has been suggested that even with access to modern methods of construction, the informal sector would still likely use more traditional materials and methods (Moreno, 2020). Further to this, future proofing concepts for buildings and construction are not widely practised and few professionals/organisations understand the concepts. Approaches have been found to be more informal – not guided by professional building practices. For example:

> *"Across the LAC region, it is common to see a one-storey house with iron rods protruding from a concrete slab on the house's roof. These rods are called varillas de la esperanza, or 'the rods of hope', and represent the hopes of the family living in that house, that someday they will be able to build a second floor and expand the house vertically. In these countries, the convention is for construction to start with a small house, which then offers the potential for expansion when there is enough money to cover the costs of doing so. Thus, future proofing is already done at a very basic level"* (Moreno, 2020, p.23).

Across the LAC region, only around 10% of waste is reused/recycled/recovered, even less than 10% for construction and demolition waste (Moreno, 2020; UN Environment, 2018). Most waste is collected without separation and typically goes to one location/facility. In some cases, there is an informal recycling market (estimated to be 25-50% of all recycled municipal waste) that has potential value such as plastic bottles, iron scrap, glass, and ceramics. Despite the valuable contribution to more sustainable waste management, these recyclers are typically from the lowest income levels of society and are exposed to great risks. From construction and demolition waste, windows, doors, copper, other metals, etc. can sometimes be sold to private collection centres but the percentage is negligible compared to overall waste (Moreno, 2020). There is a need for more formalized recycling markets and credit for informal contributions. Argentina has a solid waste treatment facility (tyre recycling, composting, mechanical-biological treatment, and degasification) that contributes to carbon emission reductions of just over one million tonnes annually. However, there is a lack of lifecycle studies in cities and countries across the region to quantify the impacts of construction and demolition waste. Wastewater is also a major sectoral concern as water is used in most construction processes and poor wastewater management has led to several highly contaminated bodies of water (Moreno, 2020; UN Environment, 2018). To adopt more sustainable practices and create a circular economy, waste needs to be separated but there are little to no incentives (legal, regulatory, market, etc.) for this in the region and no polices that require the reuse or recycling of demolition waste (Moreno, 2020).

Specifically for the Caribbean, the adoption of more sustainable building practices has been impeded by a lack of national building codes, weak policies, general unawareness of sustainable building benefits, perception of more sustainable approaches being too costly and significant reliance on energy subsidies (Chadee & Stoute, 2017). Densely populated areas are near to coastlines and prone to flooding; some areas are prone to landslides. Housing is predominantly constructed by the informal building sector, which are small businesses with limited knowledge of sustainable building requirements. In many cases, formal compliance codes are lacking or not enforced and housing is regularly severely impacted by natural disasters such as hurricanes and earthquakes (Caribbean Development Bank, 2018). Construction practices in the 2005 Regional Code of Practice (developed by the Caribbean Disaster Emergency Management Agency (CDEMA) and prepared by the Caribbean Regional Organisation for Standards and Quality (CROSQ)) only makes provisions for the construction of houses that can withstand up to Category 3 hurricanes. In 2018, the Caribbean Development Bank (CDB) -headquartered in Barbados- launched a training programme, 'Improved Practices for the Construction of Houses', with an initial focus on government planners and building inspectors from 16 countries. The aim was to help build capacity in the region on safer and more resilient construction design and methods. Training included considerations for Category 5 hurricanes (Caribbean Development Bank, 2018).

The new CARICOM Regional Energy Efficiency Building Code (CREEBC), developed by CROSQ, was approved at the end of 2018 and is part of wider Caribbean building code development aspirations for climate change adaptation and improving resilience. CREEBC is based on the International Code Council's 2018 Energy Efficiency Code and 2016 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 Code; it has been adapted for the Caribbean with a particular focus on energy conservation over the useful life of residential and commercial buildings. Over two years (2019-2021 – impacted by the COVID-19 pandemic), training sessions were held for key implementation stakeholders across the region (engineers, regulators, policymakers, etc.). The aim was to train up to 20 professionals in each country who

could then train others and assist with national adoption. CROSQ has reported that several CARICOM Member States are interested in adopting the CREEBC at national level (CROSQ, 2020) but the actual implementation of this is still to be seen. Previous research on disaster risk reduction in the construction sector highlighted barriers such as unwillingness of building owners to pay any additional costs and lack of the ability to enforce implementation (Chmutina & Bosher, 2014). Significant capacity building and regulatory reform is required and it is further slowed when there is a natural disaster. It will take time for codes to be adopted nationally and fully integrated into local building practices. There is also a lack of timely and reliable data on energy use for the region, which is hindering development (Caribbean Development Bank, 2019).

The Caribbean Development Bank (CDB) managed $711million in partnership agreement funding from 2015-2018. One of the support focus areas was economic and social infrastructure development, including road construction and rehabilitation to improve access and increase trade. Another focus area was environmental sustainability, which included investment in LED street lighting and disaster risk reduction initiatives (Caribbean Development Bank, 2019). Despite the efforts that are being made, overall SDG implementation has been slow due to the many challenges already highlighted. CDB indicated that it is necessary to *"take a more holistic and multi-sectoral approach to address the challenges and threats facing the Region by deepening resilience thinking in its operations at the institutional and project levels aimed at improving organisational efficiency and effectiveness and at the same time enhancing development effectiveness and results"* (Caribbean Development Bank, 2019, p.15). There is a need to understand, scale-up and accelerate sustainable environmental and societal transitions and reliable data is needed to help improve-decision making. Transition studies have already acknowledged that technology is not enough for systemic shifts; non-technological action, focusing on changing production and consumption behaviour is critical (Hansen et al., 2018). Actions/solutions require the involvement of all stakeholders and more research is needed on the sustainability and

circularity of the construction sector in Latin America and the Caribbean, especially in the lesser developed countries (Moreno, 2020).

3.7 Summary of contributions to the research context

Sustainable building expands beyond physical building boundaries to consider the entire lifecycle of building resources, social equity, and impacts on surroundings and community. Flexibility, adaptability and resilience over time and through unpredictable changes are fundamental considerations (Berardi, 2013; Kibert, 2016). The behavioural and societal dimensions within sustainable buildings have not been widely researched as there are varying concepts and challenges with practical implementation (Berardi, 2013; Dempsey et al., 2011; Merli et al., 2018; Nußholz et al., 2019; Pomponi & Moncaster, 2017). Overall, many scholars agree that the buildings and construction sector needs a more holistic sustainability approach along with increased research, development and training (Alwan et al., 2017; Davies & Osmani, 2011; Hagbert et al., 2013; Häkkinen & Belloni, 2011; Ma et al., 2012; Opoku & Ahmed, 2014; Pardo-Bosch et al., 2019).

Business model transformation could help the sector as it is considered a key element for sustainable development in organisations, enabling firms to quickly identify alternative ways of doing business in alignment with all stakeholders and global sustainability targets (Kiron et al., 2017; Schaltegger et al., 2016). However, business models are not widely understood in the buildings and construction sector (Abuzeinab et al., 2016; Adams et al., 2017; Aho, 2013). The lack of adequately referencing business model theoretical developments or explicitly making a connection to sustainable buildings, or components thereof, makes it even more difficult to develop the field in a coherent and holistic way. This research helps to overcome some of these barriers through using the sustainable business model to explore the buildings and construction sector and applying clearly defined theoretical positions to organise and understand existing literature. Further, this research gathers empirical data to enhance the research field and industry kowledge.

Small island developing states (SIDS) are a group of countries that encounter distinct social, economic and environmental obstacles to sustainable development. The Caribbean region consists of multiple SIDS and researchers have found that building contractors tend to focus on maximising earnings, thus adopting the most cost-effective solutions available to them (Chmutina & Bosher, 2014). Densely populated areas are near to coastlines and prone to flooding; some areas are prone to landslides. Housing is predominantly constructed by the informal building sector, which are small businesses with limited knowledge of sustainable building requirements (Caribbean Development Bank, 2018). Across the region, less than 10% of waste is reused/recycled/recovered and most waste is collected without separation. There is a lack of timely and reliable data on energy use for the region, which is hindering development. Despite the efforts being made, overall SDG implementation has been slow due to these various challenges. This research uses the sustainable business model as a lens to gather empirical data on sustainable activities in the buildings and construction sector in the Caribbean region. These results are compared with the literature and other empirical data to identify sustainability gaps and provide recommendations for adopting more sustainable practices and creating a circular economy - ultimately contributing to the first five areas of research needs described in Chapter 2.

4 Research Methodology

4.1 Chapter outline

The research approach and objectives were outlined in Chapter 1. This chapter first explains the researcher's philosophy and motivation, which guides the research design. A summary of the entire research process, including graphical and tabular summaries, is then provided followed by more detailed discussions on each method. The research approaches used to suitably complete the research objectives include systematic literature reviews and case studies with semi-structured interviews. Each approach throughout the research process is documented in this chapter with detailed descriptions, justifications and methodological reflections. Many aspects within the approaches overlap so they are referred to instead of being repeated in detail. The chapter closes with an overview of research limitations.

4.2 Research philosophy

The overall research process can be explained in three major steps – research problem, research perspective (philosophical, discipline-based, practice-based, pedagogical), and data organisation and interpretation. It is important to explicitly present the research perspective as this forms the theoretical framework that guides data collection and frames the research problem (Eisenhart, 1991). Margaret Eisenhart (1991), a distinguished professor of anthropology and education and research methodology, strongly valued the explicit use of frameworks for academic research and therefore tried to improve the understanding of how to use them. Eisenhart (1991) defines a theoretical framework as "*a structure that guides research by relying on a formal theory; that is, the framework is constructed by using an established, coherent explanation of certain phenomena and relationships*" (p.205). It outlines the underlying principles, definitions and concepts that the researcher will follow. This enables clearer communication amongst scholars and encourages researchers to be more systematic; however, it should also be considered that overreliance on a theoretical framework can inhibit important new findings (Eisenhart, 1991; Grant & Osanloo, 2014).

This interdisciplinary research focusses on sustainable business models, which are still theoretically being defined and developed. The research falls into the larger fields of sustainability and business and management research. The sustainability aspect of sustainable business model research is mostly built on objective theories from natural science but also incorporates more subjective thinking from social science. The business and management aspect is significantly more subjective. As there is a need for more empirical knowledge and theory building on sustainable business models, the nature of this research is quite exploratory. It is driven by the researcher's interest in understanding societal and organisational constructs and developing ideas through induction. This could be considered an interpretivist philosophy with an inductive approach. Interpretivism (also referred to as constructivism) involves the study of phenomena in their natural environment with the understanding that there may be various interpretations (Creswell, 2014; Mertens, 1998).

The foundations of this research, however, contain both subjective and objective perspectives and address 'wicked problems' such as climate change and social inequities. Wicked problems are complex global challenges that have significant social and institutional uncertainty. There is no 'right' approach or solution. It is more critical to quickly identify/recognise whether approaches will have negative or positive impacts and adapt accordingly (Levin et al., 2012; Mertens, 2015; Upward & Jones, 2016). The researcher therefore pragmatically embraces a whole world view when thinking about and framing problems. Pragmatism is more focused on generating solutions. The pragmatist view is that philosophies and methods can be mixed based on what is required to understand and solve research problems (Creswell, 2014; Morgan, 2007; Patton, 2015). The researcher should not be constrained to one way of thinking and doing things (distinct from establishing the research frame and guiding principles). This research predominantly adopts a qualitative stance but incorporates both qualitative and quantitative methods to adequately complete the research objectives.

4.3 Researcher's motivation

The increase in sustainable business model research activity over the last decade has highlighted strong cases that the sustainable business model concept facilitates the understanding and implementation of sustainable solutions. The research field is not yet mature. There are still attempts to develop archetypes and patterns and investigate ways to achieve sustainable business models in practice (Dentchev et al., 2016; Evans et al., 2017). Clearer guidance is required on benefits for organisations and customers along with the details of partnerships (NGOs, government, etc.) that are heavily relied on for success (Bocken & Short, 2016; Lüdeke-Freund et al., 2019). Studies specific to the buildings and construction sector are limited and this is also a sector where business models are not widely understood (Abuzeinab et al., 2016; Adams et al., 2017; Aho, 2013). Overall, there is a lack of research on the role, relevance, and features of sustainable business models in developing and emerging countries (Lüdeke-Freund et al., 2019). This qualitative research uses the sustainable business model perspective to explore the characteristics of sustainable business models in the buildings and construction sector. These characteristics are then used to explore sustainability in buildings and construction in the Latin American and Caribbean region, specifically focusing on vulnerable small island developing states (SIDS) that are under researched.

Since there is limited knowledge on the areas being investigated, this research fundamentally contributes to theory development and further research inquiries. Though the researcher has previous knowledge of business models that facilitate accelerated development of renewable energy, the researcher embarked on this study with minimal preconceived ideas of the outcomes. The goal is to gather evidence on the general expectation that sustainable business models are a sustainable development enabler while staying open-minded for new ideas to emerge.

4.4 Research design

4.4.1 Qualitative, quantitative, and mixed methods

There are a variety of research data collection methods and they can broadly fall into three categories: qualitative, quantitative and mixed methods. Qualitative research generally aims to understand individual interpretation of and responses to social challenges. Common strategies are narrative research, phenomenology, grounded theory, ethnography and case study. Approaches typically include the inductive analysis of open-ended responses from interviews, workshops, etc. to identify patterns/themes. The aim of qualitative research is much less about generalising findings and more about understanding, describing, and communicating particular findings from specific contexts. Quantitative research, on the other hand, is usually used to investigate relationships amongst measurable variables to deductively test theories. Research strategies could be experimental (such as applying something to one group and not the other) or non-experimental (such as surveys) but approaches are typically numerically based using statistical analysis to generalise findings from samples. Mixed methods combines both qualitative and quantitative approaches to address research problems. Approaches could be sequential (one method builds on the other), concurrent (merging results) or transformative (guided by the theoretical lens, incorporating either sequential or concurrent approaches). Where applicable, the mixed methods aim is typically to provide more robust study outcomes than when using one approach (Creswell, 2014; Patton, 2015). Essentially, quantitative analysis is welcomed to compliment more qualitative studies, such as this research.

Table 4:1 shows various types of qualitative and quantitative research methods, adapted from Creswell (2014), to highlight differences in research data collection and analysis. Data collection, organisation and analysis methods are further explained in the remaining sections of this chapter.

Table 4:1 - Types of research methods, adapted from Creswell (2014)

Qualitative Methods	Quantitative Methods
Emerging with open-ended questions	Pre-determined with close-ended questions
Open-ended data collection such as site visits, behaviour observation, semi/unstructured interviews, etc.	Instrument based data collection such as questionaries, structured interviews, checklists, etc.
Text and/or image analysis of interview data, observation data, document data, audiovisual data, etc.	Statistical analysis of performance data, attitude data, observational data, census data, etc.
Interpretation of themes or patterns that emerge	Statistical interpretation, structural equation models

4.4.2 Research process

This research focuses on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders. The research started with a high-level literature review of business models and sustainability that quickly narrowed to the emerging field of sustainable business models. Sustainable business models were then investigated more thoroughly to build an understanding of the literature, define the theoretical framework for this research and identify research gaps. Various approaches are being used to embed sustainability in business models and thus create sustainable business models. The researcher gravitated towards more scientific approaches, likely based on the researcher's background in engineering. This led to exploring how the framework for strategic sustainable development (FSSD) has been used to enhance sustainability in business and management research to gather insights for enhancing sustainable business models. The overall process highlighted multiple needs within the literature to be addressed (Chapters 2 and 5).

The majority of the researcher's professional experience is within the energy and construction sectors. These are major contributors to global greenhouse gas emissions (global warming) and organisations in the construction sector need help with linking financial earnings to customer value, environmental performance, and social well-being. Given the lack of sustainable business model knowledge for the buildings and construction sector, a systematic literature review was conducted to find and analyse existing empirical case study data towards the creation of a conceptual framework.

Components from a green business model framework were used as a pre-determined code to create an initial set of nodes in NVivo 12.5 software. Relevant excerpts from the case studies were added to each node and then interrelating themes were identified. A table was also created using Microsoft Excel to similarly capture the data. The approach is deductive coding and it is reliant on the initial framework. To make the analysis more holistic and help minimise inherent limitations, the approach was not limited to only extracting data on business model components. The external environment, such as general political, environmental, societal, and economic factors, was also considered. This systemic view enabled new codes to emerge from frequently occurring data, extraordinary data, and items explicitly highlighted as important for the business model. There will, however, still be bias towards areas that have already been highlighted in the literature.

A single case study (from Sweden) was then selected that fitted with the emerging theoretical profile. Semi-structured interviews were conducted to gather data on the sustainable business model and determine if any new ideas emerged. This followed a constant comparative process where any new questions emerging during an interview would be added to the next interview and also guide the selection of the next interview participant (based on their ability to contribute new knowledge to the study). On reaching the point where no new data was emerging (saturation), the findings were synthesised with the empirical literature and used to analyse an under researched geographical region – the Caribbean. The region was explored using a multiple case study approach comprising regional organisations based on the small island of Barbados. Before commencing the multiple case study, the researcher expected that the region would not exhibit as many sustainable business model characteristics due to wider systemic challenges. The aim is to highlight these gaps and inspire the creation/expansion of sustainable business models. An overview of the research process is shown in Figure 4:1.

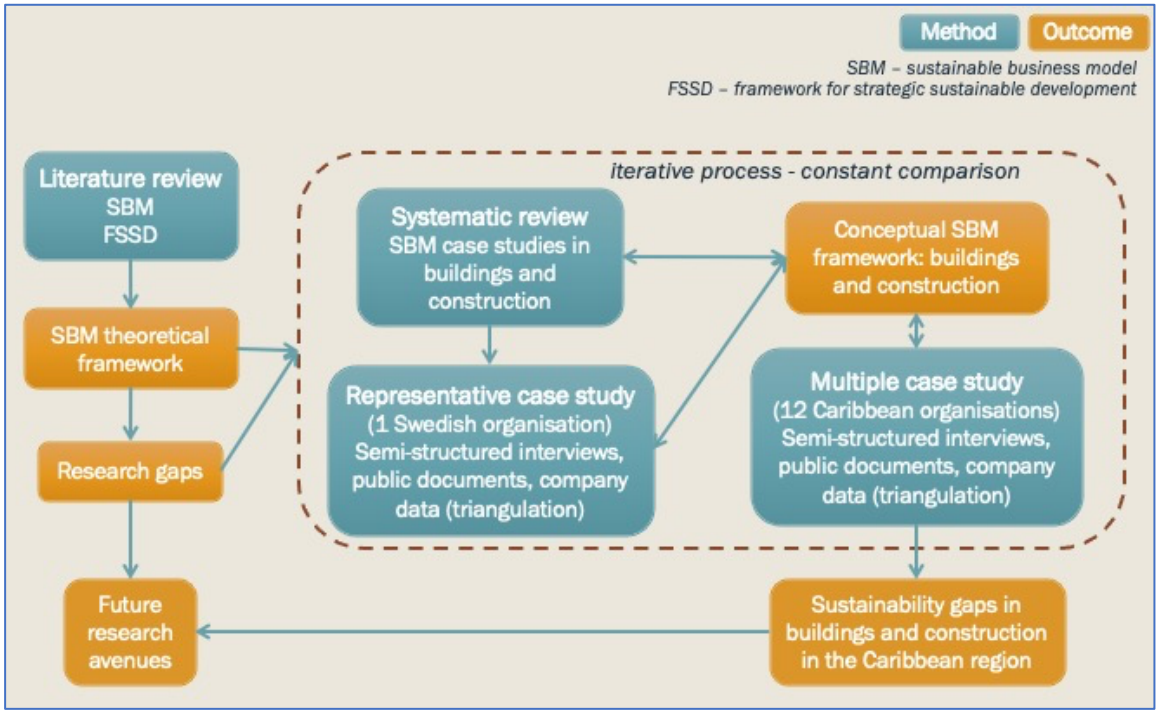

Figure 4:1 - Overview of the research process

During the single case study, data on the sustainable business model was gained through semi-structured interviews that was not found in public data and company documents; however, a more generic version of the sustainable business model was still able to be created from public data and company documents. It was therefore a consideration when starting the multiple case study to use a structured interview or survey approach for more consistency and easier comparison of results (along with the analysis of public data and company documents). This idea, however, was not feasible after the realisation that most of the reviewed organisations in the Caribbean region had minimal online presence or publications of relevance to the study. Furthermore, previous business and management research in the same region encountered challenges with more structured approaches (further explained in Section 4.11). The research therefore continued with the use of semi-structured interviews as the interview content was more heavily relied on to understand the sustainable business model. A less structured approach was also necessary given the exploratory nature of the research.

Overall, this exploratory study contributes to the relevance and characteristics of sustainable business models and in turn enables sustainable development in the buildings and construction sector. The research objectives are to:

- identify sustainable business models in buildings and construction (first in general and then more specifically to address the research gap on sustainable business models in developing countries);
- develop a conceptual sustainable business model framework for analysing business models in buildings and construction (contributing to sustainable business model research for buildings and construction); and
- identify sustainability gaps (and provide high-level recommendations for reducing the gap) in organisations in the Caribbean region through the use of the conceptual sustainable business model framework.

Along with Figure 4:1, the strategy to complete the research objectives is further explained in Table 4.2. Mainly qualitative methods are used but there are also quantitative approaches. Quantitative analysis is used to compliment some of the qualitative approaches.

Table 4:2 - Research strategy

Research Objectives	Methods	Main outcomes
(Background) Define sustainable business models	Qualitative (theoretical): literature review of sustainable business models	Existing sustainable business model archetypes and patterns; theoretical framework/lens for this research
(Background) Integrate the FSSD to enhance sustainability in business and management research	Mixed (theoretical): systematic review on strategic sustainable development using search string; informal observation	Bibliographical statistics; enhanced theoretical framework/lens for this research; conceptual framework components
(1) identify sustainable business models in buildings and construction (2) develop a conceptual sustainable business model framework for analysing business models in buildings and construction	Qualitative (empirical): preliminary industry meeting and informal interview with industry experts	Industry specific guidance; external empirical validation of research need
	Mixed (secondary empirical): systematic review of empirical case studies using search string	Conceptual framework for sustainable business models in the buildings and construction sector
	Qualitative (empirical): single case study (organisation) using semi-structured interviews, company documents, public data	Validation of conceptual framework
(3) identify sustainability gaps and provide high-level recommendations for organisations in the Caribbean region using the conceptual framework	Qualitative (empirical): multiple case study (12 organisations) using semi-structured interviews, company documents, public data	Characteristics of sustainable business models in the buildings and construction sector in the Caribbean region
	Qualitative (theoretical): Comparative analysis	Sustainability gaps in the buildings and construction sector in the Caribbean region

4.5 Literature review of sustainable business models

The sustainable business model literature was analysed with the aim of identifying key themes and theoretical concepts. The literature search used the terms 'sustainable business model' or 'business models for sustainability' in Scopus, Web of Science and De Montfort University (DMU) library catalogue. Only peer-reviewed publications in English were considered. Abstracts were reviewed to determine relevance before further

reading. Some citations were followed where more information was needed to understand the concept. The literature review structure used the six characteristics of Cooper's (1988) taxonomy of literature reviews (Table 4:3).

Table 4:3 – Sustainable business model literature review structure based on Cooper's (1988) taxonomy

Focus	Theories and applications
Goal	Synthesise key themes, theoretical concepts, and interrelationships Identify central issues to outline further research
Perspective	Neutral and descriptive - minimal personal interpretation/evaluation
Coverage	Representative and pivotal – illustrative sample of literature based on the frequency of characteristic occurrences and research impact
Organization	Conceptual – similar ideas presented together
Audience	Academic researchers and expert practitioners

4.6 Systematic review of strategic sustainable development

4.6.1 Systematic review process

A systematic review is based on a clear question, the identification of studies that answer the question, the quality of the studies, and a summary of the studies based on a stated methodology (Khan et al., 2003). It is predominantly used for evidence-based medicine and therefore is quite rigorous and held to high standards (Khan et al., 2003; Moher et al., 2015; Tsafnat et al., 2014). Tsafnat et al. (2014) analysed the simplification and automation of systematic reviews. The motivation was to streamline specific tasks and optimise the workflow. A systematic review method was developed from the Cochrane Handbook for Systematic Reviews (Higgins & Green, 2008), which is a leading publisher on systematic review guidelines and procedures. To comprehensively capture how the FSSD has been used in academic research, a systematic review on strategic sustainable development was conducted following Tsafnat et al. (2014) systematic review steps (Figure 4:2). The overall process is grouped into the following five areas: preparation, retrieval, appraisal, synthesis, and write-up. A systematic review is not a totally linear process but this method is presented clearly and linearly while capturing feedback loops and the overall classification of tasks.

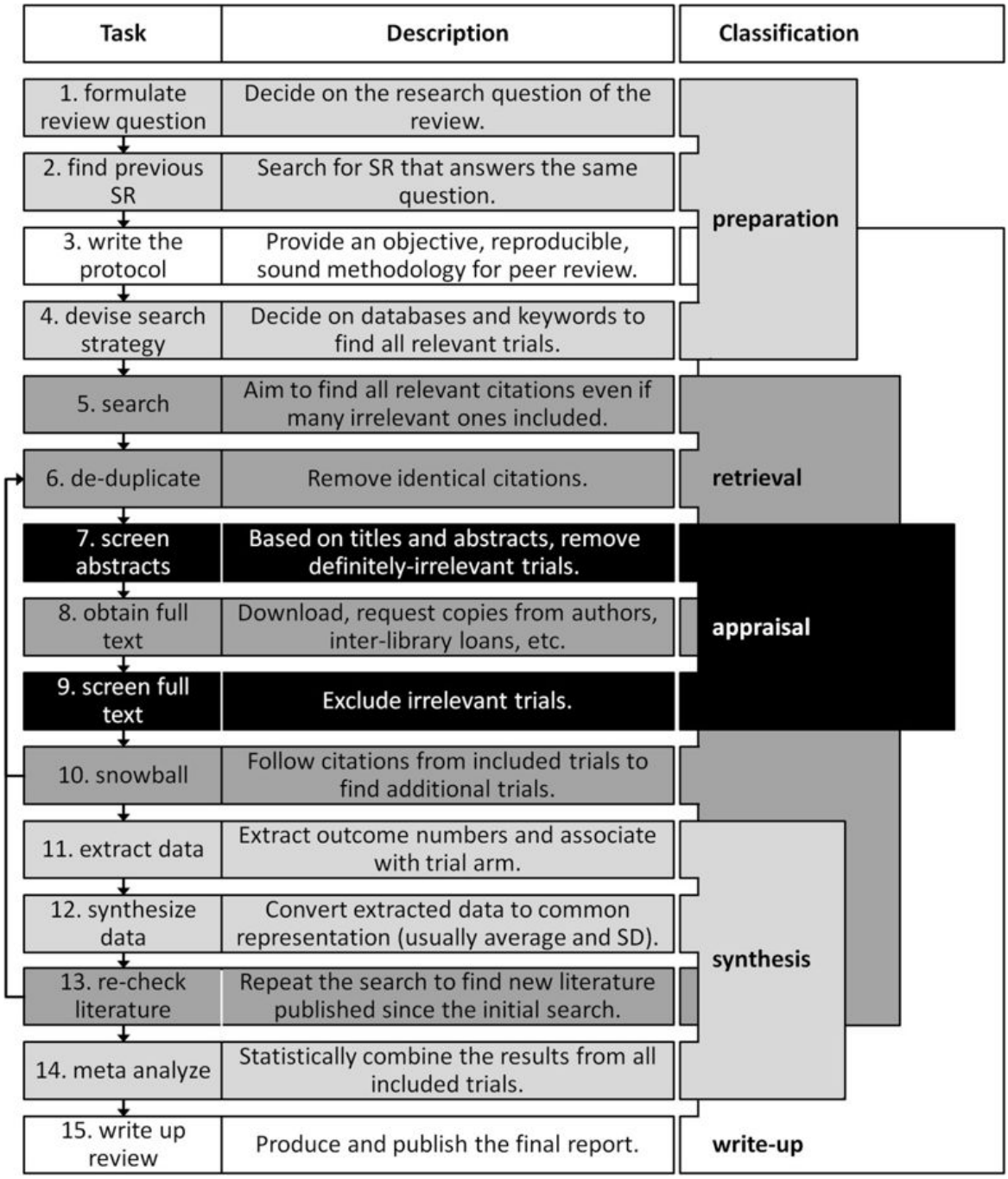

Figure 4:2 - Systematic review steps (Tsafnat et al., 2014, p.2)

The main objectives were to describe the framework, identify research methodologies and other concepts that have been integrated. Secondary objectives included identifying any gaps in knowledge and best practices that could be useful for practitioners and/or further research. The step-by-step procedure is shown in Table 4:4. Table 4:5 shows the detailed search schedule including databases used, search dates,

keywords used, results found and reviewed (by reading the abstract), results that met criteria and were therefore relevant, the number of duplicates, and overall total number of articles included in the review sample. Since electronic searches may not find all of the required articles, the 'snowballing' method (step 10) was used to continue searching, to be exhaustive. Snowballing requires searching the references from the selected articles to discover new relevant data. Out of 187 results, 73 were included in the review sample.

Table 4:4 - Systematic review step-by-step procedure

Task	Description	Outcomes
1. Research question	How has SSD been utilised in academic research? • How many publications, what are the sources, who are the authors? • What types of research are used? • What are affiliated concepts? • Which sectors/industries are dominant? • What are future research streams?	
2. Find existing reviews that answer these questions	Has anyone previously conducted a systematic review or answered any of these questions?	Partially answered by Broman and Robert (2017)
3. Review protocol	Inclusion Criteria: • Peer-reviewed original publications from journals and conferences • Presents, analyses or applies the FSSD • Written in English *Exclusions: editorial introductions to special issues to minimise duplicate information*	Reproducible methodology enabling other researchers to understand the approach and correctly apply results
4. Search strategy	Databases: • Scopus - major database for business & sustainability research, referencing all major journals • Web of Science – major multidisciplinary global citation database Keywords: "FSSD"; "framework for strategic sustainable development"; "strategic sustainable development"; "natural step framework"; "sustainability principles"	Search fields Scopus: article; title; abstract Search fields Web of Science: title; topic

5. Search	Initial searches conducted 15.06.18 to 23.06.18. Alerts set for future hits	Refer to Table 4:5
6. Remove duplications		Refer to Table 4:5
7. Screen abstracts	Remove definitively irrelevant articles	19 removed Refer to Table 4:5
8. Obtain full texts	Review full text of included literature	
9. Screen full text	Does it clearly and coherently present, analyse or apply the FSSD?	Yes
10. Snowball	Follow citations from included literature to find additional data	15 articles
11. Extract data	Bibliographical results including abstracts were extracted to Microsoft Excel. Additional columns were added to tabulate data. Pivot tables used.	
12. Synthesise data for common representation	Group by topic/concept/tool that has integrated SSD. Also consider the research approach.	Categorised by topic Refer to Chapter 5
13. Repeat the search	Check for additional publications since initial searches using search alerts up to 12.31.2018	Scopus: 5 Web of Science: 1
14. Meta-analyse – statistically combine results	• How many articles published per year? • Journals with multiple publications • Authors with multiple publications • Research approaches and concepts	Refer to Chapter 5
15. Write up review		Refer to Chapter 5

Table 4:5 - Results from initial searches conducted 15.06.18 to 12.31.18

Search terms in order of execution	Found	Relevant	Duplicate	Totals
Scopus: FSSD 15.06.18	40	22	n/a	22
Scopus: strategic sustainable development 16.06.18	69	39	19	20
Scopus: framework for strategic sustainable development 16.06.18	35	35	35	0
Scopus: natural step framework 20.06.18	15	14	3	11
Web of Science: FSSD 23.06.18	25	18	17	1
Web of Science: strategic sustainable development 30.11.18	57	30	30	0
Scopus Alerts 20.06.18 – 31.12.2018	5	4	0	4
Web of Science Alerts 23.06.18 – 31.12.2018	1	1	1	0
Snowballing	15	15	n/a	15
Totals	262	178	n/a	**73**

4.6.2 Conceptual integration

The literature review on sustainable business models analysed the current state of the academic field and established the theoretical framework for this research. The systematic review of strategic sustainable development investigated how it has been applied in academic research to explain the importance of the principles underlying the approaches and validate their use in academia. Further investigation of the integration of strategic sustainable development and sustainable business models is recommended (Small-Warner et al., 2018). This research qualitatively integrates insights from both literature reviews to propose potential sustainable business model characteristics. These proposed characteristics are integrated with the conceptual framework that is developed and tested throughout this research. Similarly, Bidmon & Knab (2018), amongst other scholars, investigated the integration of business models and transition theory. Main concepts were identified from transition literature (specifically investigating transition dynamics) and mapped with characteristics of business models to explore causal explanations. The integration of these insights was used to derive the roles of business models in societal transitions and potential impact. The findings were then examined in practice through case studies on energy companies in Germany, linking the research to practice.

4.7 Informal observation

Observational research in design science is the study of a scenario to determine influential factors whilst ensuring to have minimal to no impact on the results. It is the opposite of interventional research that intentionally influences the scenario to study the impact of the intervention (Blessing & Chakrabarti, 2009). There are various types of observational data collection such as the researcher as a participant and their role is either known or unknown to other participants. The researcher could also be fully an observer with no participation (Creswell, 2014). For six months of this research, the researcher joined the Strategic Sustainable Development department the Blekinge Institute of Technology in Karlskrona, Sweden. Formal observation during this period was not included as an aspect of the research; however, it should be highlighted that informal observation and knowledge gathering enhanced the understanding of relevant

concepts and their applications in both research and practice. The first-hand experience exposed the researcher to wider theoretical approaches through research group discussions and activities. There was also exposure to the integration of the FSSD with teaching methods and content on a master's level programme through assisting with delivery. Field notes were recorded in a daily journal but have not been further analysed for the purposes of this research.

4.8 Pretesting: research context

Pretesting and pilots are very valuable, low risk research activities to help frame the research, reflect on feedback and make revisions before there are larger implications and risks. The researcher attended an industry-roundtable in October 2018 in Birmingham with built environment professionals, hosted by the United Kingdom Green Building Council (UKGBC). The discussion focused on circular economy in the built environment, which the UKGBC indicated is of major interest to industry. It was highlighted that UKGBC members have been increasingly requesting assistance with the development of new business models. This was further evident through UKGBC's existing circular economy programme and planned business model programme. There is a need for business model research in the built environment, especially surrounding sustainable and circular concepts. Building on the knowledge and network gained during this event, the researcher scheduled an informal and unstructured interview with a principal consultant at the Building Research Establishment (BRE) Group. The consultant was also conducting academic research on circular economy in the built environment and expressed that it is a key topic of interest for clients, both in the private and public sector.

4.9 Systematic review of business models for sustainable buildings

4.9.1 Methods for data collection, organisation and analysis

To holistically understand research that has utilised the business model concept for addressing sustainability concerns in buildings and construction, a systematic review (Tsafnat et al., 2014) was conducted to find and analyse existing empirical case study

data (Chapter 6). Data organisation and analysis was guided by Creswell's (2009) data analysis in qualitative research process (Figure 4:3). The process is iterative throughout data gathering and analysis as it involves continual reflection to extract larger meanings and useful outputs from raw text and images. Raw data is first organised/formatted in a useful way for the approach to analysis such as creating transcripts. It is recommended to conduct an initial read of all data get an idea of the overall meaning and make notes of general thoughts. The next step is coding, which is the detailed analysis. Text and images are grouped into similar categories that emerge, typically linked to the language used in raw data (in vivo coding). Pre-determined codes could also be created from the theoretical structure of the research, sometimes referred to as a qualitative codebook to guide analysis. When exploring a distinct theory, it is recommended to combine these approaches such that initial codes are used for analysis but these could change throughout the process and new codes could also emerge (Creswell, 2014; Fereday & Muir-Cochrane, 2006).

Key aspects during this detailed process are deeper thought on underlying meanings when reading through data and reflection on learnings when moving from one set of data to the next. Key approaches when analysing data are to look for what is expected based on the knowledge of the field, unexpected data, and any other data that may be of interest to the wider relevant theoretical perspectives. Once an initial set of categorisations has been completed, it is recommended to review and group these by similarity, uniqueness and/or outliers. Raw data should then be reviewed again within the categorisations to see if any new codes emerge or more useful terms for referencing (labelling categories) can be extracted. On completion of the coding process, the codes are analysed to generate themes for the study that can be supported by multiple perspectives in the raw data (such a quotations). These themes are the major findings used to categorise and describe results. There are various approaches to how these findings are presented depending on the researcher's methodology. A common approach is to use a qualitative narrative. Finally, the researcher should reflect on lessons learnt from the findings and the presentation of this also varies depending on

the researcher's methodology. It could include personal interpretation based on the researcher's background, propositions/conclusions formed from comparison with the literature (confirmation and divergence), and/or unforeseen identified gaps or questions. Another common approach is to close with further questions for researchers and/or practitioners (Creswell, 2014).

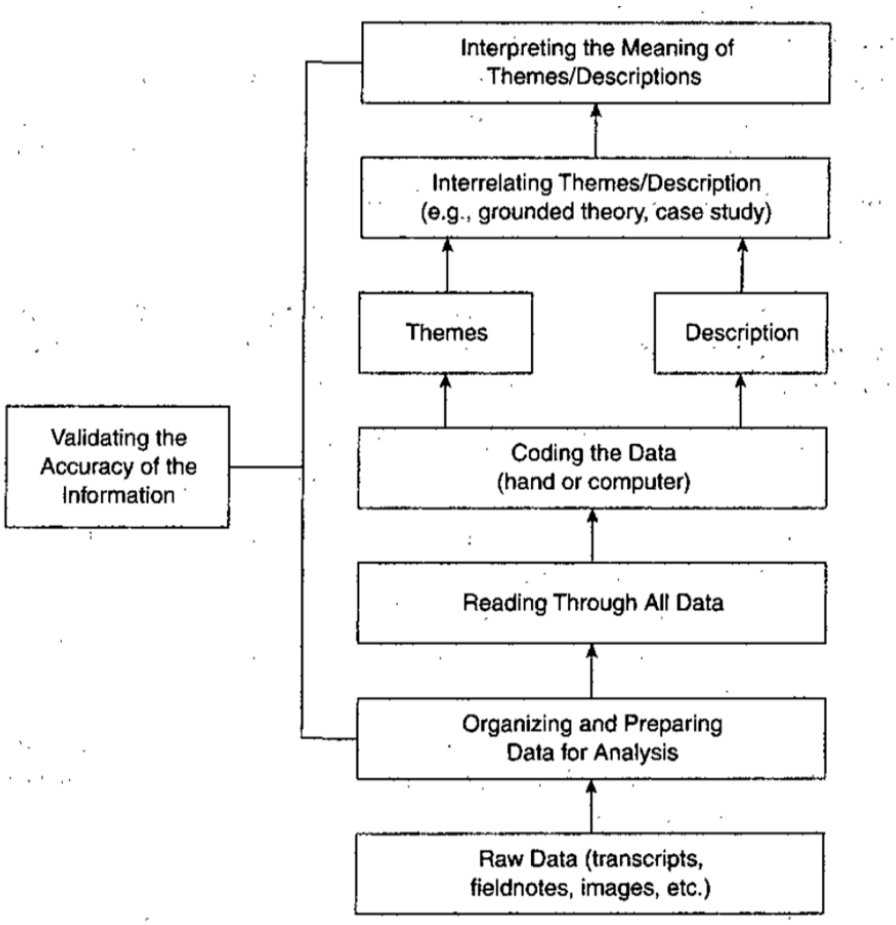

Figure 4:3 - Qualitative research approach for data analysis (Creswell, 2009, p.185)

The validation of findings occurs throughout the data analysis process by checking for accuracy and credibility. In qualitative research, validation does not serve to generalise results or confirm consistency in responses; the purpose of qualitative validity is to show the accuracy of findings. Triangulation is a common qualitative validity approach that uses data from multiple sources to help justify findings. Another common approach is to review the final outcomes with participants to gather their feedback on the accuracy. Detailed descriptions of or extractions from the raw data also help with conveying

feelings directly from participants. It is especially useful to highlight any relevant conflicting data and findings as real experiences could differ from the theoretical perspectives. Where relevant to the research methodology, extended time conducting field research could enhance the researcher's understanding and provide deeper insights, lending to increased validity. Where feasible, peer-review or external auditing would also provide strong validation (Creswell, 2014; Yin, 2014).

There is also qualitative reliability, which shows consistency with other researchers and contexts. For reliability, it is recommended to create a research protocol and database and document all or as many procedures as possible. Raw data should be checked for mistakes, codes should be reviewed to ensure correct alignment with descriptions, and findings could be compared with independently derived results (Yin, 2014). Overall, for qualitative research, it is also important to consider researcher bias and reflect on how it may have impacted the research. There will always be some level of subjective interpretation (Creswell, 2014; Yin, 2014).

4.9.2 Specific applications in this research

A systematic literature search was conducted in January 2019 and repeated in August 2019 using Scopus and Web of Science databases as used in similar reviews into corporate sustainability, strategic management, product service systems and low energy building processes (Engert et al., 2016; Kivimaa & Martiskainen, 2018). The following words and phrases were used to search titles, keywords and abstracts: (sustainab* OR environmental* OR ecolog* OR green OR "zero carbon" OR "cleaner production" OR social*) AND (construction OR building OR housing OR "built environment") AND "business model*". After snowballing some of the first selected articles, the term "housing" was added (Figure 4:4). The search process is also similar to Mokhlesian and Holmen (2012) systematic review into business model changes in green construction but has been expanded to include more keyword variations based on the researcher's knowledge of the field. This review also explicitly includes "business model".

There was no limit on the publication timeframe as this was an attempt to consolidate the research field. All articles were in English, the researcher's native language, and from peer-reviewed full-text journals. Initially, articles needed to include a business model definition, components, or framework to prevent misrepresentation of previous work that did not define how the term was being used. All included articles should have also been directly applicable to sustainable buildings as a whole (entire structure) based on Berardi's (2013) definition, expanding beyond ecological and economic considerations. Articles were excluded where the business operates without owning or directly controlling any assets (sustainable buildings). This includes business models for renewable energy and energy efficient retrofits that specifically target electricity generation and energy reduction. It also includes collaborative consumption businesses that connect peers for the distribution of products and/or services including peer to peer networks such as Airbnb, Couch Surfing, Flipkey, and HomeExchange along with the redistribution/second-life marketplace ListingDoor (Garrett et al., 2017). However, relevant insights from previous reviews in these areas were incorporated in the discussion.

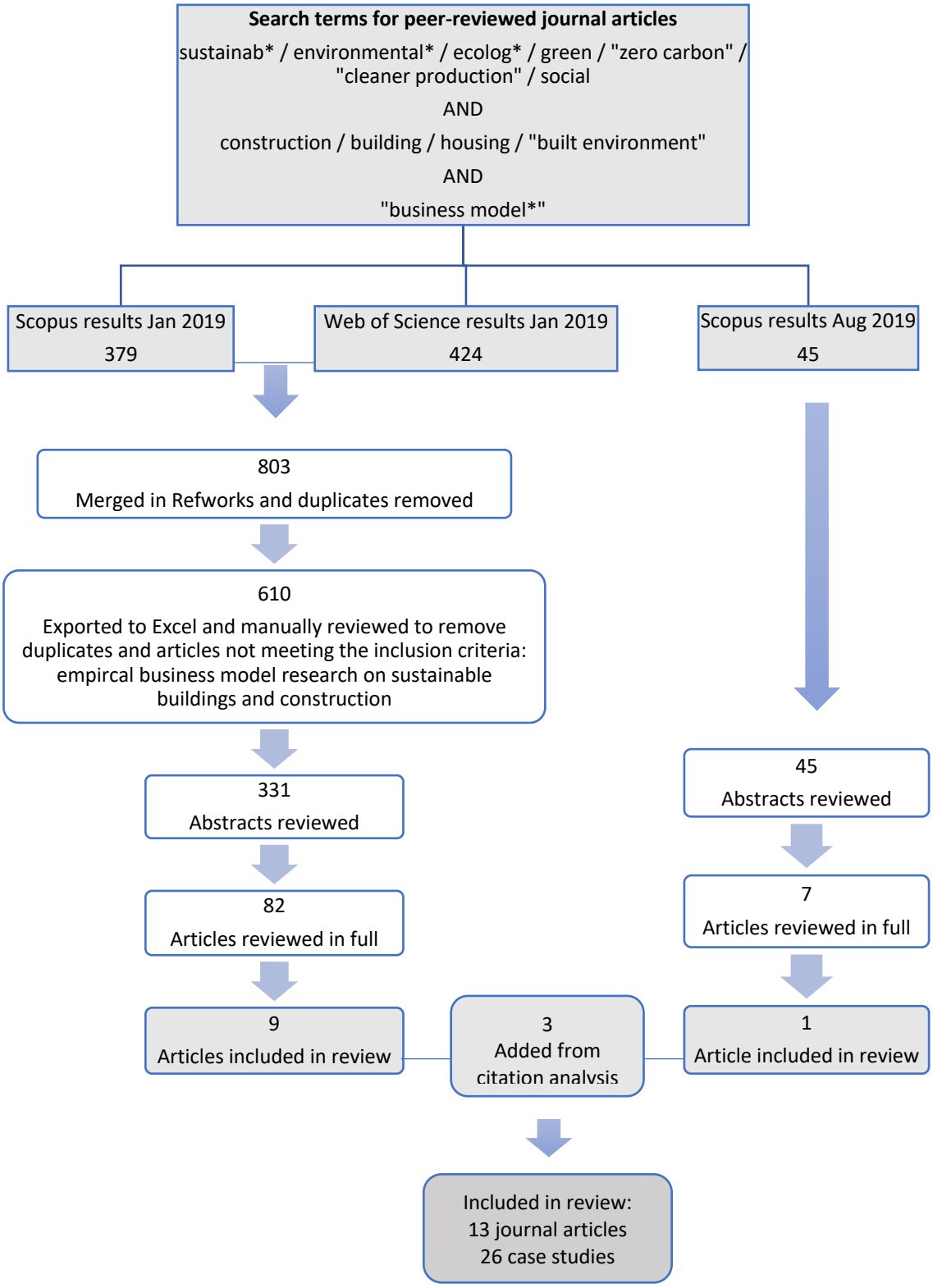

Figure 4:4 - Business models for sustainable buildings systematic literature review sample selection process

During the review process, only 7 articles were initially included based on the first search (January 2019). The criteria of referencing a theoretical business model concept was relaxed and this added 2 articles. These articles identified various components without explicitly defining the business model term or any similar theoretical reference. The review of references within the included articles (snowballing/citation analysis) lead to the full text review of an additional 10 articles out of which 3 were included. Only 1 article defined sustainable buildings and therefore the applicability of sustainable buildings was qualitatively deduced by the researcher (based on Kibert, 2016). With only 9 articles referring to the entire building structure, this criterion was also expanded to include building components. Since the majority of papers were published in recent years, the search process was conducted again using Scopus (all previously included articles were found in Scopus) in August 2019 and 1 article was added. The final total for this review was 13 peer-reviewed journal articles that covered 26 cases with empirical contributions to business models for sustainable buildings. The sample size is similar to Kivimaa & Martiskainen's (2018) review of low energy building innovation. After only identifying 23 potential articles to be fully read, a further search was conducted that removed the term 'innovation' and added terms such as 'technology' and 'actor network system'. This resulted in an additional 84 potential articles that were narrowed to a final review of 28 articles (40 case studies, with 6 overlapping). Since the focus of this research is to review 'business model' literature, it was not seen as reasonable to remove that search term. The conclusion in this research is that there is limited business model peer-reviewed academic empirical research in the context of sustainable buildings and construction.

The green business model framework (Sommer, 2012), which was previously developed to research sustainability in construction businesses (Abuzeinab et al., 2016), was used to analyse the business model case studies. This green business model framework describes value from two perspectives -value creation and value capture- that are further broken down into five components -green value proposition, target group, key activities, key resources, and financial logic (Figure 4:5).

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

Figure 4:5 - Green business model framework used by Abuzeinab et al. (2016, p.480)

A-priori higher order codes were first derived from literature and these included: green business model components; aspects that define sustainable buildings; and, other research and industry specific references such as metatheories, behavioural change and lifecycle costs. The higher order codes were used to structure data extraction (Fereday & Muir-Cochrane, 2006). NVivo software was used to facilitate data organisation and analysis. Each code was created as an NVivo node. Microsoft Excel was also used to organise key information. Relevant excerpts from the case studies were added to each node in NVivo and further analysis led to the emergence of more data-driven codes. The approach was not limited to extracting explicit data on business model components. The external environment, such as general political, environmental, societal, and economic factors, is essential to green business models and must also be considered (Sommer, 2012). This systemic view enabled new codes and themes to emerge from unique data and frequently occurring data. Zhao et al. (2016) similarly used a business model innovation framework to thematically summarise business model innovation in zero carbon building projects.

4.9.3 Qualitative validity and reliability

The narrative write-up of the review findings includes detailed descriptions of the data and identifies references that can be independently reviewed. Concepts and models emerged during the inclusion and exclusion of literature process that appeared to be of relevance to the research topic. These have been described and analysed. New and unexpected findings from the included data are also highlighted. Peer-review of the

findings was not incorporated as this is independent doctoral research. For qualitative reliability, the research process has been clearly documented and an example of the data extraction protocol can be found in Appendix 1. The narrative write-up concludes with research implications and the development of a conceptual framework for sustainable business models in buildings and construction.

Deductive coding is reliant on the initial framework and as such, making the analysis more holistic (considering the wider research context and allowing codes to emerge from the raw data) should have minimised inherent limitations. There will, however, still be bias towards areas that have already been highlighted in the literature.

4.10 Single case study: Sweden

4.10.1 Single case study approach

A case study attempts to describe what is happening in reality. As a method of data collection, it involves gathering data from a practice setting and can provide very useful and detailed information due to capturing various perspectives. There are typically too few cases in a project's timeframe to be statistically generalizable but it is an ideal method for exploratory research and pre-testing hypotheses. For industry, it is a very useful way of disseminating knowledge on practical solutions (Yin, 2014). Eisenhardt (1989) views theoretical sampling as part of the logic in case studies. Cases should further develop our theoretical knowledge through replication, expansion or the identification and investigation of outliers/polar types. The object of study for this single case study is an organisation that provides insight and learning on the construct and context of interest – sustainable business models for sustainable buildings (Chapter 7). Patton (2015) similarly refers to the approach as 'theory-based sampling' or 'operational construct sampling' where sampling is based on the potential for representing the theoretical construct(s) of interest. There is also criterion sampling where all cases must meet a set of pre-determined criteria to ensure that cases are relevant to the construct being investigated. For example, if all construction sites in a certain region are expected to reuse or recycle more than 90% of waste but this is not happening in practice,

criterion sampling could include all sites that fall below target to investigate the problem. This research predominantly adopts theory-based/operational construct sampling (Patton, 2015; Yin, 2014).

Publicly available data from the selected organisation was first narratively analysed using the sustainable business model archetypes (Figure 4:6) to confirm theoretical relevance (Ritala et al., 2018). The selection was also influenced by the level of accessibility to senior management and resources, enabling access to data that would have otherwise been inaccessible. This approach is useful when there are limited resources and time. It still does not permit broad generalisation but focuses on extracting more intense information and deriving logical conclusions (Yin, 2014).

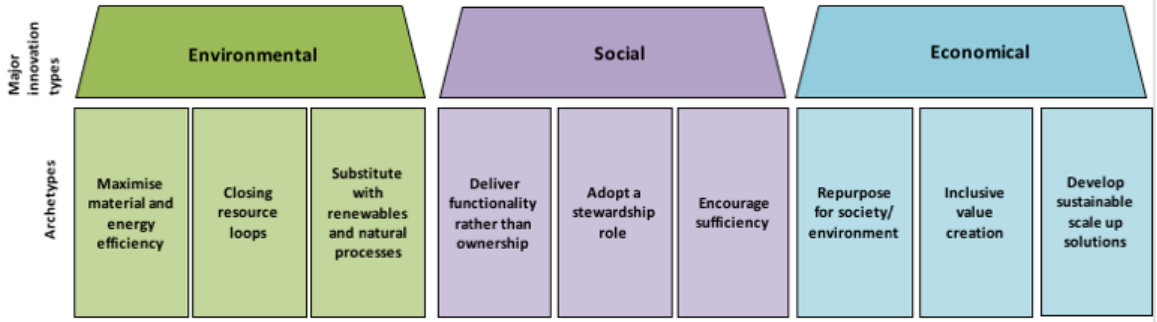

Figure 4:6 - Ritala et al. (2018) examples of SBM archetypes adapted from Bocken et al. 2014, 2016 and Ludeke-Freund et al., 2016 (Bocken, 2017). Nine sustainable business model archetypes. [image] Available at: http://nancybocken.com/sustainable-business-model-adoption-among-sp-500-firms/ [Accessed 24 April 2018].

According to Eisenhart (1991), "*a conceptual framework is an argument that the concepts chosen for investigation or interpretation, and any anticipated relationships among them, will be appropriate and useful, given the research problem under investigation*" (p.209). The approach to data organisation and analysis is identical to the systematic review of business models for sustainable buildings (Section 4.9.1). A conceptual framework was used to guide data organisation and analysis – the framework was developed by adapting the research findings from the reviews (refer to Chapter 6, Section 6.10 for more information on the conceptual framework).

Previous research into the analysis of how eight Finnish construction companies incorporate business model thinking revealed that managers in construction are not very familiar with the business model concept to begin with nor the underlying value centric thinking (value creation logic). The business model term is used differently to what is found in the literature by having a strong focus on revenue (how the company is creating value for itself), and a much lesser focus on customer or broader stakeholder value (Pekuri et al., 2013). To minimise communication challenges, characteristics of the sustainable business model conceptual framework were first generated based on publicly available data. This was used as the baseline for a face-to-face 3-hour senior management team workshop at the organisation's head office (Table 4:6) to generate discussion and gain access to company information that is not publicly available. In-depth semi-structured interviews were subsequently scheduled (Table 4:6) to get more detailed information and close data gaps. Throughout the study period, relevant information was also shared through emails and short phone calls with various members of the management team. Emerging themes were progressively discussed in subsequent interviews, creating an iterative process which is typical for case study research (Yin, 2014).

Table 4:6 - Participants in workshop and interviews

Senior management team workshop	**Semi-structured Interviews**
President	*Environmental Manager*
Property Development Manager	*Property Marketing Manager*
Environmental Manager	*Property Development Manager*
Property Manager	*Property Developer*
Property Marketing Manager	
Property Developer & Architect	
Property Developer	
Communication Manager	

4.10.2 Interviews

Interviews are used to gain further understanding of perceptions and opinions and to clarify points. Due to the exploratory nature of the study, a 3-hour session with the senior management team was organised to introduce and discuss the research topic, company operations, relevant roles and future plans. In-depth semi-structured

interviews were then conducted with persons who were very knowledgeable about the organisation's activities towards developing sustainable buildings. All interview participants had previously attended the workshop session. Semi-structured interviews include guiding questions to frame the discussion but there is no prescribed order and the session should be very interactive. The aim is for the researcher to gather deeper insight from the participant through less formal conversational exchange; however, this approach could generate a large volume of data to analyse.

The interview participants had a combined 79 years of experience in the real estate and construction sectors, ranging from 8 to 30 years. Interviews started with the Environmental Manager who was responsible for real estate management and sustainability. Based on relevant projects and activities that were mentioned during the interview, three other participants were recommended (interview snowballing) for deeper discussion on: the development and construction project process, including lifecycle considerations; the smartphone application and tenant questionnaires; and, a major extension project within one of the existing developments. During the second interview, an additional participant was recommended to discuss details on rental negotiations but this was not included due to the sensitive (proprietary) details. Futhermore, rental increase challenges and subsequent impact were also discussed at length in the first interview. A total of 4 interviews were conducted that lasted 35 minutes to 1 hour and 30 minutes. The longest interview was the first one and subsequent interviews were much shorter. All interview questions and processes were documented as replication is critical for high credibility and reliability as previously explained. The results were shared with the interview participants for feedback on content and interpretation, especially due to the language difference (Swedish being the participants' first language while the content is in English).

4.10.2.1 Interview protocol

The following questions were used as a guide for the senior management workshop and interviews. All interviewees were not asked the complete list of questions. Questions were selected based on the participant's role and knowledge.

General information

- *Brief explanation of role*
- *Years with company*
- *Years in industry*

What are the main products and services that the company offer?

- *Is there a unique selling point?*
- *Who are your main customers?*
- *Are there noticeably different demands/needs from different customer groups/segments?*
- *How would you describe your relationships with customers?*
- *Is there any public/community engagement for a new project/service/idea beyond planning/legal requirements?*
- *Has there been noticeable/quantifiable behavioral/ethical change in your customers?*

Considering the creation and delivery of your products and services:

- *What are the most important activities?*
- *Do you consider whole life cycle costs when analyzing new opportunities? Examples? Any specific tools used?*
- *Can you think of any activities that help with educating customers?*
- *What/who are the most important resources (tangible and intangible)?*
- *How has the incorporation of digital technologies impacted the business?*
- *Who would you consider to be critical partners and suppliers, influencing your operations and vice-versa?*

What are your financial revenue streams?

- *Is any of this information available to the public (considering transparency)?*
- *What are the environmental and social outcomes of your business operations?*
- *Do any of these environmental and social outcomes also have economic value?*
- *How are you mitigating or offsetting negative outcomes?*
- *Are any business activities dependent on government decisions or subsidies?*

What is your interpretation/definition of the term 'sustainable building'? What words, images, thoughts come to mind?

What is your experience with various stakeholder groups (developers, designers, consultants, contractor, clients, etc.) when establishing or agreeing on sustainable vision/goals?

Have you experienced differences between sustainability within the organization and within projects (external client work)?

Do you see any areas of value already being created that are not seen by customers or society?

- *Anything that could be beneficial from existing business practices?*

A follow up question was added based on the workshop discussion.
Are you able to have a competitive advantage while incorporating sustainability? Expand on the challenges with increasing rental income to recover sustainable investments such as the ongoing dialogue in Stockholm (or Sweden in general) with Tenant Associations.

4.10.3 Qualitative validity and reliability

The approach to this case study enabled data triangulation. Meeting with the senior management team after reviewing secondary data (publicly available data) helped to validate publicly available information, gave more insight on company operations and provided access to documents that would have otherwise been unavailable. Conducting interviews after this process enabled the interviews to be more focused on less public and less obvious details after quickly reviewing the broader questions. Interviews also aided with understanding the business model where data was missing or enriching the data. More information was gained on: roles and responsibilities (activities); differences between customer types and how that links to various business decisions (essentially customer segmentation – though not referred to by this term); challenges encountered during various real estate investments (local nuances that need to be explained); information on newest developments, collaborations and projects that are not yet publicly available; and information on activities that were never publicly disclosed. Sharing the findings with interviewees also helped with ensuring accuracy. Overall, the management workshop and interviews enhanced the researcher's understanding of the

organisation, providing clarity on activities that are important for understanding and analysing the business model. The data gathered was invaluable for richer research content but a more generic version of the sustainable business model could still be extracted from a combination of the company documents and publicly available information.

Similar to the systematic reviews, peer-review of the findings have not been incorporated as this is independent doctoral research. Analysis considered the wider research context and allowed codes to emerge from the raw data to minimise inherent limitations. An important point to note for qualitative research and especially case study research is that more holistic approaches could cause results to be too vague/abstract or oriented differently to what was prescribed in the research design. It is critical to regularly check that methods, data management and analysis are aligned with the research framework and objectives (Yin, 2014). This case study focuses on a specific phenomenon (sustainable business model) in a specific context in detail.

For qualitative reliability, the research process has been clearly documented and an example of the interview protocol has been presented. The narrative write-up of the case study findings includes detailed descriptions of the data and a variety of quotations extracted from transcripts for transparency and connectivity to the raw data. Theoretical implications are extensively discussed through the lens of the sustainable business model archetypes and also through Ludeke-Freund et al. (2019) recently developed sustainable business model patterns. Wider research and contextual implications are also presented, highlighting key characteristics of the conceptual framework and recommendations for the case study organisation.

"*In each real competitive situation, the firm's particular characteristics and history, the circumstances in the industry, and the details of each competitor, present unique challenges and opportunities. The strategy frameworks allow us to abstract from all of that detail and capture the essential elements of competition. But as we move toward execution, the detail becomes more important. The details of the firm's products and services, its activities and resources, its people, and nearly everything else about the*

firm, are the ingredients of execution. Clearly, getting the details right is enormously important to effective strategy execution. And frameworks for thinking about this problem, for helping to get the details right, are enormously beneficial"

(Richardson, 2008, p.134).

4.11 Multiple case study: Caribbean region

The knowledge gained throughout this research and the cumulative findings have been used to further explore sustainable business models in an under researched geographical setting. The focus is on small island developing states (SIDS) in the Caribbean region. More specifically and for homogeneity, all cases are headquartered in Barbados and offer products and/or services to other Caribbean countries. Multiple cases were explored to gather in-depth data. Organisations across the buildings and construction sector were found through desk research and the researcher's knowledge of the industry along with suggestions from interview participants throughout the process (opportunistic and snowball sampling). Most of the organisations have introduced new products and services to their markets and consider themselves to be pioneers or leaders in their sub-sectors, due to their experience, offering and/or market share. The organisations are also trying to achieve higher levels of sustainability within their business and community. The cases therefore are somewhat representative cases of sustainable business models but are expected to display lesser or lower sustainable business model characteristics than the Swedish case, mainly due to various systemic and external challenges encountered by SIDS (refer to Chapter 3 for further information on geographical constraints). Lambrechts et al. (2021) similarly assessed sustainable transitions in affordable social housing organisations in the Netherlands from a business model perspective by focusing on one region - Utrecht. With a larger and more structured market, the research was able to assess financial capability and soundness by using the Netherlands authority for housing corporations assessment framework and guarantee fund for social housing (which includes requirements for loan-to-value, solvency, etc.) and annual reports. The selected organisations were also based on the Aedes sustainability benchmark (Lambrechts et al., 2021) of which there is no equivalent for the Caribbean region.

For this multiple case study, one of the selected cases has been analysed at project level due to the new value offering for the project being more relevant to the study – a sustainable housing development. All other cases have been analysed at organisational level. For organisations that operate in multiple sectors, only the relevant subsidiaries were included for analysis. The final sample of 12 (Table 4:7) was also influenced by the level of accessibility to senior management as in some cases there was minimal publicly available data.

Table 4:7 - Organisational sample

Name	Specialisation	Employees	Age
C1	Manufacturing (concrete)	200	10
C2	Manufacturing (prefabricated components)	200	20
C3	Manufacturing (paint)	100	60
C4	Manufacturing (windows)	250	60
C5	Architecture (commercial and residential)	5	30
C6	General Contractor (commercial, residential, infrastructure)	800	40
C7	General Contractor (commercial, residential, infrastructure)	200	60
C8	General Contractor (commercial, residential)	10	5
C9	General Contractor (commercial, residential)	50	30
C10	Real estate (developer, management)	100	60
C11	Real estate (developer, management)	10	40
C12	Housing development (project)	10	180

The multiple case study approach is similar to the single case study approach. Data collection approach began with a preliminary desk study to narratively analyse secondary data (public data from websites and news articles, company documents) for each organisation guided by the enhanced conceptual framework. Though all of the organisations have an online presence – website and various social media channels – some are more active than others. Half of the organisations explicitly mention 'sustainability' on their website or in other online communications and where mentioned, there is minimal information to explain the extent of activities or provide further evidence (with the exception of the housing project which explicitly uses sustainability as a selling point). It was therefore critical to also conduct in-depth semi-structured interviews with business owners or senior management who were very knowledgeable about the organisations and how they operate. The details of interview

participants are presented in Table 4:8. The same interview protocol was generally followed (refer to Section 4.10.2.1). Interviews lasted 60 to 90 minutes and were all conducted through video calls. The initial research plan was to visit each organisation/project and conduct in-person interviews but this was not possible due to the COVID-19 pandemic.

The overall approach is similar to a case study on sustainability pioneers in the smartphone industry to explore how sustainable business models address socio-ecological issues (Zufall et al., 2020). Zufall et al. (2020) conducted 16 semi-structured interviews, focusing only on managers who were knowledgeable about the organisations' business models. Lambrechts et al. (2021) used semi-structured interviews with key stakeholders to gather in-depth data insights and supplemental information was gathered from company documents. 3 cases were studied with 3 interview participants from each case (Lambrechts et al., 2021).

Table 4:8 - Overview of participants in case study interviews

Organisation	Value chain	Role	Years of experience
C1	Manufacturing	General Manager	19
C3	Manufacturing	General Manager	15
C5	Architecture	Principal/Owner	26
C12	Developer	Project Development	22

Data for each organisation was kept in a separate research file. Relevant information was extracted from secondary data and transcripts, qualitatively coded and analysed in a common Microsoft Excel spreadsheet and using NVivo software. It was an iterative process of combining similar codes and themes within and across cases to reduce repetition and complexity. There was minimal conflict with pre-populated sustainable business model information and interview participant insights so it is assumed that the secondary/publicly available data has been mostly accurate.

A survey method was initially considered for more generalisable results; however, Dick-Forde, Oftedal & Bertella (2020) received a very low response rate to a sustainable

business model thinking exploratory study on the hospitality and tourism sector in the Caribbean. The survey was emailed to 128 stakeholders in the English-speaking Caribbean hotel sector (senior-level hoteliers and senior officials in national and regional hotel and tourism agencies across 12 countries) to gather their perceptions on how they create value in relation to climate change/the SDGs. Only 11 responses were received, covering 8 countries despite three reminders. Given the importance of the topic and the potential impact of non-response bias on the results, it was suggested that different research approaches should be applied such as face-to-face interviews and case studies. It was recommended to investigate the reasons for such a low response rate (Dick-Forde et al., 2020). Previous studies have found that the least cited source for climate change adaptation information in the Caribbean is the internet. The more popular sources are friends, neighbors, and television (Baptiste, 2018) and there is generally a higher level of awareness amongst younger people. Further to this, religious leaders are amongst the most trusted sources (Altschuler & Brownlee, 2016). These aspects could contribute to low levels of engagement via internet based and remote approaches.

In addition to the factors already highlighted in previous sections in this chapter on validity and reliability, after data collection and analysis, findings were compared with the sustainable business model conceptual framework and discussed within the current sustainable business model literature and political landscape. This provided context specific implications from identified 'sustainability gaps' and recommendations for future research and policy avenues. For wicked problems, qualitative research helps to provide a voice for the underrepresented. It helps to provide important real-world considerations for high level strategies and decision making, which if ignored could lead to ineffective and unsustainable outcomes (Mertens, 2015). Ionașcu et al. (2020) similarly used qualitative content analysis on data from EU real estate companies to analyse the extent to which sustainable development goals (SDGs) are used to meet stakeholders' information needs and general societal expectations. Data was extracted from sustainability reports to highlight prioritised SDGs and their depth and extent of

integration in the business model. The qualitative approach was used due to limited available literature on sustainable real estate reporting (Ionașcu et al., 2020).

4.12 Research limitations

The research process includes limitations mainly due to time and resource constraints. The research design and methods needed to be suitable for the doctoral research period.

There was no hand searching of articles that may not be online and a distinction was not made based on journal impact. Scopus and Web of Science were the main search engines used but these are the largest databases of peer-reviewed literature (Elsevier, 2017). A key point regarding the business model and sustainability literature was raised by Bocken et al. (2014) - novel business models were being explored in practice that were not yet explored within academia. Adams et al. (2016) shared similar views, indicating that research has an element of incompleteness and time delay when grey literature is excluded. The systematic reviews do not include the use of grey literature. For systematic reviews in management research, it is recommended to include grey literature such as working papers, conference proceedings, and other publications that may not be found on large academic research databases. Whilst grey literature was not included in this research, clear guidance is provided on the review method to enable future inclusion.

Semi-structured interviews are useful for generating more in-depth data, especially for exploratory research. Throughout this research, semi-structured interviews were very helpful in providing information that was not publicly available, especially regarding sustainability and for smaller, private or lesser media focused organisations that may not publish these details. The main disadvantage with this approach is that a high volume of data is generated and it is time consuming to effectively organise and analyse the data. Even with the use of software, such as NVivo to facilitate the process, significant time is still spent on manual coding and thematic analysis. Considering analysis, this was limited to variables that could be assessed using available data. For

example, longer-term revenue, costs and distribution of economic costs and benefits among stakeholders are considered a key variables but have not always been included in great detail due the lack of publicly available or provided information for assessment. Some of the selected organisations in the multiple case study also engage in informal sustainable activities, which are therefore not formally documented and reported. Since only 4 organisations have been further investigated, it is possible that other sustainable business activities have not been captured.

Overall, a case study weakness is that outcomes typically cannot be generalised due to the small sample size. It is also strongly dependent on the researcher's interpretation of the data which could add subjective bias. Specifically within sustainability research, it has been noted that some researchers are too passionate about saving the world and therefore unable to be objective enough (Peattie, 2011). The research is also being conducted by an individual researcher and therefore a second reviewer was not used to check that the methodology was accurately followed and that the generated data was comprehensive. However, many other qualitative validity and reliability strategies have been employed to overcome this such as: data triangulation; participant feedback; detailed descriptions and inclusions of raw data (from transcripts); presentation of new or unusual results; extended informal observation; documented and detailed research procedures and protocols; and, continual review and reflection by the researcher.

5 Systemic and strategic approach to sustainable development

5.1 Chapter outline

This chapter first describes the framework for strategic sustainable development (FSSD), highlighting the importance of systems thinking and strategy. Details are then presented on how strategic sustainable development has been utilised in academic research, based on the results of a systematic literature review. The review results are statistically synthesized and discussed, with the applications in business and management research (and specifically business models), being further explored. The chapter closes with a qualitative integration of sustainable business models (Chapter 2) and strategic sustainable development towards identifying potential sustainable business model characteristics and enhancing the conceptual framework. Some of this chapter is based on the researcher's first year of work and was partly published in Small-Warner et al. (2018). Informal observational data and knowledge building on the research area was also gained in the second year of work during the researcher's international placement with the Department of Strategic Sustainable Development, Blekinge Institute of Technology, Sweden.

5.2 Systems thinking and the Framework for Strategic Sustainable Development (FSSD)

"In the most basic sense, a system is any group of interacting, interrelated, or interdependent parts that form a complex and unified whole that has a specific purpose. The key things to remember is that all the parts are interrelated and interdependent in some way. Without such interdependencies, we have just a collection of parts, not a system."

Introduction to systems thinking (Kim, 1999, p.2)

All parts of a system should be somehow interrelated and interdependent and their purpose of being together defines the system as a whole (i.e. all parts are required for the purpose and the arrangement of parts is essential). Another key characteristic is built in feedback loops to maintain the intended purpose. Systems are therefore more clearly defined and understandable for man-made mechanical/inorganic functions (such

as a wind turbine or kettle) than organic/natural functions (such as eyes or lungs). This is mainly due to the impact of evolution (living systems evolve) and increased understanding of organic systems over time. To help demonstrate the importance of systems thinking, whether as a perspective, language or tool, an iceberg analogy was produced (Figure 5:1) (Kim, 1999).

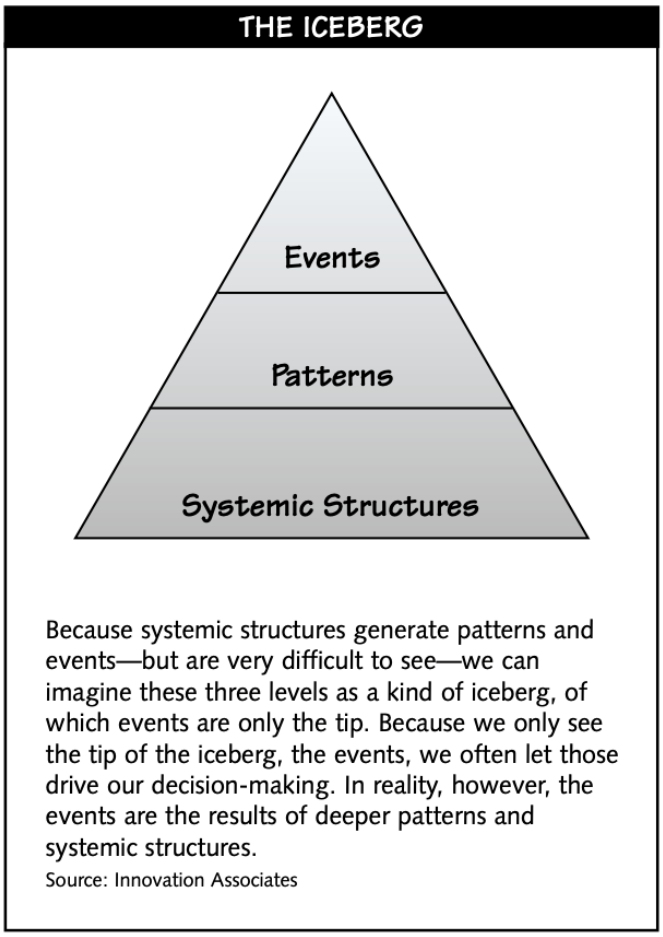

Figure 5:1 - Systems thinking iceberg analogy (Kim, 1999, p.4)

It is therefore important to have a greater understanding of the systemic level, which is the outcome of core beliefs and assumptions (mental models), as it is the basis of the more obvious/easily observable events level. The approach does not diminish the requirement for more specific analytic thinking; it moreso emphasises that both are needed to truly understand the world. The framework for strategic sustainable development (FSSD) originated as the natural step (TNS) framework in 1989 by a

Swedish medical doctor, Karl-Henrik Robert. The goal was to translate sustainable development into a practical framework for transitioning resource usage from a linear to circular model (similar to the cradle to cradle and circular economy approaches described in Chapters 2 and 3). Through feedback from other scientists and researchers, a systems thinking perspective with a scientific foundation formed the core of defining sustainability for TNS. TNS Foundation was then created to promote and educate business leaders and policy makers on the implementation of TNS along with continuously improving the framework itself – feedback loop (Broman, Goran, Holmberg and Robert, 2000).

The systems thinking rationale behind the FSSD is that to achieve the required rate of sustainability, there is a need for a thorough understanding of the enormity and urgency of sustainability challenges along with the benefits of proactively transitioning. This thoroughness requires identifying root causes, which are often overlooked or underestimated, to create possibilities for root solutions and eliminate fundamental unsustainable practices (systemic level). Unsustainable practices can result in significant losses and could arise with minimal warning such as disruptive technology, policy and regulatory changes, and resource unavailability. Strategically, the framework provides a guide to avoiding these increasing risks, which in turn highlights a full scope of challenges and opportunities, and ultimately illustrates the benefits of proactive action (Broman and Robert, 2017). The FSSD aims to be an overarching multidisciplinary structure that is complimentary to other supportive tools and frameworks for sustainable development. It has been (and continues to be) developed over 30 years through a systematic and iterative process of peer and practitioner reviewing and testing (Broman & Robert, 2017; Missimer, 2015). Best summarized by Missimer (2015), "*…the FSSD has been designed to give guidance on strategically moving any region, organization, project or planning endeavor towards social and ecological sustainability in an economically viable way*" (p.2-3).

Sustainable business models require a systems-based, boundary-spanning approach underpinned by natural and social science. Exploring the interrelationship between sustainable business models and strategic sustainable development could help improve the understanding of sustainability challenges and how they may be turned into business opportunities (Small-Warner et al., 2018).

5.3 Strategy and backcasting

"Competitive strategy is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of value."

What is strategy? (Porter, Michael E., 1996, p.6)

According to Porter (1996), there are three fundamental principles of strategic positioning: (i) creating a unique and valuable position such as serving few needs of many customers, broad needs of few customers or broad needs of many customers in a niche market; (ii) making trade-offs such as identifying incompatible activities (choosing what not to do); and (iii) creating beneficial synergy across organisational activities.

The FSSD's structural model, a five-level framework, explicitly distinguishes between system characteristics, success visions, strategic guidance, action plans, and tools to be used for planning in any complex system or as an analytical tool to assess and describe any topic. It is important to have a clear understanding of each level and their interconnections. Based on assessing a concept/entity, the levels are as follows:

1. System: the overarching system (key structures and relationships) relevant to the goal where boundaries consider the global socio-ecological context. This could be a specific entity such as an organization or concept.
2. Success: the inherent characteristics and objectives/goals that define success within the global context, ensuring not to violate the sustainability principles.
3. Strategic Guidelines: the step-by-step strategic and economically viable approaches to the objectives using a planning method called 'backcasting' - guidelines should be generalised and not entity-specific, which is formed in the strategic plan at the next level.

4. Actions: the tangible things to be done to achieve the vision and guidelines, and to be successful and compliant - this forms a strategic plan that should be regularly reassessed.
5. Tools: the concepts, methods, tools, and other supporting elements required for management, implementation, monitoring, and assessment in alignment with the strategic guidelines (3). It should be taken into consideration that existing tools may not fit the requirements and there is need for innovation or adaption.

The strategic planning approach is considered as the 'heart' of the framework. Backcasting planning is a strategic planning method where first the vision is defined and then various scenarios are created in a step-by-step process to reach that vision. The vision must be based on the principles instead of specific to a scenario because as conditions change, what was previously perceived to be ideal may no longer be relevant. This is flexible and transferable. An operational procedure for strategic transitions was created for the FSSD and is referred to as the ABCD-procedure. The ABCD-procedure and five-level model are iterative processes where discussion and decisions in one step/level could easily lead to adjustments in other steps/levels. Once completed, the strategic plan needs to be monitored and regularly re-assessed (Broman and Robert, 2017). A critique of strategic planning is that the most thoroughly planned strategy can become irrelevant due to rapid and unforeseen changes in circumstances. The key is quick adaptation and flexibility. Strategic planning should not be limited to an annual exercise but is an ongoing review of process that should be incorporated at all levels of an organisation (Mintzberg, 1994). It can be seen that this flexibility is addressed at the strategic guidelines level in the FSSD.

5.4 Sustainability principles

At the core of the FSSD's development is the creation of a science-based definition for sustainability that is flexible and adaptable for various backgrounds and disciplines. The scientific basis means compliance with available relevant scientific knowledge and allows for well-defined and measurable processes, comparisons and outcomes. This enables the quick elimination of scientifically unachievable visions. Furthermore,

preferences and values vary; therefore, trying to solve current problems without potentially creating new problems in the future (unintended negative consequences) requires agreement on what is essential for the sustenance of social and ecological systems, to prevent unsustainable development. This unifying definition is referred to as the 'sustainability principles' and follows the below criteria:

- Necessary for sustainability
- Sufficient for sustainability, covering all relevant aspects
- General, transdisciplinary
- Concrete, capable of guiding actions
- Non-overlapping, distinct, comprehensible and can be monitored

The principles (originally described as the four system conditions of a sustainable society) are the common core rules from which everything else can be developed. As shown in Figure 5:2, we should not: extract more than we can replenish, create more than we can destroy, degrade nature and natural processes, nor undermine a person's ability to meet their needs (The Natural Step, 2011a; Broman and Robert, 2017).

Figure 5:2 - The four system conditions of a sustainable society (The Natural Step, 2011a)

There are many other methods and tools to implement, monitor and/or evaluate sustainability such as Factor X, Factor 10, Lifecycle Assessment (LCA), Total Material Flow

(TMF), Ecological Management Systems (EMS) such as ISO 14001, Ecological Footprinting (EF), Triple Bottom Line (TBL), Zero Waste, Eco-Efficiency, Ebex 21, Biomimicry, Zero Emissions, Sustainable Technological Development (STD), UNEP Cleaner Production, and Natural Capitalism. The aim of the FSSD is to provide structured and coordinated usage (Robèrt et al., 2002; Broman and Robert, 2017). Researchers have explored how these various tools could be incorporated with the FSSD (Robert et al, 20012; Broman & Robert, 2017) and found that the methods and tools worked without conflicts and complemented each other in different ways. The main highlight was that having a common set of sustainability principles provided helpful guidance when developing and using the tools (Robèrt et al., 2002).

5.5 Incorporating strategic sustainable development in academic research

To comprehensively capture and understand how the FSSD has been utilised in academic research, a systematic review on strategic sustainable development was conducted following Tsafnat et al. (2014) systematic review steps. The goal was to provide a more comprehensive understanding of how the FSSD has been used as a theoretical framework, analytical tool, and methodology for enhancing sustainability research across various disciplines. The step-by-step procedure is explained in Chapter 4. In the most recent review article on the FSSD, Broman and Robèrt (2017) briefly summarized research methods that have been used throughout the years of the framework's development. The list included literature reviews, action research, interviews, case studies, surveys, modeling, hypothesis generation and testing, and logical reasoning. This review covers a recent increase in publications that would not have been previously considered. Some limitations of the review are access to published data and the exclusion of grey literature that could potentially add value.

The systematic review on strategic sustainable development resulted with a sample of n = 73 scientific articles (Appendix 2). The breakdown of articles per year is shown in Figure 5:3. There were n = 60 journal articles, n = 6 conference papers, and n = 7 reviews/editorials. The first article found was from 1997 in the International Journal of Sustainable Development and World Ecology, an indicator of the age of this research

topic. There was an increase in publications in 2009 (n = 9) followed by a more significant increase in 2017 (n = 21). An interesting finding was that the most recent article from the searches using "natural step framework" was published in 2011, raising the assumption that the term is no longer used in academia.

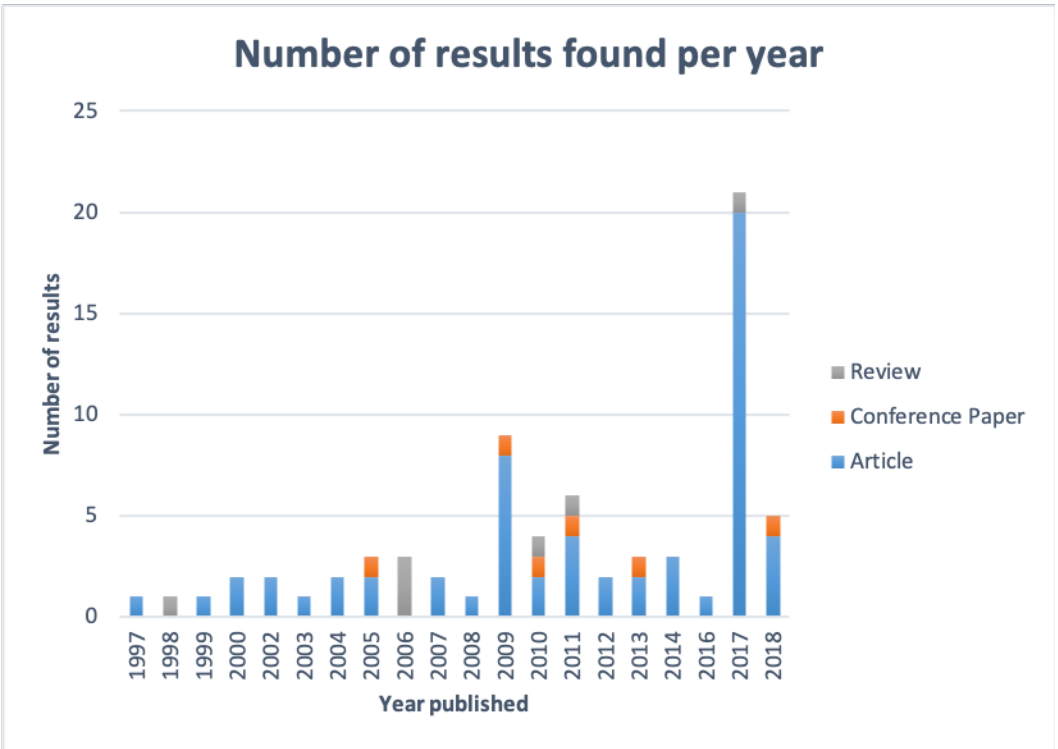

Figure 5:3 - Graph showing number of strategic sustainable development articles found per year

The majority of results, 42%, (n = 31) were published in the Journal of Cleaner Production, which in 2017 was ranked in position 1 on Google Scholar Metrics' category for sustainable development and position 26 on Scimago Journal & Country Rank for renewable energy, sustainability and the environment. This was followed by 12% (n = 9) in Progress on Industrial Ecology. The journals with more than one publication focus on sustainable development and industrial ecology and account for 74% (n = 54) of the sample. Individual articles were found in other journals with topics in energy, mechanics and materials, quality management, forecasting, and education, showing the interdisciplinary applications of the framework. One of the journals, Greener Management International: The Journal of Corporate Environmental Strategy and

Practice, which released its first publication in 1993, ceased activity in 2007. Figure 5:4 shows the distribution of results by journals/conference proceedings.

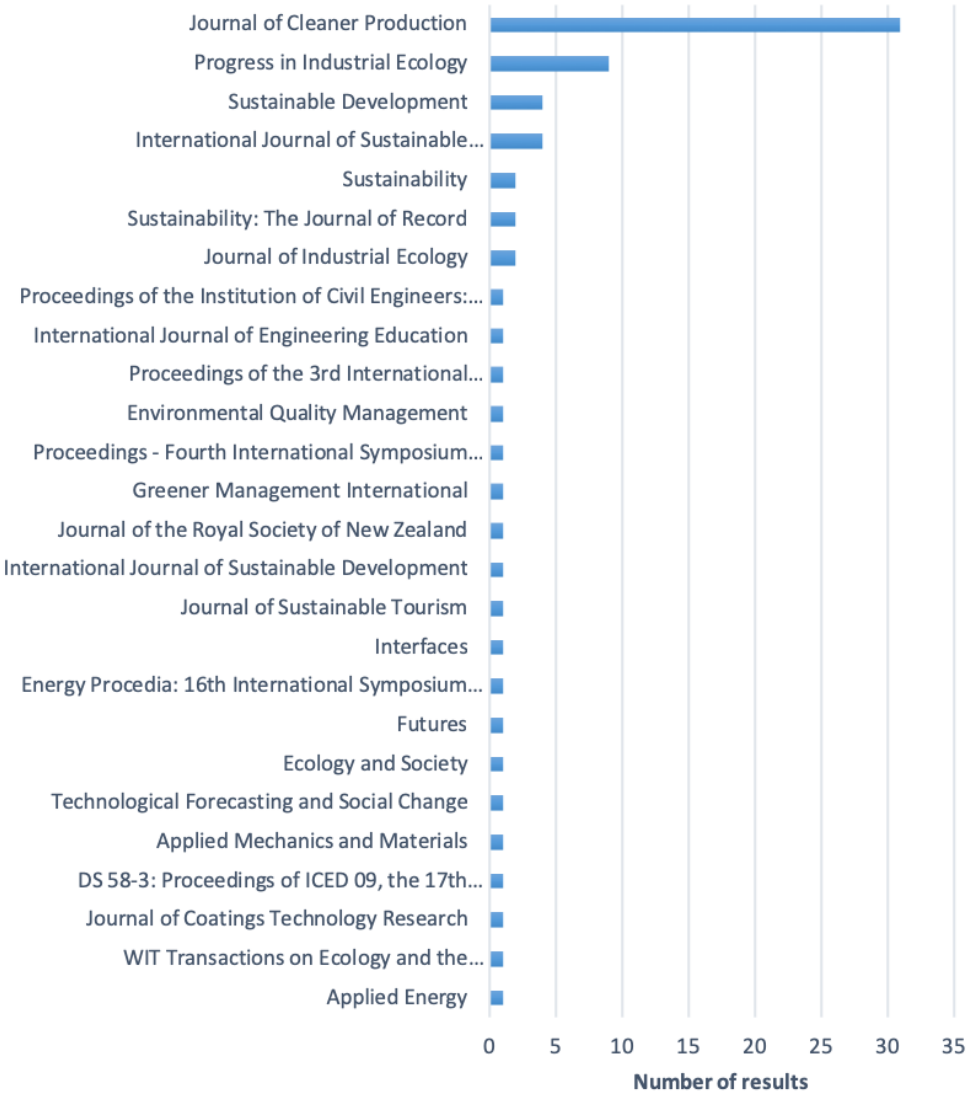

Figure 5:4 - Distribution of sample by journal or conference proceeding

Most articles refer to the Brundtland definition for sustainable development (Brundtland and World Commission on Environment and Development, 1987) within their introductions. Interestingly, some of the articles that were initially included based on the abstract (subsequently removed after further reading), also used the four sustainability principles (Robèrt et al., 2002) to define sustainable development (Baumgartner, 2014). These papers mainly focused on corporate sustainability and strategic thinking, showing that within business strategy and sustainability research, the

FSSD sustainability principles were being used as a more tangible definition of sustainable development. Other articles were excluded because the FSSD was only referred to in discussions and conclusions as a useful framework and tool that may provide a solution to the research problem (Vandenberg, Luthi and Quinerly, 2017; Schulte and Hallstedt, 2018). Overall, the research methods were the same as previously highlighted by Broman and Robèrt (2017). The majority of articles (n = 62) integrated the entire FSSD or a part thereof with another concept(s) in an attempt to embed or assess sustainability (Table 5:1). The remaining articles (n = 11) were mainly literature reviews that discuss the FSSD and other sustainability frameworks/concepts/tools.

Table 5:1 - Concepts that have been integrated with the FSSD or an element of the FSSD

Research concepts/topics	Sample	Authors
Planning & Policy future studies, regional planning, zero emissions, city planning, energy futures, urban regeneration, tourism, public procurement, planetary boundary approach, transport, building information modelling (BIM), construction, urban planning, community planning, food systems	17	Craig (2004); Varga & Kuehr (2007); Phdungslip (2011); Giurco et al (2011); Gilmour et al (2011); Gill & Williams (2011); Bratt et al (2013); Robert, Broman & Basile (2013); Farzaneh (2014); Telesford & Starchan (2017); Robert at al (2017); Boren et al (2017); Holmstedt, Brandt & Robert (2017); Robert & Broman (2017); Alwan, Jones & Holgate (2017); Carlsson et al (2017); Schulte & Ny (2018)
Environment/Ecology industrial ecology, ISO 14001, ecomaterial, lifecycle assessment (LCA), sustainable product development, cradle to cradle, water management, eco-labelling, ecological footprinting, bioremediation	16	Korhonen (2004); MacDonald (2005); Wang, Nguyen & Yamamoto (2005); Ny et al (2006, 2008); Ny (2007); Van Der Pluijm, Miller & Cuginotti (2010); Ren et al (2010); Bratt et al (2011); Giurco et al (2011); Tang, Zhang & Leng (2011); Lawton et al (2013); Lindahl et al (2014); Siyab et al (2016); Vandenberg, Luthi & Quinerly (2017); Haller, Jonsson & Froling (2018)
Business decision-making, incubators, organizational culture, leadership, corporate sustainability, corporate social responsibility, sustainable value chain, business models,	13	Waage et al (2005); Franca et al (2009); Blankenship, Kulhavy & Lagneryd (2009); Baumgartner (2009); Robert (2012); Baumgartner (2014); Alsudairy & Vasista (2014); Franca et al (2017); Allais, Rouccoules & Reyes (2017); Rauter,

product service systems, governance, business case for sustainability		Jonker & Baumgartner (2017); Kurucz et al (2017); Dyer & Dyer (2017); Broman et al (2017)
Education engineering education, research societies, music, higher education	6	Broman, Byggeth & Robert (2002); Korhonen (2006); Brooks, Magnin & O'Halloran (2009); Dave & Pong (2009); Bailey, Keen & Ap (2014); Dyer & Dyer (2017)
Design product design, ecodesign, design thinking	5	Ny et al (2006, 2008); Waage (2007); Schoggl, Baumgartner & Hofer (2017); Shapira, Ketchie & Nehe (2017)
Social conflict resolution, peacebuilding, social systems, consumer behaviour	5	Bitterman, Velasco & Wright (2009); Missimer et al (2010), Missimer, Robert & Broman (2017a, 2017b); Morgan, Tallontire & Foxon (2017)

Planning & policy and environment/ecology were the most dominant categories with business recently increasing in interest. All of the integrations with business applications were published within the last 10 years with the exception of one. Further, half of them were published in 2017. Within the business topics, three articles combined the FSSD and business models. In an effort to enhance strategic sustainable development from a business perspective, Franca et al. (2017) conceptually combined the FSSD with the business model canvas (BMC) and applied it to participatory research. Rauter, Jonker and Baumgartner (2017) used the FSSD to investigate how and why companies integrate sustainability with their business models. They found that the FSSD provided greater clarity where there was a lack of specific sustainability goals. Kurucz et al. (2017) developed a conceptual model of relational leadership for strategic sustainability, incorporating findings from leadership research on two business model development and assessment tools. The use of the FSSD therefore appears to be a recent and underdeveloped approach to embedding sustainability into the business model concept. The integration with social applications is also underdeveloped. The social dimension of the FSSD was actually previously identified as an area of weakness in comparison to the ecological dimension. Researchers have since dedicated efforts to socially strengthening the sustainability principles. This social enhancement has been ongoing for the past ten

years and continues to be an area of focus (Missimer, 2015; Missimer, Robèrt and Broman, 2017a; Missimer, Robèrt and Broman, 2017b).

The case study research highlighted several examples globally of FSSD applications that have led to comprehensively aiding organisations with sustainability transitions, reducing social and ecological non-compliance, and developing new opportunities. The principles have been applied in various ways such as investment analysis to determine if a technology will be sustainable in the future, evaluation of collaborations, and assessment of proposed actions. However, it has also been acknowledged that the framework is complex and sophisticated, requiring skilled guidance. This is the same as feedback on sustainable business model frameworks and tools.

5.6 Conceptual integration of sustainable business models and strategic sustainable development

The FSSD aims to highlight systemic problems that if left unchecked will continue to worsen the global system. It is meant to provide a strategic and structured approach and is not a replacement for other sustainability methods and tools (Robèrt et al., 2002; Broman and Robert, 2017). It has been used for over 30 years within research and industry to assess sustainability in several subject areas including education, environment/ecology, planning and policy, business, design and social systems. Sustainable business models essentially articulate how an organisation creates, delivers and captures value for its customers and all stakeholders. This value goes beyond only economic considerations to include environmental and social value. Stakeholders expand beyond organisational boundaries and are based on the entire system that the organisation is a part of (Schaltegger, Hansen and Lüdeke-Freund, 2016). Similar to the FSSD, there are strong cases that the sustainable business model perspective facilitates the implementation of sustainable solutions. Both approaches typically require fundamental changes in thought-processes and actions and the re-conceptualization of how value is created. Both approaches have identified the underdevelopment of social sustainability, with the FSSD going further to enhance the social system conditions (Figure 5:5).

In a socially sustainable society, people are not subject to structural obstacles to…

4. …health. This means that people are not exposed to social conditions that systematically undermine their possibilities to avoid injury and illness; physically, mentally or emotionally; e.g. dangerous working conditions or insufficient rest from work;
5. …influence. This means that people are not systematically hindered from participating in shaping the social systems they are part of; e.g. by suppression of free speech or neglect of opinions;
6. …competence. This means that people are not systematically hindered from learning and developing competence individually and together; e.g. by obstacles for education or insufficient possibilities for personal development;
7. …impartiality. This means that people are not systematically exposed to partial treatment; e.g. by discrimination or unfair selection to job positions;
8. …meaning-making. This means that people are not systematically hindered from creating individual meaning and co-creating common meaning; e.g. by suppression of cultural expression or obstacles to co-creation of purposeful conditions.

Figure 5:5 - System conditions for a socially sustainable society (Broman & Robert, 2017, p.29)

Considering the structure and functions of both models, the FSSD five-level model, including the operational ABCD-procedure for strategic transitions, is an iterative process where discussion and decisions in one step/level could lead to adjustments in other steps/levels. Furthermore, strategy in itself, according to Porter (1996), is about selecting activities, through making trade-offs and creating synergies, to competitively deliver a unique value mix. It therefore may be more aligned with sustainable business model innovation/development. For this doctoral research, the focus is on understanding characteristics of sustainable business models by synthesizing existing and planned sustainable activities. It does not involve formal visioning or in-depth assessment towards achieving those visions (strategic planning); however, what could be extracted is that an important sustainable business model characteristic would be to at least have a defined sustainable vision and guidelines, encapsulating FSSD levels 1 to 3 (system, success, strategic guidance). Furthermore, Figure 5:6 shows how FSSD

sustainability principles/system conditions could be broken down into dematerialisation (reducing material usage) and substitution (exchanging usage). They could then be sub-divided to include: resource productivity such as usage reduction, waste reduction, and substitution with more abundant, degradable and renewable sources; function productivity such as less area consuming activities, improved management routines, availability and distribution of resources, cultural substitutions such as product-service, and more equity across the global economy. These subdivisions already identify further potential sustainable business model characteristics, drawing similarities with sustainable business model archetypes and patterns.

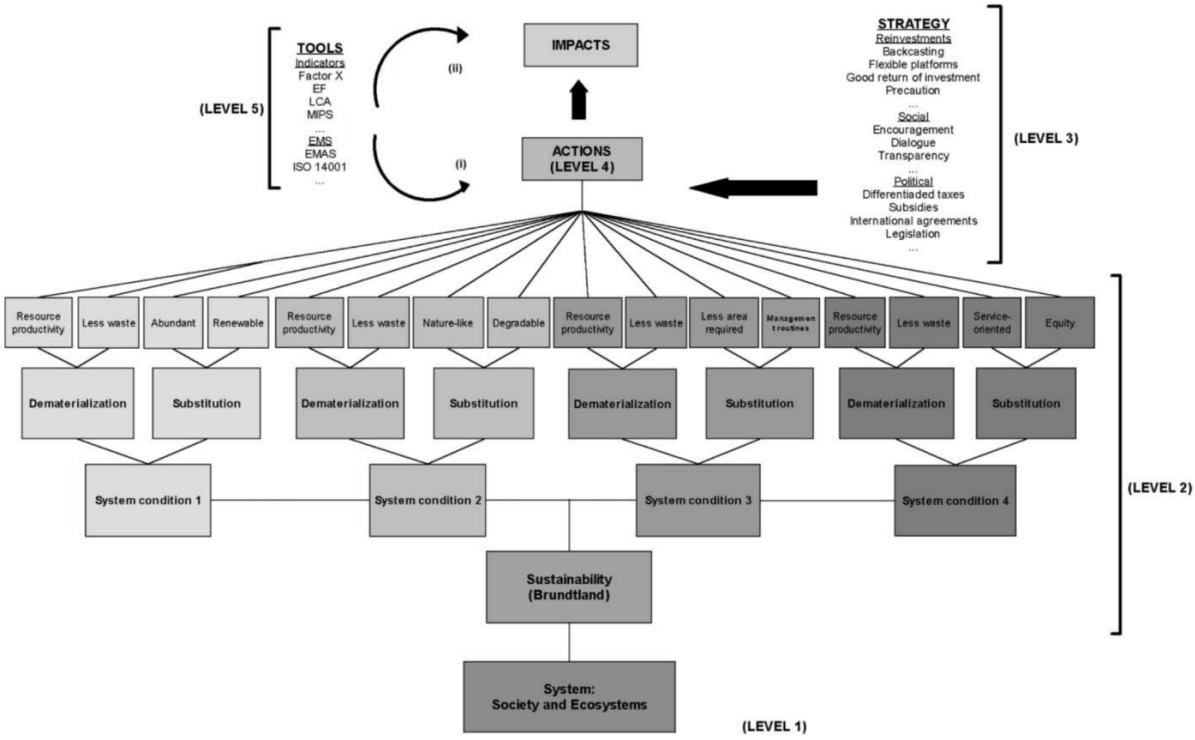

Figure 5:6 - Flowchart of FSSD five-level model showing subdivisions (Robèrt et al., 2002)

Then there is level 4 (actions), which describes tangible activities towards achieving these sustainable visions and guidelines. This logic is aligned with the sustainable business model approach of investigating organisations' activities to assess sustainability. At level 5 (supporting tools) similar to the approach with visioning, what could be extracted is that supporting methods and tools, in whichever format, are required for sustainability management, implementation, monitoring, and assessment.

This could therefore be another sustainable business model characteristic.

In previous exploration of incorporating the FSSD with other sustainability concepts, methods and tools, the main highlight was that having a common set of sustainability principles provided helpful guidance when developing and using the tools (Broman & Robert, 2017; Robèrt et al., 2002). From the three journal articles that combined the FSSD with the business model concept, it was found that the combination also helped with greater clarity where there was a lack of specific sustainability goals. It further helped with business model scalability to global level, risk identification and avoidance, investment strategy, and enhanced partnerships and social integration (Franca et al., 2017; Kurucz et al., 2017; Rauter et al., 2017). Ultimately, strategic sustainable development encompasses a systems thinking perspective and scientific approach, which may be used to enhance the development of value perspectives and sustainable business models (Franca et al., 2017; Small-Warner et al., 2018; Upward & Jones, 2016). This conceptual integration shows how it has been used to qualitatively identify and enhance potential sustainable business model characteristics (Figure 5:7), and potentially provide a complementary structured approach for sustainable business model development/innovation.

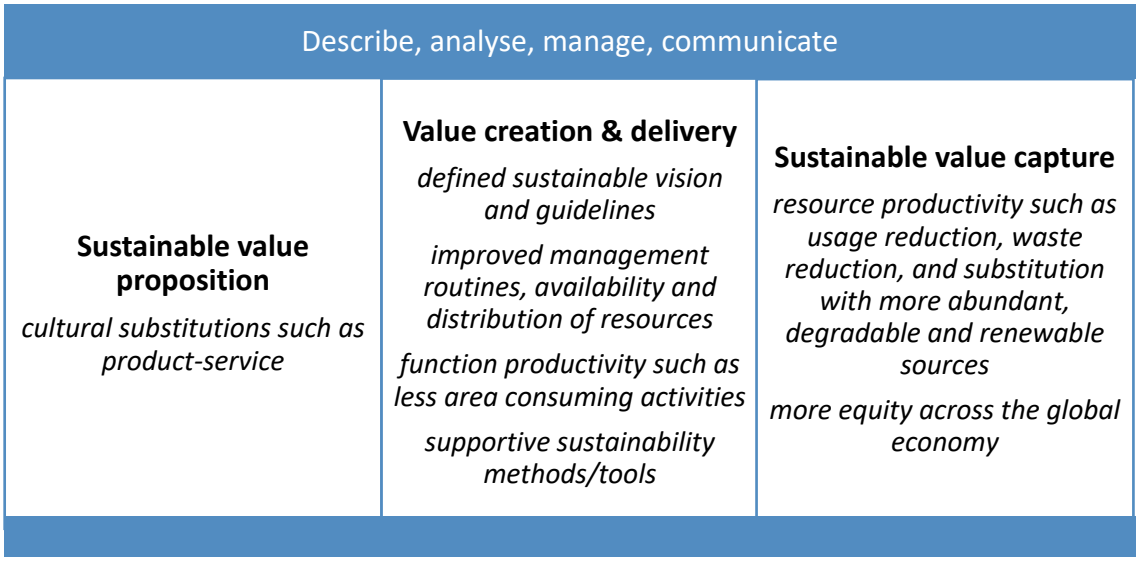

Figure 5:7 - Potential sustainable business model characteristics adapted from the FSSD five-level model

6 Sustainable business models in buildings and construction

6.1 Chapter outline

This chapter presents the results of a systematic review of empirical research on business models for sustainable buildings. The chapter begins with a bibliometric summary of the selected studies and the common research approaches. The main business model and sustainable building theoretical concepts that have been used are then outlined to clearly establish the research positioning. Relevant concepts that were found during the systematic review are also highlighted even though they were excluded from review analysis. Business model elements from the studies are then summarised in a table using the green business model framework, followed by a thematic synthesis of the results. The synthesis discusses the main value creation and value capture themes/characteristics and their research and contextual implications – including potential areas for improvement and further research. The chapter closes with the development of a sector specific sustainable business model conceptual framework.

6.2 Introduction to the selected empirical studies

A systematic literature search was conducted in January 2019 and repeated in August 2019 using Scopus and Web of Science databases to comprehensively compile case studies that utilised the business model concept for addressing sustainability concerns in the buildings and construction sector. The following words and phrases were used to search titles, keywords and abstracts: (sustainab* OR environmental* OR ecolog* OR green OR “zero carbon” OR “cleaner production” OR social*) AND (construction OR building OR housing OR “built environment”) AND “business model*”. After snowballing some of the first selected articles, the term “housing” was added. The final total for this review was 13 peer-reviewed journal articles that covered 26 cases with empirical contributions to sustainable business models in the buildings and construction sector. See Chapter 4 for more details on the research method.

The majority of publications range from 2015 to 2019 with one in 2010 and one in 2002. Three are from Journal of Cleaner Production, two from Resources, Conservation, and

Recycling and two from Organization and Environment. The other journals had one publication each – Environmental Management, Communications of the Association for Information Systems, Sustainable Cities and Society, Construction Innovation, Sustainability, and Construction Management and Economics. All of these journals have an overall aim to transform industry but are not predominantly business and management journals. The countries represented are USA, Sweden, Denmark, Finland, Germany, France, The Netherlands, Singapore, Japan, Hong Kong, Australia, UK and Mexico, which provides a variety of geographic locations but mostly developed nations.

The majority of cases, 17, focus on general construction/building companies with almost half only offering residential/housing while the others include commercial and/or industrial buildings. 3 of these cases are real estate developers that own various elements of the supply chain, essentially creating vertically integrated organisations. 1 of the cases is a large general contractor that shifted from constructing buildings to offering construction services and facilities management. Of the remaining cases, 4 focus on secondary building material/component production, that is, materials made from waste products. For example, using tree bark from the logging industry or reusing bricks and wood from previous buildings that would otherwise be discarded. These cases incorporate circular economy thinking towards creating circular business models and some also include architectural design and planning services for end of life. 5 cases focus on government-led programmes that facilitate sustainable construction services.

The most common research approach across the studies is to:

1. conduct a literature review to define/develop the theoretical/conceptual framework (research lens)
2. provide justification/define parameters for case selection such as the use of sustainability rankings, pioneering companies, innovative/early adopters, extreme exemplars
3. analyse secondary data (mainly publicly available information) such as company reports, websites, sustainability reports, corporate social responsibility reports,

company blogs, magazines, case memos, building assessment results/certifications, general news

4. conduct 2/3 semi-structured interviews with owners, executive and senior management, and/or environmental/sustainability managers (expanding to other stakeholders such as customers and partners where feasible)
5. thematically analyse and present findings, typically with initial coding based on the research lens.

The overall amount of interview participants per case ranges from 1 to 62. The reason for the large range is that 4 cases have significantly higher amounts of participants, mainly due to being embedded in a large organisation/project and/or conducting the research over a longer period of time. Roome & Louche (2016) conducted 11 interviews through participatory research on the business model transformation of a large global company, which also incorporated observational data. Gauthier & Gilomen (2016) investigated an urban district project and conducted 23 interviews to reach data saturation across the multiple companies involved. Broer & Titheridge (2010) deeply investigated a self-build sustainable housing community by incorporating 48 interviews from residents, potential customers, financiers, agents, planners, etc. (multiple stakeholder groups) over two years. Similarly, Bossink (2002) investigated six sustainable housing estates over six years, accumulating 62 interviews from multiple stakeholder groups. Beyond the semi-structured interviews, 6 cases added surveys/open ended questionnaires for interviewees; 5 cases incorporated site visits; and, 2 cases incorporated a seminar/workshop with company management.

6.3 Theoretical and conceptual references used for business models and sustainable building

Metatheory refers to foundational concepts and theoretical reflections that facilitate the emergence of other theories and concepts (Overton & Müller, 2012). It seems important to first briefly discuss some of the metatheoretical positions of the studies. Strategy (Porter, Michael E., 1980) is regularly mentioned either to establish the connection to business models or as a generic term. Connections are also directly made

to Porter's (1985) value chain, which is a set of interconnected primary and support activities that impact an organisation's competitive advantage (Porter, Micheal E., 1985; Teece, 2010). When defined, the business model is viewed as a source of competitive advantage or as a reflection of realised strategy, essentially operationalising strategy (Casadesus-Masanell & Ricart, 2010; Teece, 2010). There is regular mention of innovation (business model innovation) and inter-organisational relationships (value network). Mintzberg's (1979) notion of configurations is incorporated to consider the business model's external connection with the market environment and the internal relationships between components - inside and outside perspectives (Mintzberg, 1979). The resource-based view is used to focus on key enabling tangible and intangible assets for value creation; more specifically, the enabling collective capabilities/competences for sustaining competitive advantage (Barney, 1991; Foss, 1996; Penrose, 1959). Dynamic capabilities (DaSilva & Trkman, 2014), transaction cost economics (DaSilva & Trkman, 2014; Morris et al., 2005) and transition studies (Quist et al., 2011; Smith et al., 2005) are also background perspectives that are used. This shows that various theories, rooted in strategic management, have been combined to investigate the value dimensions of organisations.

Lessing & Brege (2015) used Brege et al. (2014) business model framework for industrial buildings that includes three main elements – market position, offering, and operational platform. The market position covers communication and development of the relationship with the targeted market segments. The offering is similar to the value proposition in the business model canvas, highlighting the value to the customer. The operational platform includes key resources, activities, partners, and suppliers for organizational functionality. Roome and Louche (2016) add value destruction to their analysis with the argument that sustainable development also requires considering how the business model does not destroy value for other stakeholders in the short and long term.

Zhao, Pan and Lu (2016) and Zhao, Hwang, and Lu (2018) view sustainable business models (Schaltegger et al., 2012) as very relevant for sustainable building because the approaches and goals are similar to the application of innovative building technologies. It is critical to address the needs of all stakeholders and utilise innovative construction processes such as lean construction and the integration of information and communication technologies (ICT). The business model for zero carbon buildings (ZCB) is therefore defined as "*a strategy to invest in a ZCB project, which creates and delivers value by various stakeholders within the project delivery process and leads to an increased competitive advantage*" (Zhao, Pan and Lu, 2016, p.257). A conceptual framework is also proposed for business models for zero carbon buildings (Figure 6:1) and it introduces a time dimension (short to long term perspective). Zhao, Hwang, and Lu (2018) then use the components of this framework, considering both the firm and project level (since the industry is built on project-based work), to analyse five leading companies in corporate sustainability rankings. When a project and firm are analysed, the firm model is used for analysis to stay consistent across the sample and to prevent duplication if the project model is inherent to the firm model. Using the business model canvas, Zhao, Hwang, and Lu (2018) also describe business models focused on energy efficiency and renewable energy in buildings, adding to the recently compiled reviews (Table 2, p.1217).

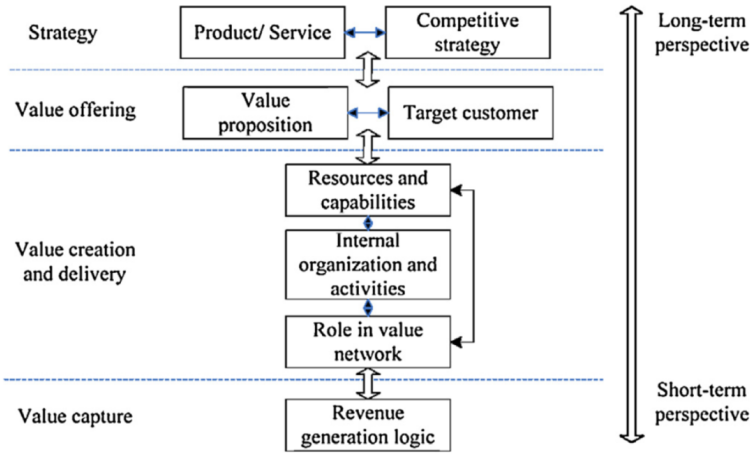

Fig. 3. A conceptual framework of business model.

Figure 6:1 - Zhao, Pan, and Lu (2016) conceptual framework for business models for zero carbon buildings (p. 258)

Leising et al. (2018) incorporate circular economy thinking, moving towards circular business models as a subset of sustainable business models. The case studies are explained using sustainable business model archetypes developed by Bocken et al. (2014) and Ritala et al. (2016). Nußholz et al. (2019) similarly indicate that *"circular business models aim to utilise embedded economic and environmental value in products and materials for as long as possible, for instance through substituting primary materials with secondary materials (Nußholz, 2017, 2018)"* (p.309). Ünal et al. (2019) states that *"circular business models are not only creating sustainable value, employing pro-active multi-stakeholder management, and have a long-term perspective, but also close, slow, intensify, de-materialize, and narrow resource loops"* (Geissdoerfer et al., 2018, p.405).

Palomares-Aguirre et al. (2018) used Boons & Ludeke-Freund's (2013) definition of sustainable business models within their selection criteria but did not go further to include a specific framework. The findings narratively express how the case studies meet the definition. Broer and Titheridge (2010) and Sakurai and Kokuryo (2018) use the term business model without including a definition or referencing other business and management frameworks; however, the findings explicitly include information regarding sustainable buildings and business models such as vision/desirable outcomes, products and services, customer segmentation, supportive partnerships, financial viability, critical factors (activities and resources), and the impact on the environment, community, and wider stakeholders. Bossink (2002) also does not use the term business model but refers to sustainable innovation processes (Rohracher, 2001) in sustainable construction (Kibert, 1994). The case studies investigate policy and governance, sustainable construction practices, and public and commercial organisational inter-relationships (how Dutch public and private organisations work together to achieve sustainable housebuilding/ construction goals on demonstration projects). The framework used for analysis (Figure 6:2) aligns with Amit and Zott's (2001) categorisation of content, structure, and governance. The analysis of practices aligns with business models as activity systems where practices are representative of the business model (Amit & Zott, 2001; Zott & Amit, 2010).

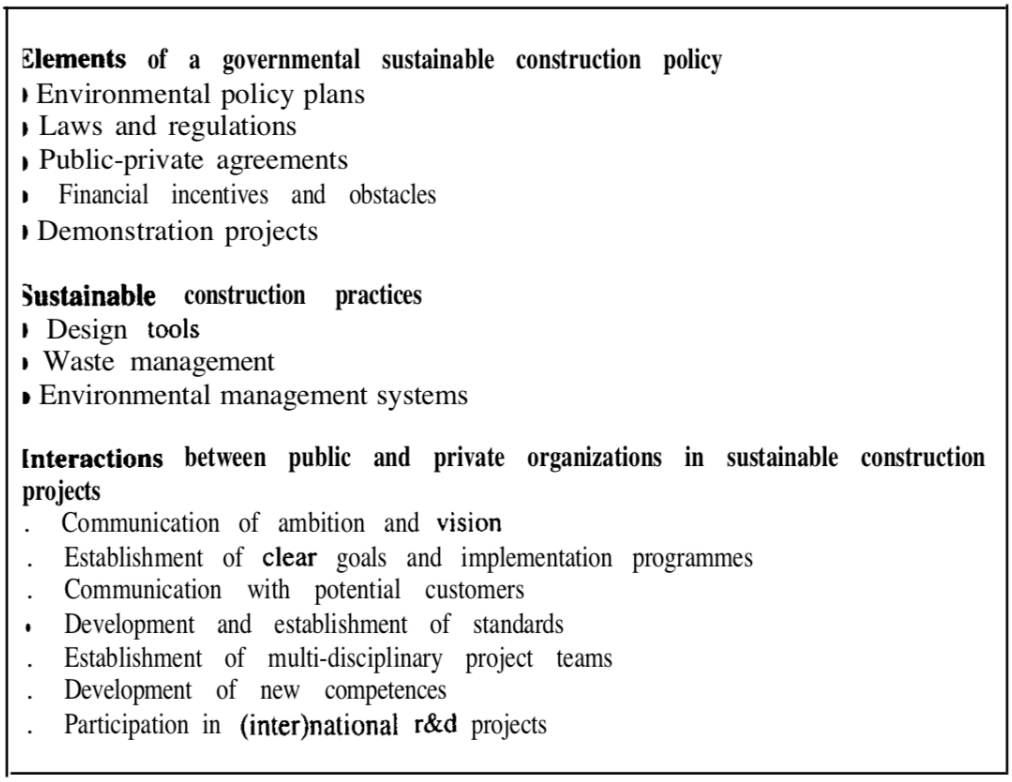

Figure 6:2 - Bossink's (2002) analytical framework (p.7)

The explicit business model concepts and frameworks used for empirical analysis all take a value-centered approach, identifying value proposition, value creation, value delivery, and/or value capture (Table 6:1). Researchers either use the business model canvas as the research lens or go further to incorporate other theories, concepts and frameworks. The majority of studies also use business activities/practices to define the business model (Zott & Amit, 2010).

Table 6:1 - Business model and sustainable building theoretical and conceptual references used in the case studies

Business Model References	Sustainability References	Geographic Locations	Case Study Sources
business model canvas (Osterwalder & Pigneur, 2011) sustainable business model (Schlategger, Ludeke-Freund & Hansen, 2012; Ludeke-Freund, 2013) business model framework for industrial buildings (Brege et al, 2014) sustainable business model archetypes (Bocken et al 2014; Ritala et al, 2016) value destruction (Roome & Louche, 2016) business model for zero carbon building (Zhao, Pan & Lu, 2016) circular business models (Nubholz et al, 2018; Geissdoerfer et al, 2018) *no explicit reference* sustainable innovation processes (Rohracher, 2001)	basic human needs sustainable construction (Kibert, 1994) sustainable communities (Huckle, 1996) triple bottom line (Elkington, 1997) design for the environment (Kibert, 2003 & 2013) sustainable building (Kibert, 2012) what, how long, and in what condition is something to be sustained (Hovorka, 2012) circular economy sustainable development (Roome & Louche, 2016)	USA Sweden Denmark Finland Germany France The Netherlands Singapore Japan Hong Kong Australia UK Mexico	Bossink (2002 Broer & Titheridge (2010) Lessing & Brege (2015) Roome & Louche (2016) Zhao et al. (2016) Gauthier & Gilomen (2016) Palomares-Aguirre et al. (2018) Leising et al. (2018) Sakurai & Kokuryo (2018) Zhao et al. (2018) Ünal et al. (2019) Nußholz et al. (2019) Pardo-Bosch et al. (2019)

A variety of terms and concepts are also used as the main reference to sustainability within the sample (Table 6:1). The most frequently mentioned author is Charles Kibert in relation to sustainable buildings, sustainable construction, and design for the environment (Kibert, 1994, 2003, 2012, 2013). Ünal et al. (2019) further proposed a

theoretical framework built on design for X practices – 'Design for Recycling (DfR), Design for Remanufacturing and Re-use (DfRe), Design for Disassembly (DfD), and Design for Environment (DfE)'. The studies that focus on housing naturally lean towards more social constructs. Broer and Titheridge (2010) study self-build housing, describing sustainable development as *"a revised form of self-reliant community development which sustains people's livelihoods using appropriate technology"* based on Huckle (1996). Roome and Louche (2016) describe sustainable development as *"how the advancement of wealth, and provisions for the health and education and other measures of social well-being can be accomplished in ways that can be sustained within the resource endowments and systems of the planet"*. Palomares-Aguirre et al. (2018) took the position that housing is a fundamental/basic human need and therefore sustainable development must address those at the 'base of the pyramid' (low/unstable income) who need assistance with securing a place to live.

Leising et al. (2018) selected BREEAM certified buildings to investigate slowing and closing material/resource loops such as reusing waste products and extending the life of new products. This showed an incorporation of industry certifications and standards with academic research to aid with identifying sustainable businesses. Furthermore, the LEED certification was investigated as a business model due to having quantifiable sustainability goals (Tisak, 2015). Nußholz et al. (2019) similarly took a circular economy principles approach focusing on secondary material use in the building sector. Interestingly 'sustainable buildings' is a keyword in Nußholz et al. (2019) but there is no explicit definition of the term. Zhao, Pan, and Lu (2016) zero-carbon building studies are the only cases that provide a definition of sustainable building, referencing Robichaud and Anantatmula (2010) and Kibert (2012) - *"sustainable building is built in a resource efficient manner based on ecological principles and lifecycle consideration, with the aim of minimizing environmental impacts and enhancing health issues"* (Kibert, 2016; Robichaud & Anantatmula, 2010).

Lessing and Brege (2014) do not make explicit reference to sustainability but investigate product-oriented prefabrication/modular construction business models that are considered as moving towards sustainable building. Sakurai and Kokuryo (2018) investigate the development of a 'sustainable smart town' using the triple bottom line concept (Elkington, 1997) coupled with a long-term perspective (100-year strategy). The key considerations are what, how long, and in what condition is something to be sustained (Hovorka et al., 2012).

6.4 Relevant concepts and models that emerged during the inclusion and exclusion of literature process

During the analysis of the literature search results against the inclusion criteria, some data on collaborative consumption firms (firms that connect peers for the distribution of products and/or services) was found. This included the peer-to-peer networks Airbnb, Couch Surfing, Flipkey, and HomeExchange along with redistribution/second-life marketplace ListingDoor (Garrett et al., 2017). These operate in the buildings and construction sector without owning or directly controlling any assets (sustainable buildings) and therefore were excluded. However, other concepts and models emerged that were relevant to the overall research objectives (such as scale up of action in the buildings and construction sector towards climate change mitigation) but did not meet the inclusion criteria (they were not empirical business model case studies). These approaches include describing exemplars or developing conceptual models for investigating and/or embedding sustainability in organisations in the buildings and construction sector.

It has already been suggested within this research that sustainable building assessments and certifications could be a key sustainable business model characteristic in the buildings and construction sector (Chapter 5). This is taken further by Tisak (2015) who investigates the Leadership in Energy and Environmental Design (LEED) certification itself as a business model for sustainability. The research reviews 112 projects in the United States and concludes that key success factors towards attaining certification (essentially towards a successful business model) include: owning and embedding

sustainability at an early stage, establishing sustainability goals; relevant training and prior experience with LEED projects; and, financial stewardship (Tisak, 2015).

Selberherr (2015) proposes a theoretical cooperative network business model for the construction sector with the aim of contributing to societal level sustainable development whilst enhancing economic value for organisations. The theory-led model takes network (inside) and environment (outside) views. The network encompasses cooperative service, which requires balancing autonomy and dependency and is built on trust and the expectation of fair and cooperative behaviour. The environment essentially encompasses the strategic positioning but considers customers plus the wider contribution to societal sustainable development. Within the network view, there is an initiation process model that aims to establish the cooperation network (the required synergies) across a building's lifecycle for the delivery of resource efficient building services; ultimately hoping to significantly reduce opportunistic behaviour. Once a network has been established, a common vision and mission must be agreed on. The network view also comprises the project process model and cooperation steering model, which both provide more detailed information on value creation and delivery. An example offering, shown in (Figure 6:3), incorporates system suppliers (heating, ventilation, and air conditioning (HV), building envelope (BE), sanitary (SN), and electrical (EL) contractors) and adds subsystem contractors (energy contractors (EN), facility management providers (FM), security control technicians (SC), and building automation (AT) providers (Selberherr, 2015, p.13).

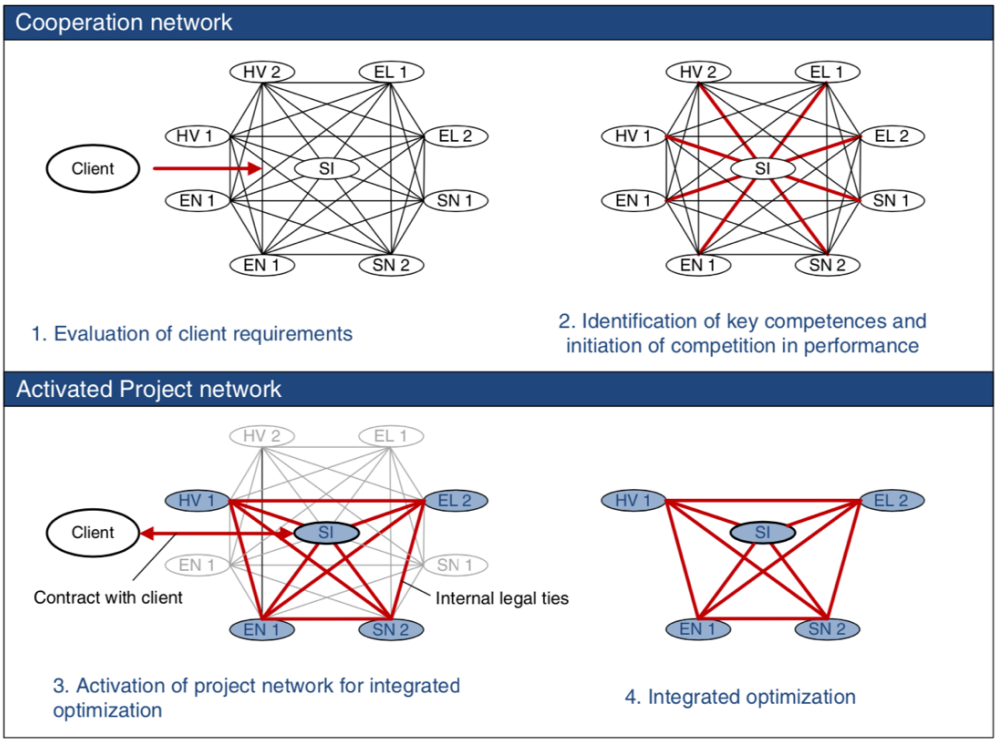

Figure 6:3 - Theoretical cooperative network business model example for sustainable building organisations and projects (Selberherr, 2015, p.12)

This approach of creating collaborative business models is also explored as a virtual/digital network of specialized SMEs that can quickly and easily adapt to various projects or project specific needs. The network covers various elements of the project value chain and aims to be more flexible than one larger organisation. This is one of the suggestions from the NewBEE European research project that created an ICT platform to facilitate innovative approaches in the energy-retrofitting sector (Disconzi & Lorenzoni, 2016). Interestingly, a similar description but of more informal cooperation, found subsequent to this review, explains a collaborative approach to construction in communities in developing countries:

> *"There is a traditional method of construction, practised especially in the Andes, called 'minga' (or minka). Minga, a quechua word, refers to the social, collective work that is sometimes used to build community infrastructure, such as a road or an irrigation system. It draws on the principle of reciprocity, such that: 'I help you to build your house, you help me to build mine'. Usually, the owner of the house asks his community for help and, through an assembly, the community assigns*

> *resources in the form of labour and construction materials. A skilled mason leads the construction and all the villagers help by providing labour or food, or even taking care of the children so that all the adults can assist in the construction. At some time, the owner of the house must return the favour and help build a neighbour's house one day. Such collaborative approaches can bring communities together"* (Moreno, 2020, p.23).

At the industrial level, collaboration, either formal or informal, is embedded in 'industrial symbiosis'. It is a collective approach to the usage of resources and by-products amongst industrial organisations that traditionally would operate independently. The aim is to reduce environmental impact while also reducing costs. These organisations exchange energy and materials in beneficial ways to all actors (Baldassarre et al., 2019). The implementation of digital ledger technology (DLT)/blockchain in the buildings and construction sector also appears to take a society-centered, transparent, and democratic approach, in hopes of improving trust and thereby collaboration. Some relevant applications are smart homes/buildings, smart contracts, and building information modelling (BIM) (Boucher et al., 2017; Li et al., 2019). The increasing levels of digitalisation and automation could have major impacts on organisations and business models. A distributed autonomous organisation (DAO) is not confined to existing regulations and requirements of a sector or country. DAOs are decentralized an automated such as a self-driving taxi that uses income to pay for maintenance and then replacement at end of life (Boucher et al., 2017; Nowiński & Kozma, 2017; Tapscott & Tapscott, 2017). Li et al. (2019) find DLT to be disruptive for each value element of the business model, such as validation of goods and services, efficiency, automated financial reporting, automated purchasing, and intermediaries (and/or human interaction) becoming redundant (through elements such as 'smart contracts'). Furthermore, DLT proposes potential changes in how projects are financially structured and funded to help mitigate some of the risk. This includes retentions, guarantees, warranties, bonds, etc. that are in place for risk mitigation.

Another interesting descriptive example, which emerged during the review but is not explicitly defined as a business model is The Detroit Land Bank as a suggested solution for managing vacant houses and revitalising regions:

> *"In the state of Michigan, the number of vacant houses exploded when employees at the automobile corporation, General Motors, drastically decreased from 80,000 to 5000–6000 people. The Detroit Land Bank was established in order to manage these vacant houses. The Detroit Land Bank reviewed whether vacant houses should be taken down or reused, and the properties that had been occupied by the demolished buildings were turned into green belts or community spaces. Over 1000 vacant houses have been managed thus far, and investments were made to turn 200–300 houses into high-quality buildings. The Detroit Land Bank operates by acquiring one-third of its funds from the Ford Foundation, among others, one-third from default payments and penalty fees charged to people who fail to make payments on time, and one-third from the rental fees and sales of buildings that they manage"* (Nam et al., 2016, p.367).

Further exploring this extension of building life, Cook and Khare (2009) use what they refer to as a 'sustainable growth model' to demonstrate how continuous commissioning aligns with economic, environmental, and societal aspirations (Figure 6:4). Continuous commissioning in buildings refers to systematically and frequently checking various building aspects, typically via automated systems, to create an optimal schedule for upgrades/retrofit/etc. The aim is to reduce operation and maintenance costs and improve indoor comfort - thermal comfort and air quality (Cook & Khare, 2009). From a wider perspective, an investigation into district management business models in Japan highlighted that the consolidation of building maintenance and management systems in the same geographical area could also reduce operational costs (Yasui & Kinoshita, 2013). Zooming in on the materials level, Tam & Tam (2008) examine economic and environmental benefits of a waste reduction incentive system, Stepwise Incentive System, in construction organisations. The system measures material input and waste output and continuously monitors activities. 23.6% waste was reduced in their Hong Kong case study, encouraging organisations to increase the priority of waste

management and expand employee knowledge of reuse, recycling, and reduction (Tam & Tam, 2008).

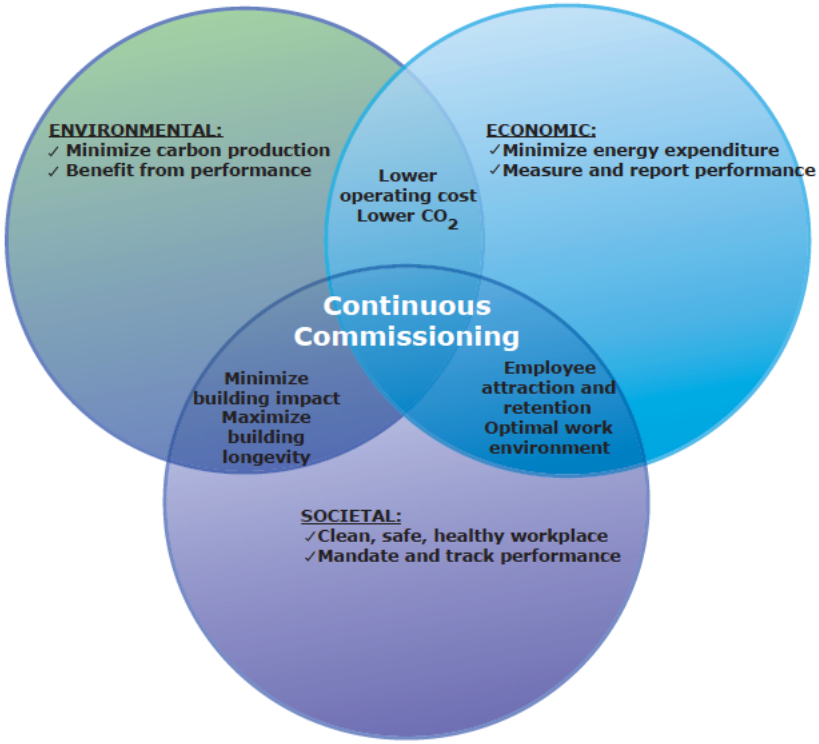

Figure 6:4 - The environmental, economic, and societal benefits of continuous commissioning (sustainable growth model) (Cook & Khare, 2009, p.151)

Olatunji (2011) refers to 'organisational models' as business models with no explicit definition of either term. Four categories, reportedly derived from construction literature are presented and these are: networked organisation/business model, where organisations are more compact, inter-operational, and adaptive; functional organisation model, refers to being highly specialised; matrix model, refers to collaborative initiatives that bring together the required skillsets for a project; and, divisional organisation structure, where there are specialised divisions for specific operations/routines (Olatunji, 2011). This categorisation appears similar to Porter's (1996) principles for strategic positioning. Pan & Goodier (2012) explain the business models that were outlined in the 2007 Calcutt Review of Housebuilding Delivery that was commissioned by the UK Secretary of State for Communities and Local Government.

Some of the models include sustainable business model characteristics. There is an 'investor model' that refers to maintaining long-term interest in development projects, such as through rentals or shared ownership schemes. This requires foregoing some upfront profit and overall project yields to maintain longer term revenue. There is a 'self-build model' that contributes to 10% of the UK market (2007) and there is a 'registered social landlord build-for-sale model' that incorporates social housing and market priced housing within one development, thus creating mixed communities. Funding for this model encourages higher focus on sustainability and quality (Pan & Goodier, 2012).

Zimina & Pasquire (2011) discuss seven principles/attributes of 'lean commercial management' that seem to align with sustainable business model thinking. These are: long-term orientation; systems thinking; ethics; flexibility and straightforwardness; rational decision making; front loading of the systems; and, active control and decentralisation. The concept similarly involves reconceptualizing cost and value through shifting to long-term orientation and adopting systems thinking. In one of the examples, Herero Contractors in San Francisco shifted from operating on a low-cost basis for bids to building a long-term relationship with subcontractors and suppliers. The view is that a lack of systems thinking can lead to local efficiencies but overall losses. It is further explained that "*a code of ethics based on the lean philosophy relies on commitment to colleagues, partners, clients as well as consideration of the wider audience – all those influenced by the company activity"* (Zimina & Pasquire, 2011, p.70). Ethical behavior is essentially required to build trust. Flexibility, being prepared to adapt to the changing environment, is seen as a necessity for survival due to the uncertain nature of the sector. Rational decision making includes techniques such as value stream mapping and front loading emerged after years of recognising there is more value if the client involves the team during planning and design when there is still time to have an impact on the outcome. Decentralisation and a more hands-on approach from managers is included because the *"bureaucratic central planning model of management has failed to demonstrate positive results in the complex systems operating in the uncertain environment*" (Zimina & Pasquire, 2011, p.71).

Some of these latter models, such as the organisational models, lean commercial management and investor model, primarily have a financial focus, albeit with implicit social benefits. However, overall, there is a common thread of enhancing the way organisations create, deliver and capture sustainable value – considering societal, environmental and economic value. In summary, key characteristics include: cooperation and collaboration; lifecycle thinking; flexibility and adaptability; defined and common vision and mission; longer-term thinking (relationship building, revenue streams); relevant training; regular building monitoring/building management systems; sustainability assessments/certifications; early-stage establishment of sustainability goals in development projects; and alternative approaches to investment/funding.

6.5 Characteristics of business models for sustainable building

The included results of the systematic review were qualitatively analysed using the lens of the green business model framework (Sommer, 2012), which was previously adapted to research environmental sustainability in construction organisations (Abuzeinab et al., 2018) (Figure 4:5). Table 6:2 summarises the business model elements that were extracted from the case studies. The elements generally align well with previous research, such as Abuzeinab et al. (2018) green business models and also with the wider literature discussed in the previous section and previous chapters. The main value creation and capture themes that emerged are discussed in the next sections.

Table 6:2 - Sustainable business model elements from the case studies

Value Creation	*Value Capture*
Key Activities Conduct market research (competitors, innovation, funding); develop or follow sustainability certifications and design standards; design (interior and exterior) sustainable buildings; estimate project costs; conduct lifecycle analysis; assess community impact; acquire land or property; manage insurance, risk assessments (shared ownership, loans), permits and other legal requirements; create or use specialized technology; construct buildings using standardized processes; use collaborative marketing; manage waste streams; use integrated management systems for facilities; conduct training for staff/partners, customers, and suppliers (finance, technical, quality, sustainability, circularity); analyze customer activity and feedback; showcase demonstration projects (new technology and competences)	**Green Value Propositions** ***Products/Services***: manufacturing, design, construction, management, sale/lease of low carbon/net-zero buildings or building components at affordable or low-income pricing ***Client/Stakeholder appeal***: reduce lifecycle costs (save energy, extend product life and quality); reduce environmental impact (reuse or repurposedmaterials, locally source materials); flexibility and adaptability (moveable buildings, mass customisation); increase sustainability expertise (certifications and standards); generate income from waste materials; customer, staff and supplier/partner capacity building; community security and development (neighborhood green spaces); social inclusion (community engagement beyond supply of buildings, collective action on reduced consumption); create jobs (self-develop/build), improve access to credit/finance; social/regenerative business (profit back into community); increase biodiversity; replicability and scalability
Financial Logic ***Vision***: building services that provide for customers while caring for the environment and local community; creating better homes for the many; customer-orientation; visionary leadership; employee empowerment; long-term perspective; relationships make the company non-displaceable in the marketplace; clearly defined shared goals; long-term collaborations to maintain stable production system; horizontal business network; willingness to experiment; regenerative, circular business model not driven by profit but driven by balance; safety and environment first; smartly built, high quality ***Costs***: materials (primary/secondary); manufacturing/production equipment and processes; labour; R&D ***Revenue***: sell, lease or manage products/services linked to sustainable performance / target segment affordability; receive public funding; reduce lifecycle costs (increase use of waste materials, improve efficiency and durability, reduce energy use, reduce transportation with modular construction, self-build/organize, control part/whole value chain); reduce or redirect waste (savings/income); increase asset value (adaptability and resilience); economies of scale (minimum sales requirement for profitability)	
Key Resources Patented processes; specialized building and construction technologies; IT tools (design software, sales platforms); environmental and waste management systems; expert project-centered teams (optimal use of individual expertise); influential leader (CEO or owner) on sustainable action; sustainability consultants mainly for visioning and communications; customers as temporary staff; customer feedback; inter-organizational/departmental expert knowledge; local authorities; governmental organizations; non-governmental organizations; research institutes/knowledge transfer centers; public-private partnerships (PPPs); consumer protection organizations; industry associations (for rapid diffusion); private landowners; waste suppliers; material and component suppliers; recycling plants; gravel mining; some have no partners/alliances	**Target Groups** ***Client/stakeholder segments***: public housing associations; building contractors; self-designers/builders; homeowners; sustainable construction consultants; open to reuse & eco-friendly design; low and medium density pre-designed housing market; low income/ineligible for assistance market; financial capacity for high upfront costs; urban, semi-urban and rural areas ***Client engagement***: intensive information sharing; interactive demonstration projects; design and functionality input throughout development process; freebies (vouchers, consultations) ***Engagement channels***: stores/offices; public information meetings; project information centers; community-based open houses; local leafletting; word-of-mouth; newspapers; local housing community; industry associations; trade fairs

6.6 Value capture themes

6.6.1 Housebuilding and the Societal Dimension

The value proposition of 13 cases surrounds housebuilding, ranging from self-construction to ready-to-move-in. All consider the societal dimension (Pomponi & Moncaster, 2017) in various ways by focusing on community security and development, community engagement beyond the supply of buildings, and collective action on reduced consumption. There is also the direct allocation of a percentage of profit to the community. Some cases align with the investor model, essentially shared ownership, where the developer of a site keeps a percentage of the development instead of immediately gaining all of the development profit. This creates longer-term commitment. Further value could be captured via shared sales or rentals towards a longer-term revenue stream. The self-build business model is also found in both forms in this review. Owners either develop their housing community from land acquisition to sales and construction (Broer & Titheridge, 2010) or self-construct their housing (Palomares-Aguirre et al., 2018). Four cases focus on low/unstable income populations and are heavily reliant on public finance; this highlights the ongoing risk that businesses are taking in regards to policy dependent business models. Two cases directly express the inability to survive without such financing.

Social and non-profit organizations dependent on government support, increasingly have to rethink their way of doing business, incorporating commercial (for-profit) business models to create hybrid business models. In social businesses, the investor typically does not use or directly benefit from the product or service, which is opposite to commercial businesses. This can therefore create stakeholder tensions in hybrid models when economic, environmental and social value do not align. Some hybrid models, if not formalized with clearly distinct profit and non-profit business models, can create complicated scenarios and legal challenges. For example, an individual may create a commercial sole-proprietorship due to legal constraints in the organizational structure; however, will utilize the organisations resources and offer complimentary/similar services. When describing social innovations, it is therefore also

important to consider the interrelationship with suborganisations (Komatsu et al., 2016; Skelcher & Smith, 2015).

Despite the clear link between housebuilding and social sustainability, the cases have not highlighted more formal social sustainability assessment tools and benchmarks. For housebuilders to help strengthen the community and quality of life, supporting evidence could be gathered to generate useful metrics. Dixon & Saffron (2013) designed and tested a social sustainability measurement framework for one of the largest UK housing developers, who began expanding the approach across their portfolio. The research demonstrated that housebuilders could understand more about residents' experiences and how communities form to help new developments flourish (Dixon & Woodcraft, 2013).

6.6.2 Circular Business Models

Circular economy principles, sometimes referred to as 'sharing economy', focus on improved usage and management of resources (Pomponi & Moncaster, 2017) that aligns with the recovery and reuse value potential of buildings. Business models surrounding the use of secondary materials could further decrease the carbon footprint of building (Nußholz et al., 2019). Bocken at al. (2018) identified two macro level categories for business models for circular economy: 'closing the loops' and 'slowing resource loops'. Slowing resource loops includes: 'extending the product value' – remanufacturing and refurbishment; 'classic life-long model' – design of long-life products; 'encourage sufficiency' – prolong product life at end user level through durability, upgradability, repair and warrantees; and 'access and performance model' – satisfy needs without physical ownership. Nine cases incorporated circular economy thinking. The majority (8) focused on 'slowing resource loops' through extending the product value, such as reusing wood, brick, steel, previous structures, and repurposing waste such as tree bark used for interior and exterior building cladding.

Sustainability certifications then strengthen the value proposition in two ways. Businesses add the key resources and key activities needed to achieve certifications such

as C2C and BREEAM. Businesses create design standards and certifications, considering the design of longer life products, building for durability and endurance, and optimising energy and material use. A dominant key resource consideration is having access to a sufficient quantity and quality of materials for secondary production. 'Buildings as Material Banks' (BAMB) was a European research project with the goal of creating circularity in the building sector through establishing the value of materials that are usually allocated as waste (BAMB, 2019). The concept could help by encouraging design and disassembly for reuse, thereby increasing supply of secondary material. Further, identifying uses for otherwise discarded materials creates a new business model for suppliers. One case incorporates multiple ways of slowing resource loops through creating a sustainable smart town. The town is based on a sharing economy with intense promotion on reduced consumption and collective action. There is also focus on durability and extended life due to the town being created under a 100-year vision (in comparison to typical 25-year town planning) (Sakurai & Kokuryo, 2018). Regarding access and performance models (Bocken et al., 2018), this appears in the construction industry through rentals and leasing. It is also present in providing energy for buildings through business models such as energy service companies (ESCOs) (Moschetti & Brattebø, 2016). Overall, research on applying circular economy thinking to buildings and construction is still in its early stages and the majority of focus is on waste management (Adams et al., 2017; Cheshire, 2016; Pomponi & Moncaster, 2017).

6.6.3 Mass customisation and digital technologies

Modular/prefabricated housing solutions including detached, semi-detached, condominiums, single-family, and multi-family can be found in 7 cases. The value propositions vary from a very minimal set of design variables to multiple layout and interior design options, depending on resources and capabilities. Advancements in digital technologies has facilitated mass customisation in housing (Friedman et al., 2013). Key resources include the expertise of architects and interior designers who work with computer-based design tools so that multiple layouts can be achieved with the same pre-fabricated products and spaces. This gives customers increased options while maintaining the prefabrication production chain. This key activity of prefabrication over

standard customisation has been highlighted as a critical business model enabler due to improved efficiency, cost reduction, and standardised processes. The value propositions of these business models are also built on affordability for the customer with some financial logics working backwards from the target group's earnings to set cost and price limits. Some cases get more involved with social equity by employing the surrounding community as temporary staff for sales and/or construction. Overall, this aligns with Theusen and Hvam (2013) view that modular construction provides a shift to value-centric models.

6.7 Value creation themes

6.7.1 Lifecycle and Long-term Thinking

Lifecycle analysis methods and tools are frequently referred to in key activities and key resources. This includes lifecycle assessments, integrated facility management systems, environmental and waste management systems, and optimizing the use of assets and human expertise. Along with the sustainable smart town, the financial logic of most cases considers long-term collaborations necessary for maintaining stability in the buildings and construction sector. Some cases include public-private partnerships (PPP) that have been used by governments for infrastructural projects to reduce risks and help with funding. One of the business models that inherently encourages a long-term perspective from the private sector is Design, Build, Finance, and Operate (DBFO). With infrastructural project arrangements typically spanning 30+ years, the private partner is incentivised to have efficient operation and maintenance (Al-Saleh & Mahroum, 2015). This trend is closely related to circular economy thinking in this review. For example, the financial logic in one of the circular cases is to focus on quality and durability to reduce operation and maintenance costs over the (extended) lifetime. These perspectives consider both operational and embodied impact (Kibert, 2016).

6.7.2 Shared Vision and Goals – Clearly Defined

The lack of a shared vision between building and construction project stakeholders and the lack of clear implementation goals has been reported to lead to project failure or stagnation. Even in cases when sustainability was regularly discussed, if it was addressed

without agreeing to and working towards achieving one vision, this resulted in some stakeholders reverting to traditional methods (Bossink, 2002). Clear goals and shared ambitions are required to realise projects. It is necessary to explicitly state and agree on desired shared outcomes from inception with all key stakeholders. This should be regularly reviewed, checking that the supporting network is working towards the agreed vision. It is of equal importance that the vision is defined well enough to be understood by all stakeholders because perceptions, values, and priorities vary. Visionary business owners/leaders with a willingness to experiment have been highlighted as inspiring motivators/influencers for sustainable action. Other businesses engaged sustainability consultants for visioning and communications when this key resource was missing. Some examples of visions and business motivations in this review are: building services that provide for customers while caring for the environment and local community; not driven by profit but driven by balance; creating better homes for the many; being the customer's friend; relationships make the company non-displaceable in the marketplace; safety and environment first. Radical visions also emerged such as Panasonic's new value proposition of a sustainable smart town, shifting their business model from mass production and the sale of physical goods to addressing social needs through ICT. Though this is enabled by their vast experience in consumer electronics and lifestyle options, it still requires a new description of the business logic. A horizontal business network of key partners and stakeholders was created for execution, first agreeing to and signing off on a shared vision and goals for the town.

6.7.3 Sustainability Training and the Behavioural Dimension

Training emerged as a key activity internally and externally for customers, partners and suppliers to develop a common language and shared understanding. Sustainability training and workshops varied from specialized topics such as waste management, circularity, and sustainability certifications to more general capacity building around environmental awareness and financial methods (improving access to credit/finance). Customer and community feedback are incorporated in product/service and operational development. Internal cross-training is also encouraged, linked to employee empowerment to develop new ways of doing business or even create their own

businesses. This training pattern along with establishing shared goals encompasses the behavioural dimension of decision-making, stakeholder influence, and leadership (Pomponi & Moncaster, 2017). Whilst not explicitly addressed as behaviour change, the majority of cases have multiple sustainability demands and/or expectations of key resources (such as sustainable supplier requirements) and target groups (such as eco-conscious customers). One notable distribution channel was intensive information sharing within communities to promote change. New business models emerged after changes in organisational culture based on leadership's commitment to transformation, employee empowerment, and a radical way of thinking. Inter and intra-organisational capacity building was highlighted within the Panasonic case through the horizontal business network. Most cases, however, do not incorporate approaches to and learnings from cross-sector engagement, which is needed (Renukappa et al., 2013). As we continue to develop more sustainable technology and markets, we should aim to understand the importance of social acceptance and behavioural considerations (Rohracher, 2003; Wolsink, 2012).

6.8 Value destruction

Value destruction was explicitly included in one of the cases as a critical business model component along with value: proposition, network, capture, creation and delivery (Roome and Louche, 2016). The value destruction perspective has not yet been widely researched in the business model literature. Bocken et al. (2013) created and tested a 'value mapping tool' that improves awareness of the positive and negative value of various business activities to all stakeholders. Geissdoerfer et al. (2016) similarly proposed a sustainable business model value mapping solution by integrating existing value mapping approaches with design thinking. Yang et al. (2017) proposed 'value uncaptured' as a new way to thoroughly evaluate value perspectives for sustainable business models. The theoretical framework considers four forms of uncaptured value - value surplus, value absence, value missed, and value destroyed- and uses six empirical studies on product-service system (PSS) firms for validation. Evans et al. (2017) 'sustainable value analysis tool' highlights this concept of uncaptured value throughout the entire product life cycle assessment (LCA). It uses a step-by-step approach across

the lifecycle to systematically identify value uncaptured and the translation to value opportunity. The tool is focused on ideation and not implementation. Simple examples of value uncaptured include waste products (including components of products) that could be repurposed and sub-optimal use of resources and expertise. All of the approaches using this perspective resulted in an increased understanding of the negative impact of unsustainable business activities in a structured way (from a new way of thinking about value), leading to the discovery of new sustainable opportunities and sustainable business models (Bocken et al., 2013; Yang et al., 2017; Yang et al., 2017). Of even greater concern is when value destruction is caused by the entire business model (value creation and capture), requiring radical change as seen in the Carillion case -one of UK's largest construction companies at the time (Roome & Louche, 2016). Value destruction is therefore quite important, especially for resource-intensive mass producers in buildings and construction. It is also relevant when investigating circularity due to the possibility of sustaining harmful chemicals and processes. Essentially, the foundation of sustainable business models requires an understanding how the business model destroys value for other stakeholders.

The value destruction approach is therefore strongly aligned with the FSSD, which aims to highlight systemic problems that if left unchecked will continue to worsen the global system. The FSSD also aims to provide a strategic and structured approach. As explored in the previous chapter, strategic sustainable development encompasses a systems thinking perspective and scientific approach, which may be used to enhance the development of value perspectives and sustainable business models (Franca et al., 2017; Small-Warner et al., 2018; Upward & Jones, 2016). More interestingly, in previous exploration of incorporating the FSSD with other sustainability concepts, methods and tools, the main highlight was that having a common set of sustainability principles provided helpful guidance when developing and using the tools (Broman & Robert, 2017; Robèrt et al., 2002). The FSSD sustainability principles, or similar, essentially establish the basis/elements for a value destruction perspective. The principles (originally described as four system conditions of a sustainable society) are the common

core rules from which everything else can be developed. They state that we should not: extract more than we can replenish, create more than we can destroy, degrade nature and natural processes, nor undermine a person's ability to meet their needs (The Natural Step, 2011a; Broman and Robert, 2017).

6.9 Conclusion to the systematic review and research implications

The aim of this review was to achieve stronger cohesion and understanding at intersection of business models and sustainability in the buildings and construction sector. This was achieved through a systematic review of business model case studies that focused on sustainable buildings. 26 cases were analyzed from 13 peer-reviewed journal articles. The majority of cases focused on general construction firms with some offering only housebuilding services. The remaining cases focused on secondary building materials, that is, materials made from waste products. Some cases also focused on government-led programmes that facilitate sustainable construction services.

A variety of theoretical sustainability and business model references were used to investigate sustainable buildings and no dominant concepts emerged. The overall findings align with most of Berardi (2013) and Kibert (2016) fundamental considerations for a sustainable building. There could be more explicit considerations for adaptability and resilience over time, relationships between a building and its surrounding environment and community (infrastructure interconnectivity), and cultural/traditional preservation. A systems and firm-level perspective is consistent throughout, even if not explicitly stated, considering organisational, environmental and societal needs. Shared sustainable visions and goals, driven by inspirational leaders, drive the behavioral change that is necessary. Zhao et al. (2016) moved further to specifically develop a conceptual business model framework for zero carbon buildings. Circular economy principles focus on improved usage and management of resources (Pomponi & Moncaster, 2017) that aligns with the recovery and reuse value potential of buildings. Circular business models for buildings made up almost half of the sample and were mainly focused on 'slowing resource loops' (Bocken et al., 2018) through extending product value, such as reusing and repurposing building materials. Some also focused

on architectural design and planning services for end of life, including considerations for durability and endurance and optimizing energy and material use.

The analysis through a sustainable business model lens enabled the emergence of useful themes. There was a high occurrence of social and non-profit housebuilding that captured the societal dimension as described by Pomponi & Moncaster (2017) by strongly focusing on communities and collaboration. However, some cases were dependent on public financing and sensitive to policy changes. Businesses should analyse the sensitivity of their business models to policy and regulatory changes and ensure to adapt over time such that the dependency does not become detrimental (Al-Saleh & Mahroum, 2015). Prefabrication over traditional individualised customisation was highlighted as an important business model enabler due to improved efficiency, cost reduction, and standardised processes. Key resources are needed such as the expertise of architects and interior designers working with computer-based design tools (digital technologies) so that multiple customer options can be achieved while maintaining the prefabrication production chain. The value propositions are mostly built on customer affordability, with some going further to employ the surrounding community as temporary staff for either sales or construction. Another dominant theme was that clear goals and shared ambitions are required to realise projects. It is necessary to explicitly state desired shared outcomes from inception and ensure that all stakeholders agree on shared goals. This must be defined well enough to be understood by all stakeholders as perceptions, values, and priorities vary. Similarly, sustainability training emerged as a key activity internally and externally for customers, partners and suppliers to develop a common language and shared understanding. This visioning and training encompass the behavioural dimension, considering decision-making, stakeholder influence, and leadership (Pomponi & Moncaster, 2017). Overall, there is clearly a requirement for shared value where both the business and its community flourish. Emphasis is also placed on behavioral changes for sustainability that are fundamental to achieving long-term results (Al-Saleh & Mahroum, 2015).

Value destruction emerged from the results and is not a business model component that has been commonly explicitly included in this research stream. So far, a value destruction perspective has resulted in increased understanding of negative impacts of unsustainable business activities in a structured way, leading to the discovery of new sustainable opportunities and sustainable business models (Bocken et al., 2013; Yang et al., 2017; Yang et al., 2017). Value destruction is therefore quite important, especially for resource-intensive mass producers in buildings and construction. It is also relevant when investigating circularity due to the possibility of sustaining harmful chemicals and processes. The approach is therefore strongly aligned with the FSSD, which aims to highlight systemic problems that if left unchecked will continue to worsen the global system. The FSSD also aims to provide a strategic and structured approach. More interestingly, the FSSD sustainability principles, or similar, essentially establish the basis/elements for a value destruction perspective. The principles (originally described as four system conditions of a sustainable society) are the common core rules from which everything else can be developed.

Overall, the academic literature on business models in sustainable buildings and construction is limited. Research is even more limited on buildings as final structures, possibly due to the focus on component redesign towards resource efficient building deconstruction and extending product value. This consolidation of existing empirical literature lays the groundwork for further exploration and experimentation. This doctoral research applies the framework to exploratory case studies (Chapters 7 & 8). In the future, to build on this systematic review work, the criteria could be expanded to include industry publications (grey literature), which is already included in some methods in both the sustainable building and business model literature. This could lead to more sector specific archetype development. For practitioners, this provides a useful overview of key value perspectives and business activities when working towards sustainability in the buildings and construction sector.

6.10 Conceptual framework: sustainable business models in buildings and construction

"A conceptual framework is an argument that the concepts chosen for investigation or interpretation, and any anticipated relationships among them, will be appropriate and useful, given the research problem under investigation" (Eisenhart, 1991, p.209). It is derived from the literature and can incorporate a wide array of current sources (Eisenhart, 1991). A conceptual framework was adapted for this research based on existing definitions, components and frameworks found in the sustainable business model literature review along with strategic sustainable development enhancements. This framework has been further adapted for the buildings and construction sector based on the results of the systematic review on business models for sustainable buildings. This sector specific conceptual framework (Figure 6:5) will be used to analyse business models in the buildings and construction sector (Chapters 7 & 8).

Describe, analyse, manage, communicate		
Sustainable value proposition **product and/or service lifecycle (beginning, middle, end of life) value to customers and all other stakeholders** a. customer segments, customer relationships, distribution channels b. value for customer, resilience/future proof c. value for society: community engagement beyond product/service supply, encouraging responsible consumption d. value for environment	**Suatinable value creation & delivery** **most important product and/or service creation and delivery activities considering the entire system/network** a. clearly defined shared vision and goals (internal and external) b. top down commitment, organizational structure and processes - employee empowerment, transparency c. optimized use of internal resources, expert knowledge and upskilling, multi-disciplinary teams, regular self-assessment d. trusted external partners and suppliers, sustainable value network management, training and information sharing e. energy and waste reduction activities - recovery and reuse, sustainability methods/standards and certifications f. specialized technology/products, radical innovations, adaptability	**Sustainable value capture** **economic value without degrading global natural, social, and economic capital** a. longer-term revenue streams, low operational costs b. distribution of economic costs and benefits among stakeholders c. compliance with FSSD principles d. value destroyed/not yet captured (non-compliance with FSSD principles), unsatisfied needs, future opportunities

Figure 6:5 - Conceptual sustainable business model framework for this research adapted from Bocken et al. (2014), Bocken and Short (2016), Schaltegger, Hansen and Ludeke-Freund (2016), Broman and Robért (2017), de Padua Pieroni et al. (2018) and systematic review of business models for sustainable buildings (author, 2019)

7 Case study: Swedish organisation

7.1 Chapter outline

This chapter presents empirical data from a buildings and construction sector organisation in Sweden that focuses on achieving higher levels of sustainability within their business and community. The chapter begins with an overview of the organisation and general activities followed by a detailed narrative of the sustainable business model based on publicly available data, company documents and semi-structured interviews. These findings are presented through the lens of the conceptual sustainable business model framework for buildings and construction organisations (Chapter 6). The findings are then discussed within the theoretical context of sustainable business models, specifically sustainable business model archetypes and patterns, towards theoretical integration. The chapter closes with key research and industry implications and recommendations.

7.2 Introduction to Wallenius Real Estate

"WE ARE PROUD to act according to our long-term values, as we carefully evaluate before deciding whether or not to get involved in an operation. At the same time, we impose great demands on the companies. They have to act – or be able to develop – in line with our sustainable principles regarding the environmental, social and economic spheres. If these requirements are not fulfilled within a reasonable period of time, the business will be phased out or sold off."

Jonas Kleberg, Chairman & CEO, Soya Group (Soya Group, 2017, p.8)

This case study is on the Soya Group of companies real estate business, Wallenius Real Estate (WRE), in Sweden (Table 7:1). WRE is one of Stockholm's largest private real estate owners. The Soya Group, founded in 1934 by Olof Wallenius, has common principles that reflect their core values and aspirations for long term environmental and social sustainability (Figure 7:1).

Table 7:1 - Wallenius Real Estate (WRE) Company Information

Location	*Stockholm, Sweden*
Location size (population)	*10.38 million (2020 Statistics Sweden)*
Company age	*1940s*
Company size	*27 employees (1,200 across Group)*
Building types	*Residential, Commercial/Office, Mixed*
Building quantities	*3,900 apartments/homes* *50,000m^2 commercial space*
Building pipeline (planned or in-progress projects)	*~1,350 homes* *>50,000m^2 commercial space*
Annual revenue	*SEK 20 billion (Group)*
Subsidiaries	*Hässelby Hem, Cisterna, Wallfast Property Development*

Figure 7:1 - The Soya Group's five core values (The Soya Group, 2017, p.6)

Each company within the group is guided by these principles to actively implement long term sustainability strategies. WRE owns, develops, constructs and manages real estate through its subsidiaries Hässelby Hem (agency), Wallfast (developer), and AB Cisterna (contractor/builder). Property acquisitions began in the 1940s and there are now 27 direct employees across three offices in Stockholm – Södermalm, Hässelby, and Lidingö. There are 3,900 rental apartments in Stockholm split between the suburb Hässelby (2,400) and the city centre (1,500) along with approximately 50,000m^2 of commercial space. There is a large portfolio of planned and in-progress projects: Värtahamnen port (200 homes, 10,000sqm office space); Ekerö Strand 2022 with Skanska New Home (400-500 condos, 25% rented); Persikan, Södermalm (117 apartments, 3 commercial plots);

Smedshagen, Hässelby expansion (450 apartments); Riddersvik garden city (108 homes); Royal Sea Port redevelopment (100 homes, 35,000m^2 commercial space) (private communication, 2019). The business has been acknowledged as one of the companies that do not only focus on environmental issues but also their social responsibility to tenants and surrounding communities (Soya Group, 2017).

7.3 WRE sustainable business model characteristics

WRE's sustainable business model (Figure 7:2) was generated based on publicly available data, company documents, a management team meeting, and 4 interviews. This section describes the sustainable business model characteristics and incorporates direct quotes from the interviews. References are only included for quotes that are not directly from the interviewees. This is to assist with readability.

Describe, analyse, manage, communicate		
Sustainable value proposition **healthy and sustainable residential apartments and commercial space/buildings; investment capital** **property development, building construction, property leasing and management** a. customer segments: residential and commercial tenants; tenant owned associations; property buyers customer relationships: local offices; mail; mobile app; community meetings distribution channels: local offices; websites b. value for customer: healthy, safe and sustainable properties - low operational costs, energy efficient, high indoor quality and tenant well-being, Nordic Swan Eco-label; affordable housing c. value for society: increased sustainable lifestyles due to housing/office design and management; sustainability communications (magazines, etc.); socially responsible projects d. value for environment: ISO14001; energy self-sufficient at all properties; construction waste reduction; general waste reduction (increased recycling/sorting waste); designing for community bike sharing, electric carpooling, attracting bees and butterflies (biodiversity)	**Sustainable value creation & delivery** **property management, resource (energy and water) management, investing, project planning & development, construction, training, property sales** a. vision and goals: holistic perspective, pioneers, upstream solutions, optimize resource use, reduce environmental impact, principle of continual improvement b. organizational strucutre: family owned and operated; CEO/Owners champion sustainability; minimal hierarchy; environmental policy; emphasis on social responsibility, activity monitoring and auditing c. internal resources: project managers/engineers; project developers; construction managers; marketing team d. external partners and suppliers: property maintenance; turnkey contractors; consultants; energy providers; expertise from other companies in Soya Group e. energy and waste reduction activities: district heating; renewable energy generation; tenant waste reduction; upskilling; ISO14001; Nordic Swan Ecolabel, wooden prefab housing (BoKlok); sustainability tips for tenant;, wireless temperature indoor sensors; exhaust air heat pump installations f. innovation and adpatbility: lifecycle carbon assessments; smart locks; EV charging	**Sustainable value capture** **shared value linking business success with social and environmental progress - long term sustainable growth** a. longer-term revenue streams: long-term ownership and management of property - rental income; residential and commercial sales; property development; energy generation low operational costs: energy and water; construction; maintenance; HR; consultants; offices b. distribution of economic costs and benefits: private ownership removes pressure of quarterly financial reporting and reduces risk of postponing environmental and sustainability projects c. compliance with sustainability principles: ecological - reduced electricity consumption (9% decrease over 10 years), self-generation (wind, solarm biogas), demolition waste reuse/recycling, reduced contribution to municipal waste; social - increased sustainability awareness and action from customers and community, charities (disaster relief aid, medical research, education funds), social housing d. value not yet captured - future opportunities: plus energy developments; increased construction material reuse and higher value recycling; social sustainability for housing

Figure 7:2 - WRE conceptual sustainable business model

7.3.1 Sustainable Value Proposition

7.3.1.1 Products and services

WRE is a long-term proprietor that has expanded into property development. WRE owns, develops, constructs, and manages residential and commercial properties. Since 2002, WRE has been ISO14001 certified (ISO14001 falls within a family of environmental management standards from the International Organization for Standardization). Most products and services carry the Nordic Swan Ecolabel, which WRE considers to be a baseline for working sustainably. The Nordic Swan Ecolabel was founded in 1989 and is the official ecolabel of the Nordic countries that covers a variety of products and processes. Nordic Swan Ecolabelled buildings are assessed from a lifecycle perspective and requirements consider energy and indoor environment, materials, quality management and control of the construction process, and instructions to residents/property managers (Nordic Swan, 2019). Property development work also incorporates the Miljöbyggnad building rating system that was developed by the Sweden Green Building Council. There are plans to add the BREEAM rating system to the value offering since this is a well-known scheme, especially for commercial customers.

7.3.1.2 Customer segments, relationships and distribution channels

Commercial customers typically request information on energy and materials so that this can be included in their own company reporting such as, "*we have moved to a better space, which is sustainable*". For residential customers, there seems to be more focus on the quality of service such as pleasant interactions and experiences with staff. Environmentally, it may be expected that certain things are provided such as waste sorting facilities and there are sometimes enquiries about energy efficiency but environmental considerations are not typically demanded – *"perhaps residential customers don't feel as though they can demand those things"*. Most of the properties are located on the outskirts of the city with diverse population demographics. To give customers easier and quicker access to property managers and payment systems, offices are also located nearer to developments. WRE has found this to be an important offering because some people find it difficult to communicate in Swedish and are more

comfortable with a nearby location to physically interact with personnel in comparison to phone calls and emails. Apartments located in the city centre are likewise managed from the main office. There is also a mobile application for tenants that provides updates and general information.

WRE's internet presence includes three websites (one for each subsidiary) and webpages dedicated to each development. Larger developments sometimes have their own website to disseminate information. The internet presence goes beyond an outline of product details and drawings to encourage sustainable living and explain the reason for using sustainable certifications and rating systems. This is mainly done through infographics and animated videos. Large projects also include public engagements to discuss development plans and get feedback from the community and surrounding communities.

7.3.1.3 Value for customers, society and the environment

WRE offers healthy and safe properties that have low operational costs and high indoor quality and tenant well-being. Highlights of environmental and social value propositions include:

- energy self-sufficiency at all properties though the production of energy from renewable sources including residential solar since 2015 (200 panels), wind turbines since 2011 (initially 2 turbines increased to 4 in 2018 allowing one site to be self-sufficient), and one biogas plant
- general waste reduction through facilitating the increase of sorting and recycling waste at properties
- design for community bike sharing, electric carpooling, attracting bees and butterflies
- reduction and recycling of building and demolition waste
- increase of indoor quality and tenant well-being
- incorporation of tenant feedback in property management processes

- dissemination of sustainability information to tenants through quarterly magazines
- financial support for disaster relief, medical science and treatments, children and youth sports and education
- collaboration with Royal Opera and local school, including a 'study-buddy' program.

Overall, "*we want to make sure that people understand that renting creates a much needed flexibility in society for people to rent a flat, live there for a couple of years, and if they were offered a job in a different city, they can move. It creates a flexibility in life that is very helpful*". The value for customers, society and/or the environment can be found within each sub-section and more specific details are included in the 'Value Capture' section.

7.3.2 Sustainable Value Creation & Delivery

7.3.2.1 Key activities

Property management is one of the key activities and energy companies (heat and electricity) and maintenance teams (cleaning, maintenance, waste collection) are considered to be critical partners. For maintenance, potential contractors are interviewed to ensure alignment with WRE's property, tenant and environmental management expectations. Once selected, there are monthly meetings with the contractor for care taking updates and any new social and environmental topics to be focused on. Property management also requires searching for and considering new technologies and approaches that could be valuable for both the business and the customers. An example initiative is a subsidized cost for smart locks. The selected product can easily replace existing locks and tenants can move with them. This could facilitate maintenance and deliveries for tenants who find it difficult to remain at home to wait for these transactions. There is also a subsidized EV initiative to encourage EV uptake. Rented car spaces can be upgraded to have a car charger at no additional cost to the tenant for installation. To establish these types of initiatives, WRE first investigates various companies and tests the products and services.

There is very high demand for apartments in central Stockholm and this reduces the need for major marketing activities. New developments have their own website to disseminate information but these are typically created and managed by larger project partners – who use their marketing teams and well established distribution channels. This capability has not yet been fully developed internally since the sales offering (build and sell) is still quite new. WRE previously purchased already built apartments or delivered turnkey construction projects for other owners. Internal effort is therefore heavily focused on existing tenant satisfaction. Incorporating tenant feedback and disseminating environmental information is considered an important part of the property management process. Two-way communication is typically via email, where possible (minimal amount of regular mail or phone calls). There is a customized mobile application for tenants to receive upcoming project and activity details and general information such as tips on recycling and avoiding water damage. Additional features are being considered and will be added over time such as the ability to book laundry facilities. Posters are also placed in buildings to provide updates and general information. There is an annual questionnaire that is circulated via email to all tenants. In the last five years, the highest average scores were from the sustainability section that includes questions about how WRE is perceived to be managing this. The questionnaires are sent to 3,000 to 4,000 households and the response rate is around 15-20%, which is considered by WRE to be a high response.

From a more general perspective, there are multiple magazines published every year, in accordance with Nordic Swan Ecolabelling, as a way to communicate with not only tenants but the wider society. Magazines are typically structured around the Soya Group's three core businesses and include operational and future thinking insight through interviews with owners, staff and key partners. Public engagement and the company's public profile has also been raised through high profile design competitions. Beyond external engagement, these types of future thinking activities create internal knowledge development and capacity building that translates to other work and

projects – "*there's lots to learn from stretching your mind*". With several major projects planned over the next decade, the priority is investment in improving competencies and capabilities to meet and exceed sustainability goals.

7.3.2.2 Vision, goals and organizational structure

WRE is family-owned and operated with a very 'hands on' Chairman. It is a private business and the owners create and drive sustainability goals (top-down), encouraging and inspiring employees to execute their vision of long-term ownership and management of property that they can be proud of. This contributes to increased awareness among employees and stakeholders and one of their guiding principles is prioritizing upstream solutions, that is, utilising measures that focus on causes rather than symptoms. Summarizing the environmental policy, WRE is committed to a safer life in properties through structured work in the areas of energy, material management, hazardous substances, indoor quality, and local environment. The owners are so ambitious that this sometimes creates a challenging environment for employees to meet sustainability expectations. Employees receive environmental training and certifications and the environment is a business goal in employee dialogues with management. There are structured supplier sustainability evaluations and internal board reports must include social responsibility updates. Employees/experts have joined the company or collaborated based on the sustainable core values and principles.

One of WRE's first property investments was an apartment building purchased from a municipality and this added content to existing community and political discussions on private owners taking control of municipal housing in Stockholm (privatization of rented dwellings). One of the major concerns was that building transformations lead to evictions. These mismanagement concerns created a starting point of distrust. Overcoming this required firmly establishing the reputation of being a responsible real estate owner beyond environmental considerations through activities such as investing and actively participating in various community projects and expanding nearby ownership to show longer-term commitment to the area. It is not a quick process and

requires continuous effort - "*we have to work on this all the time, it can take like probably 10 more years before we have really established ourselves in that area*". There is also regular evaluation of how to create the right mix of rental apartments and housing for sale to maintain diverse demographics (avoid segregation of higher or lower income populations).

"Sustainability has been a natural part of the business for some time. Our coworkers are very engaged in environmental issues. The plan for the future is to be even more sustainable. We also intend to integrate our construction work and cooperation with external suppliers even further into our environmental strategy. Being committed to the environment is like maintaining a basic level of hygiene if you are a medium-sized or large company in Sweden these days. Stakeholders react negatively if you don't have a sustainability strategy – something that has changed considerably compared with 15-20 years ago when it was considered a secondary concern. This change is a sign of significant progress and it looks set to continue, which we see as a very positive development."

Alf Wahlström, Head of Real Estate, WRE (Soya Group, 2017, p.22)

7.3.2.3 Internal resources and processes

In addition to property management, property development is also a key activity. Project activities are very diverse and typically start with identifying plots on the open market or through municipality real estate tenders. There is a preference for "*a dirty plot because we are doing a positive thing to clean it but we don't have an actual list of parameters*". This is followed by the zoning phase, which could be a considerably long period (years) involving many iterations mainly due to addressing various comments from government and other stakeholders – "*not everyone gives feedback but it seems like that*". To ease the process, meetings are sometimes held with people living nearby and discussions are initiated early on with the relevant authorities but the process is still quite challenging. Neighbours can very easily change their mind after these meetings and some of the authorities are reluctant to engage in discussion before there is a formal application. There is a lack of resources within the relevant municipality departments to handle advanced queries plus process current applications (specifically regarding Stockholm) which limits the level of prior engagement. It would be very helpful at an

earlier stage to have discussions with others involved in later aspects such as building permits but this is not allowed.

Another approach that has been recently tested in this early phase is circulating an online survey with around 10 questions to gather information from residents on likes and dislikes and suggestions for general improvements. This was seen as important because while technical and environmental details are well-defined along with general social considerations, there is much less structure surrounding the question of what the tenants actually want – "*it's easier to work with the technical stuff… and typically, people in my role probably think that we don't need to ask because it's really complicated".* However, *"I think it's really good to ask the people who live there what they want, and how they would like to design things and what they dislike, and so on. I think it's really good to make it by the web because then you get lots of answers*". There was good quality feedback that was incorporated into final plans and layouts and a report on the project plans was also sent back to respondents – "*lots of people made really interesting novels about how they would like us to change the gardens and so on and I built on that material when I planned the layouts for the new gardens so I think it will be really good…*". The process was much easier and quicker (much less administration) than formal in-person meetings and generated higher quality feedback. During the meetings, typically only a few people will make comments and maybe some people with useful feedback cannot attend. Moving forward this approach will be adopted as well but not because it's perfect – "*some people they want to make barbecues every day and then others they say absolutely no barbecues in the courtyard*". It will always be difficult to accommodate everyone.

After approvals are granted, the construction phase begins. These project activities include various sustainable building practices. There are commercial and residential developments in areas with ambitious sustainability goals set by the municipality. Council guidelines have been exceeded for demolition and construction waste sorting percentages. There is consideration for design preservation linked to the location's

history such as during the renovation of an old nursing home into a modern senior residence. There have also been projects focused on adapting the environment (physically, visually, and audibly) for occupants such as care homes for elderly people with dementia and memory problems. A fitness facility built near to a school incorporated plans to facilitate the school's sporting classes. There's a continuous process of trying to make the right decisions regarding energy, materials, adaptability, etc. and there is a learning curve. For example, timber is much better than concrete but in Sweden, for bigger houses and buildings, there is not significant experience. There is a longer tradition of wooden construction for smaller houses but for larger developments, there are concerns surrounding the risks of constructing and managing wooden buildings - "*we have seen a timber house that has taken shrinkage into the design considerations so the walls themselves move freely from both floors and ceilings but what will happen with that during the management phase, we don't know, we are still learning*".

Certifications are important but they need to be maintained such as ISO 14001 audits. Nordic Swan Ecolabel is valid for 3 years and then re-application is required. Key activities therefore also include this type administrative effort – monitoring and reporting, especially for municipal projects.

7.3.2.4 Partners and suppliers

There is frequent engagement on building development projects with multiple organizations, from 2 or 3 partners to over 20. There are partner/supplier requirements regarding technique, safety and sustainability and the response has changed in recent years with criteria now easily being met. Many partners now respond to sustainability requirements with "*ofcourse, that's what we normally do*". There are no major challenges in that regard anymore "*because we always know that each and every one of us probably should do even more… it's quite easy to agree on the baseline*". WRE prefers long-term partnerships and key development partners are turnkey contractors and expert consultants. Partnerships include organizations such as Skanska, a global project

development and construction group (Skanska, 2019), for value creation and delivery. Partnership with Skanska includes the transformation of a contaminated industrial area, Gåshaga, into a waterfront residential neighbourhood and marina completed in 2006 (Appendix 11.4). Another collaboration is the use of BoKlok -modular prefabricated wooden housing, developed by Skanska and Ikea- for residential rental apartments. More recently, Skanska and WRE are partnering again to sustainably transform an old farmland and industrial area, Ekerö Strand, into around 500 apartments on the shore of Lake Mälaren. As noted by Annika Stridh, Market Area Manager at Skanska, "*Skanska and Wallfast bring different approaches to the table. Wallfast is more of a long-term property manager, while at Skanska, we have lots of entrepreneurial knowledge*" (Soya Group, 2020, p.19). Ekerö Strand is seen as a great collaborative opportunity since Skanska has vast in-house resources across the whole chain of expertise, from marketing and sales to actual construction.

Other developments include a recent municipal grant of 4.5 million SEK from a regeneration scheme for neighbourhoods with low income and high unemployment. The aim is to improve common and public spaces so its nicer for people to live but also create a greater sense of security within developments. The scheme is managed by the government and specifically targets building owners because a stipulation is that at least half of the investment must be matched. In total, it's around a 10 million SEK project for WRE with many consultants advising on construction processes and materials, access roads and pathways, lighting, indoor climate, green spaces, and more. It's important to work with consultants on these types of projects to ensure that sustainability requirements are met or exceeded – "*many consultants in our industry are well ahead of us in thinking about what's possible so they're helping us to move forward*". Another upcoming project, where WRE's new office will be built, is within a larger municipality sustainability programme aiming for Miljöbyggnad gold and this impacts all stakeholders. There is shared understanding and alignment on the outcomes (what should be done); therefore, discussions and activities are focused on how it should be done (how to deliver the projects) in the best possible way and most cost-effective way.

These types of grants and programmes highlight the role and impact of government and regulation on WRE's operations – "*municipalities have lots of freedom to interpret the legislation and set even tougher requirements*". In fact, despite current efforts, there is still feedback from some municipality environmental offices that enough is not being done – "*if you talk to them, none of what we're doing is sustainable".* In addition to external partners, WRE also utilizes expertise and resources from other organisations within the overall Soya Group.

7.3.2.5 Innovation and adaptability

The construction sector is moving towards increased digitisation, including more structured and increased data gathering and reporting. For WRE, this is seen as "*just an extension of a tendency that we've had for maybe 30 years in the industrial parts of the world… there's always like an influx of more bureaucracy and more administration forms that are supposed to be filled in and sent away somewhere… so digitisation is just an extension of that… the need to control and regulate, it's been there for decades, the methods to do it are just even more refined but it can come to a point where the expectations get so high, perhaps we have to get statistics and report them to an agency because it's the law, but to get the statistics, you need to invest in systems and pay for that".*

Essentially, there will be expertise required and costs associated with more sophisticated data collection and reporting. A good example of this may be the introduction of regulations on climate declarations proposed by the Swedish government that will require lifecycle carbon assessments for new buildings from 2022. Given that WRE previously focused primarily on the management phase, this widens the scope – "*we're starting a project this summer and I think we should try to figure out what the demands are in that law, and how it should be done… so we're therefore trying to learn before the law is there*". Furthermore, *"many of the major construction companies or real estate owners, they have built at least one or two buildings according to LEED or BREEAM or especially Miljöbyggnad so building companies and real estate owners,*

they're much more mature now than just five years ago to tackle the issues like this… these certifications are in many ways, a very positive thing I think, because if you look at the work, you see a tendency to work more uniformly and want the same thing in regards to the characteristics of a building and where you should invest your money to increase the benefit for the environment and whatnot". However, *"the downside is that when more and more are relying on these set type of goals, more and more people are or companies are perhaps less experimental and they are less prone to take risks and try things…it's like a double-edged sword… nobody is really challenging how things are done, nobody is really experimenting anymore… there are ofcourse some exceptions to that rule but I think that's something we need to be observant of".* As WRE transitions more and more into new developments and construction, regulations like this will require new activities, some of which are already being explored.

7.3.3 Sustainable Value Capture

Sustainable value capture for WRE is about balancing profitability and responsibility - shared value linking business success with social progress. There are various ways that economic value is captured from environmental and social activities. Between 2009 and 2010, WRE set environmental targets for 2020. Targets are linked to all properties and the baseline is updated to account for new and retired or sold assets.

- 20% reduction in district heating usage compared to 2009 (in progress, 14.5% in 2018)
- 5% reduction in purchased electricity for operations compared to 2009 (exceeded, 9% in 2018)
- 30% reduction in unsorted waste compared to 2010
- continuously increase competence (increase in expertise, intangible)

Along with these targets, electricity is only purchased from renewable energy sources, around 50 electric vehicle (EV) chargers are in the parking garage at the head office, and building and construction waste is being reduced through demolition waste reuse. For example, transformation of a contaminated industrial area into a waterfront residential neighbourhood focused on reuse and higher value recycling even though it was a

contaminated site (Appendix 11.4). For the overall Soya Group (except shipping), sustainable energy production exceeds energy consumption and the carbon footprint is positive (based on electricity, heating and air travel).

Raising awareness and educating customers (and the general public) on sustainable solutions and benefits potentially increases market demand, leading to increased rentals and sales but this has been difficult to quantify (especially in a market where there is already high demand). What has been noticed is the increase in waste sorting over the years. Initially, WRE made multiple waste sorting facilities available for tenants to encourage waste sorting and sustainability. At the time there was no demand from tenants for this. Now, once a new waste stream is identified for sorting, tenants are requesting it. This could be due to a general societal shift towards more sustainable lifestyles. Receiving sustainability awards/acknowledgements and the incorporation of customer and community feedback to improve products and processes also aids with solidifying a sustainable reputation and indirectly contributing to increased revenue.

WRE also engages in social responsibility projects and makes charitable contributions, assisting with persons' abilities to meet their needs. WRE has been supporting such community, health and wellbeing projects for decades and working towards net zero and plus energy buildings. During the COVID-19 pandemic, various efforts were made to facilitate office space that could be used safely for those finding it difficult to work from home – not only for staff but also for tenants, at no cost.

7.3.3.1 Long-term revenue and low operational costs

Revenue is mainly generated from investments, rentals, developments and sales. Though the main focus is residential apartments, commercial property (only around 5-10% of the real estate stock) is very important because the small amount represents around 20-25% of turnover.

In Swedish housing, around half of the stock is owned (52%), 18% are co-operative dwellings and 30% are rented (half public and half private). There is a rental regulation system that is the same for private landlords and public/municipal owners. Pricing is mainly based on construction year and major renovations – older stock is cheaper while rent in new constructions can be double the amount of older stock. Construction prices for new builds makes it difficult for new constructions to be affordable by lower income groups. Construction prices in Sweden are amongst the highest in the EU, 44% higher than the European average, based on 2019 statistics from Eurostat. Only Norway, Switzerland and Finland had higher construction prices. Rents are negotiated annually between the landlord and tenant association (Public Housing Sweden, 2020). Over the last 3 decades, increases in population and incomes led to increasing housing demand but there has not been enough housing construction to meet this. There are longer wait times for rental housing and the situation is especially difficult for lower income groups. Municipal housing is available to all residents but allocations are based on wait time and not affordability. Therefore, even though affordable housing exists, it's not readily accessible with wait times of 5-10 years for cheaper stock. This also means that there isn't an explicit low-income housing sector in Sweden. The general view is to provide good housing for all, regardless of income. The local government, however, does take additional housing responsibility (Social Services Act) for households unable to arrange their own housing (such as people with physical and mental challenges) and this includes special arrangements with private landlords to accommodate these groups (Lind, 2017; Public Housing Sweden, 2020). For the last decade or so, WRE has allocated 1% of apartment stock to tenants unable to provide their own housing because "*it's not so easy for people without income to get an apartment because there's so much demand from our kind of companies that people must have their own income and it must be quite high so that rent is assured every month*". Revenue from this group is typically managed through special contracts with the local municipality but is still considered risky due to social problems with some tenants.

Sweden's housing shortage is combined with the need to urgently improve the energy efficiency of the municipal housing stock. Heating is typically included in rental pricing and controlled centrally (building envelopes may be well insulated but there is no insulation between apartments). Property owners are therefore responsible for energy efficiency measures (Public Housing Sweden, 2020). WRE has found that the average annual increase in residential rents is lower than the increase in costs; therefore, rental apartments have a very low profit margin at the moment. Over the past 4 years, increases have been 0.8%, 0.9%, 1.5%, and 1.8%. Without larger increases, it is economically challenging to invest in energy efficiency improvements and other sustainable investments. A garden could be added to the roof, the insulation of the building could be improved significantly or significant investment could be made in heating but this is not fairly reflected within the rental increases. In some cases, projects are approved by the Board that would unlikely be approved in perhaps a public company - "*what it really comes down to is, our owners, they want to be able to visit every building and feel degree of pride in owning it and they're very specific about that*". Revenue is also generated from sustainability grants and subsidies, as previously highlighted with the municipality regeneration scheme. There are some subsidies from investing in solar power plants and electric vehicle (EV) charging stations (green technologies).

Costs to the business are typical such as human resources, working space, and materials. Environmental performance of contractors must be considered when engaging services, to the extent that the lowest price would be rejected if the service provider fails to show how they manage environmental concerns (procurement rules/supplier guidelines). For construction, higher costs are incurred for certain materials such as less carbon intensive concrete ('green concrete') but there are also aspects that have become mainstream enough that premiums are no longer charged. The main costs for properties are linked to energy – heating and electricity. There has been uncertainty with some energy costs due to regularly changing service provider requirements but steps have been and continue to be taken to provide more stability such as investment in sustainable energy sources to reduce reliance on fluctuating and unpredictable charges. Contractor costs

also fluctuate with demand. Recently there have been 'bidding wars' which meant that prices were much more competitive but this is not always the scenario. There are times when pricing is too expensive to move forward with potential developments - "*we very much want to do all sustainable things... so if it was just up to that we would make all of our houses in the timber and we would disregard all bad materials and then we would do ground heating in every project, but that would be too costly… so we have to make choices*".

7.3.3.2 Future opportunities (value not yet captured)

WRE only became more publicly known in last six or so years due to entering high profile sustainability design competitions and projects. One example is the second-place award received in a Stockholm design competition for plus energy homes. However, WRE has found it challenging to make these designs economically feasible. This is an area that will continue to be developed. Whilst there has been success with high reuse and recycling rates from some projects, it is generally not considered cost efficient to dismantle an old house to reuse the materials. Avenues to increase the reuse and higher value recycling of construction and demolition materials will also continue to be explored. Another area for continued consideration includes social sustainability within housing, "*unfortunately, good ideas about softer values such as social issues, sharing solutions and housing commitments are often prioritized away during project development as they are perceived as uncertain and unnecessary and only hard values remain, such as technical solutions around energy saving opportunities"*. From an overall perspective, "*we're getting more and more aware of sustainability issues and people are more prepared now, compared to 15 or 20 years ago, to actually invest money in sustainability, it's more of a natural part of business… there's a tendency for the state to regulate even harder because the goals we're supposed to reach as a society, they're very, very tough... we are supposed to be more or less fossil fuel free in about 10 years time in Stockholm… they have to put more pressure on people to actually deliver*".

In a 2019 issue of the Soya Group magazine, the Chairman and CEO was asked if economic growth is compatible with sustainability as a goal for business. He said, "*our priority is long-term sustainable growth. We have the benefit of not being pressured by quarterly reports, so there is less risk of having to postpone environmental and sustainability projects. Short-termism is never good, as it can make you choose downstream solutions and unsustainable investments*." Regarding Sweden's zero target for GHG emissions by 2045, he thinks that the goal will be reached sooner – "*we have unique conditions in Sweden and we have a strong tradition of pioneering and innovating!*" (Soya Group, 2019, p.4).

7.4 Discussion

7.4.1 Sustainable business model archetypes

Eight sustainable business model archetypes were developed by Bocken et al. (2014) and subsequently evolved to nine (Bocken, Weissbrod and Tennant, 2016; Lüdeke-Freund, F. et al., 2016). The nine sustainable business model archetypes are shown in Figure 7:3. WRE's business activities appear to be primarily aligned with the social business model archetype to deliver functionality rather than ownership (Figure 7:4), the environmental business model archetype to maximise material and energy efficiency (Figure 7:5), and the economical business model archetype to develop sustainable scale up solutions (Figure 7:6). The archetypes are grouped based on the dominant component. Previous research in Sweden (agri-food sector) that surveyed 204 companies found that only half of the companies completely aligned with an archetype. This raised the question of archetype suitability for that sector (Ulvenblad et al., 2019). Findings from this case study show that one of WRE's products, real estate rentals, appears to directly align with one of the archetypes – delivering functionality over ownership. Bocken et. al (2014) highlighted that it is important for this archetype to be combined with efficiency improvements to have positive environmental impact. It is therefore well suited that characteristics from environmental archetypes have also been identified across WRE's sustainable business model. Overall, though there is not

complete alignment across all products and services, characteristics have been identified from all of archetypes.

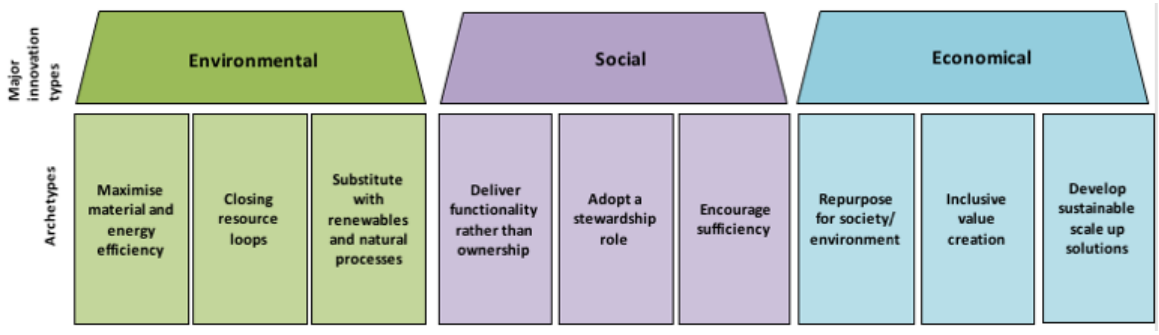

Figure 7:3 - Ritala et al. (2018) examples of SBM archetypes adapted from Bocken et al. 2014, 2016 and Ludeke-Freund et al., 2016 (Bocken, 2017) nine sustainable business model archetypes.

'Delivering functionality rather than ownership' focuses on user experiences and satisfying user needs through products or services that the user does not own such as rentals and leases. This typically encourages more sustainable behaviour from both the business and customer and should lead to a reduced need for physical goods. In Sweden, there are just over 5 million dwellings, half of which are multi-dwelling buildings. Whereas most of the single and two-dwelling buildings are privately owned, 58% of multi-dwelling buildings are rented dwellings owned by semi-public (housing cooperatives), municipal, and private housing companies (Statistics Sweden, 2020). There is therefore a large rental housing market. WRE's community engagement at project inception, structured incorporation of tenant feedback, and systematic power and water monitoring shows commitment to understanding user experiences and satisfying user needs. WRE also highlighted that more emphasis could be placed on rentals as a flexible option of choice in comparison to economic circumstances. Since this archetype also has the potential for negative impacts such as increased resource usage instead of a reduction (especially if the actual product or service is not sustainable), it fits well with WRE's long-term thinking, their focus on reducing unsustainable resource usage, and sustainable supply chain management, as outlined in the next archetype.

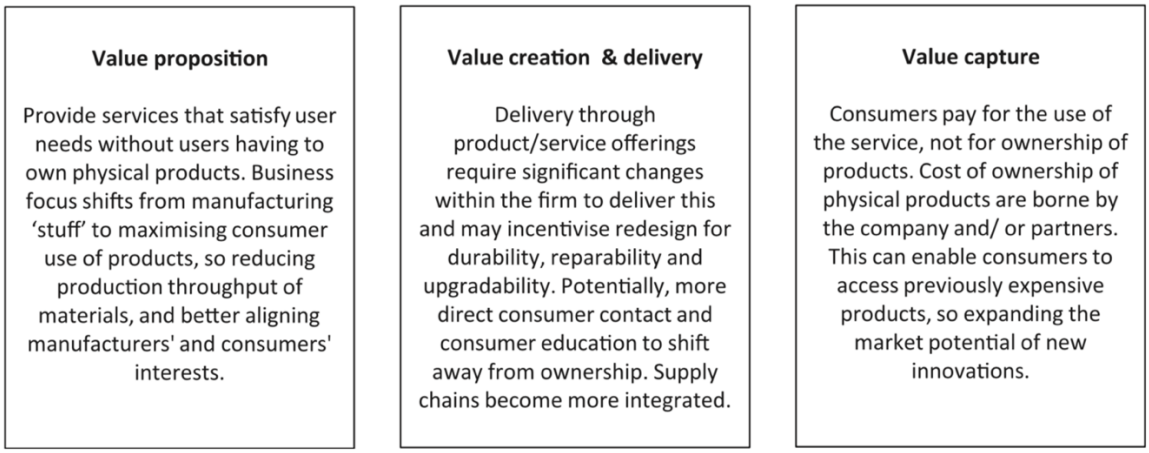

Figure 7:4 - 'Deliver functionality, rather than ownership' archetype description (Bocken et al., 2014, p.51)

'Maximise material and energy efficiency' requires using fewer resources and generating less waste for the same outcome. This is highlighted in WRE's core values (environmental and social responsibility), prefabrication/modular construction approach, the use of various sustainable building certification schemes, and internal energy targets. There is sustainable supply chain management, reduced energy consumption, and reduced waste from both construction and operations. Along with improved efficiency, benefits to WRE are lifecycle energy cost reductions and a sustainable reputation. Contrary to the assumption of competitive price advantage (value capture as shown in Figure 7:5), WRE finds it challenging to increase rental income in direct correlation with increased sustainable investments. Rental regulations in Sweden make it difficult to recover the investment on sustainable projects. This dilemma was acknowledged by Al-Saleh & Mahroum (2015) when analysing policy-reliant or policy-induced business models. Owners of rented buildings in countries with rental regulations need to rely on policy to pass on all or some of the sustainable investment cost. There can be flat rental increases or split incentives where savings are shared between tenant and landlord and this is monitored to ensure that the investment is still recovered (even if supplemented by increased rent). However, relying on policy changes can take a long time (Al-Saleh & Mahroum, 2015). Lambrechts et al. (2021) investigation into social housing in the Netherlands similarly found that subsidies were critical for the business case of housing corporations. For WRE, there has been ongoing

dialogue in Stockholm (and Sweden in general) with tenants and housing associations for many years but there has been no solution. Al-Saleh & Mahroum (2015) pointed out that some customers are willing to pay more for products and services that align with their values such as Halal businesses that cater to Muslims; however, for sustainable buildings, this has not been the typical experience for WRE. Increases in property valuation based on sustainability are also not standardised. This split incentive dilemma has been found to cause building owners to think that benefits primarily go to tenants and has been highlighted as a challenge with commercial property retrofit (Pardo-Bosch et al., 2019). So far, WRE owners have accepted lower financial margins and sometimes losses once the Group of companies can maintain stability.

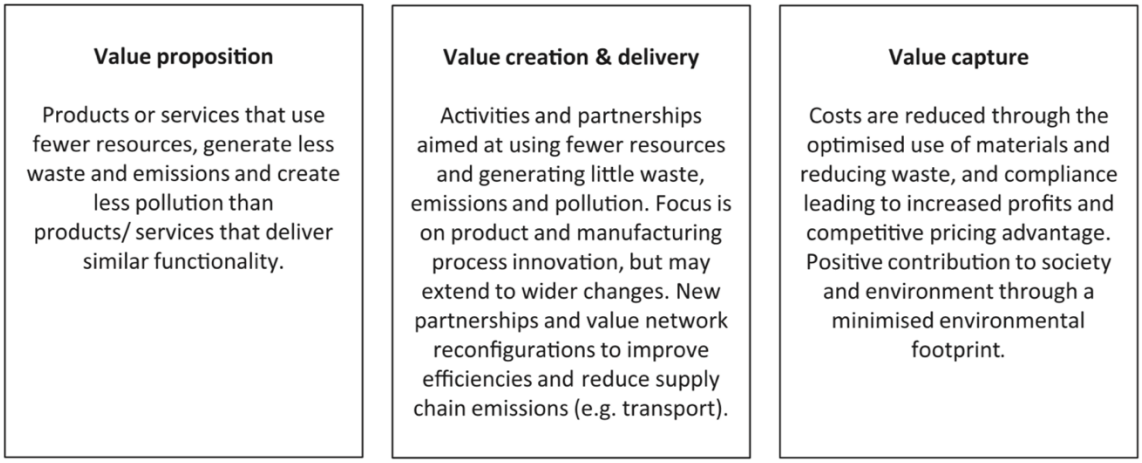

Figure 7:5 - 'Maximize material and energy efficiency' archetype description (Bocken et al., 2014, p.48)

'Developing sustainable scale up solutions' focuses on maximising environmental and societal benefits through large scale development such as slow capital and impact investing. This can potentially create industry-wide change but the sustainability focus must be maintained throughout scaling. This archetype has been selected given WRE's activities towards almost doubling their size in the near future. Expanding into affordable housing has added a previously excluded customer segment, improving on societal benefits. Partnering with similar organisations (competitors) has enabled the creation and delivery of more sustainable products and services at a quicker pace (scaling).

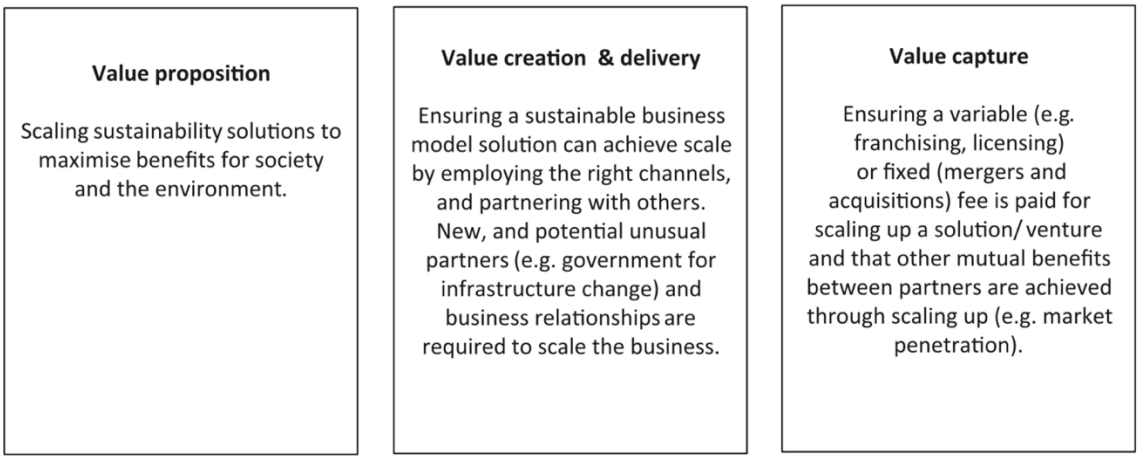

Figure 7:6 - 'Develop scale-up solutions' archetype description (Bocken et al., 2014, p.54)

There is secondary alignment with other archetypes such as 'substituting with renewables and natural processes' (renewable energy self-generation and waste reduction efforts), 'repurposing for the society and environment' (disaster relief, medical, and educational funding) and 'encouraging sufficiency' (consumer education/raising awareness, demand management, product longevity). Elements from each sustainable business model archetype can be found due to WRE's overall focus on carbon footprint reduction and social responsibility. Combining the sustainable business model archetypes should minimise the negative effects of following one model (Bocken et al., 2014); therefore, WRE appears to be a good example in the sector.

7.4.2 Sustainable business model patterns

As the sustainable business model literature evolves, researchers consolidate empirical data in various ways, similar to the overall logic for this research. Subsequent to the development of the archetypes (and building on them), Ludeke-Freund et al. (2018) developed a taxonomy of 45 sustainable business model patterns to create a more holistic and robust categorisation (Table 7:2).

Table 7:2 - Sustainable business model pattern taxonomy grouped by associated value creation (Ludeke-Freund et al., 2019, p.157)

Primary associated value creation (group)[a]	SBM pattern groups
Mainly economic	G1 Pricing & Revenue Patterns
	P1.1 "Differential pricing" P1.2 "Freemium" P1.3 "Innovative product financing" P1.4 "Subscription model"
	G9 Service & Performance Patterns
	P9.1 "Pay for success" P9.2 "Product-oriented services" P9.3 "Result-oriented services" P9.4 "Use-oriented services"
Social–economic	G7 Access Provision Patterns
	P7.1 "Building a marketplace" P7.2 "E-transaction platforms" P7.3 "Experience-based customer credit" P7.4 "Last-mile grid utilities" P7.5 "Value-for-money degrees" P7.6 "Value-for-money housing"
	G10 Cooperative Patterns
	P10.1 "Cooperative ownership"
	G2 Financing patterns
	P2.1 "Crowdfunding" P2.2 "Microfinance" P2.3 "Social business model: no dividends"
Social	G6 Giving Patterns
	P6.1 "Buy one, give one" P6.2 "Commercially utilized social mission"
	G8 Social Mission Patterns
	P8.1 "Expertise broker" P8.2 "Market-oriented social mission" P8.3 "One-sided social mission" P8.4 "Social business model: empowerment" P8.5 "Two-Sided Social Mission"
Mainly ecological	G3 Ecodesign Patterns
	P3.1 "Hybrid model / Gap-exploiter model" P3.2 "Maximise material productivity and energy efficiency" P3.3 "Product design" P3.4 "Substitute with renewables and natural processes"
	G4 Closing-the-Loop Patterns
	P4.1 "Co-product generation" P4.2 "Industrial symbiosis" P4.3 "Online waste exchange platform" P4.4 "Product recycling" P4.5 "Remanufacturing / Next life sales" P4.6 "Repair" P4.7 "Reuse" P4.8 "Take back management" P4.9 "Upgrading"
Integrative	G11 Community Platform Patterns
	P11.1 "Sharing business"
	G5 Supply Chain Patterns
	P5.1 "Green supply chain management" P5.2 "Inclusive sourcing" P5.3 "Micro distribution and retail" P5.4 "Physical to virtual" P5.5 "Produce on demand" P5.6 "Shorter supply chains"

The patterns describe repeatable solutions to core problems and propose to be applicable to various ideologies and disciplines. WRE appears to strongly incorporate supply chain (5) sustainable business model patterns – 'green supply chain management' and 'shorter supply chains' - given their sustainable procurement guidelines and partner/supplier evaluations. These supply chain patterns aim to improve both upstream and downstream activities (sourcing and delivery). The relevant ecodesign (3) patterns have already been highlighted in the archetypes – 'maximise material productivity and energy efficiency' and 'substitute with renewable and natural processes'. Ecodesign patterns embed lifecycle ecological considerations into product and service offerings. The pricing & revenue (1) patterns primarily address revenue models and are not perfectly aligned but 'innovative product financing' encompasses leasing/renting, similar to the 'delivering functionality rather than ownership' archetype. Interestingly, it also considers a progressive purchasing model, which is not included in WRE's model as yet but is similar to the shared ownership concept that emerged from the sector specific systematic review results (Chapter 6). The 'subscription model' within the pricing & revenue patterns refers to recurring revenue regardless of usage, which essentially underpins the real estate rental market. Furthermore, real estate encompasses a more elaborate and flexible subscription model, with varying contract (subscription) pricing and lengths; however, pricing is highly impacted by external conditions such as location. Finally, closing the loop (4) patterns, which embody circular economy/cradle to cradle thinking, could potentially be relevant such as 'remanufacturing' from the aspect of WRE's renovation/transformation project activities and 'reuse' from the building-level aspect of changing function/occupancy/ownership but continuing useful life.

Considering the value creation grouping of these sustainable business model patterns (1,3,4,5) on the triangular view (Figure 7:7), they fall closer to ecology and the economy than social. Perhaps this is due to the majority of WRE's social activity being conducted through social responsibility projects and charitable contributions, assisting with

persons' abilities to meet their needs. This may weakly align with the 'one-sided social mission' model within the social mission patterns (8), that are considered to be strongly social. This model targets a social group(s) that is unable to pay for a product or service of interest and is largely funded by social investors. Furthermore, WRE continuously supports community, health and wellbeing projects, internally and externally. There is therefore motivational and outcome alignment with the social mission patterns; however, they key missing aspect that creates the weak correlation is that the social target group(s) should be integrated as a customer or value creation partner. Giving patterns (6), the other consideration for alignment, donate to target groups in need but this would need to be the basis of the entire sustainable business model such as 'buy one, give one'. The overall approach does not appear to align easily with building level operations (real estate, general contractors, etc.) but may be more applicable to material-level actors (raw material extraction, manufacturing/production, waste management, etc.). The approach could also be useful for highlighting new business model ideas - sustainable business model development/innovation – similar to highlighting progressive purchasing models during this analysis.

Overall, WRE's focus is on achieving higher levels of sustainability within their business and community with an 'equal footing posture' where "*they have always done business sustainably, and their environmental and social efforts directly benefit employees, suppliers and local communities*" (Wu & Pagell, 2011, p.586). According to Wu & Pagell (2011), construction organisations with this posture are leaders with significant and equal integration of environmental and social concerns but economically develop much slower than competitors.

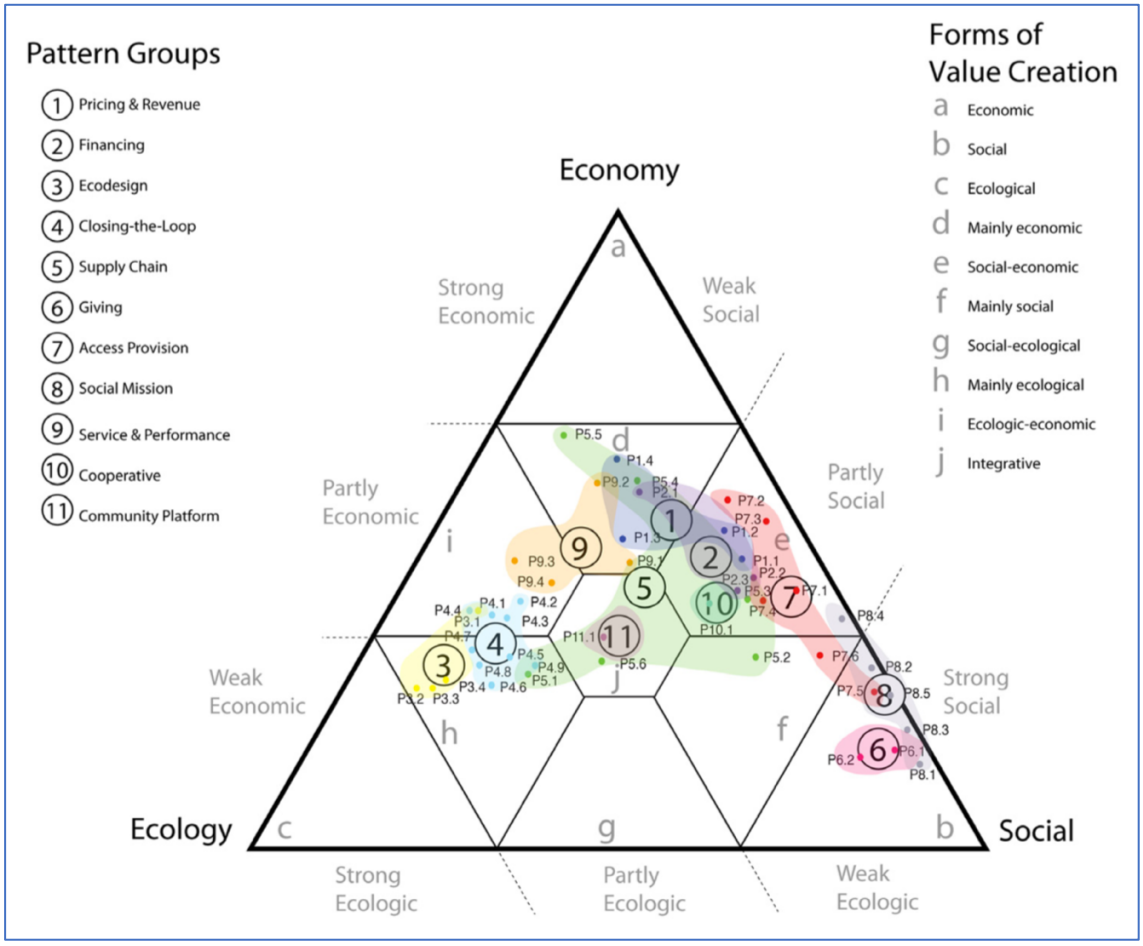

Figure 7:7 - A triangular view of the sustainable business model pattern taxonomy developed by Ludeke-Freund et al. (2019, p.156)

7.4.3 General research implications and recommendations

The sustainable business model archetypes and patterns are helpful frames for further theoretical development. This research also addresses more granular sustainable business model characteristics within the buildings and construction sector. The findings indicate that WRE operates within Zhao et al. (2017) five key factors that influence business models for sustainable building which are reduction in energy use and carbon emissions, mandatory energy efficiency building standards, company reputation and similar intangibles, internal sustainable building expertise (architects, designers), and market demand for sustainable buildings (Zhao et al., 2017). Organisations typically focus on reducing their carbon footprint through energy reduction, fuel switching, and more eco-friendly transportation options. WRE goes further to display other key requirements for sustainability success (Renukappa et al., 2013), such as visionary

leadership, management commitment, sustainability policies and structures, training programmes, and performance tracking.

Within this study, there is direct acknowledgement that visionary sustainability leadership strongly influences organisational activities. Sustainability training is required both internally and externally for sustainable value creation and delivery. It is also important to highlight that WRE goes further to include increasing sustainability competence as an organisational priority and target and systematically disseminates sustainability information to customers. This aligns with views that societal acceptance and behavioral change are critical for a systemic sustainable shift (Pomponi & Moncaster, 2017; Rohracher, 2003; Wolsink, 2012).

Another area of importance is certifications and building rating systems within the sustainable value proposition. Rating systems/certification schemes are great resources for setting objectives and benchmarks and assessing/quantifying performance (Freitas & Zhang, 2018; Tisak, 2015). WRE uses the building rating system Miljöbyggnad and are considering BREEAM. These along with Leadership in Energy and Environmental Design (LEED) and GreenBuilding (by Sweden Green Building Council) are the most popular in Sweden. It has already been acknowledged that it is challenging in practice to determine which rating system to select. Rating systems also have weaknesses. For buildings, there is especially criticism around the lack of a lifecycle approach that incorporates demolition/end-of-life and minimal social/community considerations. Therefore, whilst rating systems are helpful indicators of sustainable activity, a systemic and scientific perspective is still necessary to ensure alignment with global strategic sustainable development (Freitas & Zhang, 2018). WRE falls into this position of having to select rating systems. Both BREEAM and LEED appear to be more comprehensive than what is being used in regards to rating categories because they expand beyond a focus on energy and indoor quality to consider material/resource usage, waste disposal, project management, and impact on the surrounding community. Sweden (and therefore WRE) has also began the process of incorporating lifecycle assessment benchmark regulations

in the buildings and construction sector. To be impactful, these holistic approaches need to include existing buildings (renovations) that make up the majority of the building stock (Lambrechts et al., 2021; Pardo-Bosch et al., 2019). Overall, the quantitative approach is particularly important in this industry as pointed out by Wallfast CEO, "*we are practical people and want to work with metrics, we need a list of quantifiable goals or metrics and we can work towards this*".

For sustainable value capture, more formal circular economy approaches could be considered such as viewing 'buildings as a material banks' (BAMB). BAMB was a European research project that focused on creating value for building sector materials that are usually allocated as waste (BAMB, 2019). Leising et al. (2018) defined a circular building as "*a lifecycle approach that optimises buildings' useful lifetime, integrating the end-of-life phase in the design and uses new ownership models where materials are only temporarily stored in the building that acts as a material bank*" (p. 977). Incorporating circular economy principles requires organisations to rethink supply chains so that cycles can be reversed but it also requires the consideration of behavioural aspects, such as promoting sufficient lifestyles.

8 Multiple case study: Caribbean organisations

"*There is also much to be learned by comparing different national construction industries, for those industries display remarkably different solutions to the common problem of creating the built facilities which play such a central role in all economies and societies*."

Building Research & Information Editorial (Winch, 2000, p.88)

8.1 Chapter outline

This chapter presents data from 12 organisations in the buildings and construction sector that operate in the Caribbean region. The organisations are either market leaders in their subsectors or have sustainable value propositions. There is specific focus on the island of Barbados, which is the common country of operation for all cases. The chapter begins with an overview of the region and organisations followed by a detailed narrative of the business models based on publicly available data, company documents and semi-structured interviews. These findings are presented through the lens of the conceptual sustainable business model framework for buildings and construction organisations (Chapter 6) and compared with the findings from the Swedish case study (Chapter 7) and literature reviews. Theoretical implications are then summarised followed by potential areas for expansion and improvement - sustainability gaps. The gaps indicate key learnings from the study and help with understanding contextual implications that could lead to more effective sustainability approaches and decision making. All included data has been anonymised.

8.2 Introduction to the region and selected organisations

Small Island Developing States (SIDS) are a group of countries that encounter distinct social, economic and environmental obstacles to sustainable development. SIDS typically collaborate through regional Secretariats, such as the Caribbean Community (CARICOM) and the Secretariat for the Pacific Regional Environment Programme (SPREP), to help overcome some of these challenges. This multiple case study focuses on CARICOM. Within the Caribbean region, adaptation planning in SIDS has been predominantly at the national level with minimal translation to specific sectors, which is critical for the practical implementation of actions (Thomas et al., 2020).

Barbados, classified by the UN as a developing economy, is one of the SIDS in CARICOM that has been acknowledged for progress on and commitment to sustainable development. The Barbadian government aims to make Barbados a 'green circular economy' and the most environmentally advanced green country in Latin America and the Caribbean (European Commission, 2021). However, it has been highlighted that in the buildings and construction sector there is no vision or framework that is coordinated across all stakeholders to enable more strategic sustainable development (Moore et al., 2012). Barbados is also classified as a high-income country but as highlighted during the 2015 Third International Conference on Financing Development, using GDP per capita as a sole measure for development is inadequate and does not holistically capture development challenges. Considering the vulnerability and resilience indices, especially for highly indebted countries, is crucial for maintaining and increasing development. Caribbean SIDS are particularly vulnerable to external shocks (Permanent Mission of Barbados to the United Nations, 2015; United Nations, 2021).

A multiple case study research design has been adopted to explore sustainability in the buildings and construction sector in the Caribbean region and expand the sector's knowledge on sustainable business models. The approach provides real world data on current knowledge, products, services, plans and limitations, which could lead to more effective strategies and decision making. The selected organisations are all headquartered in Barbados with operations expanding across the Caribbean region. The markets served include: Barbados, Grenada, Trinidad & Tobago, Jamaica, St. Vincent, St. Lucia, St. Kitts, Antigua, Bahamas, Turks & Caicos, Dominica, Belize, Guyana, British Virgin Islands (BVI), Antigua, Anguilla, St. Maarten, and parts of South America. The organisations are either market leaders in their subsectors or have sustainable value propositions. Product and service offerings across the organisations comprise of building materials (aggregates, concrete products including prefabricated solutions, paint, windows, doors, furniture, architectural items), architecture, general construction, construction equipment (rentals), real estate (sales and rentals), project management

and property management. One of the selected cases has been analysed at project level due to the new value offering for the project being more relevant to the study – sustainable housing development. Overall, the company ages range from the 1950s to 2010s (Table 8:1). The most frequently occurring words across the case websites are shown in Figure 8:1 (with 4 or more letters, excluding company names). This is included to provide visual insight on the group of cases; however, due to some case websites containing significantly more information than others, it should not be used to draw further conclusions.

Table 8:1 - Organisational sample

Name	**Specialisation**	**Employees**	**Company Age**
C1	Manufacturing (concrete)	200	10
C2	Manufacturing (prefabricated components)	200	20
C3	Manufacturing (paint)	100	60
C4	Manufacturing (windows)	250	60
C5	Architecture (commercial and residential)	5	30
C6	General Contractor (commercial, residential, infrastructure)	800	40
C7	General Contractor (commercial, residential, infrastructure)	200	60
C8	General Contractor (commercial, residential)	10	5
C9	General Contractor (commercial, residential)	50	30
C10	Real estate (developer, management)	100	60
C11	Real estate (developer, management)	10	40
C12	Housing development (project)	10	180

Figure 8:1 - Most frequently occurring words across the case websites

8.3 Sustainable business model characteristics

The sustainable business models were generated based on publicly available data, company documents, and semi-structured interviews with senior management/owners (for some organisations). This section describes the sustainable business model characteristics for the project case (C12) and the combined sustainable business model characteristics of 11 organisations. Findings are also compared with the sustainable business model literature and Swedish case study (Chapter 7) to highlight commonalities and potential areas for expansion and improvement (sustainability gaps). References are only included for quotes that are not directly from the interviewees to assist with anonymity and readability.

8.3.1 Project level

The project case represents an ageing housing community development with key aims of promoting health, happiness and convenience. The lead slogan is '*Live Where You Love*' and the holistic sustainable design approach within one development is relatively new on the island. The concept was championed by the owner who felt there was a need for ageing developments in the region – *"He felt that our customers were ageing but our products weren't ageing with them well, to fit their needs"*. This realisation quickly evolved into a project idea and multiple stakeholders, dominant in their respective fields, were brought together to translate the vision to reality. Local market research was also conducted to understand the most desired amenities of modern community living. Pharmacy services, safety/security, medical services, and near to peers were amongst the most desired. Various housing options are provided from studios to two-bedroom units that are modern and ready to move in. There are a variety of amenities such as a theatre, gym, pool, tennis courts, and walking trails. There are on-site services to facilitate assisted living occupants and also other services such as food and beverage. There are multiple customer relationship and distribution channels such as marketing and promotional events both locally and internationally to expand reach and attract local and foreign investment – primarily targeting the diaspora in the US, UK and Canada. Key project partners include financiers, real estate marketing, sales and management, designers, contractors, senior care providers, and the local government.

Considering value capture, the revenue model is standard/traditional with a focus on selling all units and only managing common spaces and services. The project is solely owned by the organisation. Across the development, various ecologically sustainable elements have been considered during design such as energy efficient products, recycling faculties, community garden, large amounts of green space with biodiversity considerations, rainwater harvesting, and sewage treatment. During construction, the contractors used a form/build system that reduces form waste. For social considerations, as indicated within the value proposition, the community promotes

enhanced resident wellbeing. For the wider societal perspective, there has been job creation over the three years of construction and will be ongoing facilities management.

Immediately noticeable missing aspects on completion of populating the conceptual sustainable business model framework included the incorporation of formal/explicit sustainability training and awareness raising, sustainability certifications/schemes, and sustainable procurement rules (no formal sustainability requirements during tendering). The revenue model does not include longer term revenue streams such as unit rentals from retaining ownership. Renewable energy systems such as solar PV have also not been included but the buildings have been designed to accommodate retrofit. When discussing future opportunities, it was highlighted that there could potentially be more agricultural considerations beyond what has been planned but that more importantly, there are many institutional barriers to development that deter investors. There is a larger opportunity to help reduce the risk to develop in Barbados by working through some of the common barriers to realise more sustainable projects. In 2012, a green scoping study for Barbados found that there is a strong cultural preference for detached housing, which hinders the success of alternative housing types that facilitate land conservation (Moore et al., 2012).

Another interesting point, which was made during the interviews, is in connection to very influential roles in the sector – "*there's an inherent responsibility of an architect in any given project of many different things. And in this day and age, this sustainable approach to me is an important thing. Because you're the one that's responsible for specifying products. You're the one for specifying how certain things are supposed to be done. You're the one designing the build, you know, so you actually set the bar of the project as the architect on the direction that it should take".* This view was echoed in response to discussing customers where "*obviously they're the bigger contractors but strangely enough, I think the bigger influencers when it comes to purchases would be Barbados Architects Association or the architects whereever. Even above a contractor because the contractor is just going to do what they're told by the architect*." Though not

being investigated in this research, it has been highlighted in the literature that architects have varying levels of responsibility depending on the country – some may be more constrained and have more limited roles in construction processes than others (Winch, 2000). This discussion on architects will continue in the next section (organisation level) but overall, architects in this context have lobbied for increased responsibility to help enhance development of the buildings and construction sector. The project level sustainable business model is summarised in Figure 8:2.

Describe, analyse, manage, communicate		
Sustainable value proposition **retirement/senior village (208 condos independent) created to promote health, happiness and convenience** a. customer segments: residential (senior/retired) - independent, catered living, fulltime care - skilled nursing/dementia care (local and foreign investment) customer relationships: on-site office; online form; staged marketing (local/US/Canada/UK) distribution channels: website; on-site office; social media (facebook instagram, youtube) b. value for customer: various options (studio to 2-bed); ready to move-in (with appliances); spacious and stylish; security (gated and guard) various amenities promote wellbeing (social spaces and activities; amphitheatre; gym; tennis courts; pool; walking trails; meditation space); nearby shuttle service; on site services (medical faciltities; pharmancy, restaurant; assisted living) c. value for society: affordable housing; job creation over 3 years of project and ongoing facilities management; enhanced resident wellbeing d. value for environment: biodiversity (15 acres of greenspace); category 5 hurricane rated; rainwater harvesting to 265 gallon lake reservoir; sewage treatment plant; recycling; organic community garden	**Value creation & delivery** **project management; sales; wellbeing marketing** a. vision and goals: *Live Where You Love*; pioneer - ageing community; thoughtful and holistical design to encourage your well-being b.organizational structure: owner championed need for ageing development; company had to be created to won and manage the project; broad stakeholder group for conceptualisation; shared vision c. internal resources: project management; financing d. external partners and suppliers: financing (banks); market research; sales (real estate agency); design (local); construction; government (Home Affairs); regulators; senior care provider e. energy and waste reduction activities - LEDs, water efficient sanitary ware, retrofit ready for solar PV f. innovations and adaptability: assisted living/memory loss care considerations; 24-hour mobile medical care (one of local market research most desired amenities of modern community living); 100% ABA rated; internal walking/running trails; ageing concierge service; clubhouse focussed on community living	**Sustainable value capture** **economic value without degrading global natural, social, and economic capital** a. longer-term revenue streams: standard infrastructure project model; duty free and VAT exempt; Bds$200+ million investment; property sales $US 174,491 to $US 362,500 [48 sales out of 88 for phase 1 up to Q32021]; own & manage common areas and services low operational costs: facilities management; maintenance b. distribution of economic costs and benefits among stakeholders: sole owner c. compliance with sustainability principles: ecological - reducing electricity consumption with EE products; minimal impact on surrounding community during development (blending with existing landscape) d. value not yet captured - future opportunities: energy generation (retrofit ready); more agricultural considerations; community sharing schemes; sustainability awareness raising; innovative financing mechanisms

Figure 8:2 - Sustainable business model for the ageing housing development project (C12)

The research data analysis process for the Swedish case study and project case study (C12) highlighted overlaps when populating the proposed conceptual sustainable

business model framework regarding value for the environment and society. To reduce repetition, some adjustments were made to present the combined findings of the 11 organisational cases. The value proposition components of 'value for the environment' and 'value for society' have mostly been combined with the value capture characteristic of 'compliance with sustainability principles'. 'Energy and waste reduction activities' within value creation and delivery has been combined with 'internal resources' or 'innovation and adaptability' and 'training' has been combined with 'internal resources'. The other noticeable change that was required was either removal of the 'value not yet captured/future opportunities' component or addition of content boundaries. For example, opportunities that do not mostly fit within the existing business model would be excluded as they would not really reflect the overall description. Longer term and more radical developments would be incorporated in strategic sustainable planning and sustainable business model innovation processes i.e. populating the sustainable business model for the future opportunity.

8.3.2 Organisation level: sustainable value proposition

8.3.2.1 Products and services

The 12 cases comprise of building materials (aggregates, concrete products including prefabricated solutions, paint, windows, doors, furniture, architectural items), architecture, general construction, construction equipment (rentals), real estate (development, sales and rentals), project management and property management.

8.3.2.2 Customer segments, relationships, and distribution channels

Customer segmentation across the cases includes subsectors such as commercial building and renovation; residential building and renovation; civil projects/roads & pavements; marine projects/sea & river defences; land; sales; and rentals. Some organisations segment customers based on business to business, business to customer and export. Some within larger groups of companies segment by internal and external. For example, *"we have internal customers, which would be various construction divisions within the larger group… then there are external customers… that's the segmentation that we really focus on."* Ultimately*, "I always say anybody who has an interest in a*

property is a potential customer so it could be anywhere from the homeowner to someone involved in property maintenance too."

More specific applications are also referred to such as private residences; condominiums; townhouses; luxury villas; historic plantation homes; beachfront condominiums; healthcare; hotels/hospitality; retail; marinas; stadiums; prisons; low and middle income housing; and drainage. The markets served include: Barbados, Grenada, Trinidad & Tobago, Jamaica, St. Vincent, St. Lucia, St. Kitts, Antigua, Bahamas, Turks & Caicos, Dominica, Belize, Guyana, BVI, Antigua, Anguilla, St. Maarten, and parts of South America. All cases have at least one local office or store and offices and/or distributors in each market of operation. Sales and expert advisory services are available from local offices and in some cases, employees are based in distributor's stores to provide expert customer support. Other typical forms of communication with customers includes email, online forms, and phonecalls.

For some cases, digital applications are incorporated into marketing such as free software on websites to assist customers with construction planning and selecting products. Product and service quotations can typically be requested online but where products are for sale, only one case offers online purchasing. All companies have news blogs and social media accounts such as Facebook, Youtube and Instagram; however, the majority are not regularly active and some have not been updated in recent years. There is a view that on a small island, *"if you offer a good service and you continue to do good things, you would automatically get people. People will come to you. Word will spread."* However, it has also been highlighted that *"in a lot of cases, it's who you know, who you're connected to."*

8.3.2.3 Value for customers (society and the environment)

The recurring buildings and construction references used to attract customers include: strength; durability; speed; efficiency; bespoke/customisable; turnkey/full service; savings; beauty/aesthetic appeal; luxury; variety/range of options; high

quality/performance; low maintenance; reliability; safety; commitment; fire, hurricane and seismic resistant; low sound transmission; professionalism; after sales service; local experience; and strategic partnerships. Societal and environmental references are mentioned across all cases. The term 'sustainable' is explicitly used by half of the cases. For example, one case states that their *"portfolio allows our clients to design sustainable buildings and structures*." Figure 8:3 shows the overall word frequency from value propositions for customers.

Figure 8:3 - Most frequently occurring words that refer to value for the customer

All cases place emphasis on social responsibility through various charitable donations and community initiatives. The importance of employee wellbeing is also a key message in public profiles such as *"commit to providing a working environment that fosters growth, development, teamwork and financial prosperity for our employees and*

shareholders." Overall, the majority of value propositions focus more on the customer and society than the environment. For most cases, characteristics of value for the environment were not immediately obvious from company profiles. Further information had to be gathered from local news reports and magazine articles. Interviewees provided significantly more data on environmental sustainability practices. The project case is an exception because the primary offering is an affordable and sustainable housing development and therefore the data heavily promotes social and environmental aspects. Considering the overall approach to providing sustainable value, one interviewee explained it as "*over the years, we've done a few things internally to be a little bit more sustainable and also to try and you know, at the risk of sounding cliche, reduce our carbon footprint."*

8.3.3 Organisation level: sustainable value creation & delivery

8.3.3.1 Key activities

Key activities vary across cases and include extraction (aggregates), product design and engineering, manufacturing/production (cement/concrete, prefabricated concrete solutions, paint, windows, doors, furniture, architectural items), retail/distribution (various building materials), architectural design, real estate development, construction (project management, commercial, residential, industrial), property sales and management (property purchases, sales, long-term rentals, management, surveys, valuations), managing equipment rentals, and quality control.

8.3.3.2 Vision, goals and organisational structure

Most of the organisations have introduced new products and services to their markets and consider themselves to be pioneers or leaders in their sub-sectors, due to their experience, offering and/or market share – "*that is a big part of what we have become known for, forward looking and being an innovator*." The visions and goals typically refer to leadership and pioneering, with a focus on innovative thinking, superior quality and performance, and service excellence. Example statements include:

"to be the leading general contractor in the region";

"integrity and excellence in construction";

"excellence is not just a word, it's our way of life";

"committed to becoming the Caribbean's leading multidisciplinary organisation";

"*Our plan is to expand regionally and beyond, to take what we have developed and introduce the concepts in other developing countries, to help with their needs and help us realize projects in new markets."*

There is also emphasis on social responsibility and the wellbeing of employees with references to integrity, honesty, and openness. There is overall promotion of personal excellence, constructive self-criticism, continual self-development, mutual respect, and accountability to all stakeholders. Example statements include:

"develop innovative ways to improve working practices";

"a superior team produces a higher quality product and delivers greater results";

"the cornerstone of our success has been the loyalty and dedication of our employees";

"actively invest in knowledge and resources to become the preferred contractor and project management firm";

"a company our customers look forward to work with, and our employees are proud to work for."

Some of the company owners or leaders have received accolades and awards for their work in the built environment such as preservation of historic buildings and commitment to society such as contribution to youth development; however, whilst it is great that these aspects are acknowledged in the vision and goals, further research would be needed to know if this is truly translated to practice.

All organisations are headquartered in Barbados, a small island developing state (SIDS) in the Caribbean and range from small to large private and publicly-owned companies

(including family-owned operations). The companies typically follow a traditional hierarchy, where decisions are made from the top with clear lines of authority, information flows to the top to those in power, the majority of knowledge and skill are in the upper levels of the organisation, and rewards are vertically scaled (Ashkenas et al., 2015). Effort was made to select cases that were not subsidiaries of other cases; however, some of the most dominant companies in the sector are subsidiaries of larger groups. Even for companies where the parent group differs, further investigation of shareholders highlights significant overlap across the groups. Monopolistic organisations are already acknowledged as a key characteristic of SIDS due to various reasons. The lack of economies of scale typically leads to minimal competition in the private sector, which adds to the country's vulnerability (IMF, 2013). Some organisations operate with a managerial 'open door policy', but this is mostly due to the nature of operations in this sector. A challenge with the organisational structure in these types of cases is that longer term strategy is typically discussed at group level and sometimes never trickles down.

For some organisations, leadership mindsets are slowly changing to include focus on environmental issues, such as "*one of the corporate KPIs is to reduce waste."* This appears to be primarily linked to reducing costs (financial driver, economic benefits) – "*obviously the driver is purely financial*." There is also acknowledgement linked to local and international climate change pressure such as, *"we do recognize the fact that cement and the concrete industries do contribute quite a bit"*; however, the motivations were not fully investigated within this research. There seems to be an understanding that sustainability should be championed from the top-down but is not yet dominant in all cases. For example, in one of the smaller organisations, sustainability is inherent to leadership thinking and embedded in products and services – "*…sometimes it's not even important to them [customers], but it's become instilled in me that no matter what project I do, the choice of products with choice of materials and the way of design, it's always follows through with that. There's always some level of sustainability to it."*

8.3.3.3 Internal resources and processes

A strongly recurring theme is pointing out extensive knowledge and industry experience in the local markets as a selling point for customers. Key resources identified are: project managers; engineers (structural design, modelling, production, maintenance); experts/technologists (concrete, paint, technical issues, prefabrication, R&D); certified technicians (testing & assurance); quality control; design consultants; artisans/craftsmen; property/facilities managers; customer service (technical issues, complaint resolution); sales; marketing; financial and valuation consultants; legal advisory; surveyors; and project development. Health and safety policies and quality control are also common themes but environmental policies or frameworks are lacking. There is one mention of ISO 14001 (certified since 2006) across the cases (though a limitation with this result is the predominant reliance on secondary data). ISO 14001 is globally recognised and provides certification criteria for an environmental management system for companies. Considering product standards, some products have to meet local standards and specifications from the Barbados National Standards Institution (BNSI), which is a joint initiative between the government and the private sector. Both internal quality control and external verification has been found such as *"we have our own in-house QC and we do random tests"* and *"some of our more sophisticated customers will take samples of what we deliver to them and get it tested independently through BNSI or through MPW [government ministry]."* Strong technical teams appear to be an overall key resource – "*if you have a very specific challenge with say fungus or you know, something strange, we have that resource in technology that could do a full investigation*."

Managers indicate that professional development and training is encouraged and companies provide job specific training. For example, there is typically in-house training for customer service representatives and sales staff. However, professional licenses and other more technical credentials are not typically held unless required by law for the profession (such as architecture and engineering). For one of the cases, a virtual learning platform has been recently made available for all employees, similar to the approach in

the Swedish case. The platform provides both job specific and general learning for professional and personal development.

To improve sustainability within the organisation, all cases have incorporated or intend to incorporate renewable energy generation from solar PV and LED lighting in buildings and plants. For manufacturers, there are ongoing efforts to improve the energy efficiency of production such as modifications to diesel generators and automated systems. Most of the cases have reuse/recycling initiatives but they are predominantly informal/adhoc such as *"we have a technical guy here who is very good… he helps us and guides us in terms of what rate to add some of that recycled material."* Another response highlighted that while "*it is not in a structured way, they know how to do it. You know, they do it almost by default. There is product that comes back and they're very, very good at reworking it, what they call integrating it into new batches as opposed to throwing away."* Overall, there is recycling of aluminum scrap and packaging, recycling of concrete and paint waste, and donating of timber offcuts to the community. These recycling aspects will be explored later in the chapter. None of the cases have been found to incorporate sustainability certifications, with the exception of one specific paint product under Coating Research Group Inc. (CRGI) Green Wise performance standards (CRGI, 2022). This finding, however, does not automatically mean that products do not meet international sustainability standards. For example, some of the cases manufacture building materials and products to high level specifications but there is no strong demand from customers for more sustainable products and services. Additional cost and effort is therefore not used for certification – "*my technology manager tells me that for sure, based on the benchmark, they do meet the specs, but they don't shout about it… is it recognisable to our customers, is it worth the investment?*" Where there is demand for more sustainable products and services, it is primarily driven by architects and typically for commercial projects – "*working with clients, I found mostly that commercial projects are ones that tend to want to go down that more sustainable path."*

Architects make recommendations and decisions on supply and newer buildings could typically have more sustainable products due to being procured and imported from more developed markets. There is a view that *"you can build an entire building that could have saved 75% green accreditation without even knowing or trying because the products take it there, you know."* However, it has been found, interlinked with lack of demand mentioned above, that this is not explicitly communicated to the customer. For example, the specified carpet may be hypoallergenic and the specified paint may have no volatile organic compounds (VOCs) but it is considered that from the customer perspective it is still just carpet and paint. In some instances, details about more sustainable components are even strategically withheld from customers as they may automatically be perceived as more expensive and additional effort would be required to justify procurement.

Regarding more sustainable design practices, some architects have specialised in more sustainable practices throughout their entire career and view further incorporation as natural progression. For example, biophilic design has been found in one of the cases as an area of specialty from company inception. Furthermore, on cleaning out some old items, "*I remember looking through some actual renders and stuff I did, hand rendering when I was actually in school and a few of my projects all had this sustainability to it. Going back, way back."* Echoing these sentiments, a Trinidadian lead architect on a government building project stated that "*what has been hailed recently as green architecture represents…for some architects common sense and a means of working which they have pursued diligently for many years*" (Allen-Agostin, 2012). An architect and board member of the Trinidad & Tobago Green Building Council (GBC) has also contended that most architects in the region naturally want to build green and do indeed incorporate green design but it is unknown due to the lack of regional green certification for buildings and cost for using international certification experts (Allen-Agostin, 2012).

8.3.3.4 Partners and suppliers

As highlighted in organisational structure, some of the most dominant organisations in the sector are subsidiaries of one larger group or set of shareholders. Many of the organisations therefore work closely with other organisations in the same group, sometimes similar to a vertically integrated structure. A range of 3 to 7 explicitly identified complementary key partners are mentioned on organisation websites for most of the cases. The types of products and services offered by key partners are typically other building materials or managerial services. More generally, partners and suppliers consist of general contractors, project managers, architects, surveyors, tradesmen and other freelancers. Freelancers are especially important for some of the smaller organisations – "*basically everyone that I work with is on contract basis. That's been a sort of a rule of thumb because… in times like this where it's really bad, you're not forced to have to lay people off and stuff."* This approach is not too far off from Disconzi & Lorenzini (2017) virtual collaborative networks of specialised small to medium sized enterprises (SMEs) that facilitate easier adaptation to project specific needs. The collaborative approach covers various elements of the project value chain in comparison to larger organisations with less flexible business models (Disconzi & Lorenzoni, 2017).

8.3.3.5 Innovation and adaptability

Generally, it has been highlighted that products are created based on the Caribbean environment (such as hurricane resistant) and there is ongoing adaption based on consumer needs. For example, products are "*very targeted… very specific for the conditions that the Caribbean has and the trends of the customers*." Specialised equipment such as cranes and bulk transport vehicles are fairly modern and regularly maintained to meet the sector's needs. For products, there has been an increase in LEDs, occupancy sensors (lighting and AC), and more efficient AC units.

For the manufacturing companies, investments have been made to increase plant efficiency and product quality such as more advanced and automated equipment, while still considering energy efficiency. For some technical teams, "*their day-to-day is quality*

control, but they spend a lot of time in development, improving, benchmarking and testing products and raw materials". Some manufacturers distinguish themselves based on the type of plant or processes they operate. For example, for paint production, there is a tint from base approach one case has adopted that creates bases in bulk instead of specific colours in the factory. Their previous approach was to create every colour in factory (factory shading) and others still use this method - "*so you migrate from what we call factory shading to tint from base, is what the process is called. It's probably the single biggest sustainable transition to happen in the industry"*. Another case offers prefabricated concrete building products and homes. Prefabrication falls into modern methods of construction (MMC), which is a growing area of focus in construction globally due to various aspects such as the potential to reduce waste and shorten installation times.

In general, though the cases show interest and have made prior investment in innovative technology and services, the use of this as a unique selling point could be questioned - "*we are a commodity at the end of the day so you could try and leverage certain things, some customers get it, others don't, others don't care. It comes down to am I going to get what I need for the cheapest price or is it that your service is a little better than the other guys down the street."* A similar and reflective perspective was shared from another case, *"obviously in the early 90s and 2000s, trying to get people to see that sort of sustainable approach is very difficult because it was a relatively new approach especially in the Caribbean, and I think a lot of it had to do with the fact that because we were and still are a sort of small island developing state, there're so many things that we do that have to be imported. So sometimes we just settle in and accept what is there because it's the easiest path to travel right? And then, because you have the affordability issues and stuff through the years."*

8.3.4 Organisation level: sustainable value capture

8.3.4.1 Long-term revenue and low operational costs

For most of the cases, it was difficult to gather detailed information on financial aspects such as revenue, operational cost and the distribution of economic benefits. For

organisations within larger groups, the structure generates 'internal customers' such as *"in the concrete division, the majority of our clientele is external… in the quarry, not so much, because we buy from ourselves, we are our own largest customer. Asphalt is primarily government roles and that type of thing."*

Generally, financial profit is the primary driver, *"…at the end of day, it's to make money. It's to produce a profit for the directors and shareholders and where we can do that, you know, we are obligated to and there are savings being sustainable."* Similarly, *"the idea is that what we're recognizing is that there's money in it [sustainability], there's savings and it's to identity that. We exist to make a profit."* There is also the typical margin-centric view where *"we have a propensity to want to earn as much money off of a single unit..."* Where long-term approaches are adopted, it is typically linked to longer term ownership of plants, buildings and equipment. Renewable energy generation has also recently increased and would typically be considered a longer-term investment; however, energy tariffs in Barbados make renewable energy investments relatively attractive with paybacks typically being below 10 years (in comparison to 30+ years of operation). Some cases produce excess generation, which translates to additional income – *"our bill used to be like 15,000 a month and now it's a credit every month end so it works for us, I guess both environmentally and economically."*

For the developers/general contractors/real estate, it has not been typical for ownership to be maintained after projects have been completed; however, the research did not zoom in on this sub-sector to be able to generalise that finding. As highlighted above, one of the barriers to longer term approaches is a fixation on maximising profit from one project. More general costs include human resources, rent/financing, marketing and promotion, energy and water, office equipment, maintenance; management fees, and IT support.

Some cases are dependent on government subsidies and some could be significantly impacted by changes in regional/international trade agreements and local duties. For

example, there are agreements in place to help protect lesser developed countries from more developed countries such as lower/no duties on local products; however, this has an impact on the ability to scale up certain operations across the region as there is a risk of other countries establishing their own operations and placing a premium on imported products/services. Another highlighted area of risk in this area for local manufacturers is when competitors label their imports as 'raw materials' to reduce/avoid duties when in actuality, these are not truly raw materials (product assembly in comparison to manufacture).

Overall, a point that reflected most of the findings is that *"I think when it comes to just senior management level… there is a sort of goal to yes be more sustainable going forward and what we can do to help… I don't know that it will drive profits, but it will actually result in savings going forward. So there would be some sort of trickle up effect..."*

8.3.4.2 Value to environment and society

All of the cases have been trying to achieve higher levels of environmental sustainability within their business and community mainly through informal and semi-formal recycling initiatives (including back into the manufacturing process), more energy efficient/environmentally friendly materials/products (such as high-performance water-based paint solutions to reduce solvent based), energy and water conservation, and renewable energy generation from solar PV. For renewable energy, cases are typically energy self-sufficient or produce excess generation. Typical comments include *"we renovated the offices and we put in all LED lights on the exterior and the interior.*" One case explained part of their energy efficiency approach "…*every office that we do, we put sensors in for lights and sensors in for air conditioning. This is occupancy sensor. So basically if no one is in their office their lights go off automatically after two minutes of no movement. Or you will have air conditioning with the same thing if there is no one in the room, the air condition will slow down to not waste extra energy into space that's*

not being occupied." For the architectural case, passive design and biophilic design are key offerings.

Rainwater harvesting from roof drainage has also been incorporated, such as, *"we have a 20,000 gallon tank that we pull rainwater from all of our roofs. We're trying to figure out a way to capture the overflow right now… and we have a long term goal to develop a pond."* Further exploring reuse and recycling initiatives, steps are being slowly taken to recycle waste concrete back into production, *"waste concrete may come off of our plant or spills that occur in the yard from time to time and where the guys may wash out if they come up from a job and have some concrete leftover in the barrel. It used to be typically dumped in the quarry… we've started to go back to these areas, dig them up and send that material to the crusher… so we send that back through."* The approach is very ad-hoc and not yet based on a formalised quality protocol. One of the technical leads on staff assist with specification and guidance. There are ambitions to go further, however, "*we are not there yet as a country… as a company we are trying to get there, considering investment for special plant and equipment, but you also have to change the mindset as well for some of the workers, because you know, these guys get so accustomed to doing things, any time you go to them or anything different than what they're used to, it's a little bit of a challenge. So it requires a lot of energy."*

For manufacturers the majority of product to meet local demand is manufactured locally; however, this is mainly an economical decision as further considerations such as carbon emissions impact have not been formally incorporated into decision making – "*I can say with some confidence that we had not considered the carbon impact of making a decision like that*." Social impact is sometimes considered from the aspect of jobs. In Barbados, construction is the third highest employment industry after wholesale & retail trade and accommodation & food services (Ministry of Economic Affairs & Investment, 2018). Of particular interest is a recently launched a programme that donates used timber and offcuts to the community (JADA Group, 2021). These types of programmes could be closely monitored to quantify benefits and set examples for others.

Socially responsible initiatives have been more dominantly portrayed on websites in comparison to environmental. Typical messaging includes *"improves the quality of life of our community"* and *"acknowledge society's contribution in making us what we are today and understand the importance of giving it back to the society."* All of the cases support charities, education, sports, youth and/or communities in various ways, mainly through sponsorship, scholarships and general donations. Some cases also offer job placement opportunities and host or organise fundraising activities. Another key aspect is the involvement with disaster relief such as rebuilding homes and also supplying personal protective equipment (PPE) during the COVID-19 pandemic. There is general encouragement amongst organisations to be philanthropic and *"align our philanthropic interests with people who are committed to driving change and building a better nation."*

Interesting feedback on embedding more holistic value capture was linked to working with international organisations that have offices in Barbados, where *"the good thing about working with a lot of the bigger companies is that they know about it and they know that they have to exhibit some level of consciousness towards that aspect of life… so that's why they always tend to do things in the design stage and the construction stage to make sure that they're building is at a certain level."*

8.3.5 Future opportunities (value not yet captured)

Future opportunities were only discussed with interviewees and therefore these findings only reflect those cases. This section describes potential opportunities that mostly fit within the existing business model and are being considered within the organisation. Further opportunities and recommendations from literature and industry have been included next section.

A variety of future opportunities were identified by interviewees, typically through the process of highlighting where value was being destroyed. More structured/formalised waste sorting and reduction activities are viewed as an area requiring development. This includes waste back into production and better sorting of waste, in plants and offices

and on projects. Improved hazardous waste management is being worked on as well, "*trying to eliminate spillage of different chemicals that we use because if something spilled right now, it kind of just runs on the ground and we wash it away when we can pick that up."* There is exploration of producer take-back schemes and community reuse schemes, which are currently not formally established. These approaches will require more focus on quantifying waste and identifying the best available (or to be created) management routes. Most of the cases already have in-house technical teams or experts that may be able to help develop trial programmes.

Energy efficient lighting solutions and renewable energy generation has been a focus across the cases; however, wider incorporation of building management systems for monitoring and auditing performance may be useful for some assets. Interviewees have indicated that much more knowledge about the benefits of these approaches is required to convince shareholders or clients to invest. It was also highlighted that legislation against hazardous products and incentives for responsible sourcing may be helpful.

Rainwater harvesting systems could be expanded to capture more runoff. For one case, *"we've started to pick up the drainage from our yard area and channel it into a central area in a pond… with time, the excess water is collected and then we somehow use it, run it through some filters and put it back into whatever it is that we're doing... that's our longer term plan, we're going forward with that in mind."*

Overall, it has been acknowledged that much more could be done to raise sustainability awareness and action amongst customers and communities – "*I think that's something we can probably do a little bit more with as a company and raise that awareness with our customers going forward."* This includes championing sustainability from top-down an identifying internal sustainability champions. Some thoughts are that any behavioral change in customers so far may be attributed to people being well-travelled and/or more exposed to sustainable activities on television shows. Whilst sustainability certifications could also potentially be a useful educational and communication

pathway, there is still hesitation due to the time and cost involved in comparison to perceived value. More immediate awareness raising could be to highlight and promote existing sustainability practices and initiatives, internally for employees and externally for customers (such as case studies). The sustainable business model characteristics are summarised in Table 8:2

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“I think that there's more that we can do but it comes down to resources because you have to put time into make things happen.”

Table 8:2 - Sustainable business model elements from the selected cases

Value proposition

Product/service: building materials; architecture; general construction; construction equipment (rentals); real estate (development, sales and rentals); project management; property management

Value for customer: strength; durability; speed; efficiency; bespoke; turnkey; savings; aesthetic appeal; luxury; variety; high quality; high performance; low maintenance; reliability; safety; hurricane resistant; low sound transmission; professionalism; commitment; after sales service; local experience; strategic partnerships; sustainability

Customer segments: commercial & residential building/renovation; land; industrial/commercial B2B; export; rentals | private residences; condominiums; townhouses; luxury villas; plantation homes; beachfront condominiums; health care; hotels/hospitality; retail; marinas; stadiums; prisons; low and middle income housing; drainage

Customer relationships: expert advisors in local offices/stores; email; phone; website/online software and services; social media (Facebook, Instagram, Youtube)

Distribution channels: direct retail from local office/store; online retail (website); B2B/distributors

Value creation and delivery

Key activities: mining/extraction; design and manufacture/production; architecture; real estate development; construction; project management; property management

Vision: leaders/pioneers; innovative; service excellence and expertise; superior quality and value; enhance surrounding community; create relationships with customers, partner and employees; meet and exceed needs of customers; agile; sustainable development

Structure: traditional hierarchy; emphasis on social responsibility and social wellbeing of employees; integrity, honesty, openness, personal excellence, constructive self-criticism, continual self-development; mutual respect; accountability to customers, shareholders, partners and employees; health and safety policies; quality standards

Resources: project managers; engineers; certified technicians; product standards; quality control; health and safety; design consultants; R&D; facilities management; customer service; sales; marketing; finance; valuation; legal; project development; extensive local knowledge

Partners: partner companies/subsidiaries offering complementary services; government departments; architects; technical/product societies; subcontractors; artisans and construction workers; distributors

Innovation: technologically-advanced/modern plant and equipment; automation; high quality/efficient production methods; adaptability to Caribbean environment and consumer needs; passive design; hurricane resistant design; software; advisory services

Value capture

Revenue: product/service sales and rentals; long-term ownership and management of plant, buildings and equipment; renewable energy generation

Costs: energy, water; maintenance; HR; offices; marketing; HSSE; IT; maintenance

Distribution of benefits: profit driven; private; publicly listed

Society: fundraising/awareness raising initiatives and donations for healthcare, schools, sports and youth/cultural/community activities; pandemic relief; disaster relief; job placements; encouraging reduced material consumption through prefabricated solutions; attempting to meet local demand through local manufacturing; job creation; raising sustainability awareness; biophilic design

Environment: renewable energy generation (solar PV); rainwater harvesting; recycling waste from manufacturing/production; recycling waste from packaging; adaptable building components; prefabricated components to reduce material consumption; materials and designs to reduce energy demand for cooling; energy and waste reduction KPIs; biophilic design; passive design; water conservation

Value not yet captured – future opportunities

reduce waste to landfill (transform informal recycling to formal schemes, incorporate community reuse schemes); resource efficiency audits beyond LED/solar PV (calculate carbon impacts, expand rainwater harvesting); increase sustainability awareness and action from employees, customers and community (champion sustainability from top-down, identify internal sustainability champions, highlight sustainability in previous projects); incorporate responsible sourcing/sustainable procurement guidelines and sustainability certifications/standards for products/services; leverage existing technical expertise for more sustainable initiatives; encourage legislation and government incentives for sustainable sourcing; increase monitoring and auditing (building management systems, employee development)

8.4 Conclusion to the multiple case study and theoretical implications

Moving towards a more sustainable world requires a *"fundamental shift in the purpose of business and almost every aspect of how it is conducted"* (Bocken et al., 2014, p.43). Embedding sustainable development (encompassing the environment, society, and economy) into all business processes and expanding considerations beyond organisational boundaries are essentially the foundations of a sustainable business model. Across all of the cases, there are sustainable practices that have been highlighted such as improving energy efficiency and focussing on societal wellbeing; however, there appears to be minimal formal and quantitative embedding of holistic sustainable practices.

More specifically, the project case has alignment with aspects of the environmental sustainable business models archetypes (Bocken et al., 2014), mainly to 'maximise material and energy efficiency' and 'closing resource loops'. There could be more holistic sustainability awareness raising campaigns, beyond just marketing the development such as promoting high indoor quality and performance, energy efficiency, biodiversity benefits, and reuse and recycling benefits (improved waste management). This is also applicable to the organisational level cases. For example, in the Swedish case study, promotion goes beyond an outline of product/service details to encourage sustainable living and explain the reason for incorporating various sustainable practices (including explaining the use of sustainable certifications and rating systems). This is mainly done through infographics, animated videos, customer newsletters/updates, and magazine publications. The project case also has plans for a shuttle service for residents to nearby locations, which could extend to the formal facilitation of a community sharing economy with cars, bikes, etc. Community activities are already being coordinated for the shared spaces such as the clubhouse. These sorts of approaches incorporate aspects of social archetypes such as 'adopting a stewardship role' and 'encouraging sufficiency'. Scholars already report a lack of focus or suitable inclusion of the social element of sustainability (Bocken et al., 2014; Upward and Jones, 2016; Ritala et al., 2018).

Considering the sustainable business model patterns (Lüdeke-Freund et al., 2018), 'innovative product financing' in the pricing & revenue patterns outlines a progressive purchasing model, similar to the English shared ownership concept that emerged from the sector specific systematic review results (Chapter 6). The approach in England aims to enable lower income homeownership through a government supported 'staircase' structure (gradual increases in the percentage of the home that is owned versus rented). There are various strengths and weaknesses in the approach that have been reviewed over last few decades. These could be explored within the local context to determine suitability. Ultimately, the goal is to provide alternative financing mechanisms that provide the lower income population with more purchasing power. These financing considerations are also applicable for the organsational level cases.

Across the organisational level cases, there is alignment with aspects of all of the environmental sustainable business models archetypes - 'maximise material and energy efficiency', 'closing resource loops' and 'substitute with renewable and natural processes'. The future opportunities section highlighted multiple options towards further improvement in this regard. The social business model archetype to 'deliver functionality rather than ownership' can be seen in the rental segments across the applicable cases. This seems especially important for a sector where products could be very costly and may only be required for a relatively short period of time; however, 'innovative product financing' approaches could be investigated.

Overall, conducting the analysis through the sustainable business model lens has identified some sustainability strengths and weaknesses. The sustainable business model archetypes and patterns have also provided some helpful insight for developing new approaches to existing products and services or creating completely new offerings. The next section outlines these sustainability gaps and provides considerations and recommendations.

8.5 Highlighted sustainability gaps in the multiple case study results

The conceptual framework that has been adapted throughout this research for the buildings and construction sector is shown in Figure 8:4 and identifies where the multiple case study results predominantly do not align (highlighted in grey). As explained when presenting the organisation level results, framework aspects have been combined where there was significant repetition regarding value for the environment and society. A boundary has been proposed for 'value not yet captured' and compliance expands beyond the FSSD sustainability principles to encompass any suitable and supportive sustainability methods/tools that may be referred to with different terminology (as highlighted in Chapter 5). The following sections discuss the highlighted gaps in more detail based on case study results and overlapping aspects have been combined.

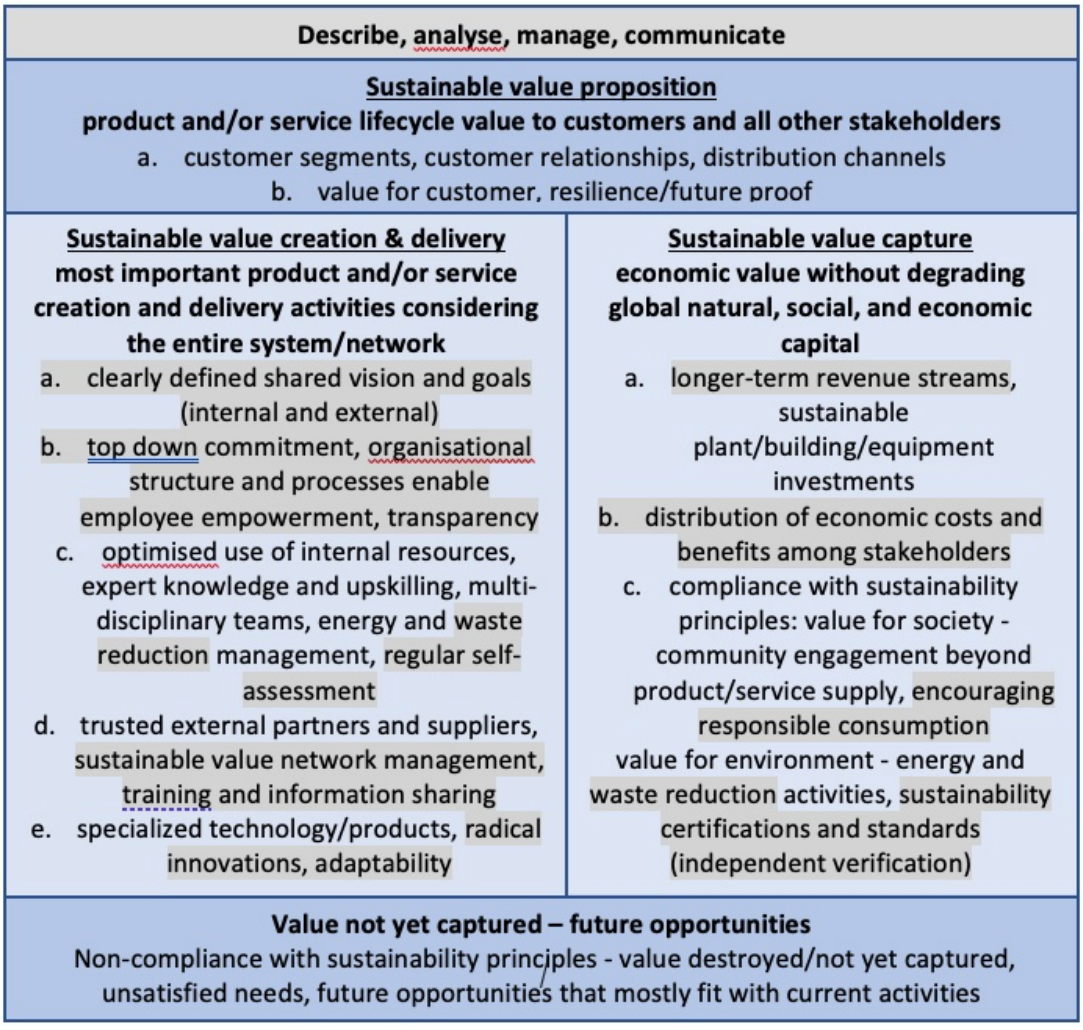

Figure 8:4 - Conceptual sustainable business model framework for the buildings and construction sector

8.5.1 Sustainable value creation and delivery

8.5.1.1 Shared sustainable visions and sustainability champions

The traditional organisational hierarchy appears to be dominant in the Caribbean, where decisions are made from the top with clear lines of authority, information flows to the top to those in power, the majority of knowledge and skill are in the upper levels of the organisation, and rewards are vertically scaled (Ashkenas et al., 2015). Many companies are subsidiaries of larger groups owned by the same set of shareholders. Monopolistic organisations are already acknowledged as a key characteristic of SIDS. A challenge with the organisational structure in these types of cases is that longer term strategy is typically discussed at group level and sometimes never trickles down. There is also a lack of sustainability championing within the organisations (both top down and bottom up). This is vastly different from the Swedish case where sustainability is driven by the owners and entire board, quickly cascading to all employees, formally and informally. Long-term thinking and broader definitions of value are embedded (Figure 8:5).

Figure 8:5 - The Soya Group's five core values (The Soya Group, 2017, p.6)

It does appear that for some of the Caribbean cases, the leadership mindsets are slowly changing but the ripple effect is yet to be seen. Changing mindsets could be due to a variety of reasons such as local and international climate change pressure or increasing interest from younger staff who take on managerial roles; however, feedback within the

study indicated that the primary driver is economic benefits. Overall motivations were not further investigated. There are regional examples of top-down championing that could be built on. For example, at governmental level, Dominica's recovery strategy includes a focus on rebuilding environmental assets such as coral reefs, forests, and mangroves in order to help its tourism and agricultural sectors to recover. These aspects provide important protection from hurricanes and could therefore be critical for future resilience of vulnerable SIDS. Dominica's overall vision, based on an understanding of collective responsibility, is to build the world's first climate resilient country (Government of the Commonwealth of Dominica, 2020). Another important point is that whilst the visions and goals of the Caribbean cases place strong emphasis on social responsibility and the social wellbeing of employees; further research would be needed to understand the extent to which this translates to practice. In the Swedish context, formal monitoring of employee satisfaction is incorporated.

8.5.1.2 Environmental management systems (EMS) and standards – comprehensive environmental policies

For decades, companies globally have been adopting environmental management strategies towards achieving benefits such as improved resource efficiency, pollutants reduction, increased innovation, improved reputation, and employee satisfaction (Meyer, 2000). Across the Caribbean cases, health and safety policies and quality control are common themes but environmental policies or frameworks are lacking. There appears to be more focus on promoting socially responsible activities than environmental. Whereas environmental management, certifications and labels were dominant in the Swedish case and are also explicitly included in the initial sector specific conceptual framework (Chapter 6).

Best & Thapa (2011) investigated the implementation of environment management in hotels across the Caribbean and found that 68% had adopted some form of environmental management; however, levels of environmental management can range from basic practices to more advanced management and 44% of adopters were

categorised as basic (e.g. energy and water saving devices, linen reuse, and waste separation). Furthermore, these practices were on an ad-hoc basis. 25% had an environmental programme such as a policy for reducing resource consumption and waste generation. Only 14% incorporated a comprehensive programme, an environmental management system (EMS), which required setting objectives and targets, creating a plan of action and consistently monitoring performance. Quite interestingly, their findings showed that the non-adopters from the study were more likely to think that their sector positively impacted the natural environment. Another interesting aspect was that hotel characteristics, such as size and ownership, did not have an influence on the results (Best & Thapa, 2011). Many similarities can be seen with the multiple case study results in this research. There could potentially be a predominantly informal and ad hoc approach to environment management within organisations across the Caribbean. Environmentally sustainable activities such as energy efficient lighting solutions and renewable energy generation have been dominant across the cases; however, formal programmes and wider incorporation of building management systems for setting targets, monitoring and auditing performance may be helpful to progress this area.

An interviewee considered how even these ad-hoc sustainability activities started to be embedded in the sector, *"…I think when I saw a lot of people coming on board was when LEED became an international benchmark to follow for sustainable development. And I think that that's when I saw a lot of my peers really getting on board with it. But I never took to it, not that I didn't respect it, I think it's a fantastic thing to work with, but there were a couple reasons I didn't …I always found that's how I designed anyway from the beginning… and the other reason I didn't really take too much to it is that I found that for some reason, even though it was a good thing, it felt as though it was a label that people wanted to carry, just to say that that's what they do, and that was more important than the actual benefits. I may be wrong, but that's the thought I had from it".*

There are both real and perceived barriers to incorporating environmental standards and certifications in the Caribbean. As explained by a LEED-accredited architect practising in Trinidad & Tobago, *"it's the manpower cost of having a commissioner come in and verify the systems… it can start anywhere from US$200,000 for a simple commercial building and all the stakeholders have to be involved, not just the client and the consultants – it's everybody: the contractors, the suppliers and installers"* (Allen-Agostin, 2012). Interestingly, the Swedish case started with regional (Nordic) and local (Swedish) certification programmes and is now considering more internationally recognised certifications (mainly due to demand from multi-national commercial customers). While this finding cannot be generalised for all of Sweden, a deeper understanding of the approach to and uptake of local and regional certifications could be helpful for developing regions aspiring to achieve international standards. Though assessment and certification incur a cost, building standard methodologies, such as BREEAM, are typically openly and freely available.

For the wider Latin American & Caribbean (LAC) region, in 2012 the World Bank funded a building certification system for emerging economies called 'Excellence in Design for Greater Efficiencies' (EDGE). The InterAmerican Development Bank (IDB) has reported that EDGE is in all of the LAC countries and that training programmes for professionals have been rolled out since 2019 in Bolivia, El Salvador, Nicaragua and the Dominican Republic. EDGE has not appeared throughout this research of the Caribbean region so this is a certification system that could be further investigated specifically for CARICOM and also for SIDS in general. The IDB also pointed out that local certifications systems have been emerging in various LAC countries such as Brazil and Chile (Dalaison et al., 2020).

For the Caribbean, the new CARICOM Regional Energy Efficiency Building Code (CREEBC), approved at the end of 2018, is part of wider Caribbean building code development aspirations for climate change adaptation and improving resilience. CREEBC has already been adapted from international standards for the Caribbean and

with a particular focus on energy conservation over the useful life of residential and commercial buildings. This shows that there has been some progress with this type of approach in the region. Several CARICOM Member States have expressed intertest in adopting the CREEBC at national level, (CROSQ, 2020) but the implementation of this is still to be seen. This connects with the suggestion of investigating uptake. Significant capacity building and regulatory reform is still required in the Caribbean region. There is also a lack of timely and reliable data on energy use for the region, which is hindering development (Caribbean Development Bank, 2019). It would therefore also appear that relying on policy changes could take a long time and voluntary action from the private sector may be needed to accelerate development in this area. One private sector challenge that has already been found in previous research is that hopes of selling or renting at a premium is risky since increases in valuation based on sustainability are not standardised. The market has to be willing to pay more for these 'premium' products and services (Al-Saleh & Mahroum, 2015). Fundamentally, there is a need for increased awareness of the benefits of sustainable buildings to the owner, occupants and surrounding communities. All stakeholders need to be involved in more holistic and systemic sustainability approaches in buildings and construction. On investigating disaster risk reduction in Barbados' construction sector, Chmutina & Lee (2014) confirmed stakeholder fragmentation, highlighting that it was either very informal or there was no collaboration at all.

8.5.1.3 Sustainability training and education internally and externally - information sharing and awareness raising

Throughout this research, results have highlighted that much more knowledge about the benefits of more sustainable approaches is required to convince shareholders or clients to develop the built environment in a sustainable manner. Similarly, for disaster risk reduction in construction sector, recommendations include improving public awareness and stakeholder collaboration and cooperation towards upskilling (Chmutina & Bosher, 2014). The multiple case study findings showed that the involvement of customers and the general public was sometimes not perceived as important or even

necessary, mainly due to the risk of problematic consultations (lack of understanding leading to the exclusion of more sustainable practices). There is some minor similarity in this aspect with the Swedish case, where some wider stakeholder consultations became difficult; however, the response was not to deem the engagement less important. The aim is to overcome such barriers by trying different approaches to engagement and awareness raising activities such as introducing information at earlier stages and in different formats. For example, the incorporation of certifications with lifecycle perspectives such as the Nordic Ecolabel, automatically requires organisations to consider the entire lifecycle of buildings and their impact on the environment and society from 'cradle to cradle'. Further, for the Swedish case, there are multiple magazines published every year, in accordance with Nordic Swan Ecolabelling, as a way to communicate with not only tenants but the wider society. Public engagement and the company's public profile was also raised through high profile sustainable design competitions. Beyond external engagement, these types of future thinking activities also create internal knowledge development and capacity building that translates to other work and projects. In 2020, there was an ecological design challenge for an ocean front site on the French island of Martinique in the Caribbean. The question posed was '*how can a hotel complex be built today while minimising its carbon footprint and offering sustainable and responsible construction techniques for a local activity that needs to be revitalised and perpetuated?*'. It would be interesting to further explore the regional involvement in such competitions and if it could be a successful avenue for awareness raising and capacity building (Because Architecture Matters, 2020).

On the wider societal level in Barbados, a recycling initiative has recently (2022) been launched across the country. Though it is a municipal waste initiative, hopefully it would eventually lead to behavioural change and is a step towards increased awareness and action more broadly. The behavioural and societal dimensions within sustainable buildings have not been widely researched. The behavioural dimension considers cognitive elements of material and technology usage and management such as decision-making, peer/stakeholder influence, leadership impact, etc. The societal dimension

fundamentally refers to strong communities and collaborations. This requires partnership and wider stakeholder engagement to rethink the way that buildings are designed and share knowledge on various approaches (Pomponi & Moncaster, 2017). A key challenge has been the ability to demonstrate the value of new approaches. Interestingly, previous research into infrastructure projects in the Caribbean region explored the impact on long-term sustainability from engaging local communities. It was found that community inclusion in early stages improved the overall quality of the projects and construction but did not have substantial impact on maintenance (Holcombe et al., 2018). Understandably, more specialist skills may be required for the management and monitoring during building operational stages but it is a useful regional finding that early involvement may facilitate higher quality outputs.

Over the years, architects in the region have also lobbied to increase the importance of the field. In 2011, the Barbados Architects Registration Board (ARB) updated the Architects Registration Act so that it is now law that you should not use the term architect unless you are licensed. The ARB issues general guidance on the types of buildings that shall be designed and stamped by registered architects (BIA, 2011). Historically, and still to this day, 'contractors' use and sell building designs without any formal qualifications - *"they have lots of draftsmen that people assume are architects or they call them architects because they draw plans. But that's not the case so the architectural registration board and Barbados Institute of Architects have actually for the better part of 12 years been really pushing very hard so that people understand the importance. Its actually law now that you can't use the term architect, unless you are a licensed architect".* The average draftsman does not likely have the additional skillset for more holistic considerations - *"…as far as looking at orientation, the same passive design that we have talked about and that sort of stuff, it doesn't exist. They literally give you a square box. It's very hot."*

To help overcome this, most financial institutions in Barbados now require qualified professionals to be involved with building projects before loan approval – still leaving a

gap in the less formal market. Jamaica is trying to address the problem of informal housing through its new Building Act. The Act creates a new category of "building practitioner". These are non-professionals with vocational training who would be legally allowed to construct small buildings. According to the Jamaican Minister of Local Government and Community Development, "*the Act is critical to the effort to prevent new squatter settlements from being built, promote sustainable development, establish and enforce internationally-accepted building standards and rules for individuals and entities providing construction material and services*" (Government of Jamaica, 2019).

Mobile/digital communication is another area that is popular given technological advancement. The Swedish case incorporated mobile applications to enhance customer relationships. Promotional content mainly focuses on encouraging sustainable living and explaining certification systems (with effort to make content very easy to understand). This is in some ways similar to the Caribbean project case but not the organisation cases. Even within the project case, emphasis is not explicitly placed on sustainability (making a clear connection between product features and sustainability). Dick-Forde, Oftedal & Bertella (2020) conducted an exploratory study on hospitality and tourism in the Caribbean to generate insights on how sustainable business model thinking could prepare the sector for the future (climate smart and resilient development). Overall, "*the responses suggest that key actors appreciate the relevance of climate change. They are aware that it could contribute to a new value proposition. Customers are perceived to have an appreciation for climate action and SDG-related activity. However, only few of the hotel managers and umbrella agencies are perceived to have the tools to adapt their current operations toward climate resilience. Additionally, respondents suggest that awareness and education about these issues are needed for relevant and effective policy and programs for climate action in the Caribbean*" (Dick-Forde et al., 2020, p.255).

There is a clear gap in education and awareness raising around more sustainable buildings and lifestyles. This potentially helps to explain the overall lack of demand for more sustainable products and services. Helpful research in this area could be more in

depth understanding of the sector to know specifically where more effort is required. For example, it seems important to quantify the informal sector where a lot of activity is happening with questions such as how many buildings plans are being prepared by unqualified persons and how many people seek formal loans for construction in comparison to lower cost staged and DIY approaches. Recent research in the wider region has already started to suggest ecological design strategies for informal settlements to protect vulnerable cities, increasing resilience. This is from the position that urbanisation will continue to comprise of informal settlements where housing is mostly self-built and maintained; however, there is an opportunity to build and/or maintain public spaces, within informal settlements, that contribute to increased resilience, health and wellbeing. Two examples from the proposed strategies are included below (Vera & Sordi, 2021):

> *"In Argentina, for example, only 24% of informal settlements include a plaza or park. Approximately 45% of these neighbourhoods are in environmentally high-risk zones, making them ideal locations for implementing solutions that, on top of consolidating public spaces and improving their usability, also emphasize green infrastructure in order to make the area more sustainable and resilient. One example would be to pave roadways, not with concrete or asphalt, but with porous and permeable materials. Another example would be to include vegetation and productive green spaces like gardens or orchards."*

> *"The Plaza Estacional Project, developed by AGA estudio, PICO, and the Barrio Canaima community in the Frailes and Canaima neighbourhoods of Caracas, Venezuela, for example, aims to lower the flooding risk in these informal areas by stabilizing the terrain and garden spaces outside the remodelled houses. The gardens house plants with deep roots as well as permaculture, transforming the neighbourhood plaza into a productive common space for the neighbourhood residents."*

In Barbados, a similar but more national level initiative can be found. It is the 'Trailway Project' that is creating a tree lined pedestrianised trail and cycle path across the island to promote active transport, health and wellbeing and local heritage. In Dominica, the government (in partnership with international development organisations) produced a

simplified guide alongside their new building standards in an attempt to provide referencing that is easier to understand for all stakeholders (Government of the Commonwealth of Dominica, 2018). The impact of such initiatives in the Caribbean region and strategies for further sustainable development could be researched and promoted, similar to these Latin American examples.

8.5.1.4 Construction and demolition waste management – understanding embodied carbon and circularity

In the 1980's, Stahel (1982) and McDonough & Braungart (2002) highlighted that waste came at a cost but produced no value to customers when it could actually be utilised. The core idea was to avoid waste where possible by reusing it in production. For industrial/commercial processes, materials should maintain a closed loop cycle where possible, also ideally maintaining their highest value for as long as possible. Cradle to cradle moves beyond reducing harmful environmental impact to encouraging prosperous regenerative activity (McDonough & Braungart, 2002; Stahel, 1982).

There is clearly a focus on utilising renewable energy and incorporating more energy efficient equipment and processes within both the Swedish and Caribbean cases. The key area that could be more formalised in the Caribbean is improving construction and demolition waste management, which is inherently connected with increased knowledge and understanding of embodied carbon and circularity in the built environment. Barbados has a waste transfer station that opened in 2009 for recovery, composting and hazardous waste management to reduce waste to landfill. For construction and demolition waste, this is reported to include plastics, wood pallets, glass and metals (Moore et al., 2012) but further end of life information is not clearly reported. To adopt more sustainable practices and create a circular economy, waste needs to be separated but there are little to no incentives (legal, regulatory, market, etc.) for this in the region and no polices that mandate the reuse or recycling of demolition waste. Most of the Caribbean cases have an ad hoc approach to recycling initiatives. More formalised waste sorting and reduction activities could include waste

back into production and better sorting of waste, both in plants and offices and on projects. It could also include producer take-back schemes and community reuse schemes, which are currently not formally established. These approaches will require more focus on quantifying waste and identifying the best available (or to be created) management routes. Most of the cases already have in-house technical teams/experts that may be able to help develop trial programmes.

Previous research has highlighted various barriers to competitive reuse and recycling markets. One key financial consideration is the cost for waste disposal – low cost to dispose of waste without considering the environmental impact. Minimal governance and regulation are known challenges along with confidence and certifications to reuse products in new construction activities. For the wider LAC region, in 2011, an initiative for inclusive recycling was launched to encourage a cultural shift towards waste collection and acknowledge the key role of recyclers (LatitudeR, 2022). There has been policy progress in larger countries such as Colombia and Mexico. Mexico City's Zero Waste Plan for construction and demolition waste management requires manufacturers to reduce packaging and identify waste streams in their products. They're regulations for single use products and consideration of preferential interest/tax rates for social housing. For increasing awareness, there is a civic waste separation campaign across Mexico (Moreno, 2020). Going back to the early 2000s, the Organisation for Economic Co-operation and Development (OECD), which globally collaborates to find solutions to various social, economic and environmental issues and provides advice on public policy and international standards, launched a sustainable building project. The OECD's Sustainable Building Project, 2001 to 2004, was developed to assist countries with the reduction of environmental impacts from the buildings sector; more specifically, assistance on the reduction of carbon emissions, construction and demolition waste and indoor air pollution. The outputs included key policy design enhancement recommendations and discussions on sustainable use of building stock that are still very relevant (OECD, 2004).

Within the Caribbean, the importance of considering carbon emissions is clearly an area to work on, especially for large emitters such as concrete. Historically, housing was typically wooden chattel houses at almost 75% of housing up to 1970. By 2000, this had changed significantly with almost 45% of housing made from concrete blocks, mainly due to increased standards of living (Moore et al., 2012). That is the most recent estimate, however, it can be assumed that the rate is currently much higher and there is significant use of concrete in construction activities. Overall, it has been highlighted that products are created based on the Caribbean environment (such as hurricane resistant) and there is ongoing adaption based on consumer needs. Further useful research could consider the carbon impact of the local manufacturing sector and the impact of importing materials and products.

8.5.2 Sustainable value capture

8.5.2.1 Longer-term and whole lifecycle thinking - triple bottom line

Sustainable value capture, in the Swedish case, is seen as balancing profitability and responsibility - shared value linking business success with social progress. The Caribbean cases have been trying to achieve higher levels of environmental sustainability within their business and community mainly through informal and semi-formal recycling initiatives, more energy efficient/environmentally friendly materials and products, energy and water conservation, and renewable energy generation. All of the cases support charities, education, sports, youth and/or communities in various ways; however, it was generally found that financial profit is still the primary business driver. Further considerations such as carbon emissions impact have not been formally incorporated into decision making. Social impact is sometimes considered but mainly from the aspect of job creation. Some cases are dependent on government subsidies and are sensitive to changes in duties and trade agreements. Similarly, when investigating disaster risk management in the construction sector, decisions not to progress with measures were typically financially driven and overall, it was concluded that the country takes a reactive approach (Chmutina & Bosher, 2014). Sustainable development requires longer-term and whole lifecycle thinking to be embedded in the sustainable business model.

General barriers to longer term approaches have been echoed in previous research. One of the key challenges has been the ability to demonstrate the value of new approaches such as whole lifecycle costing (Ellen Macarthur Foundation, 2016). Clients focus on initial costs instead of the whole lifecycle, thus associating sustainable construction with high costs (Abuzeinab et al., 2017; Darko & Chan, 2017; Davies & Osmani, 2011; Hagbert et al., 2013; Opoku & Ahmed, 2014; Rizos et al., 2016). In the Caribbean, some may share the sentiment that "*being a small island development state means that you are forced to do what the world tells you to do*."

8.5.2.2 Wider distribution of economic costs and benefits

The lack of economies of scale creates monopolistic structures. Even for publicly listed corporations in SIDS, the majority have been found to have one dominant shareholder that is typically a family or the state (with control through cash flow rights) and is involved with management through a Board of Directors. Research into corporate ownership of 221 companies in SIDS has suggested that "*the notion of diffuse shareholders and a separation between ownership and management, which forms the dominant paradigm in the fields of economics, finance and management, is not the norm in SIDS*". On average, 78% (ranging from 72% to 100%) of publicly traded organisations had a dominant shareholder with, on average, 46% ownership interest. The dominant threshold is typically 20% so these findings are closer to majority shares – 50%, which was indeed the result for some countries. Dominant shareholders were also active in management. The conclusion was that this requires further exploration of corporate behaviour in SIDS because *"protecting the interests of minority shareholders may be the major corporate governance challenge, as distinct from aligning the interests of shareholders and managers"* (Robinson, C., 2017). Essentially, shareholder ownership is not widely dispersed and shareholders are also managers. There has also been a call for more financial market integration locally and regionally to support 'bottom-up' sustainable development. This includes supporting innovation from the smallest levels,

especially for small to medium sized enterprises (SMEs) and organisations serving the community (ECLAC, 2013).

8.5.3 Sustainable value proposition

8.5.3.1 Circular economy business models

In February 2021, ministers across Latin America and the Caribbean (LAC) agreed to work together on the central integration of environmental issues in coronavirus pandemic recovery and regional action plans. More specifically, the signed 'Bridgetown Declaration' requires social inclusion, low carbon and resilient economies and the conservation and sustainable use of natural resources. United Nations Environment Programme (UNEP) will coordinate a 'Circular Economy Coalition' for LAC that will create a common regional vision for sustainable production and consumption, encouraging governmental collaboration and knowledge sharing and exploring new business opportunities (UNEP, 2021).

Circular economy business models (CEBMs) are essentially sustainable business models that primarily focus on closing and slowing material loops. They require coordinated interconnectivity within complex stakeholder networks (Antikainen & Valkokari, 2016; Bakker et al., 2020; Bocken et al., 2018). Figure 8:6 shows design options from a general typology for circular economy business models (not sector specific) that could be explored to develop sector specific ideas for sustainable business models.

BM Dimensions		CEBM design options derived from reviewing 26 CEBMs (the number of CEBMs that mention the respective design option is indicated in parentheses)[a]														
Value proposition	**Products**	Repaired, refurbished, remanufactured, or recycled products (3)		Reusable or recyclable products (3)			Products based on recycled waste (3)		Long-lasting products (3)			Used products, components, materials, or waste as production inputs (5)		Reusable or recyclable production inputs (1)		n.s. (9)[b]
	Services	Facilitating collaboration (3)		Take-back management (4)		Customer education (3)	Waste handling, processing (3)	Product-/service-based functions (2)	Maintenance, repair, control (4)			Product-/service-based results (1)	Upgrading (2)		Auxiliary services (2)	n.s. (11)
Value delivery	**Target customers**	Quality-conscious customers (1)		Cost-conscious customers (1)		Green customers (2)	B2B customers (4)		B2C suppliers (1)			B2B suppliers (2)		C2C suppliers (1)		n.s. (17)
	Value delivery processes	Connecting suppliers and customers (5)		Providing access to a product's functionality (2)		Providing (product-based) services and results (2)	Providing used products, components, materials, or waste (4)					Taking back used products, components, materials, or waste (4)		Sharing products, components, materials, or waste (2)		n.s. (11)
Value creation	**Partners and stakeholders**	Suppliers (1)		Manufacturers (5)		Retailers (2)	Service providers (2)		Public institutions (2)			Collectors of products, components, materials, waste (2)		Others (e.g., researchers) (1)		n.s. (17)
	Value creation processes	Maintaining or repairing products, components (6)	Refurbishing or remanufacturing products, components (5)	Recycling of products, components, materials, waste (3)	Upgrading or upcycling of products, components, materials, waste (3)		Reselling products, components, materials, waste (3)	Taking back or recapturing products, components, materials, waste (7)	Winning back base materials (4)		Using used products, components, materials, waste as input (8)		Matching over- and under-capacities (4)	Designing products, components, materials (4)		n.s. (1)
Value capture	**Revenues**	Additional product revenues (3)		Payments per unit of service (5)				Payments for functions or results (1)				Price premiums (6)				n.s. (12)
	Costs	Labor (1)	Repair, maintenance, control (3)		Waste handling, processing (7)		Manufacturing (1)	Resource inputs (13)			Transportation, logistics (1)			Supply risks (1)		n.s. (11)

Figure 8:6 - Design options for circular economy business models (Lüdeke-Freund et al., 2019, p.44)

8.5.3.2 Modern methods of construction

For the manufacturing companies, investments have been made to increase plant efficiency and product quality such as more advanced and automated equipment, while still considering energy efficiency. Some manufacturers distinguish themselves based on the type of plant or process they operate. Prefabrication falls into modern methods of construction (MMC), which is a growing area of focus in construction globally due to various aspects such as the potential to reduce waste and shorten installation times. Offsite manufacturing was identified as a practice that facilitates a shift in thinking by incorporating mass customisation strategies (system deliveries theory) to highlight how value can be created for the customer, business, and society (Thuesen & Hvam, 2013). Instead of the mass production of standardised goods, mass customisation involves high volume delivery of individually customised products or services at relatively low costs (Pine, 1993). Advancements in digital technologies and computer-based design enabled rapid expansion of mass customisation in housing. Complex architectural design can be efficiently and effectively managed and customers can be involved in the design process using interactive programs (Friedman et al., 2013).

A recent regional example that has combined these approaches is the Roatán Próspera Residences project design by Zaha Hadid Architects. Roatán is in the Bay of Islands of Honduras. The team developed a digital architectural configuration platform for the project to integrate local culture, manufacturing, materials and craftmanship in the design process and enable client customisation. The approach also considers the use of digital technologies for energy and waste reduction, incorporating off-site manufacturing (Zaha Hadid Architects, 2021). Overall, the global construction sector is moving towards increased digitalisation, including more structured and increased data gathering and reporting. The public sector in the Caribbean is the largest owner of assets and the largest employer in the region but many government ministries and agencies are still predominantly paper-based with several inefficiencies. This results in high transaction costs (not easy to do business) and low levels of competitiveness (Caribbean Development Bank, 2019).

"…how do we get people to understand it? There have been a few companies in Barbados that have been trying to push for many decades but you can't sell that to anyone here. You and I know that you can really get a nice looking house. You can get one that's hurricane proof and earthquake proof. And if you're using steel, you're not using wood so it's fireproof. It can go up once your foundation is done. It takes a month to do your excavation and set your foundation. Your house can go up in a month so you can get your house in two months and this is a house that is extremely strong and engineering tested. I'm used to it because in North America, that's how we build. We don't use concrete blocks up there the way we use concrete blocks down here. Up there, it's used basically for your foundation or certain structural elements, but the entire house is done, as they call it - stick frame, which is your stud work, and then your veneer, which is either stucco or brick or stone, or whatever. But you see to them, if it goes up easy, it means that it can be destroyed easily, but that's not true, right?"

8.6 Conclusion to the sustainability gap analysis and research and industrial implications

In 2012, a green economy scoping study was conducted for Barbados and proposed enabling conditions for a sustainable buildings and construction sector. These conditions included: initiatives for energy conservation; implementation of international programmes for environmental certification; fiscal incentives and supportive institutional frameworks; and access to supportive grant funding for development. It was suggested that there should be further investigation into the energy used to produce the most used building materials - concrete, wood and steel. Key future opportunities for more sustainable development of the sector included converting vacant sugar factories for waste-to-energy, improving education and technology, and creating recycling communities (Moore et al., 2012).

The analysis of gaps in the conceptual sustainable business model framework for buildings and construction identified multiple needs in the Caribbean region that align with and build on these previous findings. Visionary business owners/leaders with a willingness to experiment have been highlighted in the literature as inspiring motivators/influencers for sustainable action. Shared sustainable visions and goals along with sustainability champions could therefore be important aspects for regional

organisations to incorporate. Sustainable development also requires longer-term, whole lifecycle thinking and wider distribution of benefits to be embedded in the sustainable business model. Exploration of corporate behaviour in SIDS is therefore required because shareholder ownership (and essentially management) is not widely dispersed, questioning the protection of the interests of minority shareholders. There has also been a call for more financial market integration and support for innovation, especially for small to medium sized enterprises (SMEs) and organisations serving the community. Considering transparency and employee empowerment, there could be further research into understanding if the public promotion of employee wellbeing is translated to practice.

Formal programmes and wider incorporation of building management systems for setting targets, monitoring and auditing performance is another key area for development. Considerations for carbon emissions impact have not been formally incorporated into decision making. Social impact is sometimes considered but mainly from the aspect of job creation. There appears to be a predominantly informal approach to current environmental management activities. This point is interconnected with the need for a deeper understanding of the approach to and uptake of local and regional sustainability certifications and standards in other countries/regions. For example, several islands in the Caribbean region have expressed intertest in adopting the new CARICOM building code developed in 2018 but implementation is still to be seen. Significant capacity building and regulatory reform is still required. There is also a lack of timely and reliable data on energy use for the region, which is hindering development. It would therefore appear that relying on policy or regulatory changes could take a long time and voluntary action from the private sector may be needed to accelerate development. Though assessment and certification incur a cost, building standard methodologies, such as BREEAM, are typically openly and freely available and the organisations from this research already have technical teams/experts that appear ideally positioned for upskilling.

There is clear a need for increased awareness of the benefits of sustainable buildings to the owner, occupants and surrounding communities. All stakeholders need to be involved in more holistic and systemic sustainability approaches in buildings and construction. Sustainable design competitions require future thinking and could potentially create internal knowledge development and capacity building that translates to other work and projects. The approach could also help organisations with public engagement and improving reputation. In 2020, there was an ecological design challenge for an ocean front site on the French island of Martinique in the Caribbean. It would be interesting to further explore the regional involvement in such competitions and if it could indeed be a successful avenue for awareness raising and capacity building. Similarly, digital communication such as the use of animated videos and mobile applications to enhance customer relationships has been found to be useful as technology advances. There is a need in the region for more promotional content that encourages sustainable buildings and lifestyles (with effort to make content very easy to understand). Organisations could make a clearer connection between product features and sustainability. The lack of this potentially helps to explain the overall lack of demand for more sustainable products and services.

Recent research in the wider region has suggested ecological design strategies for informal settlements to protect vulnerable cities, increasing resilience. This is from the position that urbanisation will continue to comprise of informal settlements where housing is mostly self-built and maintained. It seems important for the Caribbean region to quantify the informal sector where a lot of activity is happening with questions such as how many buildings plans are being prepared by unqualified persons and how many people seek formal loans for construction in comparison to lower cost, staged and DIY approaches. There is also an opportunity to build and/or maintain public spaces, within informal settlements, that contribute to increased resilience, health and wellbeing. The impact of such initiatives in the Caribbean region and strategies for further sustainable development could be researched and promoted. Sustainable value capture should be

seen as balancing profitability and responsibility - shared value linking business success with social progress.

The circular economy concept moves beyond reducing harmful environmental impact to encouraging prosperous regenerative activity. The core idea is to avoid waste where possible by reusing it in production. For industrial/commercial processes, materials should maintain a closed loop cycle where possible, also ideally maintaining their highest value for as long as possible. In February 2021, ministers across Latin America and the Caribbean (LAC) signed the 'Bridgetown Declaration', which requires social inclusion, low carbon and resilient economies and the conservation and sustainable use of natural resources. There will be a 'Circular Economy Coalition' for LAC that will create a common regional vision for sustainable production and consumption, encouraging governmental collaboration and knowledge sharing and exploring new business opportunities. Circular economy business models (CEBMs) are essentially sustainable business models that primarily focus on closing and slowing material loops. There are CEBM design options in the literature that could be explored to develop sector specific ideas for sustainable and circular business models.

Whilst these are very useful outcomes to build on, as seen from the 2012 scoping study for Barbados, some of these gaps have already been highlighted over the years, which could be concerning. Cultural perceptions and the lack of training programmes (followed by economic constraints and lack of policy) were two of the strongest barriers reported in the scoping study. Perhaps these are still critical areas to address towards increasing the presence of sustainable business models in the Caribbean region, ultimately contributing to social, environmental and economic prosperity.

"Regional cooperation and integration offers an opportunity for small countries to accelerate growth, reduce economic disparities and facilitate closer policy coordination and collaboration on a range of issues affecting their development."

(Caribbean Development Bank, 2019, p.62)

9 Conclusions

9.1 Chapter Outline

This chapter concludes the dissertation with a summary of the key findings for each research objective. Contributions to knowledge and implications for research and practice are integrated within the key findings and then outlined again in the next section. The dissertation closes with a summary of reflections from the research approach and recommendations for future research.

9.2 Sustainable business models

What is a sustainable business model?

In the theoretical and practical development of sustainable business models, scholars aim to embed sustainable development (encompassing the environment, society, and economy) into all business processes and expand beyond organisational boundaries. This has been presented through definitions, archetypes, frameworks and tools but research has not yet matured. The discourse shows a general alignment on systems thinking as a necessary approach for this topic along with the expected business research approaches such as innovation, organisational management, and strategic management. Other approaches also emerged such as ecological modernisation, network theory, design thinking, lifecycle thinking, flourishing enterprise, sociology, relational leadership, system dynamics, natural science and strategic sustainable development. The majority of methods utilised for research are literature reviews and exploratory empirical case studies with questionnaires, interviews and workshops on firms already engaging in sustainable business practices. Sustainable business practices are typically used as an indicator of the presence of sustainable business models. There is also the creation of conceptual models or descriptive frameworks, with some using abductive reasoning and grounded theory. The majority of approaches have restrictive sample sizes that limit further generalisation. Longitudinal studies and big data analyses now seem to be emerging in an attempt to include quantitative methods and enhance the analysis of sustainable business model patterns, progress and performance.

Sustainable business model archetypes were published in 2014, mainly from academic and grey literature. Building on this approach to unify existing research and build a stronger theoretical base, sustainable business model patterns were published in 2019. Circular economy business model patterns were also proposed in 2019 to focus on sustainable business models that are built on circular economy principles. Researchers have so far identified that two of the archetypes are rarely found ('repurpose the business for society/environment' and 'encourage sufficiency') and that the archetypes have research limitations in some sectors. Industry specific tools are needed to help with novel business model development and further research is needed on sufficiency as a business strategy.

Overall, there are strong cases that the sustainable business model concept facilitates the articulation and implementation of sustainable solutions. Despite increased sustainable business model research activity over the last decade, there are still ongoing attempts to unify concepts, explore and test frameworks and archetypes, and investigate the ways to achieve sustainable business models in practice. Researchers report a lack of focus or suitable inclusion of the social element of sustainability. Clearer guidance is required on benefits for both companies and customers along with the details of partnerships that have been found to be heavily relied on for success. Integrative research is recommended to continue development for a sustainable economy and society and emphasis is needed on methodological rigour and consistent usage of terms so that research processes can be followed and built on. This is especially the case for developing and emerging countries where there is a clear research gap.

A systems-based approach underpinned by natural and social science is also critical to sustainable business model research and practice. The framework for strategic sustainable development (FSSD) has shown that science can help business leaders with sustainability transitions. Exploring the interrelationship between sustainable business models and the FSSD could improve the understanding of sustainability challenges and how they may be turned into business opportunities. Based on the reviewed sustainable

business model literature, this research focused on the sustainable business model as a tool/unit of analysis to describe and communicate sustainable value to all stakeholders. The following theoretical framework was used to frame this research (Figure 9:1).

Describe, analyse, manage, communicate		
Sustainable value proposition to customers and all other stakeholders	**Sustainable value creation & delivery**	**Sustainable value capture** economic value without degrading global natural, social, and economic capital

Figure 9:1 - Theoretical sustainable business model framework adapted from Bocken et al. (2014) and Schaltegger, Hansen and Ludeke-Freund (2016)

The following research gaps were identified:

1. Systems-based, boundary-spanning approach underpinned by natural and social science
2. Emphasis on the social element of sustainability
3. Clearer guidance on benefits for both companies and customers
4. Sector specific empirical data (contextual implications)
5. Analysis from developing and emerging economies (contextual implications)
6. Analysis of partnerships (NGOs, government, etc.) that are relied on for success
7. Real world applications and how to understand or measure their success
8. Attention to the importance of customer heterogeneity through better definition and analysis of target groups
9. Empirical data on the lesser found archetypes 'repurpose the business for society/environment' which requires changing the business vision and aims to positively contribute sustainable development and 'encourage sufficiency' which requires slowing consumption patterns (examples include Vitscoe and Patagonia)
10. Capacity building approaches/tools for the use of specialized methods and tools or simplified versions of the tools and frameworks to guide individuals and corporations

11. Analysis of the contribution of online communities and tools (linked to above point).

9.3 Strategic sustainable development

How has the framework for strategic sustainable development (FSSD) been used to enhance sustainability in business and management research?

This research explored how the FSSD has been used to enhance sustainability in business and management research to gather insights for enhancing sustainable business models. Several global examples of FSSD applications have been highlighted that led to comprehensively aiding organisations with sustainability transitions, reducing social and ecological non-compliance, and developing new opportunities. One of the main findings was that having a common set of sustainability principles provided helpful guidance when developing and using sustainability tools. The FSSD sustainability principles (originally described as four system conditions of a sustainable society) are the common core rules from which everything else can be developed. They state that we should not: extract more than we can replenish, create more than we can destroy, degrade nature and natural processes, nor undermine a person's ability to meet their needs. These principles have been applied in various ways such as investment analysis to determine if a technology will be sustainable in the future, evaluation of collaborations, and assessment of proposed actions. From the limited research that combined the FSSD with the business model concept, it was found that the combination helped with greater clarity where there was a lack of specific sustainability goals. It further helped with business model scalability to global level, risk identification and avoidance, investment strategy, and enhanced partnerships and social integration. Ultimately, strategic sustainable development encompasses a systems thinking perspective and scientific approach, which may be used to enhance the development of value perspectives and sustainable business models. The overall outcome for this research is a conceptual integration that shows how the FSSD five-level model can qualitatively identify and enhance sustainable business model characteristics (Figure 9:2). The FSSD also provides a complementary and structured approach for sustainable business model transformation and innovation.

Describe, analyse, manage, communicate		
Sustainable value proposition to customers and all other stakeholders *cultural substitutions such as product-service*	**Value creation & delivery** *defined sustainable vision and guidelines* *improved management routines, availability and distribution of resources* *function productivity such as less area consuming activities* *supportive sustainability methods/tools*	**Sustainable value capture** economic value without degrading global natural, social, and economic capital *resource productivity such as usage reduction, waste reduction, and substitution with more abundant, degradable and renewable sources* *more equity across the global economy*

Figure 9:2 - Proposed sustainable business model characteristics adapted from the FSSD five-level model

9.4 Sustainable business models for buildings and construction

What are the characteristics of sustainable business models in the buildings and construction sector?

9.4.1 Sustainable value proposition

The majority of sustainable value propositions found that have been reviewed focus on 'slowing resource loops' through extending product value, such as reusing wood, brick, steel, previous structures, and repurposing waste such as tree bark used for interior and exterior building cladding. There are 'access and performance models' such as building/apartment rentals and product leasing. Energy is also provided for buildings through business models such as energy service companies (ESCOs). Modular/prefabricated housing solutions include a variety of tenures with value propositions varying from a very minimal set of design variables to multiple layouts and interior design options, depending on resources and capabilities. Multiple layouts can be achieved with the same prefabricated products and spaces, giving customers increased options. Advancements in digital technologies have facilitated mass customisation in this area.

Sustainability certifications, such as C2C and BREEAM, are used to strengthen value propositions. Organisations add the key resources and activities needed to achieve

certifications or create their own standards and certifications, considering the design of longer life products, building for durability and endurance, and optimising energy and material use. For some housing organisations, expanding into affordable housing has added a previously excluded customer segment, improving on societal benefits. One notable distribution channel was intensive information sharing within communities to promote change. Digital communication such as the use of animated videos and mobile applications to enhance customer relationships has been found in the Swedish case study to be useful as stakeholders increasingly adopt more digital technologies and services. The Swedish case also highlighted that more emphasis could be placed on promoting rentals as a sustainable option that enables flexibility of choice in comparison to being a representation of economic circumstances.

9.4.2 Sustainable value creation and delivery

Visionary business owners and leaders with a willingness to experiment have been highlighted as inspiring motivators or influencers for sustainable action. The research shows that it is important to explicitly state and agree desired shared outcomes from visions with all key stakeholders. Further, these should be regularly reviewed, checking that the supporting network is working towards agreed visions. It is of equal importance that visions are defined well enough to be understood by all stakeholders because perceptions, values, and priorities vary. Some organisations engage sustainability consultants for visioning and communications when this key resource was missing. In general, partnering with similar organisations (competitors) has also enabled the creation and delivery of more sustainable products and services at a quicker pace (scaling). Some examples of visions and business motivations from this research are: building services that provide for customers while caring for the environment and local community; not driven by profit but driven by balance; creating better homes for the many; being the customer's friend; and, relationships make the company non-displaceable in the marketplace.

Lifecycle analysis methods and tools are frequently referred to in key activities and key resources. This includes lifecycle assessments, integrated facility management systems,

environmental and waste management systems, and optimising the use of assets and human expertise. These perspectives consider both operational and embodied impact. An important resource consideration is access to a sufficient quantity and quality of materials for secondary production. Researchers are working to increase the value of materials that are seen as waste by encouraging disassembly/deconstruction for reuse, thereby increasing supply of secondary material. Further, identifying uses for otherwise discarded materials creates a new business model for suppliers. The expertise of architects and interior designers who work with computer-aided building design and modelling tools are considered key resources, especially to facilitate the creation and delivery of prefabricated products. This gives customers increased options while maintaining the prefabrication production chain. This key activity of prefabrication over standard customisation has been highlighted as a critical business model enabler due to improved efficiency, cost reduction, and standardised processes, ultimately shifting to more value-centric models.

Training emerged as a key activity internally and externally for customers, partners and suppliers to develop a common language and shared understanding. Sustainability training and workshops varied from specialised topics such as waste management, circularity, and sustainability certifications to more general capacity building around environmental awareness and financial methods (improving access to credit/finance). Internal cross-training is also encouraged, linked to employee empowerment to develop new ways of doing business or even create their own businesses. Whilst not explicitly addressed as behaviour change, many cases have multiple sustainability demands and/or expectations of key resources (such as sustainable supplier requirements) and target groups (such as eco-conscious customers).

Overall, the majority of cases show alignment with aspects of all of the environmental sustainable business models archetypes (‘maximise material and energy efficiency’, ‘closing resource loops’ and ‘substitute with renewable and natural processes’). The social business model archetype to ‘deliver functionality rather than ownership’ can be

seen in the rental segments across the applicable cases. However, most cases do not appear to incorporate approaches to and learnings from cross-sector engagement, which has been previously highlighted as an area that is needed. All cases, with the exception of the Swedish case study, also have not highlighted more formal social sustainability assessment tools and benchmarks. For housebuilders to help strengthen community and quality of life, supporting evidence could be gathered to understand more about residents' experiences and how communities form to help new developments flourish.

9.4.3 Sustainable value capture

Contrary to the general assumption of the business model creating competitive price advantage, organisations in this review find it difficult to increase rental income in direct correlation with increased sustainable investments. Rental regulations sometimes make it difficult to recover the investment on sustainable projects. Increases in property valuation based on sustainability are also not standardised. This split incentive dilemma has previously been found to cause building owners to think that benefits primarily go to tenants and has been highlighted as a challenge with commercial property retrofit. It has also been previously acknowledged by researchers when analysing policy-reliant or policy-induced business models. One of the cases in this research accepts lower financial margins and sometimes even losses (covered by other subsidiaries in larger owned groups) to create or maintain sustainable offerings. Social and non-profit organisations dependent on government support also have to consider the incorporation of commercial (for-profit) business models to maintain their operations. Organisations in the Caribbean region, however, are predominantly driven by financial metrics. Incorporation of environmental concerns appear to be purely financially motivated. Specifically for the Caribbean, further research could experiment with the use of formal environmental and social metrics for assessing organisational performance.

The financial logic of most cases considers long-term collaborations necessary for maintaining stability in the buildings and construction sector. Some cases include public-private partnerships (PPP) that have been used by governments for infrastructural

projects to reduce risks and help with funding. Some value propositions are built on affordability for the customer with some financial logics working backwards from the target group's earnings to set cost and price limits. Some cases get more involved with social equity by employing the surrounding community as temporary staff for sales and/or construction. Considering the sustainable business model patterns, 'innovative product financing' in the pricing & revenue patterns outlines a progressive purchasing model, similar to the English shared ownership concept that emerged from the sector specific systematic review results. The approach in England aims to enable lower income homeownership through a government supported 'staircase' structure (gradual increases in the percentage of the home that is owned versus rented). There are various strengths and weaknesses in the approach that have been reviewed over last few decades. These could be explored within local contexts to determine suitability. Ultimately, the goal is to provide alternative financing mechanisms that provide the lower income population with more purchasing power. Sustainable value capture should be seen as balancing profitability and responsibility - shared value linking business success with social progress.

9.4.4 Value not yet captured – future opportunities

Multiple researchers have recently proposed 'value uncaptured' and 'value destroyed' as another way to thoroughly evaluate value perspectives for sustainable business models. The approach is typically used so far for ideation and there is a step-by-step approach across the lifecycle to systematically identify value uncaptured and the translation to value opportunity. Simple examples of value uncaptured include waste products and materials that could be repurposed and sub-optimal use of resources and expertise. All of the approaches using this perspective resulted in an increased understanding of the negative impact of unsustainable business activities in a structured way, leading to the discovery of new sustainable opportunities and sustainable business models. The value destruction approach is strongly aligned with the FSSD, which aims to highlight systemic problems that if left unchecked will continue to worsen the global system. The FSSD sustainability principles, or similar, essentially establish the basis/elements for a value destruction perspective. The overall approach could

therefore be quite useful for resource-intensive mass producers in the buildings and construction sector. It is also relevant when investigating circularity due to the possibility of sustaining harmful chemicals and processes. Essentially, the foundation of sustainable business models requires an understanding how the business model destroys value for other stakeholders.

9.4.5 Conceptual sustainable business model framework for buildings and construction

Throughout the research process, overlaps in the initially proposed framework were highlighted regarding value for the environment and society. To reduce repetition, some adjustments were made to finalise the conceptual framework (Figure 9:3) and to create a graphical version that could facilitate using the framework in practice (Figure 9:4). The most noticeable change that was required was either complete removal of the 'value not yet captured/future opportunities' component or the addition of content boundaries. For example, opportunities that do not mostly fit within the existing business model would be excluded as they would not really reflect the overall description. Longer term and more radical developments would be incorporated in strategic sustainable planning and sustainable business model innovation processes i.e. populating the sustainable business model for the future opportunity. A boundary has therefore been proposed for 'value not yet captured'. Compliance expands beyond the FSSD sustainability principles to encompass any suitable and supportive sustainability methods/tools that may be referred to with different terminology.

<table>
<tr><td colspan="2">Describe, analyse, manage, communicate</td></tr>
<tr><td colspan="2"><u>Sustainable value proposition</u>
product and/or service lifecycle value to customers and all other stakeholders
a. customer segments, customer relationships, distribution channels
b. value for customer, resilience/future proof</td></tr>
<tr><td><u>Sustainable value creation & delivery</u>
most important product and/or service creation and delivery activities considering the entire system/network
a. clearly defined shared vision and goals (internal and external)
b. top down commitment, organisational structure and processes enable employee empowerment, transparency
c. optimised use of internal resources, expert knowledge and upskilling, multi-disciplinary teams, energy and waste reduction management, regular self-assessment
d. trusted external partners and suppliers, sustainable value network management, training and information sharing
e. specialized technology/products, radical innovations, adaptability</td><td><u>Sustainable value capture</u>
economic value without degrading global natural, social, and economic capital
a. longer-term revenue streams, sustainable plant/building/equipment investments
b. distribution of economic costs and benefits among stakeholders
c. compliance with sustainability principles: value for society - community engagement beyond product/service supply, encouraging responsible consumption
value for environment - energy and waste reduction activities, sustainability certifications and standards (independent verification)</td></tr>
<tr><td colspan="2">Value not yet captured – future opportunities
Non-compliance with sustainability principles - value destroyed/not yet captured, unsatisfied needs, future opportunities that mostly fit with current activities</td></tr>
</table>

Figure 9:3 - Conceptual sustainable business model framework for the buildings and construction sector (final version)

The developed conceptual framework graphic (Figure 9:4) could be used to facilitate using the framework in practice. The inner core of the circular graphic is sustainability compliance i.e. core set of principles. Different colour text is used for components to enhance readability. Dotted lines are used to separate value creation and delivery from value capture. The dotted lines (and overall circular structure) are also used to demonstrate the interconnectivity of components across the model.

Figure 9:4 - Conceptual sustainable business model framework for the buildings and construction sector (graphic to facilitate usage)

9.5 Sustainability gaps in buildings and construction in the Caribbean region

What are the sustainability gaps in buildings and construction in the Caribbean region when analysed using a sustainable business model framework?

9.5.1 Sustainable value proposition

9.5.1.1 Circular economy business models

The circular economy concept moves beyond reducing harmful environmental impact to encouraging prosperous regenerative activity. Materials should maintain a closed loop cycle where possible, also ideally maintaining their highest value for as long as possible. Circular economy business models (CEBMs) are essentially sustainable business models that primarily focus on closing and slowing material loops. There are CEBM design options in the literature that could be explored to develop sector specific ideas for sustainable and circular business models in the Caribbean region.

9.5.1.2 Modern methods of construction

Prefabrication falls into modern methods of construction (MMC), which is a growing area of focus in construction globally due to various aspects such as the potential to reduce waste and shorten installation times. Offsite manufacturing was identified as a practice that facilitates a shift in thinking by incorporating mass customisation strategies to highlight how value can be created for the customer, business, and society (Thuesen & Hvam, 2013). The global construction sector is also moving towards increased digitalisation, including more structured and increased data gathering and reporting. The public sector in the Caribbean is the largest owner of assets and the largest employer in the region but many government ministries and agencies are still predominantly paper-based with several inefficiencies. This results in high transaction costs (not easy to do business) and low levels of competitiveness.

9.5.2 Sustainable value creation and delivery

9.5.2.1 Shared sustainable visions and sustainability champions

For some of the Caribbean cases there has been a recent increase in business leaders' willingness to experiment with sustainable business ideas and inspire sustainable action; however, this is still in early stages with minimal tangible outcomes so far. These changing mindsets could be due to a variety of reasons but feedback within the study indicated that the primary driver is economic benefits. Overall motivations were not further investigated but shared sustainable visions and goals defined amongst key stakeholders along with internal sustainability champions could be important aspects for regional organisations to incorporate. Within public profiles, most organisations highlight employee wellbeing and satisfaction as a key focus area. Considering transparency and employee empowerment, there could be further research into understanding if the public promotion of employee wellbeing is translated to practice.

9.5.2.2 Environmental management systems (EMS) and standards – comprehensive environmental policies

There is a predominantly informal approach to current environmental management activities. Considerations for carbon emissions impact have not been formally incorporated into decision making. Social impact is sometimes considered but mainly from the aspect of job creation. These findings align with previous research on environmental management in hotels across the Caribbean region. Formal programmes and wider incorporation of building management systems for setting targets, monitoring and auditing performance is therefore a key area for development. Significant capacity building and regulatory reform is required and there is a lack of timely and reliable data on energy use for the region, which is hindering development. Environmental management, certifications and labels were dominant in the Swedish case. It may therefore be helpful to gain a deeper understanding of the approach to and uptake of local and regional sustainability certifications and standards in other countries/regions. It also appears that relying on policy or regulatory changes could take a long time and voluntary action from the private sector may be needed to accelerate

development. Though assessment and certification incur a cost, building standard methodologies, such as BREEAM, are typically openly and freely available and the organisations from this multiple case study already have technical teams and experts that appear ideally positioned for upskilling.

9.5.2.3 Sustainability training and education internally and externally - information sharing and awareness raising

Perhaps interconnected with the identified gaps so far, the findings indicate an overall lack of demand for more sustainable building and construction products and services and a clear need for increased awareness of the benefits of sustainable buildings to all stakeholders. In fact, throughout this research, results have highlighted that much more knowledge about the benefits of more sustainable approaches is required to convince shareholders or clients to develop the built environment in a sustainable manner. The Caribbean cases showed that the involvement of customers and the general public was sometimes not perceived as important or even necessary, mainly due to the risk of problematic consultations (lack of understanding leading to the exclusion of more sustainable practices). There is some minor similarity in this aspect with the Swedish case, where some wider stakeholder consultations became difficult; however, the response was not to deem engagement as less important. The aim is to overcome such barriers by trying different approaches to engagement and awareness raising activities such as introducing information at earlier stages and in different formats. For example, the incorporation of certifications with lifecycle perspectives, automatically requires organisations to consider the entire lifecycle of buildings and their impact on the environment and society from 'cradle to cradle'. Sustainable design competitions require future thinking and could potentially create internal knowledge development and capacity building that translates to other work and projects and public engagement as found in the Swedish case.

Concerns about informal construction practices also emerged from the Caribbean cases. To help overcome this, some financial institutions require qualified professionals to be

involved with building projects before loan approval – still leaving a gap in the less formal market. Some countries are trying to address the problem of informal housing through new building laws but there are challenges with the timeliness and effectiveness of regulatory approaches, as previously mentioned. For the Caribbean, organisations could start or increase promotional content that encourages sustainable buildings and lifestyles (with effort to make content very easy to understand). Organisations could make a clearer connection between product features and sustainability as a way to communicate with not only customers but the wider society. Overall, recent research in the wider region has suggested ecological design strategies for informal settlements to protect vulnerable cities, increasing resilience. This is from the position that urbanisation will continue to comprise of informal settlements where housing is mostly self-built and maintained. It seems important for the Caribbean region to quantify the informal sector where a lot of activity is happening with questions such as how many buildings plans are being prepared by unqualified persons and how many people seek formal loans for construction in comparison to lower cost, staged and DIY approaches. There is also an opportunity to build and/or maintain public spaces, within informal settlements, that contribute to increased resilience, health and wellbeing. The impact of such initiatives in the Caribbean region and strategies for further sustainable development could be researched and promoted.

9.5.2.4 Construction and demolition waste management – understanding embodied carbon and circularity

There is clearly a focus on utilising renewable energy and incorporating more energy efficient equipment and processes but the key area that could be more formalised in the Caribbean is improving construction and demolition waste management. To adopt more sustainable practices and create a circular economy, waste needs to be separated but there are little to no incentives (legal, regulatory, market, etc.) for this in the region and no polices that mandate the reuse or recycling of demolition waste. More formalised waste sorting and reduction activities could include waste back into production and better sorting of waste, both in plants and offices and on projects. It

could also include producer take-back schemes and community reuse schemes, which are currently not formally established. These approaches will require more focus on quantifying waste and identifying the best available (or to be created) management routes. The importance of considering carbon emissions is also an area to work on, especially for large emitters such as concrete. Most of the cases already have in-house technical teams/experts that may be able to help develop trial programmes.

9.5.3 Sustainable value capture

9.5.3.1 Longer-term and whole lifecycle thinking - triple bottom line

The Caribbean cases have been trying to achieve higher levels of environmental sustainability within their business and community mainly through informal recycling initiatives, more energy efficient/environmentally friendly materials and products, energy and water conservation, and renewable energy generation. All of the cases support charities, education, sports, youth and/or communities in various ways; however, it was generally found that financial profit is still the primary business driver. Further considerations such as carbon emissions impact have not been formally incorporated into decision making. Social impact is sometimes considered but mainly from the aspect of job creation. Some cases are dependent on government subsidies and are sensitive to changes in duties and trade agreements. Previous research into disaster risk management in the construction sector similarly found that decisions not to progress with measures were typically financially driven. Sustainable development requires longer-term and whole lifecycle thinking to be embedded in the sustainable business model.

9.5.3.2 Wider distribution of economic costs and benefits

The lack of economies of scale in the Caribbean region creates monopolistic structures. Even for publicly listed corporations in SIDS, previous research found the majority to have one dominant shareholder that is typically a family or the state who is directly involved with management. Essentially, shareholder ownership is not widely dispersed and shareholders are also managers. Other researchers have already called for more financial market integration locally and regionally to support 'bottom-up' sustainable

development. This includes supporting innovation from the smallest levels, especially for small to medium sized enterprises (SMEs) and organisations serving the community.

9.6 Contributions to knowledge

This research contributed to the first five areas of research needs identified in the researcher's review of the sustainable business model literature:

1. Systems-based, boundary-spanning approach underpinned by natural and social science
2. Emphasis on the social element of sustainability
3. Clearer guidance on benefits for both companies and customers
4. Sector specific empirical data (contextual implications)
5. Analysis from developing and emerging economies (contextual implications)

More specifically, as described in the key findings, this research has made the following contributions:

- Recognising and consolidating the emergence of sustainable value destruction (value destroyed, uncaptured, etc.)
- Outlining a perspective relationship between 'value destroyed' and the 'sustainability principles' from the FSSD (negative avoidance)
- Illustrating that integrating the FSSD with sustainable business models could help increase the systemic and scientific approach needed to underpin sustainable business models
- Highlighting that the FSSD five-level framework includes key aspects to be considered as sustainable business model characteristics
- Comprehensively consolidating secondary empirical data on sustainable business models in the buildings and construction sector, creating a conceptual framework (industry specific tool to help with novel business model development)
- Presenting empirical sustainable business model case study data from a Swedish buildings and construction organisation

- Presenting empirical data on business models and sustainability in the buildings and construction sector in the Caribbean region, which is an under researched geographical location for the theoretical framework (sustainable business models) and also the research context (buildings and construction)
    - Sustainable business models in the Caribbean region represent fewer characteristics of sustainable business models when compared to previous case study research and the empirical data from the Swedish case study in this research
    - The most dominant tangible outcomes are the 'maximise renewable energy' sustainable business model archetype in the form of renewable energy and energy efficient lighting usage
- Introducing a conceptual sustainable business model framework for the buildings and construction sector, categorised by sustainable value proposition, sustainable value creation and delivery, sustainable value capture and value not yet captured – future opportunities
    - Theoretical and practical recommendations for enhancing sustainable business models and more specifically, sustainable business models in the buildings and construction sector.
    - The need for defining boundaries when using the sustainable business model as a tool/unit of analysis, ensuring to separate strategy and innovation to minimise over complication of the model and its application
- Using the sustainable business model as a useful tool/unit of analysis for identifying sustainability gaps and providing initial recommendations
    - Identification of potential sustainability gaps in the buildings and construction sector in the Caribbean region
    - Sustainability considerations are slowly increasing in the buildings and construction sector in the Caribbean region from the top down through laws/regulations and business leader 'acknowledgement' but informal approaches are still dominant and there are minimal tangible/quantifiable outcomes beyond renewable energy and energy efficient lighting usage

- Theoretical and practical recommendations for addressing sustainability gaps in the buildings and construction sector in the Caribbean region
- Identifying research gaps in the sustainable business model academic literature and future avenues for sustainable business model research (and other research areas) in the buildings and construction sector.

9.7 Limitations and recommendations for further research

This research has contributed to knowledge on sustainable business models, sustainability in buildings and construction, and sustainability in the Caribbean region; however, the research process and outcomes still include limitations. Limitations to the research process are addressed in Chapter 4. This section summarises those limitations and expands to include overall limitations of the research and suggested areas for future research.

The academic literature on business models in sustainable buildings and construction is limited. Research is even more limited on buildings as final structures, possibly due to the focus on component redesign towards resource efficient building deconstruction and extending product value. The consolidation of existing and new empirical literature in this research lays the groundwork for further exploration and experimentation. To build on this systematic work and widen the validation of the conceptual framework, the review criteria could be expanded to include industry publications (grey literature), which is already included in some methods in both the sustainable building and business model literature. This could lead to more sector specific archetype development. For practitioners, this provides a useful overview of key value perspectives and business activities when working towards sustainability in the buildings and construction sector.

Semi-structured interviews are useful for generating more in-depth data, especially for exploratory research. Throughout this research, semi-structured interviews were very helpful in providing information that was not publicly available, especially regarding sustainability and for smaller, private or lesser digitally/media oriented organisations that may not publish these details. The main disadvantage with this approach is that a

high volume of data is generated and it is time consuming to effectively organise and analyse the data. Even with the use of software to facilitate the process, significant time is still spent on manual coding and thematic analysis. Considering analysis, this was limited to variables that could be assessed using available data. For example, longer-term revenue, costs and distribution of economic costs and benefits among stakeholders are considered key variables but have not always been included in great detail due the lack of publicly available or provided information for assessment. Some of the selected organisations in the multiple case study also engage in informal sustainable activities, which are therefore not formally documented and reported. Since only 4 organisations have been further investigated in the multiple case study, it is possible that other sustainable business activities have not been captured. Futhermore, a case study weakness is that outcomes typically cannot be generalised due to the small sample size. Future research could similarly assess more organisations towards generalisable results (expanding framework validation with additional empirical data). Specifically for the Caribbean region, since organisations with large market shares have already been included in this research, a higher priority for future research in this region could be to investigate the identified sustainability gaps. Guiding approaches could be:

- Using the FSSD as a complementary and structured approach for sustainable business model transformation and innovation
- Investigating the most effective communication and distribution channels to promote change
- Engaging with other sectors towards shared goals and incorporating learnings from cross-sector engagement
- Exploring the use of formal environmental and social metrics for assessing organisational performance
- Exploring the use of formal social sustainability assessment tools and benchmarks to understand more about building occupant experiences and how communities form to help new developments flourish
- Considering the carbon impact of local manufacturing sectors and the impact of importing materials and products.

Conducting the analysis through the sustainable business model lens has identified sustainability strengths and weaknesses. The analysis of gaps in the conceptual sustainable business model framework for buildings and construction identified multiple needs in the Caribbean region. The sustainable business model archetypes and patterns have also provided helpful insight for developing new approaches to existing products and services or creating completely new offerings; however, these types of frameworks are complex and sophisticated, typically requiring skilled guidance. Interestingly, analysing the case study data highlighted overlaps in the initially created conceptual framework and identified aspects that needed to be further defined. This part of the research process emphasised the importance of defining a research framework and objectives and ensuring to reflect on the research design throughout the process. It also helped with learning how to consolidate large volumes of data and reduce some of the confusion and complexity for framework users. The use of the sustainable business model framework could be further developed through: academic discourse, specifically in the Caribbean region, to strengthen research into sustainable business models; and, industry discourse to help organisations increase sustainable activities holistically - create and deliver value for themselves, their staff, their surrounding communities and to meet global targets.

Overall, the research has been independently conducted without a second reviewer, which is one way to check for accuracy and bias. However, many other qualitative validity and reliability strategies have been employed to overcome this such as: data triangulation; participant feedback; detailed descriptions and inclusions of raw data (from transcripts); presentation of new or unusual results; extended informal observation; documented and detailed research procedures and protocols; and continual review and reflection by the researcher. Further research could consider longitudinal studies such as comparing the characteristics of sustainable business models over time and quantitative studies on sustainability performance where suitable measurable data is available.

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11 Appendices

11.1 Participant information sheet and consent form

DE MONTFORT UNIVERSITY LEICESTER

Participant Information Sheet

Sustainable Business Models

Please take some time to read this information and ask questions if anything is unclear.
Contact details can be found at the end of this document.

What is the purpose of this study?
This study aims to enhance the integration of sustainability in business models for the built environment. This would help embed sustainability at the core of the organization.

Who is organising this research?
The research for this study is being undertaken by Kaie Small-Warner who is a PhD student in Leicester School of Architecture, Arts, Design & Humanities Faculty at De Montfort University. De Montfort University Research Ethics Committee has reviewed and approved this research.

Why have I been chosen?
You have been chosen because of your position in the organization and familiarity with the organization's business model development and sustainable business practices. Through questionnaires, interviews and workshops, this study hopes to reveal the impact of a systematic and scientific approach to the integration of sustainability in business model development.

Do I have to take part?
Participation in this study is voluntary and you may ask the researcher questions before agreeing to participate. Your contribution will greatly assist in the research validation. If you agree to participate, you will be asked to sign a consent form. However, you are free to withdraw from the study at any time and if you choose to withdraw, you are not required to provide a reason.

What will happen to me if I take part?
If you agree to take part in this study, you will be interviewed and the audio will be recorded. The interview will be conducted at your organization by Kaie Small-Warner and will last approximately 30 minutes. You may be asked to participate in a follow-up interview and acceptance/participation in this is optional.

What are the possible benefits of participating?
The study aims to improve the participants knowledge of sustainable business models in the built environment

What are the possible risks of taking part?
While all questions are professional and pleasant, if any questions make you feel uncomfortable, please notify the researcher. At any time during the interview you can choose to withdraw.

How will my interview be used?
Data collected from the interview will be used to analyse the integration of sustainability within business model development. On the consent form we will ask you to confirm that you are happy to assign your copyright for the interview to us, which means that you consent to the researcher using and quoting from your interview.

What will happen to the results of the project?
All the information collected about you during the course of the research will be kept strictly confidential. You will not be identified in any reports or publications and your name and other personal information will be anonymised.

What happens to the interviews collected during the study?
Interviews will be audio recorded and stored digitally, managed by the researcher for the duration of the project. Only the researcher and supervisor will have access to the interviews and data.

What happens at the end of the project?
If you agree to participate in this project, the research will be written up as a dissertation. You may request a summary of the research findings by contacting the researcher. On successful submission of the dissertation, it will be deposited both in print and online at De Montfort University, to facilitate its use in further research. The digital online copy of the dissertation will be deposited with De Montfort Open Research Archive ("**DORA**") and will be published with open access meaning that it will be available to all internet users. At the end of this project, the audio and digital data collected from interviews with participants will be deposited at the UK Data Service for use by future researchers.

What about use of the data in future research?
If you agree to participate in this project, the research may be used by other researchers and regulatory authorities for future research.

Who is funding the research?
This research is funded by De Montfort University via a PhD studentship with the Leicester School of Architecture.

What should I do if I have any concerns or complaints?
If you have any concerns about the project, please speak to the researcher, who will acknowledge your concerns within ten (10) working days and give you an indication of how your concern will be addressed. If you remain unhappy or wish to make a formal complaint, please contact Dr. Amal Abuzeinab, amal.abuzeinab@dmu.ac.uk.

Fair Processing Statement
This information which you supply and that which may be collected as part of the project will be entered into a filing system or database and will only be accessed by the researcher and supervisor involved in the project. The information will be retained by De Montfort University and will only be used for the purpose of research, statistical and audit and possibly commercial purposes. By supplying this information you are consenting to us storing your information for the purposes above. The information will be processed by use in accordance with the provisions of the Data Protection Act 1998. No identifiable data will be published.

Many thanks,

[redacted]

DE MONTFORT UNIVERSITY LEICESTER

Participant Consent Form

Sustainable Business Models

Kaie Small-Warner
[redacted]

This agreement is made in regard to the recorded interview(s) which took place on _____

In consideration of my participation in the research and other valuable consideration provided by the De Montfort University ("**University**"), I declare the following:

Declaration:

- I confirm that I have read and understood the participant information sheet for this study
- I have had the opportunity to ask questions if necessary and have had these answered satisfactorily
- I understand that my participation is voluntary and that at any time, I am free to withdraw without giving any reason
- If I withdraw, my data will be removed from the study and will be destroyed
- I understand that De Montfort University Ethics Committee has reviewed and approved this study
- I give permission to the University and those authorised by the University to audio record me for the above project ("**Recordings**")
- I grant to the University the right and right to authorise others to make the Recordings available across all platforms and in all media (in whole or in part, transcribed or otherwise) in perpetuity throughout the world for educational, research, commercial and promotional purposes at the University, such uses include but not limited to print and online publication and broadcast
- I agree to taking part in the above study and recording, and hereby assign to the University all copyright in my contribution for use in all work resulting from this project and future projects
- I agree that my data may be managed, stored and archived at the University in accordance with the UK Data Protection Act 1998 http://www.dmu.ac.uk/research/research-support/research-data-management.aspx, and that the University may store electronically the information and Recordings outside the European Economic Area (EEA)
- I understand that **my responses will be kept strictly confidential**, that **all my personal and sensitive data will be anonymised in any reports or publication** and **my name will not be identified in any reports or publication**
- I understand that sensitive personal data may be collected during this interview. This may include information relating to race or ethnic origin, political opinions, religious beliefs, physical/mental health, trade union membership, sexual life or criminal activities
- I understand that the research will be written up as a dissertation by Joe Bloggs
- I give permission to other researchers and regulatory authorities to have access to my data in relevant future research
- I understand how to raise any concerns or complaints about this study
- I am aware that there are no compensation arrangements
- I will inform the researcher should my contact details change
- This consent form shall be governed in all respects by English law and the English courts

Name, signature and date:

Name of participant..... Date..... Signature.....

Postal address/phone/email

You will receive a copy of the signed and dated consent form for your records.

De Montfort University Faculty of Arts, Design & Humanities (ADH) ethics application to gain ethical approval for research activities

Application form tracking number: R58

Date approved: 12.06.18

11.2 Example case study data extraction protocol

Year	*2019*	*2019*	*2019*	*2019*
Title	Value Creation in Circular Business Models: The case of a US small medium enterprise in the building sector	Circular building materials: Carbon saving potential and the role of business model innovation and public policy		
Journal	Resources, Conservation & Recycling	Resources, Conservation & Recycling		
Authors	Unal et al.	Nubholz et al.	Nubholz et al.	Nubholz et al.
Case	Bark House, Appalachian Region	PolyPlank	Lendager	Gamle Mursten
Country	USA	Sweden	Denmark	Denmark
Building type	n/a - secondary materials	n/a - secondary materials		
Company/ Project size	30 employees	20 employees	38 employees	23 employees
BM/Org Age	1990			
Subsector	Building materials, using waste products	Manufacturing; Secondary material and component production	Architecture and manufacturing; Secondary material and component production/design + end of life	Secondary material and component production + end of life
	Sustainability/Sustainable Building			
Definition	industrial ecology, cradle-to-cradle (C2C), closed-loop flows of materials and novel design for products (McDonough and Braungart, 2002; Stahel, 1994); Design for X practices; circular buildings (Pomponi & Moncaster, 2017)	Reduce carbon emissions across the building lifecycle. Operation and embodied energy/impact (Rasmussen et al., 2018; Shadram & Mukkavaara, 2018). LCA and LCEA of buildings (Cabeza et al, 2014)		
	Research Methods - Data Collection			
Justification	Circular BMs provide several new perspectives in terms of value creation and capture that need to be analysed in-depth.	Despite the enabling role of BM innovation, utilisation of secondary materials in construction of new buildings remains low (Herczeg et al., 2014).		
Contribution	Understanding the role of the context and the mediating effect of managerial practices on value creation in CBMs. Advance CE research knowledge.	Advance understanding of the relevance of secondary material use to help decarbonise the building sector, and the interplay of business model innovation and policy instruments to enable this transition		

Methods and primary data	develop research protocol and theoretical framework from lit review; semi-structured interviews	mixed methods; comparative case study design and desk study of LCA data of a strategic sample (Verschuren et al, 2010) preliminary document analysis; semi-strucutred interviews; Lickert-type scale survey (to interviewees) to identify barriers and policy interventions; review of existing LCA data In-depth analysis and triangulation		
Number of cases	1 - extreme exemplar; C2C; early adopter; pionerring	3 - pioneering (2 countries, same region, similar regulatory framework to increase comparability)		
Number of participants	5	2	2	2
Type of participants	[8 interviews] CEO; sustainability officer/co-founder; client (arch company founder); stakehoder engagement manager from C2C Product Innovation Institute; sustainability and regenerative planning expert (LEED)	CEO (two sessions); senior consultant		
Documents	company website, company blog, magazines, documents shared by interviewees, case memos, certifications	company reports and website		
Other	internal and external analysis (Klein & Sorra, 1996); focus on SMEs (98% on US enterprises <20 employees)			
	Business Model			
BM (components) Definition	BMC (Osterwalder & Pigneur); Using managerial practices based on activities logic (Zott & Amit) and BMs as managerial schema (Martins et al., 2015)	value creation, capture & delivery, proposition Richardson (2008); **Osterwalder & Pigneur (2010)**; Bocken et al. (2014); Bocken et al. (2016)		
BM Analysis Level	Firm	Firm	Firm	Firm
SBM Archetype/ Pattern	circular BM	G4 closing the loop - P4.7 reuse; P4.5 remanufacturing/ next life sales		
	Value Proposition			
Product/ service/ value for customer	Bark shingles for exterior and interior wall coverings; C2C Platinum Certified Product since 2017	Wood Planks (recycled material)	Architectural/building design (sustainable focus)	Bricks (secondary/re used)
Customers/ segments/ relations/ service		Public housing associations	Organisations open to reuse and eco-friendly design	

Value proposition for environment/society	All of our material processing is completely net zero. Our energy consumption is going to be limited to vastly less than any other building material because our material is organic in shape and nature	Made from moisture-resistant and recyclable composite material with long life span. Reduced environmental impact and life cycle costs.	Focus on reused materials/circularity. Standards regarding price, quality, aesthetics, functionality, safety. solutions such as public housing organisations.	Unique look of reused brick. Competitive price and quality with primary bricks. Reduced environmental impact.
	Value creation & delivery			
Key activities (process, R&D, sales model)	created the customized machinery and dry-kiln process from scratch (5 years R&D); employee empowerment to give feedback on how their functions and the company can improve; cross-training	Patented closed-loop process. Sales channels.		Develop certification standards for quality assurance.
Key resources (materials, infrastructure, human resources)	coaching and visionary leadership styles, constantly motivate, encourage, and inspire both employees and supply chain partners.			
Distribution channels				
Suppliers/ partners/ coalitions	trained over 1000 loggers from 250 suppliers	Supply (facilitated by key partners) requires access to sufficient quantities and quality of secondary materials (by products of wood and plastics).	Partners: mobile concrete recycling plant; gravel mining company	Supply requires sufficient access to used bricks. Partners help with supply and certification: research institutes, governmental organisations, consumer protection organisations
Key sufficiency - enabling technologies and process/ product features	working with suppliers, and training and educating them regarding quality, best-management practices and sustainability are essential - We relate to them the practices that we want to see implemented. Relationships make the company non-displaceable in the marketplace		Improve secondary concrete production compatibility with primary concrete and develop certification standards for quality assurance.	Brick cleaning and stacking technology.

		Value capture		
Cost & revenue model. Product pricing/ownership model	Being a small company allows them to be entrepreneurial, "not driven by profit but driven by balance", core of the company's regenerative, circular business model; reserving 70% of the income for giving back to the community as a regenerative business	Main costs: secondary materials, manufacturing processes, labour. Revenue: sales of products.	Revenue: building contractors; public funding for technology development. Main costs: labour, materials, research and development.	Revenue: sales of the bricks. Main costs: purchase used bricks, labour, technology development, production facilities.
Value capture for others (environment, society)	Win-win scenario because loggers selling waste bark - sale vs. waste mgmt cost (increased income). Finding use for items that are generally discarded. Building trust - Not seeing it just as transaction, but partnership. 70% income reservbed for giving back to the community as a regenerative business	Substitute for primary wood & HDPE.	Substitute for primary concrete. Reuse from building demolitions (locally sourced reuse of concrete)	Reuse from building demolitions.
Growth ethos (vision)	Goal is to improve and regenerate local region (Appalachians). "how this company can become larger than a company, how can it just become a life for an area"			
		Additional information		
Behavioral change, lifecycle costs, etc.	increasing the income in the Appalachian Region, and focusing on small independent business owners, growing that vendor base, nurturing some of our employees to move into their own business ownerships (not explicitly highlighted as behaviour change) husband and wife are founders (family owned); article focuses only on value creation	Development of recovery technologies and capability; partner networks to access secondary materials; customers that value lower environmental and lifecycle costs; operational flexibility due to supply fluctuations; expand beyond existing operations/ add new operations	meet DGNB or LEED certification standards	Time-intensive to establish due to cheaper current disposal practices.

11.3 Bibliography of FSSD Systematic Review Results

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11.4 WRE Gåshaga transformation project with Skanska

Overview of the Gåshaga transformation project with Skanska (Soya Group, 2019, p.17)

TEXT SOFIA ZETTERMAN PHOTO HELIKOPTERFOTO.SE, KARIN RÖSE, CISTERNA

The Gåshaga project

A SUSTAINABLE VISION COME TRUE

After. As a result of the collaboration between Skanska Nya Hem, AB Cisterna and the architects White Arkitekter, Gåshaga Piers was finished in 2007. Attention was paid to every little detail. The streets were built to limit traffic. Every apartment has a sea view, and carefully chosen materials make them soundproof.

The idea to transform the old oil storage on Lidingö into a sustainable, modern residential area right on the water originated from Margareta Wallenius-Kleberg. After two decades of hard work, the first tenants finally moved into the new Gåshaga area – a neighbourhood out of the ordinary.

The project became a family affair imbued by the vision to decontaminate and reconstruct Gåshaga in the most sustainable way possible, focusing on upstream solutions to solve existing problems without causing new, future ones.

IN 1937, SHIPOWNER and Wallenius Lines' founder Olof Wallenius purchased the area on Lidingö, outside Stockholm, to use for oil storage. Through the years, the area was used as a shipyard, as well as for other industrial activities. In the early 1980s, 27 oil storage cisterns were still operational, although none by Wallenius Lines. At that time, Margareta Wallenius-Kleberg had the idea to transform Gåshaga into a residential neighbourhood. Jonas Kleberg insisted the clearing of the area had to be done the right way – the sustainable way – even though it meant many extra years of hard work before the vision would come true.

The goal was to recycle as much material as possible. The first step was to sanitize the area and the polluted soil using the most sustainable methods available. Some 1,000 cubic metres of soil were cleaned through land farming, a method similar to composting. The soil was placed in rows, water was added, and the soil was purified by turning and airing it, letting the water evaporate, a procedure that took about eight months.

THE NEXT BIG challenge was cleaning and dismantling the 27 cisterns. The contaminated cleaning water was sent to Loudden oil port and purified there. The cisterns were cut apart and 11,000 tonnes of sheet metal was sold. All the pipes were recycled, as well as the concrete and bricks. In total, as much as 98% of the old facility could be recycled.

At the same time, the municipality in Lidingö planned to blow out a new underground chamber, in order to extend the heating plant Käppala, next to Gåshaga pier. Margareta Wallenius-Kleberg and Jonas Kleberg approached the municipality with the idea to use the Käppala excess stone to build quays, piers and a bathing island for the residential area. Since then, the cooperation has continued and Käppala offers the heating plant's waste heat to the Gåshaga tenants at an affordable price.

TODAY, WHAT USED to be a contaminated oil storage has turned into an attractive residential area, combining modern apartments of the highest quality and design with the enchanting setting of the Stockholm archipelago.

During the Gåshaga project, Chairman and CEO Jonas Kleberg was working as the Group's Environmental Manager.

Before.